



Industria y Comercio
SUPERINTENDENCIA

FORMULARIO UNICO DE CORREC

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO



No. 05-028045-00006-0000

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Tra. 11 PATENTEIYII Eve 379 FASENACIONALII
Act 329 CTOINFORMACION Folios 70

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SOLICITUD DE

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Corrección de Error Material

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Modificación de una solicitud

②

SOLICITANTE

Nombre: CO 2 PAC LIMITED

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Nacionalidad o Domicilio: Auckland, Nueva Zelanda

Lugar de Constitución: Nueva Zelanda

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Fax:

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IDENTIFICACION

C.C.

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NIT

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C.E.

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Otro

☐

Cual

Número

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**REPRESENTANTE
O APODERADO**

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IDENTIFICACION

C.C.

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Cual

Número 79.143.366

TP 20.281

④

Numero de expediente

05.028.045

⑤

Descripción de la corrección o modificación solicitada

El solicitante presenta nuevo capítulo reivindicatorio

⑥

Comprobante de Pago No.

07- 39324

Fecha

16 - MAY - 07

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Anexos

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Comprobante de pago de la tasa.

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Poderes, si fuere el caso.

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Documento que acredita la existencia y representación legal de las partes, cuando sean personas jurídicas.

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NOMBRE ALVARO CORREA ORDOÑEZ

FIRMA

C.C. 79.143.366

T.P. 20.281

Instrucciones para el diligenciamiento del presente formulario, ver reverso de esta página.

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SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO



No. 06-028045- -00008-0000

Fecha: 2007-07-23 15.53 38 Dep. 2020 NUECREACIONE

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SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

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RECIBO OFICIAL DE CAJA : 07 - 39,324
FECHA : MAYO 16 DE 2007

***** CONSIGNACION *****

DEPOSITANTE	TIPO PAGO	BANCO	CUENTA	No. PAGO	FECHA PGO	Vr. PAGO
RAISBECK LARA RODRIGUEZ	CONSIGNACION	BANCO POPULAR	050-00110-6	55091064	16/05/2007	59,800,000.00

***** CONCEPTO *****

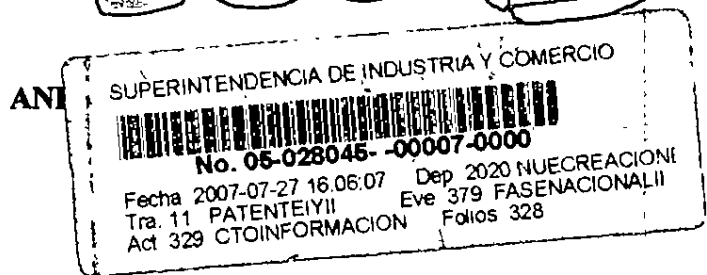
CANT.	RENTISTICO	CONCEPTO	TOTAL CONCEPTO
1	50005-01-03	CAMBIO DE MODALIDAD Y MODIFICA	
		12 MARCAS Y LENAS COMERCIALES	99,000.00
		TOTAL :	\$ 99,000.00

SON: NOVENTA Y NUEVE MIL PESOS

RESPONSABLE : 

RECIBO DE CAJA APLICADO AL EXPEDIENTE No. _____

05-28045 328 184



Referencia: Pruebas
Patente: Estructura de recipiente para eliminación de presión de vacío
Exp. No.: 05-28.045
Solicitante: CO 2 PAC LIMITED.

Yo, MÓNICA WOLF WASSERMAN, mayor de edad, domiciliada en esta ciudad, e identificada con Cedula de Ciudadanía No. 51.711.267 de Bogotá y Tarjeta Profesional No. 46.034 expedida por el Consejo Superior de la Judicatura, actuando como apoderada de la sociedad **Plásticos desechables de Colombia Plasdecot S.A.**, por medio del presente escrito y dentro del termino legal me permito allegar las correspondientes pruebas a efectos de demostrar que la patente en mención no es una solución innovadora ni novedosa y la misma carece de nivel inventivo.

Para tal efecto, me permito adjuntar catorce (14) búsquedas realizadas en la OMPI, que obedecen a una fecha anterior a la de la patente presentada.

De acuerdo a lo anterior, respetuosamente solicito se tengan en cuenta las pruebas aportadas y que como consecuencia de ello se declare fundada la presente oposición y se niegue el registro de la patente citada en la referencia.

NOTIFICACIONES

Recibiré notificaciones ante ese Despacho o en mi oficina, Diag 83A No 23-90 de esta ciudad.

Del Señor Jefe,

Atentamente,

MÓNICA WOLF WASSERMAN
CC No. 51.711.267 de Bogotá
T.P. No. 46034 C. S. de la J.

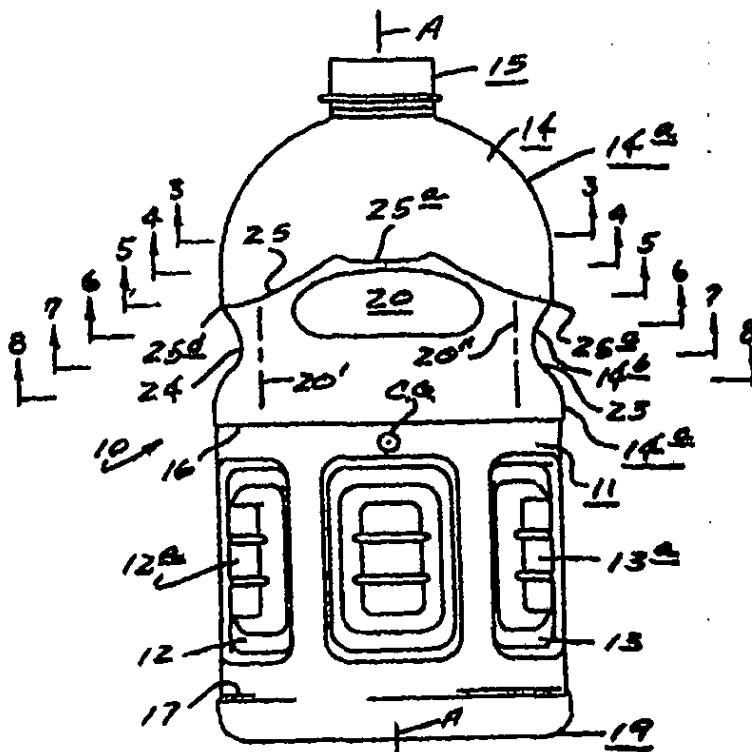
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(22) International Filing Date: 9 June 1999 (09.06.99)		(74) Agents: KITA, Stanley, B. et al.; Howson and Howson, Spring House Corporate Center, P.O. Box 457, Spring House, PA 19477 (US).
(30) Priority Data: 09/093,655 12 June 1998 (12.06.98) US		(81) Designated States: CA, MX, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).
(63) Related by Continuation (CON) or Continuation-in-Part (CIP) to Earlier Application US 09/093,655 (CIP) Filed on 12 June 1998 (12.06.98)		Published With international search report.
(71) Applicant (for all designated States except US): GRAHAM PACKAGING COMPANY, L.P. [US/US]; 1110 East Princess Street, P.O. Box 2618, York, PA 17405-2618 (US).		
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(54) Title: GRIP DOME CONTAINER

(57) Abstract

An ergonomically friendly container (10, 30) having hot-fill capabilities is disclosed. The container (10, 30) has a pre-ovalized dome (14, 34) with grip surfaces (20, 21, 40, 42) that undergo controlled deformation for accommodating a portion of the volumetric shrinkage due to hot filling, capping and cooling. Preferably, anti-racking ribs (32a, 32b) extend laterally between the grip surfaces (20, 21, 40, 42) to prevent unwanted racking or twisting of the dome (14, 34) during vacuum absorption.



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GRIP DOME CONTAINER

Field of the Invention

The present invention relates to grippable blow-molded plastic containers, and more particularly, the present invention relates to hot-fillable blow-molded plastic
5 containers having grip features that facilitate lifting and pouring.

Background of the Invention

The conventional hot-fillable blow-molded PET container is generally characterized by a body portion having a series of vertically elongate vacuum flex panels disposed in spaced relation about its periphery for accommodating volumetric
10 shrinkage in the container due to the vacuum created after the container has been hot-filled with liquid, capped and cooled to ambient temperature. The upper portion, or dome, of the container has been generally characterized by a circular cross-section having a waist. Some people use the waist to grip the container for pouring with one hand, but this is not satisfactory because the waist is too large to be gripped readily.
15 A stepped dome is easier to grip, but does not facilitate pouring from the container because it is too far from the filled container center of gravity.

At present, it has been necessary to make the vacuum flex panels relatively long in order to accommodate the amount of vacuum induced shrinkage required to provide a commercially satisfactory container. Examples of such containers are
20 disclosed in the following U.S. patents owned by the assignee of the present application: D366,416; D366,417; D366,831.

Efforts have been made to incorporate grips in hot-fillable containers to afford both ease of pouring and to accommodate the vacuum induced shrinkage of the container. An example of such a container manufactured by the assignee of the
25 present application is disclosed in the following U.S. Patents: D344,457; 5,392,937; and 5,598,941.

The aforementioned containers have certain advantages and certain disadvantages. The conventional vacuum panel has the advantage of enabling relatively large size containers with large labelable areas to be produced; however, it

has disadvantage of making such containers difficult to handle. Grip panel containers, on the other hand, have the advantage of providing relatively easy pourability for certain sizes; however, grip panels are difficult to provide in large size containers, and labelable areas are reduced. It is apparent, therefore, that there is a need for a blow-molded plastic container that provides both the ready gripability and pourability afforded by grip-panel containers while providing large labelable areas and avoiding the limitations associated with conventional vacuum-panel containers.

Objects of the Invention

With the foregoing in mind, a primary object of the present invention is to provide a novel grippable container that provides facile gripping and pouring of its contents.

Another object of the present invention is to provide an improved hot-fillable blow-molded container which utilizes conventional vacuum panels in combination with a specially configured grip dome that cooperates with the vacuum panels to accommodate the requisite vacuum induced shrinkage of the container due to hot-filling, capping and cooling.

Another object of the present invention is to provide a container having grips formed in its dome to facilitate gripping and pouring of contents from the container while utilizing shorter conventional vacuum panels to thereby provide the container with an ergonomically-improved lifting and pouring balance.

A still further object of the present invention is to provide a plastic blow-molded container having a reinforced grip dome which resists distortion from forces caused by hot-fill processing.

Summary of the Invention

More specifically, the present invention provides a blow-molded grippable container having a body portion with a series of vacuum panels and a dome portion which incorporates grip panels to facilitate gripping and pouring of contents from the container. In the illustrated embodiment, the dome portion has a non-circular

transverse cross-section with opposed elongate sides in which are provided an opposed pair of grip surfaces connected at their opposite ends by a recess extending around opposed peripheral portions of the dome. The grip surfaces are adapted to be engaged between a finger and thumb of the user while the user's hand portion is engaged in the recess. The dome is configured to enable the opposed grip surfaces to flex toward one another to accommodate a predetermined amount of volumetric shrinkage due to hot-filling, capping and cooling. The vacuum flex panels provided in the body portion below the dome accommodate another predetermined amount of volumetric shrinkage.

10 According to another aspect of the present invention, the peripheral recess of the dome includes a peripheral "anti-racking link", or rib, to prevent unwanted distortion of the dome. The rib permits a controlled amount of dome flexure so that the dome can accommodate a predetermined amount of volumetric shrinkage, but resists so-called "racking", or twisting, of the dome which would distort the appearance of the dome.

Brief Description of the Drawings

The foregoing and other objects, features and advantages of the present invention should become apparent from the following description when taken in conjunction with the accompanied drawings, in which:

20 Fig. 1 is a side elevational view of a grippable container embodying the present invention;

Fig. 2 is a front elevational view of the container illustrated in Fig. 1 but with portions broken away;

Fig. 3 is a transverse sectional view taken along line 3-3 of Fig. 1;

25 Fig. 4 is a transverse sectional view taken along line 4-4 of Fig. 1;

Fig. 5 is a transverse sectional view taken along line 5-5 of Fig. 1;

Fig. 6 is a transverse sectional view taken along line 6-6 of Fig. 1;

Fig. 7 is a transverse sectional view taken along line 7-7 of Fig. 1;

Fig. 8 is a transverse sectional view taken along line 8-8 of Fig. 1;

Fig. 9 is a side elevational view of a top portion of a second embodiment of a grippable container according to the present invention; and

Fig. 10 is a front elevational view of the top portion of the container illustrated in Fig. 9 but with portions broken away.

5 Description of the Preferred Embodiment

Referring now to the drawings, Fig. 1 illustrates a grippable container 10 which is particularly suited for hot fill applications. As best seen therein, the container 10 has a body portion 11, which may be of tubular cross section, such as cylindrical or rectangular, having a plurality of circumferentially spaced vacuum panels, such as the
10 panels 12 and 13. The body portion 11 of the container 10 has an upper label bumper 16 and a lower label bumper 17 both of which extend continuously about the periphery of the body portion 11. The vacuum panels 12 and 13 are located between the label bumpers 16 and 17 for accommodating vacuum induced shrinkage resulting from liquid contraction due to the hot fill process. Thus, the term vacuum induced
15 volumetric shrinkage as used herein refers to such shrinkage, and not to inherent thermally-induced volumetric shrinkage. The vacuum panels 12 and 13 also include customary label support regions 12a and 13a for supporting a label (not shown) in the region between the upper and lower label bumpers 16 and 17 as well known in the art. A suitable base 19 is provided below the lower label bumper 17. The base 19 is of
20 conventional construction having appropriate reinforcing ribs, such as radial ribs, to provide the desired stiffness and anti-everting capabilities preferred for a hot fill container, as well known in the art.

The container 10 has a dome portion 14 superposed on the body portion 11. The dome portion 14 has a conventional flanged finish 15 with threads (not shown)
25 adapted to receive a cap. The dome portion 14 has an upper section 14a, an intermediate section 14b, and a lower section 14c superadjacent the upper label bumper 16. The dome 14 lies within a cylindrical plane extending upwardly tangent to the upper label bumper 16.

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As best seen in Fig. 3, the upper dome section 14a has a non-circular transverse cross-section that diverges outwardly and downwardly from the finish 15. Preferably, both the upper and intermediate dome sections 14a and 14b, respectively, have elliptical transverse cross-sections in a plane perpendicular to a longitudinal axis A-A extending vertically through the center of the container 10. The lower dome section 14c also has an elliptical cross section that flares circularly outwardly and downwardly to merge with the circular upper label bumper 16.

As also seen in Fig. 3, the major, or long, axis B-B of the elliptical sections of the dome 14 extends front to rear of the container 10, and the minor, or short, axis C-C of the dome 14 extends side to side of the container 10. The dome 14 has an opposed pair of inwardly concave, curved elongate sidewalls 14', 14' connected at their ends to inwardly concave curved arcuate endwalls 14'', 14''.

Referring to Fig. 2, the upper section 14a of the dome 14 has an inwardly concave vertical cross-section providing a chamber having a generally bulbous concave configuration. The upper dome section 14a terminates in a continuous curved undulating brow rib 25 having an opposed pair of flattened apogees 25a and 25b located in the dome sidewalls, and having an opposed pair of perigees 25c and 25d located in the dome endwalls. Anti-slip ledges, or shoulders 26a and 26b are provided above each apogee, such as apogee 25a, for purposes to be described.

The intermediate dome section 14b has a pair of opposed transversely elongate grip surfaces 20 and 21 which are inset deeply into the dome 14 below the brow rib apogees 25a and 25b, respectively, and are preferably outwardly concave to afford engagement between a user's thumb and finger, such as the index finger. The grip surfaces 20 and 21 extend equidistantly on opposite sides of the container longitudinal axis A-A and are located above, but adjacent to, the upper label bumper 16. Recesses 23 and 24, which are less deeply inset into the dome 14 than the grip surfaces 20 and 21, interconnect the grip surfaces 20 and 21 at their opposite ends. The grip surfaces 20 and 21 cooperate with the peripheral recesses 23 and 24 to enable the user to place his or her index finger and thumb on the grip surfaces 20 and 21 and the connecting hand region in either the recess 23, or the recess 24, to lift and

pour from either the front or back of the container 10. The brow rib 25 above the grip surfaces 20 and 21 and recesses 23 and 24 cooperates with the anti-slip ledges 26a, 26b to provide a surface region against which the upper sides of the user's finger, thumb, and hand may be placed, while the user's palm engages the generally circular surface of the lower dome section 14c when manipulating the container 10.

In the illustrated embodiment (drawn in Figs. 1 and 2 to approximately half full scale) the container 10 has a filled nominal capacity of 96 ozs. The capacity of the body portion 11 up to the upper label bumper 16, is about 56 ozs. The capacity of the dome between the upper label bumper 16 and the top of the finish 15 is about 40 ozs. As a result, the dome portion provides approximately 41 percent of the total nominal volumetric capacity of the container 10. By way of comparison with a stock 96 oz circular bell cross-section conventional vacuum panel container of Applicant's manufacture, the bell volume constitutes about 30% of the total container filled volume.

The filled center of gravity of the container (C.G.) is located about 125mm of the overall height of the container 10 which is 292mm measured from a base support datum, such as a flat surface on which the container is placed. Preferably, the filled center of gravity is located in a range of about 40% to about 45% of the overall container height, or length, and the grip surfaces 20, 21 are located upwardly adjacent the filled center of gravity within about 55% to about 65% , and more preferably about 60% of the overall container height. Desirably, the grip surfaces 20 and 21 are separated by a distance in a range of about 75 to about 90mm across the minor axis C-C of the elliptical cross-section illustrated. The grip surfaces have an overall length of about 70mm, and the shortest peripheral distance from the center of one grip surface 20 to the center of the opposite grip surface 21 is about 175mm. The aforedescribed dimensional and surface configurations cooperate to provide a container which can be lifted and its contents poured in a facile manner.

The container 10 is particularly suited for hot-fill applications. Under conditions of hot-filling with liquid at a temperature approaching 200° F, capping, and cooling to ambient temperatures of about 72° F, the body portion vacuum panels, such

the panels 12 and 13, flex inwardly as well known in the art to accommodate volumetric shrinkage. However, unlike conventional hot fill containers, in the container 10 of the present invention, the vacuum panels do not accommodate all of the container's volumetric shrinkage. Rather, in the container of the present invention, the dome 14 accommodates approximately 5% of the total volumetric shrinkage of the container 10 due to hot fill, capping, and cooling. The balance is accommodated by the conventional vacuum panels, such as panels 12 and 13.

In the present invention, the grip surfaces 20 and 21 are mounted to flex inwardly toward one another by means of flexible webs to accommodate volumetric shrinkage in the dome 14. Such flexural movement may be seen in Fig. 5 which schematically illustrates in phantom lines the inward deflection of the grip surfaces 20 and 21 in their inwardly-flexed positions. The geometry of the dome tends to afford flexure primarily from side to side to provide the requisite grip surface movement. Flexure occurs about two pairs of vertical hinge lines located generally in the regions 20', 20" and 21', 21" shown in Figs. 1 and 5. Shrinkage is also facilitated to some extent by the inwardly concave peripheral hinge web region 28 (Fig. 2) located adjacent the juncture of the intermediate dome section 14b and lower dome section 14c in conjunction with the overlying brow rib 25. As seen in Fig. 2, the hinge web 28 is inwardly convex relative to upper and lower spaced lines of inflection 28a and 28b, respectively, which extend peripherally around the dome 14.

Preferably, the container is provided with means to reinforce the dome to prevent unwanted distortion while permitting the required amount of vacuum absorption. The container 30, illustrated in FIGs. 9 and 10, is identical to the container 10 except for the peripheral reinforcement ribs 32a and 32b. To this end, the container 30 has a finish 38 and a dome portion 34 with an upper section 34a, an intermediate section 34b, and a lower section 34c superadjacent an upper label bumper 36. The intermediate dome section 34b has a pair of opposed grip surfaces 40 and 42 which are inset into the dome 34 and which afford engagement of the dome 34 between a user's thumb and finger. Peripheral recesses 44 and 46 are inset into the

intermediate dome section 34b and interconnect the grip surfaces 40 and 42 at their opposite ends.

The peripheral reinforcement rib, or so-called "anti-racking link", 32a extends in the peripheral recess 44 laterally between the grip surfaces 40 and 42, and the
5 peripheral reinforcement rib, or so-called "anti-racking link", 32b extends in the peripheral recess 46 laterally between the grip surfaces 40 and 42. Each rib, 32a and 32b, is transversely elongate and extends to the opposite ends of the grip surfaces 40 and 42. As illustrated, the ribs 32a and 32b are outwardly concave, or C-shaped, in vertical cross-section and are located on the innermost portions of peripheral recess
10 44 and 46. The opposed ribs 32a and 32b cooperate to reinforce the dome 34 and prevent unwanted "racking", or twisting, of the dome 34 as might occur during certain vacuum absorption conditions of the dome 34. Thus, the ribs 32a and 32b allow the grippable dome 34 to accommodate a pre-determined amount of vacuum in a controlled manner, while preventing the bell-shaped dome 34 from becoming
15 distorted. If conditions conducive to dome racking are not encountered, the use of the ribs, or anti-racking links, 32a and 32b can be eliminated.

As a result of dome vacuum absorption, the vacuum panels in the body portion 11 are shorter in vertical height than conventional flex panels, since they do not provide the sole means for vacuum absorption. By reducing the height of the vacuum
20 panels, and providing a predetermined measure of vacuum absorption in the domes 14 and 34, the grip surfaces 20, 21, 40 and 42 are able to be located at a point slightly higher than the filled center of gravity of the container 10 or 30, making the containers 10 and 30 easy to grasp, lift, and pour, as contrasted with conventional cylindrical vacuum flex panel containers which simply have circular dome cross-sectional
25 configurations with concomitant ergonomic limitations.

The dome configurations 14 and 34 not only provide ergonomically-desirable lift and pour capabilities, but also provide the containers 10 and 30 with excellent top loading capabilities. The shortened height of the flex panels reduces the height of the label, but still provides a label area larger in size than on a comparable sidewall grip

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container. The larger dome enables customer designs and logotypes to be molded prominently in the dome.

Preferably, the containers 10 and 30 are blow molded of PET plastic in a heat-set mold utilizing commercially available blow-molding equipment.

5 If the hot fill capabilities are not required, the body portion flex panels may be eliminated, and other plastic materials may be used. The containers 10 and 30 would still retain their ergonomic lift and pour capabilities.

While a preferred embodiment of the present invention has been described in detail, various modifications, alterations and changes may be made without departing
10 from the spirit and scope of the invention as defined in the appended claims.

CLAIMS:

1. A grippable container (10, 30) comprising:
a body portion (11),
a dome portion (14, 34) with a finish (15) above said body portion (11),
said dome portion (14, 34) having a non-circular transverse cross-section and
an outwardly and downwardly divergent longitudinal cross-section
below said finish (15),
said transverse cross-section having an opposed pair of grip surfaces (20, 21,
40, 42) affording engagement between a user's thumb and finger,
whereby the grip surfaces (20, 21, 40, 42) afford facile lifting and pouring of contents
from the container (10, 30).
2. A container (10, 30) according to claim 1 wherein said dome portion (14,
34) has a volumetric capacity in a range of about 35 to about 45% of the total
volumetric capacity of the container (10, 30).
3. A container (10, 30) according to claim 1 wherein said container (10, 30)
has a filled center of gravity located in a range of about 40 to about 45% of the
overall height of the container (10, 30), and said grip surfaces (20, 21, 40, 42) are
located upwardly adjacent said filled center of gravity within about 60% of said
overall height.
4. A container (10, 30) according to claim 1 wherein said transverse cross-
section is elliptical and has opposed inwardly concave elongate side portions 14', and
said grip surfaces (20, 21, 40, 42) are located in said elongate side portions (14').
5. A container (10, 30) according to claim 1 wherein said body portion (11)
has a circular upper label bumper (16, 36), and said grip surfaces (20, 21, 40, 42) are
located adjacent said bumper (16, 36) and are inset therefrom.

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6. A container (10, 30) according to claim 1 wherein said inwardly divergent longitudinal cross section is concave inwardly to provide said dome (14, 34) with a bulbous configuration.

7. A container (10, 30) according to claim 1 wherein said dome (14, 34) transverse cross section has a pair of elongate sides (14') and a pair of arcuate ends (14'') connecting said elongate sides (14'), and said dome (14, 34) has a peripheral recess (23, 24, 44, 46) in each arcuate end (14'') connecting said opposed grip surfaces (20, 21, 40, 42) in said elongate sides (14').

8. A container (10, 30) according to claim 1 wherein said body portion (11) has a periphery, and said dome (14, 34) has an intermediate peripheral section inset from said body portion periphery with said grip surfaces (20, 21, 40, 42) being further inset in said intermediate peripheral section.

9. A container (10, 30) according to claim 1 including flexible webs (28) in said dome portion (14, 34) mounting said grip surfaces (20, 21, 40, 42) for movement inwardly toward one another in response to vacuum-induced shrinkage of the container (10, 30).

10. A readily grippable, hot-fillable, container (10, 30) having facile handling characteristics, comprising:

- a body portion (11),
- a dome portion (14, 34) with a finish (15) overlying said body portion (11),
- said dome portion (14, 34) having an elliptical transverse cross-section and an inwardly concave longitudinal cross section providing a bulbous configuration,

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said elliptical transverse cross section having side portions (14') each with a grip surface (20, 21, 40, 42) formed therein to afford engagement by a user's thumb and finger when the user's hand is engaged transversely with the dome (14, 34),

at least said grip surfaces (20, 21, 40, 42) being moveable inwardly toward one another to accommodate vacuum-induced volumetric shrinkage resulting from hot filling, capping and cooling of the container (10, 30) when filled with liquid,

whereby at least some of the vacuum-induced volumetric shrinkage of the container (10, 30) is accommodated by the dome portion (14, 34) while the grip surfaces (20, 21, 40, 42) afford facile lifting and pouring of the container contents by the user.

11. A container (10, 30) according to claim 10 wherein said elliptical transverse cross-section of said dome (14, 34) lies within a longitudinal plane extending upwardly from said body portion (11).

12. A container (10, 30) according to claim 11 wherein said grip surfaces (20, 21, 40, 42) are formed integral with said sides (14') and are interconnected at their opposite ends by opposed continuous inset peripheral recesses (23, 24, 44, 46).

13. A container (10, 30) according to claim 12 wherein said grip surfaces (20, 21, 40, 42) are inset further into said dome (14, 34) than are said opposed peripheral recesses (23, 24, 44, 46).

14. A container (10, 30) according to claim 13 wherein said grip surfaces (20, 21, 40, 42) are transversely elongate and are outwardly concave.

15. A container (10, 30) according to claim 14 including an anti-slip ledge (26a, 26b) located above at least a portion of each grip surface (20, 21, 40, 42).

16. A container (10, 30) according to claim 14 wherein said dome (14, 34) has a continuous curved peripheral brow (25) that overlies said grip surfaces (20, 21, 40, 42) and said inset recesses (23, 24, 44, 46).

17. A container (10, 30) according to claim 14 wherein said grip surfaces (20, 21, 40, 42) are spaced apart a distance in a range of about 75 to about 90mm at the minor axis of said elliptical cross-section.

18. A container (10, 30) according to claim 10 wherein said body portion (11) has a plurality of vacuum flex panels (12, 13) spaced apart around the periphery thereof for accommodating a first predetermined amount of vacuum induced volumetric shrinkage of the container (10, 30).

19. A container (10, 30) according to claim 10 wherein said dome portion (14, 34) accommodates about 5% of the total vacuum-induced shrinkage of the container (10, 30) after hot-filling, capping and cooling to ambient conditions.

20. A container (10, 30) according to claim 10 wherein said container (10, 30) has a predetermined volumetric capacity, and said dome portion (14, 34) comprises at least about 35% of said volumetric capacity.

21. A container (10, 34) according to claim 10 wherein said container (10, 34), when filled, has a center of gravity located at about 42% of its overall height, and said grip surfaces (20, 21, 40, 42) are located within about 55% to about 65% of said overall height of the container (10, 30).

22. A readily grippable, hot-fillable, container (10, 30) having facile handling characteristics, comprising:

a body portion (11) having a plurality of peripherally spaced vacuum flex panels (12, 13), said body portion (11) having an upper label bumper (16, 36) with said vacuum flex panels (12, 13) located therebelow, a dome portion (14, 34) with a finish (15) overlying said body portion (11), said dome portion (14, 34) having an elliptical transverse cross-section and an inwardly concave longitudinal cross section, said elliptical transverse cross section having side portions (14') each with a grip surface (20, 21, 40, 42) formed therein to afford engagement by a user's thumb and finger when the user's hand is engaged transversely with the dome portion (14, 34), said dome portion (14, 34) above said upper label bumper (16, 36) being flexible to enable at least said grip surfaces (20, 21, 40, 42) to move inwardly toward one another for accommodating vacuum-induced shrinkage resulting from hot filling, capping and cooling of the container (10, 30),

whereby at least some of the vacuum-induced volumetric shrinkage of the container (10, 30) is accommodated by the dome (14, 34) while the grip surfaces (20, 21, 40, 42) afford facile lifting and pouring of the container contents by the user.

23. A container (10, 30) according to claim 22 wherein said body portion (11) accommodates less than about 95% of the total vacuum induced volumetric shrinkage of the container (10, 30).

24. A container (10, 30) according to claim 22 wherein said dome portion (14, 34) is immediately superadjacent said upper label bumper (16, 36) and accommodates at least about 5% of the total vacuum induced volumetric shrinkage of the container (10, 30).

25. A container (10, 30) according to claim 22 wherein said container (10, 30) has a filled center of gravity at a predetermined location, and said grip surfaces (20, 21, 40, 42) are located above and adjacent to said filled center of gravity location.

26. A container (10, 30) according to claim 22 wherein said upper label bumper (16, 36) has a circular periphery and said dome portion (14, 34) lies within a cylindrical plane extending axially upward tangent to said label bumper (16, 36) periphery, said grip surfaces (20, 21, 40, 42) are outwardly concave and are inset into said dome (14, 34), and said grip surfaces (20, 21, 40, 42) are interconnected at their opposite ends by a recess (23, 24, 44, 46) in said dome (14, 34) sized to receive a user's hand region between the index finger and thumb.

27. A hot-fillable container (10, 30), comprising:
a body portion (11) having a bottom (19) and a sidewall with a plurality of vacuum absorption panels (12, 13) for accommodating a first predetermined amount of a vacuum-induced volumetric shrinkage,
a dome portion (14, 34) overlying said body portion (11) and having opposed side walls (14') mounted for flexural movement toward one another to accommodate a second predetermined amount of vacuum-induced volumetric shrinkage,
said first predetermined amount of volumetric shrinkage constituting less than about 95% of the total amount of the total vacuum-induced volumetric shrinkage to which the container (10, 30) is subject as a result of hot-filling, capping and cooling to ambient temperatures.

28. A hot-fillable container (10, 30) according to claim 27 wherein said dome portion (14, 34) has a non-circular transverse cross-section with opposed wall portions that flex inwardly toward one another to provide said second predetermined amount of vacuum-induced volumetric shrinkage.

29. A hot-fillable container (10, 30) according to claim 28 wherein said opposed wall portions have transversely elongate grip surfaces (20, 21, 40, 42) enabling the container (10) to be gripped between a user's finger and thumb for lifting and pouring contents from the container (10, 30).

30. A hot-fillable container (10, 30) according to claim 29 wherein said non-circular transverse cross-section is elliptical, said dome portion (14, 34) is inwardly concave, and opposite ends of said grip surfaces (20, 21, 40, 42) are connected together by peripheral recesses (23, 24, 44, 46).

31. A hot-fillable container (10, 30) according to claim 30 wherein said grip surfaces (20, 21, 40, 42) have centers spaced apart across the ellipse minor axis in a range of about 75 to about 90mm, and a peripheral spacing of about 175mm.

32. A container (10, 30) according to claim 27 wherein said dome portion (14, 34) has a volumetric capacity in a range of about 35 to about 45% of the total volumetric capacity of the container (10, 30).

33. A container (10, 30) according to claim 31 wherein said container (10, 30) has a filled center of gravity located in a range of about 40 to about 45% of the overall height of the container (10, 30), and said grip surfaces (20, 21, 40, 42) are located upwardly adjacent said filled center of gravity at about 60% of said overall height.

34. A container (10, 30) according to claim 27 wherein said container (10, 30), when filled, has a center of gravity located at about 42% of its overall height, and said grip surfaces (20, 21, 40, 42) are located within about 55% to about 65% of said overall height of the container (10, 30).

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35. A container (10, 30) according to claim 27 wherein said grip surfaces (20, 21, 40, 42) are spaced apart a distance in a range of about 75 to about 90mm at the minor axis of said elliptical cross-section.

36. A container (10, 30) according to claim 7, wherein a peripheral anti-racking rib (32a, 32b) extends on each of said peripheral recesses (23, 24, 44, 46).

37. A container (10, 30) according to claim 8, wherein a pair of opposed inset peripheral anti-racking ribs (32a, 32b) extend on said intermediate peripheral section laterally of said grip surfaces (20, 21, 40, 42).

38. A container according to claim 12, wherein each of said peripheral recesses (23, 24, 44, 46) has an inset peripheral rib (32a, 32b) for reinforcing said dome portion (14, 34).

39. A container (10, 30) according to claim 26, wherein said recess (23, 24, 44, 46) has a peripheral anti-racking rib (32a, 32b) which extends between said grip surfaces (20, 21, 40, 42).

40. A container (10, 30) according to claim 30, wherein a peripheral anti-racking rib (32a, 32b) extends on each of said peripheral recesses (23, 24, 44, 46) to reinforce said dome portion (14, 34).

41. A readily grippable, hot-fillable, container (10, 30) having facile handling characteristics, comprising:

a body portion (11);

a dome portion (14, 34) with a finish (15) overlying said body portion (11);

said dome portion (14, 34) having an elliptical transverse cross-section and an inwardly concave longitudinal cross section providing a bulbous configuration;

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said elliptical transverse cross section having side portions (14') each with a grip surface (20, 21, 40, 42) formed therein to afford engagement by a user's thumb and finger when the user's hand is engaged transversely with the dome (14, 34), said grip surfaces (20, 21, 40, 42) being formed integral with said elongate side portions (14') and being interconnected at their opposite ends by an opposed pair of continuous inset peripheral recesses (23, 24, 44, 46);

said inset peripheral recesses (23, 24, 44, 46) each having a further inset peripheral reinforcement rib (32a, 32b) formed therein, said reinforcement ribs (32a, 32b) extending laterally of said grip surfaces (20, 21, 40, 42);

said grip surfaces (20, 21, 40, 42) and said reinforcement rib (32a, 32b) being transversely elongate, outwardly concave, and inset further into said dome (14, 34) than said opposed peripheral recesses (23, 24, 44, 46);

at least said grip surfaces (20, 21, 40, 42) being moveable inwardly toward one another to accommodate vacuum-induced volumetric shrinkage resulting from hot filling, capping and cooling of the container (10, 30) when filled with liquid,

whereby at least some of the vacuum-induced volumetric shrinkage of the container (10, 30) is accommodated by the dome portion (14, 34) while the grip surfaces (20, 21, 40, 42) afford facile lifting and pouring of the container contents by the user.

FIG. 1

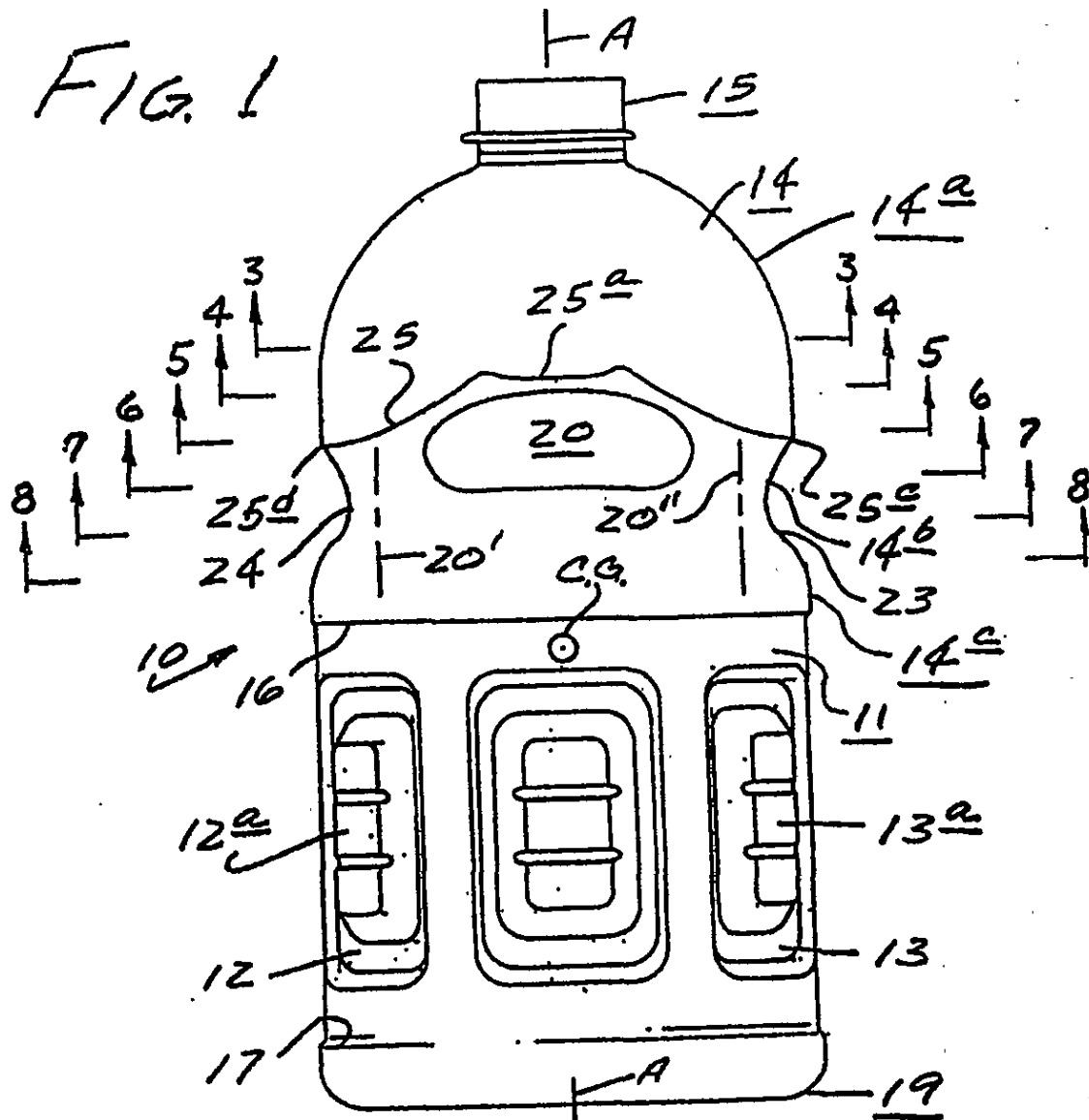


FIG. 3

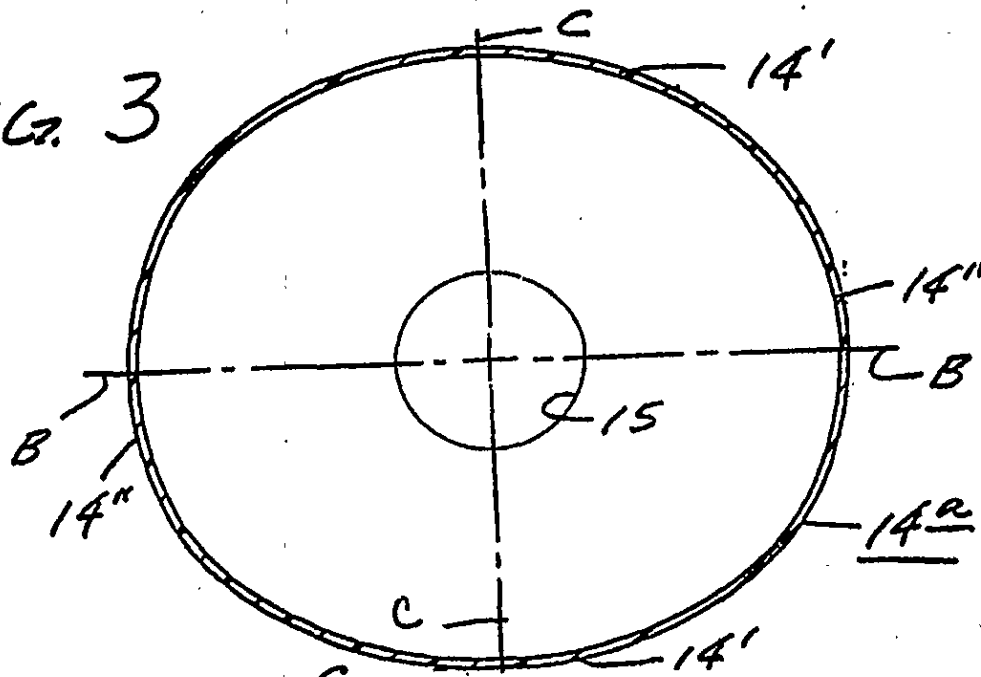
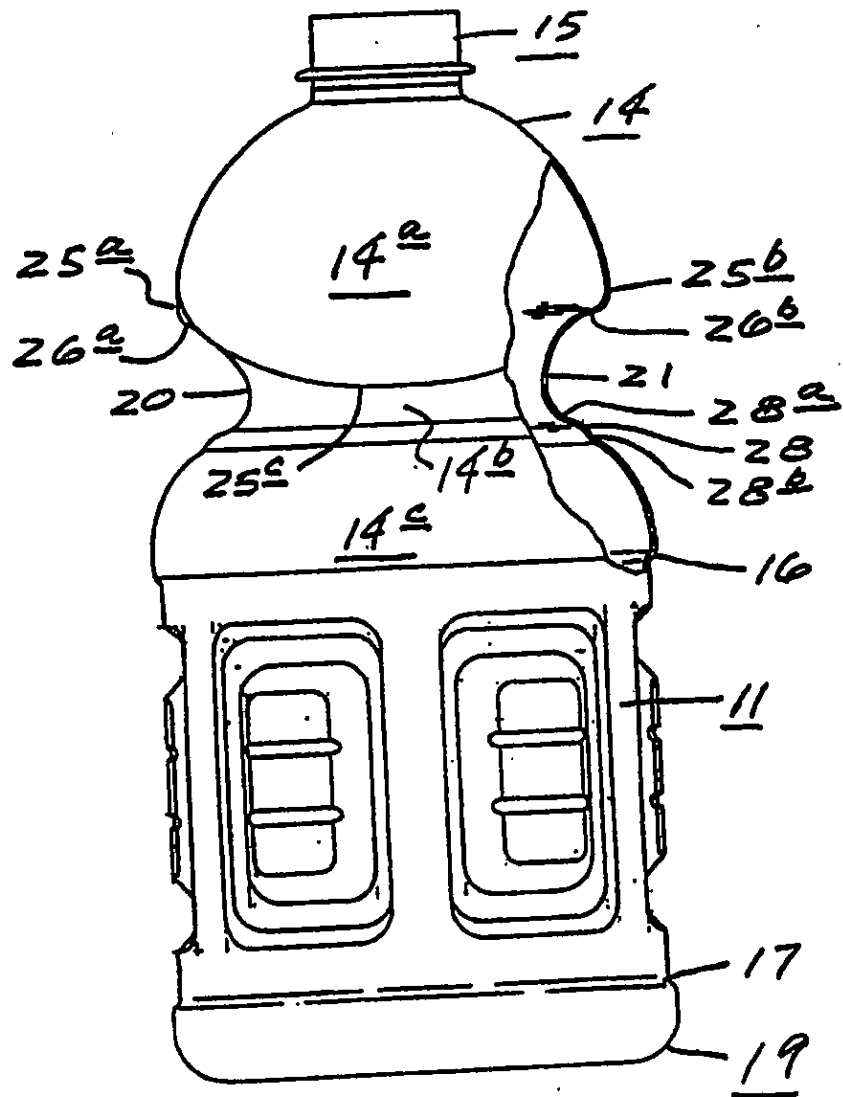


FIG. 2



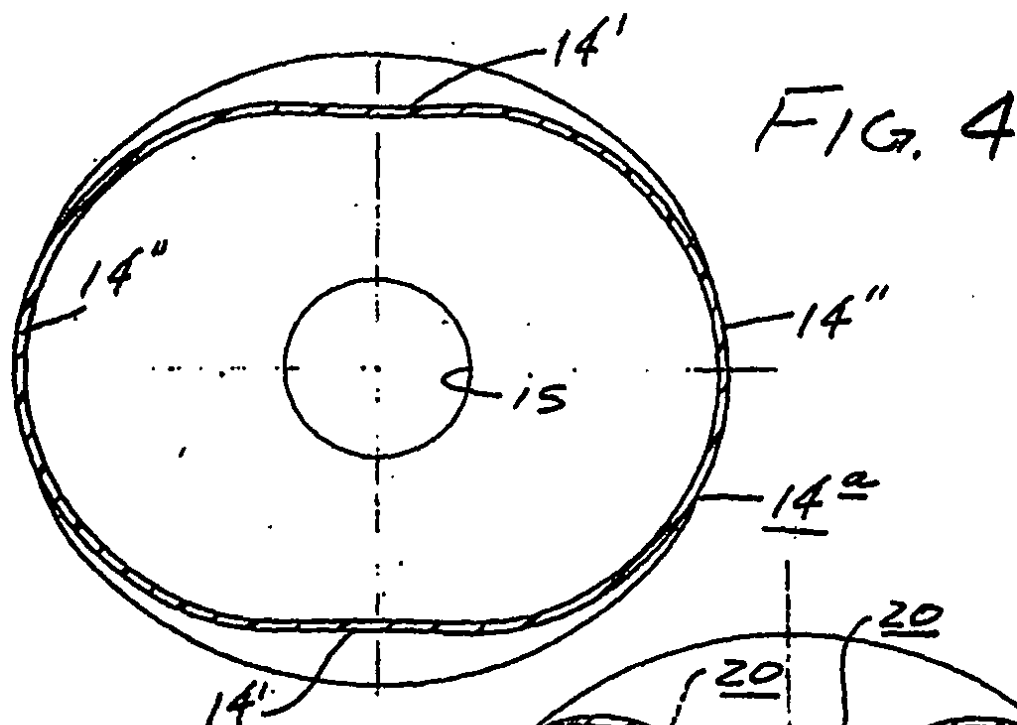


FIG. 5

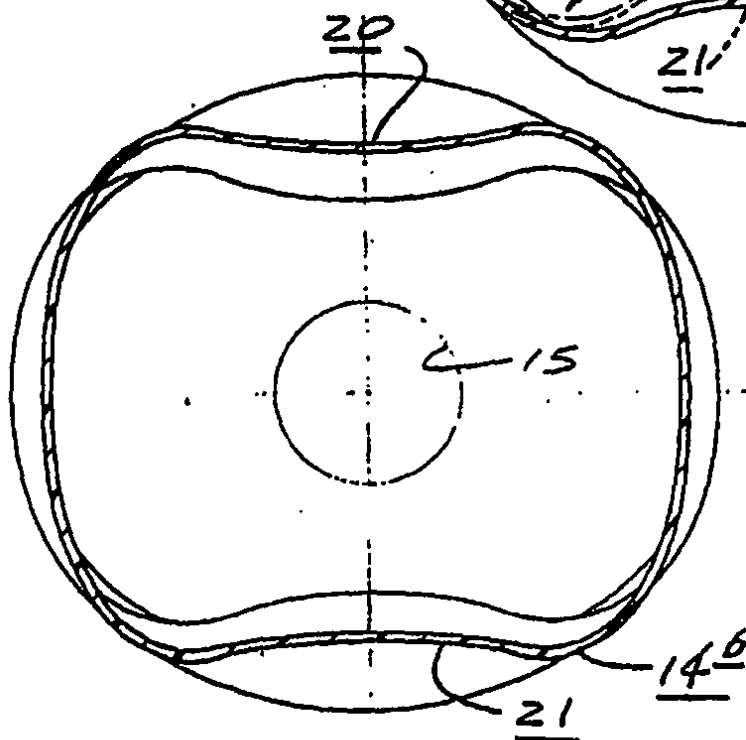
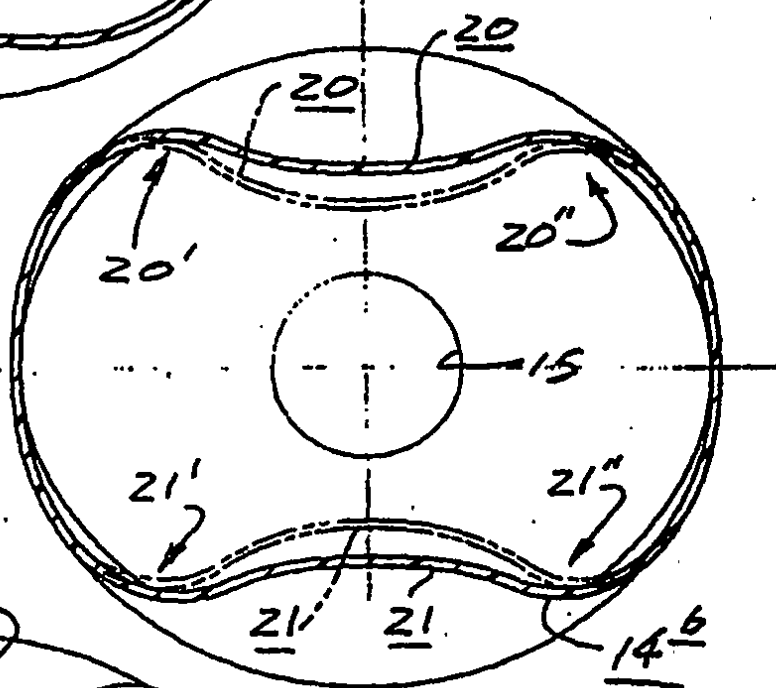


FIG. 6

FIG. 7

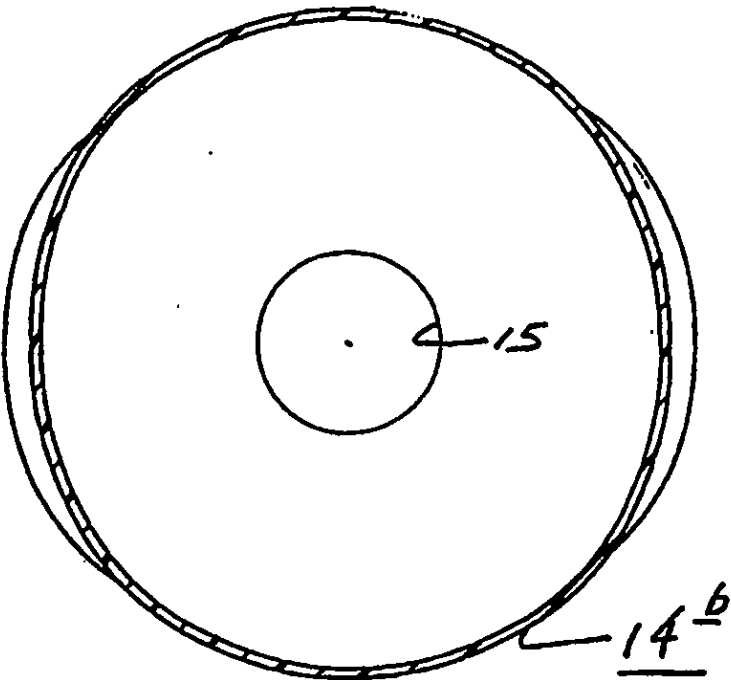


FIG. 8

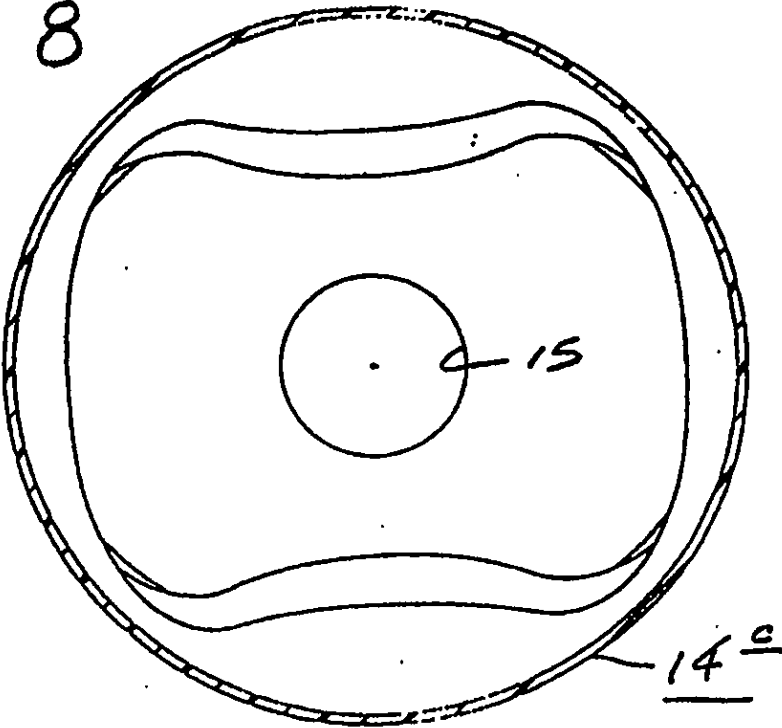


FIG. 9

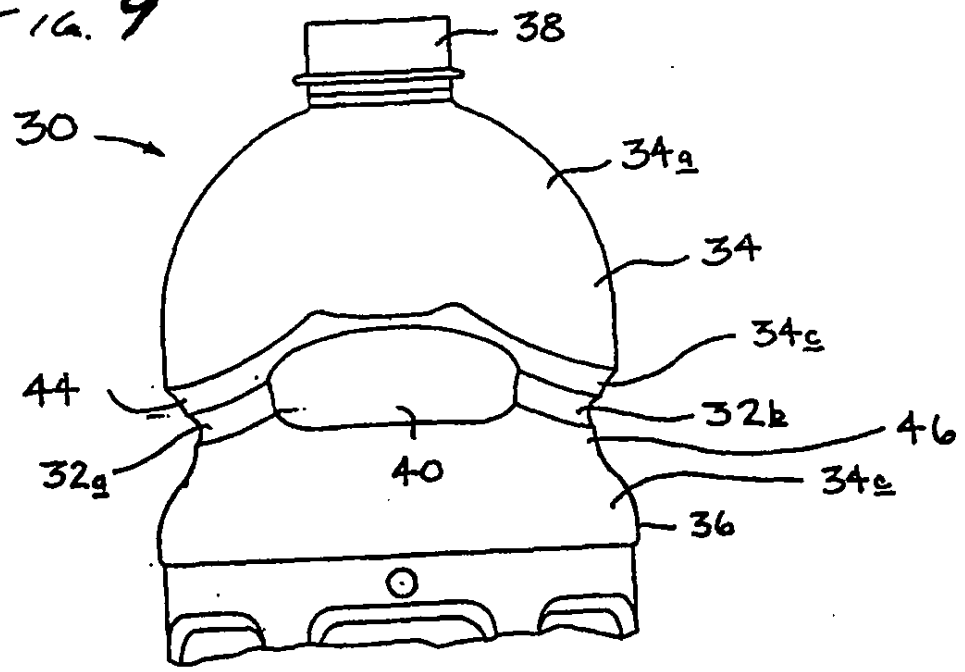
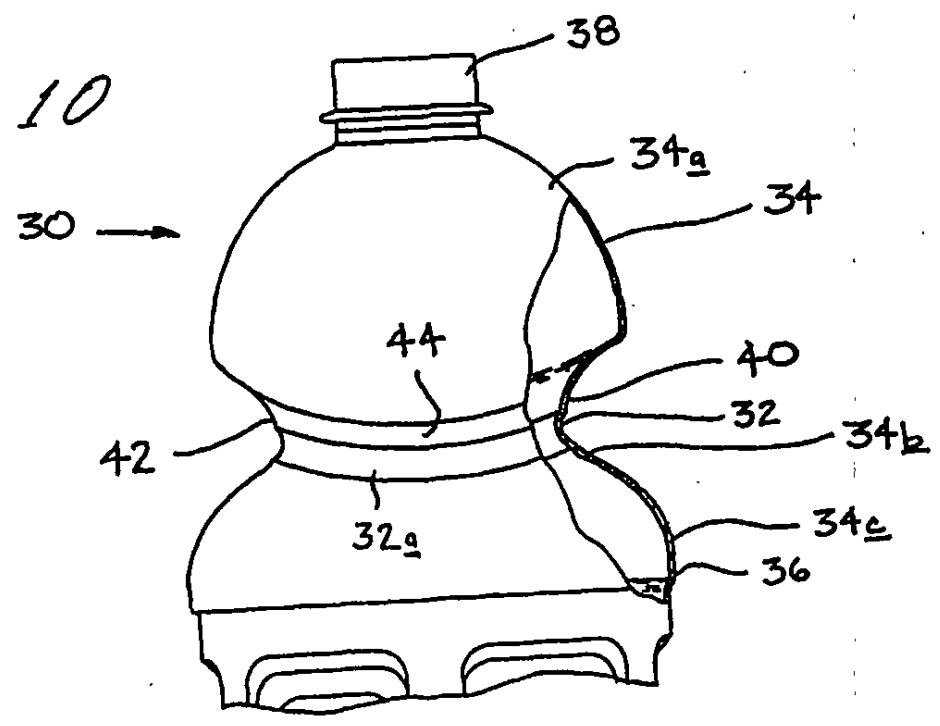


FIG. 10



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/12883

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :B65D 1/42; B65D 23/10

US CL :D9/542, 215/382, 11.3, 11.1; 220/504

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : D9/542, 215/382, 11.3, 11.1; 220/504

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X — Y	US DES. 398,538 (FUQUEN ET AL.) 22 SEPTEMBER 1998, SEE THE FIGURES	1-4, 6-13, 27-30,32,3 3,34,36-40 14-17, 19-25,31,35,41
X — Y	US 5,224,614 A (BONO ET AL.) 06 JULY 1993, SEE THE FIGURES	1-4,7-9, 27-29 14,41
Y	US 5,178,289 A (KRISHNAKUMAR ET AL.) 12 JANUARY 1993, SEE ENTIRE DOCUMENT	5, 18, 26
Y	US DES. 387,279 A (EMRE ET AL.) 09 DECEMBER 1997, SEE THE FIGURES	1-41



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

27 JULY 1999

Date of mailing of the international search report

19 AUG 1999

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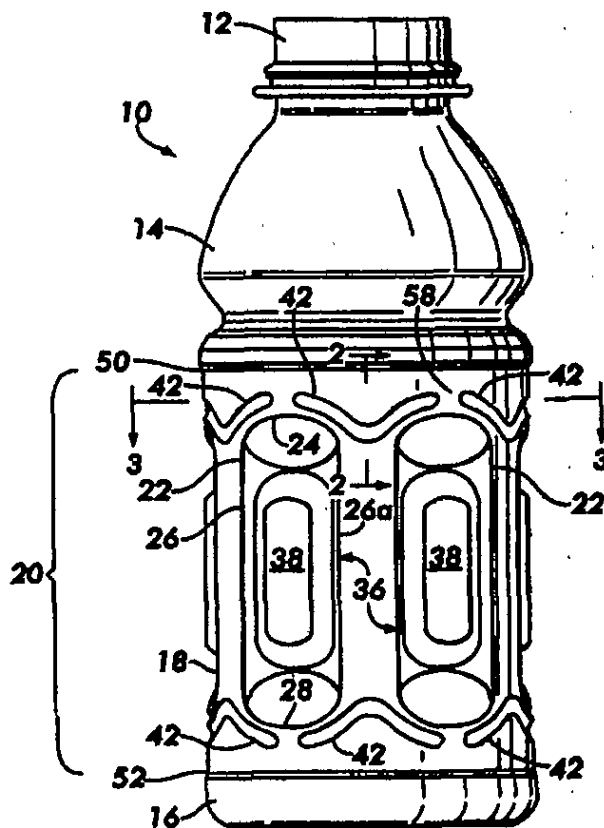
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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		(43) International Publication Date: 11 November 1999 (11.11.99)
(21) International Application Number: PCT/US99/09126 (22) International Filing Date: 28 April 1999 (28.04.99) (30) Priority Data: 09/071,752 1 May 1998 (01.05.98) US (71) Applicant: CROWN CORK & SEAL TECHNOLOGIES CORPORATION [US/US]; 11535 South Central Avenue, Alsip, IL 60803 (US). (72) Inventor: EBERLE, Theodore, F.; Apartment 1702, 800 South Wells Street, Chicago, IL 60607 (US). (74) Agent: HEIST, Dale et al.; Woodcock Washburn Kurtz Macdonald & Norris LLP, 46th floor, One Liberty Place, Philadelphia, PA 19103 (US).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published With international search report.

(54) Title: HOT FILL PLASTIC CONTAINER HAVING SPACED APART ARCHED RIBS

(57) Abstract

The present invention provides an improved blow molded plastic container (10) that is adapted for hot fill applications. The hot fill container (10) of the present invention comprises a plurality of vacuum panels (22), having substantially arched upper (24) and lower ends (28), as opposed to the substantially straight upper and lower ends as described in the related art. The hot fill container (10) of the invention further comprises novel and unique vacuum panel reinforcement means. The vacuum panel reinforcement means are a series of arched ribs (42). One series of ribs is placed in the label mounting area (50) above the vacuum panels (22) and one series of ribs is placed in the label mounting area (52) below the vacuum panels (22). The ribs (42) extend noncontinuously around the circumference of the body (18) of the plastic container and are spaced apart from each other by a land area (58). Each rib (42) is also spaced apart from the vacuum panel (22) and is centered over a land area (58) between vacuum panels. The hot fill bottle of the invention is particularly adapted to minimize the stress placed on the corners of vacuum panels and to resist flexing when the container is filled with a hot liquid.



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HOT FILL PLASTIC CONTAINER HAVING SPACED APART ARCHED RIBS

BACKGROUND OF THE INVENTION

5 This application is a continuation-in-part of application Serial No. 29/080,237, filed on December 5, 1997 in the name of Eberle, now pending.

1. Field of the Invention

This invention relates to hot fill plastic containers, and more particularly, to such containers having an improved label mount area in the body portion.

10 2. Description of the Related Technology

The use of blow molded plastic containers for packaging "hot fill" beverages is well known. However, a container that is used for hot fill applications is subject to additional mechanical stresses on the container that result in the container being more likely to fail during storage or handling. For example, it has been found that the thin
15 sidewalls of the container deform or collapse as the container is being filled with hot fluids. In addition, the rigidity of the container decreases immediately after the hot fill liquid is introduced into the container. As the liquid cools, the liquid shrinks in volume which, in turn, produces a negative pressure or vacuum in the container. The container must be able to withstand such changes in pressure without failure.

20 As described in U.S. Patent No. 5,337,909, hot fill containers typically comprise substantially rectangular vacuum panels that are designed to collapse inwardly after the container has been filled with hot liquid. However, the inward flexing of the panels caused by the hot fill vacuum creates high stress points at the top and bottom edges of the pressure panels, especially at the upper and lower corners of the panels. These stress points
25 weaken the portions of the sidewall near the edges of the panels, allowing the sidewall to collapse inwardly during handling of the container or when containers are stacked together.

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The hot-fill container disclosed in U.S. Patent No. 5,337,909 has annular reinforcement ribs that extend continuously around the circumference of the container sidewall. It is stated that the reinforcement ribs support the vacuum panels at their upper and lower edges, holding the edges fixed, while permitting the center portions of the vacuum panels to flex inwardly while the bottle is being filled and to resist deformation of the vacuum panels subsequent to inward flexing of the vacuum panels due to filling and sealing of the container. Figures 5 and 6 depict an embodiment wherein the reinforcement ribs merge with the edges of the vacuum panels at the edge of the label upper and lower mounting panels.

10 Another hot-fill container having reinforcement ribs is disclosed in WO 97/34808. The container described in 97/34808 comprises a label mounting area having an upper and lower series of peripherally spaced, short, horizontal ribs separated endwise by label mount areas. It is stated that each upper and lower rib is located within the label mount section and is centered above or below, respectively, one of the lands. The container further comprises several rectangular vacuum panels that also experience high stress point at the corners of the collapse panels. It is further stated that the ribs stiffen the container adjacent lower corners 46 of the collapse panels 28.

20 It is an object of the present invention to provide a hot-filled, blow molded, plastic container which provides improved vacuum panels that minimize the stress points on the corners of the vacuum panels, by substantially removing these stress points, and thereby provide lower failure rates.

It is another object of the invention to provide a hot fill bottle having vacuum panels with sufficient reinforcement and support means.

25 It is another object of the invention to provide a hot fill bottle that maximizes the areas of contact between the label and the label mounting areas.

SUMMARY OF THE INVENTION

The present invention provides an improved blow molded plastic container that is adapted for hot fill applications. In hot fill applications, the plastic container is filled with a liquid that is above room temperature and then sealed so that the cooling of the liquid creates a reduced volume in the container. The preferred hot fill container of the present

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invention comprises a plurality of vacuum panels, having substantially curved upper and lower ends, as opposed to the substantially straight upper and lower ends as described in the related art. The preferred hot fill container of the invention further comprises novel and unique vacuum panel reinforcement means. The vacuum panel reinforcement means are a plurality of curved ribs. Preferably, the ribs are substantially identical to each other, and at least one series of ribs is placed in the label mounting area above the vacuum panels and/or at least one series of ribs is placed in the label mounting area below the vacuum panels. The ribs extend noncontinuously around the circumference of the body of the plastic container and are spaced apart from each other by a land area. Each rib is also spaced apart from the vacuum panel and is centered over a land area between vacuum panels. Preferably, each rib is substantially arched.

The hot fill bottle of the invention is particularly adapted to minimize the stress placed on the corners of vacuum panels and to resist flexing when the container is filled with a hot liquid. The substantially straight upper and lower ends of the vacuum panels of the related art create high stress at the corners of the vacuum panels that frequently result in failure of the container during storage or use. The novel structure of the container of the invention, including the unique structure of the vacuum panels combined with novel reinforcement means, reduces the stress placed on the corners of the vacuum panels when the panels are flexed inwardly during filling and cooling and provide additional support to the panels to resist flexing and deformation due to sealing of the container. The arched ribs of the container also provide additional support to the vacuum panels at their upper and lower edges. In addition, the novel design of the hot fill container also provides for additional areas on the label mounting area for receiving an adhesive or for contact with a shrink wrap label, thereby improving the process for applying a label to the container.

These and various other advantages and features of novelty which characterize the invention are pointed out with particularity in the claims annexed hereto and forming a part hereof. However, for a better understanding of the invention, its advantages, and the objects obtained by its use, reference should be made to the drawings which form a further part hereof, and to the accompanying descriptive matter, in which there is illustrated and described a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is an elevational view of a container having ribs in accordance with the present invention;

FIGURE 2 is a cross section taken along line 2-2 of Figure 1;

5 FIGURE 3 is a cross section taken along line 3-3 of Figure 1;

FIGURE 4 is an enlarged view of the label portion of a container of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A thin-walled container in accordance with the present invention is intended to be
10 filled with a liquid at a temperature above room temperature. According to the invention, a container may be formed from a plastic material such as polyethylene terephthalate (PET) or polyester. Preferably, the container is blow molded. The container can be filled by automated, high speed, hot-fill equipment known in the art.

Referring now to the drawings, a preferred embodiment of the container of this
15 invention is indicated generally at 10, as shown in FIG. 1, as generally having many of the well known features of hot-fill bottles. The container (10) has a longitudinal axis (40) when the container is standing upright on its base. The container comprises a closable neck (12) for filling and dispensing fluid. Neck (12) also is sealable. The preferred container further comprises base (16) and at least one shoulder (14) located below neck
20 (12) and above base (16). The preferred container of the present invention also has a body (18) of generally circular cross section that connects shoulder (14) and base (16). The body of the preferred container has a label mounting area (20) that is located between upper label bumper (50) and lower label bumper (52). A label can be applied to the label mounting area using methods that are well known to those skilled in the art, including
25 shrink wrap labeling and adhesive methods. As applied, the label extends around the entire body of the container.

The label mount area of the preferred container comprises a plurality of identical, space-apart vertically elongate vacuum panels (22). The vacuum panels permit the bottle to flex inwardly upon filling with the hot fluid, sealing, and subsequent cooling. The
30 number of vacuum panels is variable, although six panels generally are preferred.

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Preferably, the vacuum panel is substantially ellipsoidal in shape and has a curved upper edge (24), a curved lower edge (28), substantially straight side edges (26) and (26a), and a panel portion (38) that is intermediate the upper and lower edges. Preferably, the upper and lower edges of the vacuum panels are substantially arched. Adjacent vacuum panels are spaced apart from each other by land area (36). The upper edges of the vacuum panels are spaced apart from the upper label bumper (50) (or the upper label mount area) and the lower edges of the vacuum panels are spaced apart from the lower label bumper (52) (or the lower label mount area). The vacuum panels are covered by the label once it is applied to the container.

10 The label mount area of the preferred container further comprises reinforcement means for providing support to adjacent vacuum panels after the container is filled with hot fluid. The reinforcement means include a plurality of curved ribs, and preferably, at least one series of upper and/or lower arched ribs (42). Preferably, a plurality, or more preferably one series of ribs, is located in the upper label mount area between the upper edge of the vacuum panels and the upper label bumper. The remainder of the ribs, or another series of ribs, is located in the lower label mount area between the lower edge of the vacuum panels and the lower label bumper. Each rib extends longitudinally around the circumference of the body of the container and is spaced apart from an adjacent rib by land area (58). The ribs are also spaced apart from the upper and lower edges of the vacuum panels, respectively, and are placed proximate to land area (36). Preferably, the ribs are centered so that the peak of the arched rib is centered over land area (36). The ribs of each series are noncontinuous, i.e., they do not touch each other. Nor do they form a ring around the body of the container.

25 As shown in FIG. 1, in a preferred embodiment there are six vacuum panels, six land areas (36), six upper arched ribs, and six lower arched ribs. Of course, the number of arched ribs may vary, although it is preferred that the length and configuration of each rib is substantially identically to that of the remaining ribs of the series.

30 As shown in FIG. 2, the ribs preferably have a generally semi-circular cross section and may be directed radially inward toward longitudinal axis (40) or outward (away from longitudinal axis (40)), with radially inward being preferred. In a preferred embodiment and as depicted in FIG. 1, the contour of at least a portion of the rib is

substantially similar to at least a portion of the contour of the adjacent vacuum panels. Therefore, the contour of each series of ribs appears to be generally scalloped.

For a twenty ounce plastic container having an outer diameter of approximately 72 mm and as depicted in FIG. 4, the vertical length of the label area is approximately 96 mm and the vertical length of the vacuum panels is approximately 75 mm.

As depicted in FIG. 4, the radius of the cross section of each of the arched ribs is about 1.8 mm. The depth of the cross section of each arched rib is approximately 1 mm. The length of each arched rib from end to end is about 32.2 mm. The width of an arched rib, *i.e.*, the dimension of the rib from top edge to bottom edge, is approximately 4 mm.

As shown in FIG. 4, for the upper series of ribs, the end of each arched rib is spaced from the upper edge of the upper bumper area by a distance of about 3.5 mm. For the lower series of ribs, the end of each arched rib is spaced from the lower edge of the lower bumper area by a distance of about 3.5 mm. The distance from the peak of an arch to the edge of the adjacent bumper area is about 15.7 mm. The gap between the vacuum panels and the arched ribs is approximately 2.5 mm.

The center or peak of each arched rib is located about 38 mm from the center or peak of the adjacent arched rib. The distance between arched ribs, from the end of one to the end of the adjacent rib, (*i.e.*, the length of land area (58)) is approximately 5.9 mm.

Of course, the curved ribs of the invention may take many different forms. For example, the curved ribs may be substantially round, horseshoe, lancet, ogee, trefoil, basket-handle, or Tudor shaped arches or the like. The radius of the point or center of the arch may also vary. For example, the radius may vary from greater than about 10 to less than about 100 mm, preferably between about 10 and 50 mm, even more preferably between about 10 to 30 mm.

The above is offered by way of example only, and the size of the reinforcement rib is a function of the size of the container, and would be increased from the values given in proportion to an increase in the dimensions of the container from the dimensions given for container (10).

In a preferred embodiment, the elevation of the land area (58) between the arched ribs is substantially similar to the elevation of the land area (36) between the vacuum panels and is also substantially similar to an elevation located in the intermediate panel

portion (38). This is to provide additional areas for receiving and adhering a label during the label application process.

Thus, the present invention provides a hot-fill bottle which has improved vacuum panels and reinforcement ribs that resist deformation. The novel structure of the hot fill bottle minimizes the stress points on the corners of the vacuum panels. This advantage is achieved by providing the container with a label mount area having vacuum panels with upper and lower edges that are substantially arched (as opposed to substantially straight) in combination with reinforcement ribs that are also substantially arched. The novel structure of the hot-fill container of the present invention provides the vacuum panels with additional resistance to flexing and deformation, thereby minimizing the likelihood of container failure during storage and use.

It is to be understood, however, that even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the disclosure is illustrative only, and changes may be made in detail, especially in matters of shape, size and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

WHAT IS CLAIMED IS:

1. A thin walled, hot-fillable, plastic container for containing a liquid filled initially in a hot state and then sealed, the container having a longitudinal axis and comprising,
 - 5 a closable neck,
 - at least one shoulder below the neck,
 - a base,
 - and a body connecting the shoulder and the base and having a label mount area,
 - 10 the label mount area comprising a plurality of spaced-apart vertically elongate vacuum panels with an upper edge and a lower edge and a panel portion intermediate said upper edge and said lower edge, adjacent vacuum panels being spaced apart from each other by a first land area located therebetween, the upper edges of vacuum panels being spaced
 - 15 apart from an upper label mount area, the lower edges of the vacuum panels being spaced apart from an lower label mount area,
 - said label mount area further comprising a plurality of arched ribs, said ribs extending noncontinuously around the circumference of said body and being spaced apart from each other by a second land area, being
 - 20 spaced apart from said vacuum panels, and being positioned proximate to said first land area.
2. The container of claim 1 where each rib is directed radially inward.

- 221 38
3. The container of claim 1 where each rib is directed radially outward.
 4. The container of claim 1 wherein the contour of at least a portion of said rib is substantially similar to at least a portion of the contour of the adjacent vacuum panel.
 5. The container of claim 1 wherein said label mount area comprises an upper and lower series of ribs and wherein the contour of each series of ribs is substantially scalloped.
 6. The container of claim 1 wherein said ribs are substantially semi circular in cross section.
 7. The container of claim 1 wherein an elevation of said second land area between said ribs is substantially similar to an elevation of said first land area between said vacuum panels and to an elevation located in said intermediate panel portion, such that there is provided additional areas for receiving a label.
 8. The container of claim 1 wherein the vacuum panels are substantially elliptical.
 9. The container of claim 1 wherein the upper and lower edges of the vacuum panels are substantially arched.
 10. The container of claim 1 further comprising a label extending around said container over said vacuum panels and secured to said container in said label mounting area.
 11. A thin walled, hot-fillable, plastic container for containing a liquid filled initially in a hot state and then sealed, the container having a longitudinal axis and comprising,

222 39

a closable neck,

at least one shoulder below the neck,

a base,

and a body connecting the shoulder and the base and having a label mount area,

the label mount area comprising a plurality of spaced-apart vertically elongate vacuum panels with an upper edge and a lower edge and a panel portion intermediate said upper edge and said lower edge, adjacent vacuum panels being spaced apart from each other by a first land area located therebetween, the upper edges of vacuum panels being spaced apart from an upper label mount area, the lower edges of the vacuum panels being spaced apart from an lower label mount area,

said label mount area further including an upper series of arched ribs, said ribs extending noncontinuously around the circumference of said body and being spaced apart from each other by a second land area, being spaced apart from said vacuum panels, and being positioned proximate to said first land area.

12. The container of claim 11 where each rib is directed either radially inward or outward .

13. The container of claim 11 wherein the contour of at least a portion of said rib is substantially similar to at least a portion of the contour of the adjacent vacuum panel.

14. The container of claim 11 wherein the vacuum panels are substantially elliptical.

15. The container of claim 11 wherein the upper and lower edges of the vacuum panels are substantially arched.

16. A thin walled, hot-fillable, plastic container for containing a liquid filled initially in a hot state and then sealed, the container having a longitudinal axis and
5 comprising,

a closable neck,

at least one shoulder below the neck,

a base,

10 and a body connecting the shoulder and the base and having a label mount area,

the label mount area comprising a plurality of spaced-apart vertically elongate vacuum panels with an upper edge and a lower edge and a panel portion intermediate said upper edge and said lower edge, adjacent vacuum panels being spaced apart from each other by a first land area
15 located therebetween, the upper edges of vacuum panels being spaced apart from an upper label mount area, the lower edges of the vacuum panels being spaced apart from an lower label mount area,

said label mount area further including a lower series of arched ribs, said ribs extending noncontinuously around the circumference of said body
20 and being spaced apart from each other by a second land area, being spaced apart from said vacuum panels, and being positioned proximate to said first land area.

- 224
17. The container of claim 16 where each rib is directed either radially inward or outward .
18. The container of claim 16 wherein the contour of at least a portion of said rib is substantially similar to at least a portion of the contour of the adjacent vacuum panel.
- 5 19. The container of claim 16 wherein the vacuum panels are substantially elliptical.
20. The container of claim 16 wherein the upper and lower edges of the vacuum panels are substantially arched.
-

225 *wt*

1/3

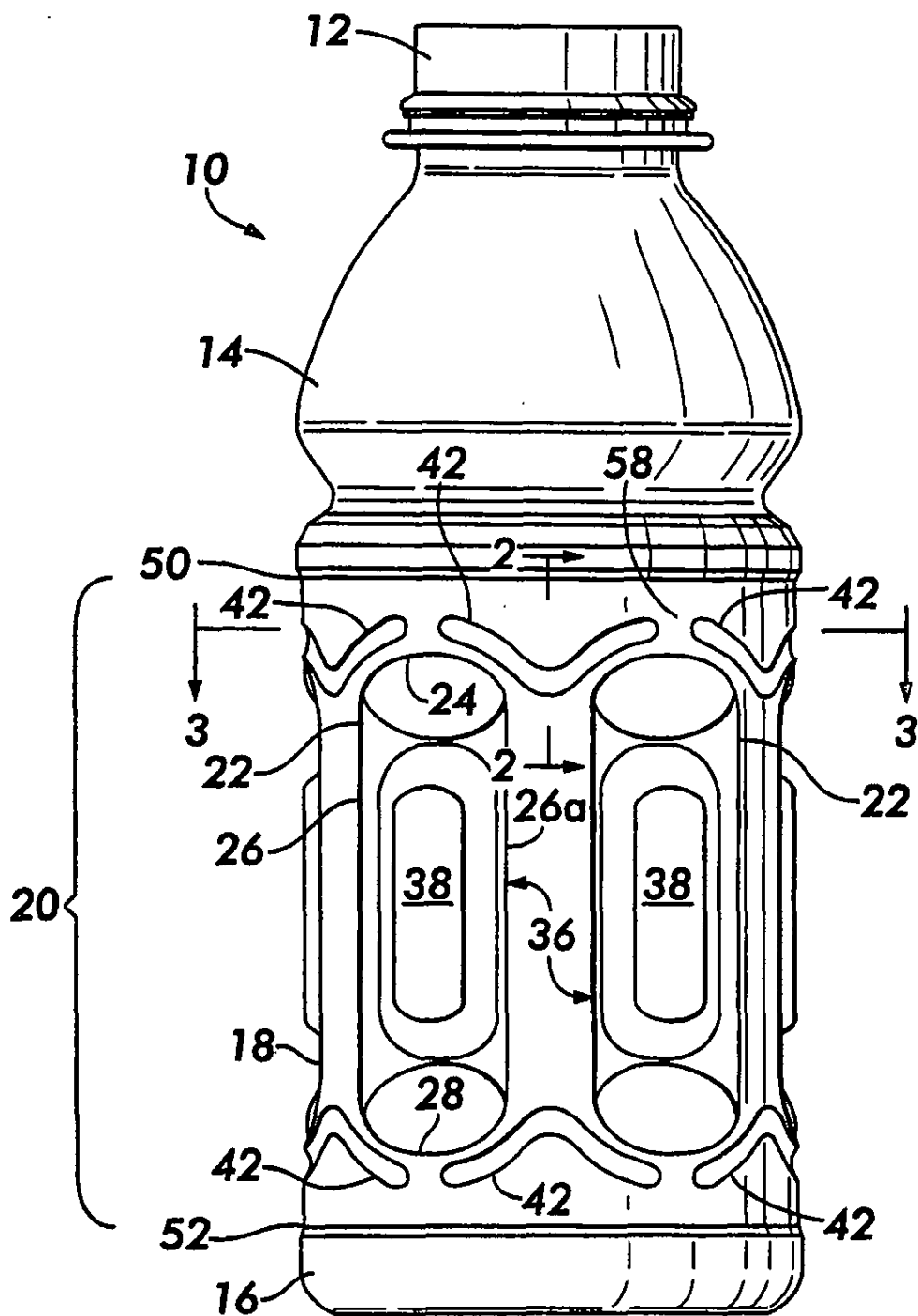


FIG. 1

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FIG. 2

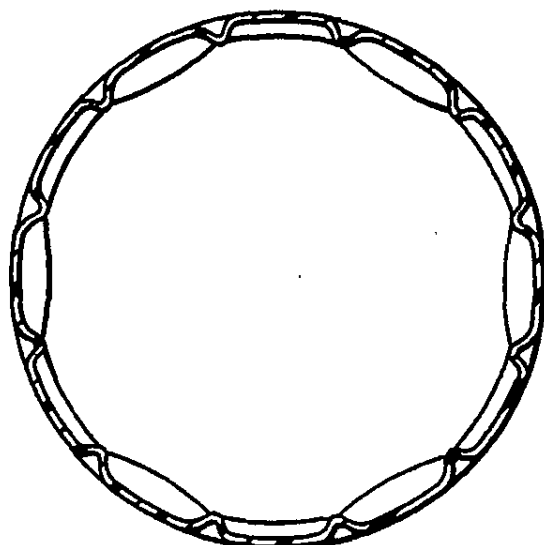


FIG. 3

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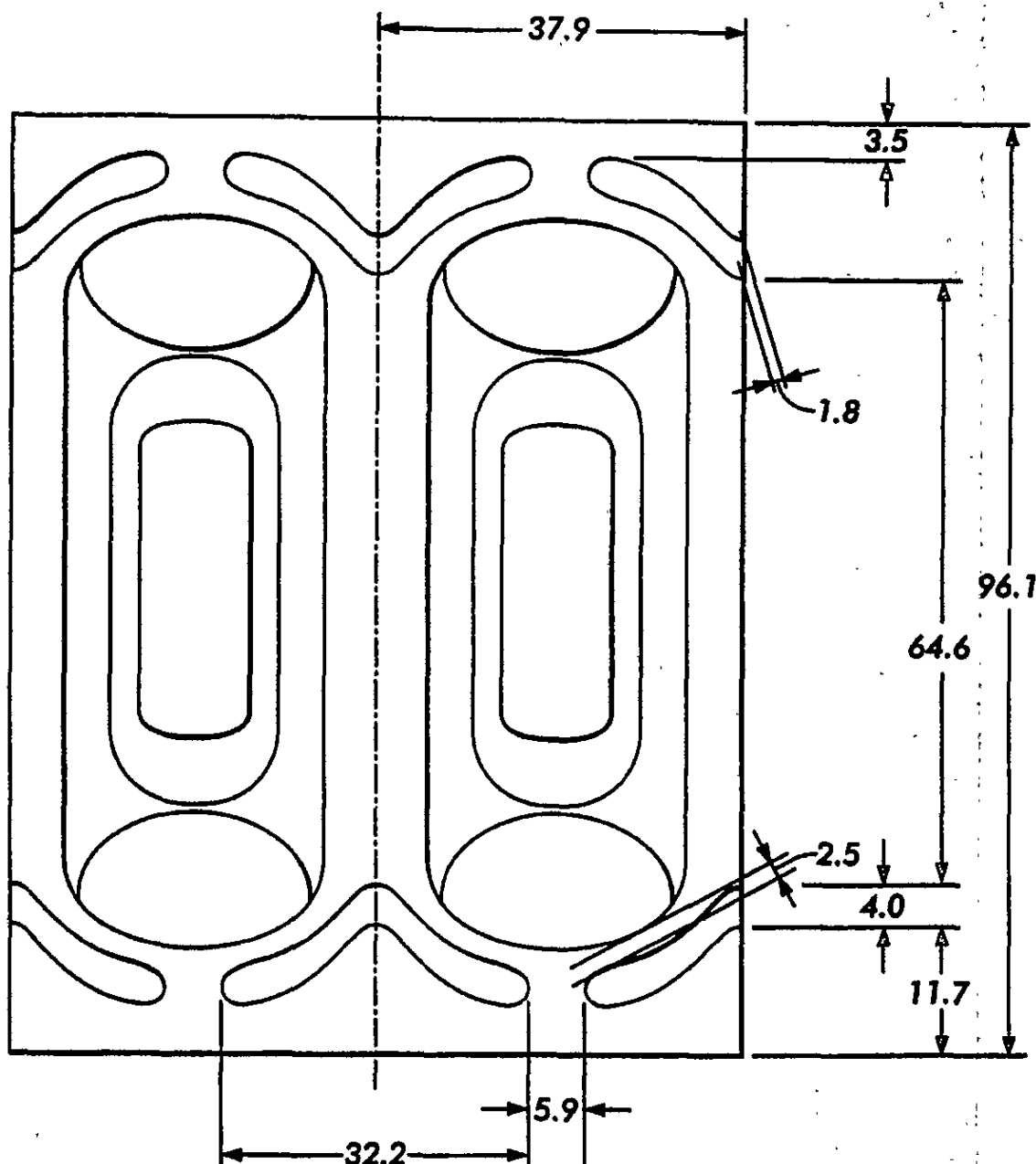


FIG.4

SUBSTITUTE SHEET (RULE 26)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/09126

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 86501/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 8650

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	WO 97 34808 A (GRAHAM PACKAGING CORP ;TOBIAS JOHN W (US)) 25 September 1997 (1997-09-25) cited in the application page 3, line 16 - page 4, line 20 page 5, line 6 - line 28 figures 1,2	1,2,5-8, 10-12, 14,16, 17,19 3,4,13, 18
Y	US 5 101 990 A (KRISHNAKUMAR SUPPAYAN M ET AL) 7 April 1992 (1992-04-07) column 1, line 34 - line 57 column 4, line 1 - line 39 figures 1-9	1,2,5-8, 10-12, 14,16, 17,19
	-/--	

☒ Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search

16 August 1999

Date of mailing of the international search report

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229 46

INTERNATIONAL SEARCH REPORT

In International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 341 946 A (VAILLIENCOURT DWAYNE G ET AL) 30 August 1994 (1994-08-30) column 1, line 36 - line 60 column 2, line 67 - column 3, line 50 column 4, line 61 - column 5, line 40 column 5, line 61 - column 6, line 18 figures 1-9 -----	1,9,15, 20

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int. National Application No
PCT/US 99/09126

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
W0 9734808	A	25-09-1997	CA	2248957 A	25-09-1997
US 5101990	A	07-04-1992	NONE		
US 5341946	A	30-08-1994	DE	69410867 D	16-07-1998
			DE	69410867 T	04-02-1999
			EP	0616949 A	28-09-1994
			ES	2122064 T	16-12-1998



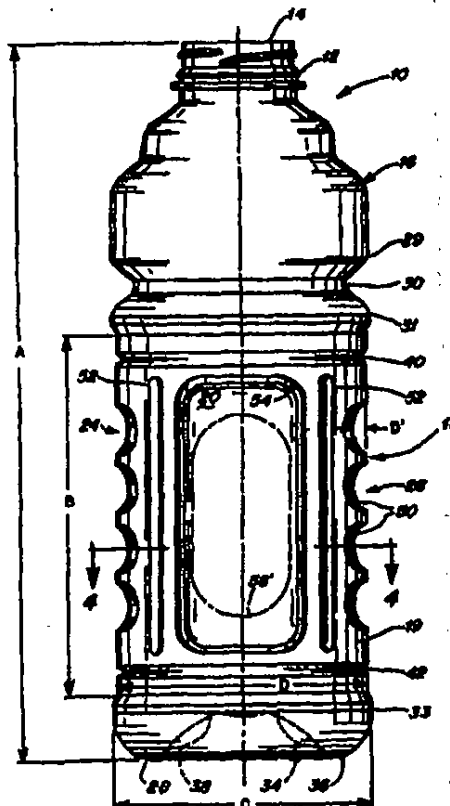
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/US98/22843		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).	
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(74) Agent: HENDRICKS, Therese, A.; Wolf, Greenfield & Sacks, P.C., 600 Atlantic Avenue, Boston, MA 02210 (US).			

(54) Title: HOT-FILLABLE PLASTIC CONTAINER WITH GRIPPABLE BODY

(57) Abstract

A hot-fillable plastic container having a panel section of a size suitable for gripping the container in one hand. The panel section includes two opposing vertically-elongated vacuum panels, and two opposing horizontally-disposed and radially-indented finger grips. Each vacuum panel preferably has an invertible central wall portion movable from a convex first position prior to hot-filling of the container, to a concave second position under vacuum pressure following hot-filling and sealing of the container.



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HOT-FILLABLE PLASTIC CONTAINER WITH GRIPPABLE BODY

Field of the Invention

The present invention relates to a hot-fillable plastic container having a panel section suitable for gripping the container in one hand.

5 Background of the Invention

The packaging of certain liquids requires that they be placed in a container while hot to provide for adequate sterilization. Hot-filled containers are designed for this purpose. During filling, the container is subjected to elevated temperatures on the order of 82°C (the product temperature) or higher. The container is then capped and as the product cools, a negative
10 internal pressure is formed in the sealed container.

Biaxially-oriented polyethylene terephthalate (PET) beverage bottles have been designed to receive a hot-fill product with a minimum of thermal shrinkage and distortion. One such bottle is described in U.S. Patent No. 4,863,046 entitled "Hot Fill Container," which issued September 5, 1989 to Collette et al. The Collette et al. container has six recessed vacuum panels
15 in the middle panel section of the container. The panels reduce the magnitude of the vacuum generated in the filled and capped container to prevent any large uncontrolled shape distortion. As the product cools, the vacuum panels (all of them) deform and move inwardly in unison. A wrap-around label covers the vacuum panels and is supported by raised central wall portions in the vacuum panels, post areas between the vacuum panels, and horizontal glue land areas above
20 and below the vacuum panels. Longitudinal (vertical) recessed ribs may be provided in the post areas and raised wall portions in the vacuum panels to increase the longitudinal stiffness of the panel section.

The design of the vacuum panels may vary; other designs are illustrated in: 1) U.S. Design Patent 315,869, "Container Body for Liquids Or The Like," April 2, 1991 to
25 Collette; 2) U.S. Patent 5,255,889, "Modular Mold," October 26, 1993 to Collette et al; 3) U.S. Patent 5,178,289, "Panel Design For A Hot-Fillable Container," January 12, 1993 to Krishnakumar et al.; and 4) U.S. Patent 5,303,834, "Squeezable Container Resistant To Denting," April 19, 1994 to Krishnakumar et al.

Providing a container with a gripping portion to facilitate handling has become
30 increasingly popular in recent years. Generally, it is not sufficient to simply add a gripping

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portion to the container; rather, the container design and/or wall thickness needs to be modified to strengthen the container walls and control the amount of deformation which occurs when the container is grasped. Increasing the container wall thickness is undesirable as this leads to a substantial increase in the amount of material and thus cost of the container. These increased costs are unacceptable in the extremely competitive container industry. Thus, as the demand for grippable bottles has continued to grow, especially in the soft-drink and sports-drink industries, new and improved designs that retain their shape when firmly grasped are required.

Summary of the Invention

10 The present invention is directed to a hot-fillable plastic container having a grippable panel section.

 In a first embodiment, the panel section includes a panel wall having two vertically-elongated and radially-indented vacuum panels, and two sets of horizontally-disposed and radially-indented finger grip portions. Each vacuum panel has an invertible central wall portion movable from a convex first position prior to hot-filling of the container, to a concave second position under vacuum pressure following hot-filling and sealing of the container. Preferably a pair of vertically-elongated and radially-indented ribs are provided in the panel wall, adjacent either side of each vacuum panel, which act as hinge points to facilitate movement of the central wall portions. The inversion of the central wall portion from a convex to a concave configuration increases the amount of vacuum panel movement and thus alleviates sufficient vacuum pressure to enable the use of only two vacuum panels in the container. The hinge points further increase movement of the central wall portion to alleviate the vacuum in a container having only two vacuum panels.

 The panel wall diameter is selected to enable gripping in one hand. For example, a preferred range of panel diameter is 60-120mm (roughly 2.5-4.5 inches). The two opposing sets of finger grips, between the vacuum panels, enable the container to be readily grasped in one hand during use. The finger grips are a plurality of indented channels, each channel being configured to receive a finger or thumb of the user. The finger grip channels also provide resistance to bending of the panel in the hoop direction. The vertical ribs, disposed adjacent either side of the vacuum panels, isolate the vacuum panel movements from the finger grips. The vertical ribs also resist the longitudinal bending of the panel section.

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By providing alternating vacuum panels and finger grip portions about the circumference of the panel wall, there is effectively provided two alternative mechanisms for gripping the container. The first is the two sets of finger grips. The second alternative is the two vacuum panels, which have a concave central wall portion that enables gripping between the fingers and thumb of one hand. Providing two options for gripping is particularly desirable and convenient for the user. The concave vacuum panels generally provide a smaller span (width) than the finger grips, thus providing ease of gripping for two users with different sized hands.

These and other features and benefits of the present invention will be more particularly understood with regard to the following detailed description and drawings.

10

Brief Description of the Drawings

Fig. 1 is a front elevational view of a first embodiment of a hot-fillable container of this invention, showing one of two opposing vertically-disposed vacuum panels and a pair of vertical ribs adjacent either side of the vacuum panel.

15

Fig. 2 is a side elevational view of the container of Fig. 1, showing one of two opposing finger grip portions.

Fig. 3 is a bottom plan view of the base of the container.

Fig. 4 is an enlarged cross-sectional view of the panel section of the container of Fig. 1, taken along section line 4-4, showing the various positions of the vacuum panel as manufactured (solid lines) and the inward movement (following hot-filling and capping) to alleviate the negative pressure generated in the container (dashed lines).

20

Fig. 5 is a longitudinal sectional view of the container of Fig. 1 taken along line 5-5 of Fig. 4, showing a vertical rib which is radially indented from the panel diameter (dashed line).

25

Fig. 6 is a longitudinal sectional view of the container of Fig. 1 taken along line 6-6 of Fig. 4, showing a vacuum panel as molded which is radially indented from the panel diameter (outer dashed line), but having a convex central wall portion.

Fig. 7 is a side elevational view of a vacuum panel, showing the invertible central wall portion.

30

Fig. 8 is a cross-sectional view of the container showing a user holding the container at the opposing finger grip portions.

Fig. 9 is a cross-sectional view of the container showing a user holding the container at the opposing vacuum panels.

Detailed Description

5 Fig. 1 shows a particular embodiment of the present invention -- a 1.2 litre (40 oz) polyethylene terephthalate (PET) hot-fillable beverage bottle. The bottle 10 has an overall height A of about 206mm, a panel section height B of about 125mm, and an overall diameter C of about 92mm. The thickness of the container at the panel section B is on the order of 0.4mm.

The bottle is blow-molded from an injection molded preform (not shown), having
10 an upper threaded neck finish and a lower tube portion. During blowing, the preform is expanded and assumes the shape of an interior molding surface (not shown) to form a substantially transparent, biaxially-oriented bottle. The neck finish is not expanded and remains as the neck finish 12 of the bottle with an open mouth 14 for receiving a screw-on cap (not shown). The lower preform tube portion is expanded to form: (a) a shoulder section 16
15 increasing generally in diameter from the neck finish 12 to a substantially cylindrical panel section 18; (b) the panel section 18 including a pair of front and back vertically-elongated vacuum panels 20, 22, and right and left sets of horizontally-disposed finger grips 24, 26; and (c) a base 28.

A lower shoulder portion includes a radially-recessed hoop rib 30 between
20 enlarged diameter portions 29, 31. The hoop rib 30 helps prevent ovalization of the container (nonsymmetrical radial deformation caused by the negative pressure generated in the container during cooling of the hot-filled product). The enlarged portion 31 forms an upper bumper, just above the panel section 18. The base 28 includes an enlarged diameter lower bumper 33, and a central recessed dome portion 34 surrounded by a standing ring or chime 36. As is well-known
25 in the base design of hot-fillable containers, the dome includes biaxially-oriented elements 38 such that the dome moves inwardly to reduce the negative pressure generated during product cooling.

The panel section of height B extends between the upper and lower bumpers 31, 33 respectively. The upper and lower bumpers are of greater diameter than the panel wall 19.
30 The substantially cylindrical panel wall 19, having a diameter D of 88mm, includes upper and lower radially-indented hoop ribs 40, 42 disposed above and below the vacuum panels and finger

grips. These hoop ribs in the panel section are intended to prevent buckling of the panel section, when the vacuum panels move to alleviate the negative pressure.

As shown in horizontal cross-section in Fig. 4, the substantially cylindrical panel wall 19 includes the two opposing radially-recessed vacuum panels 20, 22 symmetrically disposed both with respect to a first vertical plane 44 and a second transverse vertical plane 46. This is desirable to provide symmetrical vacuum panel movement, and is particularly useful for smaller diameter containers, i.e., on the order of 4.5 inches (120mm) and smaller in diameter. Each vacuum panel is disposed between left and right sets of grip portions 24, 26. The grip portions each include four parallel, vertically-disposed, and radially-indented channels 50, each channel being horizontally-disposed and of a width adapted to receive a finger or thumb of the user. In this example, the width W of the channel is 18mm, the length L of the channel is 48mm, and the depth D' of the channel is 4mm. The vertical distance between channels is 23mm.

As shown in Fig. 4, a pair of vertical ribs are disposed adjacent the vertical side edges of each vacuum panel. These four vertical ribs 52 are symmetrically disposed about the circumference of the panel section. Each rib has a radial extent R of about 60°, and a depth D" of about 3.8mm.

Each vacuum panel 20, 22 includes a radially-recessed shoulder portion 54, forming a continuous boundary with the panel section 18. Inside the shoulder portion is a central invertible wall portion 56. The wall portion 56 as molded is convex (as viewed from the exterior of the container); this position is shown in solid lines in Fig. 4. Once the container is hot-filled and capped, the product begins to cool and generates a negative pressure inside the container. This causes the convex central wall portion to move radially inwardly, and adopt a first concave position 56' (as viewed from the outside of the container), shown in dashed lines in Fig. 4. To further alleviate the negative pressure, the entire vacuum panel 20, 22 and portions 58 of the panel wall 19 adjacent the vacuum panels, move radially inwardly (56", 58") as shown in dashed lines in Fig. 4. The vertical ribs 52 act as hinges which allow this further movement of the panel wall and vacuum panels, without undue distortion of the container. As described later and shown in Fig. 9, this final concave position 56" of the vacuum panel provides an alternative means of gripping the container.

The rectangular vacuum panel in the embodiment of Fig. 4 is 105mm in height and 47.7mm in width. A majority of this area (see Fig. 7) is available for inversion, other than

the stepped shoulder. In this embodiment, the vertical ribs 52 are disposed a circumferential distance of about 10mm from the side edges of the vacuum panel 20, 22.

Fig. 5 illustrates a longitudinal sectional view of one half of the container, showing the container profile in cross-section with one of the four vertical ribs 52. The rib 52 is
5 recessed from the panel diameter D, by a depth D", as previously described.

Fig. 6 shows another longitudinal sectional view through one of the vacuum panels 20. It illustrates in solid lines the original convex profile of the central wall portion 56, and the final concave profile 56" in dashed lines after filling and cooling. As previously described, this ability to invert the central wall portion of the vacuum panels increases the
10 amount of negative pressure which can be alleviated in the container, while utilizing only two vacuum panels. In addition, the inversion is reversible and once the container is opened by the customer, the vacuum panel wall portion 56 will revert to a convex profile. This may serve as a safety feature to notify the consumer that the container has not been opened since it was hot-filled and sealed by the beverage supplier.

Fig. 7 shows a front view of the invertible central wall portion 56 of the vacuum panel container 20 of Fig. 6. In this example, a large percentage (i.e., 60%) of the central wall portion has inverted.
15

Fig. 8 is a schematic cross-sectional view showing one of two mechanisms for gripping the container. In Fig. 8, a human hand 2 is shown with a thumb 3 engaging one hand
20 grip channel 50 on a first side of the container, and the four fingers 4 placed in each of the four channels 50 on the opposite side of the container. These channels have not been deformed in spite of the temperature/pressure conditions generated by the hot-filling and cooling process.

Fig. 9 shows an alternative mechanism for holding the container in one hand. In Fig. 9, the user's thumb 3 is placed in one convex vacuum panel portion 56", while the opposing
25 fingers 4 are placed in the other convex vacuum panel portion 56". This provides an alternative mechanism for holding the container in one hand, and a smaller grip scan (e.g., for a smaller hand).

The container may be made of any of the known polymer resins which provide good strength at elevated fill temperatures, such as polyesters, polyolefins, polycarbonates,
30 nitriles, and copolymers of the above, as well as other high-temperature polymers.

Phthalic acid polyesters based on terephthalic or isophthalic acid are commercially available and convenient. The hydroxy compounds are typically ethylene glycol

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and 1,4-di-(hydroxymethyl)-cyclohexane. The intrinsic viscosity for phthalate polyesters is typically in the range of 0.6 to 1.2, and more particularly 0.7 to 1.0 (for O-chlorophenol solvent). 0.6 corresponds approximately to a viscosity average molecular weight of 59,000 and 1.2 to a viscosity average molecular weight of 112,000. In general, the phthalate polyester may
5 include polymer linkages, side chains, and end groups not related to the formal precursors of a simple phthalate polyester. Conveniently, at least 90 mole percent will be terephthalic acid and at least 45 mole percent an aliphatic glycol or glycols, especially ethylene glycol.

Another useful polymer, with physical properties similar to PET, is polyethylene naphthalate (PEN). PEN provides higher thermal resistance and a 3-5X improvement in oxygen
10 barrier property (over PET), at some additional expense.

The container may be either a monolayer, or a multilayer construction, including layers of an oxygen barrier material such as ethylene vinyl alcohol or polyvinylidene chloride, and may include a layer of reprocessed scrap material, such as post-consumer or recycled PET.

The container may have a closure other than a screw threaded cap, such as a
15 slidable nozzle as used on sports bottles.

In this embodiment, a wrap-around or partial label may be applied to the shoulder portion 16; alternatively a shrink-wrap label may be applied around the panel section (which adopts the shape of the finger grips and vacuum panels).

Preferably the angular extent of each of the two vacuum panels is 50 to 90°, and
20 each finger grip 50-90°. The angular extent between the vacuum panel and finger grip is preferably 18 to 30°. The height of each vacuum panel is preferably at least 1.5 times the width of the vacuum panel.

The two vacuum panels are preferably symmetrically disposed about the panel circumference, i.e., their vertical center lines are 180° apart. However, there may be applications
25 where they are somewhat offset, e.g., 150-180°.

The container of the present invention may alternatively be described as a hot-fillable plastic container, having alternate panel sections and reinforcing sections, wherein the panel sections have an invertible central wall portion, movable from a convex first position prior to hot-filling of the container, to a concave section position under vacuum pressure following
30 hot-filling and sealing of the container. The reinforcing sections have two or more horizontal, radially-indented channels. The channels provide resistance to bending of the panel in the hoop

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direction. Preferably, the radially-indented channels are of a sufficient size and shape to also act as finger grips.

Although certain preferred embodiments of the invention have been specifically illustrated and described herein, it is to be understood that variations may be made without
5 departing from the spirit and scope of the invention as defined by the appended claims. For example, container sizes and shapes may be varied as well as the vacuum panel design. Thus, all variations are to be considered as part of the invention as defined by the following claims.

CLAIMS

1. A hot-fillable plastic container having a panel section configured to be gripped in one hand, the panel section including two opposing and vertically-elongated and radially-
5 indented vacuum panels, two opposing horizontally-disposed and radially-indented finger grips, each vacuum panel having an invertible central wall portion movable from a convex first position prior to hot-filling of the container to a concave second position under vacuum pressure following hot-filling and sealing of the container.
- 10 2. The container of claim 1, wherein the panel section includes a pair of vertically-elongated and radially-indented ribs adjacent either side of each vacuum panel which act as hinge points to facilitate movement of the central wall portions.
- 15 3. A hot-fillable plastic container having a panel section configured to be gripped in one hand, the panel section including two opposing horizontally-disposed and radially-indented finger grips which as as first gripping members, and two opposing vertically-elongated and radially-indented vacuum panels which act as alternative second gripping members.
- 20 4. A hot-fillable plastic container, having alternate vacuum panel sections and reinforcing sections, wherein the vacuum panel sections have an invertible central wall portion, movable from a convex first position prior to hot-filling of the container, to a concave second position under vacuum pressure following hot-filling and sealing of the container, and wherein the reinforcing sections have two or more horizontal radially-indented channels.
- 25 5. The container of claim 4, wherein the radially-indented channels are configured to act as a finger grip.
- 30 6. A hot-fillable plastic container having a panel section configured to be gripped in one hand, the panel section including two alternating vertically-elongated and radially-indented vacuum panels and two horizontally-disposed and radially-indented finger grips, each vacuum panel having an invertible central wall portion movable from a convex first position prior to hot-filling of the container to a concave second position under vacuum pressure following hot-filling and sealing of the container.

7. The container of claim 6, wherein the finger grips are a vertical arrangement of horizontal channels, each channel being configured to receive a finger.

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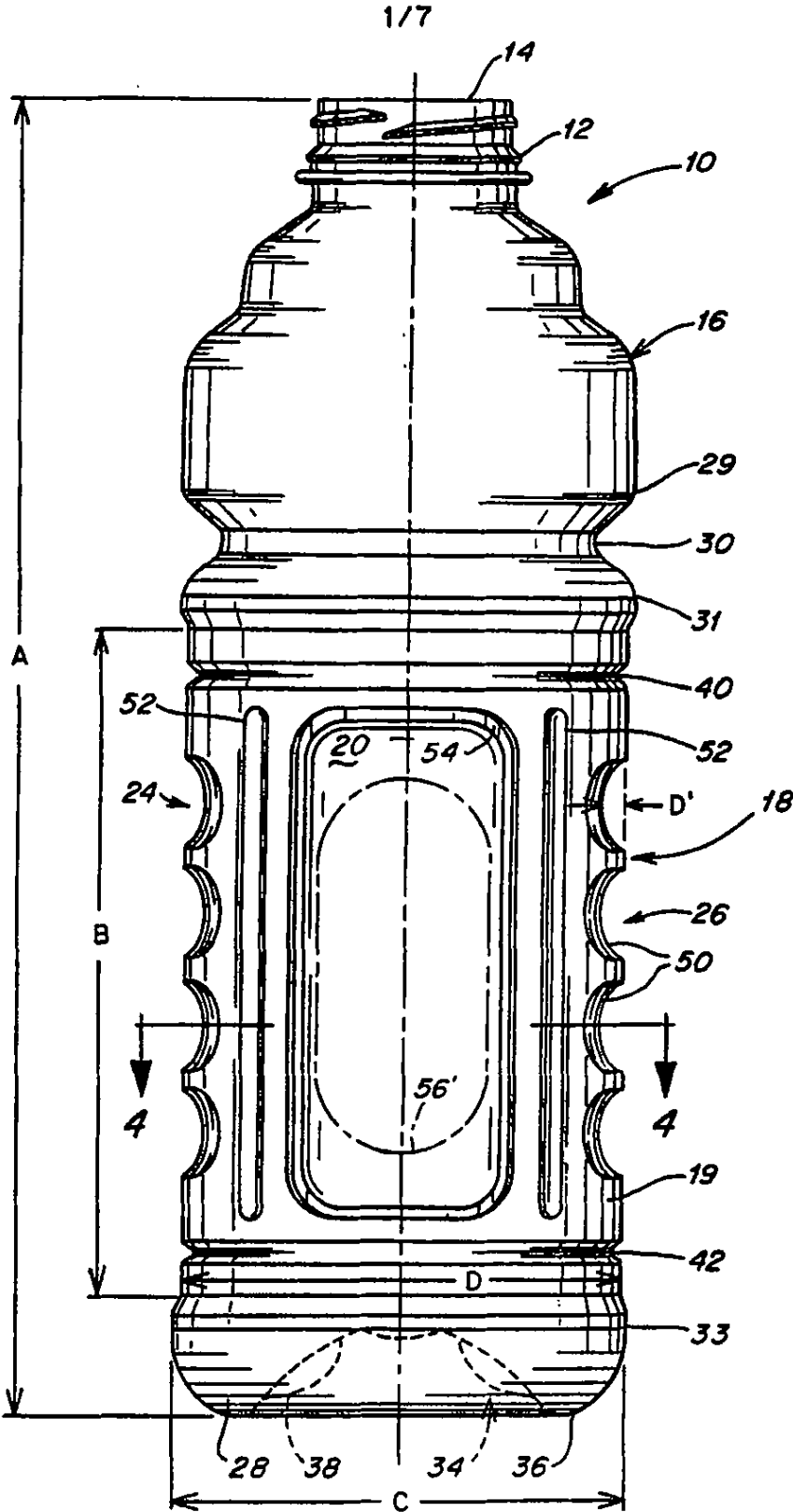


Fig. 1

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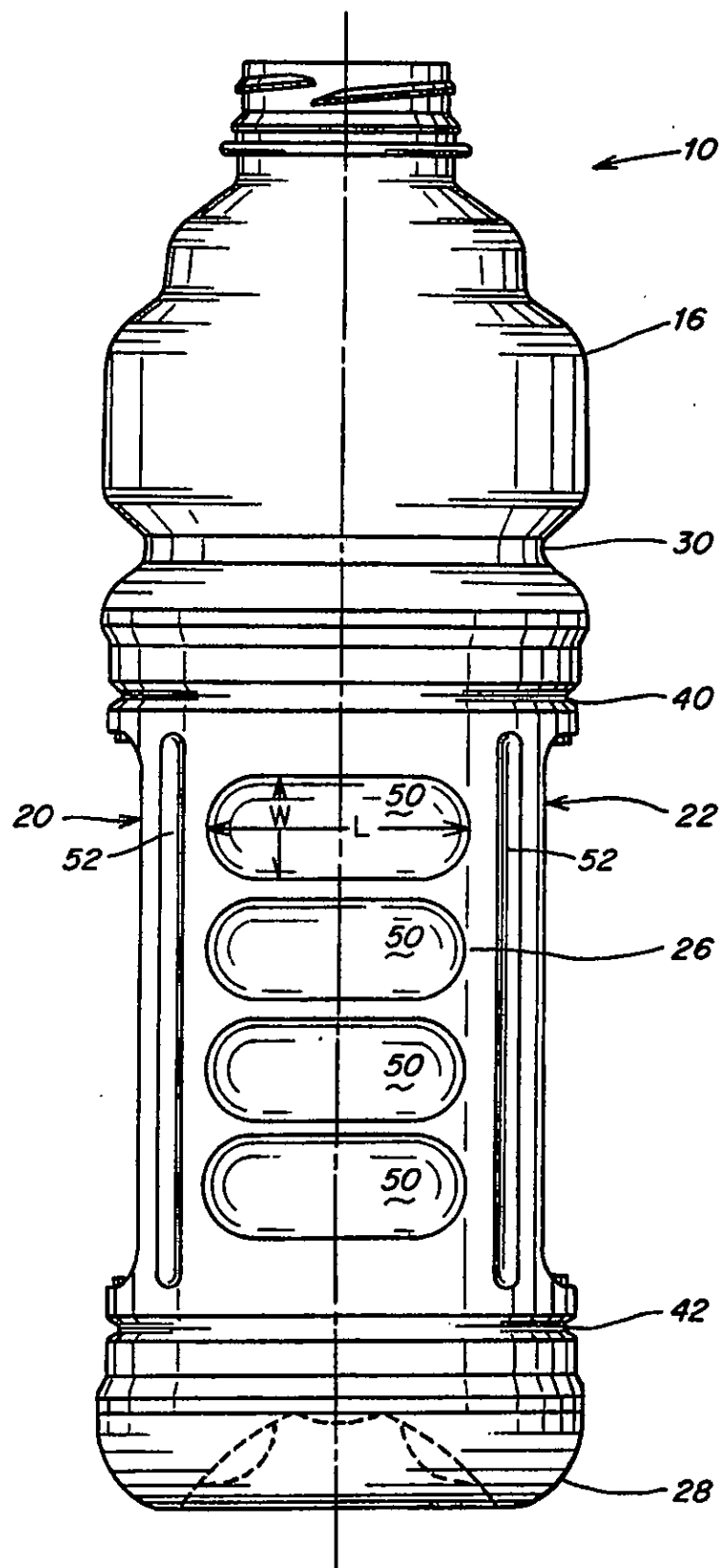


Fig. 2

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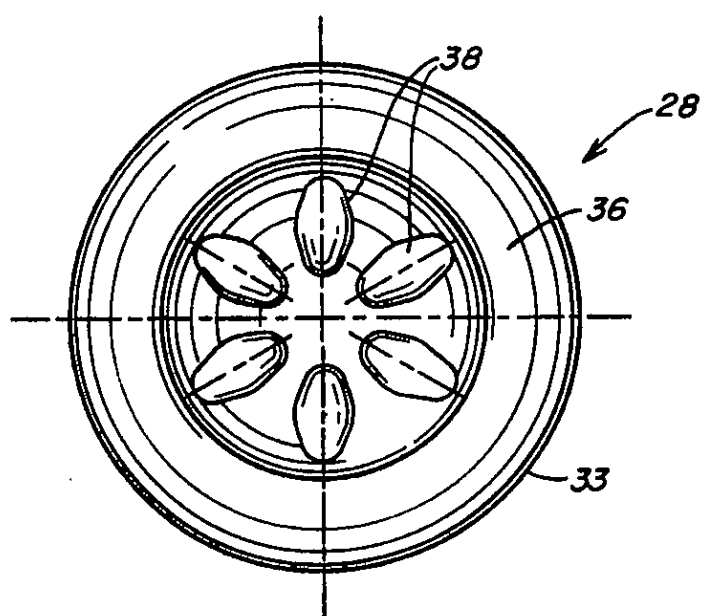


Fig. 3

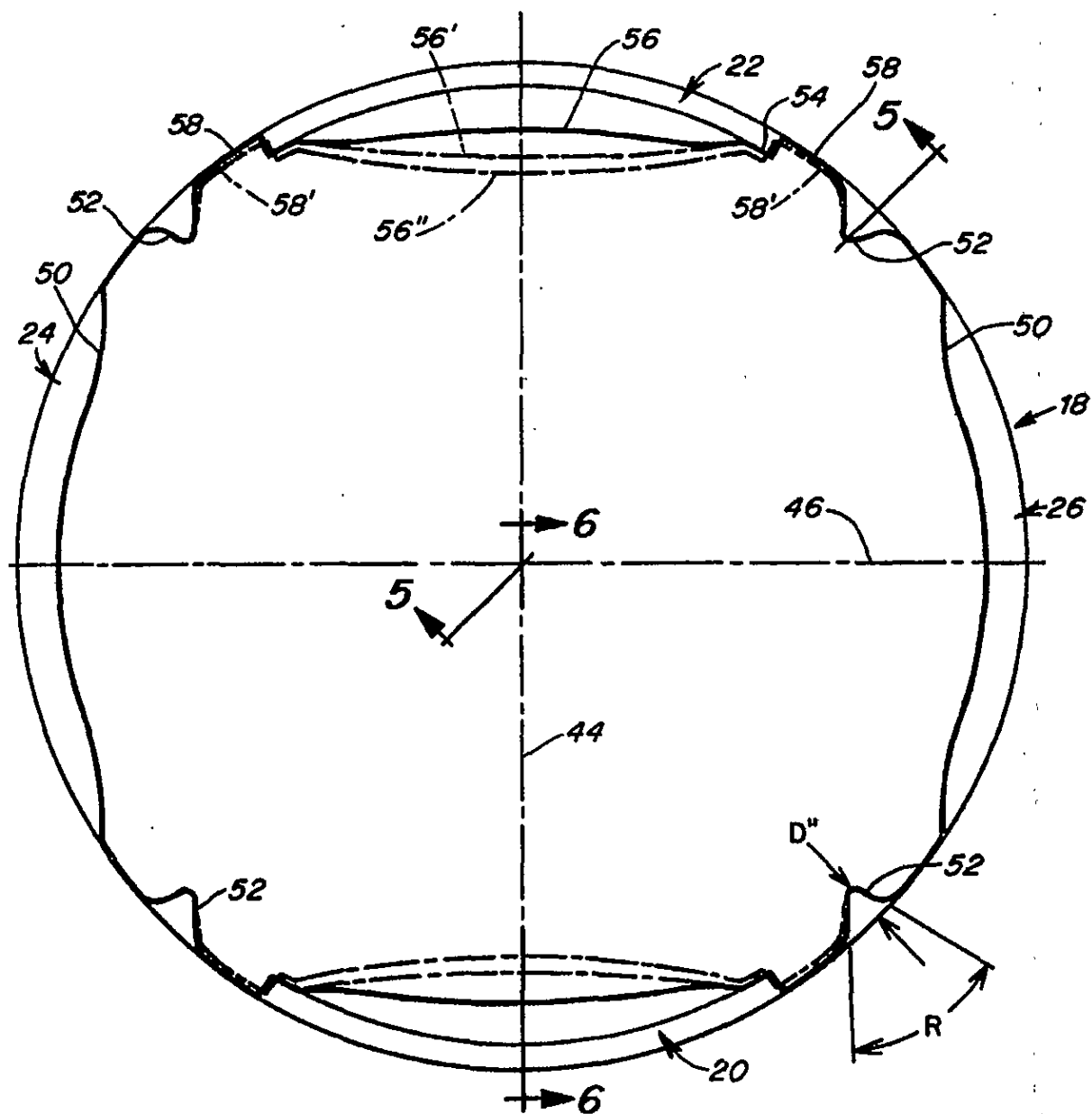


Fig. 4

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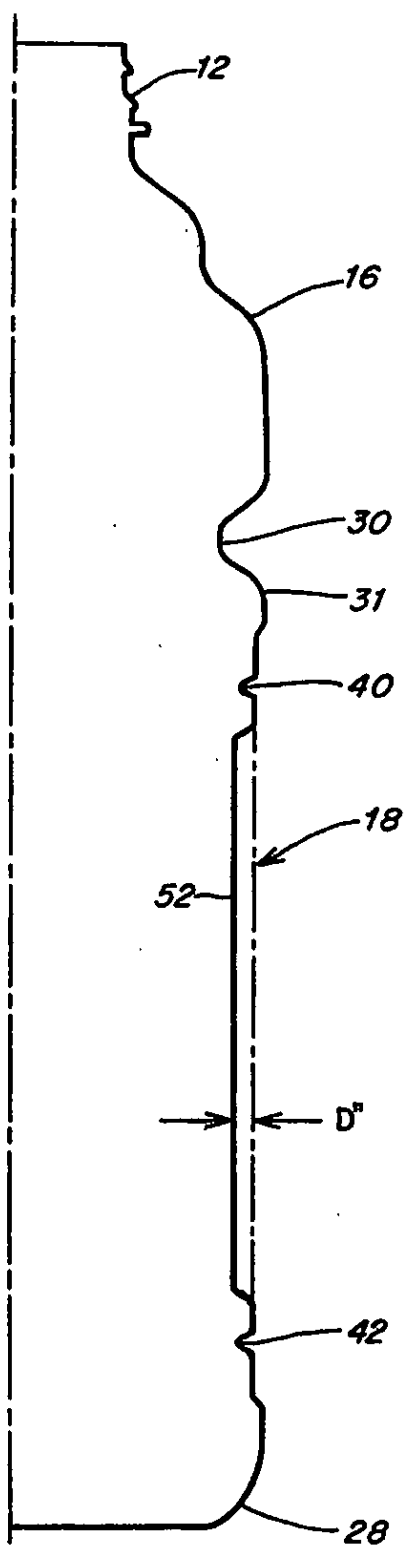


Fig. 5

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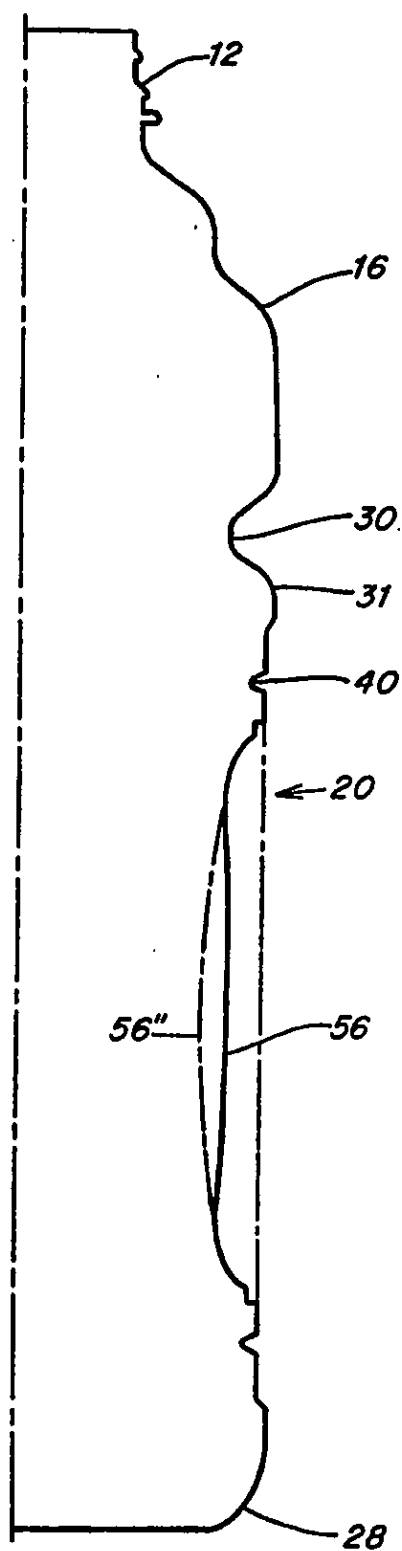


Fig. 6

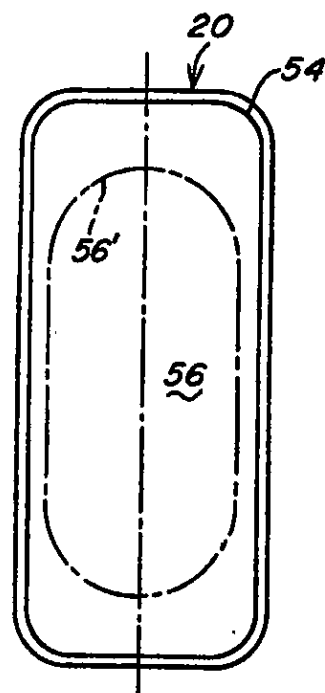


Fig. 7

Fig. 8

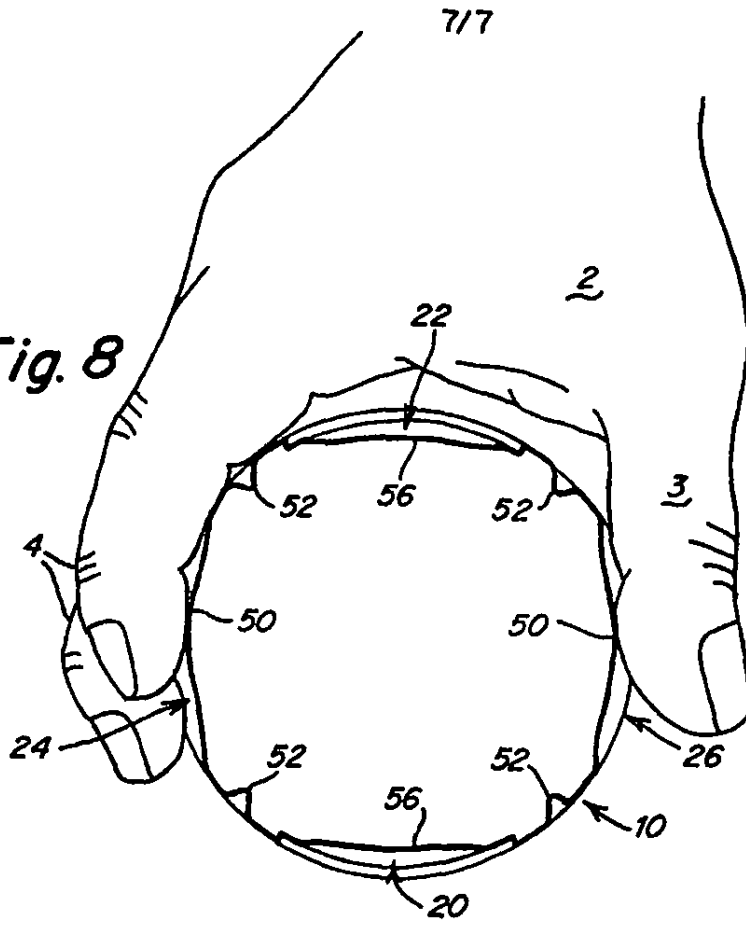
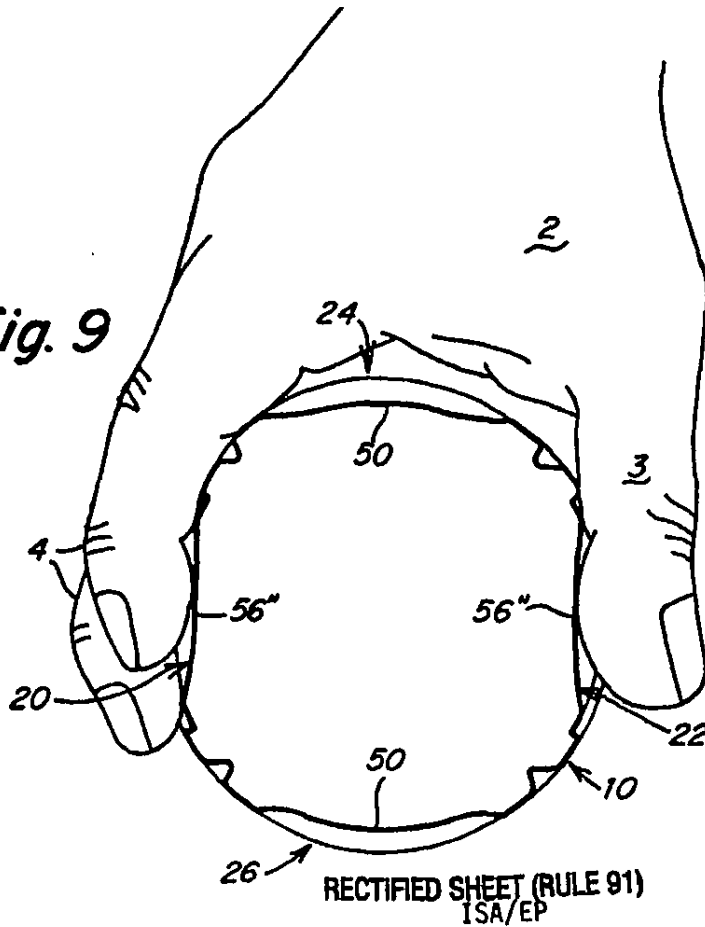


Fig. 9



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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER IPC 6 B65D23/10 B65D1/02		Intern. Appl. No. PCT/US 98/22843
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC 6 B65D		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 505 054 A (BROWN) 23 September 1992 see column 3, line 4 - column 4, line 35; figures 1-5	1-7
A	EP 0 198 587 A (YOSHINO KOGYOSHO) 22 October 1986 see page 4, line 1 - page 8, line 8; figures 1-6	1-7
A	EP 0 446 352 A (HAYASHI) 18 September 1991 see column 5, line 4 - column 6, line 29; figures 1-3	1-7
A	US 5 598 941 A (SEMERSKY) 4 February 1997 see column 2, line 66 - column 4, line 39; figures 1-3	1-7
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Date of the actual completion of the international search 4 February 1999		Date of mailing of the international search report 11/02/1999
Name and mailing address of the ISA European Patent Office, P.O. 5818 Patentstein 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer Vantomme, M

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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PCT/US 98/22843

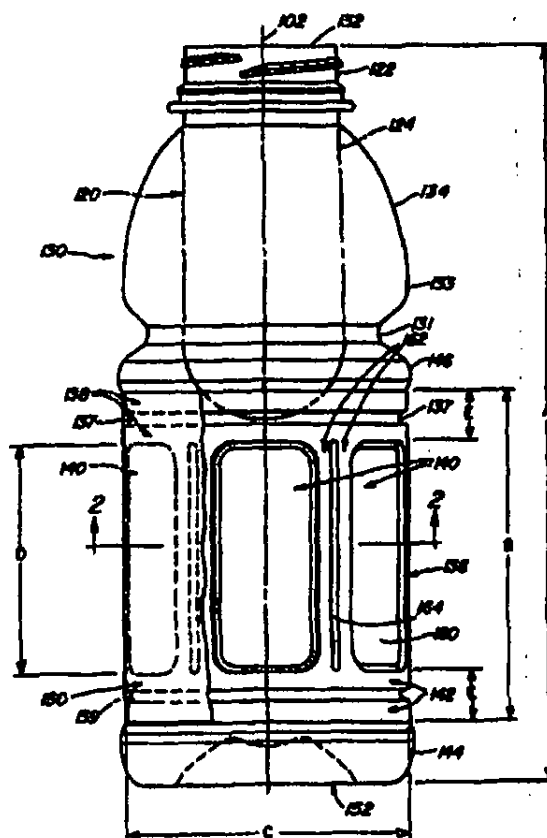
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(21) International Application Number: PCT/US95/13941 (22) International Filing Date: 27 October 1995 (27.10.95) (30) Priority Data: 08/331,041 28 October 1994 (28.10.94) US (71) Applicant: CONTINENTAL PET TECHNOLOGIES, INC. [US/US]; Suite 490, 7310 Turfway Road, Florence, KY 41042 (US). (72) Inventors: KRISHNAKUMAR, Suppayan, M.; 23 Old Coach Road, Nashua, NH 03062 (US). COLLETTE, Wayne, N.; 19 French Court, Merrimack, NH 03054 (US). (74) Agent: HENDRICKS, Therese, A.; Wolf, Greenfield & Sacks, P.C., 600 Atlantic Avenue, Boston, MA 02210 (US).	(81) Designated States: AL, AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TT, UA, UG, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, LS, MW, SD, SZ, UG). Published <i>With international search report.</i> <i>Before the expiration of the time limits for amending the claims and to be republished in the event of the receipt of amendments.</i>	

(54) Title: **HOT-FILLABLE PLASTIC CONTAINER WITH TALL AND SLENDER PANEL SECTION**

(57) Abstract

A panel design for a hot-fillable plastic container having a tall and slender panel section. The panel configuration provides increased resistance to longitudinal bending and hoop failure, yet provides good hoop flexibility to maximize vacuum panel movement. The panel section (136) has a substantially cylindrical circumference with a plurality of vacuum panels (140) symmetrically disposed about the panel circumference, post walls (162) between the vacuum panels, and land areas (138, 142) above and below the vacuum panels. The ratio of vacuum panel height D to panel diameter C is on the order of 0.85 to 1.05. Longitudinal post ribs (164) are provided in the post walls. The land areas above and below the vacuum panels are of a height E greater than on the order of 0.45 inch, and the ratio of the land area height E to panel diameter C is on the order of greater than 0.1. Circumferential hoop ribs (137, 134) are provided in the land areas to prevent ovalization and hoop collapse.



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HOT-FILLABLE PLASTIC CONTAINER WITH TALL AND SLENDER PANEL SECTION

Field of the Invention

The present invention relates to a panel design for a hot-fillable plastic container having a tall and slender panel section, and more particularly to providing such a panel section with increased resistance to longitudinal bending and hoop collapse.

Background of the Invention

Hot-fill containers are designed for the packaging of liquids which must be placed in the container while hot to provide for adequate sterilization. During filling, the container is subjected to elevated temperatures on the order of 180-185°F (the product temperature) and positive internal pressures on the order of 2-5 psi (the filling line pressure). The container is then capped and as the product cools a negative internal pressure is formed in the sealed container.

Biaxially-oriented polyethylene terephthalate (PET) beverage bottles have been designed to receive a hot-fill product with a minimum of thermal shrinkage and distortion. Such a bottle is described in U.S. Patent No. 4,863,046 entitled "Hot Fill Container," which issued September 5, 1989 to Collette et al. The Collette et al. container is provided with a plurality of recessed vacuum panels in the middle panel section of the container, which reduce the magnitude of the vacuum generated in the filled and capped container to prevent any large uncontrolled shape distortion. As the product cools, the vacuum panels (all of them) deform and move inwardly in unison. A wrap-around label covers the vacuum panels and is supported by raised central wall portions in the vacuum panels, post areas between the vacuum panels, and horizontal glue land areas above and below the vacuum panels. Longitudinal (vertical) recessed ribs may be provided in the post areas and raised wall portions of the panels to increase the longitudinal stiffness of the panel section.

The design of the vacuum panels may vary; other designs are illustrated in: 1) U.S. Design Patent 315,869, "Container Body For Liquids Or The Like," April 2, 1991 to Collette; 2) U.S. Patent 5,255,889, "Modular Mold," October 26, 1993 to Collette et al.; 3) U.S. Patent 5,178,289, "Panel Design For A Hot-Fillable Container," January 12, 1993 to Krishnakumar et al.; and 4) U.S. Patent 5,303,834, "Squeezable Container Resistant To Denting," April 19, 1994 to Krishnakumar et al., each of which is hereby incorporated by reference in its entirety.

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There is a need for a hot-fillable plastic container having a tall and slender panel section, in order to accommodate a long label or to achieve a certain volume capacity for a given panel diameter. This tall and slender configuration makes it more difficult to withstand the increase in pressure during filling and to provide a uniform vacuum collapse during cooling. More specifically, it is difficult to make the long and narrow vacuum panels sufficiently flexible to achieve the necessary deformation under vacuum, and at the same time make the surrounding land areas and post walls sufficiently rigid to withstand collapse. In particular, it would be desirable to provide a relatively tall and slender sport bottle, such as the type used by runners and bicyclists, which can be hot-filled directly by the beverage manufacturer. Instead, most hot-fill beverages today are sold in larger containers and transferred by the user to a separate polyethylene sport bottle.

Summary of the Invention

This invention provides a tall and slender panel section for a hot-fillable plastic container having increased resistance to longitudinal bending and hoop collapse, while still providing high hoop flexibility for maximum movement of the vacuum panels. To prevent uncontrolled longitudinal buckling of the panel post walls, longitudinal post ribs are provided and a limit on the ratio of the vacuum panel height to panel diameter is specified. More specifically, the ratio of vacuum panel height D to panel diameter C (see Fig. 1) is on the order of 0.85 to 1.05. To prevent ovalization or hoop collapse in the panel section, horizontal hoop ribs are provided in the land areas above and below the vacuum panels. Such hoop ribs are required where the land areas are of a height E greater than on the order of 0.45 inches, and where the container has a ratio of land area height E to panel diameter C on the order of greater than 0.1.

A specific embodiment is described having six symmetrically disposed vacuum panels. Alternatively, four or eight vacuum panels may be provided. The tall and slender panel section generally has a ratio of panel height B to panel diameter C on the order of 1.2 and greater. A mold for making such a container is also described.

These and other advantages of the present invention will be more particularly described in regard to the following description and drawings of select embodiments.

Brief Description of the Drawings

Fig. 1 is a front elevational view of a first embodiment of the hot-fillable container of this invention having six symmetrically disposed vacuum panels, with a partial label shown over a portion of the panel section.

Fig. 2 is a cross-sectional view of the container of Fig. 1 taken along section line 2-2, showing six vacuum panels separated by post areas with longitudinal post ribs, and showing in phantom lines the deflection of the vacuum panels and post areas during product cooling.

Fig. 3 is an enlarged fragmentary cross-sectional view of one vacuum panel of Fig. 2, showing in phantom lines the deformed vacuum panel and post area.

Fig. 4 is a longitudinal-sectional view of the panel section taken along section line 4-4 of Fig. 2, showing in phantom lines the deformation of the vacuum panel.

Fig. 5 is a longitudinal-sectional view of the panel section taken along section line 5-5 of Fig. 2, showing in phantom lines the deformation of the post area and post rib, and defining the relative heights of the vacuum panel and upper and lower glue land areas.

Fig. 6 is a sectional view, similar to Fig. 5, showing an alternative post rib configuration of a non-uniform depth, for maximizing the resistance to longitudinal bending at the center point of the rib.

Fig. 7 is a sectional view similar to Fig. 5, showing an alternative panel configuration in which the original panel (before filling) is barrelled outwardly (solid lines) so that upon vacuum deformation it becomes substantially vertically disposed (phantom lines).

Fig. 8 is a front elevational view of another embodiment of the hot-fillable container of this invention, showing an alternative vacuum panel configuration having a raised central area incorporating a longitudinal panel rib.

Fig. 9 is a cross-sectional view of the container of Fig. 8 taken along section line 9-9, showing the six vacuum panels separated by post areas.

Fig. 10 is a cross-sectional view showing a molding apparatus for blow molding the container of this invention from a preform.

Fig. 11 is a front elevational view of a further embodiment of the hot-fillable container of this invention, showing an alternative panel configuration with interrupted radial hoop rib sections joined to longitudinal post ribs.

Fig. 12 is a front elevational view of a still further embodiment of the hot-fillable container of this invention, showing an alternative panel configuration with interrupted radial hoop rib sections disposed above and below longitudinal post ribs.

Detailed Description

Fig. 1 shows a particular embodiment of the present invention, namely a 20-ounce, hot-fillable PET beverage bottle. The bottle 130 is blow molded from an injection molded preform 120 (shown in phantom) having an upper thread finish 122 and a lower tube portion 124. During blowing, the preform is expanded and assumes the shape of an interior molding surface (see Fig. 10) to form a substantially transparent, biaxially-oriented bottle. The thread finish 122 is not expanded and remains the thread finish of the bottle with an open mouth 132 for receiving a screw-on cap (not shown). The lower preform tube portion 124 is expanded to form: (a) a shoulder section 134 increasing generally in diameter from the neck finish to a cylindrical panel section 136; b) the panel section 136 including upper and lower glue lands 138 and 142, vacuum panels 140, and post walls 162; and (c) a base 144. A full-wrap label is applied over the panel section 136; a portion of label 150 is shown.

The 20-oz bottle 130 has a total height A (see Fig. 1) of about 195 mm, a panel section height B of about 89 mm, a diameter C of about 72 mm, a vacuum panel height D of about 62 mm, and each of upper and lower land areas of height E of about 13.5 mm. The thickness of the container at the panel section is on the order of 0.4 mm.

In this embodiment, the lower shoulder section includes a recessed radial hoop rib 131 between enlarged diameter portions 133 and 146. The lower portion 146 forms an enlarged bumper, just above the panel section, which is of a greater diameter than the panel section, in order to protect the attached label 150 during shipment and storage. The base 144 also includes an enlarged diameter bumper 144 to protect the label. The base further includes a recessed closed bottom end 152 which may include additional deformable elements which move inwardly to reduce the negative pressure generated during product cooling.

The substantially cylindrical panel 136, shown in horizontal cross-section in Fig. 2, includes six recessed vacuum panels 140 symmetrically disposed about a vertical centerline 102. The panels 140 are also symmetrical about each of two orthogonal vertical planes 104A, 104B passing through the centerline 102. Each vacuum panel 140 is disposed between a pair of post walls 162, which constitute part of the outermost cylindrical panel wall disposed at a first radial

distance D_1 from the vertical centerline 102. Each vacuum panel 140 includes a vertically-disposed rectangular recess 160 which forms an arc or other inwardly concave shape in horizontal cross-section (see Fig. 2), the midpoint P of the recess being disposed at a second distance D_2 from the vertical centerline 102 which is less than the first distance D_1 of post wall 162. A vertically elongated and recessed post rib 164 is provided in the post wall 162 midway between each vacuum panel 140, to provide longitudinal stiffness, and is disposed a third distance D_3 from the vertical centerline 102 which is less than the first distance D_1 of the post wall 162. The post rib 164 is a relatively small-diameter arc with rounded edges for a smooth continuation into the adjoining post wall, while the vacuum panel recess 160 is a generally deeper and broader concave portion.

In this six-panel embodiment, each vacuum panel occupies an angular extent G (see Fig. 2) on the order of 39 to 46°, out of the total panel circumference of 360°. The combined angular extent F of one vacuum panel 140 and one post wall 162 is 60° ($360 \div 6 = 60$), leaving the post wall with an angular extent on the order of 14 to 21°. The relative angular extents of the vacuum panel and post wall are adjusted to maximize the vacuum deformation of recess 160, without allowing collapse or ovalization of the post walls 162 as described hereinafter.

Fig. 2 shows in phantom lines the controlled deformation under vacuum of the six vacuum panels and post areas. Vacuum panel 140 deforms substantially radially inwardly to deformed vacuum panel 140', while post wall 162 deforms slightly inwardly to deformed post wall 162'.

Fig. 3 shows the controlled deformation of one representative vacuum panel and the adjacent portions of the post walls. As desired, the maximum deformation occurs at the center point P of the vacuum panel 140, which moves inwardly to point P'. A much lesser deformation occurs at points Q, R, S, T, and U, defining the post wall and post rib, which deform inwardly to points Q', R', S', T', and U', respectively. The peripheral length of P' to U' is the same as that of P to U, but the radial deflection P, P' is much larger than U, U'. To maximize the inward movement of P, P', the hoop rigidity of segment PU must be lowered by providing a relatively thin wall vacuum panel section, and two corner sections Q-R-S and T-U on either side of post wall ST. The corners open up (i.e., increase in angular extent) under deformation to allow maximum inward movement of PP'. At the same time, the longitudinal bending resistance of the post wall ST is increased by maximizing the radial depth of RS and TU, and the angular extent STU. In this embodiment, STU is in the middle of the preferred range of 14 to 21° (see Fig. 3), or on the

order of 7 to 10.5°. The depth RS and depth TU are preferably on the order of 0.030 to 0.100 inches.

It is important to note that the longitudinal post rib 164 lowers the hoop rigidity, while at the same time maximizing the longitudinal bending resistance. The longitudinal post ribs enable light-weighting of the label panel of the container. In a 20-oz container, the panel wall thickness with the longitudinal post ribs incorporated in this design is 20 to 25% thinner (.010" to .013" vs. .015" to .016"). This translates to a panel weight reduction of 17 to 20%.

Referring again to Fig. 1, C is the diameter of the panel section and D is the height of the vacuum panel. The larger the ratio D/C, the higher the longitudinal bending moment on the post walls and the more the need for longitudinal post ribs. The longitudinal post ribs are necessary when D/C is on the order of at least 0.85. The upper limit of D/C (with post ribs) is on the order of 1.05.

The angular extent of the vacuum panel (G in Fig. 2) is on the order of 39 to 46°. If the angular extent is too low, the vacuum panel will not be sufficiently flexible. If the angular extent is too large, the post wall will not be sufficiently strong.

Referring to Fig. 1, B is the height of the panel section and E is the height of each label land area above and below the vacuum panel. To prevent ovalization of the panel and hoop collapse during vacuum deformation (i.e., a vertical crease formed above or below the vacuum panel), recessed hoop ribs 137, 139 are provided in the middle of the upper and lower glue land areas 138, 142 when E is on the order of greater than 0.45 inches, and when the ratio E/C is on the order of greater than 0.1.

The tall and slender panel section preferably has a panel height B on the order of 2.4 to 8 inches, and a panel diameter C on the order of 2 to 6 inches. The panel wall thickness is preferably on the order of 0.012 to 0.025 inches.

Fig. 4 illustrates in longitudinal cross-section the deflection of the vacuum panel 140. More specifically, the recessed vacuum panel wall 160 is deformed inwardly to 160' with a maximum deformation occurring at the vertical center point P-P'. Fig. 5 shows substantially smaller post wall and post rib deformations; the post wall 162 is deformed to 162', and the post rib 164 is deformed to 164'.

Fig. 6 shows in longitudinal section, similar to Fig. 5, a post rib 264 of an alternative container 230. Unless otherwise indicated, container 230 is identical in all respects to container 130, and corresponding elements have been numbered by simply adding "100" to the

corresponding figure number from Fig. 1, to form a "200" number series. The difference in Fig. 6 is that the post rib 264 is of variable depth in the longitudinal direction in order to maximize the resistance to longitudinal bending. More specifically, the post rib 264 has a maximum depth d_2 at a vertical mid-point, compared to a relatively lesser depth d_1 at points adjacent to the upper and lower land areas 238 and 242. The maximum depth at the mid-point provides the maximum resistance to longitudinal bending, where the bending moment is the greatest.

Fig. 7 is a longitudinal-sectional view of an alternative container 330 similar in all respects to the container 130 of Fig. 1, and where corresponding elements have been given a 300 series designation. However, in container 330, the panel section 336 is originally formed (i.e., blow molded) with an outwardly barrelled configuration, as shown by solid line 262 for the post wall, and solid line 264 for the post rib. Upon vacuum deformation during product cooling, the outwardly bowed post wall and post rib move radially inwardly to a substantially vertical configuration at 262' and 264', respectively.

Figs. 8-9 shows front elevational and cross-sectional views respectively of a further alternative container 430 having a modified vacuum panel construction. Again, corresponding elements are given similar numbers as in Fig. 1 to form a "400" series. However, in this embodiment, each vacuum panel 440 further includes a vertically-elongated, rectangular raised wall 466 in the middle of recess 460, which is disposed at a fourth distance D_4 from the centerline 102 which is greater than the second distance D_2 of recess 460. In this example, D_4 is the same as the first distance D_1 of post wall 462. Raised wall 466 provides another area for supporting the label, along with the post walls 462 and upper and lower glue lands 438, 442. In addition, a vertically-elongated and recessed panel rib 468 in the center of raised wall 466 provides further longitudinal stiffness, said panel rib 468 being disposed at a distance D_3 from centerline 102, which is less than the first distance D_1 of the post wall 462 and raised wall 466.

Fig. 10 illustrates a blow-molding apparatus 500 used in making the container of this invention. More specifically, a substantially amorphous and transparent PET preform 120 (see Fig. 1) is reheated to a temperature above the glass transition temperature and placed in a blow mold 502. A stretch rod 504 axially elongates the preform within the blow mold to ensure complete axial elongation and centering of the preform. A blowing gas (shown by arrows 506) is introduced to radially inflate the preform in a customary manner to match the configuration of the inner molding surface 508 of the blow mold. The formed container 510 remains substantially transparent but has undergone strain-induced crystallization to provide increased strength.

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The container may be made of any of the known polymer resins which provide good strength at elevated fill temperatures, such as polyesters, polyolefins, polycarbonates, nitriles, and copolymers of the above, as well as other high temperature polymers.

Phthalic acid polyesters based on terephthalic or isophthalic acid are commercially available and convenient. The hydroxy compounds are typically ethylene glycol and 1,4-di-(hydroxymethyl)-cyclohexane. The intrinsic viscosity for phthalate polyesters are typically in the range of 0.6 to 1.2, and more particularly 0.7 to 1.0 (for O-chlorol-phenol solvent). 0.6 corresponds approximately to a viscosity average molecular weight of 59,000, and 1.2 to a viscosity average molecular weight of 112,000. In general, the phthalate polyester may include polymer linkages, side chains, and end groups not related to the formal precursors of a simple phthalate polyester. Conveniently, at least 90 mole percent will be terephthalic acid and at least 45 mole percent an aliphatic glycol or glycols, especially ethylene glycol.

Another useful polymer, with physical properties similar to PET, is polyethylene naphthalate (PEN). PEN provides a 3-5X improvement in oxygen barrier property (over PET), at some additional expense.

The container may be either a monolayer, or a multilayer construction, including layers of an oxygen barrier material such as ethylene vinyl alcohol or polyvinylidene chloride, and may include a layer of reprocessed scrap material, such as post-consumer or recycled PET.

The container may have a closure other than a screw threaded cap, such as a slidable nozzle as used on sports bottles.

Two further alternative configurations for the radial hoop ribs and longitudinal post ribs are shown in Figs. 11-12. Both incorporate an interrupted hoop rib which does not extend around the full circumference of the panel section, but rather comprises hoop rib sections disposed above and below the longitudinal post ribs. This provides resistance to ovalization and hoop collapse where greatest resistance is required, namely above and below the post wall areas. More specifically, Fig. 11 shows an alternative container 630 with panel section 636 having an "I-beam" shaped rib 670 which incorporates upper and lower horizontal hoop sections 671, 672 respectively which are joined by a longitudinal post rib section 673. Fig. 12 shows an alternative container 730 having panel section 736, with upper and lower horizontal hoop sections 771, 772 respectively centered above and below, but spaced from a longitudinal post rib 773.

Although certain preferred embodiments of the invention have been specifically illustrated and described herein, it is to be understood that variations may be made without

departing from the spirit and scope of the invention as defined by the appended claims. For example, the container sizes and shapes may be varied as well as the vacuum panel design. Further, the containers may be other than bottles and they may be made from other thermoplastic resins or materials. Thus, all variations are to be considered as part of the invention as defined by the following claims.

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264

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CLAIMS

1. In a hot-fillable plastic container including a panel section having a substantially cylindrical panel circumference and a plurality of vacuum panels symmetrically disposed about the panel circumference, the panel section further including post walls between the vacuum panels and land areas above and below the vacuum panels, the improvement comprising:
the container having a relatively tall and slender panel section and a ratio of vacuum panel height D to panel diameter C on the order of 0.85 to 1.05;
longitudinal post ribs in the post walls;
the land areas each having a height E greater than on the order of 0.45 inch and the ratio of E to C being on the order of greater than 0.1; and
circumferential hoop ribs in the land areas.
2. The container of claim 1, wherein the tall and slender panel section has a ratio of panel height B to panel diameter C on the order of 1.2 and greater.
3. The container of claim 2, wherein the panel height B is on the order of 2.4 to 8 inches and the panel diameter C is on the order of 2 to 6 inches.
4. The container of claim 3, wherein the panel section has a wall thickness on the order of 0.012 to 0.025 inches.
5. The container of claim 4, wherein the container has six vacuum panels.
6. The container of claim 5, wherein each vacuum panel has an angular extent of on the order of 39 to 46°.
7. The container of claim 6, wherein the post walls meet the vacuum panels at corners having a radial depth on the order of 0.030 to 0.100 inches.
8. The container of claim 7, wherein the longitudinal post ribs extend radially inwardly from the post walls on the order of 0.030 to 0.100 inches.

9. The container of claim 3, wherein the number of vacuum panels are selected from the group consisting of four, six and eight.

10. The container of claim 9, wherein the number of vacuum panels is six.

11. The container of claim 1, wherein the circumferencial hoop ribs extend around the entire panel circumference.

12. The container of claim 1, wherein the circumferential hoop ribs comprise interrupted hoop rib sections above and/or below the post walls.

13. The container of claim 12, wherein the hoop rib sections are disposed above and below the post walls.

14. The container of claim 12, wherein the hoop rib sections are connected to the longitudinal post ribs.

15. The container of claim 12, wherein the hoop rib sections are separate from the longitudinal post ribs.

16. The container of claim 1, wherein the longitudinal post ribs are of variable depth in the longitudinal direction, and have a greater depth adjacent a mid-portion of the panel section.

17. The container of claim 1, further including a label engaging the land areas and post walls.

18. The container of claim 1, wherein the vacuum panels have a raised central wall for supporting a label disposed around the panel section.

19. The container of claim 18, wherein the raised central wall has a longitudinal rib.

20. The container of claim 1, wherein the panel section is outwardly barrelled prior to application of a negative internal pressure within the container.

21. The container of claim 1, wherein the plastic is selected from the group consisting of polyesters, polyolefins, polycarbonates, polyethylene naphthalates, nitriles, and copolymers thereof.

22. The container of claim 1, wherein the container is a substantially transparent, biaxially-oriented, blow-molded polyester container.

23. The container of claim 22, wherein the polyester is substantially polyethylene terephthalate.

24. In a mold for making a hot-fillable plastic container having an inner mold surface including a substantially cylindrical panel section with a plurality of longitudinal vacuum panel forming sections symmetrically-disposed about the circumference of the panel section for forming vacuum panels in a cylindrical panel wall of the container, longitudinal areas between the vacuum panels for forming post walls in the container, and circumferential areas above and below the vacuum panel forming sections for forming upper and lower land areas in the container, the improvement comprising:

the panel section being relatively tall and slender and having a ratio of vacuum panel forming height D to panel forming diameter C on the order of 0.85 to 1.05;

longitudinal raised ribs in the longitudinal areas for forming post ribs in the post walls of the container;

the circumferential areas each being of a height E on the order of greater than 0.45 inch, and the ratio E to C being on the order of greater than 0.1; and

circumferential raised ribs in the circumferential areas for forming hoop ribs in the land areas of the container.

25. The mold of claim 24, wherein the tall and slender panel section has a ratio of panel forming height B to panel forming diameter C on the order of 1.2 and greater.

26. The mold of claim 25, wherein the panel forming height B is on the order of 2.4 to 8 inches and the panel forming diameter C is on the order of 2 to 6 inches.

27. The mold of claim 24, wherein the number of vacuum panel forming sections is selected from the group consisting of four, six and eight.

28. The mold of claim 27, wherein the mold has six vacuum panel forming sections.

29. The mold of claim 28, wherein each vacuum panel forming section has an angular extent of on the order of 39 to 46°.

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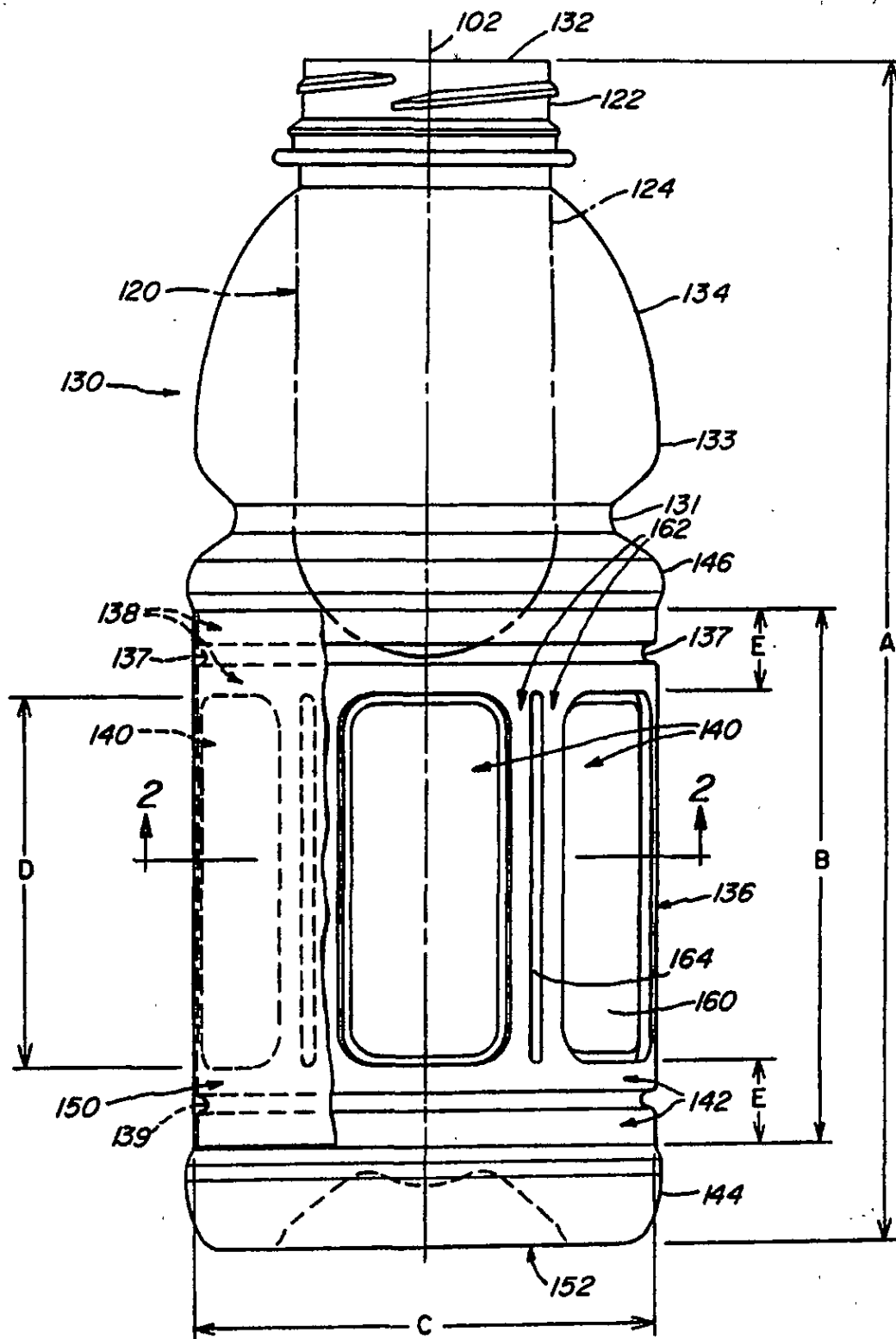


Fig. 1

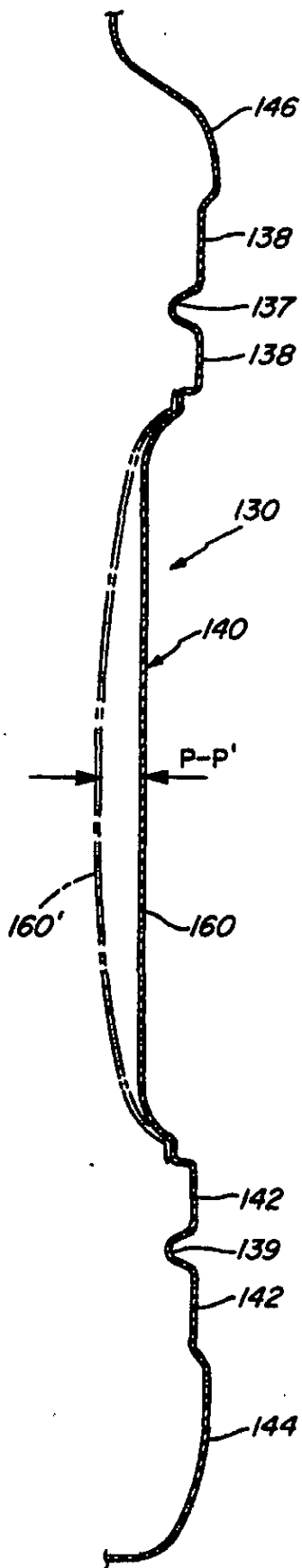


Fig. 4

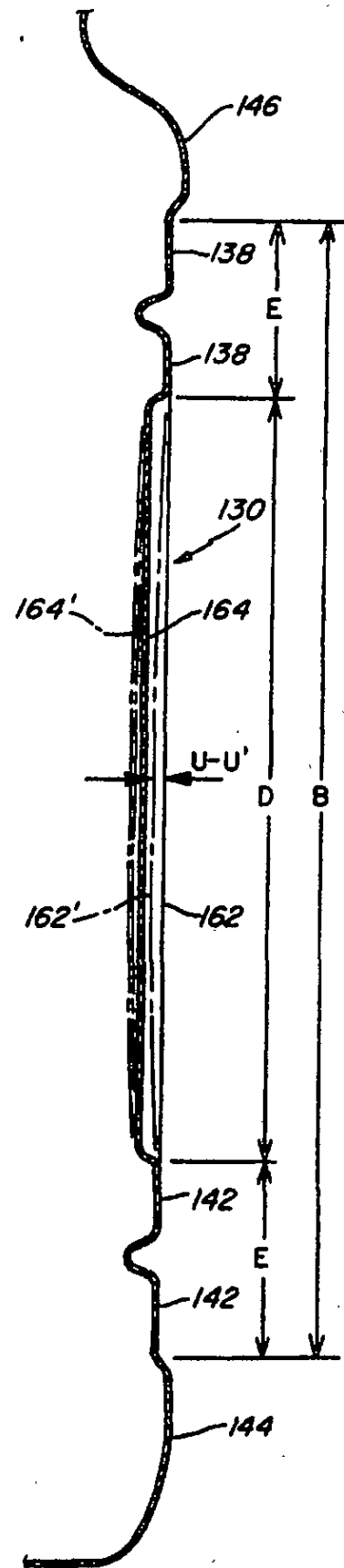


Fig. 5

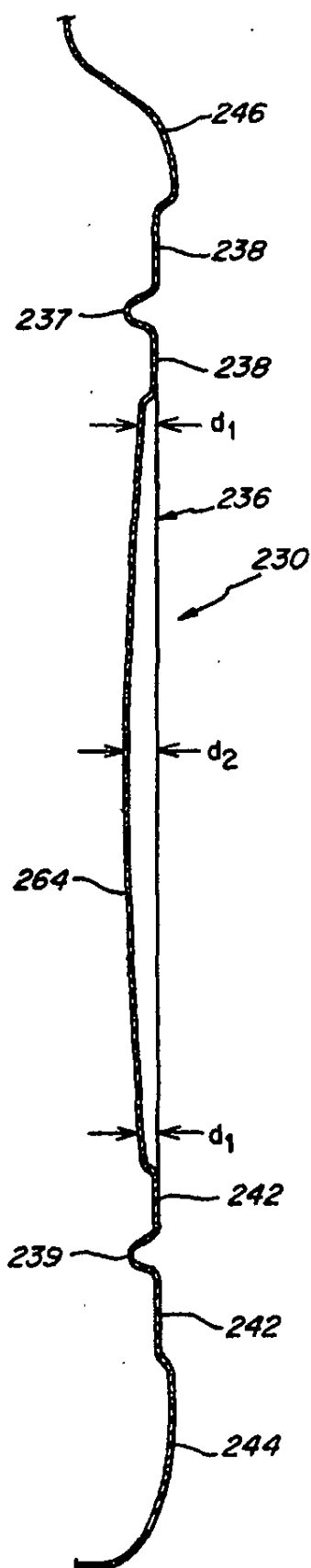


Fig. 6

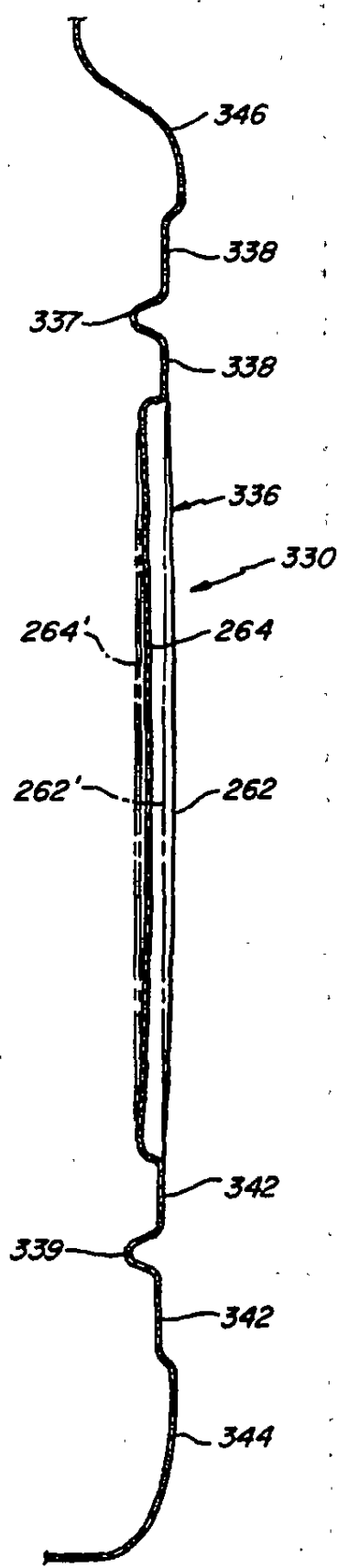
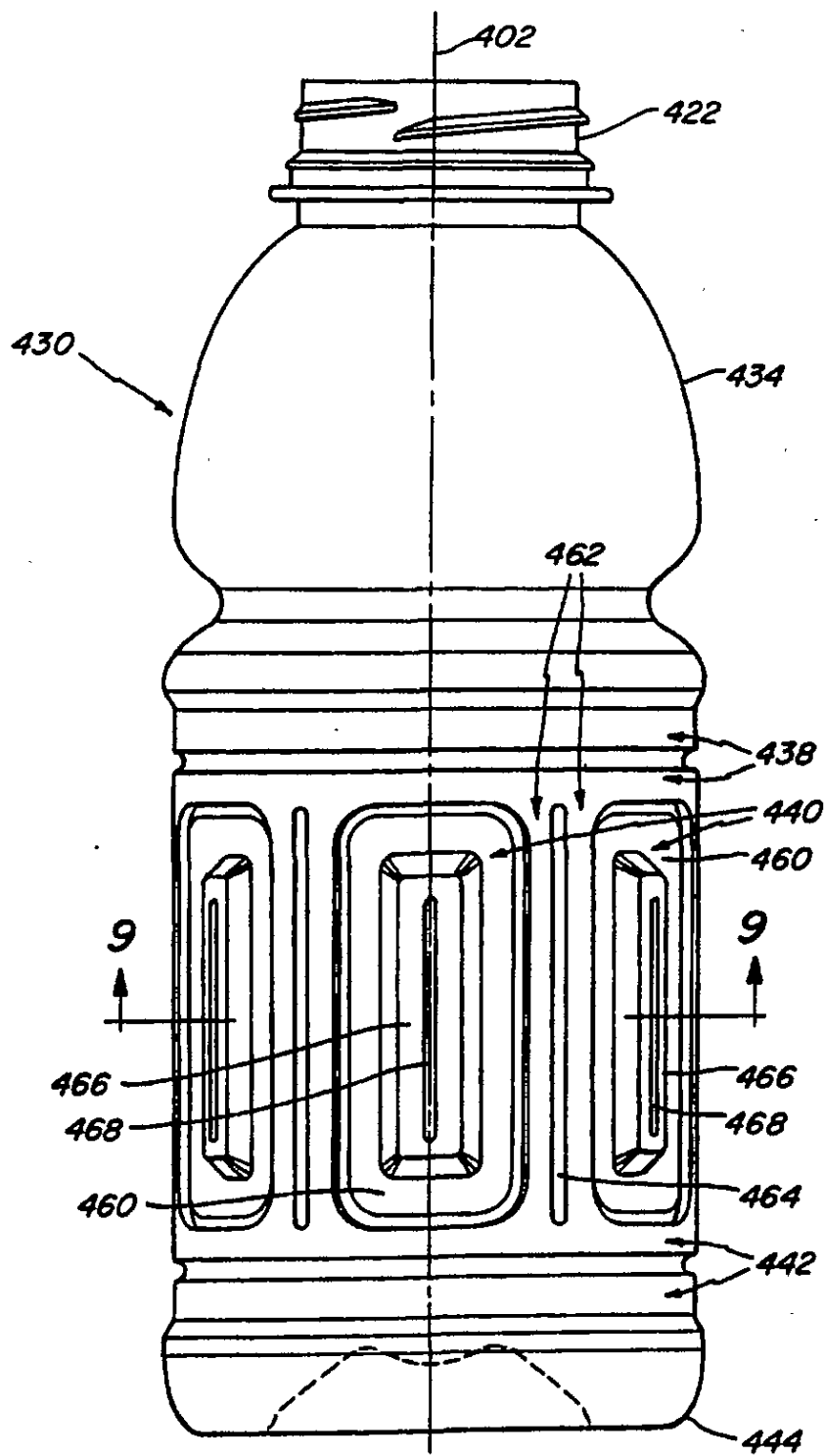


Fig. 7

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*Fig. 8*

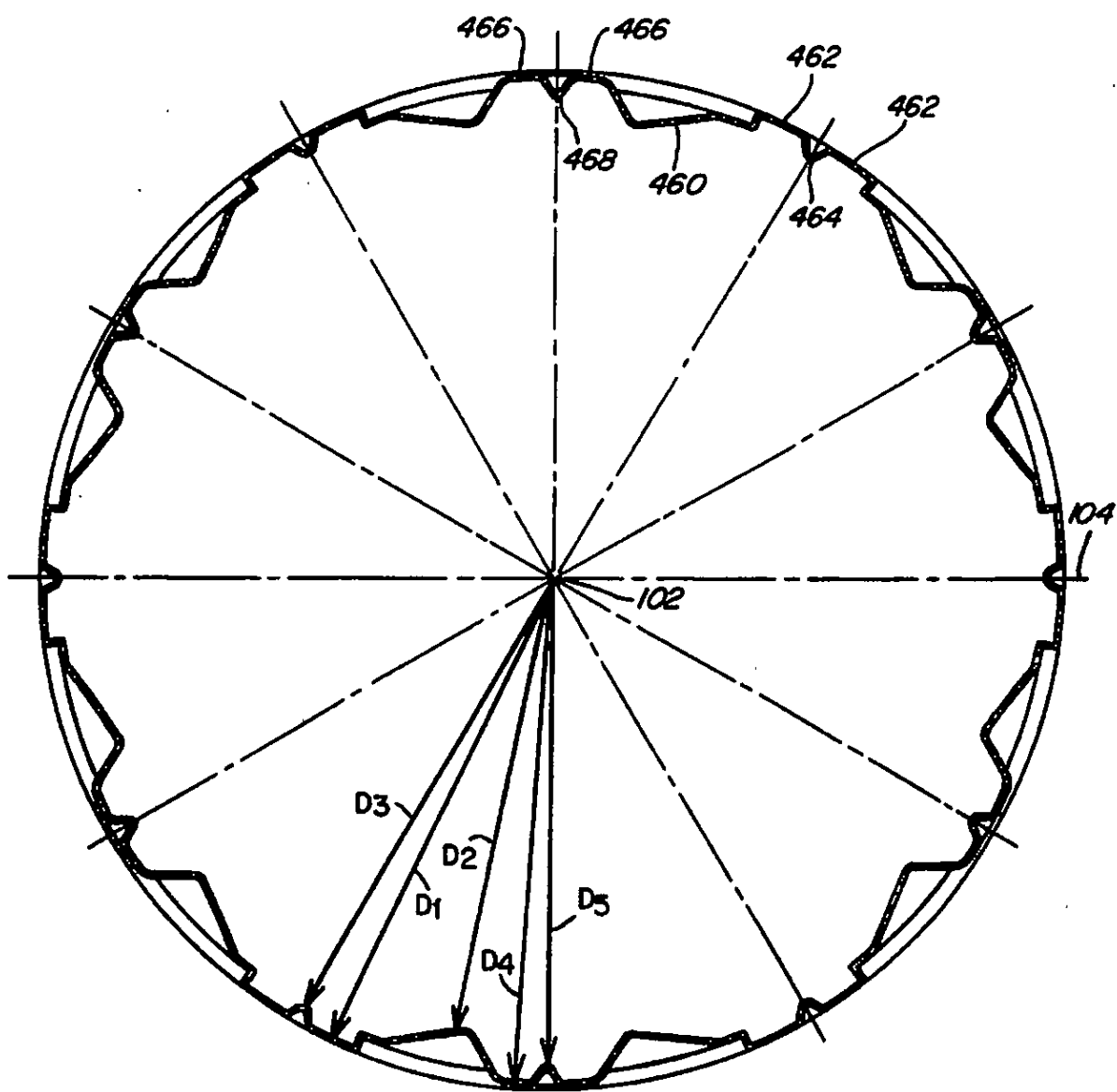


Fig. 9

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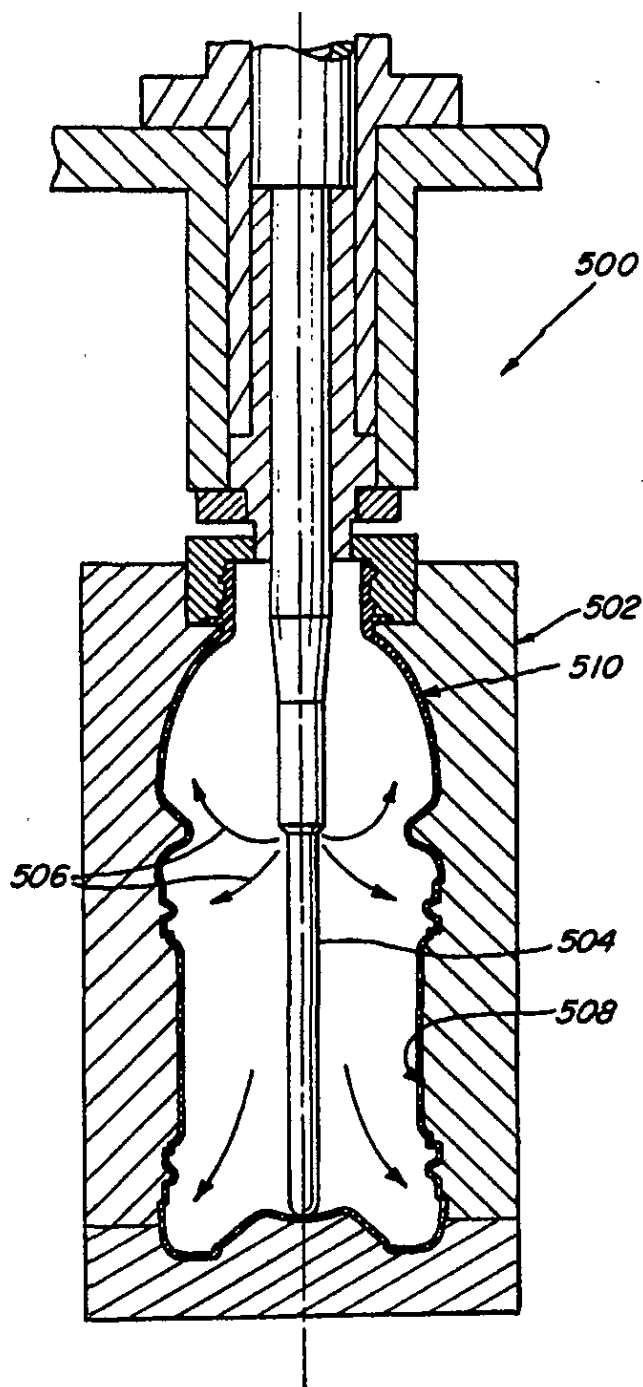


Fig. 10

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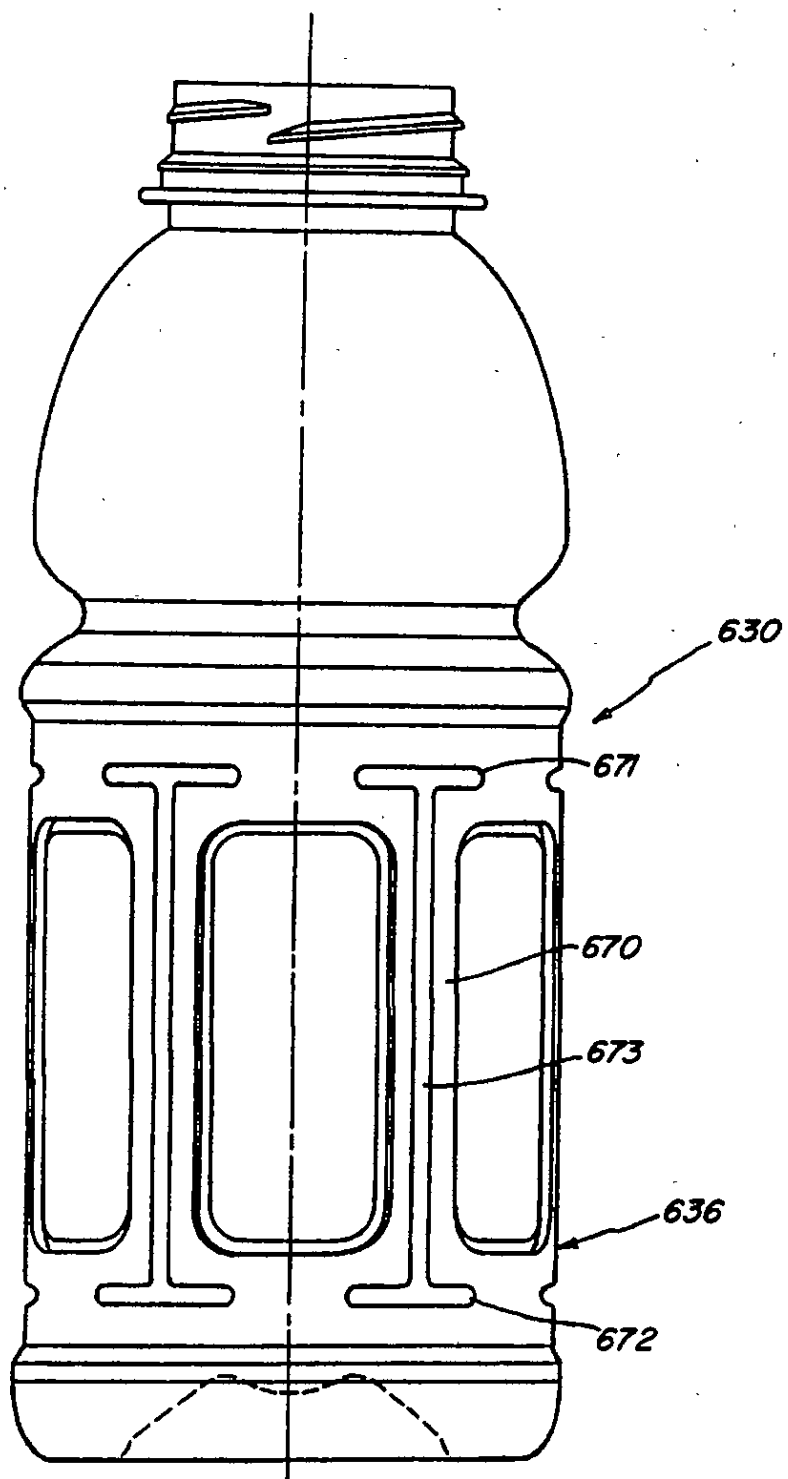


Fig. 11

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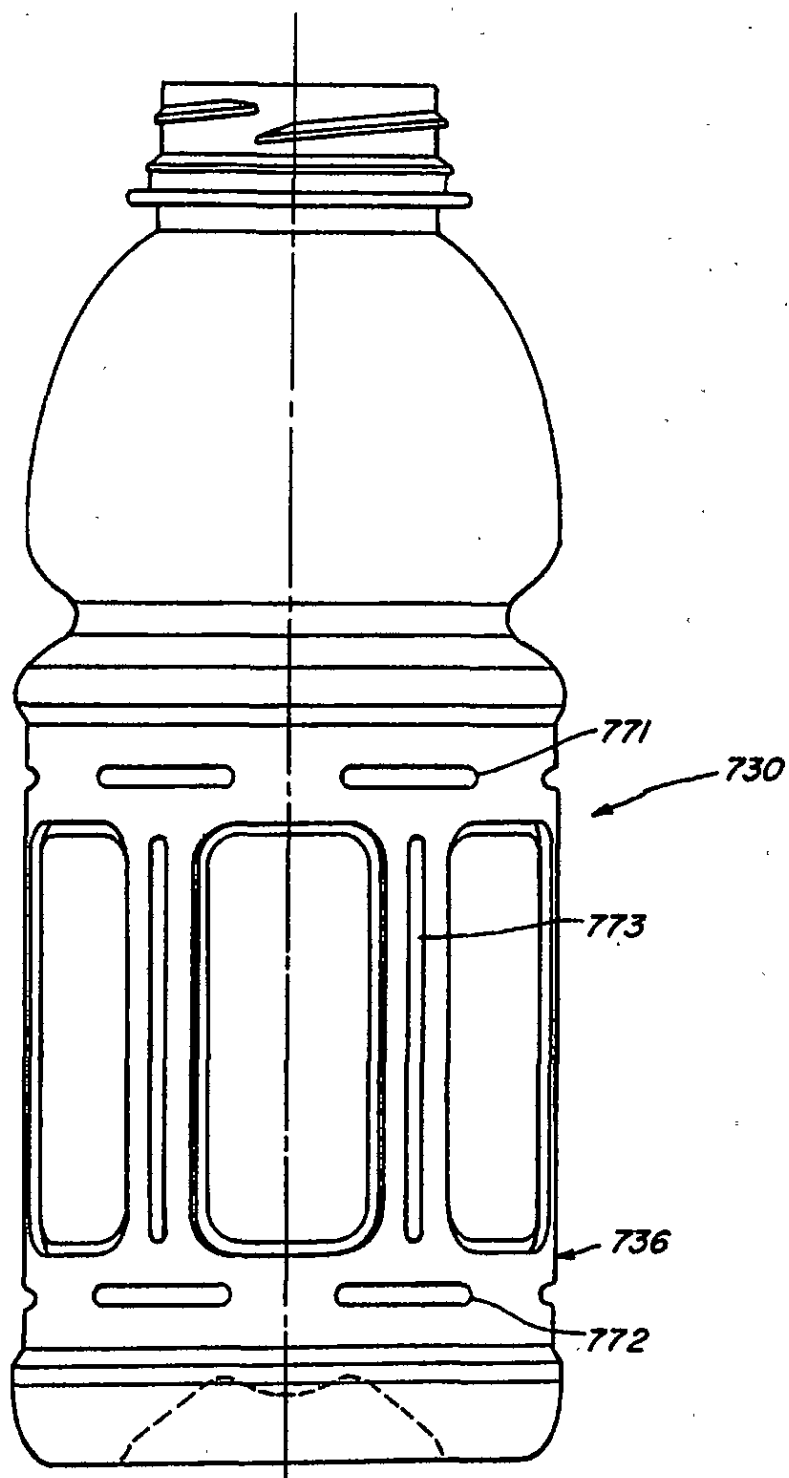


Fig. 12

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/US 95/13941

278

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B65D1/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data bases consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,5 178 289 (S.M. KRISHNAKUMAR) 12 January 1993 cited in the application see column 3, line 61 - column 4, line 65 see figures 1-3 ---	1-10, 17-29
A	US,A,4 863 046 (W.N. COLLETTE) 5 September 1989 cited in the application see claims; figures ---	1-10, 24-29
A	US,A,5 303 833 (Y. HAYASHI) 19 April 1994 see abstract; figure 4 ---	1,11
A	WO,A,94 18077 (HOOVER UNI.) 18 August 1994 see abstract; figure 1 ---	1,11
	-/--	

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

28 February 1996

Date of making of the international search report

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Authorized officer

Leitner, J

INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,5 341 946 (D.G. VAILLIENCOURT) 30 August 1994 see abstract; figure 1 ---	1,11
A	EP,A,0 279 628 (YOSHINO KOHYOSHO CO.) 24 August 1988 see figures 8,9 -----	1,12

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 95/13941

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US-A-5303833	19-04-94	NONE	
WO-A-9418077	18-08-94	US-A- 5337909 EP-A- 0636089	16-08-94 01-02-95
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EP-A-279628	24-08-88	JP-A- 63203541 JP-A- 63203542 AU-B- 613601 AU-B- 1191388 CA-A- 1312559 DE-D- 3852894 DE-T- 3852894 DE-A- 3880708 EP-A- 0506065 US-A- 4877141 US-A- 5064081	23-08-88 23-08-88 08-08-91 18-08-88 12-01-93 09-03-95 24-05-95 09-06-93 30-09-92 31-10-89 12-11-91

281 98
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(21) International Application Number: PCT/US94/01492 (22) International Filing Date: 14 February 1994 (14.02.94) (30) Priority Data: 08/016,635 12 February 1993 (12.02.93) US (71) Applicant: HOOVER UNIVERSAL, INC. [US/US]; 49200 Halyard Drive, Plymouth, MI 48170 (US). (72) Inventor: VAILLIENCOURT, Dwayne, G.; 304 Riverbend, Manchester, MI 48158 (US). (74) Agents: LEVINE, Edward, L. et al.; Johnson Controls, Inc., 5757 North Green Bay Avenue, Milwaukee, WI 53209 (US).		(51) Designated States: BR, CA, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published With international search report.
(54) Title: HOT FILL PLASTIC CONTAINER HAVING A RADIAL REINFORCEMENT RIB (57) Abstract A container (10) of a heat set plastic material adapted for hot fill applications includes a plurality of elongated vertically oriented vacuum panels (24) in its sidewall (12) and first and second circumferentially extending inwardly directed reinforcement ribs (31, 32) which are located in the label mounting areas (29, 30) above and below the vacuum panels and which cooperate with upper and lower label bumpers (21, 22) of the container to support the upper and lower edges (25, 26) of the vacuum panels, permitting the center portions of the panels to flex inward during filling and sealing the container with a hot liquid, but resisting deformation of the container sidewall in compensating for the hot-fill vacuum. 		

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HOT FILL PLASTIC CONTAINER HAVING A RADIAL REINFORCEMENT RIB

Background of the Invention

This invention relates to hot-fill plastic or polyester containers, and more particularly to such a container having an improved sidewall construction.

In the past, most plastic or polyester containers were used to contain liquids that are initially dispensed at room temperature or chilled. However, in recent years, there has been a significant increase in the demand for polyester containers for packaging "hot fill" beverages. "Hot-fill" applications impose additional mechanical stresses on the container structure which cause the container to be less resistant to deformation when the container is being handled or if it is dropped. The thin sidewalls of conventional polyester containers deform or collapse at hot fill temperatures. Moreover, the rigidity of the container decreases immediately after the "hot-fill" liquid is introduced into the container, making the container more susceptible to failure due to mechanical stresses. As the hot-filled liquid cools, it shrinks in volume which has the effect of producing a negative pressure or "hot-fill" vacuum in the container. The container must be able to sustain such internal pressure changes while maintaining its configuration.

Various methods have been devised to counter thermal instabilities. One method broadly involves heat treating the polyester to induce molecular changes which will result in a container exhibiting thermal stability. Other methods involve forming the polyester structure into a structural configuration which can maintain stability during hot fill. Thus, the hot-fill containers being produced have a generally cylindrical main body which is provided with a plurality of elongated vertically oriented panels. These panels, which are commonly referred to as pressure or vacuum panels, are designed to collapse inwardly after the container has been filled with a hot liquid so as to accommodate the inevitable volume shrinkage of the liquid in the container as the liquid cools. However, the inward flexing of the panels caused by the hot fill vacuum creates high stress points at the top and bottom edges of the pressure panels, and especially at the upper and lower corners of the panels. These stress points weaken the portions of the sidewall near the edges of the panels, allowing the

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sidewall to collapse inwardly during handling of the container or when containers are stacked together.

This problem could be alleviated by increasing the thickness of the container wall. However, increasing the wall thickness results in an increase in material cost for the container and in the weight of the finished container, which results are not acceptable to the container industry. The effects of hot-fill stresses can be minimized by providing pressure panels which extend substantially the entire vertical length of the sidewall and with longitudinally extending ribs extending along the edges of the panels. Examples of containers of this type are shown in U.S. patent nos. 4,805,788 and 4,863,046. The hot-fill container disclosed in U.S. patent no. 4,863,046, for example, has a cylindrical main body portion which includes a plurality of vertically oriented pressure panels separated by vertically elongated land areas. The pressure panels extend from just below the label upper bumper to just above the lower label bumper. The vertically elongated land areas between the pressure panels are reinforced by vertical ribs. Each of the pressure panels includes a plurality of transverse, horizontally extending radially recessed rib segments within the panel which ensure that the panel moves uniformly. Because the pressure panels extend from just below the upper label bumper to just above the lower label bumper, the area for securing the label to the container body is minimized. This imposes significant constraints on the manufacturing tolerances in applying the label to the container. Label placement is critical because the areas above and below the panels for placement of the upper and lower edges of the label are relatively small. Moreover, because the size of the panels is large relative to the label bearing portion of the sidewall, there is a minimal flat cylindrical area for securing the label to the container.

Another container construction for hot-fill applications, which is disclosed in U.S. patent no. 5,067,622, has its sidewall rigidized by a plurality of concentric rings which prevent inward flexing of the sidewall. The container includes a plurality of small vacuum panels in the neck portion of the container. The vacuum panels in the neck portion of the container and a vacuum panel in the base of the container permit the container to deflect under hot fill and subsequent vacuum conditions. However, the body portion does not undergo

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either radial or longitudinal contraction, and the vacuum panels work independently of the sidewall reinforcement. Moreover, this construction results in a minimal flat cylindrical sidewall area for receiving the upper and lower edges of the label so that label placement is critical.

Another hot-fill container, which is disclosed in U.S. patent no. 4,749,092, includes a sidewall portion which contains a plurality of pressure panels and a smooth surfaced cylindrical portion, which is located above the pressure panels, which is adapted for affixation of a label. In one embodiment, the label receiving portion includes annular grooves which reinforce only the label receiving portion of the container, and the label does not cover the pressure panels.

Summary of the Invention

The present invention provides a thin-walled plastic container formed from a heat set plastic material which is adapted for hot-fill applications and which includes a plurality of vacuum panels which are adapted to flex inwardly due to filling the container with a hot-fill liquid, sealing the container and subsequent cooling of the liquid. In accordance with the invention, at least one of the label mounting areas above and below the vacuum panels, and preferably both label mounting areas, include annular reinforcement ribs which extend continuously around the circumference of the container sidewall. The reinforcement ribs support the vacuum panels at their upper and lower edges, holding the edges of the panels fixed, while permitting the center portions of the vacuum panels to flex inwardly under hot fill and subsequent vacuum conditions and resisting deformation of the vacuum panels subsequent to inward flexing of the vacuum panels due to filling and sealing of the container. In addition, this reinforcement of the vacuum panels enables the container to resist sidewall deformation during handling of the container or when containers are stacked. The reinforcement ribs are located in the label upper and lower mounting areas, spaced from the edges of the vacuum panels but located closer to the edges of the panels than to the upper and lower edges of the label upper and lower mounting areas. In another embodiment, the reinforcement ribs merge with the edges of the vacuum panels at the edge of the label upper and lower mounting panels. The provision of reinforcement ribs which support the vacuum panels at their upper and lower edges permits smaller size vacuum panels to be used for a given size container,

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so that the size of the upper and label lower panels can be maximized for a given size container. Because the size of the label upper and lower mounting panels is maximized, label placement is less critical, resulting in more flexibility in the process for applying the label to the container.

Description of the Drawings

FIG. 1 is an elevation view of a container provided by the present invention;

FIG. 2 is an enlarged vertical sectional view taken along the lines 2-2 of FIG. 1;

FIG. 3 is an enlarged vertical sectional view taken along the lines 3-3 of FIG. 1;

FIG. 4 is a view similar to FIG. 2, but illustrating the reinforcement rib directed outwardly;

FIG. 5 is an elevation view of a container provided in accordance with a second embodiment of the present invention;

FIG. 6 is an enlarged fragmentary view of a portion of the container illustrated in FIG. 5; and,

FIG. 7 is a transverse sectional view taken along the lines 7-7 of FIG. 5, but rotated 30 degrees.

Description of a Preferred Embodiment

Referring to the drawings, the container of this invention, indicated generally at 10, is illustrated in FIG. 1 as having a main sidewall portion 12 of generally round cylindrical shape, an upper portion 14 defining a sealable closure 15, and a base portion 16 closing the bottom of the container. The sidewall portion 12 is formed integrally with and extends between the upper portion 14 and the base portion 16. The upper portion 14, which is located between the sidewall portion 12 and the closure 15, includes a generally dome shaped portion 17, a necked down portion 18 and an annular shoulder 19. The annular shoulder 19, which is located at the transition between the container sidewall 12 and the upper portion 14 of the container, has a lower edge 19a which is offset relative to the sidewall, defining an upper label bumper 21. Similarly, at the transition between the container sidewall 12 and the base portion 16 of the container, the annular upper edge 16a of the base portion 16 is

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offset relative to the sidewall, defining a lower label bumper 22. A full wrap label 23 is applied to the container sidewall portion 12 between the upper and lower label bumpers and is secured to the sidewall in a suitable manner as is known in the art.

The container 10 is a "hot-fill" container which is adapted to be filled with a liquid at a temperature above room temperature. The container is formed in a blow mold and is produced from a polyester or other plastic material, such as a heat set polyethylene terephthalate (PET). The sidewall portion 12 includes a plurality of vertically elongated oriented vacuum panels 24 which are disposed about the circumference of the container, spaced apart from one another by smooth, elongated vertically land areas 38. Each of the panels is generally rectangular in shape and has an upper edge 25, a lower edge 26, and side edges 27 and 27a. The vacuum panels are adapted to flex inwardly due to filling the container with a hot-fill liquid, capping the container, and subsequent cooling of the liquid. In addition, the base portion 16 may be adapted to deflect upwardly and inwardly in response to the hot fill process as is known in the art. During the hot fill process, the vacuum panels 24 of container 10 operate in conjunction with the base portion 16 to compensate for the hot fill vacuum. The vacuum panels 24 may contain one or more transverse ribs 28 which serve to strengthen the panels 24 against deformation during fabrication and under evacuation.

The sidewall portion which extends between the upper label bumper and the lower label bumper is commonly referred to as the label panel which includes flat surfaces which facilitate securing the label 23 to the container. The vacuum panels 24 are located in the label panel between the upper label bumper 21 and the lower label bumper 22, and thus are covered by the label 23. The marginal area 29 between the upper edges 25 of the vacuum panels and the upper label bumper 21 defines a flat label upper mounting panel and the marginal area 30 between the lower edges 26 of the vacuum panels 24 and the lower label bumper 22 defines a flat label lower mounting panel. For one twenty ounce container which was produced having an outer diameter of 2.75 inches, the length of the vacuum panels was approximately 2.75 inches and the vertical length of the label upper mounting area was approximately .5 inch and the

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vertical length of the lower label mounting area was approximately .5 inch. The label 23 has its upper and lower edges glued to the upper and lower mounting panels in the conventional manner.

In accordance with the present invention, the container sidewall portion 12 includes two inwardly directed reinforcement ribs 31 and 32. One of the reinforcement ribs 31 is located in the label upper panel 29 between the upper edges 25 of the vacuum panels 24 and the upper label bumper 21, but closer to the panel upper edges 25 than to the upper label bumper 21. The other reinforcement rib 32 is located in the label lower panel 30 between the lower edges 26 of the vacuum panels 24 and the lower label bumper 22, but closer to the panel lower edges 26 than to the lower label bumper 22. The annular reinforcement ribs 31 and 32 are continuous and extend around the inner circumference of the sidewall.

Referring to FIGS. 2-4, the reinforcement ribs 31 and 32 each are generally semicylindrical in shape and are directed radially inward, as illustrated in FIGS. 2-3, relative to the portions of the sidewall which define the upper label mounting area 29 and the lower label mounting area 30. However, one or both of the reinforcement ribs may be directed outwardly in the manner of reinforcement rib 31' shown in FIG. 4. As illustrated in FIG. 2, the lower end 19a of the shoulder 19 is offset relative to the surface of the upper label mounting area 29, defining the upper label bumper 21. Similarly, the upper end 16a of the base 16 is offset relative to the surface of the lower label mounting area 30, defining the lower label bumper 22. The annular ribs 31 and 32 are rigid and do not expand or contract under vacuum conditions. For one twenty ounce container which was produced having an outer diameter of 2.75 inches, the radius of each of the reinforcement ribs 31 and 32 was approximately 3/64 inches. The center line of the reinforcement rib 31 was located approximately 7/64 inch from the upper edge 25 of the vacuum panels. The centerline of the reinforcement rib 32 was located approximately 7/64 inch from the lower edge 26 of the vacuum panels. The size of the reinforcement ribs 31 and 32 is a function of the size of the container, and by way of example, would be increased from the value given in proportion to an increase in the dimensions of the container from the dimensions given for the exemplary container 10.

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The reinforcement ribs support the vacuum panels at their upper and lower edges. This permits smaller size vacuum panels to be used for a given size container, so that the size of the upper and lower panels is increased for a given size container. Because of the increased size of the upper and lower mounting panels, label placement is not critical resulting in more flexibility in the process for applying the label to the container. A secondary benefit is that the reinforcement ribs rigidize the side wall at the top and bottom edges of the vacuum panels 24. This makes the container sidewall, including the vacuum panels, less susceptible to deformation in shipping and handling of the container.

The inward flexing of the vacuum panels 24 caused by the hot fill vacuum creates high stress points, at the top corners 33 and 34 of the vacuum panels 24 and at the bottom corners 35 and 36 of the vacuum panels 24, which otherwise would flex inwardly, causing the container sidewall to collapse. The radial reinforcement ribs 31 and 32 which are molded concentric with the upper panel 29 and the lower panel 30 support the vacuum panels along their upper and lower edges, holding the edges fixed while permitting the center portions of the vacuum panels 24 to flex freely inward and without deforming the panels so that the vacuum panels operate in conjunction with the base 16 to allow the container to contract somewhat in volume during the "hot-fill" process to compensate for the volume shrinkage of the "hot-fill" liquid as the liquid cools. In addition, the reinforcement ribs strengthen the cylindrical portions of the sidewall between the upper and lower edges and the upper and lower bumpers, enabling the upper and lower label mounting areas to resist the vacuum deformation.

Referring to FIGS. 5-7, in accordance with a further embodiment, a container 40 has integrally molded reinforcing ribs 41 and 42 which merge with the upper edges 25 and the lower edges 26 of the vacuum panels 24. More specifically, reinforcing rib 41, which is molded integrally with the upper edges 25 of the vacuum panels 24, extends circumferentially across the flat areas 38 of the sidewall between each of the panels and merges with the upper edge 25 of each of the vacuum panels. Similarly, reinforcement rib 42, which is molded integrally with the lower edges 26 of the vacuum panels 24, extends circumferentially across the flat areas 38 of the sidewall between the panels and

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merges with the lower edge 26 of each of the vacuum panels. As shown in FIG. 7, the portions 44 of the reinforcement rib 42 which are adjacent the vacuum panels 24 are located radially inwardly relative to the portions 45 of the reinforcement rib 42 that are located in the flat, vertically extending areas 38 between the vacuum panels 24. The reinforcement rib 41 has the same configuration as reinforcement rib 42. Thus, the reinforcement ribs 41 and 42 have a scalloped appearance or configuration.

The effect of the reinforcement ribs 41 and 42 is the same as that provided by the reinforcement ribs 31 and 32 of container 10 illustrated in FIGS. 1-3. The reinforcement ribs 41 and 42 support the vacuum panels 24 at their upper and lower edges and rigidize the sidewall portion of the container 40 at the upper edges 25 and the lower edges 26 of the vacuum panels 24, preventing the sidewall from collapsing inwardly while permitting the vacuum panels 24 to operate in conjunction with the base portion 16 of the container to compensate for the volume shrinkage of the hot-fill liquid as the liquid cools.

Thus, it can be seen that the present invention provides a plastic container for hot-fill applications which has an improved sidewall construction afforded by annular inwardly directed reinforcement ribs which support the upper and lower edges of the vacuum panels. This reinforcement allows the vacuum panels to deflect under hot fill and subsequent vacuum conditions and operate in conjunction with the container base to compensate for volume shrinkage of the hot fill liquid, while resisting deformation of the vacuum panels subsequent to inward flexing of the vacuum panels due to filling and sealing of the container. In the accordance with preferred embodiments, the reinforcement ribs are located in the label upper and lower mounting panels, spaced from the edges of the vacuum panels or merging with the edges of the vacuum panels. However, it is within the scope of the present invention that the sidewall may include only one reinforcement rib, located in the label lower mounting cylinder or in the label upper mounting cylinder and either spaced apart from the edges of the vacuum panels or merging with the edges of the vacuum panels. Moreover, more than one reinforcement rib may be provided in one or both of the label upper and lower mounting panels. In addition, although the reinforcement ribs are illustrated in the preferred embodiments as being semicircular in shape, the

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reinforcement ribs could have other geometrical shapes and may be directed radially outward.

The invention has been described with reference to a preferred embodiment and is not limited to the exact construction or method illustrated, it being understood that various changes and modifications may be made without departing from the spirit, or scope of the invention as defined in the following claims.

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Claims:

1. A thin-walled container formed from a heat set plastic material and adapted to be filled with a liquid at a temperature elevated above room temperature and then sealed, said container comprising: an upper portion which includes a sealable closure and an upper walled portion, a lower portion including a base closing the bottom of the container, and a sidewall portion which is generally tubular in shape and being formed integrally with and extending between said upper walled portion and said lower portion, said sidewall portion including a plurality of elongated vertically oriented vacuum panels which are adapted to flex inwardly due to filling and sealing of the container with a liquid at an elevated temperature and subsequent cooling of the liquid, each of said vacuum panels having an upper edge, a lower edge, and a panel portion intermediate said upper and lower edges, said upper edges of said vacuum panels being spaced apart from said upper walled portion defining an upper label mounting area above said vacuum panels, and said lower edges of said vacuum panels being spaced apart from said lower portion defining a lower label mounting area below said vacuum panels, and reinforcement means including at least one annular reinforcement rib located in one of said label mounting areas, said reinforcement rib being directed radially inward and extending continuously around the circumference of said sidewall portion, said reinforcement rib supporting said vacuum panels along at least one of their edges to hold said supported edges fixed while permitting said panel portions intermediate said edges of said panels to flex inwardly during filling and sealing of the container and resisting deformation of said vacuum panels subsequent to inward flexing of said vacuum panels after filling and sealing of the container.

2. The container according to claim 1, wherein said reinforcement rib is spaced apart from the edges of said panels which are located adjacent to said one label mounting area, and is located closer to said supported panel edges than to said upper walled portion and said lower portion.

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3. The container according to claim 1, wherein said reinforcement rib merges with the edges of said panels which are located adjacent to said one label mounting area.

4. The container according to claim 1, wherein said reinforcement means includes first and second reinforcement ribs, said first reinforcement rib extending adjacent to said upper edges of said panels in said label upper mounting area and said second reinforcement rib extending adjacent to said lower edges of said panels in said label lower mounting area.

5. The container according to claim 4, wherein said first and second reinforcement ribs are located in said label upper and lower mounting areas, respectively, spaced apart from the edges of said panel, and said first reinforcement rib is located closer to said panel upper edges than to said upper walled portion and said second reinforcement rib is located closer to said panel lower edges than to said lower portion of said container.

6. The container according to claim 4, wherein said first and second reinforcement ribs merge with the upper and lower edges, respectively, of said panels.

7. The container according to claim 1, and including a label extending around said container over said vacuum panels and secured to said container in said label upper and lower mounting areas.

8. The container according to claim 1, wherein said reinforcement rib is generally semi-cylindrical in cross section.

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9. A thin-walled container formed from a heat set plastic material and adapted to be filled with a liquid at a temperature elevated above room temperature and then sealed, said container comprising: an upper portion which includes a sealable closure and an upper walled portion, a lower portion including a base closing the bottom of the container, and a sidewall portion which is generally tubular in shape and being formed integrally with and extending between said upper walled portion and said lower portion, said sidewall portion including a plurality of elongated vertically oriented vacuum panels which are adapted to flex inwardly due to filling and sealing the container with a liquid at an elevated temperature, and subsequent cooling of the liquid, said vacuum panels each having an upper edge, a lower edge, and a panel portion intermediate said upper and lower edges, said upper edges of said vacuum panels being spaced from said container upper walled portion defining a label upper mounting area and said lower edges of said vacuum panels being spaced from said container lower portion defining a label lower mounting area, a first annular reinforcement rib located in said label upper mounting area, and a second annular reinforcement rib located in said label lower mounting area, said first and second reinforcement ribs extending continuously around the inner circumference of said sidewall portion, said first and second reinforcement ribs supporting said vacuum panels at their upper and lower edges, respectively, in such a way as to permit said vacuum panels to flex inwardly under hot fill conditions and to resist deformation of said vacuum panels subsequent to inward flexing of said vacuum panels after filling and sealing of the container.

10. The container according to claim 9, wherein said first and second reinforcement ribs support said upper and lower edges of said vacuum panels to hold said upper and lower edges fixed while permitting said panel portions intermediate said upper and lower edges to flex inwardly during filling and sealing of the container and resisting deformation of said vacuum panels subsequent to inward flexing of said vacuum panels after filling and sealing of the container.

11. The container according to claim 9, wherein said first reinforcement rib is located closer to said upper edges of said vacuum panels than to said upper walled portion and said second reinforcement rib is located closer to said lower edges of said vacuum panels than to said lower portion of the container.

12. The container according to claim 9, wherein said first reinforcement rib merges with said upper edges of said vacuum panels and said second reinforcement rib merges with said lower edges said vacuum panels.

13. The container according to claim 9, wherein said reinforcement ribs are directed radially inward.

14. The container according to claim 9, wherein said reinforcement ribs are directed radially outward.

15. The container according to claim 9, and including a label extending around said container over said vacuum panels and secured to said container in said label upper and lower mounting areas.

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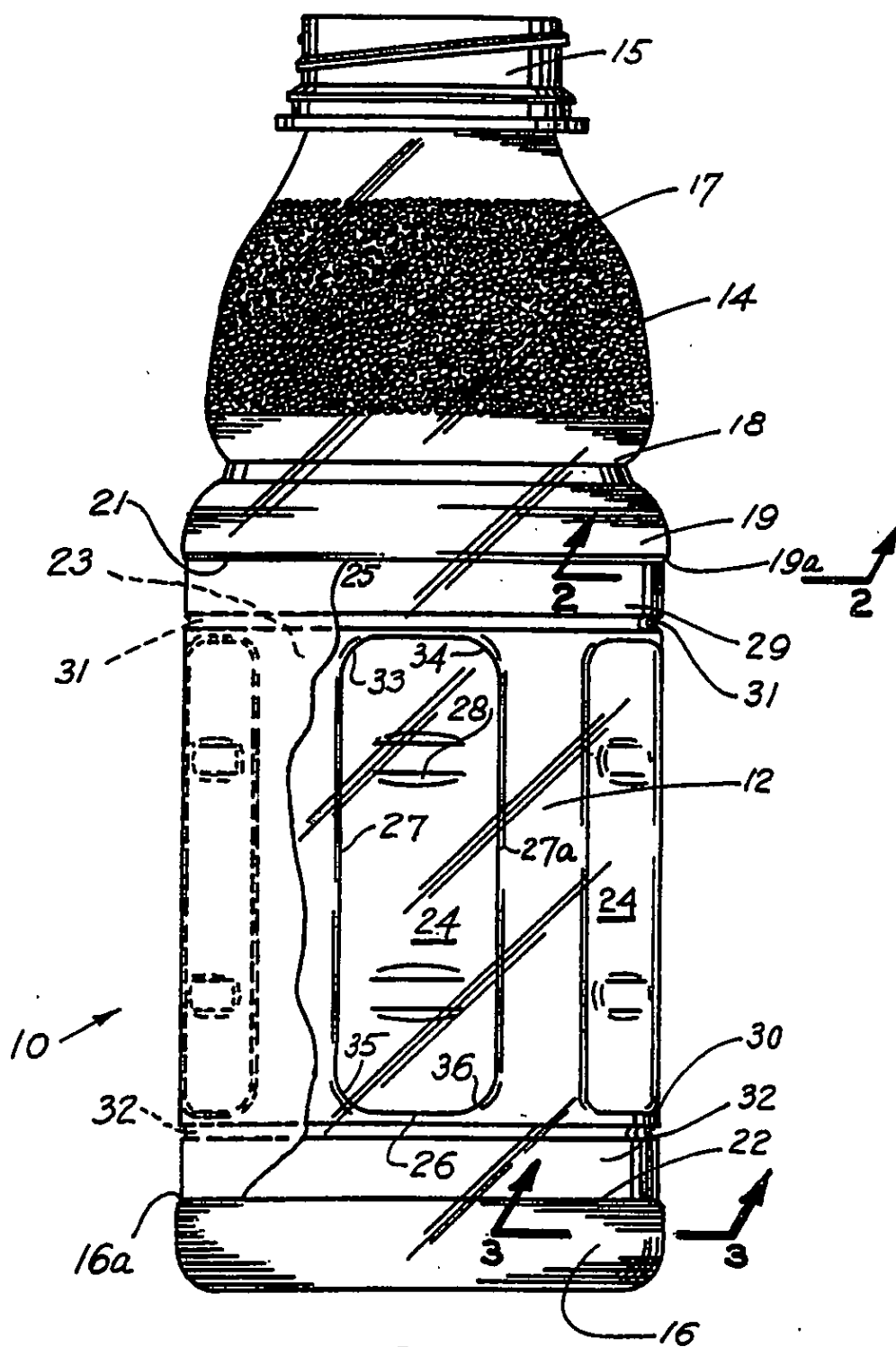


FIG.1

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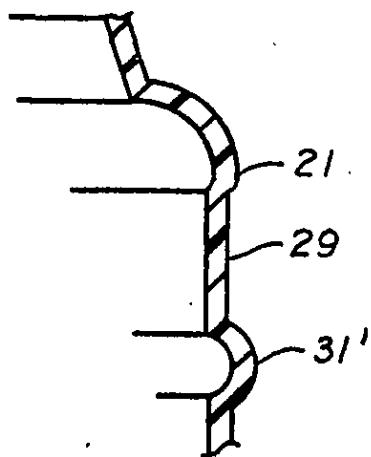


FIG. 4

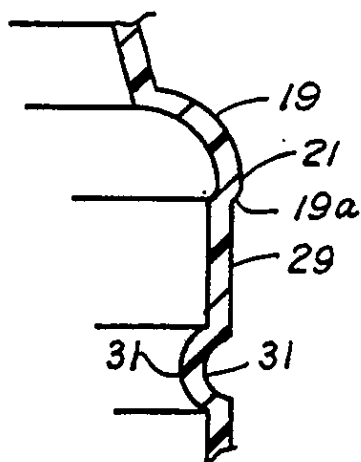


FIG. 2

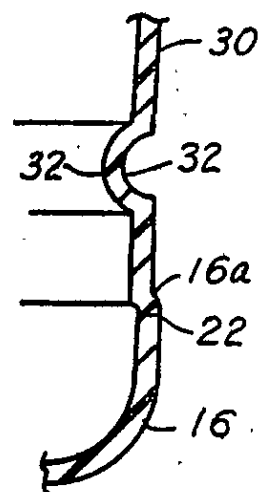


FIG. 3

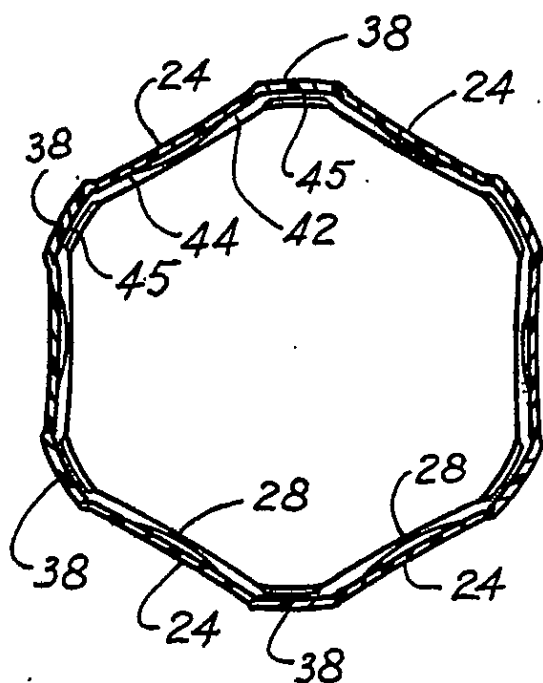


FIG. 7

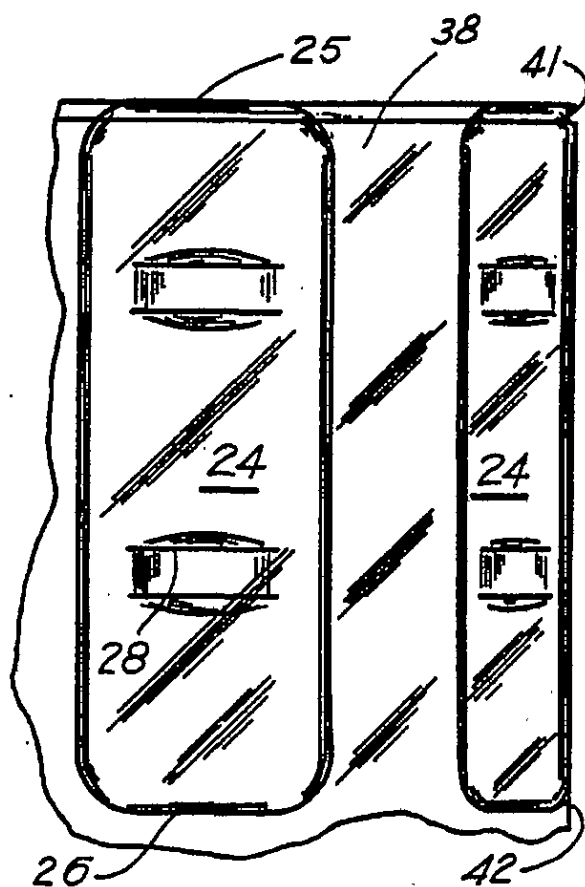


FIG. 6

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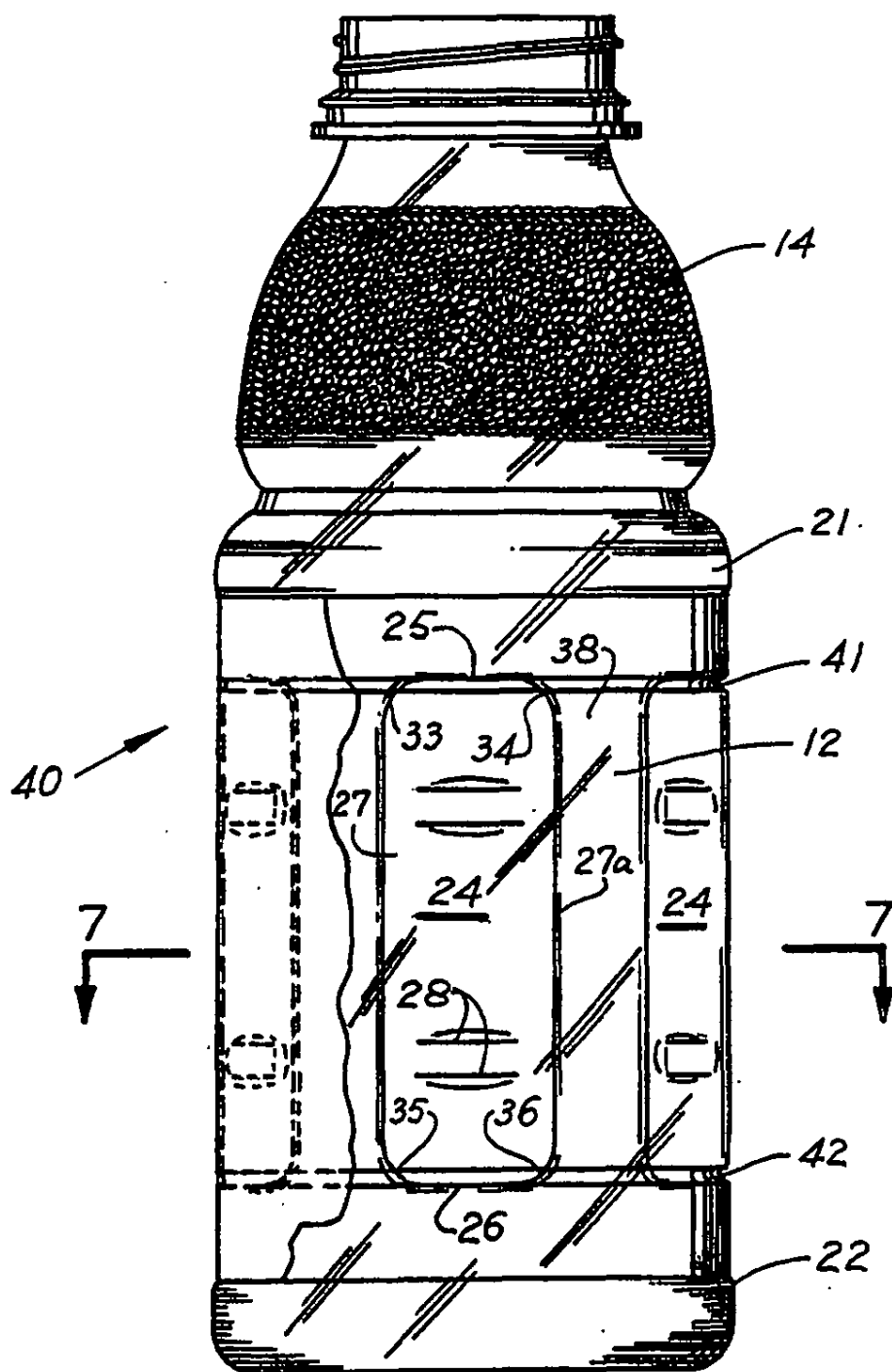


FIG. 5

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INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER IPC(5) :B65D 1/02, 1/42, 23/08 US CL :215/1C, 40/310; 220/609, 672, 675 According to International Patent Classification (IPC) or to both national classification and IPC				
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) U.S. : 215/1C, 40/310; 220/609, 672, 675 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)				
C. DOCUMENTS CONSIDERED TO BE RELEVANT				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
X	US, A, 5,054,632 (ALBERGHINI ET AL.) 08 October 1991 see entire document.	1, 2, 7		
Y	US, A, 4,863,046 (COLLETTE ET AL.) 05 September 1989 see entire document.	8		
A	US, A, 5,064,081 (HAYASHI ET AL.) 12 November 1991	1		
A	US, A, 5,178,289 (KRISHNAKUMAR ET AL.) 12 January 1993	1		
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.				
<table border="0"> <tr> <td> * Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed </td> <td> "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "A" document member of the same patent family </td> </tr> </table>			* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "A" document member of the same patent family
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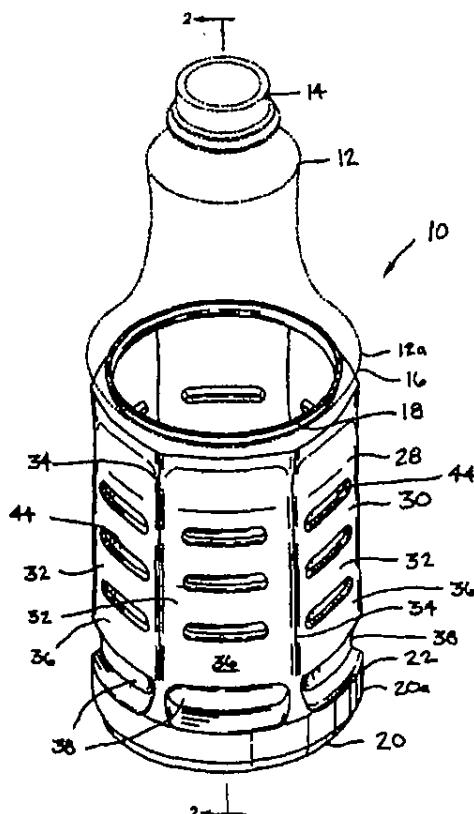
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(54) Title: HOT-FILLABLE MULTI-SIDED BLOW-MOLDED CONTAINER



(57) Abstract: A plastic blow molded bottle (10) or wide mouth jar useful in containing hot-filled beverages or food products. The container has a multi-sided sidewall (28) which is capable of accommodating vacuum associated with hot filling, capping and cooling of the container, which is reinforced to resist unwanted deformation, and which enables a label to be aesthetically displayed on the container sidewall. To this end, the sidewall comprises a plurality of panels (32) which include outwardly bowed arcuate sections (36), as-formed, which flatten to accommodate induced vacuum. Thus, a label can be supported on the sidewall with very few voids, or like sunken areas, behind the label to ensure that the label is prominently displayed on the aesthetically appealing novel container configuration.

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Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR,
GB, GR, IR, IT, LU, MC, NL, PT, SE, TR), OAPI patent
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HOT-FILLABLE MULTI-SIDED BLOW-MOLDED CONTAINER

FIELD OF THE INVENTION

5 The present invention relates to a plastic blow molded bottle or wide mouth jar useful in containing hot-filled beverages or food products, and more particularly, the present invention relates to a container having a multi-sided sidewall which is reinforced to resist unwanted deformation, which enables a label to be aesthetically displayed on the container sidewall, and which is capable of accommodating vacuum associated with hot filling, capping and cooling of the container.

10 BACKGROUND OF THE INVENTION

Hot-fillable, blow-molded plastic containers are well known in the art. The problems associated with accommodating vacuum deformations associated with hot filling, capping and cooling, and their solutions are also well known. Typically, so-called vacuum flex panels are formed as relatively large indented panels in the sidewall
15 of containers and accommodate the vacuum that develops in the containers as a result of hot fill processing. Examples of cylindrical containers having indented flex panels are disclosed in U.S. Patent Nos. 5,762,221 issued to Tobias et al.; D.402,563 issued to Prevot et al.; D.366,831 issued to Semersky et al.; and D.366,416 issued to Semersky.

20 Hot-fillable blow-molded containers having multi-sided sidewall configurations with indented vacuum flex panels are disclosed, for example, by U.S. Patent Nos. 5,178,290 issued to Ota et al. and 5,238,129 issued to Ota. In particular, FIGs. 7-8 of the Ota '290 patent and FIGs. 5-8 of the Ota '129 patent illustrate and disclose hexagonal and octagonal container sidewall configurations which have indented flex
25 panels.

Hot-fillable, multi-sided containers have also been provided with a series of walls which are formed planar and which bow, flex, or warp inwardly in response to induced vacuum. Thus, the resulting shape of each panel of such hot-filled, capped and cooled containers is concave, or inwardly bowed, thereby providing the sidewall
30 with an undulating shape in plan. Examples of such containers are disclosed by U.S.

Patent Nos. 4,749,092 issued to Sugiura et al. and 4,497,855 issued to Agrawal et al. For instance, see FIGs. 2 and 5 of the '092 Sugiura patent and FIG. 7 of the Agrawal '855 patent. U.S. Patent No. 3,923,178 issued to Welker, III discloses another multi-sided container having a plurality of sidewall panels which, as-formed, are planar and which are designed to flex inwardly. For instance, see FIG. 7 of the Welker, III '178 patent.

Other related container designs are disclosed by U.S. Patent No. 4,946,053 issued to Conrad which discloses an ovalized label panel for a hot-fillable bottle having a circular footprint; U.S. Patent No. 5,908,127 issued to Weick et al. which discloses an ovalized or "rounded-off" rectangular sidewall of a hot-fillable bottle having front and rear outwardly bowed panels; and U.S. Patent No. 5,690,244 issued to Darr which discloses a paneled sidewall of a jar having a circular footprint. Also see the container configurations disclosed in U.S. Patent Nos. 4,818,575 issued to Hirata et al.; 5,866,419 issued to Meder; D.189,372 issued to Adell; D.402,896 issued to Conrad; D.318,422 issued to Rumney; D.418,760 issued to Blank; and D.419,886 issued to Gans.

A problem experienced with hot-fillable containers having flex panels, particularly indented or concave flex panels, is that voids are created within the label mounting region behind the labels. Voids behind a label can prevent the label from being prominently displayed on the container sidewall and can provide areas on the label which are prone to tearing, undesirable stretching, or the like. In addition, the use of certain labels, such as shrink wrap labels, can result in the labels extending into, or shrinking within, the voids which also negatively effects container aesthetics.

Another problem experienced with hot-fillable containers is the occurrence of creases, dents or like deformations in the sidewalls of the containers which damage, weaken, and/or detract from the aesthetics of the container. Such deformations can result, for instance, due to line pressure experienced during transferring, filling, capping and packing operations. To this end, adjacent containers in such operations can become tightly engaged, particularly adjacent the base and lower bumper areas of the containers, thereby causing at least selected ones of the containers from being

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dented or provided with undesirable crease marks. More specifically, multi-sided containers typically experience such deformations adjacent the vertical post structures adjacent the base of the containers.

5 A still further problem relates to the occurrence of creases, dents or like deformations in the sidewalls of the containers experienced as a result of shipping and handling of the containers due to inadequate top loading or drop capability. To this end, creases or dents can result in containers located in bottom rows of containers on which many other rows of containers are stacked during shipping. In addition, forces exerted on the containers during loading and unloading of the stacked containers can
10 also cause creases and dents. Multi-sided containers are particularly prone to such deformation along post structures adjacent the base of the containers along an area of contact of the containers with adjacent containers in the stack.

Although various ones of the above referenced containers may function satisfactorily for their intended purposes, there is a need for a hot-fillable, blow-
15 molded container having a flex panel and sidewall structure which permits a label to be completely wrapped around the container sidewall and prominently displayed thereon and which limits voids behind the label. In addition, preferably the sidewall structure should be multi-sided and should be reinforced to resist creasing, denting and the occurrence of like deformations. Further, the container should provide
20 improved top loading capability and improved drop testing results. Still further, the container should be capable of efficient and relatively inexpensive manufacture and should be capable of being made from a minimum of thermoplastic material.

OBJECTS OF THE INVENTION

25 With the foregoing in mind, a primary object of the present invention is to provide a blow-molded plastic bottle and/or wide mouth jar having a multi-sided sidewall capable of accommodating induced vacuum within a hot-filled, capped and cooled container.

Another object of the present invention is to provide a hot-fillable, multi-sided container providing a label mounting area which encompasses flex panel structures on

the sidewall and which can prominently support and display a label, including shrink wrap labels and the like.

A further object is to provide a hot-fillable, multi-sided, plastic, blow-molded container which provides a novel visual appearance and which has enhanced structural integrity.

SUMMARY OF THE INVENTION

More specifically, the present invention provides a hot-fillable plastic container provided by a blow molded plastic container body having a circular base, a sidewall, a circular lower bumper between the base and sidewall, and a dome having an upstanding finish. The sidewall has a plurality of panels positioned circumferentially in a side-by-side relationship about the sidewall thereby forming a multi-sided sidewall structure. Each adjacent pair of panels interconnect at an obtuse angle and form a vertically-extending post structure which extends continuously through the multi-sided sidewall structure.

Each panel, as-formed, has a section which is arcuate in a plane extending perpendicular to an imaginary central axis extending longitudinally through the container. The arcuate sections provide the panel with a slightly outward bow and are formed having a predetermined radius of curvature within a predetermined range of radius of curvatures. Preferably, the radius of curvature of the panels varies along the length of the panels. This structure permits the arcuate sections of the panels to flex inwardly for accommodating induced vacuum created when the container is hot-filled, capped and cooled.

Each panel also has an inset circumferentially-extending reinforcement area adjacent the lower bumper of the container. Each inset area extends between an adjacent pair of the post structures and terminates a spaced distance from the post structures to reinforce and strengthen the circular lower bumper and post structures. This structure enables the container to resist creasing, denting and like deformation, and enhances top loading capability and drop testing results.

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306**BRIEF DESCRIPTION OF THE DRAWINGS**

The foregoing and other objects, features and advantages of the present invention should become apparent from the following description when taken in conjunction with the accompanying drawings, in which:

5 FIG. 1 is a perspective view of a container embodying the present invention with the dome of the container being illustrated in phantom;

FIG. 2 is a cross-sectional view of the container illustrated in FIG. 1 taken longitudinally of the container along line 2--2;

10 FIG. 3 is a cross-sectional view of the container taken transversely through the container along line 3--3 of FIG. 2;

FIG. 3 is a cross-sectional view of the container taken transversely through the container along line 3--3 of FIG. 2;

FIG. 4 is a cross-sectional view of the container taken transversely through the container along line 4--4 of FIG. 2;

15 FIG. 5 is a cross-sectional view of the container taken transversely through the container along line 5--5 of FIG. 2;

FIG. 6 is a cross-sectional view of the container taken transversely through the container along line 6--6 of FIG. 2; and

20 FIG. 7 is a cross-sectional view of the container taken transversely through the container along line 7--7 of FIG. 2;

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment of a blow-molded plastic container body 10 according to the present invention is illustrated in FIG. 1. The illustrated container body 10 is utilized
25 to package beverages, such as juice, and is capable of being filled in either high-speed hot-fill or cold fill operations. The container 10 can be manufactured in various sizes to provide a fill capacity of, for instance, 64 fluid ounces. Of course, the container 10 can be made smaller, or larger, to provide any desired pre-determined capacity and also can be made having a wide-mouth finish so that the container can be utilized as a
30 jar to package food products, such as, sauces, relishes, pickles, and the like.

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As best illustrated in dashed lines in FIGs. 1 and 2, the container body 10 has a dome 12 with an upstanding finish 14. The particular shape of the dome can vary as desired. In the illustrated embodiment, the dome 12 has a lower end 12a providing an upper label bumper 16 which is circular and which projects outwardly directly above an inset circumferential groove 18. The groove 18 provides hoop strength and resists ovalization-type distortion of the container body 10. Preferably, the finish 14 is provided in narrow sizes for beverage bottle-type containers and is provided in wide-mouth sizes for jar-type food containers. In addition, the finish 14 can be an injection molded finish or a blown finish and is preferably provided with threads for cooperatively engaging a cap (not shown) used to seal the container body 10.

Preferably, a closed ended base 20 provides the container body 12 with a circular footprint. An outer peripheral sidewall 20a of the base 20 provides a lower label bumper 22 which, as illustrated, is circular. An endwall 24 of the base 20 can be of any desired shape, such as, a concave-shaped base structure 26 as shown in FIG. 2. To this end, the base 20 is a so-called push-up style base and is capable of accommodating a percentage of the induced vacuum created in a hot-filled, capped and cooled container.

One important aspect according to the present invention is that the container body 10 has a multi-sided sidewall 28 which extends between the dome 12 and base 20. In the illustrated embodiment, the entire sidewall 28 is multi-sided and provides a label mounting region 30 extending between the upper and lower label bumpers, 16 and 22. Alternatively, although not illustrated, only a portion of the sidewall 28 need be formed as a multi-sided structure, and the label mounting region can be limited to less than the entire sidewall 28.

In the preferred embodiment, a label (not shown) can be applied to the sidewall 28 to cover the entire sidewall 28 and extend 360° about the sidewall 28. For example, the label can be a paper label adhesively applied to the sidewall 28 or a tubular plastic shrink wrap label shrunk to tightly engage the sidewall 28. Most importantly, the container body 10 is capable of prominently displaying these and

other types of labels because the sidewall 28 has relatively few voids, or sunken areas, behind the label.

As illustrated, the multi-sided sidewall 28 is formed by six panels 32 positioned in a side-by-side relationship about the periphery of the sidewall 28. Each pair of adjacent panels 32 interconnect at an obtuse angle "A", and a column, or post, 34 is formed at each interconnection. Thus, the illustrated container body 10 has six circumferentially-spaced, longitudinally-extending posts 34. Preferably, each panel 32 is identical in shape and size, and only a corner-shaped post 34 is located between each pair of adjacent panels 32. Alternatively, at least selected ones of the panels can be provided with a different shape and/or dimension, and intermediate structures can be located between each adjacent pair of panels. In addition, the number of panels 32 utilized to form the sidewall can vary, such as within a range of 3 to 12 panels.

Preferably, each panel 32 has at least a section 36 thereof which is flexible to accommodate induced vacuum created in a hot-filled, capped and cooled container. In accordance with the objectives of the present invention to reduce the number of voids or the like behind a label and to enhance the prominence of the display provided by the label, the flexible sections 36 are not formed as indented structures. Rather, the flexible sections 36 of the panels 32 are formed with a slight gentle outward bow between each pair of adjacent posts 32. For example, as illustrated in FIG. 6, the section 36 is arcuate in a plane "P₁" extending perpendicular to an imaginary central axis "C₁" of the container body 10 and is formed at a predetermined radius of curvature "Rc₁". Also see the cross-sections of the panels 32 which are illustrated in FIGs. 3, 4, and 5 along planes "P₄", "P₃" and "P₂", respectively, and which are formed at predetermined radius of curvatures "Rc₄", "Rc₃" and "Rc₂", respectively.

When the container body 10 is hot-filled and capped and as the hot-filled container body 10 and its contents cool, a vacuum is created which reduces the internal volume of the sealed container. The outwardly bowed sections 36 of the panels 32 of the container body 10 accommodate the vacuum by flexing inwardly to a substantially flattened condition. Thus, the sidewall 28 of the hot-filled, capped and

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cooled container body 10 maintains a uniform multi-sided configuration and is capable of prominently displaying a label.

According to one contemplated embodiment of the present invention, the outward bow of the flexible sections 36 of the panels 32, as-formed, becomes either greater, or gentler, as the panel extends in a direction parallel with the central axis "C_L". For example, section 36 of each panel 32 bows outward to a greatest extent in plane "P₁" and flattens as the panel 32 extends upwardly toward plane "P₄". To this end, sections 36a illustrated in FIG. 5 are flatter and have a greater radius of curvature than sections 36b illustrated in FIG. 6. Preferably, the radius of curvature "Rc₁" defines a minimum radius of curvature of the section 36 of the panel 32, and the radius of curvature "Rc₂" defines a maximum radius of curvature. In addition, preferably the minimum and maximum radius of curvatures are within 5% of one another so that the change in radius of curvature, if any, is gentle and difficult to visualize.

As an alternative to the above discussed and illustrated structure of the flexible sections 36 of the panels 32, the entire flexible section 36, or each entire panel 32, can be formed having a constant radius of curvature. Another alternative is for the sections 36 to flatten as the sections 36 extend in a direction toward the base 20. Yet another alternative is a flexible section 36 which is provided with upper and lower arcuate areas and a relatively flat intermediate area located therebetween (ie. a so-called "H-panel" structure).

An advantage of providing a multi-sided sidewall 28 having panels 32 which flex inwardly according to the present invention is that as the panels accommodate vacuum they are also reinforcing the post strength of the sidewall 28 by pinching, and preferably vertically-straightening, the posts 34 formed at the interconnection of each adjacent pair of panels 32. For instance, the obtuse angle "A" of the interconnection between adjacent panels 32, as formed, reduces as the outwardly bowed flexible sections 36 flatten. Thus, the posts 34 progressively become stiffer as the sidewall 28 accommodates the induced vacuum and provides the filled and sealed container body 10 with improved top-loading capability.

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Preferably, the posts 34 on the multi-sided sidewall 28 are continuous and without interruption thereby maximizing top-loading capability of the container body 10. In addition, preferably at least a portion of each post 34 is located adjacent an inset reinforcement area, or rib, 38. The ribs 38 are located on each panel 32 adjacent areas of the posts 34 that tend to crease or dent due to line pressures which are experienced during transferring, filling, capping, and packing operations and which result in adjacent containers being forced tightly together in a restricted amount of space.

Preferably, one circumferentially-extending rib 38 is located on each panel 32 between and adjacent the lower label bumper 22 and the flexible sections 36 of the panels 32. As best illustrated in FIG. 7, each rib 38 extends between an adjacent pair of posts 34 and does not interrupt the posts 34 to permit the posts 34 to extend continuously from the groove 18 of the dome 12 to the lower label bumper 22 of the base 20. The ribs 38 function to reinforce and strengthen the lower label bumper 22 and the posts 34 and to prevent deformation thereof. In addition, the ribs 38 permit the arcuate flexible sections 36 to flatten, yet reinforce the sections 36 from unwanted inward denting and like deformation. Thus, creasing and like deformations which structurally weaken and blemish the aesthetics of the container body 10 are prevented at locations particularly susceptible to such deformations.

By way of example and not by way of limitation, the container body 10 is manufactured of PET utilizing injection blow-molding techniques. Of course, other plastic materials and multi-layered plastic materials can be utilized as well as other blow molding techniques. The container body 10 is dimensioned to have a capacity of 64 fluid ounces and a multi-sided sidewall with a total of six identical panels 32. Each panel 32 has a flexible section 36 which, as formed, bows outwardly. A lower portion of the flexible section 36 has a radius of curvature of about 5.5 inches and an upper portion of the flexible section has a radius of curvature of about 5.7 inches. The sidewall 28 has six vertically extending posts 34, and each panel 32 has one circumferentially extending inset rib 38 which is located between and adjacent the lower label bumper 22 and the flexible sections 36. Each rib 38 terminates a spaced

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distance from an adjacent pair of posts 34, and preferably the innermost walls 40 of the ribs 38 are planar as illustrated in FIG. 7 and have ends 42 which interconnect to form a portion of the posts 34. In addition, preferably the upper and lower label bumpers 16 and 22 are circular in plan and the base 20 of the container body 10
5 provides a circular footprint. Finally, each panel 32 has three longitudinally-spaced, circumferentially extending inset reinforcement ribs 44 which prevent unwanted over flexure of the panels 32 and assures that the panels 32 uniformly accommodates the induced vacuum.

While a preferred hot-fillable container body having a multi-sided sidewall has
10 been described in detail, various modifications, alterations and changes may be made without departing from the spirit and scope of the present invention as defined in the appended claims.

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Claims:

1. A hot-fillable plastic container, comprising:
a blow molded plastic container body (10) having a circular base (20),
a finish (14) opposite said base (20), and a sidewall (28)
5 extending therebetween;
a portion of said sidewall (28) having a plurality of panels (32)
positioned circumferentially about said sidewall portion to form
a multi-sided sidewall structure;
each adjacent pair of panels (32) interconnecting to form an obtuse
10 angle (A) therebetween and to form a continuous
longitudinally-extending post structure (34) therebetween; and
at least selected ones of said panels (32) having a section (36) thereof
formed outwardly bowed of the container (10) at a radius of
curvature (R_c) within a predetermined range of radius of
15 curvatures;
whereby, when the container (10) is hot-filled and capped and as the hot-filled and
capped container (10) is permitted to cool, said outwardly bowed section (36) flattens
to accommodate induced vacuum created within the capped and filled container (10).
2. A hot-fillable plastic container according to claim 1, wherein said sidewall
20 (28) has an outwardly extending, circumferentially-disposed, circular bumper (22).
3. A hot-fillable plastic container according to claim 2, wherein at least
selected ones of said panels (32) have an inset reinforcement area (38) adjacent said
bumper (22), each of said inset areas (38) extending between an adjacent pair of post
structures (34) and terminating a spaced distance from said post structures (34),
25 whereby said inset areas (38) function to reinforce and strengthen said bumper (22)
and post structures (34) to prevent deformation thereof.

4. A hot-fillable plastic container according to claim 3, wherein said bumper (22) is a lower label bumper located adjacent said base (20), and wherein said outwardly bowed sections (36) of said panels (32) are located above said inset areas (38).

5. A hot-fillable plastic container according to claim 1, wherein said outwardly bowed sections (36) of said panels (32) flex inwardly when said container (10) is hot-filled and capped and as the hot-filled and capped container (10) is permitted to cool to accommodate induced vacuum created within the capped and filled container (10).

6. A hot-fillable plastic container according to claim 3, wherein said sidewall portion includes at least five panels (32) each having an as-formed outwardly bowed section (36) and an inset reinforcement area (38).

7. A hot-fillable plastic container according to claim 6, wherein said sidewall portion is formed from six identical panels (32) positioned side by side.

8. A hot-fillable plastic container according to claim 1, wherein said radius of curvature (R_{C_1}) of each of said outwardly bowed sections (36) extends on a plane (P_1) perpendicular to an imaginary central axis (C_1) extending longitudinally through the container (10).

9. A hot-fillable plastic container according to claim 8, wherein said radius of curvature (R_{C_1}) of each outwardly bowed section (36) varies as said outwardly bowed section (36) extends in a direction parallel to said imaginary central axis (C_1).

10. A hot-fillable plastic container according to claim 9, wherein said radius of curvature (R_{C_1}) of each outwardly bowed section (36) increases as said outwardly bowed section (36) extends toward said finish (14).

11. A hot-fillable plastic container according to claim 9, wherein said radius of curvature (R_{c1}) of each outwardly bowed section (36) decreases as said outwardly bowed section (36) extends toward said finish (14).

12. A hot-fillable plastic container according to claim 9, wherein said range of radius of curvatures (R_{c1}) includes a maximum radius of curvature and a minimum radius of curvature, and wherein said maximum radius of curvature is within 5% of said minimum radius of curvature.

13. A hot-fillable plastic container according to claim 1, wherein said sidewall portion having said panels (32) provides a label mounting area (30), and wherein said sidewall (28) includes a circular upper label bumper (16) above said label mounting area (30) and a circular lower label bumper (22) below said label mounting area (30).

14. A hot-fillable plastic container according to claim 1, wherein said finish (14) is selected from the group consisting of an upstanding threaded narrow neck finish, an upstanding threaded wide mouth finish, an upstanding injection molded finish, and an upstanding blown finish.

15. A hot-fillable plastic container, comprising:
a blow molded plastic container body (10) having a circular base (20),
a sidewall (28), a circular lower bumper (22) between said base (20) and sidewall (28), and a dome (12) having an upstanding finish (14) opposite said base (20);
said sidewall (28) having a plurality of panels (32) positioned circumferentially in a side-by-side relationship about said sidewall (28) thereby forming a multi-sided sidewall structure;

- each adjacent pair of panels (32) interconnecting to form an obtuse angle (A) therebetween and a vertically-extending post structure (34) which extends continuously through said multi-sided sidewall structure; and
- 5 each panel (32), as-formed, having a section (36) which is arcuate in a plane (P_1) perpendicular to an imaginary central axis (C_L) extending longitudinally through the container (10), each arcuate section (36) providing said panel (32) with a slightly outward bow and having a predetermined radius of curvature (R_{c_1}) within a predetermined range of radius of curvatures, and
- 10 each panel (32) having an inset circumferentially-extending reinforcement area (38) adjacent said lower bumper (22), each of said inset areas (38) extending between an adjacent pair of said post structures (34) and terminating a spaced distance
- 15 from said post structures (34) to reinforce and strengthen said circular lower bumper (22) and post structures (34), and each of said arcuate sections (36) of said panels (32) flexing inwardly for accommodating induced vacuum created when the container (10) is hot-filled, capped and cooled.
- 20 16. A hot-fillable plastic container according to claim 15, wherein said sidewall (28) has at least five of said panels (32).
17. A hot-fillable plastic container according to claim 16, wherein said radius of curvature (R_{c_1}) of said arcuate sections (36) varies as said arcuate sections (36) extend in a direction parallel to said imaginary central axis (C_L).
- 25 18. A hot-fillable plastic container according to claim 16, wherein said radius of curvature (R_{c_1}) of said arcuate sections (36) decreases as said arcuate sections (36) extend toward said base (20).

19. A hot-fillable plastic container according to claim 16, wherein said radius of curvature (R_{c1}) of said arcuate sections (36) increases as said arcuate sections (36) extend toward said base (20).

5 20. A hot-fillable plastic container according to claim 18, wherein said range of radius of curvatures (R_{c1}) includes a maximum radius of curvature and a minimum radius of curvature, and wherein said maximum radius of curvature is within 5% of said minimum radius of curvature.

FIG. 1

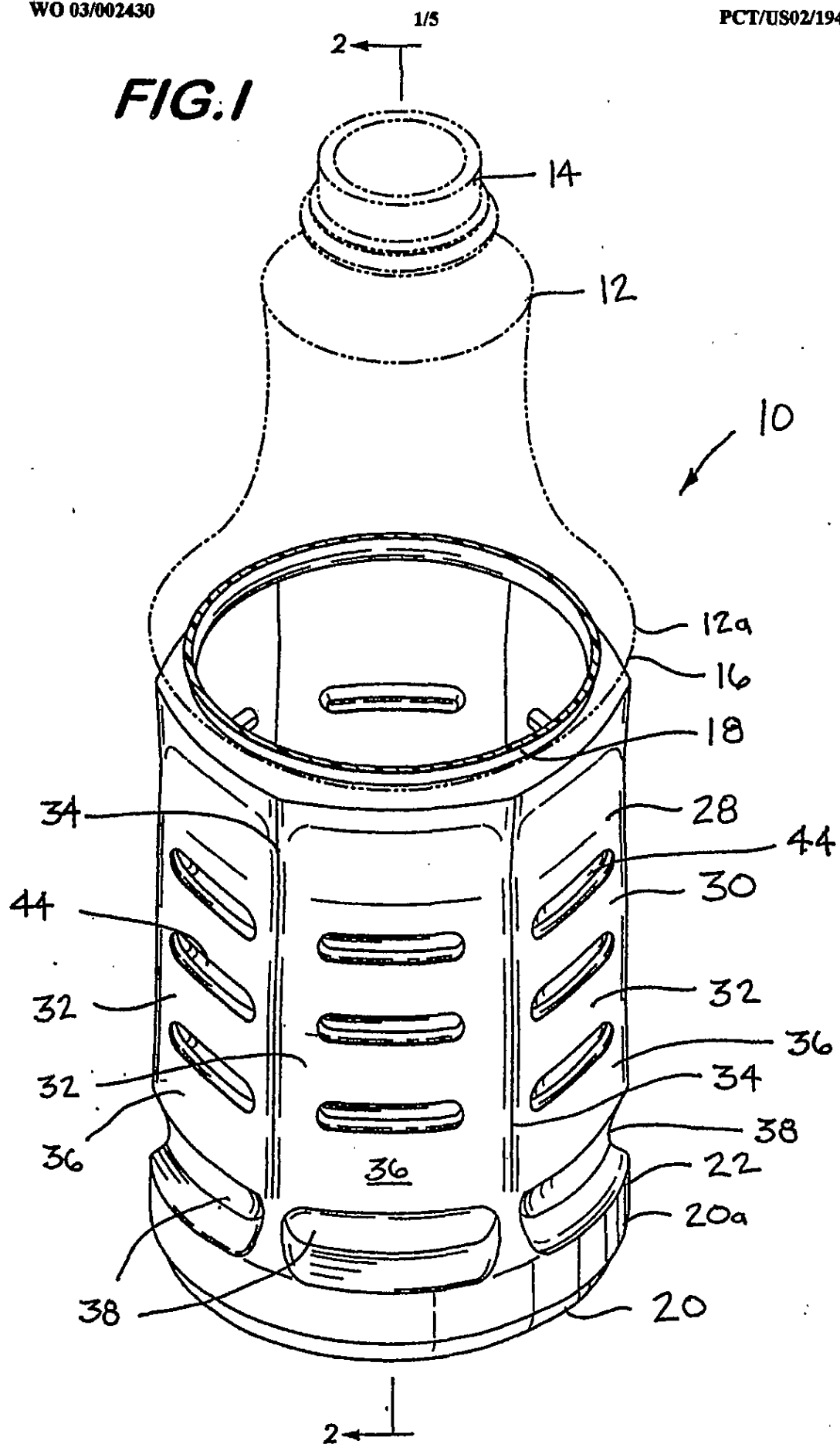


FIG. 2

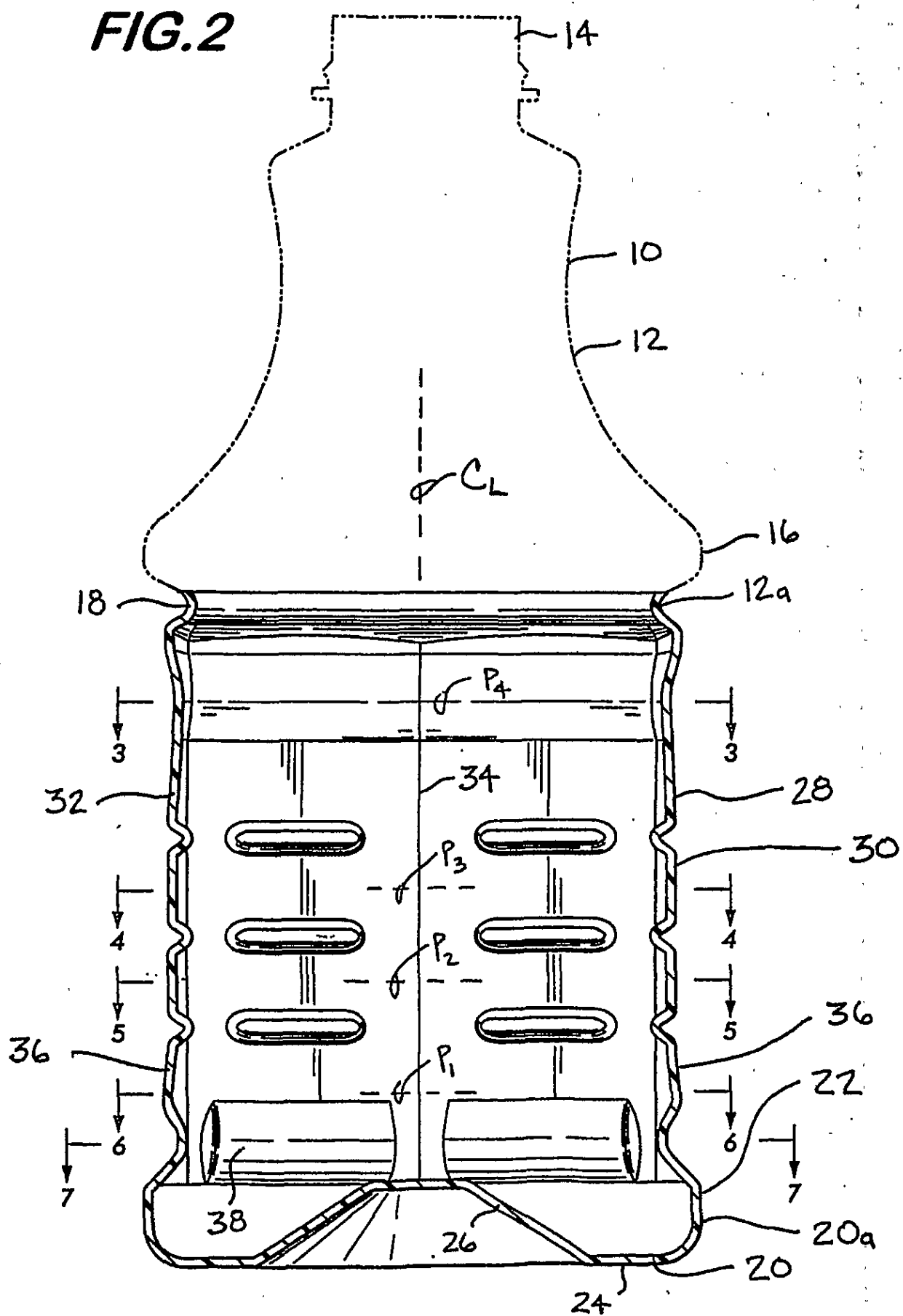


FIG. 3

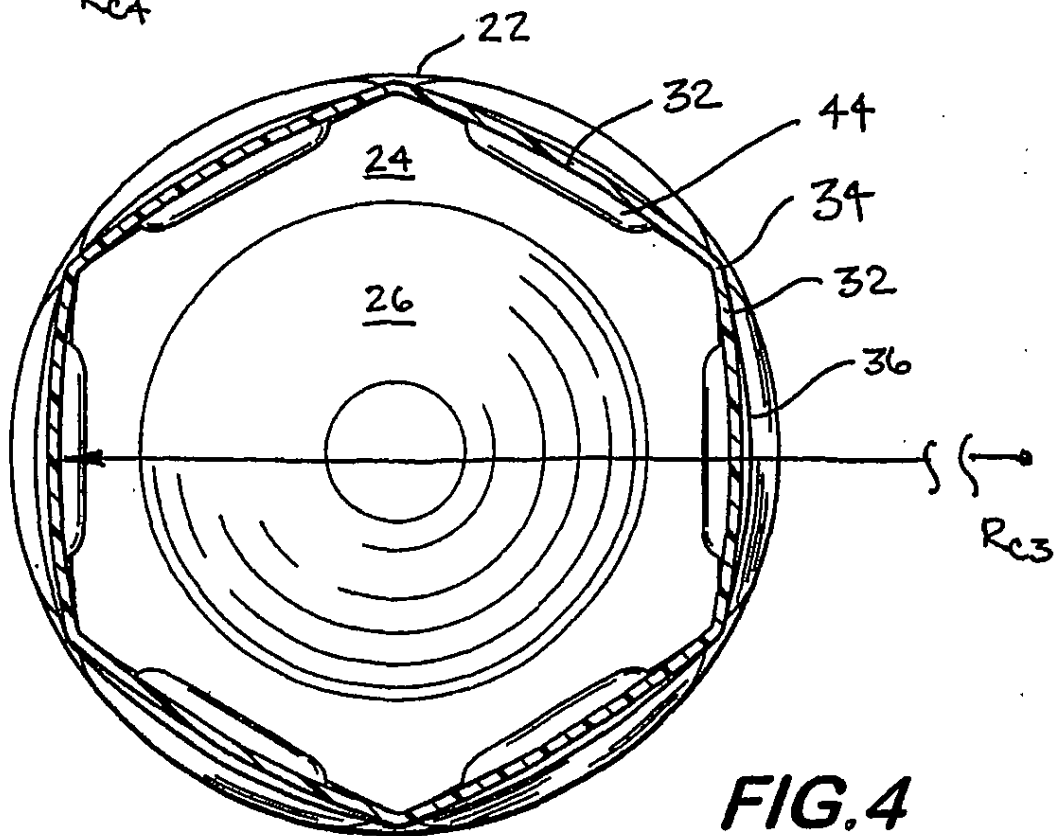
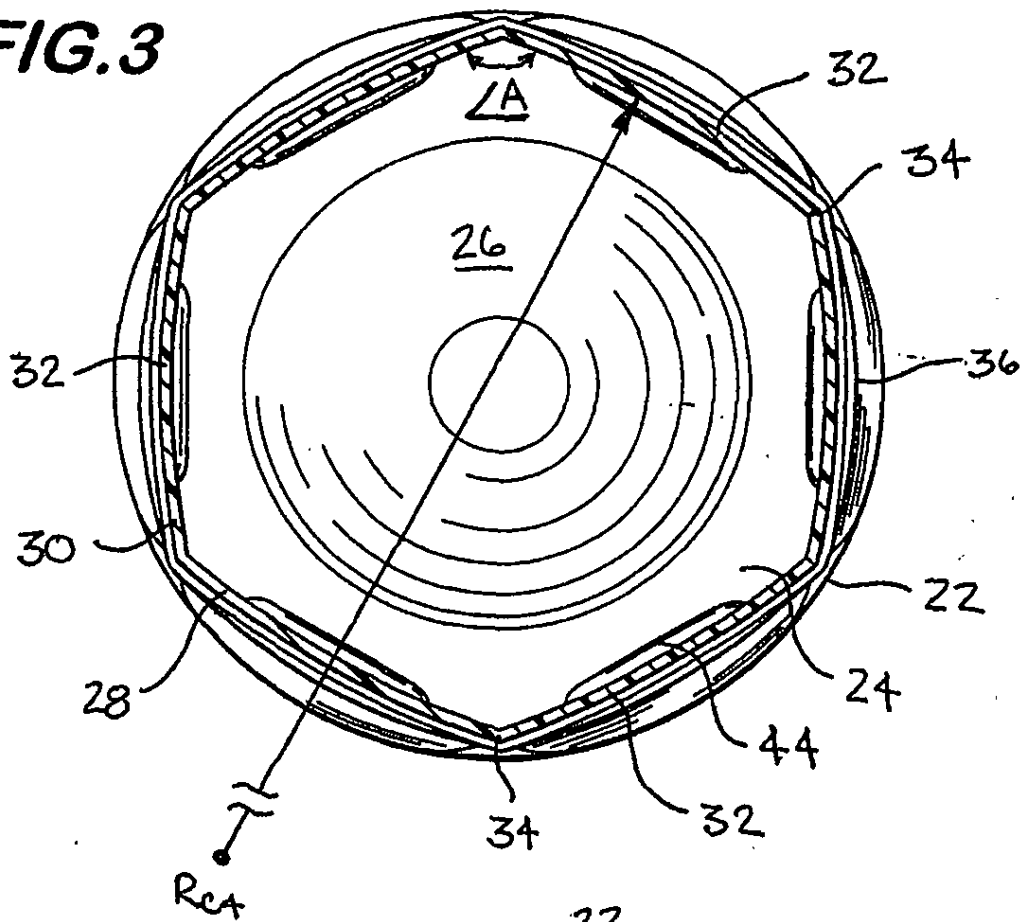


FIG. 4

FIG. 5

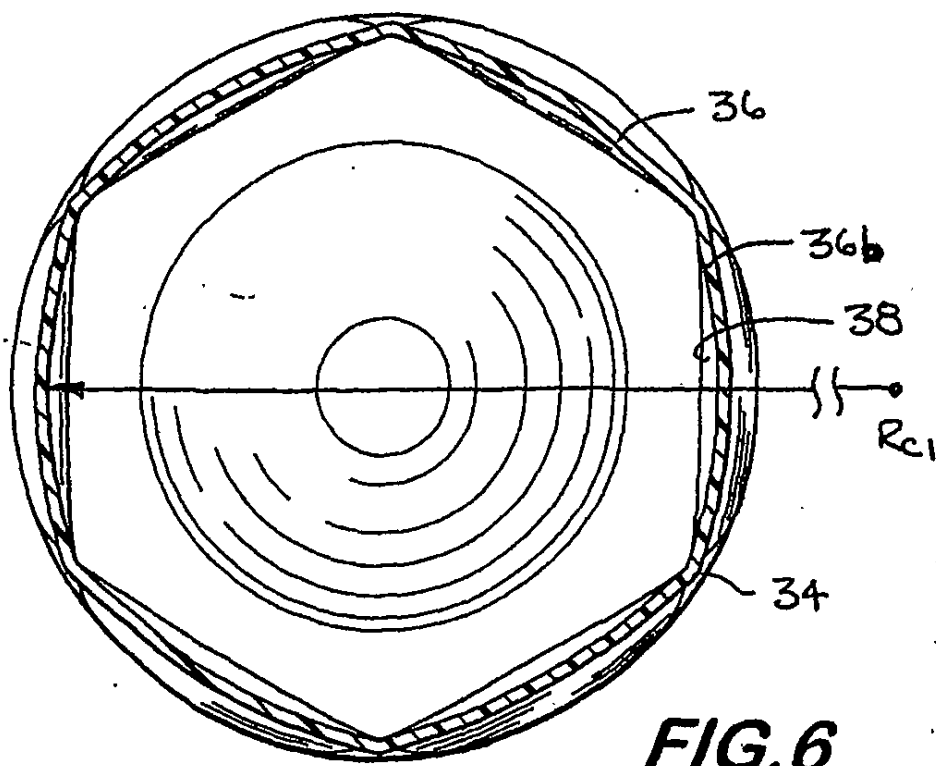
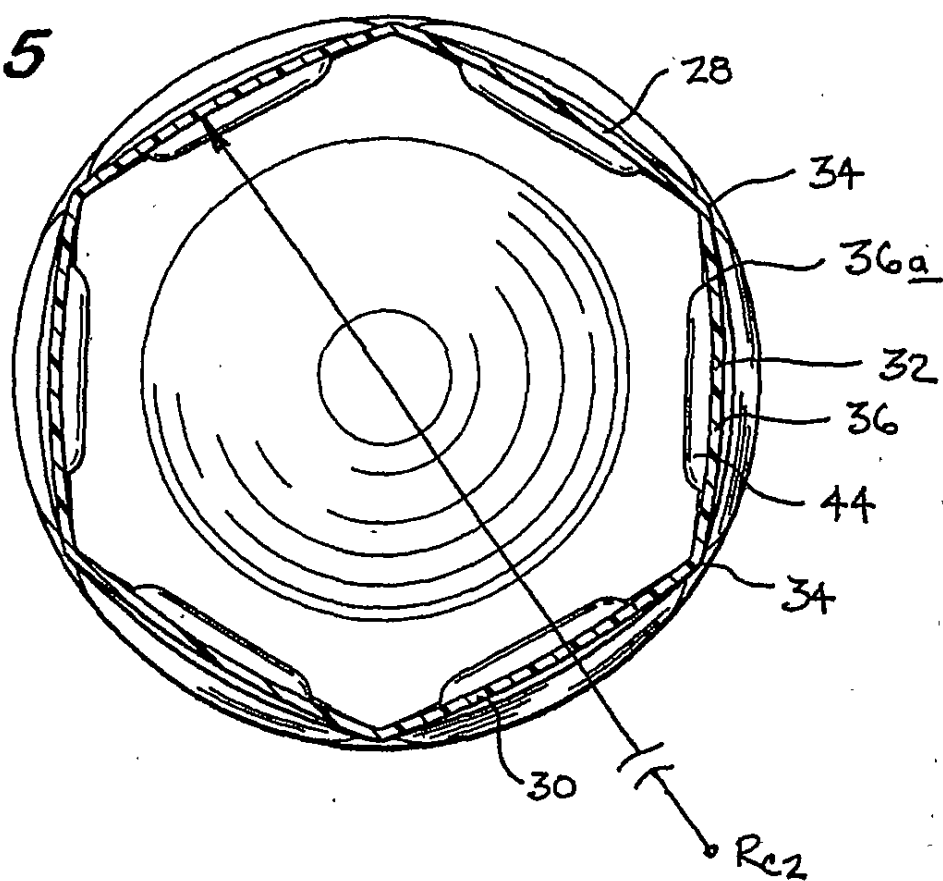
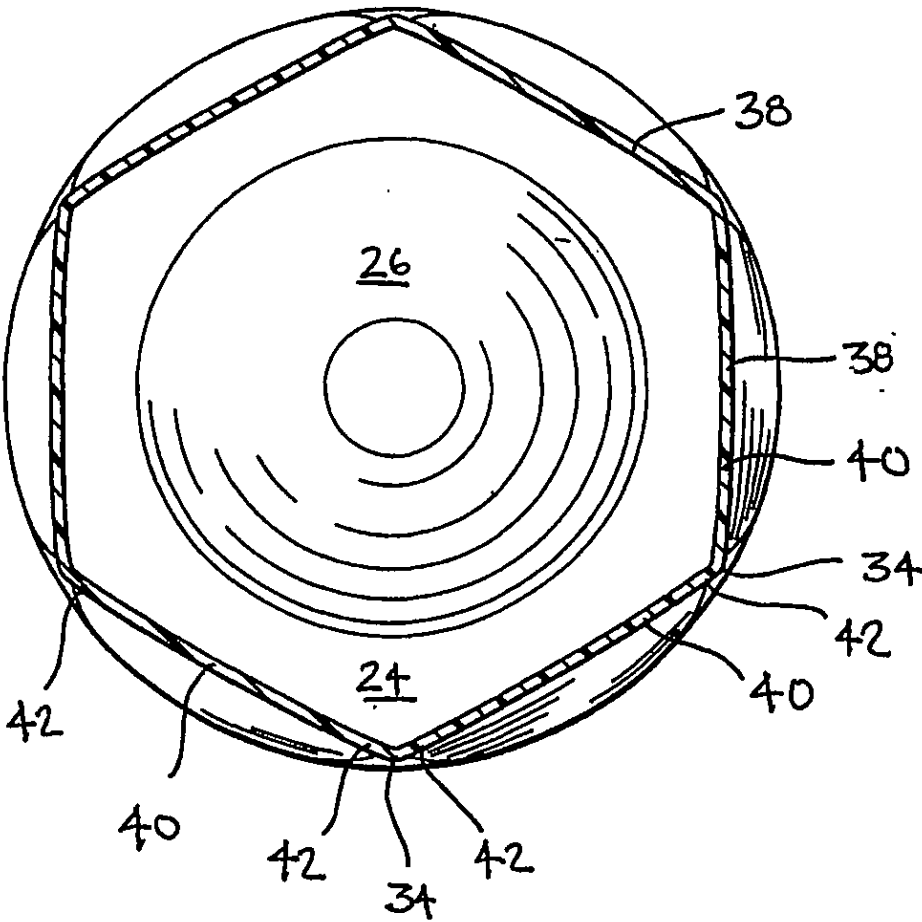


FIG. 6

FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US02/19436

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : B65D 90/02, 90/12

US CL : 215/373, 379, 381, 382, 384

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 215/373, 379, 381, 382, 384

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,690,244 A (DARR) 25 November 1997 (25.11.1997), see figures.	1-8, 13-16
Y	US DES. 213,824 S (LUBDTKE) 15 April 1969 (15.04.1969), see figures.	1-8, 14-16
Y	US 5,238,129 A (OTA) 24 August 1993 (24.08.1993), see figures.	1-8, 14-16
Y	US DES. 356,737 S (GINSBERG) 28 March 1995 (28.03.1995), see figures.	3-4, 6-7

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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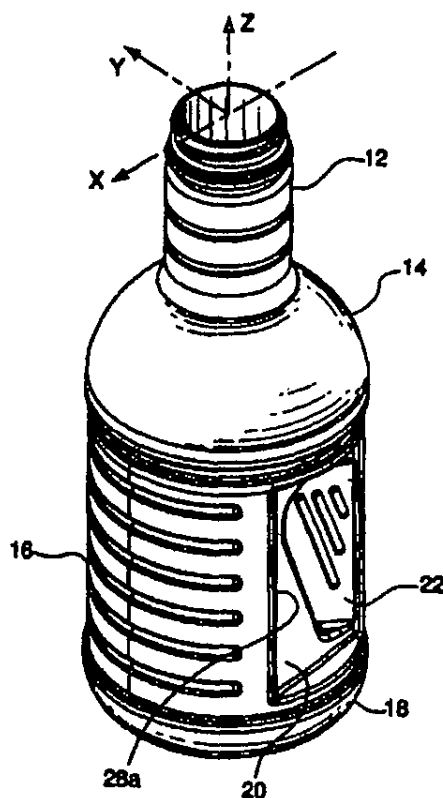
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[Continued on next page]

(54) Title: HOT-FILLABLE CONTAINER WITH GRIP



(57) Abstract: A blow-moulded plastic container (10) is provided suitable for hot-filling under pressurize-fill conditions, and under gravity-fill conditions. The container (10) includes opposing handgrips (22) within panels (20) which lack hinges and thus do not function as conventional vacuum panels as the inward deformation is spread beyond the panels (20). The handgrips include a distal, relatively stiffened portion (36) formed by a sidewall that forms a thumb piece (44) and a proximal, relatively unstiffened portion the smooth merges into a cylindrical sidewall (24) of the container.

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- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

HOT-FILLABLE CONTAINER WITH GRIP

This application relates to blow-molded containers, and more particularly to hot-fillable containers having integral grip portions formed therein.

Perishable beverage and food products are often placed into containers at elevated temperatures. In a conventional hot-fill process, the liquid or flowable product is charged into a container at elevated temperatures, such as 180 to 190 degrees F, under approximately atmospheric pressure. Because a cap hermetically seals the products within the container while the products are at the hot-filling temperature, hot-fill plastic containers are subject to negative internal pressure (that is, relative to ambient pressure) upon cooling and contraction of the products and any entrapped air in the head-space.

It has been an inherent goal of conventional hot-fill container design to form stiff cylindrical portions (in transverse cross section) that maintain a cylindrical shape upon cooling. Thus, conventional hot-fill containers include designated flexing portions -- vacuum panels -- that deform when subject to typical hot-fill negative internal pressures. The inward deflection of the vacuum panels tends to equalize the pressure differential between the interior and exterior of the container so as to enhance the ability of the cylindrical sections to maintain an attractive shape, to enhance the ease of labeling, or like commercial appeal. Some container designs are symmetric about a longitudinal centerline and designed with stiffeners to maintain the

intended cylindrical shape while the vacuum panels deflect. For example, United States Patent Numbers 5,178,289, 5,092,475, and 5,054,632 teach stiffening portions or ribs to increase hoop stiffness and eliminate bulges while integral vacuum panels collapse inwardly. United States Patent Number 4,863,046 is designed to provide volumetric shrinkage of less than one percent in hot-fill applications.

Other containers include a pair of vacuum panels, each of which has an indentation or grip portion enabling the container to be gripped between a user's thumb and fingers. For example, United States Patent Number 5,141,120 teaches a bottle having a hinge continuously surrounding a vacuum panel, which includes indentations for gripping. In response to cooling of the container contents, the hinge enables the entire vacuum panel to collapse inwardly. United States Patent Number 5,141,121 similarly teaches a bottle having an outward bulge that inverts in response to cooling of the container contents. Each of the patents referred to herein by patent number is incorporated by reference in its entirety.

Some hot-fill technology employs charging the product under atmospheric pressure (that is, gravity filling). However, metering the products under a positive pressure pumping system has been found to increase the accuracy and precision of the product volume charged into the container. Such positive pressure filling systems enable better accuracy and precision of the predetermined product volume, better control of the headspace volume, and other benefits. The metering

typically subjects the container to a positive pressure (relative to ambient pressure) of a few PSI during charging. Typical charging pressures may be 1 to 2 PSI, although 5 PSI or greater may be encountered in certain circumstances. After filling, the pressure is typically released by exposing the contents to approximately atmospheric pressure prior to capping. It is a goal to provide improved containers.

Conventional containers often include stiffeners to enhance the stiffness of portions thereof. Some containers even have stiffeners within the vacuum panels themselves. It has been found that stiffened containers may have a tendency to form a crease or kink in the container sidewall upon being subjected to the positive pressures inherent in pressure filling technology and techniques. In this regard, the sidewall forms an undesirable outer bulge or crease, thereby weakening the sidewall. Further, sometimes the sidewall crease does not snap back towards a cylindrical shape upon pressure release. Thus, stiffeners intended to maintain a cylindrical container shape or resist distortion, in some circumstances, may result in a container that is overly stiff and subject to creasing, and the stiffeners tend to inhibit the creased sidewall from snapping back upon pressure release.

Figure 1 is a perspective view of a container according to an aspect of the present invention;

Figure 2 is a rear elevation view of the container of Figure 1;

Figure 3 is a front elevation view of the container of Figure 1;

Figure 4 is a side elevation view of the container of Figure 1;

Figure 5 is a transverse cross sectional view taken through line 5-5 in Figure 4;

Figure 6A is a color deformation diagram of a first side of a bottle indicating the magnitude of inward and outward deformation of the bottle between its pre-filling, blow molded state and its final, hot-filled, cooled state with a scale in millimeters;

Figure 6B is a color deformation diagram of the first side of the bottle of Figure 6A but employing a different color scale;

Figure 7A is a color deformation diagram of a first side of another bottle;

Figure 7B is a color deformation diagram of the first side of the bottle of Figure 7A but employing a different color scale;

Figure 8A is a color deformation diagram of a second side of the bottle of Figure 6A;

Figure 8B is a color deformation diagram of the second side of the bottle of Figure 8A but employing a different color scale;

Figure 9A is a color deformation diagram of the second side of the bottle of Figure 7A; and

Figure 9B is a color deformation diagram of the second side of the bottle of Figure 9A but employing a different color scale.

As illustrated in Figures 1 through 5, a container 10 includes a neck 12, a dome portion 14, a body 16 and a base or bottom 18. Neck 12 extends upwardly from dome 14 and includes threads formed thereon for receiving a closure (not shown). Dome 14 extends between neck 12 and body 16. Base 18 encloses the lower portion of body 16, and may include any upwardly extending portion or geometry (not shown). Body 16 includes a pair of opposing panels 20 disposed between a rear sidewall portion 24 and a front sidewall portion 26. Rear sidewall 24 is opposite front sidewall 26, and each are substantially cylindrical in shape (that is, each is a segment of a substantially cylindrical shape). Preferably, the cylindrical shape preferably is circular in transverse cross section. Each of portions 24 and 26 includes horizontal ribs for stiffening so as to maintain the substantially cylindrical shape. Thus, each of sidewalls 24 and 26 is suitable for receiving a conventional label thereon. For ease of reference, each of Figures 1 through 5 includes mutually orthogonal axes x, y, and z. The positive x-axis is defined as oriented from rear sidewall 24 to front sidewall 26. Vertical axis z is co-linear with the longitudinal centerline of container 10.

As best shown in Figures 4 and 5, each panel 20 includes a peripheral edge 22 including: a substantially straight distal edge 28a; an opposing, substantially straight proximal edge 28b; an upper shoulder 30a; and a lower shoulder 30b. Edges 28a and 28b preferably smoothly merge into rear and front portions 24 and 26.

Shoulders 30a and 30b extend between panel 20 and a cylindrical portion of container 10 above and below panel 20. Preferably panel 20 is substantially planar, as best shown in Figures 1 and 5. Edges 28a and 28b provide, in transverse cross section, the transition between the circular sides 24 and 26 and the subtending straight portion 20, and between the circular sides of body 16 above and below panel 20 and the subtending straight portion 20. In this regard, panel 20 has an outer edge having an overall rectangular shape formed by substantially parallel sides 28a and 28b and by substantially parallel shoulders 30a and 30b. As best shown in Figure 4, each of shoulders 30a and 30b form an arc where it meets the flat portion of panel 20. A portion of shoulder 30a is shown in phantom in Figure 5 to further illustrate such configuration.

Panel 20 preferably is formed by an insert into the mold in which container 10 is blown. Such an insert preferably is capable of being shimmed relative to the remainder of the mold such that the depth of panel 20 can be modified to modify the volume, thereby enabling the volume of the containers to be adjusted in a predetermined manner. Aspects of the present invention are illustrated by employing a particular geometry of container 10, including, but not limited to, panels 20. The present invention is not limited to such particular geometry, but rather encompasses any structure that is recited in the claims or structure that functions as described in the claims.

Grip 22 extends inwardly from panel 20 so as to form an indentation suitable for gripping by a user's hand. As best shown in Figures 1, 4, and 5, grip 22 includes a main grip surface 34 and a grip wall 36 (Figure 2). As shown in phantom in Figures 3 and 4, grip surface 34, which preferably is planar, is inclined relative to plane x-z (that is, the plane defined by axes x and z) by an angle A1 such that grip 22 has a depth (that is, the radial distance between the projected, imaginary cylinder and a point on grip surface 34) that is non-uniform within grip 22. Angle A1 is measured between the z-axis and the projection of the innermost surface (that is, the portion that protrudes toward centerline z) of panel 20 onto the y-z plane (indicated by line z') as shown in Figures 2 and 3. The magnitude of angle A1 may be determined according to the desired grip characteristics (including depth and other dimensions), panel dimensions (including depth and other dimensions), and related parameters, as well as for its deformation characteristics as described below. For the particular configuration of the embodiment shown in the Figures for a 48 ounce volumetric size, angle A1 preferably is between 4 and 12 degrees, more preferably between 5 and 10 degrees, and even more preferably approximately 7 degrees.

Thus, grip wall 36 is formed by a grip upper wall 38a, distal grip wall 38b, and lower grip wall 38c, which vary in depth. Each grip wall 38a, 38b, and 38c has an outer transition 40a, 40b, and 40c, respectively, that preferably gradually merges wall 38a, 38b, and 38c into

panel 20 and has an inner transition 42a, 42b, and 42c that preferably abruptly (that is, having a small radius so as to substantially form a corner) merges wall 38a, 38b, and 38c into grip surface 34.

In this regard, grip wall 36 forms a modified C-shape such that each wall 38a, 38b, and 38c has a straight section that merges into a rounded transition between upper wall 38a and distal wall 38b, and between lower wall 38c and distal wall 38b. According to an aspect of the present invention (which is independent of other aspects described herein) and as shown in the Figures, upper and lower walls 38a and 38c have a depth that increases at distal ends that merge with distal wall 38b, and a depth that gradually decreases to substantially zero at opposing proximal ends such that walls 38a and 38c smoothly merge into panel 20. Distal wall 38b has a depth that, upwardly toward upper wall 38a, gradually increases to form a thumb piece (or, opposite, a finger piece) indentation 44 substantially at the portion of panel 20 having the greatest depth. In this regard, panel 20 may substantially be a plane that is inclined to the substantially vertical panel proximal edge 28b. Further, upper wall 38a is inclined from a horizontal reference to receive a user's thumb (or forefinger or index finger) at a natural gripping angle, thereby enhancing gripping ease and comfort.

According to an aspect of the present invention, grip surface 34 (that is, the flat portion of grip 22) has a boundary that is formed by proximal edge 28b of panel 20 and is not indented therefrom (that is, a

portion of grip surface 34 at the open end of its C-shape is unbounded by walls 38a, 38b, and 38c). Rather, grip surface 34 smoothly merges into rear sidewall 34 without a hinge or like structure therebetween. Grip surface 34 gradually increases in depth from rear sidewall portion 24 toward front sidewall portion 26 and gradually increases in depth from a lower portion thereof (defined by lower wall 38c) toward an upper portion thereof (defined by upper wall 38a), thereby forming thumb piece 44. Further, grip walls 38a, 38b, and 38c are oriented substantially radially so as to provide a relatively large moment of inertia to resist deformation inherent in hot-filling technology. Such a configuration provides a comfortable grip while thumb piece 44 enables secure grasping.

According to another aspect of the present invention, container 10 lacks hinges that enhance or facilitate deformation of a portion thereof. Further, even though panel edges 28a, 28b, 30a, and 30b visually resemble conventional vacuum panels, panel 20 does not collapse inwardly in response to negative internal pressure corresponding to cooling subsequent to a hot-fill process. Rather, inward deflection of the container walls relative to its pre-filled state is distributed beyond panel 20. Therefore, the maximum magnitude of such deflection of the container 10 is less than the maximum magnitude of corresponding deflection of prior art containers (that is, to achieve the same volumetric decrease). As shown in Figure 6, the maximum magnitude inward deflection of the embodiment of container 10 for a

48 ounce container size is less than approximately 1.8 millimeters.

Further, according to another aspect of the present invention, panel 20 includes a handgrip 22 having a stiffened wall 36 proximate the distal portion of grip 22 (that is, relative to the user's hand position) that resists deformation upon internal vacuum conditions, as well as a substantially un-stiffened proximal portion or edge (into which grip 22 merges). Thus, the relatively stiffened portion and relatively unstiffened portion are disposed on opposing sides of grip 22. In this regard, the stiffening provided by grip wall 36 increases as the depth of grip wall 36 increases. Thus, the grip wall 36 is most stiff at the upper left portion of grip 34 (as oriented in Figure 4), and the stiffening gradually decreases toward the proximal edge of upper wall 38a and lower wall 38c. The stiffening where grip 34 merges into rear sidewall 24 is minimal.

As indicated in Figure 5, an angle A2 is formed by the planar portion of grip 22 and the x-z plane, which is indicated on Figure 5 by line x'. The magnitude of angle A2 may be chosen according to the desired depth of grip 22 and like dimensions. In the embodiment shown in the Figures, angle A2 may be preferably between approximately 5 and 20 degrees, more preferably between 8 and 16 degrees, and most preferably approximately 12 degrees. Grip 22 forms an angle A3 with a tangent line T1 drawn on rear sidewall 24 and edge 28b. The magnitude of angle A3 depends upon the desired depth of grip 22, as well as upon angle A2 and the arc A4 defining the rear

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portion 24, which is indicated by arc A4 on Figure 5. Preferably, angle A3 is approximately between 35 and 65 degrees, preferably between 45 and 65 degrees, and more preferably about 50 degrees. The angles A4 and A5 defining rear and front sidewalls 24 and 26 are approximately 83 and 100 degrees, respectively.

To illustrate the vacuum deformation characteristics of container 10, and containers having like geometry, Figures 6A and 6B through 9A and 9B were produced by laser scanning a blow-molded container, and subsequently filling the container at a temperature of approximately 185 degrees at 1 to 2 PSI, releasing the pressure to expose the contents to atmospheric pressure, and capping the container while hot. After cooling, the filled container was again scanned to produce the data - that is, the graphic representation of the deformation of the bottle's surface from its pre-filled at-rest state, to its post-filling, cooled, vacuum deformed state -- represented in the Figures. Such laser scanning technology is available from Digibotics, Inc. of Novi, Michigan. Figures 6A and 6B show identical views of vacuum deformation of container 10, but employing different color scales to correspond to the magnitude of the container deformation. Similarly, each of the figures designated by an A and B extension show the same view but employ different color scales. Figures 8A and 8B show the opposing side view of the same container as shown in Figures 6A and 6B. Figures 7A and 7B show views of another container, and Figures 9A and 9B show the

opposing side view of the same container as shown in Figures 7A and 7B.

As shown in Figure 6A and 6B through 9A and 9B, container 10 as configured above produces container deformation (that is, deformation of a hot-filled container upon cooling) that is not limited to panel 20, but rather is distributed over an area of the bottle that is larger than the panel area. The deformation distribution is, at least in part, enhanced by the hingeless nature of panel 20 and/or handgrip 22. Further, the Figures illustrated that the stiffened portion deflects significantly less than the un-stiffened portion. The configuration, however, is not prone to sidewall collapse of early containers.

Aspects of the present invention have been illustrated by employing the particular embodiment shown in the Figures. However, the present invention is not limited to the particular embodiment shown or described, but rather encompasses other container configurations embodying the inventive aspects described herein. Further, each aspect of the invention referred to in the specification is independent of other of such aspects such that the claims define the invention and no single aspect is relied upon as essential.

CLAIMS:

1. A hot-fillable container formed by blow-moulding a thermoplastic, the container having a body portion including a pair of opposing handgrip portions, characterised in that the handgrip portions include a relatively stiffened boundary that resists deformation upon internal vacuum conditions and a relatively unstiffened boundary disposed opposite the relatively stiffened boundary.

2. A hot-fillable container formed by blow molding a thermoplastic, said container comprising:

a neck portion;

an enclosed bottom portion; and

a body portion disposed between the neck portion and the bottom portion, the body portion including a substantially cylindrical front segment, a substantially cylindrical rear segment opposite the front segment, and a pair of opposing handgrips disposed therebetween;

each one of the handgrips including a relatively stiffened boundary that resists deformation upon internal vacuum conditions and a relatively un-stiffened boundary, the relatively unstiffened boundary being disposed opposite from the relatively stiffened boundary and non-parallel thereto such that a portion of the handgrip forms a thumb-piece.

3. The container of claim 1 or claim 2, further comprising a pair of opposing panels formed in the body portion, the handgrips being formed in the panels.
4. The container of any of claims 1 to 3, wherein the panels and/or handgrips are hingeless.
5. The container of any of claims 1 to 4, wherein the relatively stiffened portion is formed by a distal grip wall extending therefrom.
6. The container of claim 5, wherein the distal grip wall is formed between a distal portion of the handgrip and the panel.
7. The container of claim 4 or claim 5, wherein the distal grip wall is at least partially radially oriented.
8. The container of any of claims 2 to 7, wherein each one of the handgrips also includes an upper boundary formed between an upper portion of the handgrip and the panel.
9. The container of any preceding claim, wherein the handgrip is inclined relative to a longitudinal axis of the container.
10. The container of any preceding claim, wherein the handgrip has a depth that is greater proximate the relatively stiffened boundary than proximate the relatively unstiffened boundary.

11. The container of claim 10, wherein the depth increases from the relatively unstiffened boundary toward the stiffened boundary and gradually increases from a lower portion of the handgrip toward an upper portion of the handgrip.

12. The container of claim 11, wherein the handgrip depth is greatest proximate an intersection of the distal grip wall and the upper grip wall.

13. The container of any of claims 2 to 12, wherein each of the panels is substantially planar.

14. The container of any preceding claim, wherein each of the handgrips define a substantially planar grip surface.

15. The container of claim 14, wherein each of the planes defined by the grip surfaces is inclined along two axes.

16. The container of any preceding claim, wherein the stiffened boundary is disposed on a distal portion of handgrip and the unstiffened boundary is disposed on a proximal portion of the handgrip, whereby the proximal and the distal boundaries are defined relative to a user's hand.

17. The container of any preceding claim, wherein the stiffening produced by the relatively stiffened boundary gradually diminishes toward the unstiffened boundary.

18. The container of any preceding claim, wherein the relatively unstiffened boundary smoothly merges into the container sidewall.

19. The container of any preceding claim, wherein the relatively unstiffened boundary lacks a hinge.

20. A hot fillable container formed by blow molding a thermoplastic, said container comprising:
a neck portion;
an enclosed bottom portion; and
a body portion disposed between the neck portion and the bottom portion;

wherein the bottle deforms upon hot-filling, capping, and cooling less than approximately 2.0 mm at any location on the bottle compared with dimensions after blow-molding.

21. The container of claim 20, wherein said deformation is created by filling the container with contents at a temperature up to approximately 220 degrees.

22. The container of claim 20 or claim 21, wherein said deformation is created by filling the container with contents at a temperature above approximately 135 degrees F.

23. A hot-fillable container formed by blow-moulding a thermoplastic, the container having a body portion including a pair of opposing handgrip portions, characterised in that the handgrip portions have upper

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and lower walls which increase in depth towards distal ends and a sidewall, joining the upper and lower walls at the distal ends, which increases in depth towards either the upper or lower wall to form an indentation in the handgrip portions.

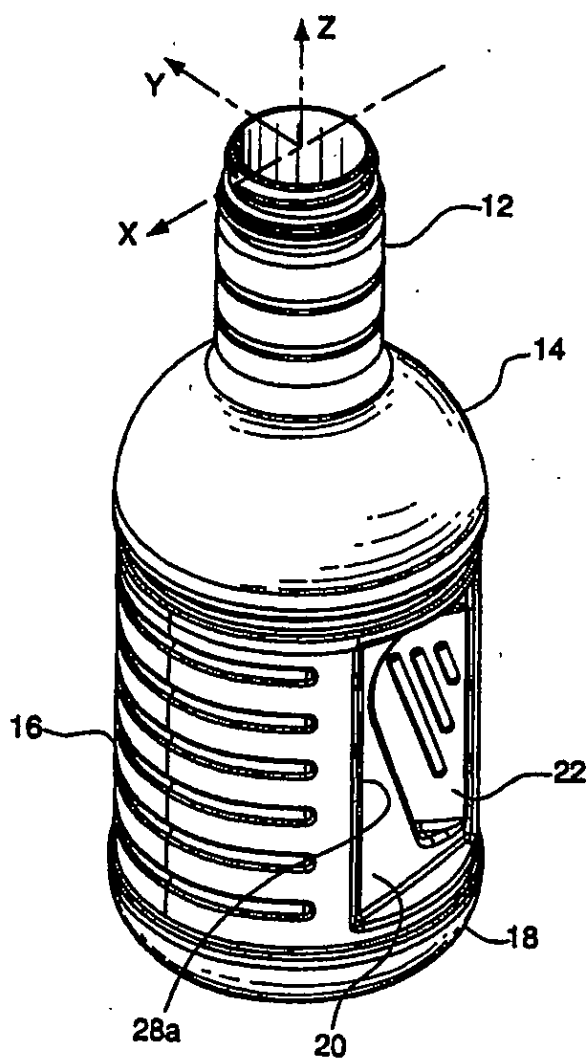


FIG. 1

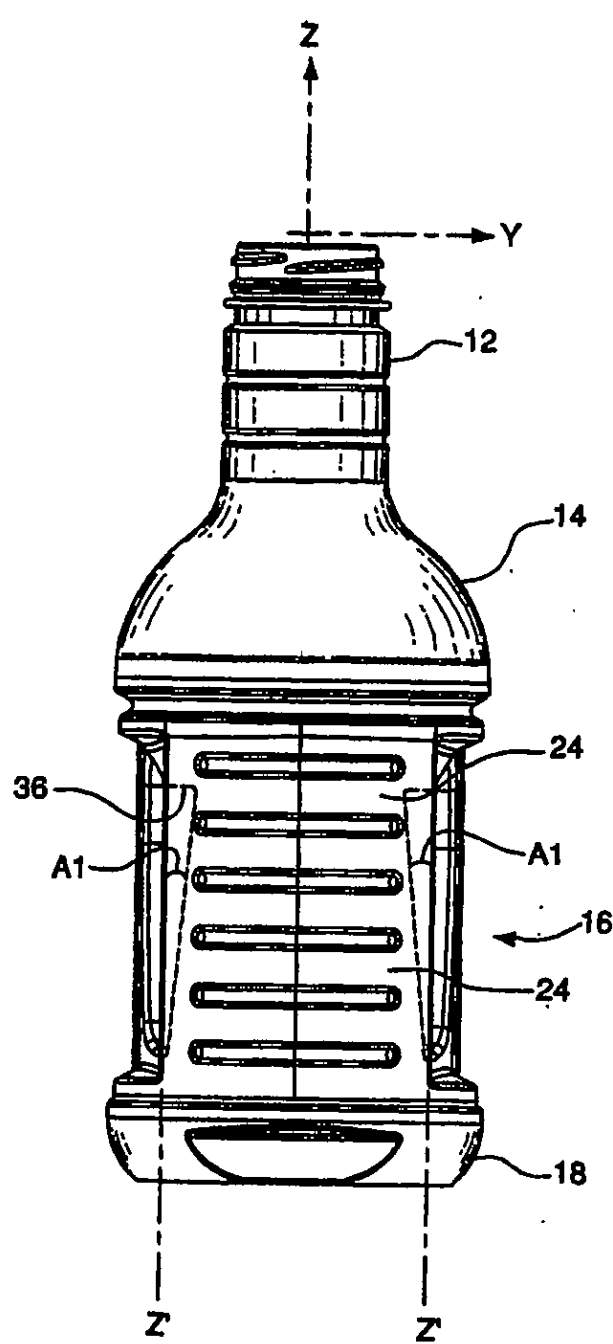


FIG. 2

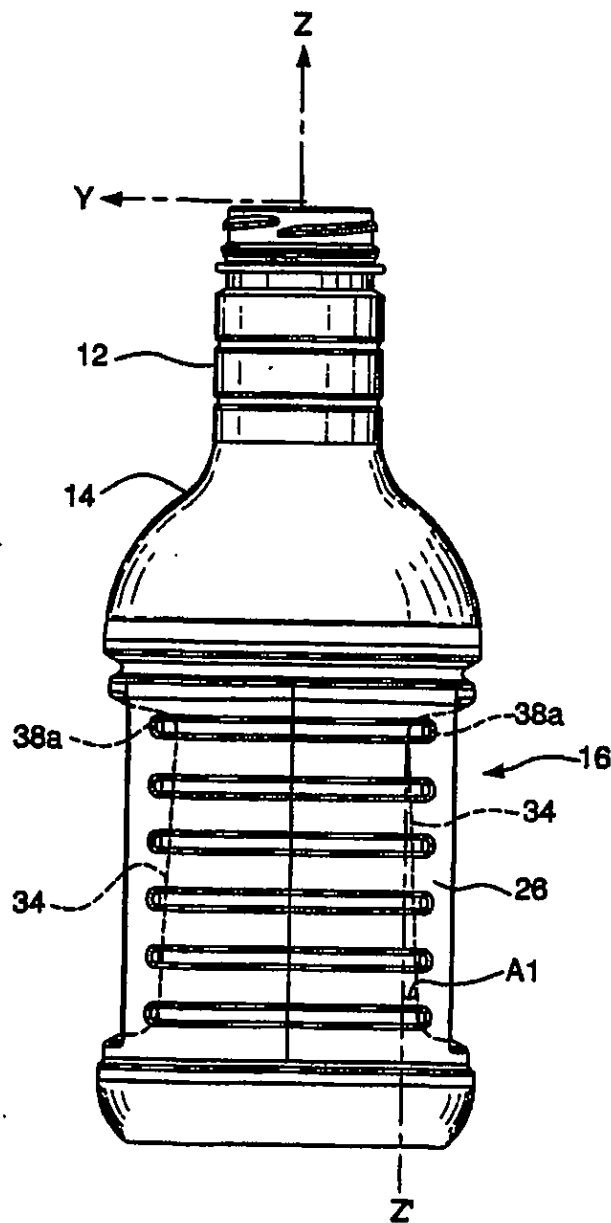


FIG. 3

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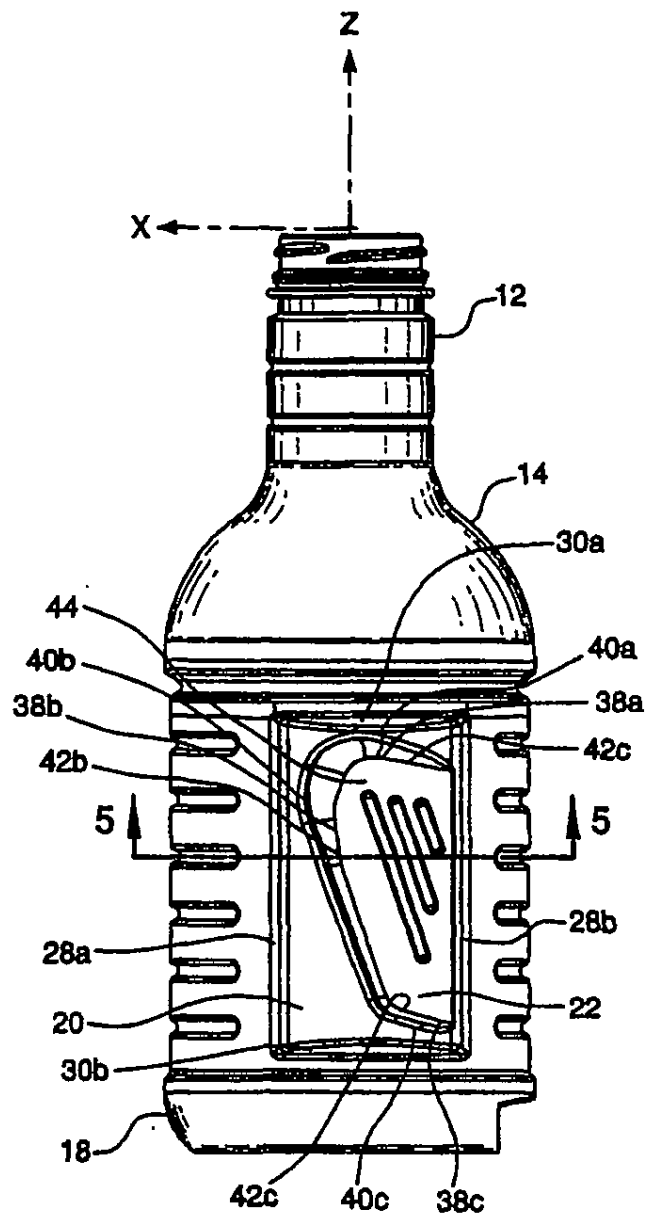


FIG. 4

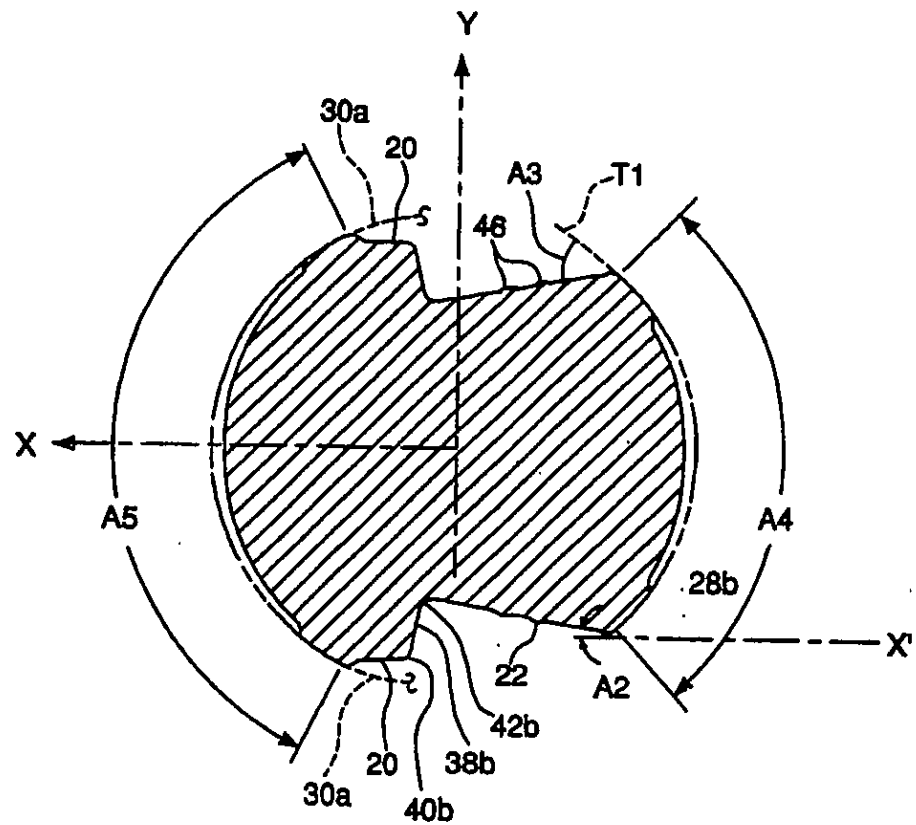


FIG. 5

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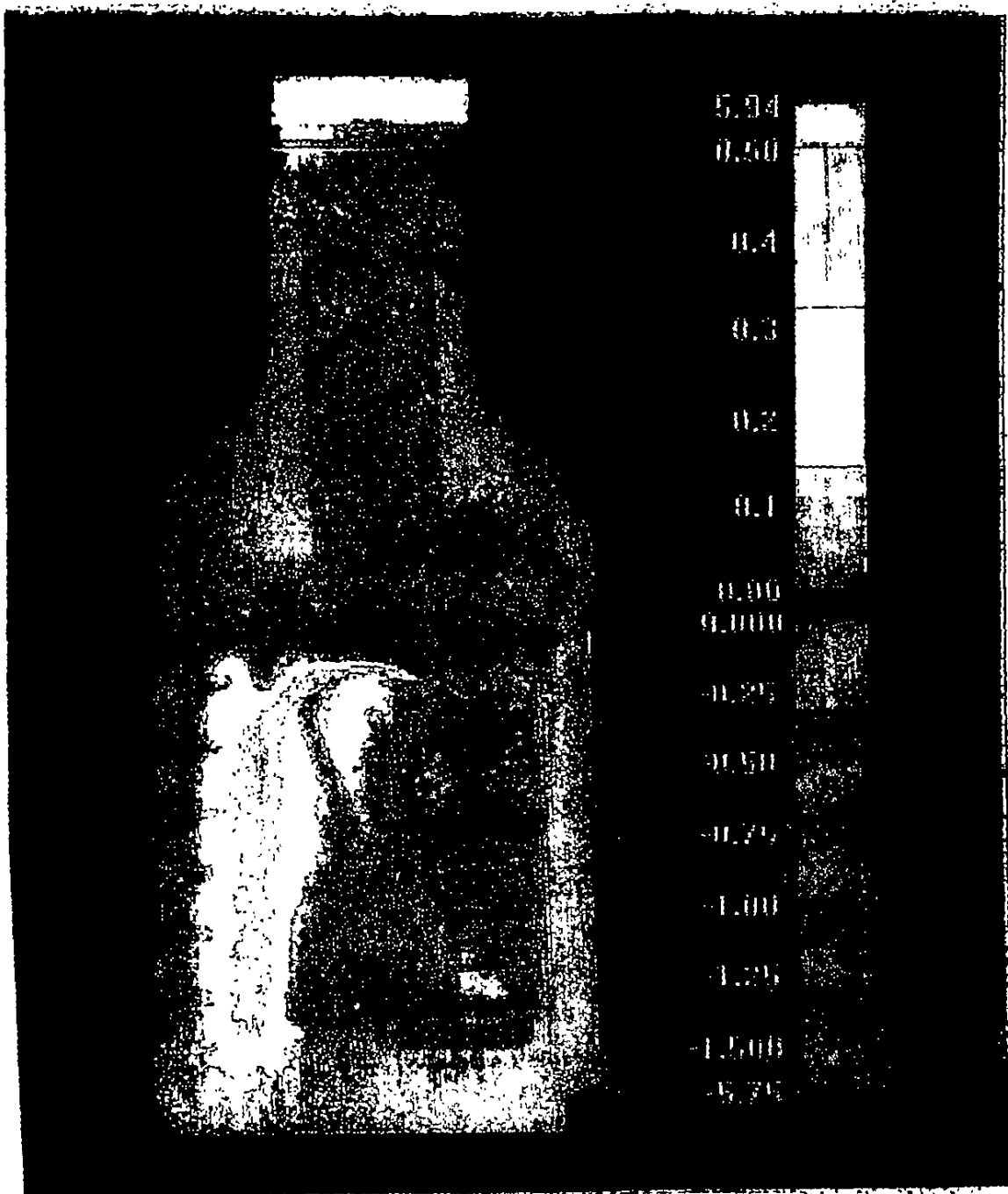


FIG. 6A

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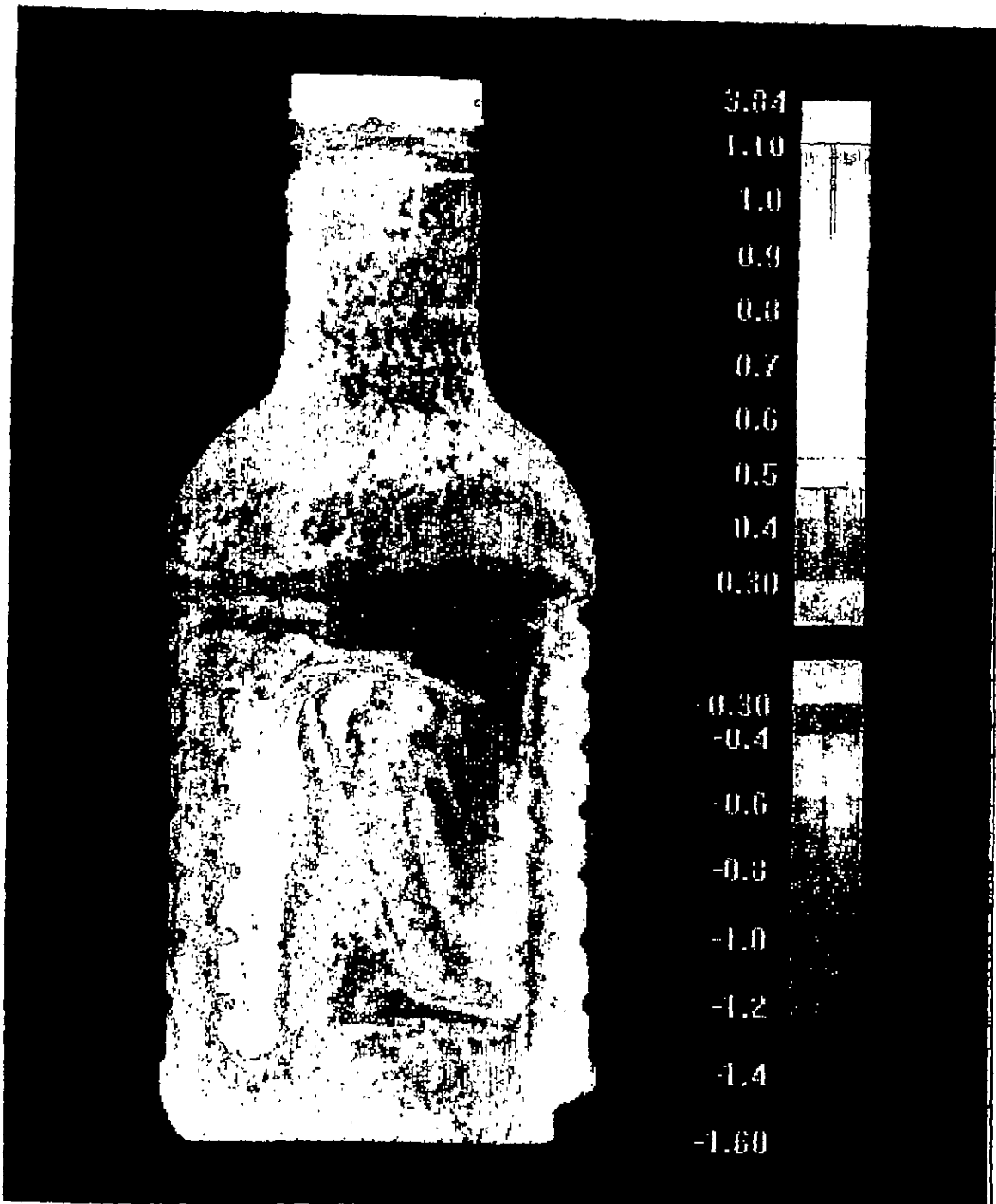


FIG. 6B

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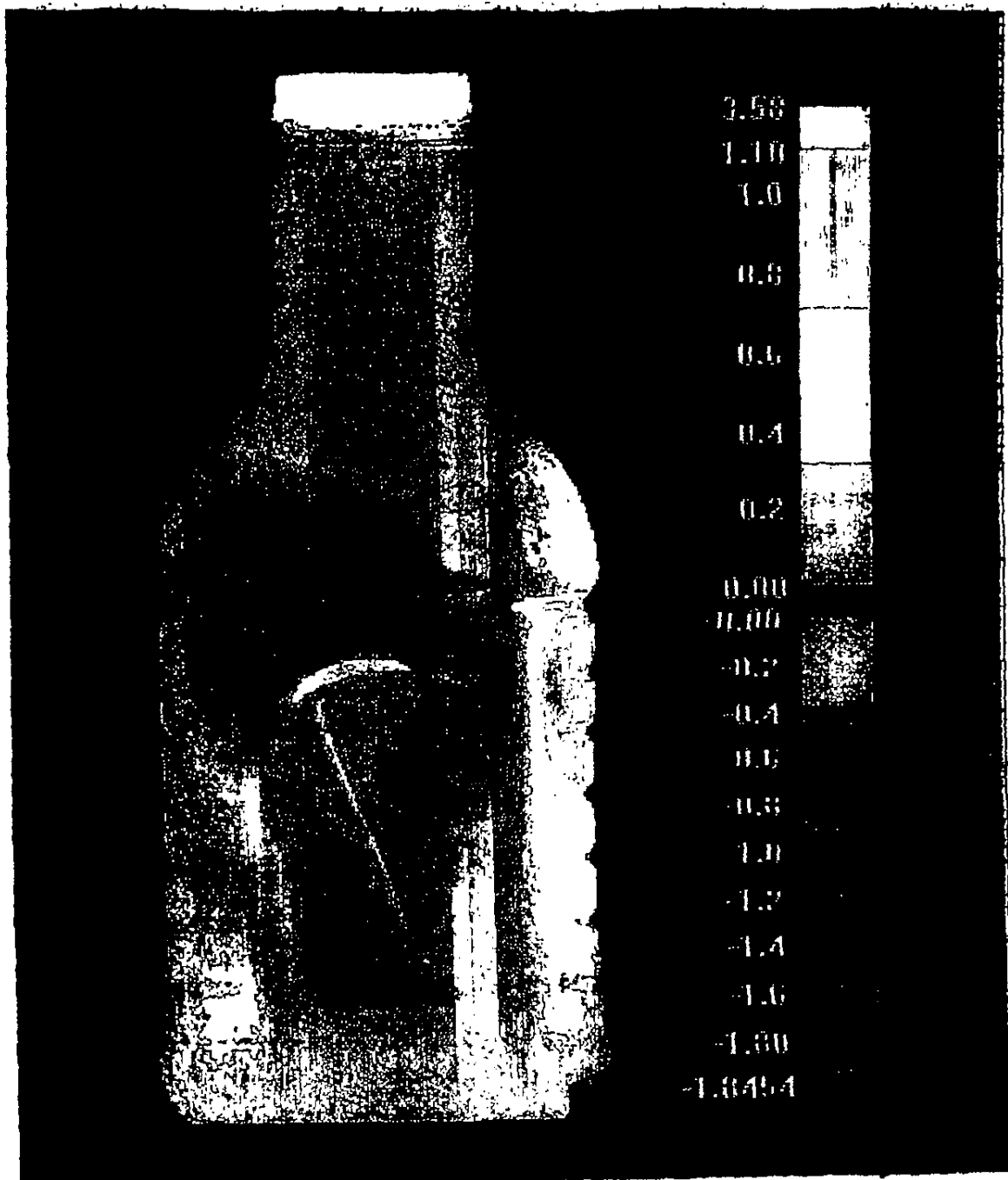


FIG. 7A

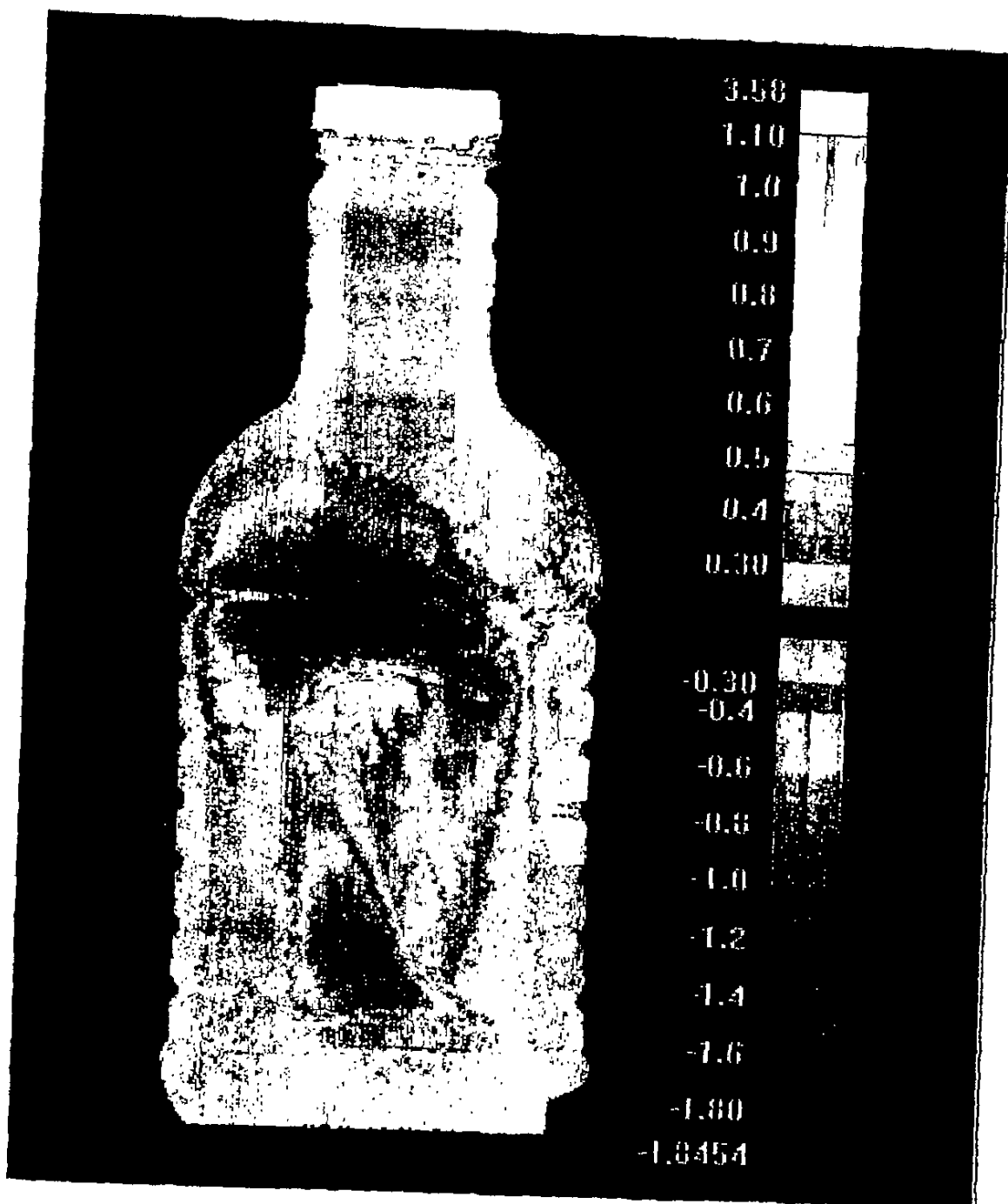


FIG. 7B

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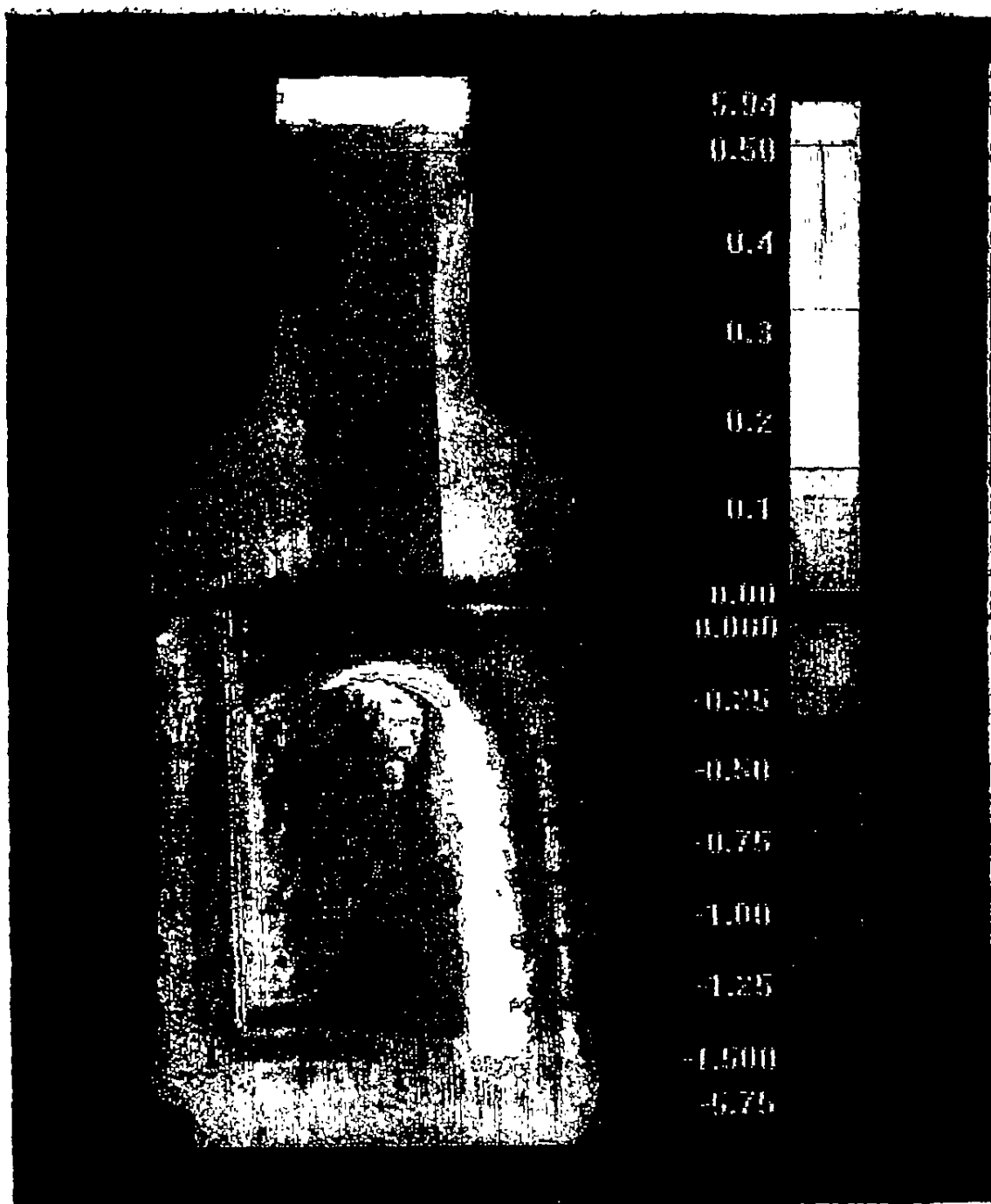


FIG. 8A

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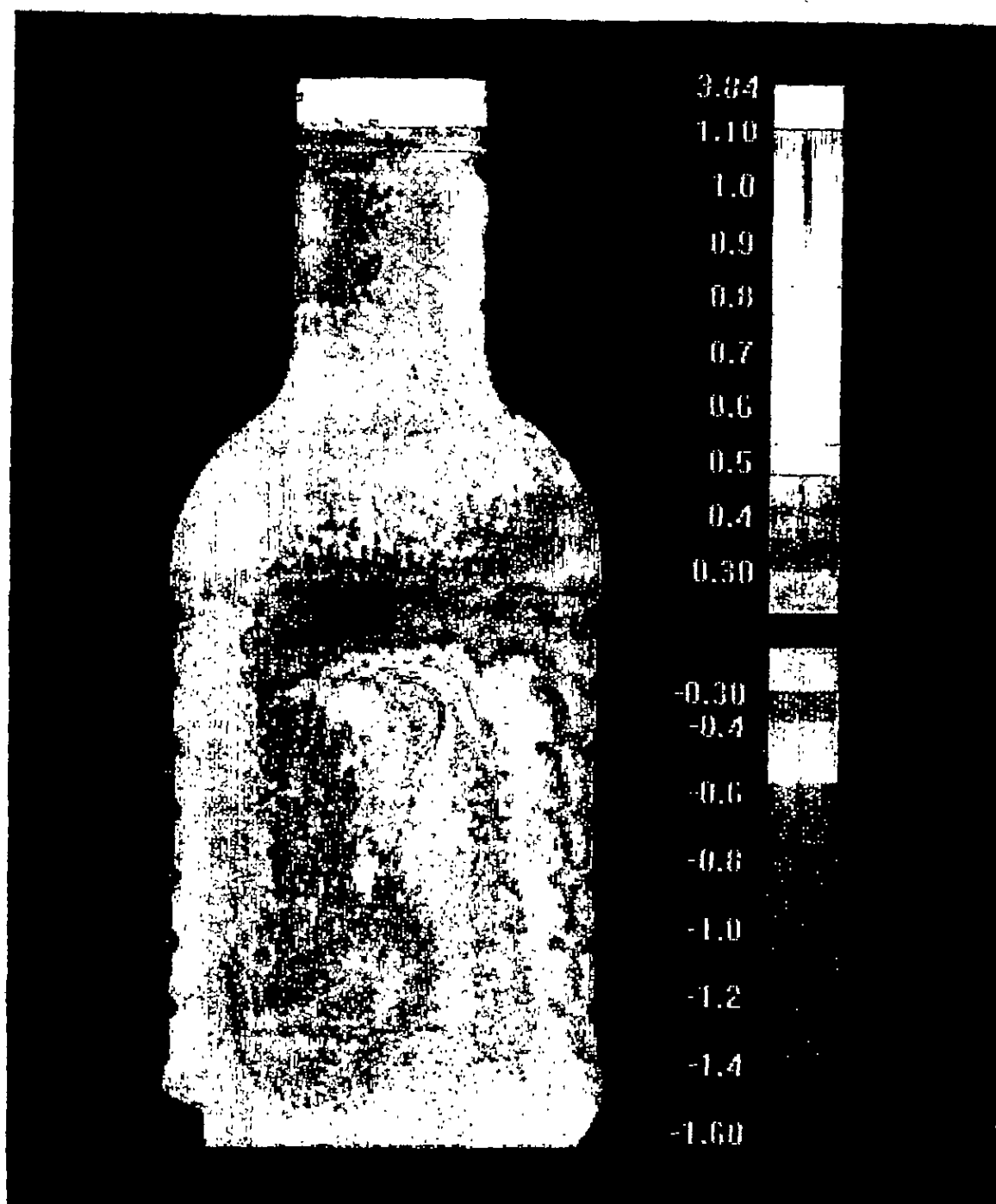


FIG. 8B

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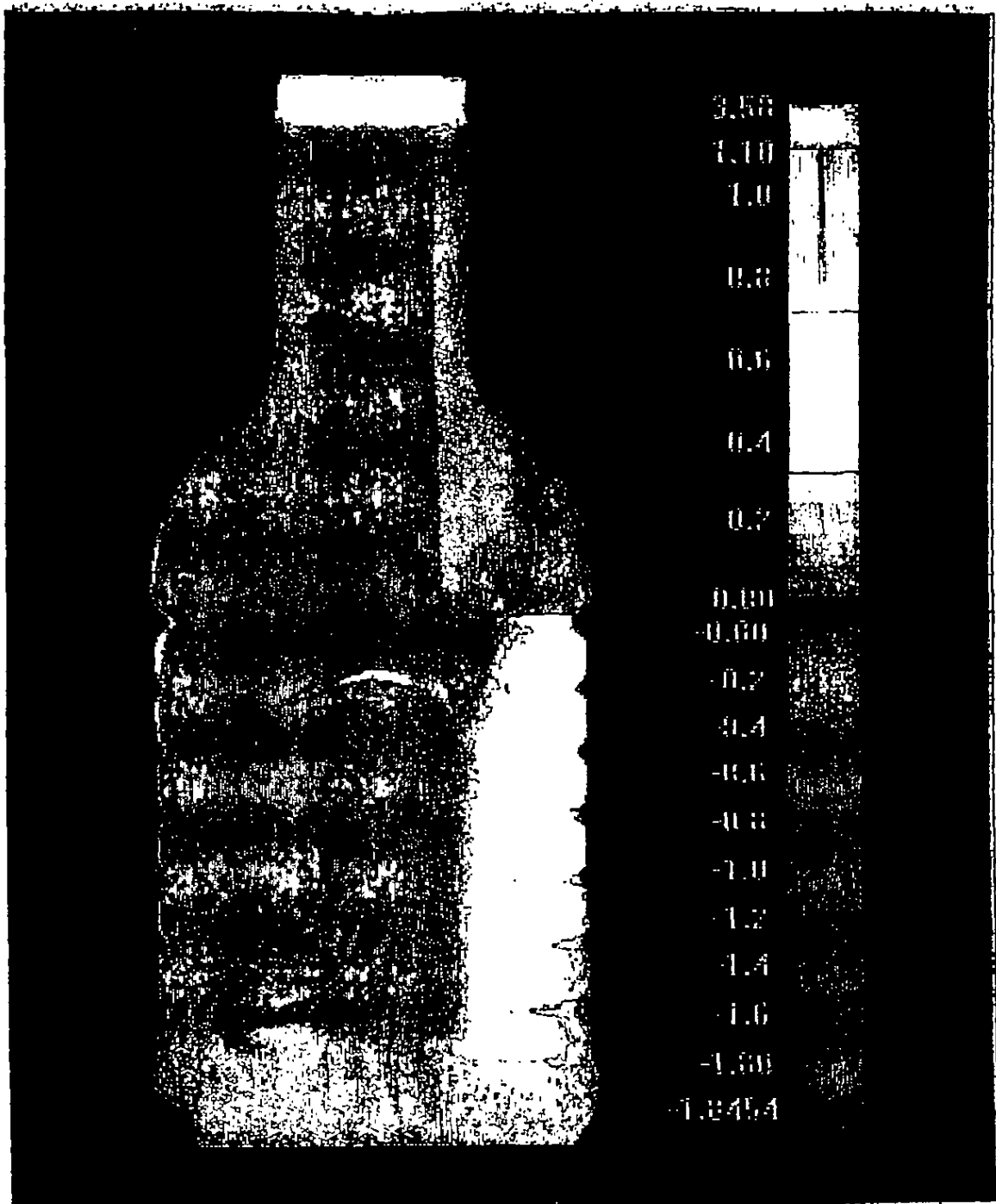


FIG. 9A

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A. CLASSIFICATION OF SUBJECT MATTER
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Minimum documentation searched (classification system followed by classification symbols)

IPC 7 8650

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched.

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

PAJ, EPO-Internal

G. DOCUMENTS CONSIDERED TO BE RELEVANT

Y Patient family members are listed in annex.

* Special categories of cited documents :

A document defining the general state of the art which is not considered to be of particular relevance

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* Inter document published after the international filing date or priority date and not in conflict with the application believed to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

'&' document member of the same patent family

Date of the actual completion of the international search

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Authorized Officer

Gino, C

INTERNATIONAL SEARCH REPORT

PCT/88 02/02295

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D. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 230 912 B1 (RASHID) 15 May 2001 (2001-05-15) abstract; figures column 5, line 14 - line 17 -----	20, 22
A	PATENT ABSTRACTS OF JAPAN vol. 1998, no. 10, 31 August 1998 (1998-08-31) & JP 10 139028 A (MITSUBISHI PLASTICS IND LTD), 26 May 1998 (1998-05-26) abstract -----	1, 2, 23
A	US 5 350 078 A (HODGE MARVIN W ET AL) 27 September 1994 (1994-09-27) abstract; figures -----	1, 2, 23

Form PCT/AB/216 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

PCT/GB 02/02295

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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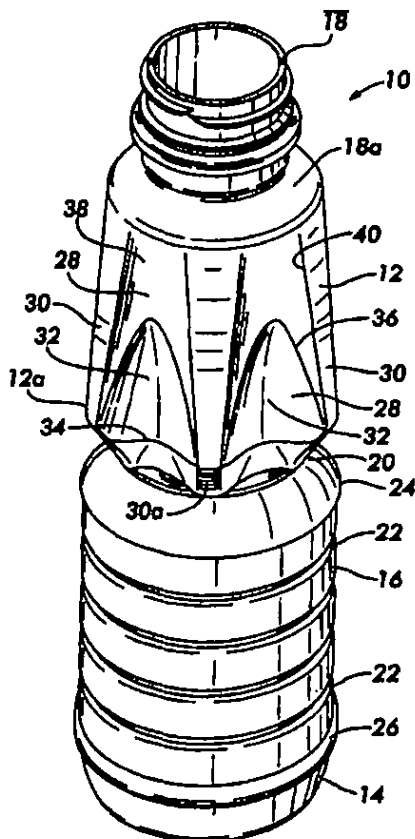
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[Continued on next page]

(54) Title: BLOW MOLDED SLENDER GRIPPABLE BOTTLE HAVING DOME WITH FLEX PANELS



(57) Abstract: A blow-molded plastic bottle body (10) for use in containing hot-filled beverages. The bottle body (10) has a dome (12) with various interactive functional zones. For example, some of the zones are primarily responsible for accommodating vacuum absorption, while other zones are primarily intended to rigidify the container such as by providing column strength to improve container top loading capability. Although each zone may have a primary function, each zone also aids adjacent zones in providing their functions. Thus, the entire dome (12), and not merely selected locations, reacts in a progressive manner to the forces generated by the hot-fill process on the bottle body (10). Preferably, the bottle body (10) is slender and capable of readily being gripped by a single hand, and preferably the flex panels (28) in the dome (12) accommodate at least 90 % of the total vacuum absorption required by the bottle (10).

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European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

— with international search report

**BLOW MOLDED SLENDER GRIPPABLE BOTTLE
HAVING DOME WITH FLEX PANELS**

FIELD OF THE INVENTION

The present invention relates to slender, grippable, blow-molded plastic bottles useful in containing hot-filled beverages.

BACKGROUND OF THE INVENTION

5 So-called hot-fillable, blow-molded plastic containers are well known in the art. The problems associated with accommodating vacuum deformations associated with hot filling, capping and cooling, and their solutions are also well known. Typically, so-called flex panels are provided in the containers at various locations to accommodate the vacuum that develops in the container as a result of hot fill
10 processing.

 Prior art large capacity containers, eg. 64 fluid ounces, have had cylindrical sidewalls and flex panels spaced apart therein. Labels have been applied entirely around the sidewalls over the flex panels to conceal them. Examples of such containers are disclosed in U.S. Patent Nos. D.366,416 issued to Semersky,
15 5,407,086 issued to Ota et al. and 5,178,289 issued to Krishnakumar et al.

 The handling problems associated with such containers was overcome with the introduction by Graham Packing Company, LP of its commercially successful bottles having sidewalls with grips and associated flex panels. Examples of these containers are disclosed in Graham's U.S. Patent Nos. 5,598,941 issued to Semersky et al. and
20 5,392,937 issued to Prevot et al. Other sidewall grip container patents include the following: U.S. Patent Nos. 5,472,105 issued to Krishnakumar et al. and 5,141,120 and 5,141,121 issued to Brown et al..

 One known attempt has been made to provide a large capacity bottle having flex panels in both the dome and the base to accommodate the requisite vacuum
25 absorption function created during hot fill processing. Such a container is disclosed in U.S. Patent No. 5,067,622 issued to Garver et al. and assigned to Van Dorn. In this patented container, about one-half of the vacuum absorption is provided in the dome, and the remainder is provided by the base. The container does not have any flex

panels in the sidewall, and is not readily grippable with one hand due to its relatively large sidewall diameter.

So-called single serve hot-fill slender containers are known. Such containers are relatively long, have small diameters, and have capacities of about 20 fluid ounces. They are readily grippable by one hand placed about either the container sidewall or about the waist located between the dome and the sidewall. Examples of such containers are disclosed in U.S. Patent Nos.: D.366,831 issued to Semersky et al.; 5,762,221 issued to Tobias et al.; and 5,971,184 and 5,303,834 issued to Krishnakumar et al.

At present, there is no known commercially acceptable hot fill, slender, grippable bottle that has a cylindrical labelable body, a grippable waist, and a dome provided with flex panels that are capable of accommodating substantially all of vacuum absorption required by the container when subjected to hot fill processing.

In known hot-fillable containers a series of well-defined, spaced-apart vacuum flex panels are generally provided to compensate for the internal volume reduction. The vacuum flex panels provide a sufficient amount of flexure without adversely affecting the structural integrity of the hot-filled container. The adjacent portions of the container, such as the so-called lands, or columns, which are located between, above, and below the flex panels, are intended to resist any deformation which would otherwise be caused by hot-fill processing. Wall thickness variations, or geometric structures, such as ribs, projections and the like, are often utilized in the structure of a container to prevent unwanted distortion.

An example of a hot-fillable container having flex panels framed within the dome of the container is disclosed by the above referenced Garver '622 patent. Examples of hot-fill containers having a plurality of framed flex-panels in the sidewalls of the containers are provided by the above referenced Semersky '416 and '831 patents, the above referenced Ota '086 patent, the above referenced Krishnakumar '289 and '834 patents and U.S. Patent No. 5,381,910 issued to Sugiura et al.

As disclosed in the above references, the typical structure for a hot-fillable container is one that has certain pre-defined limited functional areas which flex to

accommodate volumetric changes and certain other pre-defined structural areas which frame the periphery of the flex panels and resist deformation. Thus, conventional hot-fill bottles have flex panels with well-defined boundaries which are distinctly visually apparent before and after filling. These containers also have other geometric structures which are completely segregated from the flex panels, which are also distinctly visually apparent prior to filling, and which resist structural change caused by volume reduction. Typically, all of these structures are framed about substantially their entire peripheries and are completely separated from the bottle's aesthetic features. For example, as illustrated in the above referenced Garver patent, flex panels are often indented into the container via stepped transitional framing walls which form sharp-angled junctures with a planar flex panel and the adjacent container wall from which the flex panel is indented.

Other examples of container sidewalls having flexible panels are disclosed in U.S. Patent No. 4,749,092 issued to Sugiura et al.; U.S. Patent No. 3,923,178 issued to Welker III; U.S. Patent No. 4,497,855 issued to Agrawal et al.; U.S. Patent No. 5,690,244 issued to Darr; U.S. Patent No. 5,740,934 issued to Brady; and U.S. Patent No. 5,704,504 issued to Bueno. The Sugiura '092, Welker, Agrawal and Darr patents disclose inwardly deflecting vacuum flex panels which are located between substantially planar lands; the Bueno patent discloses inwardly deflecting panels which are located between angled grooves; and the Brady patent discloses outwardly deflecting panels which intersect at vertically disposed corners.

Although various ones of the above referenced containers may function satisfactorily for their intended purposes, there is a need for a hot-fillable blow molded slender bottle which integrates functional and aesthetic components in such a manner as to provide a package having enhanced visual interest.

OBJECTS OF THE INVENTION

With the foregoing in mind, a primary object of the present invention is to provide a hot-fillable bottle which integrates vacuum absorption, structural reinforcement, and other functional features with aesthetic and ergonomic properties

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by providing various interactive functional zones in the container structure.

Another object of the present invention is to provide a bottle having a dome with a plurality of alternating unframed flex panels and unframed lands, or columns, which laterally merge directly together, which are jointly reactive to hot-fill process forces acting thereon, and which do not have boundaries that are clearly visually identifiable.

A further object is to provide a slender blow-molded, plastic, hot-fillable bottle having a waist grip structure which cooperates with a novel vacuum reactive dome to enhance both the structural integrity of the container and the visual appearance of the container.

SUMMARY OF THE INVENTION

More specifically, the present invention provides a slender, blow-molded, hot-fill bottle having a body portion with a base, a dome with a finish located above the body portion, and a waist connecting the dome and body portion. The dome is composed of a plurality of upright columns extending lengthwise of the dome in spaced relation between the columns from the waist to the finish and a plurality of recessed panels extending between the waist and the finish for accommodating substantially all of the vacuum induced in the bottle. Selected ones of the recessed panels are outwardly concave and are adapted to flex in a controlled manner in response to vacuum induced in the bottle. The aforedescribed structure is particularly suited for use in a single-serve size bottle which is readily grippable with one hand, which can accommodate a label wrapped about the entire sidewall of the bottle, and which has a dome that accommodates substantially all of the vacuum-induced reduction of internal container volume.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features and advantages of the present invention should become apparent from the following description when taken in conjunction with the accompanying drawings, in which:

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FIG. 1 is a perspective view of a container embodying the present invention;
FIG. 2 is an elevational view of the container illustrated in FIG. 1;
FIG. 3 is a cross-sectional view taken transversely of the dome of the
container along line 3—3 shown in FIG. 2;

5 FIG. 4 is a cross-sectional view taken longitudinally of the container along line
4—4 shown in FIG. 3;

FIG. 5 is a perspective view of the same container dome illustrated in FIG. 1
having alternate shading lines to better illustrate the contours of the panels;

FIG. 6 is an elevational view of the container illustrated in FIG. 5;

10 FIG. 7 is an elevational view of the container illustrated in FIG. 6 having been
rotated 36° about the longitudinal axis of the container;

FIG. 8 is a cross-sectional view taken transversely of the container dome along
line 8—8 of FIG. 6;

15 FIG. 9 is a cross-sectional view taken transversely of the container dome along
line 9—9 of FIG. 6; and

FIG. 10 is a cross-sectional view taken transversely of the container dome
along line 10—10 of FIG. 6.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

20 An embodiment of a blow-molded plastic bottle body, or container body, 10
according to the present invention is illustrated in FIG. The body 10 is utilized to
package beverages and is capable of being filled in either high-speed hot-fill or cold fill
operations. As is typical with such containers, the body 10 has a dome 12, a close
ended base 14 and a sidewall 16 located between the dome and base. An upstanding
25 threaded finish 18 projects from the dome 12 via a substantially annular shoulder 18a
and cooperates with a closure, such as a cap, (not shown) to seal the bottle body 10
after filling.

30 An inset grip ring 20 provides the body 10 with a readily grippable waist
which is located between, and connects, the dome 12 to the sidewall 16. In addition
to providing a structure for permitting convenient and comfortable single-hand

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gripping of the bottle body 10, the circumferentially-extending grip ring 20 enhances the hoop strength of the bottle and provides resistance to ovalization distortion which may otherwise result due to hot-filling. The grip ring 20 also functions to stiffen the transition between the dome 12 and sidewall 16.

5 As illustrated, the preferred bottle body 10 has a tubular-shaped sidewall 16 which is reinforced with a plurality of longitudinally-spaced, circumferentially-extending grooves 22 that rigidify the sidewall 16 and prevent it from ovalizing due to forces created by hot-fill processing. Alternatively, the sidewall can be provided using other cross sectional shapes, such as, square, rectangular, oval, or other multi-sided
10 configurations, and other reinforcement structures can be utilized to prevent unwanted deformation of the sidewall. Preferably, a label (not shown) is wrapped around and mounted on the sidewall 16 between upper and lower label bumpers, 24 and 26. An advantage of the above described relatively smooth-surfaced sidewall 16 is that labels are not required to be mounted over flex panels or like structures which tend to
15 negatively affect the aesthetic appearance of labels.

 The dome 12 of the present invention integrates various functional and aesthetic features in a unique manner without clearly segregating the features. To this end, the dome 12 is provided with various interactive zones of function. Some of the zones are primarily responsible for accommodating vacuum absorption, while other
20 zones are primarily intended to rigidify the container body such as by providing column strength to improve container top loading capability. Although each zone may have a primary function, each zone also aids adjacent zones in providing their functions. Thus, the entire dome 12, and not merely selected locations, reacts to the forces generated by hot-fill processing of the bottle body 10.

25 To provide the above stated functions, the dome 12 of the present invention has a plurality of vacuum flex panels 28 and support columns 30 which interact to provide vacuum absorption functions and structural reinforcement functions. The panels 28 are without clearly identifiable boundaries and are thereby considered as being "unframed". As illustrated, the substantially smooth-surfaced flex panels 28 are
30 circumferentially-spaced in the dome 12 in an alternating array with the plurality of

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circumferentially-spaced, longitudinally-extending elongate columns 30.

In the "as-formed" condition, ie. after blow-molding but before hot-filling, and in the absence of any internal or external applied forces, at least a portion 32 of each panel 28 is formed outwardly concave. This is best illustrated in FIG. 3 in which the horizontal cross section of the dome 12 taken through portions 32 of panels 28 is fluted, or substantially star-shaped. Preferably, as best illustrated in FIG. 4, the as-formed outwardly concave portions 32 of the panels 28 are located in the lower portion 12a of the dome 12 adjacent the waist 20 and provide finger receivable grips. Thus, each panel 28 has a lower edge 34 which is outwardly concave and merges directly into the grip ring 20, and each portion 32 has an upper section 36 which, as formed, becomes progressively less concave as the panel 28 extends in a direction toward the finish 18 of the bottle body 10. Preferably, the uppermost section 38 of each panel 28, as formed, bows outwardly.

Each column 30, as formed, tapers inwardly and widens peripherally in an upward direction from the waist as each of the panels 28 narrows correspondingly. For example, see FIG. 2. The angle of taper "t" relative to a central longitudinal axis "A" of the bottle is about 5°, and is preferably in a range of about 1° to about 10°. The columns, as formed, also bow slightly outwardly in transverse cross-section. The columns 30 have lower ends 30a adjacent the waist 20 that taper inwardly and merge into the waist 20. Preferably, the columns 30 extend substantially the entire longitudinal extent of the dome 12 except where they gently merge into the panels 28 adjacent the shoulder 18a. For example, the columns 30 and panels 28 are not clearly identifiable in a portion of the dome adjacent the shoulder 18a where the uppermost section 38 of each panel 28 bows outwardly.

The panels 28 extend and merge directly into adjacent columns 30 without the presence of transitional framing walls as required by prior art conventional flex panels. As a result, a panel-to-column juncture 40 is formed at the interconnection of each adjacent panel 28 and column 30. As best illustrated in FIG. 3, the intersection of the panels 28 and columns 30 intersect at the junctures 40 form an obtuse angle $\dagger$. For example, the angle $\dagger$ illustrated in FIG. 3 is about 135°. However, the obtuse angle $\dagger$

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is not constant along the length of the juncture 40; rather, the obtuse angle $\dagger$ is greatest in an area where the juncture 40 extends within the uppermost section 38 of each panel 28 and is least where the juncture 40 extends within the inwardly concave portion 32 of each panel 28. Thus, the lack of transitional framing walls forming right-angular junctures between flex panels and adjacent container walls and the changing obtuse angle $\dagger$ of the junctures 40 of the present invention enable the panels 28 and columns 30 to jointly respond to a reduction in internal volume of the hot-filled, capped and cooled bottle body 10 and provides an aesthetically pleasing appearance which can be left exposed and not hidden from the ultimate customer by a label as with bottles having conventional flex panels.

When the container body 10 is hot-filled with a beverage, capped and permitted to cool, each panel 28 deflects inwardly, as best illustrated by the dashed lines in FIGs. 3 and 4, to effectively reduce the volume of the bottle body 10. As each panel 28 progressively deflects inwardly, the columns 30 progressively flatten and strengthen to enhance bottle top loading capability. This occurs due to the increase in lateral pinching of the columns 30 as a result of the panels 28 deflecting inwardly. See the dashed lines in FIG. 3. Thus, the intended altered shape of the dome 12 both resists unwanted container distortion and provides enhanced visual aesthetic interest in the container. This structure is referred to as a so called "active-cage," and is disclosed in International Application No. PCT/US00/12625 which was published on November 16, 2000 as WO 00/68095, owned by Graham Packaging Co., L.P. and incorporated by reference herein.

Preferably, the panels 28 deflect inwardly to reduce container volume in a controlled progressive directional manner similar to the flex panels disclosed in International Application No. PCT/NZ00/00019 which was published on August 31, 2000 as WO 00/50309 and which is incorporated by reference herein. To this end, each panel 28 includes a structure which initiates flexure as the hot filled and capped bottle begins to cool. The as-formed inwardly concave portion 32 functions as the initiator of the illustrated panel 28. Thus, the portions 32 of each panel 28 deflect inwardly to reduce the internal volume of the body 10, and thereafter, as the internal

volume progressively decreases as the bottle and hot filled beverage cool; further deflection of each panel 28 occurs adjacent the upper sections 36 of portions 32 and continues in a direction toward the uppermost sections 38 of the panel 28, as needed. Thus, depending on filling conditions, ie. filling temperature, beverage type, fill levels, etc., the dome 12 of the present invention can accommodate a wide range of container internal volume reduction while providing an aesthetic appearance throughout such range. The panels 28 of the dome 12 accommodate at least 90% of the total vacuum absorption required by the bottle.

The bottle body 10 of the present invention is particularly suited for use in providing grippable slender bottles, such as illustrated in FIGs. 1 and 2 which are drawn to full scale. The bottle body 10 has a predetermined slenderness ratio which, as used herein, is the length of the bottle measured axially from the upper edge of the finish 18 to the bottom of the base 14 divided by the mean diameter of the sidewall 16. In the illustrated bottle 10, the bottle body 10 has an overall height of about 8 inches, an outermost sidewall diameter of less than 3 inches, and provides an intended beverage capacity of about 20 fluid ounces. Its slenderness ratio is about 2.9:1. Of course, container bodies having other sizes and slenderness ratios can be made in accordance with the present invention.

By way of example, and not by way of limitation, the bottle body 10 is manufactured by blow molding in a heat set blow mold an injection molded preform made of about 36 grams of PET. The dome 12 of the bottle body may include any number of panels 28 and columns 30, such as in a range of two through ten. The preferred illustrated embodiment includes five panels 28 and five columns 30. All or selected ones of the panels 28 can be designed to flex in response to vacuum induced in the bottle. The sidewall 16 can be formed with any number of reinforcing circumferential grooves or like reinforcement structures. Preferably, the bottle body has a slenderness ratio of at least 2.5:1 and the dome 12 from shoulder 18a to waist 20 constitutes at least about 28% of the overall bottle length.

The dome 12 of the bottle 10 illustrated in FIG.1 is also shown in FIGs. 5-7 utilizing an alternate style of shading lines to better show the contour of the panels 28,

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as formed. The contour of the panels 28 is also illustrated in FIGs. 8-10 in which: a lower section 32 is shown as bowing inwardly in FIG. 8; an upper section 38 is shown as bowing outwardly in FIG 10; and intermediate the upper and lower ends, the panels 28 are shown as being substantially planar in FIG. 9. For ease of illustration, one
5 panel 28 in each of FIGs. 8-10 is shown with dashed lines in a flexed position that the panel assumes after the bottle 10 is hot-filled, capped and cooled. Of course, all panels in the preferred embodiment would assume the illustrated flexed position.

From the foregoing, it should be apparent that the present invention provides a hot-fillable, grippable, slender container which integrates various functional and
10 aesthetic features without clearly segregating these features. Unframed panels and columns interact to provide vacuum absorption functions and structural reinforcement functions. As more vacuum develops in the container, greater structural changes occur in the dome of the container to provide a container which is functional, structurally strong and aesthetically pleasing to the consumer. An inset waist, or grip
15 ring, enables ready single-handed gripping of the container and resists ovalization of the bottle.

While a preferred embodiment of a container having a dome with unframed flex panels has been described, various modifications, alterations, and changes may be made without departing from the spirit and scope of the present invention as defined
20 in the appended claims.

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CLAIMS:

1. In a slender, blow-molded, hot-fill bottle (10), including a body portion (10) with a sidewall (16), a base (14), a dome (12) with a finish (18), and a waist (20) connecting the dome (12) and sidewall (16), the improvement comprising:
- 5 a plurality of upright columns (30) extending lengthwise of said dome (12) in spaced relation between said waist (20) and said finish (18); and
- a plurality of recessed panels (28) extending between said waist (20) and said finish (18), selected ones of said recessed panels (28)
- 10 being outwardly concave (32) and being adapted to flex in response to vacuum induced in the bottle (10).
2. A slender, blow-molded, hot-fill bottle (10) according to claim 1, wherein said columns (30) taper inwardly in an upward direction from said waist (20).
3. A slender, blow-molded, hot-fill bottle (10) according to claim 2, wherein
- 15 said columns (30) widen peripherally in an upward direction from said waist (20) and said panels (28) narrow correspondingly in the same direction.
4. A slender, blow-molded, hot-fill bottle (10) according to claim 3, wherein said columns (30) taper inwardly in an upward direction at an angle in a range of about 1° to about 10° relative to a central longitudinal axis of the bottle (10).
- 20 5. A slender, blow-molded, hot-fill bottle (10) according to claim 1, wherein said columns (30) have lower ends (30a) adjacent the waist (20) that taper inwardly and merge into said waist (20).
6. A slender, blow-molded, hot-fill bottle (10) according to claim 1, wherein at least selected ones of said panels (28) are outwardly concave (32) between columns
- 25 (30) adjacent said waist (20) to provide finger-receivable grips.

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7. A slender, blow-molded, hot-fill bottle (10) according to claim 1, wherein said columns (30) have a longitudinal extent about equal to the longitudinal extent of the dome (12).

8. A slender, blow-molded, hot-fill bottle (10) according to claim 1, wherein
5 said plurality of panels (28) and columns (30) are five in number.

9. A slender, blow-molded, hot-fill bottle (10) according to claim 1, wherein said bottle (10) has a slenderness ratio of at least about 2.5, and said dome (12) constitutes at least about 40% of the overall bottle length.

10. A slender, blow-molded, hot-fill bottle (10) according to claim 1, wherein
10 said flex panels (28) in said dome (12) accommodate at least about 90% of the total vacuum absorption requirement of the bottle (10).

11. A bottle (10) comprising:

a blow-molded plastic body (10) having a dome (12) with an
upstanding finish (18), a base (14), a substantially tubular
15 sidewall (16) projecting from said base (14), and an inset
circumferentially-extending grip ring (20) extending between
and connecting said dome (12) and sidewall (16);
said dome (12) having an alternating array of a plurality of
circumferentially-spaced longitudinally-extending columns (30)
20 and a plurality of circumferentially-spaced panels (28) which
extend laterally between and connect to an adjacent pair of said
columns (30);
each of said panels (28) having at least a portion thereof which is
outwardly concave (32), as formed, including an outwardly
25 concave lower section (34) which merges directly into said
inset grip ring (20) to provide finger receiving recesses.

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12. A bottle (10) according to claim 11, wherein selected ones of said panels (28) flex inwardly in response to a reduction in internal volume when the bottle (10) is hot-filled, capped and permitted to cool, and wherein said columns (30) on opposite sides of said selected ones of said flex panels (28) have an, as manufactured, inwardly concave shape with an upwardly progressively decreasing concave shape that increases as the internal volume of the bottle (10) is progressively reduced.

13. A bottle (10) according to claim 11, wherein said inwardly concave portion (32) of each of said flex panels (28), as formed, has an upper section (36) which is inwardly concave, and flex panel (28) has an initiator portion (32) that causes the panel (28) to flex progressively inwardly in an upward direction from said waist (20).

14. A bottle (10) according to claim 11, wherein said dome (12) accommodates at least about 90% of the total vacuum absorption required of the bottle (10) resulting from hot-fill processing.

15. A bottle (10) according to claim 11, wherein a flex panel-to-column juncture (40) is formed between each adjacent flex panel (28) and adjacent columns (30), and wherein each of said junctures (40), as formed, defines an obtuse angle $\dagger$ that varies progressively along the length of the columns (30).

16. A bottle (10) according to claim 15, wherein, as formed, each of said adjacent columns (30) widens progressively in an upward direction and their associated flex panel (28) narrows in an upward direction, said obtuse angle $\dagger$ at each of said junctures (40) varies along its length with said obtuse angle $\dagger$ being greatest where said juncture (40) extends within an upper portion of said dome (12) nearer to said finish (18) than to said waist (20) and being least where said juncture (40) extends within a lower portion (12a) of said dome (12) nearer to said waist (20) than to said finish (18).

17. A bottle (10) according to claim 16, wherein each of said panels (28) are outwardly concave and have initiator portions (32) that function to cause flex panel deflection to occur progressively in a direction from said outwardly concave portions (32) toward said finish (18) in a controlled manner in response to increasing reduction
5 of internal volume of the bottle (10).

18. A bottle (10) comprising:
a blow-molded plastic body (10) having a dome (12) with an
upstanding finish (18), a base (14), and a sidewall (16)
projecting from said base (14) toward said dome (12);
10 said dome (12) having a plurality of circumferentially-spaced
longitudinally-extending columns (30) and a plurality of
circumferentially-spaced flex panels (28) which extend laterally
between and connect to an adjacent pair of said columns (30),
each of said panels (28) flexing inwardly in response to a
15 reduction in internal volume when the bottle (10) is hot-filled,
capped and permitted to cool for accommodating at least about
90% of a total vacuum absorption required of the bottle (10).

19. A bottle (10) according to claim 18, wherein, as formed, each column
(30) extending along opposite sides of each said panels (28) has a lower end (30a)
20 merging into said waist (20), and the flex panel (28) between said columns (30) is
outwardly concave (34) adjacent said waist (20) to provide finger receiving recesses.

20. A bottle (10) according to claim 19 wherein each flex panel (28) narrows
peripherally in an upward direction and each column (30) widens peripherally in an
upward direction.

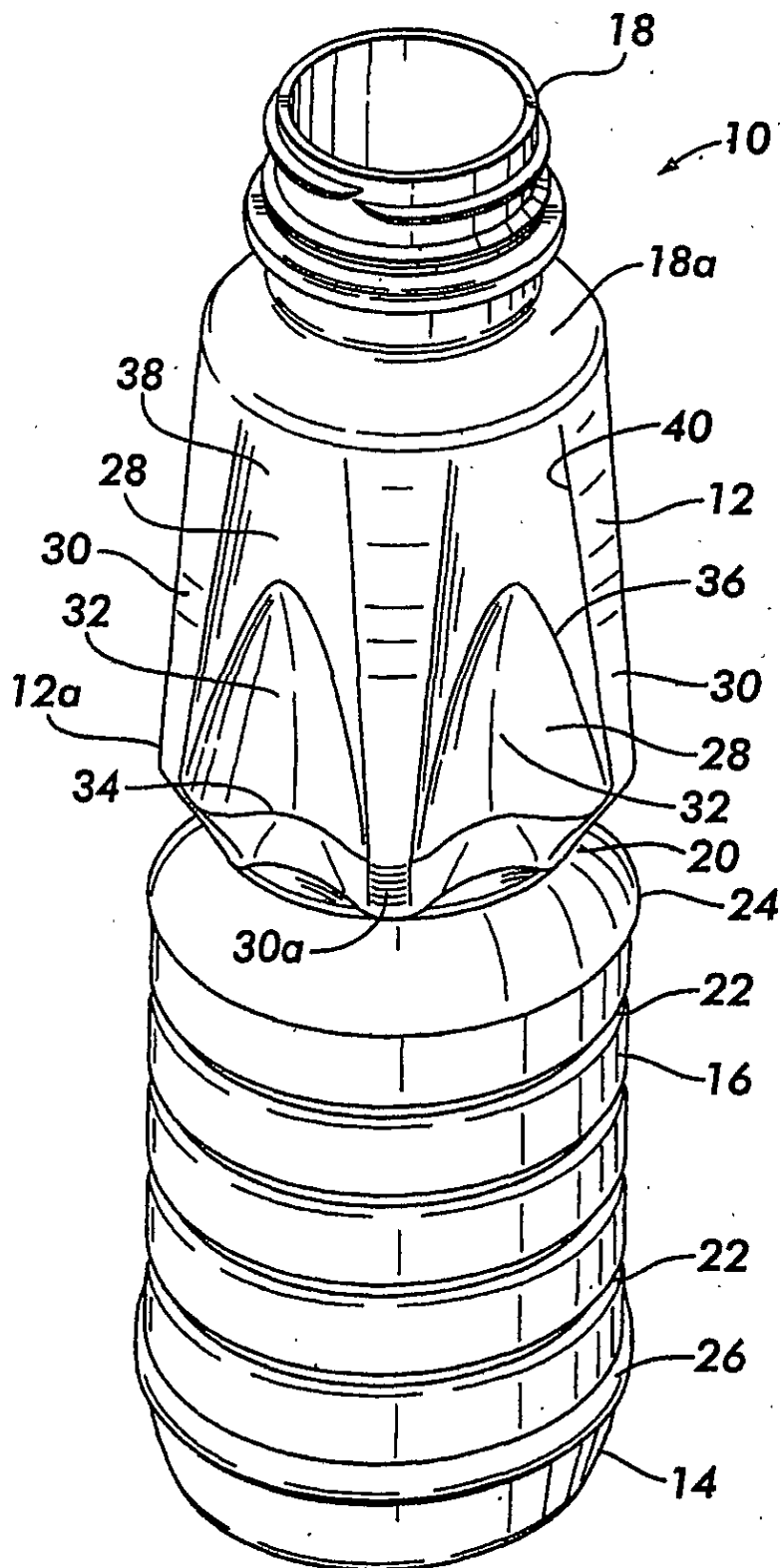
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21. A bottle (10) according to claim 20, wherein each of said flex panels (28) has an initiator portion (32) which causes controlled inward flexure of said flex panel (28) with increasing vacuum in the bottle (10).

5 22. A bottle (10) according to claim 21, wherein each of said panels (28), as formed, becomes progressively less outwardly concave from said waist (20) and becomes inwardly concave toward said finish (18).

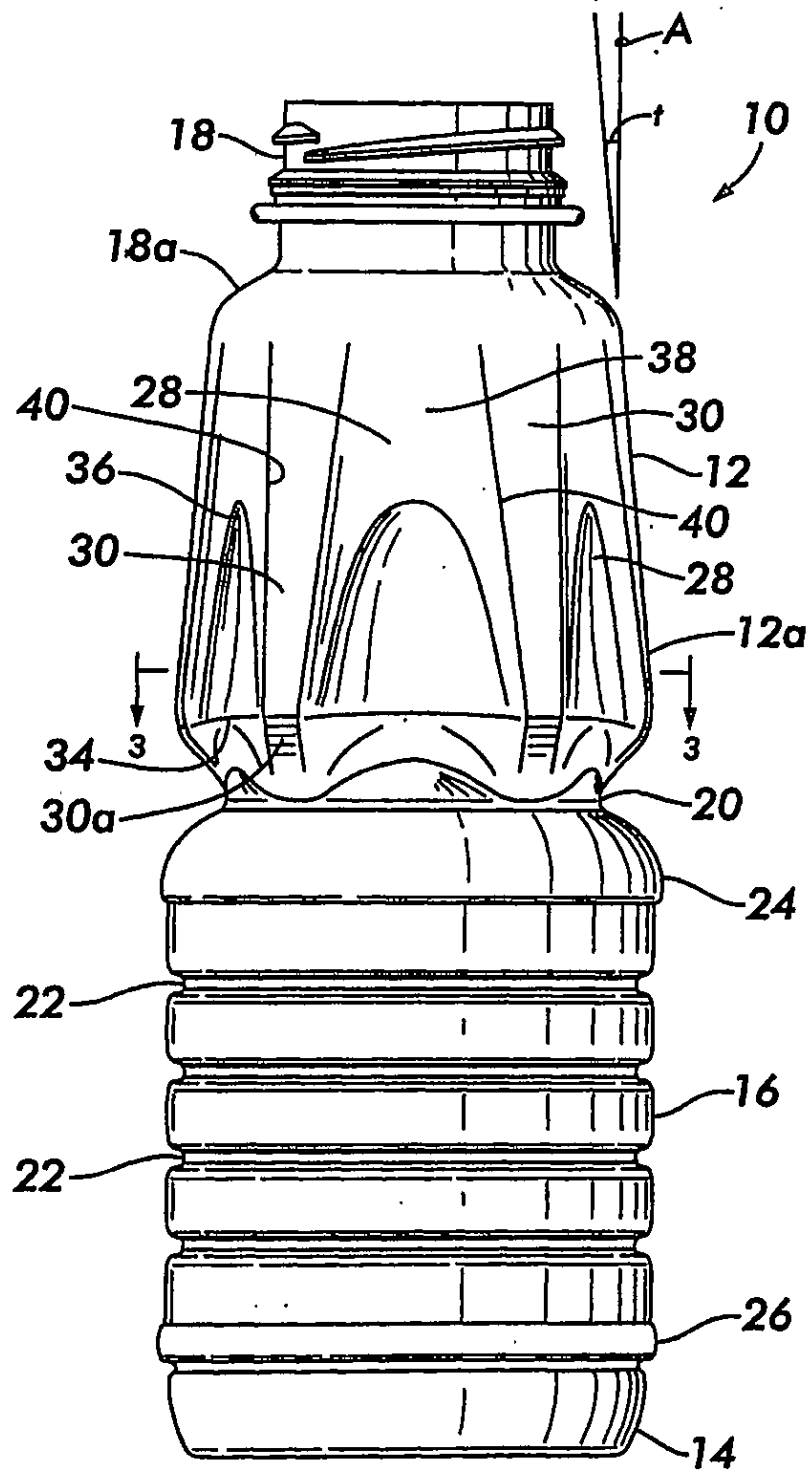
10 23. A bottle (10) according to claim 22, wherein said body (10) has an inset circumferentially-extending grip ring (20) extending between and connecting said dome (12) and said sidewall (16).

FIG. 1



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FIG. 2



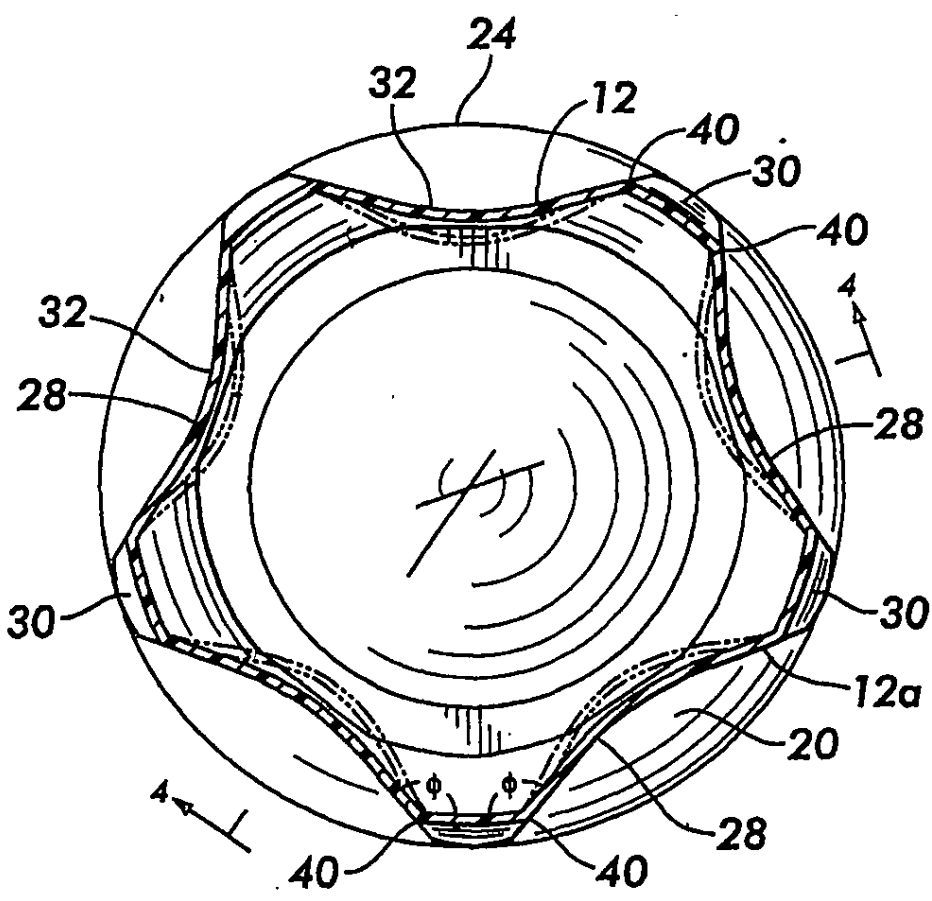
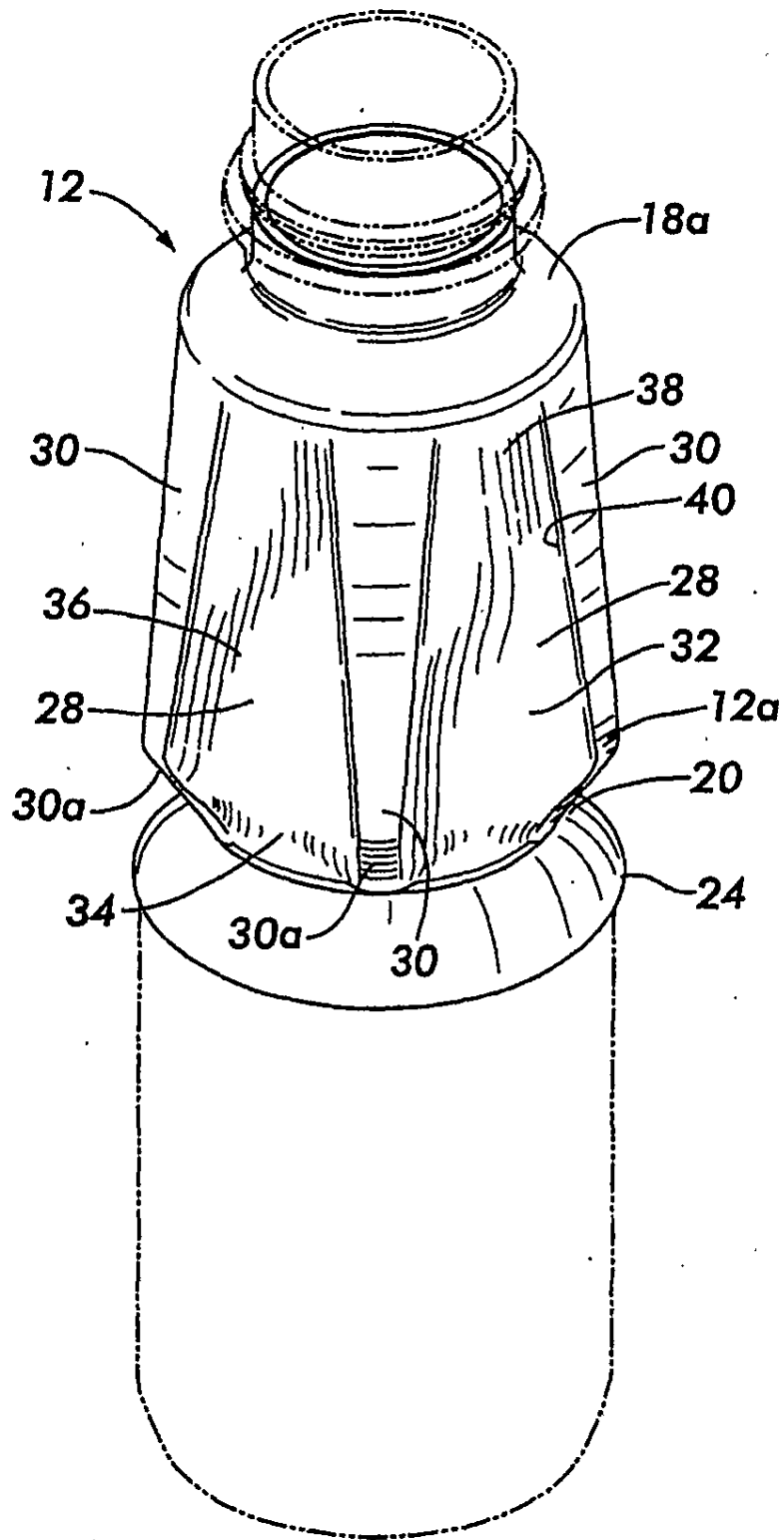


FIG.3

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FIG. 5

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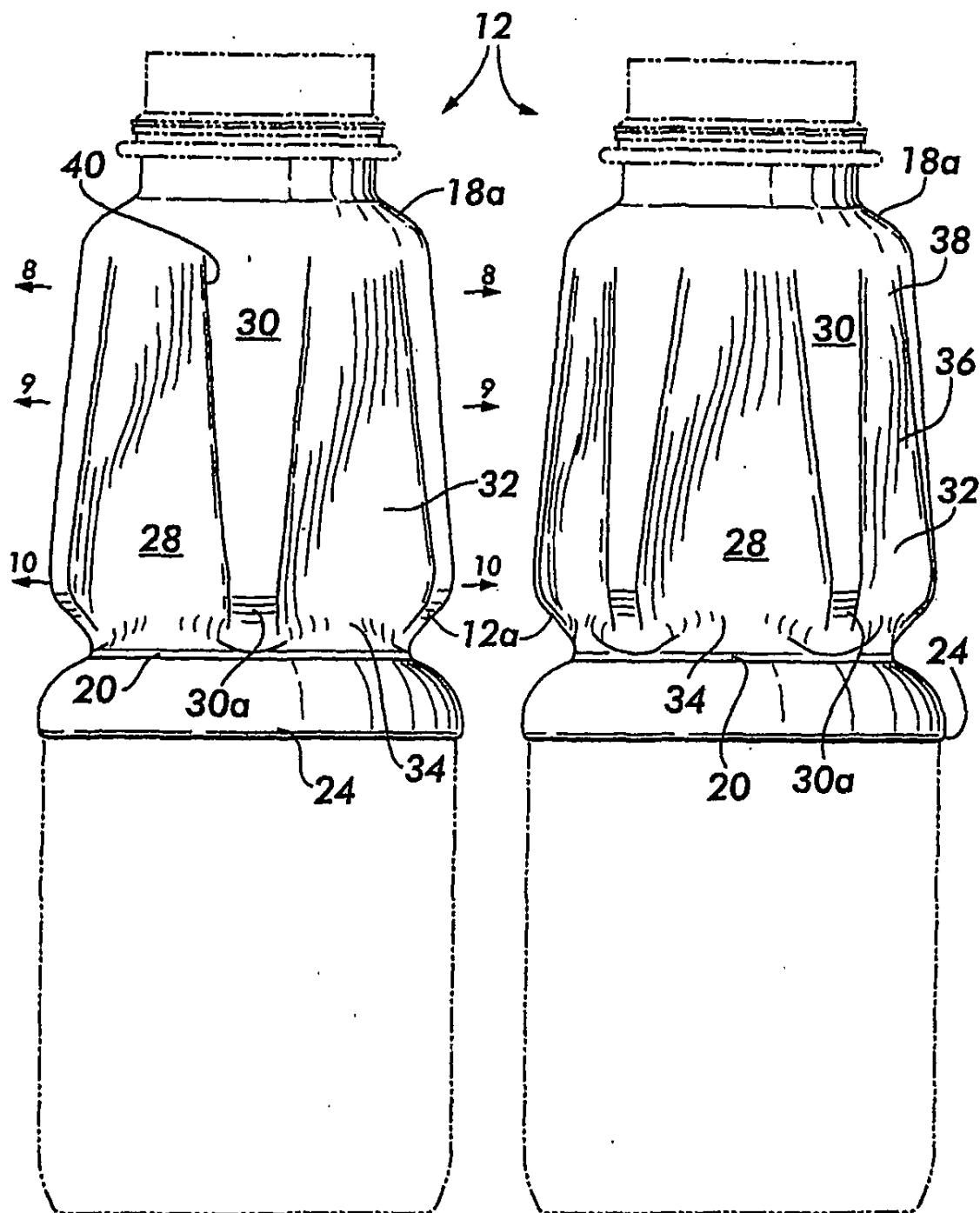


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FIG. 6

FIG. 7



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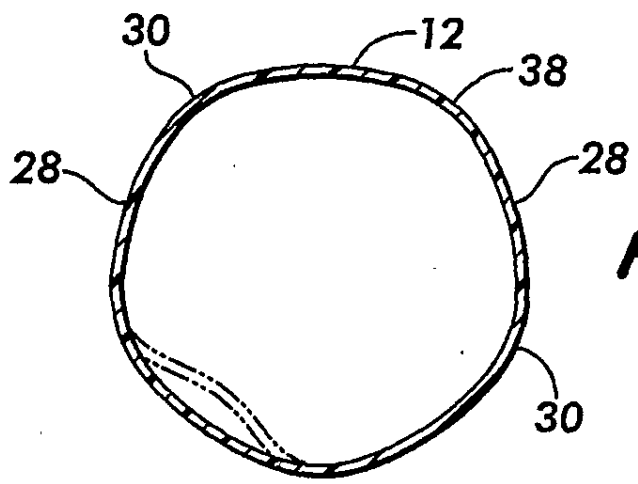


FIG. 8

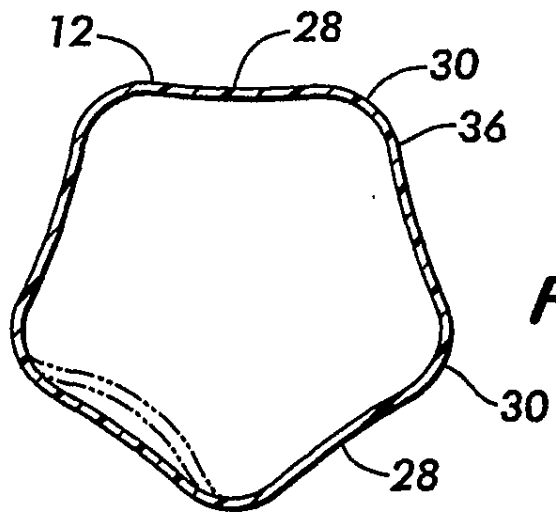


FIG. 9

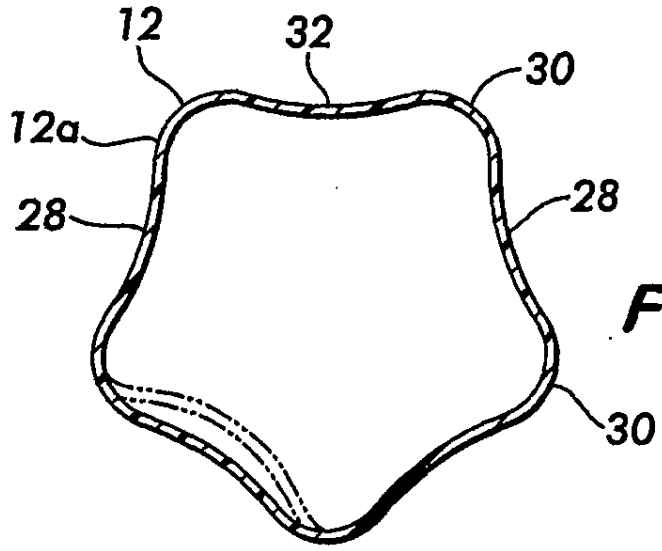


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : B65D 1/02
US CL : 215/381

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 215/381, 382, 383, 384, 385, 379; 220/660, 669, 670-676; D9/503-641

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6,095,360 A (SHMAGIN et al.) 01 August 2000, figs. 2 and 3A1.	1-3, 5-7, 11, 12 and 18
X	US 6,044,996 A (CAREW et al.) 04 April 2000, fig. 1.	1-4, 6-12, 14 and 18-21
X	US 6,016,932 A (GAYDOSH et al.) 25 January 2000, fig. 3.	11-14 and 18-21
X	US DES. 61,658 S (GRAHAM) 14 November 1922, figs. 1 and 2.	1-4, 6, 7 and 9-23
X	US 6,161,713 A (KRICH) 19 December 2000, See the whole document.	1-23
X	US DES. 322,562 S (NARSUTIS) 24 December 1991, See the whole document.	1-23

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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P document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

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383 201

INTERNATIONAL SEARCH REPORT

International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US DES. 374,826 S (MACKINSON et al.) 22 October 1996, See the whole document.	1-23

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International Bureau



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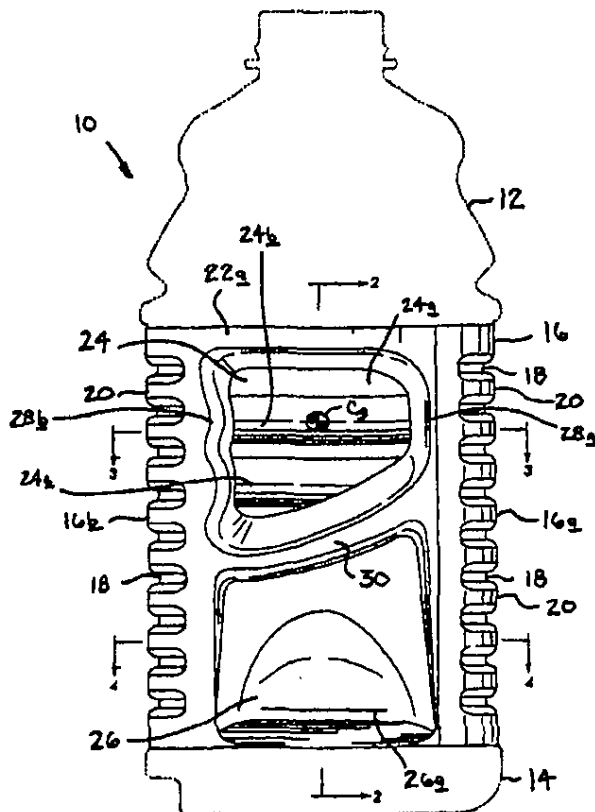
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[Continued on next page]

(54) Title: HOT FILLABLE CONTAINER HAVING SEPARATE RIGID GRIPS AND FLEX PANELS

(57) Abstract: A lightweight hot-fill blow-molded plastic container (10, 110) having a sidewall (16) with a rigid grip portion (24, 124) and a flexible vacuum absorption portion (26, 126).



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patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

— with international search report

HOT FILLABLE CONTAINER HAVING SEPARATE RIGID GRIPS AND FLEX PANELS

Field of the Invention

5 The present invention relates to hot-fill blow-molded plastic containers, and more particularly, the present invention relates to hot-fill blow-molded plastic containers having opposed grips affording facile handling of the container by the consumer.

Background of the Invention

10 In the early 1990s, Graham Packaging Company pioneered the commercialization of hot-fill blow-molded plastic containers having sidewalls with elongate flex panels that incorporated grip structures. These containers are the subject of U.S. Patent Nos. 5,392,937 and D.344,457. In the patented containers, the grip structure moves with the vacuum panel in response to vacuum induced inside the container in response to hot filling, capping and cooling of the container contents.

15 While the patented Graham containers have been commercially successful, there is a desire to reduce the amount of plastic used in the manufacture of the container without sacrificing performance, to enhance ergonomic handling attributes, and to resist unwanted deformations in handling.

Objections of the Invention

20 With the foregoing in mind, an object of the present invention is to provide a light-weight hot-fillable blow-molded grip container which functions at least as well as the aforementioned Graham Packaging grip containers.

Another object of the present invention is to provide a lightweight hot-fillable blow-molded plastic container having enhanced ergonomic handling qualities.

25 Another object of the present invention is to provide a user-friendly, hot-fillable blow-molded plastic grip container that is sufficiently robust as to resist deformations that may occur in handling of the container during manufacture and after hot filling and capping.

Summary of the Invention

More specifically, the present invention provides a hot-fillable blow-molded plastic container having a sidewall with opposed label panels and intermediate panels each having a separate grip portion and a separate vacuum absorption portion. The grip portion has a wall portion inset into the container and extending chordally thereof to provide surfaces engageable by a user's finger and thumb when gripping the container. The grip wall portion is rigid to resist deflection when gripped and to resist flexure in response to normal vacuum conditions induced in the container in response to hot-fill processing. A vacuum absorption wall portion is located adjacent the grip wall portion and is separated therefrom by a rigid rib which extends between the label panels to rigidly interconnect them. Preferably, the grip portion is located superadjacent the vacuum absorption wall portion. Substantially the entire region between the label panels and the rib is occupied by the vacuum absorption wall portion. In one preferred embodiment, a smooth wall of a particular construction provides the entire vacuum absorption function. In another embodiment, a pair of vertically elongate vacuum panels separated by a post are provided to accommodate the requisite vacuum absorption. The rib that divides each intermediate panel into complementary configurations preferably extends diagonally thereacross, and is arcuate and of substantially the same radius of curvature as the label panels in order to provide a peripheral bumper between the label panels.

Brief Description of the Drawing

The foregoing and other objects, features and advantages of the present invention should become apparent from the following description when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a side elevational view of one preferred embodiment of the present invention;

FIG. 2 is a longitudinal sectional view taken on Line 2-2 of Fig 1;

FIG. 3 is a transverse sectional view taken on Line 3-3 of Fig. 1;

FIG. 4 is a transverse sectional view taken on Line 4-4 of Fig. 1; and
FIG. 5 is a side elevational view of another preferred embodiment of the
present invention.

Detailed Description of the Preferred Embodiments

5 Referring now to the drawings, Fig. 1 illustrates one preferred embodiment of
a container 10 embodying the present invention. The container 10 has a conventional
dome 12 and base 14, both shown in phantom, and a sidewall 16 between the dome
and base, shown in full. The sidewall 16 has opposed label panels 16a and 16b
reinforced by a series of horizontally disposed grooves 18 and ribs 20 of conventional
10 construction. The sidewall 16 has opposed intermediate panels 22a and 22b extending
between the label panels 16a and 16b, the front one of which is indicated at 16a, and
the rear one which is indicated at 16b. The intermediate panel 22a has a separate rigid
grip portion 24 and separate flexible vacuum absorption portion 26. The intermediate
panel 22b is of like construction and is disposed diametrically opposite the panel 22a
15 shown in Fig. 1. See Figs. 3 and 4.

The grip portion 24 has a generally planar wall portion 24a which is inset into
the container 10 from its generally cylindrical shape, and which extends chordally to
provide opposed surfaces engageable by a user's fingers and thumb when gripping the
container by placing the thumb in the obverse grip shown in Fig. 1 and the fingers in
20 the reverse grip on the other side of the container 10. The grip portion 24 has a pair
of vertically spaced horizontally extending undulations 24b, 24c that rigidify the grip
wall portion 24 and also provide an anti-slip function. The grip wall portion 24 is
thereby formed to be rigid to resist deflection when gripped and to resist flexure in
response to normal vacuum conditions induced in the container in response to hot
25 filling, capping and cooling of the container contents.

The grip portion 24 is of a generally irregular trapezoidal shape, having a base
28a located adjacent the rear label panel 16b and a frustum 28b located adjacent the
front label panel 16a. As best seen in Fig. 3, the front and rear label panels have the
same radius of curvature to provide the container with a generally circular transverse

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cross section, although the invention has applicability to containers having generally rectangular or square transverse cross sectional configurations.

Preferably, the grip wall portion 24 is located in proximity with the filled container center of gravity Cg. The configuration of the grip is such as to provide a target for the user to grip the container at an ergonomically desirable location for pouring from the container when filled.

As best seen in Fig. 1, each intermediate panel 22a has a separate vacuum absorption wall portion 26 located immediately below the grip wall portion 24. The grip wall portion 24 and vacuum absorption wall portion 26 are separated by a rigid rib 30 which extends between the front and rear label panels 16a, 16b for rigidly connecting the label panels for providing flexure resistance.

The separate vacuum absorption wall panel 26 is located subjacent the grip wall portion 24. The vacuum absorption wall portion 26 and grip wall portion 24 are thereby vertically aligned in the intermediate panels 22a, 22b, and the vacuum absorption panel 26 occupies substantially the entire space between the front and rear label panels 16a, 16b, the rib 30, and the base 14 of the container 10. The vacuum absorption wall panel 26 is designed and sized to provide substantially all of the normal hot-filled vacuum absorption required of the container sidewall.

A preferred form of vacuum absorption wall construction is disclosed in PCT application published on 31 August 2000 under publication No. WO 00/50309 filed in the name of David Melrose of Auckland, New Zealand. In the present invention the preferred vacuum absorption wall panel has an initiator section 26a for causing the wall portion to deflect inwardly in a controlled manner in response to vacuum induced inside the container as a result of filling, capping, and cooling. For a more complete description of the structure and function of a preferred vacuum absorption panel, reference is made to the aforementioned published PCT application, the disclosure which is incorporated by reference herein.

In the embodiment of Figs. 1-4, the rib 30 extends diagonally across the intermediate panel and has a radius of curvature corresponding substantially to the front and rear label panels 16a, 16b to provide a robust lateral bumper that aids in

preventing the container from being deformed in the course of handling during manufacture, filling and shipment to the ultimate consumer.

Turning now to Fig. 5, another preferred embodiment 110 is provided utilizing the same general overall configuration as the aforementioned embodiment, but with some differences. For instance, the inset grip wall portion 124 has a pair of
5 horizontally spaced, vertically elongated anti-slip ribs 124b, 124c extending outwardly in spaced parallel relation adjacent to the rear label panel 116b. The vacuum absorption wall portion 126 below the grip includes a pair of vertically elongate flex panels 134, 136 which may be of conventional construction, or which may be in
10 accordance with the teachings of the aforementioned PCT published application. The flex panels 134, 136 extend vertically in spaced parallel relation subjacent the grip wall portion 124. The flex panels 134, 136 are separated horizontally by a post 138 which extends vertically between and interconnects the rib 130 and container base 114. The pair of flex panels are disposed in an arcuate array extending generally peripherally in
15 substantial alignment with the arc of the rib and label panels. These vacuum absorption wall portions function to accommodate vacuum induced inside the container in response to hot filling, capping and cooling of the container contents.

In both of the preferred embodiments, the center of gravity of the filled container is located in the region indicated generally at Cg in Figs. 1 and 5. Both
20 embodiments are designed to have a nominal filled capacity of 64 fluid ounces. The containers are designed to be filled hot, ie. at a temperature of at least about 185°F.

By way of example, the comparison with a Graham patented grip container, such as disclosed in the aforementioned Graham patents, the container of the embodiment depicted in Figs. 1-4 made of PET plastic weighs 75 grams, or less;
25 whereas, the patented Graham container in production weighs 81 grams, or more.

The containers are ergonomically friendly because the rigid grip wall portions are located at a desirable targeted lifting location and do not deflect in response to normal gripping pressure applied when lifting and pouring from a filled container. The rigidity enables all of the sidewall required vacuum accommodation to be accepted by
30 the subjacent flexible vacuum absorption wall portions.

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While preferred embodiments of the present invention have been described in detail, various modifications, alterations and changes may be made without departing from the spirit and scope of the present invention as defined in the appended claims.

392 ~~210~~CLAIMS

1. In a hot-fill blow-molded container (10, 110) having a sidewall (16) with opposed label panels (16a, 16b) and opposed intermediate panels (22a, 22b) connecting the label panels (16a, 16b) for affording gripping of the container (10, 110) and pouring contents therefrom, the improvement wherein each intermediate panel (22a, 22b) has a separate grip portion (24, 124) and a separate vacuum absorption portion (26, 126), said grip portion (24, 124) having a wall portion (24a) inset into the container (10, 110) and extending chordally thereof for providing opposed surfaces engageable by a user's fingers and thumb when gripping the container (10, 110), said grip wall portion (24a) being rigid to resist deflection when gripped and to resist flexure in response to normal vacuum conditions induced in the container (10, 110) in response to hot filling, capping and cooling of the container contents, said separate vacuum absorption wall portion (26, 126) being located adjacent to said grip wall portion (24, 124) and being separated therefrom by a rigid rib (30, 130) extending between said label panels (16a, 16b) for rigidly connecting together the label panels (16a, 16b) intermediate the grip and flex portions (24, 26, 124, 126) and providing a sidewall bumper that resists flexure, said separate vacuum absorption portions (26, 126) of both intermediate panels (22a, 22b) cooperating to provide a substantial portion of the normal hot-fill vacuum absorption required of the container sidewall (16).
2. The container (10) according to Claim 1 wherein said grip wall panel (24) is located superadjacent said vacuum absorption wall portion (26) in said intermediate wall (22a, 22b).
3. The container (10) according to Claim 2 wherein said grip wall portion (24) is located in proximity with the filled container center of gravity (Cg).
4. The container (10) according to Claim 3 wherein said grip wall portion (24) has a plurality of anti-slip protrusions (24b, 24c).

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5. The container (10) according to Claim 1 wherein said grip and flex wall portions (24, 26) are complementary in shape and are separated by a peripheral rib (30) connecting the opposed label panels (16a, 16b).

6. The container (10) according to Claim 5 wherein said peripheral rib (30) extends diagonally between said grip and flex wall portions (24, 26).

7. The container (10) according to Claim 6 wherein said peripheral rib (30) is of substantially the same radius of curvature as said opposed label panels (16a, 16b) to provide a peripheral bumper.

8. The container (10, 110) according to Claim 1 wherein said vacuum wall portion (26, 126) is located subjacent said grip wall portion (24, 124), and including a rib (30, 130) separating said vacuum wall portion (26, 126) from said grip wall portion (24, 124).

9. The container (10) according to Claim 8 wherein said vacuum wall portion (26) occupies substantially the entire region of said intermediate panel (22a, 22b) below said rib (30) and between said label panels (16a, 16b).

10. The container (10) according to Claim 8 wherein said rib (30) extends diagonally between said opposed label panels (16a, 16b).

11. The container (10) according to Claim 8 wherein said rib (30) connects said label panels (16a, 16b) and is of substantially the same radius of curvature to provide an arcuate bumper.

12. The container (110) according to Claim 8 wherein said vacuum wall portion (126) includes a plurality of elongate flex panels (134, 136), and at least one post (138) extending between said elongate flex panels (134, 136).

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13. The container (110) according to Claim 12 wherein said elongate flex panels (134, 136) and post (138) are disposed vertically.

14. The container (110) according to Claim 12 wherein said rib (130) is arcuate and of substantially the same radius of curvature as said label panels, and said flex panels (134, 136) are disposed in an arcuate array extending generally peripherally in substantial alignment with said rib (130) and said label panels.

15. In a hot-fill blow-molded container (10) having a base (14) and a sidewall (16) with opposed label panels (16a, 16b) and opposed intermediate panels (22a, 22b) connecting the label panels (16a, 16b) for affording gripping of the container (10) and pouring contents therefrom, the improvement wherein each intermediate panel (22a, 22b) has a separate grip portion (24) and a separate vacuum absorption portion (26) located vertically adjacent one another, said grip portion (24) having a wall portion (24a) inset into the container (10) and extending chordally thereof in proximity with the filled center of gravity (Cg) of the container (10) for providing opposed surfaces engageable by a user's fingers and thumb when gripping the container (10), said grip wall portion (24) being rigid to resist deflection when gripped and to resist flexure in response to normal vacuum conditions induced in the container (10) in response to hot filling, capping and cooling of the container contents, said separate vacuum absorption wall portion (26) being shaped complementary to said grip wall portion (24) and being separated therefrom by a rigid rib (30) extending arcuately between said label panels (16a, 16b) for rigidly connecting together the label panels (16a, 16b) intermediate the grip and flex portions (24, 26) and providing a sidewall bumper that resists flexure, said vacuum absorption wall portion (26) occupying substantially the entire space between said label panels (16a, 16b), said rib (30) and said base (14), said separate vacuum absorption wall portion (26) of both intermediate panels (22a, 22b) cooperating to provide substantially all of the normal hot-fill vacuum accommodation required of the container sidewall (16).

395 283 31

16. The container (10) according to Claim 15 wherein said grip portion (24) is located above said vacuum absorption portion (26).

17. The container (10) according to Claim 15 wherein said rigid rib (30) is disposed diagonally across said intermediate panel (22a, 22b).

5 18. In a hot-fill blow-molded container (10) having a base (14) and a sidewall (16) with opposed label panels (16a, 16b) and opposed intermediate panels (22a, 22b) connecting the label panels (16a, 16b) for affording gripping of the container (10) and pouring contents therefrom, the improvement wherein each intermediate panel (22a, 22b) has a separate rigid grip portion (24) and a separate
10 vacuum absorption portion (26) located vertically adjacent one another.

19. The container (10) according to Claim 18 wherein said grip portion (24) has a wall portion (24a) inset into the container (10) in proximity with the filled center of gravity (Cg) of the container (10) for providing opposed surfaces engageable by a user's fingers and thumb when gripping the container (10), said grip wall portion
15 (24) being rigid to resist deflection when gripped and to resist flexure in response to normal vacuum conditions induced in the container (10) in response to hot filling, capping and cooling of the container contents.

20. The container (10) according to Claim 19 wherein said separate vacuum absorption wall portion (26) is shaped complementary to said grip wall portion (24) and is separated therefrom by a rigid rib (30) extending between said
20 label panels (16a, 16b) for rigidly interconnecting the label panels (16a, 16b) intermediate the grip and flex portions (24, 26) and providing a robust sidewall bumper, said vacuum absorption wall portion (26) occupying substantially the entire space between said label panels (16a, 16b), said rib (30) and said base (14), to provide
25 substantially all of the normal hot-fill vacuum accommodation required of the container sidewall (16).

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21. A container (10, 110) according to any of claims 1, 15 or 18 having a nominal filled capacity of 64 fluid ounces and an empty weight that does not exceed 75 grams.

FIG. 2

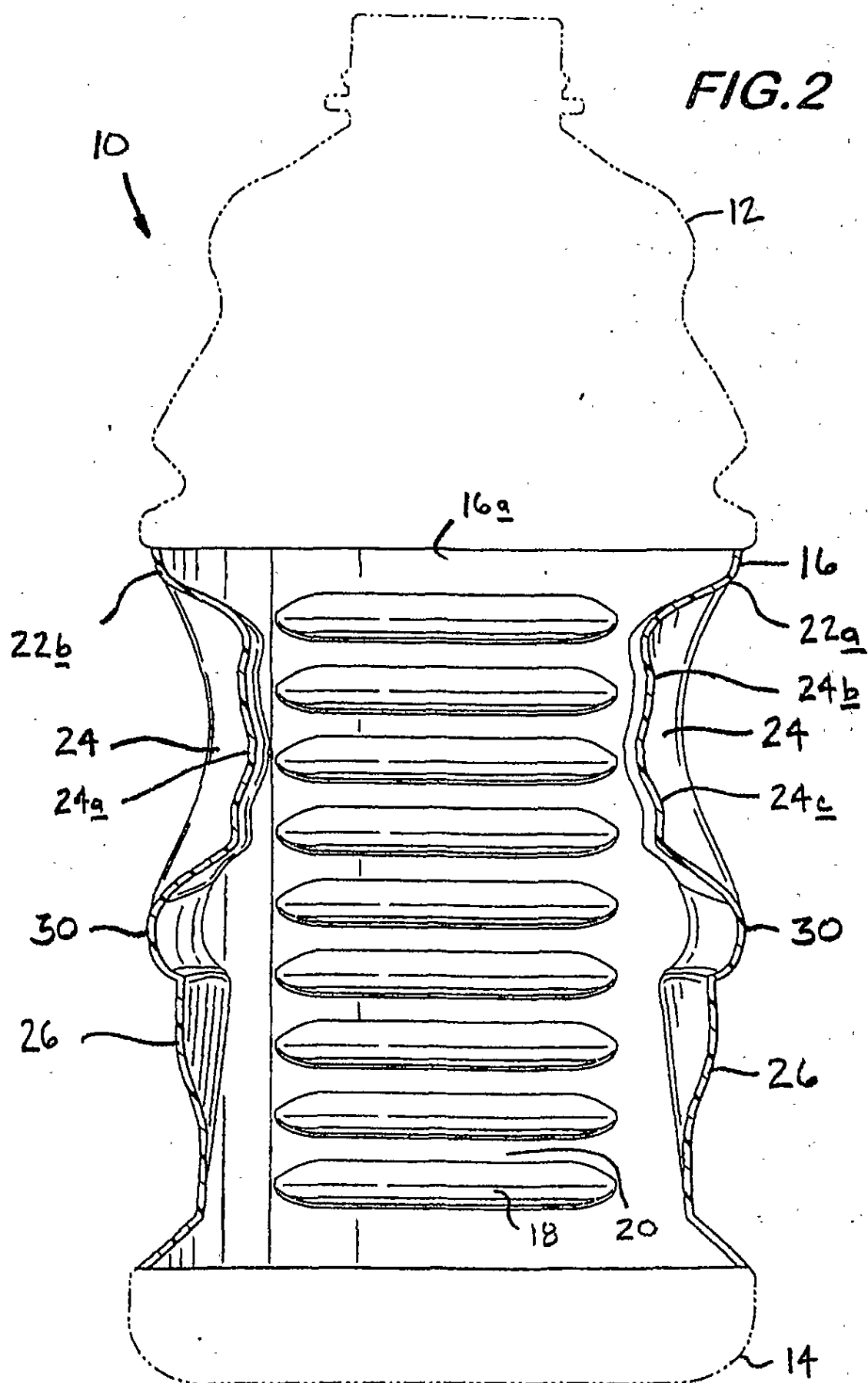


FIG.3

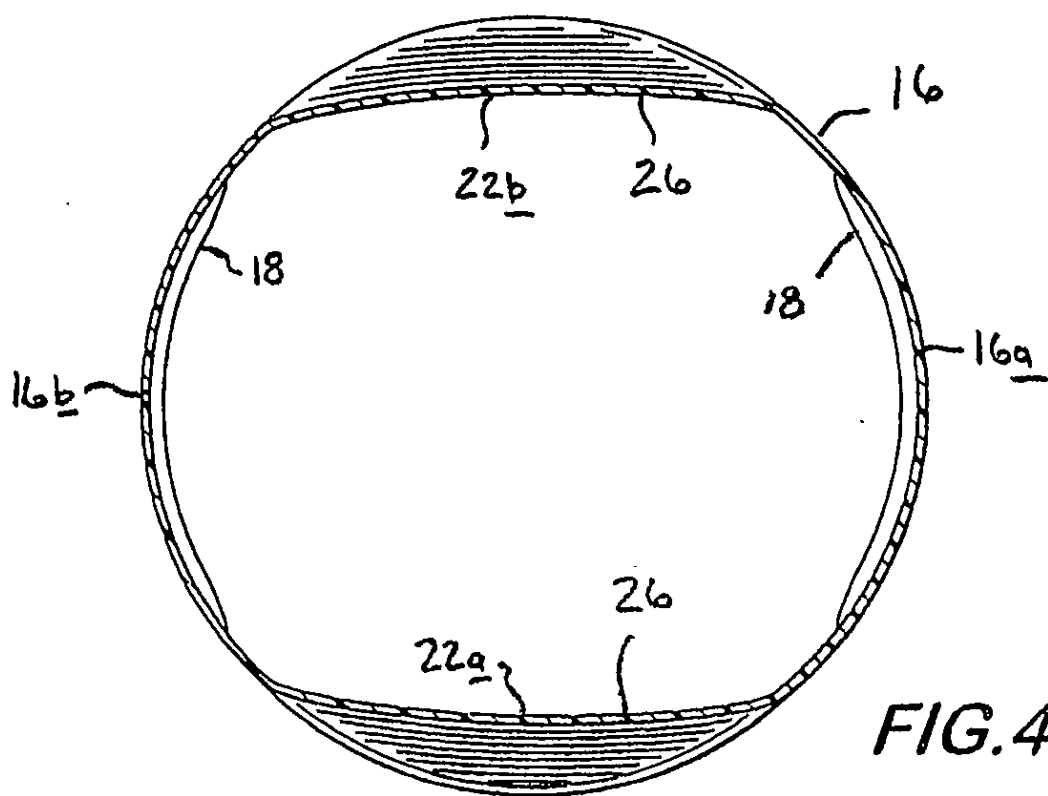
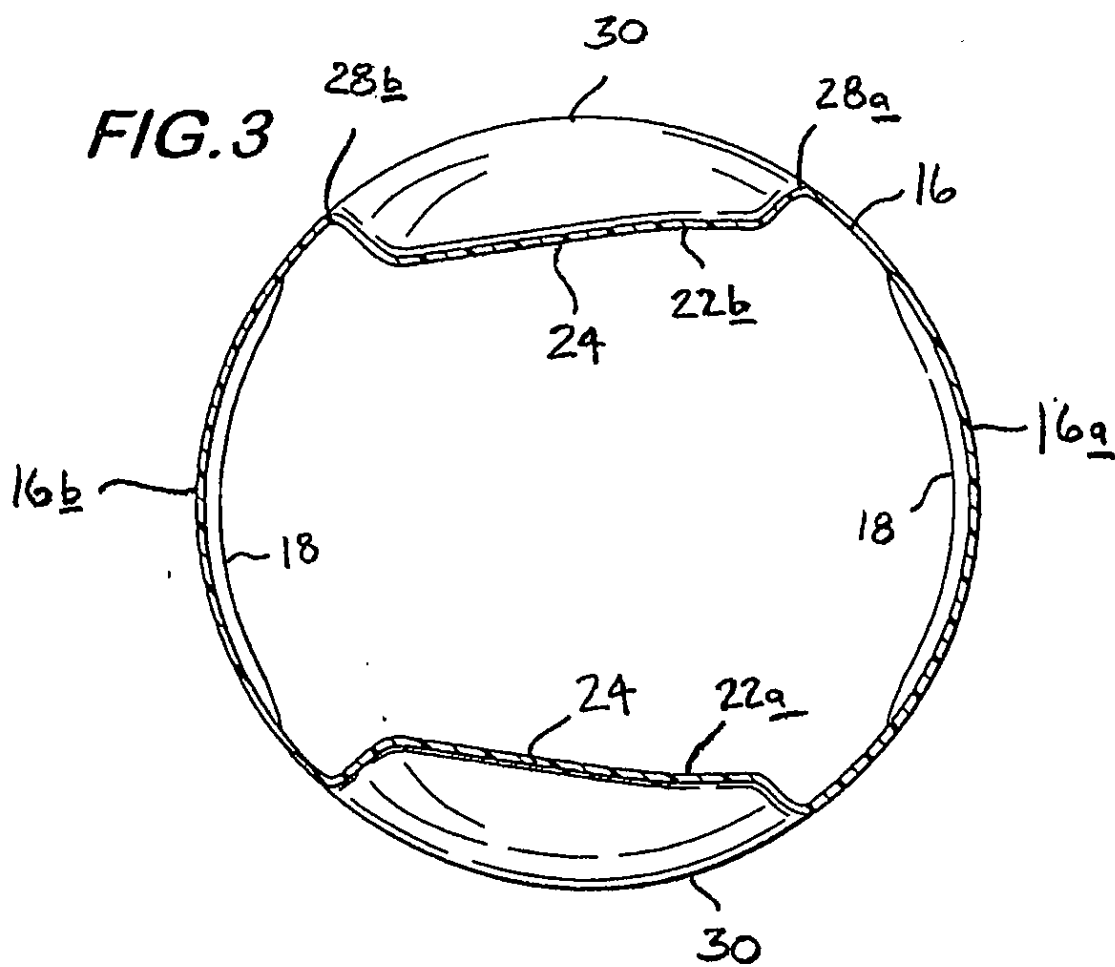
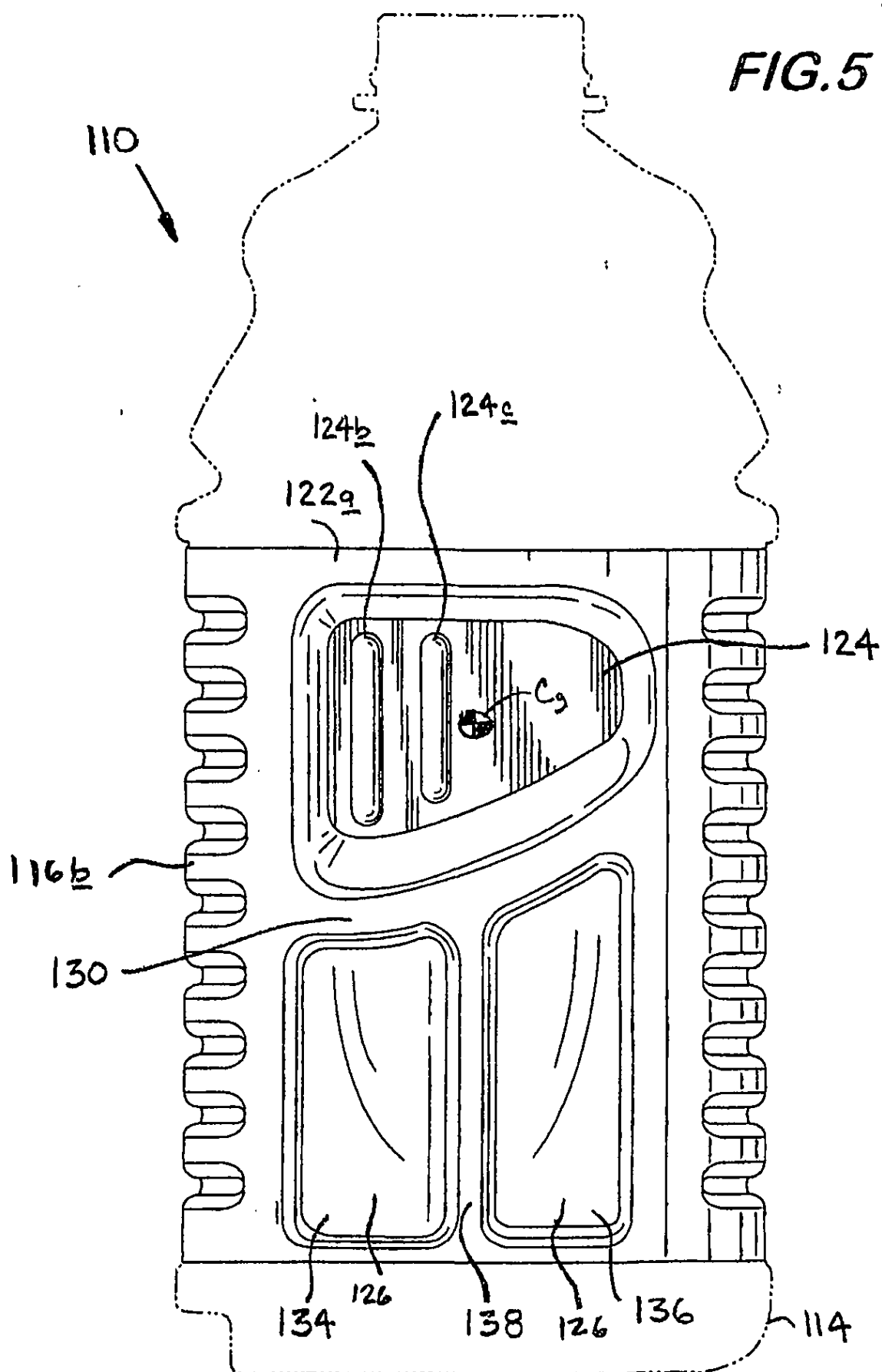


FIG.4

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FIG. 5



INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :B65D 1/02, 1/42, 23/00

US CL :215/582, 583, 584

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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U.S. : 215/582, 583, 584

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,279,433 (KRISHNAKUMAR ET AL.) 18 JANUARY 1994, SEE FIGURES 11 AND 13-15.	1-5,8,9,11- 13
Y	US 3,537,498 A (AMAND) 03 NOVEMBER 1970, SEE DOCUMENT.	1-21
Y	US 5,472,105 A (KRISHNAKUMAR ET AL.) 05 DECEMBER 1995, SEE DOCUMENT.	1-21
Y	US 5,226,550 A (MIKOLAITIS ET AL.) 13 JULY 1993, SEE DOCUMENT.	1-21

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents	* " later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier document published on or after the international filing date	"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) to which is cited to establish the publication date of another citation or other special reason (as specified)	"Z" document member of the same patent family
"T" document relating to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

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- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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(54) Title: SEMI-RIGID COLLAPSIBLE CONTAINER

(57) Abstract: A semi-rigid collapsible container (10) has a side-wall with an upper portion (5), a central portion (6), a lower portion (7) and a base (8). The central portion (6) includes a vacuum panel portion having a control portion (2) and an initiator portion (1). The control portion (2) is inclined more steeply in a vertical direction, i.e. has a more acute angle relative to the longitudinal axis of the container (10), than the initiator portion (1). On low vacuum force being present within the container panel following the cooling of a hot liquid in the container (10), the initiator portion (1) will flex inwardly to cause the control portion (2) to invert and flex further inwardly into the container (10) and the central portion (6) to collapse. In the collapsed state upper and lower portions of the central portion (6) may be in substantial contact so as to contain the top-loading capacity of the container (10). Raised ribs (3) made an additional support for the container in its collapsed state. In another embodiment the telescoping of the container back to its original position occurs when the vacuum force is released following removal of the container cap.

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(102)

Semi-Rigid Collapsible Container

Background To Invention

5 This invention relates to polyester containers, particularly semi-rigid collapsible containers capable of being filled with hot liquid, and more particularly to an improved construction for initiating collapse in such containers.

10 'Hot-Fill' applications impose significant mechanical stress on a container structure. The thin side-wall construction of a conventional container deforms or collapses as the internal container pressure falls following capping because of the subsequent cooling of the liquid contents. Various methods have been devised to sustain such internal
15 pressure change while maintaining a controlled configuration.

 Generally, the polyester must be heat-treated to induce molecular changes resulting in a container that exhibits thermal stability. In addition, the structure of the container must be designed to allow
20 sections, or panels, to 'flex' inwardly to vent the internal vacuum and so prevent excess force being applied to the container structure. The amount of 'flex' available in prior art, vertically disposed flex panels is limited, however, and as the limit is reached the force is transferred to the side-wall, and in particular the areas between the panels, of the
25 container causing them to fail under any increased load.

 Additionally, vacuum force is required in order to flex the panels inwardly to accomplish pressure stabilisation. Therefore, even if the panels are designed to be extremely flexible and efficient, force will still
30 be exerted on the container structure to some degree. The more force that is exerted results in a demand for increased container wall-thickness, which in turn results in increased container cost.

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The principal mode of failure in all prior art known to the applicant is non-recoverable buckling, due to weakness in the structural geometry of the container, when the weight of the container is lowered
5 for commercial advantage. Many attempts to solve this problem have been directed to adding reinforcements to the container side-wall or to the panels themselves, and also to providing panel shapes that flex at lower thresholds of vacuum pressure.

10 To date, only containers utilising vertically oriented vacuum flex panels have been commercially presented and successful.

In our New Zealand Patent 240448 entitled "Collapsible Container", a semi-rigid collapsible container is described and claimed in
15 which controlled collapsing is achieved by a plurality of arced panels which are able to resist expansion from internal pressure, but are able to expand transversely to enable collapsing of a folding portion under a longitudinal collapsing force. Much prior art in collapsible containers was disclosed, most of which provided for a bellows-like, or accordion-
20 like vertical collapsing of the container.

Such accordion-like structures are inherently unsuitable for hot-fill applications, as they exhibit difficulty in maintaining container stability under compressive load. Such containers flex their sidewalls away from
25 the central longitudinal axis of the container. Further, labels cannot be properly applied over such sections due to the vertical movement that takes place. This results in severe label distortion. For successful label application, the surface underneath must be structurally stable, as found in much prior art cold-fill container sidewalls whereby corrugations are
30 provided for increased shape retention of the container under compressive load. Such compressive load could be supplied by either

increased top-load or increased vacuum pressure generated within a hot-fill container for example.

Objects of the Invention

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It is an object of the invention to provide a semi-rigid container which is able to more efficiently compensate for vacuum pressure in the container and to overcome or at least ameliorate problems with prior art proposals to date and/or to at least provide the public with a useful

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choice.

Summary Of The Invention

According to one aspect of this invention there is provided a

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semi-rigid container, a side wall of which has at least one substantially vertically folding vacuum panel portion including an initiator portion and a control portion which resists being expanded from the collapsed state.

Preferably the vacuum panel is adapted to fold inwardly under an

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externally applied mechanical force in order to completely remove vacuum pressure generated by the cooling of the liquid contents, and to prevent expansion from the collapsed state when the container is uncapped.

According to a further aspect of this invention there is provided a semi-rigid container, a side wall of which has a substantially vertically folding vacuum panel portion including an initiator portion and a control portion which provides for expansion from the collapsed state.

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Preferably the vacuum panel is adapted to fold inwardly under a vacuum force below a predetermined level and to enable expansion from

30

the collapsed state when the container is uncapped and vacuum released.

Further aspects of this invention, which should be considered in all its novel aspects, will become apparent from the following description.

Brief Description Of Drawings

- 10 **Figure 1:** shows diagrammatically a semi-rigid collapsible container according to one possible embodiment of the invention in its pre-collapsed condition;
- 15 **Figure 2:** shows the container of Figure 1 in its collapsed condition;
- Figure 3:** very diagrammatically shows a cross-sectional view of the container of Figure 2 along the arrows A-A;
- 20 **Figure 4:** shows the container of Figure 1 along arrows A-A;
- Figure 5:** shows a container according to a further possible embodiment of the invention;
- 25 **Figure 6:** shows the container of Figure 5 after collapse;
- Figure 7:** shows a cross-sectional view of the container of Figure 6 along arrows B-B; and
- 30 **Figure 8:** shows a cross-sectional view of the container of Figure 5 along arrows B-B.

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Description Of Preferred Embodiments

The present invention relates to collapsible semi-rigid containers having a side-wall with at least one substantially vertically folding vacuum panel section which compensates for vacuum pressure within the container.

Preferably in one embodiment the flexing may be inwardly, from an applied mechanical force. By calculating the amount of volume reduction that is required to negate the effects of vacuum pressure that would normally occur when the hot liquid cools inside the container, a vertically folding portion can be configured to allow completely for this volume reduction within itself. By mechanically folding the portion down after hot filling, there is complete removal of any vacuum force generated inside the container during liquid cooling. As there is no resulting vacuum pressure remaining inside the cooled container, there is little or no force generated against the sidewall, causing less stress to be applied to the container sidewalls than in prior art.

Further, by configuring the control portion to have a steep angle, expansion from the collapsed state when the container is uncapped is also prevented. A large amount of force, equivalent to that mechanically applied initially, would be required to revert the control portion to its previous position. This ready evacuation of volume with negation of internal vacuum force is quite unlike prior art vacuum panel container performance.

The present invention may be a container of any required shape or size and made from any suitable material and by any suitable technique. However, a plastics container blow moulded from polyethylene tetrphalate (PET) may be particularly preferred.

One possible design of semi-rigid container is shown in Figures 1 to 4 of the accompanying drawings. The container referenced generally by arrow C is shown with an open neck portion 4 leading to a bulbous upper portion 5, a central portion 6, a lower portion 7 and a base 8.

5

The central portion 6 provides a vacuum panel portion that will fold substantially vertically to compensate for vacuum pressure in the container 10 following cooling of the hot liquid.

10

The vacuum panel portion has an initiator portion 1 capable of flexing inwardly under low vacuum force and causes a more vertically steeply inclined (a more acute angle relative to the longitudinal axis of the container 10), control portion 2 to invert and flex further inwardly into the container 10.

15

The provision of an initiator portion 1 allows for a steep, relative to the longitudinal, angle to be utilised in the control portion 2. Without an initiator portion 1, the level of force needed to invert the control portion 2 may be undesirably raised. This enables strong resistance to expansion from the collapsed state of the bottle 1. Further, without an initiator portion to initiate inversion of the control portion, the control portion may be subject to undesirable buckling under compressive vertical load. Such buckling could result in failure of the control portion to fold into itself satisfactorily. Far greater evacuation of volume is therefore generated from a single panel section than from prior art vacuum flex panels. Vacuum pressure is subsequently reduced to a greater degree than prior art proposals causing less stress to be applied to the container side walls.

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Moreover, when the vacuum pressure is adjusted following application of a cap to the neck portion 4 of the container 10 and subsequent cooling of the container contents, it is possible for the

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collapsing section to cause ambient or even raised pressure conditions inside the container 10.

This increased venting of vacuum pressure provides
5 advantageously for less force to be transmitted to the side walls of the container 10. This allows for less material to be necessarily utilised in the construction of the container 10 making production cheaper. This also allows for less failure under load of the container 10, and there is much less requirement for panel area to be necessarily deployed in a
10 design of a hot fill container, such as container 10. Consequently, this allows for the provision of other more aesthetically pleasing designs to be employed in container design for hot fill applications. For example, shapes could be employed that would otherwise suffer detrimentally from the effects of vacuum pressure. Additionally, it would be possible
15 to fully support the label application area, instead of having a 'crinkle' area underneath which is present with the voids provided by prior art containers utilising vertically oriented vacuum flex panels.

In a particular embodiment of the present invention, support
20 structures 3, such as raised radial ribs as shown, may be provided around the central portion 6 so that, as seen particularly in Figures 2 and 3, with the initiator portion 1 and the control portion 2 collapsed, they may ultimately rest in close association and substantial contact with the support structures 3 in order to maintain or contribute to top-
25 load capabilities, as shown at 1b and 2b and 3b in Figure 3.

In a further embodiment a telescopic vacuum panel is capable of flexing inwardly under low vacuum force, and enables expansion from the collapsed state when the container is uncapped and the vacuum
30 released.

410 *2.28*

Preferably in one embodiment the initiator portion is configured to provide for inward flexing under low vacuum force. The control portion is configured to allow for vacuum compensation appropriate to the container size, such that vacuum force is maintained, but kept relatively low, and only sufficient to draw the vertically folding vacuum panel section down until further vacuum compensation is not required. This will enable expansion from the collapsed state when the container is uncapped and vacuum released. Without the low vacuum force pulling the vertically folding vacuum panel section down, it will reverse in direction immediately due to the forces generated by the memory in the plastic material. This provides for a 'tamper-evident' feature for the consumer, allowing as it does for visual confirmation that the product has not been opened previously.

15 Additionally, the vertically folding vacuum panel section may employ two opposing initiator portions and two opposing control portions. Reducing the degree of flex required from each control portion subsequently reduces vacuum pressure to a greater degree. This is achieved through employing two control portions, each required to vent only half the amount of vacuum force normally required of a single 20 portion. Vacuum pressure is subsequently reduced more than from prior art vacuum flex panels, which are not easily configured to provide such a volume of ready inward movement. Again, less stress is applied to the container side-walls.

25 Moreover, when the vacuum pressure is adjusted following application of the cap to the container, and subsequent cooling of the contents, top load capacity for the container is maintained through side-wall contact occurring through complete vertical collapse of the vacuum 30 panel section.

Still, further, the telescopic panel provides good annular strengthening to the package when opened.

Referring now to Figures 5 to 8 of the drawings, preferably in this embodiment there are two opposing initiator portions, upper initiator portion 103 and lower initiator portion 105, and two opposing control portions provided, upper control portion 104 and lower control portion 106. When the vacuum pressure is adjusted following application of a cap (not shown) to the container 100, and subsequent cooling of the contents, top load capacity for the container 100 is maintained through upper side-wall 200 and lower side-wall 300 contact occurring through complete or substantially complete vertical collapse of the vacuum panel section, see Figures 6 and 7.

This increased venting of vacuum pressure provides advantageously for less force to be transmitted to the side-walls 100 and 300 of the container 100. This allows for less material to be necessarily utilised in the container construction, making production cheaper.

This allows for less failure under load of the container 100 and there is no longer any requirement for a vertically oriented panel area to be necessarily deployed in the design of hot-fill containers. Consequently, this allows for the provision of other more aesthetically pleasing designs to be employed in container design for hot-fill applications. Further, this allows for a label to be fully supported by total contact with a side-wall which allows for more rapid and accurate label applications.

Additionally, when the cap is released from a vacuum filled container that employs two opposing collapsing sections, each control portion 104, 106 as seen in Figure 7, is held in a flexed position and will

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immediately telescope back to its original position, as seen in Figure 8. There is immediately a larger headspace in the container which not only aids in pouring of the contents, but prevents 'blow-back' of the contents, or spillage upon first opening.

5

Further embodiments of the present invention may allow for a telescopic vacuum panel to be depressed prior to, or during, the filling process for certain contents that will subsequently develop internal pressure before cooling and requiring vacuum compensation. In this embodiment the panel is compressed vertically, thereby providing for vertical telescopic enlargement during the internal pressure phase to prevent forces being transferred to the side-walls, and then the panel is able to collapse again telescopically to allow for subsequent vacuum compensation.

15

Although two panel portions 101 and 102 are shown in the drawings it is envisaged that less than two may be utilised.

Where in the foregoing description, reference has been made to specific components or integers of the invention having known equivalents then such equivalents are herein incorporated as if individually set forth.

Although this invention has been described by way of example and with reference to possible embodiments thereof, it is to be understood that modifications or improvements may be made thereto without departing from the scope of the invention as defined in the appended claims.

30

Claims

1. A semi-rigid container a side-wall of which has at least one substantially vertically folding vacuum panel portion to compensate for vacuum pressure change within the container.
5
2. A semi-rigid container as claimed in claim 1 wherein said vertically folding vacuum panel portion includes an initiator section and a control section, said initiator section providing for vertical folding before said control section.
10
3. A semi-rigid container as claimed in claim 2 wherein said control section resists being expanded from the collapsed state.
- 15 4. A semi-rigid container as claimed in claim 2 wherein the vacuum panel is adapted to flex inwardly under a vacuum force below a predetermined level and enables expansion from the collapsed state when the container is uncapped and vacuum released.
- 20 5. A semi-rigid container as claimed in claim 2 wherein said side-wall has said vacuum panel portion provided between an upper portion and a lower portion, the initiator portion intermediate between a lower end of said upper portion and said control portion.
25
6. A semi-rigid container as claimed in claim 5 wherein said control portion has a more acute angle than the initiator portion relative to the longitudinal axis of the container and wherein the initiator portion causes said control portion to invert and flex further inwardly into the container.
30

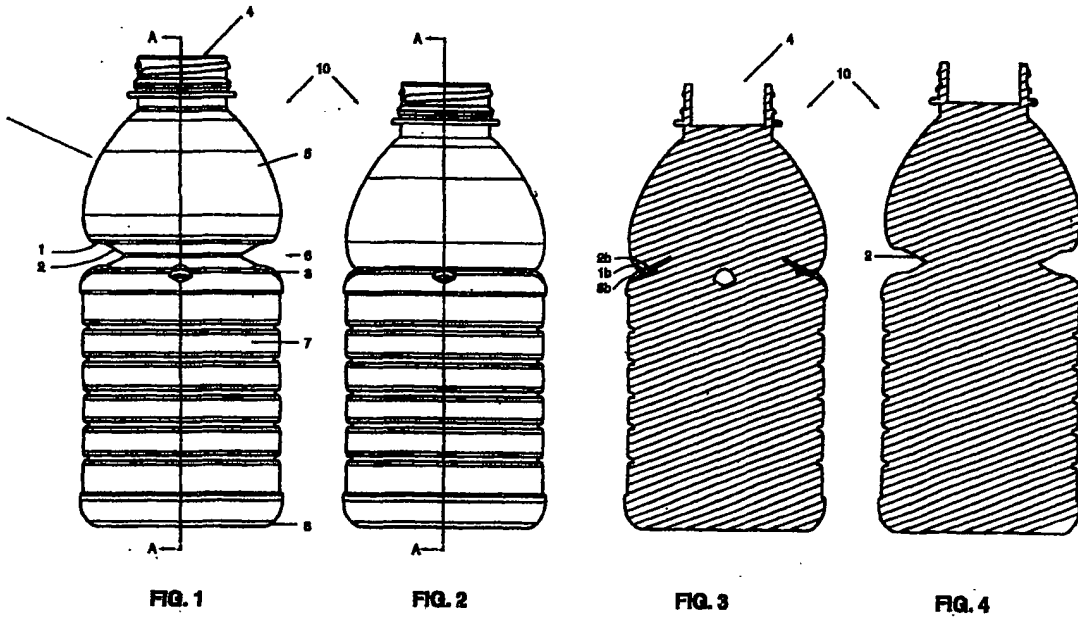
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7. A semi-rigid container as claimed in claim 6 wherein in the collapsed state upper and lower portions of said vacuum panel portion are adapted to be in substantial contact.
- 5 8. A semi-rigid container as claimed in claim 7 wherein said vacuum panel portion includes a plurality of spaced apart supporting ribs adapted to be in substantial contact with said control portion when the vacuum panel portion is in its collapsed state to contribute to the maintenance of top-load capabilities of the container.
- 10 9. A semi-rigid container including a side-wall with an upper portion and a lower portion and a substantially central portion having a substantially vertically folding vacuum panel portion, said vacuum panel portion including an initiator portion and a control portion, said control portion being inclined along a longitudinal axis of the container at a lesser angle than that of the initiator portion, the arrangement being such that the initiator portion will react to a vacuum force within the container to cause said control portion to invert and flex further inwardly into the container wherein the vacuum panel portion is adapted to revert to its original position on the removal of a cap from the container releasing the vacuum pressure.
- 15 20 25 10. A semi-rigid container as claimed in claim 2 wherein said side-wall has said vacuum panel portion provided between an upper portion and a lower portion, the control portion intermediate between a lower end of said upper portion and said initiator portion.
- 30

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11. A semi-rigid container as claimed in claim 1 wherein said side-wall has said vacuum panel portion provided between an upper portion and a lower portion wherein in the collapsed state said upper and lower portions of said container are adapted to be in substantial contact.
12. A semi-rigid container as claimed in claim 1 wherein said vertically folding vacuum panel portion includes two initiator sections and two control sections, said initiator sections providing for vertical folding before said control sections.
13. A semi-rigid container as claimed in claim 13 wherein said control sections are held in a flexed position under vacuum pressure, such that upon release of said vacuum pressure, said control sections and said initiator sections revert back to their original position.
14. A semi-rigid container as claimed in claim 2 wherein said control section is held in a flexed position under vacuum pressure, such that upon release of said vacuum pressure, said control section and said initiator section revert back to their original position.
15. A semi-rigid container substantially as herein described with reference to Figures 1 to 4 or Figures 5 to 8 of the accompanying drawings.

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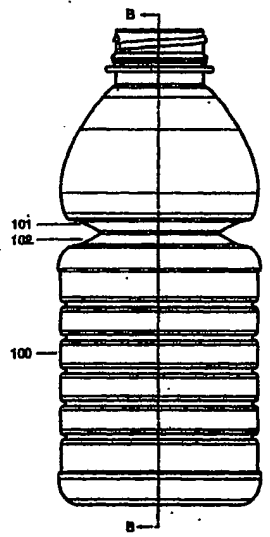


FIG. 5

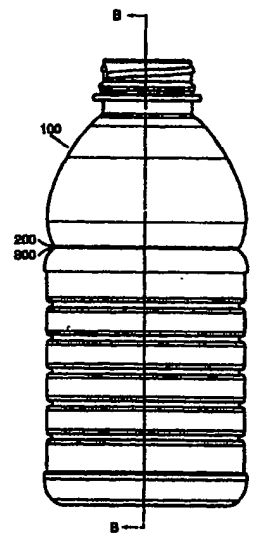


FIG. 6

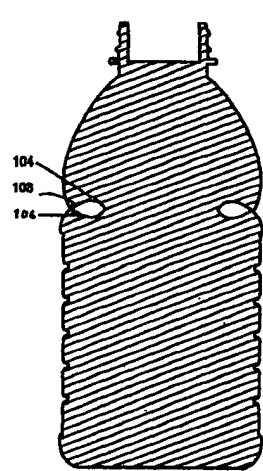


FIG. 7

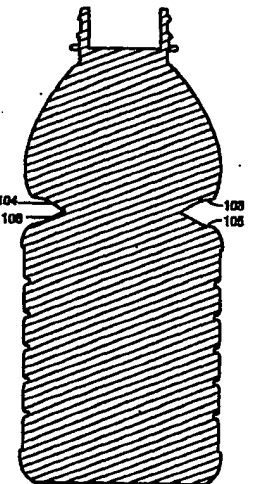


FIG. 8

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/NZ01/00176

418 298

A. CLASSIFICATION OF SUBJECT MATTER		
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B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
DWPL IPC B65D 1/02, 1/40, 1/00, 23/00, 25/00, 37/00, 85/72, 85/00 & keywords: (collapse, cool, vacuum, compensate, fold) and similar terms		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Derwent Abstract Accession No. 97-294279/27, Class A92, JP 09110045 A (SHINTANI T) 28 April 1997 Abstract	1-15
X	Derwent Abstract Accession No. 96-493250/49, Class A92 B07, JP 08253220 A (MORISHITA ROUSSEL KK) 1 October 1996 Abstract	1-15
X	Derwent Abstract Accession No. 95-057240, Class Q32, JP 06336238 A (MITSUBISHI PLASTICS IND LTD) 6 December 1994 Abstract	1-15
☒ Further documents are listed in the continuation of Box C ☒ See patent family annex		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
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Name and mailing address of the ISA/AU		Authorized officer
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5341946 A (VAILLIENCOURT ET AL) 30 August 1994 Whole document	1-15
X	WO 97/03885 A (CONTINENTAL PET TECHNOLOGIES INC) 6 February 1997 Whole document	1-15
X	US 5472105 A (KRISHNAKUMAR ET AL) 5 December 1995 Whole document	1-15

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/NZ01/00176

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report			Patent Family Member				
JP	9110045	NONE					
JP	8253220	NONE					
JP	6336238	NONE					
US	5341946	EP	616949				
WO	9703885	AU	64753/96	EP	839109	HU	9802562
		NZ	312834	US	5908128		
US	5472105	NONE					
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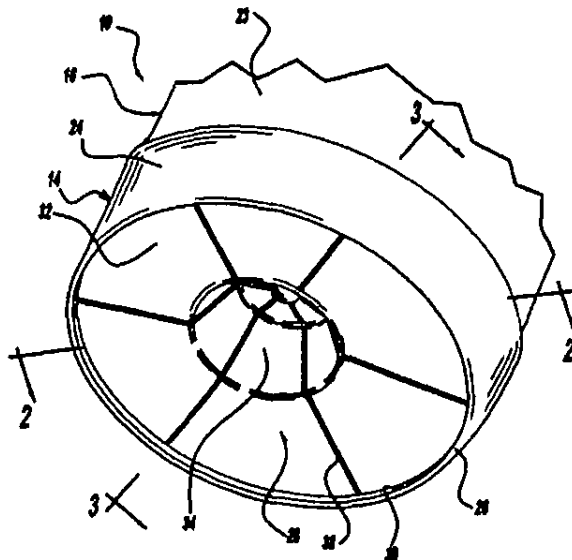
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[Continued on next page]

(54) Title: CONTAINER BASE STRUCTURE



(57) Abstract: A plastic container (10) having a base portion (14) adapted for vacuum absorption. The base portion including a ring (26) upon which the container is supported, an upstanding wall (30) and a recessed portion (28). The upstanding wall being adjacent to and generally circumscribing the contact ring. The recessed portion being defined in at least part by a flat base region (32) and a central base region (34). The flat base region extending from the upstanding wall toward a longitudinal axis of the container. The flat base region defining a projected surface area of at least 45% of a total projected surface area of the container. The flat base region being moveable to accommodate vacuum forces within said container.

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WO 02/08068 A1



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CONTAINER BASE STRUCTURE

TECHNICAL FIELD OF THE INVENTION

5 This invention generally relates to plastic containers for retaining a commodity, and in particular a liquid commodity. More specifically, this invention relates to a plastic container base structure that allows for significant absorption of vacuum pressures by the base without unwanted deformation in other portions of the container.

BACKGROUND

10 Numerous commodities previously supplied in glass containers are now being supplied in plastic, more specifically polyester and even more specifically polyethylene terephthalate (PET) containers. The manufacturers and fillers, as well as consumers, have recognized that PET containers are lightweight, inexpensive, recyclable, and manufacturable in large quantities.

15 Manufacturers currently supply PET containers for various liquid commodities, such as beverages. Often these liquid products, such as juices and isotonic, are filled into the containers while the liquid product is at an elevated temperature, typically 88°C - 96°C (155°F - 205°F) and usually about 85°C (185°F). When packaged in this manner, the hot temperature of the liquid
20 commodity is used to sterilize the container at the time of filling. This process and the containers designed to withstand it are respectively known as hot filling, and hot fill or heat set containers.

Hot filling works, and is an acceptable process, with commodities having a high acid content. Non-high acid content commodities, however, must be
25 processed in a different manner. Nonetheless, manufacturers and fillers of non-high acid content commodities desire to supply PET containers for these commodities as well.

For non-high acid commodities, pasteurization and retort are the preferred sterilization methods. Pasteurization and retort both present an
30 enormous challenge for manufacture of PET containers in that heat set containers cannot withstand the temperature and time demands of pasteurization and retort.

Pasteurization and retort are both methods for cooking or sterilizing the contents of a container after it has been filled. Both processes include the heating of the contents of the container to a specified temperature, usually above about 70°C (about 155°F), for a specified length of time (20 - 60 minutes).

- 5 Retort differs from pasteurization in that higher temperatures are used, as is an application of pressure externally to the container. The pressure is necessary because a hot water bath is often used and the overpressure keeps the water, as well as liquid in the product, in liquid form above its boiling point temperature.

- The present invention will find particular utility in hot fill applications, vacuum seal applications and applications where water loss through the container is a concern. It may also find utility in pasteurization and retort applications.

- PET is a crystallizable polymer, meaning that it is available in an amorphous form or a semi-crystalline form. The ability of a PET container to maintain its material integrity is related to the percentage of the PET container in crystalline form, also known as the "crystallinity" of the PET container. Crystallinity is characterized as a volume fraction by the equation:

$$\text{Crystallinity} = \frac{\rho - \rho_a}{\rho_c - \rho_a}$$

- where ρ is the density of the PET material; ρ_a is the density of pure amorphous PET material (1.333 g/cc); and ρ_c is the density of pure crystalline material (1.455 g/cc).

The crystallinity of a PET container can be increased by mechanical processing and by thermal processing.

- Mechanical processing involves orienting the amorphous material to achieve strain hardening. This processing commonly involves stretching a PET container along a longitudinal axis and expanding the PET container along a transverse or radial axis. The combination promotes what is known as biaxial orientation in the container. Manufacturers of PET bottles currently use mechanical processing to produce PET bottles having about 20% crystallinity in the container's sidewall.

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Thermal processing involves heating the material (either amorphous or semi-crystalline) to promote crystal growth. On amorphous material, thermal processing of PET material results in a spherulitic morphology that interferes with the transmission of light. In other words, the resulting crystalline material is opaque (and generally undesirable). Used after mechanical processing, however, thermal processing results in higher crystallinity and excellent clarity. The thermal processing of an oriented PET container, which is known as heat setting, typically includes blow molding a PET preform against a mold heat to a temperature of about 120°C - 130°C (about 100°F - 105°F), and holding the blown container for about 3 seconds. Manufacturers of PET juice bottles, which must be hot filled at about 85°C, currently use heat setting to produce PET bottles having a crystallinity range of 25 - 30%.

After being hot filled, the heat set containers are capped and allowed to reside at generally about the filling temperature for approximately five minutes. The container along with the product is then actively cooled so that the container may be transferred to labeling, packaging and shipping operations. Upon cooling, the volume of the liquid in the container is reduced. This reduction in volume results in the creation of a vacuum within the container. Generally, vacuum pressures within the container range from 1-300 mm/Hg. If not controlled or otherwise accommodated, these vacuum pressures result in deformation of the container which leads to either an aesthetically unacceptable container or one which is unstable. Typically, vacuum pressures have been accommodated by the incorporation of structures in the sidewall of the container. These structures are commonly known as vacuum panels. Vacuum panels are designed to distort inwardly under the vacuum pressures in a controlled manner so as to eliminate undesirable deformation in the sidewall of the container.

While vacuum panels have allowed the containers to withstand the rigors of a hot fill procedure, they do present some limitations and drawbacks. First, during labeling, a wrap-around or sleeve label is applied to the container over the vacuum panels. Often, the appearance of these labels over the sidewall and vacuum panels is such that the label is wrinkled and not smooth. Additionally, when grasping the container, the vacuum panels are felt beneath the label

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resulting in the label being pushed into the various crevasses and recesses of the vacuum panels.

It would therefore be desirable to have a container which could accommodate the vacuum pressures which result from hot filling yet which has
5 or is capable of having smooth sidewalls.

In view of the above, it is an object of the present invention to provide a plastic container which principally accommodates vacuum pressure through a mechanism other than vacuum panels in the sidewalls of the container.

A further object of the present invention is to provide a container having
10 a base structure which accommodates vacuum pressure while preventing undesirable distortion in other parts of the container.

Still another object of this invention is to provide a plastic container in which the base structure is substantially flat in cross-section in a wall portion thereof which cooperates with an upstanding shoulder wall or ridge to permit the
15 accommodation of vacuum pressures within the base structure.

SUMMARY OF THE INVENTION

Accordingly, this invention provides for a plastic container which maintains aesthetic and mechanical integrity during any subsequent handling after being
20 hot filled and cooled to ambient.

Briefly, the plastic container of the invention includes an upper portion, a body or sidewall portion and a base. The upper portion includes an opening defining the mouth of the container, a threaded portion (or other configuration) as a means to engage a closure, and a support ring that is used during handling,
25 before, during, and after manufacturing. The upper portion further includes a shoulder extending down to the sidewall portion which generally defines the greatest diameter of the container.

Additional benefits and advantages of the present invention will become apparent to those skilled in the art to which the present invention relates from the
30 subsequent description of the preferred embodiment and the appended claims, taken in conjunction with the accompanying drawings.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a bottom perspective view of a portion of a plastic container according to the present invention;

FIG. 2 is a cross-sectional view of the plastic container, taken generally along line 2-2 of FIG. 1;

FIG. 3 is a cross-sectional view of the plastic container, taken generally along line 3-3 of FIG. 1; and

FIG. 4 is an elevational view of the plastic container according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The following description of the preferred embodiment is merely exemplary in nature, and is in no way intended to limit the invention or its application or uses.

As discussed above, to accommodate vacuum forces during cooling of the contents within a heat set container, containers have been provided with a series of vacuum panels around their sidewalls. The vacuum panels deform inwardly under the influence of the vacuum forces and prevent unwanted distortion elsewhere in the container. However, with the vacuum panels, the container sidewall can not be smooth, an overlying label is not smooth, and end users can feel the vacuum panels when grasping and picking up the containers.

As shown in FIGS. 1 and 4, a plastic container 10 of the invention includes a finish 12, a base portion 14, and a body portion 16. The finish 12 of the plastic container 10 includes portions defining an aperture or mouth 18, a threaded region 20, and a support ring 21. The aperture 18 allows the plastic container 10 to receive a commodity while the threaded region 20 provides a means for attachment of a similarly threaded closure or cap (not shown), which preferably provides a hermetical seal for the plastic container 10. The support ring 21 may be used to carry or orient the preform (the precursor to the container 10) (not shown) through and at various stages of manufacture. For example, the preform may be carried by the support ring 21, the support ring 21 may be used

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to aid in positioning the preform in the mold, or the support ring 21 may be used by an end consumer to carry the container 10.

The base portion 14 of the plastic container 10, which generally extends inward from the body portion 16, includes a chime 24, a contact ring 26, and an
5 inwardly recessed region 28. The base portion 14 functions to close off the bottom of the container 10 and, together with the finish 12 and the body portion 16, to retain the commodity.

In the preferred embodiment of the invention, the body portion 16, which generally extends downward from the finish 12 to the base portion 14, includes
10 a shoulder region 22 providing a transition between the finish 12 and a sidewall 23. Because of the specific construction of the base 14 of the container 10, the sidewall 23 for the heat set container 10 may be formed without the inclusion therein of vacuum panels, and if desired, smooth.

The plastic container 10 of the present invention is a blow molded,
15 biaxially oriented container with an unitary construction from a single or multi-layer material such as polyethylene terephthalate (PET) resin. Alternatively, the plastic container 10 may be formed by other methods and from other conventional materials. Plastic containers blow-molded with an unitary construction from PET materials are known and used in the art of plastic
20 containers, and their general manufacture in the present invention will be readily understood by a person of ordinary skill in the art.

The plastic container 10 is preferably heat set according to the above mentioned process or other conventional heat set processes.

To accommodate vacuum forces and allow for the omission of vacuum
25 panels in the body 16 of the container 10, the base 14 of the present invention adopts a novel and innovative construction. Generally, the round base 14 is provided with an inwardly recessed region 28 having a generally "flat" area whose projected area is at least 45%, and preferably greater than 55%, of the overall projected area of the base 14. Additionally, an upstanding circumferential
30 wall or ridge 30 forms a transition between the contact ring 26 and the recessed region 28. As used herein, the term "flat" does not, but may, mean precisely flat

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or without any curative. The term "flat" is primarily being used to differentiate between two or more portions of the recessed region 28.

As shown in FIGS. 2 and 3, the recessed region 28 includes a flat base region 32 and a central base region 34. The flat base region 32 when viewed in cross section is generally planar and slightly up sloping toward a central longitudinal axis 36 of the container 10. The flat base region 32, when viewed three dimensionally, defines a conical surface which lacks an apex because of the central base region 34. In cross section, the flat base region 32 may be provided with a slight curvature (inward or outward, but preferably inward).

The central base region 34 is seen as being a steeply domed area. The exact shape of the central base region 34 can vary greatly depending on various design criteria. For the purposes of the present application, the central base region 34 may be of any shape which deviates significantly from the shape of the flat base region 32.

When initially formed, the flat base region 32 may be substantially parallel to a horizontal plane or a support surface 40. Upon filling, this flat base region 32 will sag or deflect toward the support surface under the temperature and weight of the product. Radial ribs 38, starting in the central base region 34 and terminating at the ridge 30, may be provided in the recessed region 28 to minimize sag and prevent irreversible sagging within the container 10. Upon capping and cooling, the flat base region 32 is raised or pulled upwardly, displacing volume, as a result of the vacuum forces. In this position, the flat base region 32 may exhibit more of the conical shape of FIG. 2. This conical shape may be defined at an angle of about 4° to about 10° relative to the horizontal plane or the support surface 40. The amount or volume which the flat base region 32 displaces is dependent on the projected surface area of the flat base region 32. As used herein, projected surface area means the relative surface area when viewing along the central longitudinal axis 36.

As illustrated in FIG. 2, the relevant projected linear lengths across the base 14 are identified as A_1 , B_2 , C , B_3 and A_4 . The projected total surface area (PSA_T) of the base 14 is readily defined by the equation:

$$PSA_T = \pi (1/2 (A_1 + B_2 + C + B_3 + A_4))^2.$$

The projected surface area for the flat base region 32 (PSA_F) is defined by the equation:

$$PSA_F = \pi (1/2 (B_2 + C + B_3))^2 - PSA_C$$

5 The projected surface area of the central base region 34 (PSA_C) is defined by the equation:

$$PSA_C = \pi (1/2 C)^2$$

10 In order to eliminate the necessity of providing vacuum panels in the body 16 of the container 10, the flat base region 32 is provided with a projected surface area (PSA_F) of at least 45%, and preferably greater than 55%, of the total projected surface area (PSA_T). The greater this percentage, the greater the amount of vacuum the container 10 can accommodate without unwanted deformation in other areas of the container 10.

15 The ridge 30, defining the transition between the contact ring 26 and the recessed region 28, is an upstanding wall (approximately 0.03 inches (0.76mm) to approximately 0.05 inches (1.27mm) in height) and is generally seen as being parallel to the center longitudinal axis 36 of the container 10. While the ridge 30 need not be exactly parallel to the central longitudinal axis 36, it should be noted that the ridge 30 is a distinctly identifiable structure between the contact ring 26 and the recessed region 28. The contact ring 26 is itself that portion of the base
20 14 which contacts the surface 40 upon which the container 10 is supported. As such, the contact ring 26 may be a flat surface or a line of contact generally circumscribing, continuously or intermittently, the base 14.

25 By providing the ridge 30, the transition between the flat base region 32 and the contact ring 26 is strengthened. This increases resistance to creasing in the base 14. In an alternate embodiment where reduced vacuum forces are encountered, the ridge 30 may be omitted.

30 While the above description constitutes the preferred embodiment of the present invention, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope and fair meaning of the accompanying claims.

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CLAIMS

1 Claim:

1. A plastic container having a base portion adapted for vacuum absorption, said container comprising:
 - 5 an upper portion having a mouth defining an opening into said container, a body portion extending from said upper portion to a base, said base closing off an end of said container; said upper portion, said sidewall portion and said base cooperating to define a receptacle chamber within said container into which product can be filled; said base including a chime extending from said sidewall
 - 10 portion to a contact ring which defines a surface upon which said container is supported, said base further including a recessed portion defined in at least part by a flat base region extending toward a longitudinal axis of said container, said flat base region being moveable to accommodate vacuum forces generated within said container, said flat base region at least partially circumscribing said
 - 15 axis, said flat base region defining at least 45% of a total projected surface area of said base.
2. The container of Claim 1 wherein said flat base region defines at least 55% of said total projected surface area of said base.
3. The container of Claim 1 wherein said flat base region defines a
- 20 conical portion.
4. The container of Claim 3 wherein said conical portion is defined at an angle of less than 10° relative to a horizontal surface.
5. The container of Claim 4 wherein said conical portion is defined at an angle of about 4° relative to a horizontal plane.
- 25 6. The container of Claim 1 wherein said flat base region is generally parallel to a horizontal plane after initial forming and prior to filling.
7. The container of Claim 1 wherein said recessed portion further includes a central base region, said central base region being located centrally within said flat base region.
- 30 8. The container of Claim 7 wherein said central base region is inwardly domed.

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9. The container of Claim 7 wherein said central base region defines a substantial surface deviation from said flat base region.

10. The container of Claim 1 wherein said flat base region is generally planar in cross section of half the width of said container.

5 11. The container of Claim 1 further comprising means for coupling said recessed portion to said contact ring and preventing deformation of said contact ring.

12. The container of Claim 11 wherein said means for coupling said recessed portion to said contact ring comprising a plurality of radial ribs.

10 13. The container of Claim 1 wherein said body includes a substantially smooth sidewall.

14. A plastic container having a base portion adapted for vacuum absorption, said container comprising:

an upper portion having a mouth, a body extending from said upper
15 portion to a base, said base closing off a bottom of said container, said upper portion, said body and said base cooperating to define a chamber into which product can be filled; said base including a contact ring upon which said container is supported, said base further including an upstanding wall and a recessed portion, said upstanding wall being adjacent to and generally
20 circumscribing said contact ring, said recessed portion being defined in at least part by a substantially flat base region and a central base region, said flat base region extending from said upstanding wall toward a longitudinal axis of said container, said flat base region generally circumscribing said central base region and being generally planar when viewed in a one-half cross-section taken axially
25 through said base, said flat base region defining a projected surface area of at least 45% of a total projected surface area of said container, said flat base region being moveable to accommodate vacuum forces within said container.

15. The container of Claim 14 wherein said upstanding wall is generally planar in cross section.

30 16. The container of Claim 14 wherein said upstanding wall is generally coaxial with said axis.

17. The container of Claim 14 wherein said upstanding wall is generally parallel with said axis when viewed in axial cross-section.
18. The container of Claim 14 wherein said upstanding wall has a height of at least 0.030 inches (0.762 mm).
- 5 19. The container of Claim 14 wherein said upstanding wall has a height of at least 0.050 inches (1.27mm).
20. The container of Claim 14 wherein said upstanding wall is immediately adjacent to said contact ring.
21. The container of Claim 14 wherein said flat base region defines a
10 projected surface area of at least 55% of said total projected surface area.
22. The container of Claim 14 wherein said flat base region defines a projected surface area of at least 80% of said total projected surface area.
23. The container of Claim 14 wherein said flat base region circumferentially defines a conical surface.
- 15 24. The container of Claim 14 wherein said flat base region is defined at an angle parallel to a support surface for said container.
25. The container of Claim 23 wherein said flat base region is defined at an angle of less than 10° relative to a horizontal surface.
26. The container of Claim 23 wherein said flat base region is defined
20 at an angle of about 4° relative to a horizontal surface.
27. The container of Claim 14 wherein said upstanding wall transitions to said flat base region at a substantially sharp corner.
28. A container adapted for accommodating vacuum absorption, said container comprising:
- 25 an upper portion having a mouth defining an opening;
a sidewall cooperating with said upper portion; and
a base portion cooperating with said sidewall, said base portion having a recessed first and second region, said first and second region being defined within a standing ring, said first region being upwardly movable along a
30 longitudinal axis in relation to said second region, said movement being in response to changes in pressure in said container.

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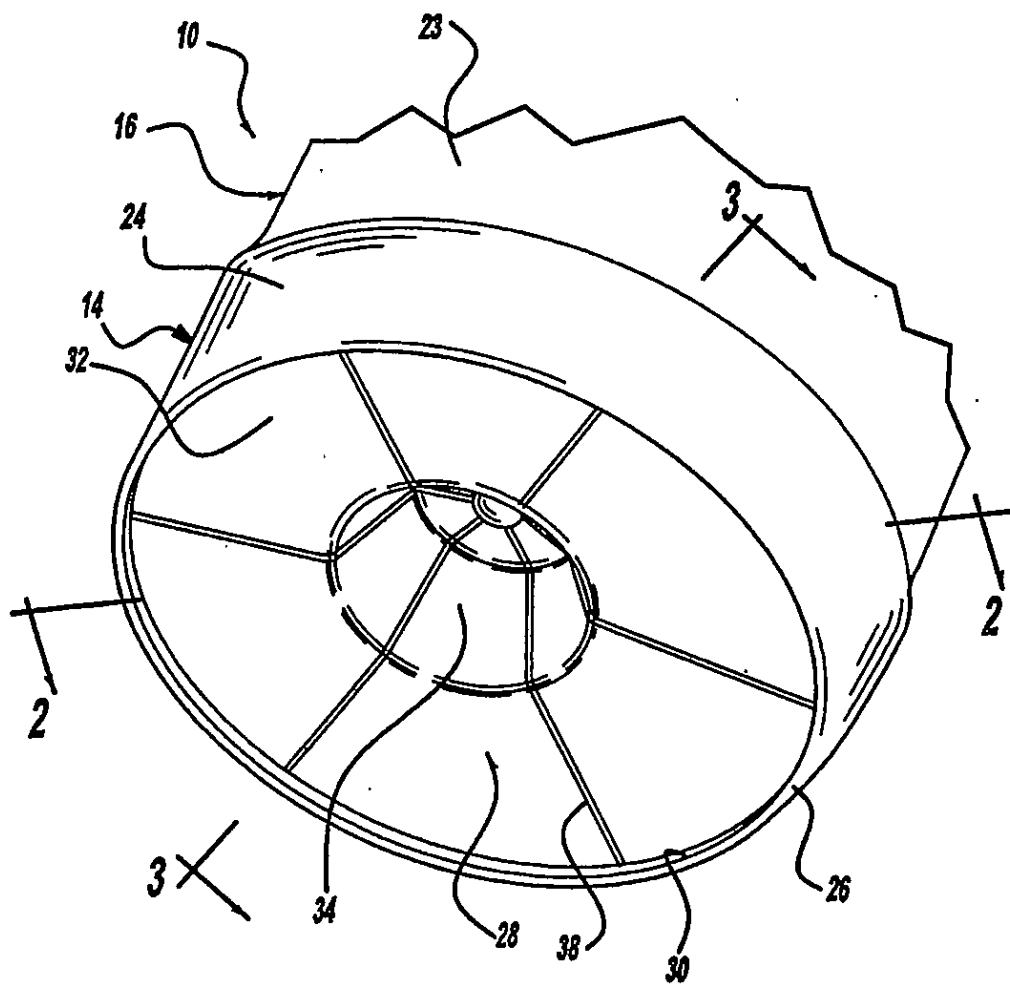


Figure - 1

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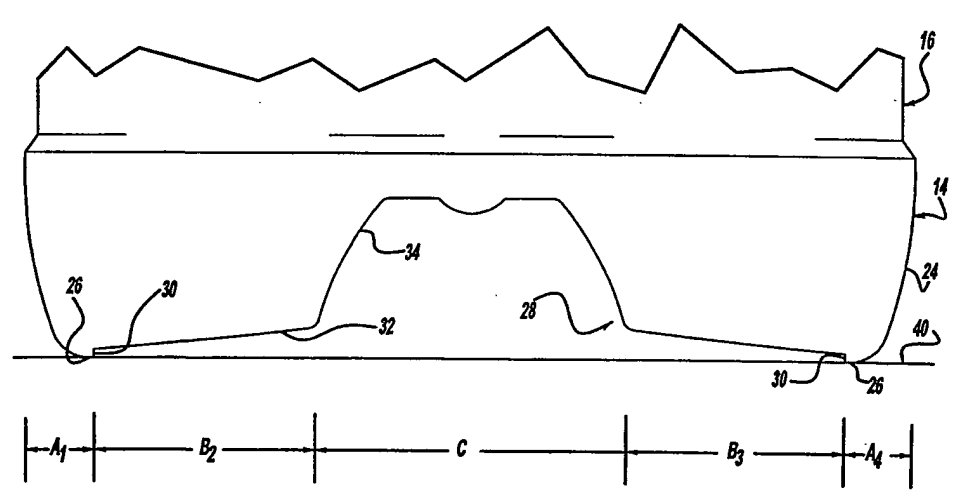


Figure - 2

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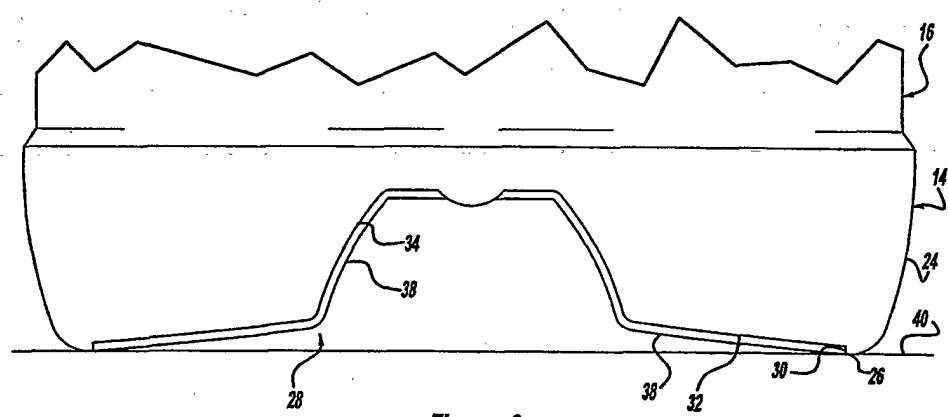


Figure - 3

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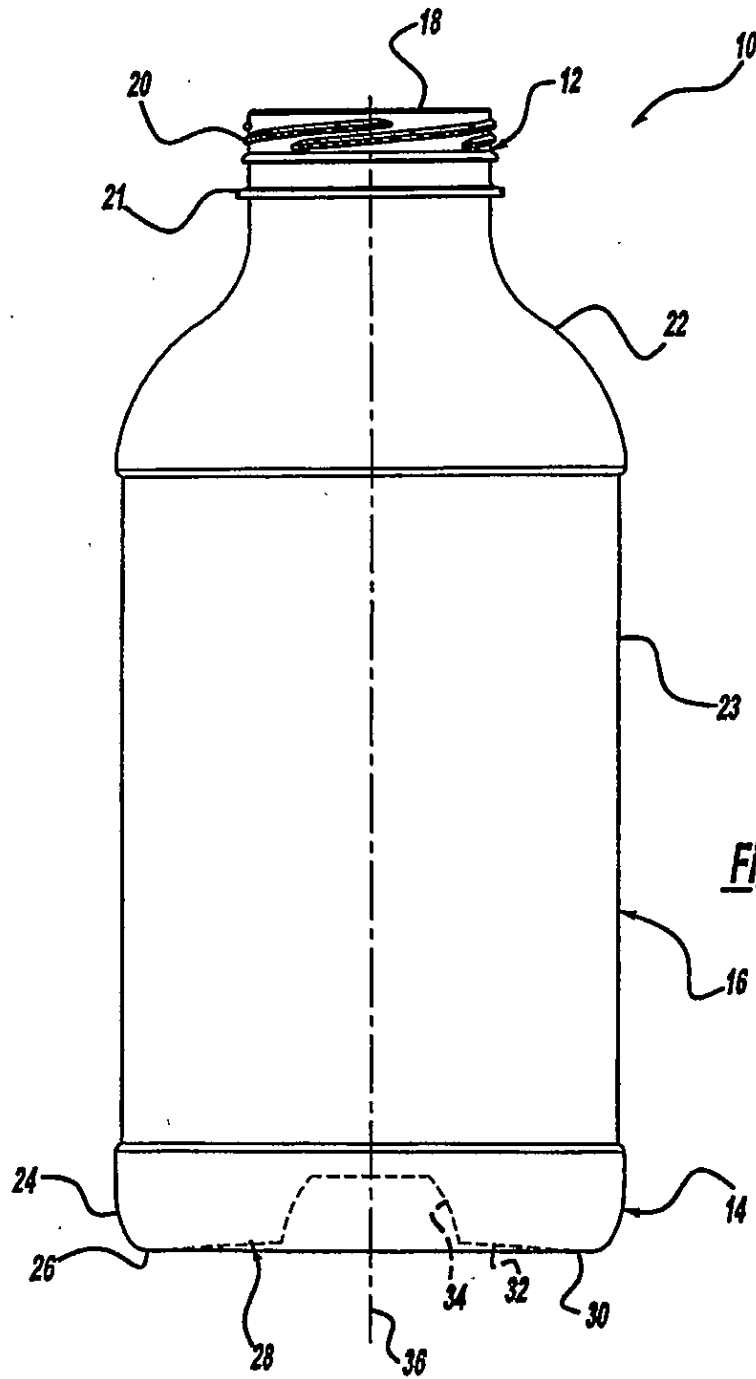


Figure - 4

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/US 01/23067

A. CLASSIFICATION OF SUBJECT MATTER
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IPC 7 B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 217 737 A (GYGAX ET AL.) 8 June 1993 (1993-06-08) abstract; figure 1	1-5, 7, 13, 28
A		14, 21-26
A	FR 2 503 665 A (L'OREAL) 15 October 1982 (1982-10-15) the whole document	1, 3
A	US 6 065 624 A (STEINKE) 23 May 2000 (2000-05-23) the whole document	1, 11, 12
A	US 5 005 716 A (EBERLE) 9 April 1991 (1991-04-09) abstract; figures	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
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- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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- "&" document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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FR 2503665	A	15-10-1982	FR 2503665 A1	15-10-1982
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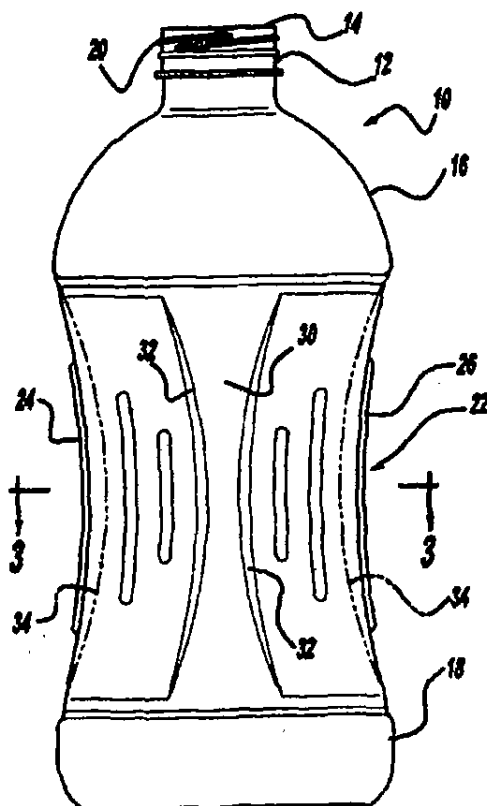
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[Continued on next page]

(54) Title: HOT-FILLABLE, BLOW MOLDED CONTAINER



(57) Abstract: A plastic container having a sidewall extending between a shoulder portion and a bottom portion. The sidewall has a substantially oval shape in cross-section and includes a pair of opposing columns and a pair of opposing panels. The columns are located at opposing ends of the oval shape and the panels are located at opposing sides of the oval shape. This configuration allows for reduced as-packaged vacuum pressures when the container is used in hot-fill applications.

WO 01/89934 A2



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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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HOT-FILLABLE, BLOW MOLDED CONTAINER

REFERENCE TO PRIOR PROVISIONAL APPLICATION

This application claims the benefit of prior provisional application number
5 60/206,516 filed May 22, 2000.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention generally relates to a hot-fillable, blow molded plastic container. More particularly, the invention relates to containers of the
10 above variety having a novel construction and also having panel sections resisting undesirable deformation in accommodating reductions in product volume during cooling of a hot-filled product.

2. Description of the Prior Art

Hot-fillable plastic containers have become commonplace for the package
15 of products (e.g., juices) which must be filled into the container while hot to provide for adequate sterilization. During filling, the product is typically dispensed into the container while at a temperature of 180° F and above. Such a container is known as a "hot-fill" container. After filling, the container is sealed or capped and, as the product cools, a negative internal pressure forms within
20 the sealed container. If not properly designed, the negative internal pressure will cause the container to deform in unacceptable ways, both from an aesthetic and a performance perspective.

Biaxially-oriented polyethylene terephthalate (PET) containers have long been used to receive the hot-filled product with a resulting minimal amount of
25 distortion in the container after cooling. To accommodate the shrinkage and negative internal pressure, the most often employed method is the incorporation of a plurality of recessed vacuum panels into the body portion of the container.

The vacuum panels are designed so that as the product cools, they will deform and move inwardly. In one style of container having vacuum panels, the vacuum
30 panels are equidistantly spaced around the body of the container and separated by land portions. A wrap around label is then used to cover all of the vacuum panels and provide the container with an aesthetically pleasing look.

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A major problem with containers of the above mentioned vacuum panel design is that they are not easily handled by the end consumer, particularly in 48 oz., 64 oz. and larger varieties.

Plastic containers having specifically designed gripping areas, hereinafter referred to as pinch-grips, were originally seen in containers for "cold-fill" applications. Not being specifically designed for receiving a hot-fill product, those containers, which did not include vacuum panels, could not accommodate the hot-filling procedure or the decrease in internal pressure which occurs in a hot-fill application.

U.S. Patent Nos. 5,141,120 and 5,141,121, both to Brown et al., are believed to be the first patents which disclose vacuum panels and pinch-grips in combination in a hot-fill container. More particularly, these patents illustrate and describe the incorporation of the vacuum panels and the pinch-grips together into a common vacuum/pinch-grip panel of the container.

Since the issuance of the Brown et al. patents, other containers have also adopted the vacuum/pinch-grip panel construction. Examples of such patents include U.S. Design Patent No. 334,457 and U.S. Patent Nos. 5,392,937; 5,472,105 and 5,598,941.

By combining the pinch-grips and vacuum panels into a common panel as done in the above referenced patents, front and rear label areas can be provided in such a manner that eliminates the need for vacuum panels beneath the label. Instead, horizontal stiffening ribs are provided in these label panel areas for reinforcement and distortion resistance.

When properly designed, vacuum panels of all varieties move inwardly as the container's internal pressure decreases and the product cools. As with all PET or other plastic containers, it is desirable to minimize the weight of the container in order to reduce the material cost in forming the container as well as the shipping costs associated with the container. Because of the vacuum applied to these containers and the need to control distortion of the container under vacuum, weight reduction is increasingly hard to achieve.

Another variety of container is the squeezable container used to dispense a product such as margarine, catsup, lotion, creams or even liquid beverages.

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A problem associated with containers of this variety is the inconsistent delivery of the amount of product. The amount of product delivered is controlled by the user of the container depending on how much they squeeze the container. While in theory there is a maximum amount of product which can be delivered from a container with one squeeze, these containers are not designed to deliver a preset amount of product per squeeze.

In view of the above and other limitations, one object of the present invention is to provide a lightweight plastic container which resists deformation and distortion during filling, cooling and subsequent handling of the container, which can be easily handled by an end consumer.

Another object of the present invention is to provide a plastic container having a vacuum panel structure which resists undesired deformation and distortion during filling and subsequent cooling, and which absorbs a majority of the vacuum pressure applied to the container.

A further object of this invention is to provide a squeezable container.

Still another object of this invention is to provide a squeezable container wherein a controlled amount of product is dispensed per squeeze.

SUMMARY OF THE INVENTION

In achieving the above and other objects, the present invention provides a hot-fillable, blow molded plastic container suitable for receiving a product which is initially filled in a hot state, the container subsequently being sealed so that cooling of the product creates a reduced volume of product and a reduced pressure within the container. Another aspect of the invention is that the container is lightweight, compared to containers of similar size, while still controllably absorbing the vacuum in the container and providing excellent structural integrity and resistance to top loadings from filler valves and alike. These aspects are achieved through implementation of a novel sidewall construction. Finally, the container of the present invention is also a squeezable container which delivers or dispenses a predetermined amount of product per squeeze. When used in this capacity, the container can be used in non-hot or cold fill applications as well as hot-fill applications.

Additional objects, features and advantages of the present invention will

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become apparent to a person skilled in the art after consideration of the following description, taken in conjunction with the appended claims and figures.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a side elevational view of a container embodying the principles
5 of the present invention;

Figure 2 is a front elevational view of the container shown in Figure 1;

Figure 3a is a cross-sectional view taken substantially along line 3-3 of
Figure 1 of a container embodying the principles of the present invention and
generally illustrates the container shape prior to deflection under vacuum forces;

10 Figure 3b is a cross-sectional view similar to that seen in Figure 3a and
generally illustrates the container shape after deflection under vacuum forces;

Figure 4 is a cross-sectional view taken substantially along line 4-4 in
Figure 2 through the shoulder of the container;

15 Figure 5 is a cross-sectional view taken substantially along line 5-5 in
Figure 2 through the bottom of the container;

Figure 6 is a side elevational view of a second embodiment of a container
according to the present invention;

Figure 7 is a front elevational view of the container shown in Figure 6;

20 Figure 8 is a chart comparing the weight of current stock containers with
that of the container embodying the principles of the present invention; and

Figure 9 is a table comparing the weight of current stock containers with
that of the container according to the present invention.

DESCRIPTION

Referring now to the drawings, Figure 1 illustrates a hot-fillable, blow
25 molded plastic container 10 which embodies the principles of the present
invention. The container 10 is designed to be filled with a product, typically a
liquid, while the product is in a hot state. After filling, the container 10 is sealed
and cooled. During cooling, the volume of the product in the container 10
decreases which in turn results in a decreased pressure within the container 10.

30 While designed for use in hot-fill applications, it is noted that the container 10
is also acceptable for use in non-hot-fill applications.

Since the container 10 is designed for "hot-fill" applications, the container

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10 is manufactured out a plastic material, such as polyethylene terephthalate (PET), and is heat set enabling the container 10 to withstand the entire hot-fill procedure without undergoing uncontrolled or unconstrained distortions. Such distortions are typically a result of either the temperature and pressure during the initial hot-filling operation or the subsequent partial evacuation of the container's interior as a result of cooling of the product. During the hot-fill process, the product is normally heated to a temperature of about 180° F or above and dispensed into the already formed container 10 at these elevated temperatures.

As illustrated in the figures, the container 10 generally includes a neck 12, which defines a mouth 14, a shoulder portion 16 and a bottom portion 18. As illustrated in Figures 4 and 5, the shoulder portion 16 and the bottom portion 18 are substantially annular or circular in cross-section. A cap (not shown) engages threads 20 on the neck 12 to close the mouth 14 and seal the container 10.

Extending between the shoulder portion 16 and the bottom portion 18 is a sidewall or body 22 of the container 10. As shown in Figures 3a and 3b, the body 22 has a shape which, when viewed cross-sectionally, is generally elliptical or oval. As illustrated in Figures 1, 3a and 3b, the body 22 includes a front panel 24, which extends vertically between the shoulder portion 16 and the bottom portion 18 of the container 10, and a rear panel 26 that similarly extends vertically between the shoulder portion 16 and the bottom portion 18 of the container 10. The front and rear panels 24 and 26 are located diametrically opposite one another and, if desired, can be mirror images of one another. Thus, the "front" and "rear" designations are merely used for differentiation purposes and not to designate actual front and rear portions of the container 10.

As illustrated in Figure 1, the front and rear panels 24 and 26 exhibit a generally inward, arcuate shape from top to bottom between the shoulder portion 16 and the bottom portion 18. This arcuate shape could also be described as concave, defining a hourglass silhouette. The two panels 24 and 26 cooperate to define a minimum diameter for the container 10 generally at about their longitudinal midpoint.

As illustrated in Figures 3a and 3b, the front and rear panels 24 and 26 are also arcuately shaped in a transverse direction. Transversely, however, the

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arcuate shape is shown as being generally outwardly shaped or convex. Thus, the panels 24 and 26 are structured such that a person handling the container 10 can grasp the container 10 between his/her thumb and fingers of one hand.

5 The panels 24 and 26 are also provided with ribbings 28. The ribbings 28 provide a grip surface on the panels 24, 26 so that the container 10 can be easily handled by an end consumer. The ribbings 28 may be vertically oriented, as shown in Figures 1 and 2, horizontally oriented, or as a combination of vertically and horizontally oriented. Instead of ribbings 28, other grip features such as dimples, protrusions or the like, could also be used and are
10 contemplated. In addition, it is anticipated that a decorative embossed motif, such as, a simulation of water beads or the trunk and leaves of a tree, could be superimposed over areas of the shoulder portion 16, the bottom portion 18, and the body 22 to create a continuous integrated appearance.

Separating the front panel 24 from the rear panel 26 is a pair of column
15 portions 30. Located on opposing sides of the container 10, the column portions 30 are shown in Figures 3a and 3b to be located at the ends of the oval cross-sectional shape of the container 10.

As shown in Figures 1 through 3b, the column portions 30 extend from the shoulder portion 16 to the bottom portion 18. Over their length, the width of
20 the column portions 30 varies. In Figure 1, the column portions 30 (from the shoulder portion 16 to the bottom portion 18) decrease in width to about their longitudinal midpoint and thereafter increase in width. This width variation is generally symmetrical about the midpoint of the column portions 30 and provides the column portions 30 with a hourglass silhouette. In alternative embodiments,
25 the column portions 30 width need not vary as described above. Instead they may be asymmetrical about a medial line through the column portions 30 or may increase, decrease or remain constant in width from the shoulder portion 16 to the bottom portion 18.

As illustrated in Figure 2, the column portions 30 also exhibit a shape
30 which is generally inwardly shaped or concave, at least when the container 10 is initially formed. The radial extent of this concave shape, however, is less than that of the panels 24 and 26 discussed above.

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The transition between the column portions 30, and the panels 24 and 26 comprises a transition wall or step 32 which exhibits a contour similar to that of the column portions 30 themselves. This transition wall 32 defines a step downward from the column portions 30 to the panels 24 and 26 since the column portions 30 are located a greater radial distance from the central axis of the container 10.

A second preferred embodiment, which provides certain additional structural and functional advantages over the first described embodiment, is illustrated in Figures 6 and 7. Like elements have been given like reference numeral designations including a prime (''). The hot-fillable, blow molded plastic container 10' includes a neck 12', which defines a mouth 14', a shoulder portion 16' and a bottom portion 18'. A cap (not shown) engages threads 20' on the neck 12' to close the mouth 14' and seal the container 10'.

A recessed rib or groove 50 is provided in the shoulder portion 16'. A recessed rib or groove 52 is provided in the bottom portion 18'. Recessed ribs or grooves 50 and 52 transition into a sidewall or body 22'. Similar to the body 22 of the container 10, the body 22' of the container 10' has a shape, when viewed cross-sectionally, is generally elliptical or oval. The body 22' includes a front panel 24' and a rear panel 26'. The front panel 24' and the rear panel 26' exhibit a generally inward, arcuate shape which could also be described as concave, defining a hourglass silhouette. The front panel 24' and the rear panel 26' are also arcuately shaped in a transverse direction. Transversely, the arcuate shape is generally outwardly shaped or convex.

Similar to the container 10, the front panel 24' and the rear panel 26' of the container 10' are provided with ribbings 28'. Unlike the container 10, the ribbings 28' of the container 10' are oriented in both vertical and horizontal directions. As illustrated in Figures 6 and 7, front panel 24' and rear panel 26' each include horizontal sections 29 separated by horizontally oriented ribbings 28'. In each horizontal section 29 are located varying amounts of vertically oriented ribbings 28'. As can be appreciated, varying amounts of horizontally oriented and vertically oriented ribbings are contemplated.

Separating the front panel 24' from the rear panel 26' is a pair of column portions 30'. The column portions 30' exhibit a shape which is generally inwardly shaped or concave, at least when the container 10' is initially formed. The radial extent of this concave shape is less than that of the front panel 24' and the rear panel 26'. The transition between the column portions 30', and the front panel 24' and the rear panel 26' comprises a transition wall or step 32' which exhibits a contour similar to that of the column portions 30' themselves.

The front panel 24', the rear panel 26', the vertically and horizontally oriented ribblings 28' and the column portions 30' of the container 10', when hot-filled, all function similar to the front panel 24, the rear panel 26, the ribblings 28 and the column portions 30 as disclosed above for the container 10.

The containers 10 and 10' as thus described are as originally formed. For the sake of brevity, the discussion will now focus on the container 10, however, it is contemplated that the following would equally apply to the container 10' as well. After being filled with a hot product, capped and cooled, the product within the container 10 decreases in volume. This reduction in volume produces a reduction in pressure. The front and rear panels 24 and 26 of the container 10 controllably accommodate this pressure reduction by being capable of pulling inward, under the influence of the reduced pressure, as shown in phantom lines 34 in Figure 1 and as further shown in Figure 3a. The overall large dimension of the two panels 24 and 26, approximately two-thirds (2/3) of the angular or circumferential extent of the container 10, facilitates the ability of the panels 24 and 26 to accommodate a significant amount of the reduced pressure or vacuum. The panels 24 and 26 are configured such that they absorb at least 50% of the reduced pressure or vacuum, and preferably at least 65%, and most preferably about 85% upon cooling.

As the panels 24 and 26 contract inward, the generally elliptical shape of the body 22 causes the more rigid column portions 30 to deflect more radially outward, providing the column portions 30 with a more upright orientation. This phenomenon is shown in phantom lines 36 in Figure 2 and further shown in Figure 3b. Additionally, when a force is applied to the top of an empty container 10, panels 24 and 26 are caused to contract inward. This in turn causes the

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generally elliptical shape of the body 22 and the column portions 30 to assume a more upright orientation enhancing resistance to the applied force.

In an alternative use, once opened, the containers 10 and 10' are squeezable to dispense product therefrom. Initially, there is little resistance to squeezing against the panels 24 and 26, and 24' and 26'. This is in part because of the panel's large size, and in part because of reduced weight and corresponding wall thickness reductions as discussed below. However, the resistance to further squeezing generally increases in a repeatable manner. This resistance is consistently applied because of the mirrored nature of the panels 24 and 26, and 24' and 26', and because the concave shaped panels 24 and 26, and 24' and 26' resist buckling. As a result, a consistent amount of product is repeatedly delivered from the containers 10 and 10'. By varying panel and column size, the specific amount generally dispensed for a container of a given capacity can be designed into the containers 10 and 10'.

Because of the significant reduction in vacuum pressure capabilities within the containers 10 and 10' after cooling, the containers 10 and 10' have a greater propensity to not retain dents which normally occur during handling or shipping. Containers with higher resultant vacuum pressures (and therefore less vacuum accommodation) tend to retain or hold such dents as a result of the vacuum forces themselves.

The novel shape of the containers 10 and 10' further lends the containers 10 and 10' to light weighting. As compared to containers of similar volumetric sizes and types, the containers 10 and 10' generally realize at least a twenty-two percent (22%) reduction in weight. For example, a current round 500-ml container, approximately sixteen (16) fluid ounces, manufactured by a competitor, weighs 29.0 grams (including the finish) and 24.5 grams (without the finish) (designated as ● in Figures 8 and 9). A 500-ml container according to this invention weighs 22.5 grams (including the finish) and 18 grams (without the finish) (designated as ♦ in Figures 8 and 9), a reduction of 6.5 grams.

Reductions of at least 5 grams are expected for other similar containers as well.

For comparison, the Assignee of the present invention owns a current round 500-ml container, with vacuum panels, weighing 31.5 grams (including the finish)

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and 27 grams (without the finish) (designated as ■ in Figures 8 and 9). Figures 8 and 9 illustrate, in chart and table form, weight comparisons for current stock containers, and the containers 10 and 10' in an approximately sixteen (16) fluid ounce variety. It should be noted that the weights in the chart of Figure 8 were
5 calculated without the neck or finish weight while the weights in the table of Figure 9 were calculated with the neck or finish weight. Thus, as illustrated in Figures 8 and 9, the containers 10 and 10' exhibit a significant amount of weight reduction which lends the containers 10 and 10' to light weighting.

10 While the above description constitutes the preferred embodiment of the present invention, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope and fair meaning of the accompanying claims.

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CLAIMS

What Is Claimed Is:

1. A biaxially oriented plastic container comprising:
a neck portion defining a mouth;
5 a shoulder portion formed with said neck portion and extending downward therefrom;
a bottom portion forming a base of the container;
a sidewall extending between and joining said shoulder portion with said bottom portion, said sidewall having a substantially oval shape in cross-section,
10 said oval shape including a pair of opposing ends and a pair of opposing sides, said sidewall including a pair of opposing columns and a pair of opposing panels, said columns being located at said opposing ends of said oval shape and said panels being located at said opposing sides of said oval shape and between said columns.
- 15 2. The container according to Claim 1 wherein said panels vary in width progressing from a top to a bottom thereof.
3. The container according to Claim 1 wherein said columns vary in width progressing from a top to a bottom thereof.
4. The container according to Claim 1 wherein said panels are mirror
20 images of one another.
5. The container according to Claim 1 wherein said columns are mirror images of one another.
6. The container according to Claim 1 wherein a combined circumferential length of said panels is greater than two-thirds (2/3) of a total
25 sidewall circumference defined at a midpoint of said sidewall.
7. The container according to Claim 1 wherein said columns include an upper end, a lower end and a center, and decrease in width over at least a portion of their length progressing from said upper end and said lower end toward said center.
- 30 8. The container according to Claim 1 wherein said columns include a longitudinal midpoint and have a minimum width about said longitudinal midpoint.

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9. The container according to Claim 1 wherein said sidewall has an inwardly concave silhouette elevationally viewed from a side facing one of said columns.

5 10. The container according to Claim 1 wherein said sidewall has a first hourglass silhouette when viewed from a side facing one of said columns and has a second hourglass silhouette when viewed from a side facing one of said panels, said second hourglass silhouette being less pronounced than said first hourglass silhouette.

10 11. The container according to Claim 1 wherein a material forming said sidewall is heat treated.

12. The container according to Claim 1 wherein said panels are vacuum panels.

15 13. The container according to Claim 12 wherein said panels absorb greater than 50% of a vacuum applied to the container upon cooling after hot-filling.

14. The container according to Claim 12 wherein said panels absorb greater than 65% of a vacuum applied to the container upon cooling after hot-filling.

20 15. The container according to Claim 12 wherein said panels absorb greater than 85% of a vacuum applied to the container upon cooling after hot-filling.

16. The container according to Claim 12 wherein said panels deflect inwardly under a vacuum and said columns deflect outwardly under a vacuum.

25 17. The container according to Claim 12 wherein said columns deflect to a more vertical orientation under a vacuum.

18. The container according to Claim 12 wherein a 500 ml version weighs less than 23 grams inclusive of said neck portion.

19. The container according to Claim 12 wherein a 500 ml version weighs less than 18.5 grams exclusive of said neck portion.

30 20. The container according to Claim 1 wherein a 500 ml version weighs less than 23 grams inclusive of said neck portion.

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21. The container according to Claim 1 wherein a 500 ml version weighs less than 18.5 grams exclusive of said neck portion.

22. The container according to Claim 1 wherein said panels progressively exhibit an increase in deflection resistance as said panels are deflected inward.

23. The container according to Claim 22 wherein a substantially consistent dosage of a product contained therein is dispensed upon successive manual inward deflection of said panels.

24. The container according to Claim 12 wherein said panels progressively exhibit an increase in deflection resistance as said panels are deflected inward.

25. The container according to Claim 24 wherein a substantially consistent dosage of a product contained therein is dispensed upon successive manual inward deflection of said panels.

26. The container according to Claim 1 wherein said shoulder portion defines a generally circular cross section immediately adjacent to said sidewall and said bottom portion defines a generally circular cross section immediately adjacent to said sidewall.

27. The container according to Claim 26 wherein said shoulder portion defines a maximum diameter of the container.

28. The container according to Claim 26 wherein said bottom portion defines a maximum diameter of the container.

29. The container according to Claim 28 wherein said shoulder portion defines a second diameter, said second diameter being substantially equal to said maximum diameter.

30. The container according to Claim 1 wherein said shoulder portion, said bottom portion and said sidewall include an embossed motif.

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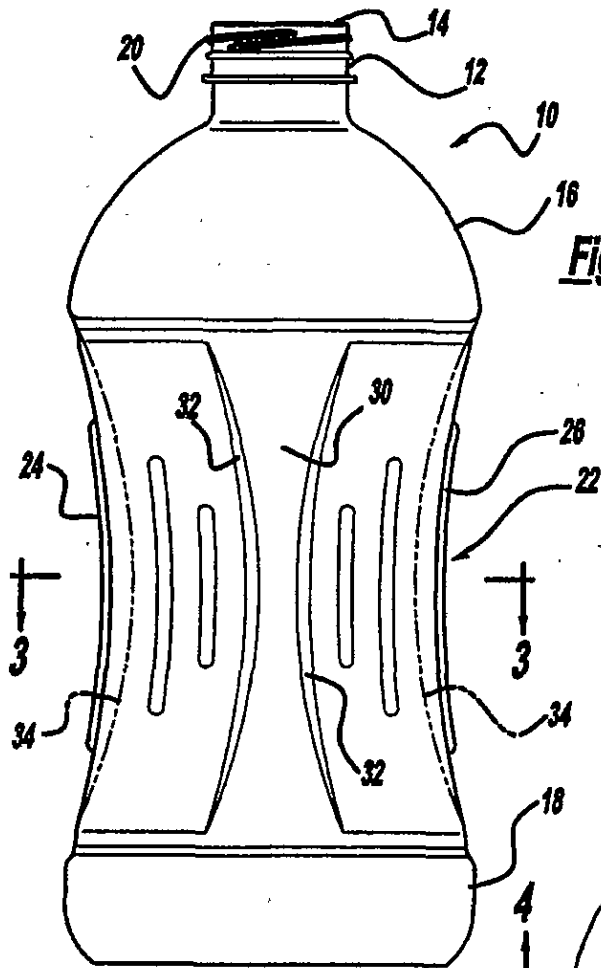


Figure - 1

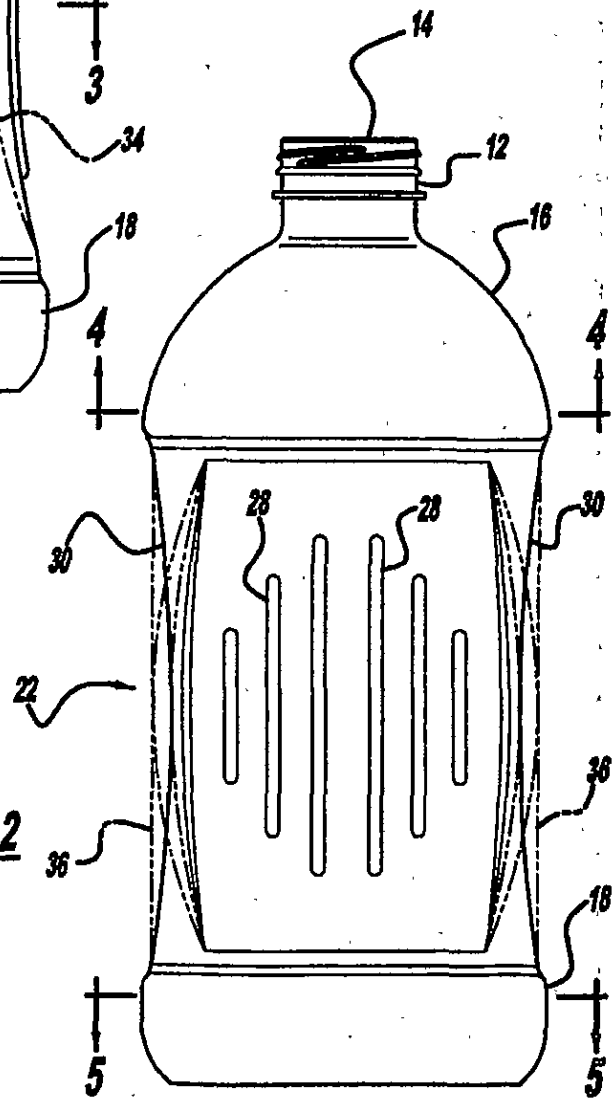


Figure - 2

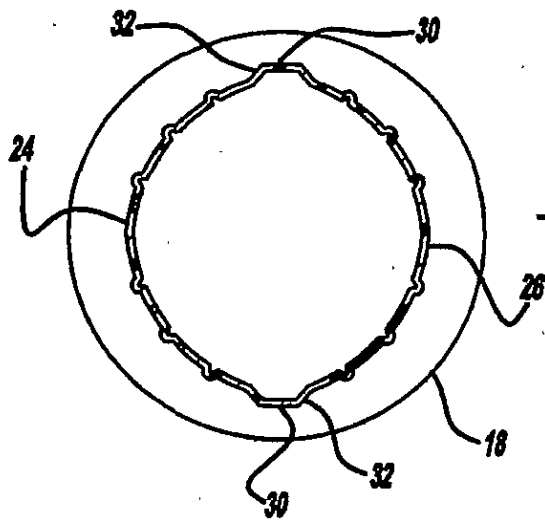


Figure - 3a

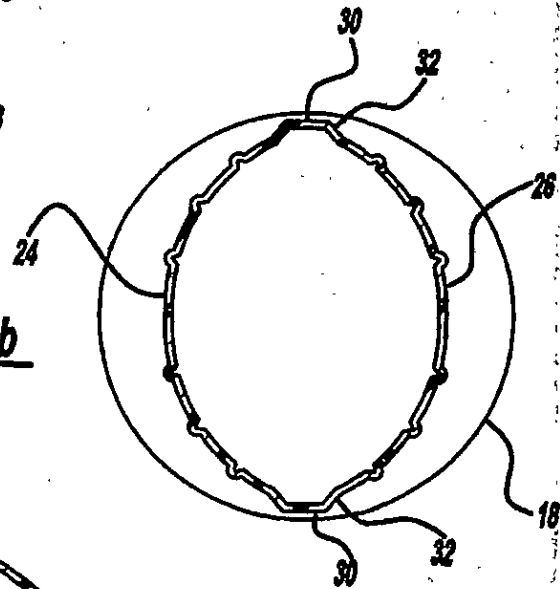


Figure - 3b

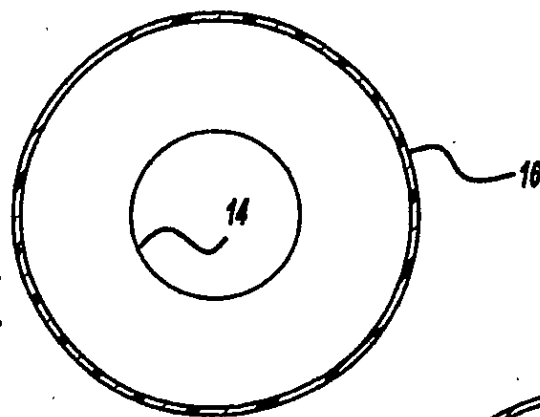


Figure - 4

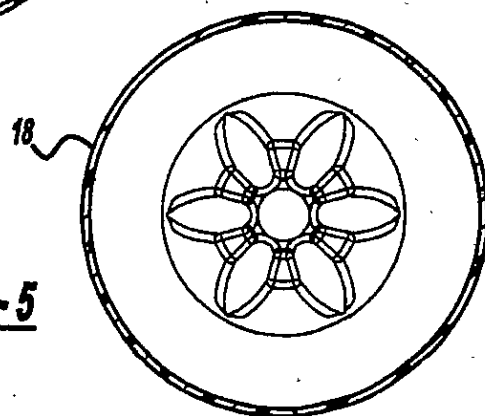


Figure - 5

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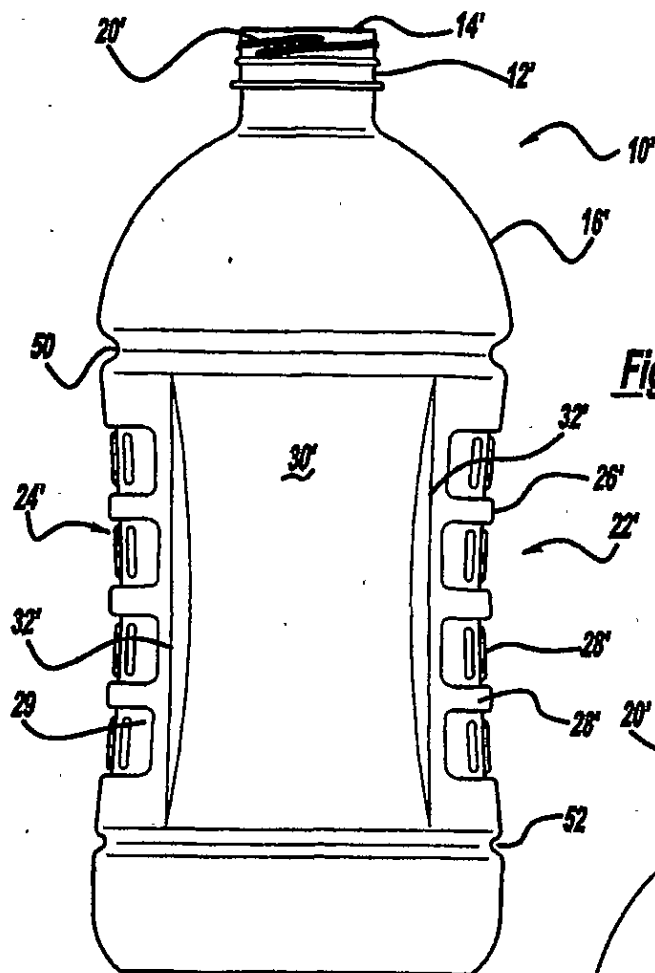


Figure - 6

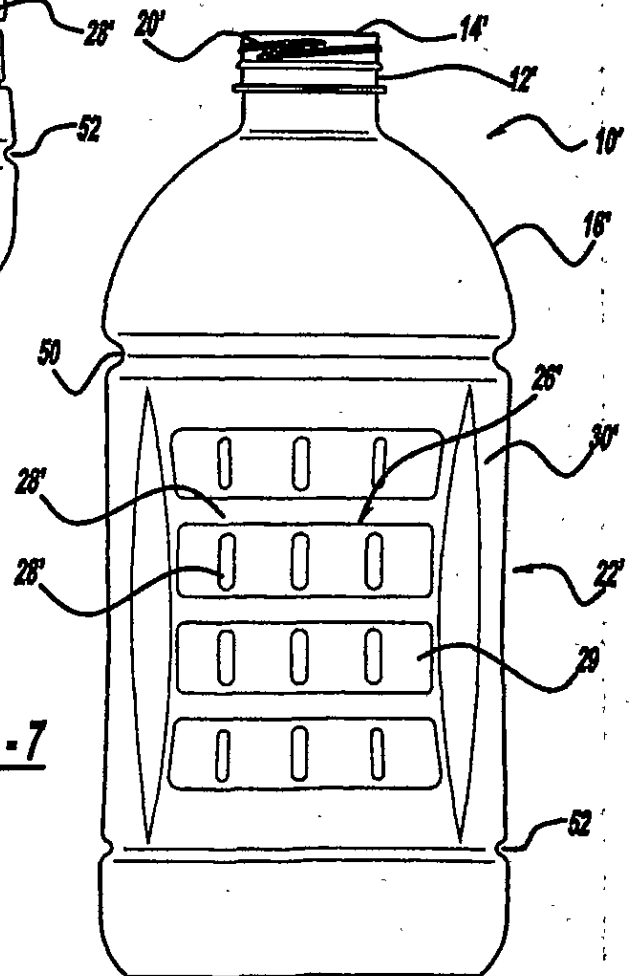


Figure - 7

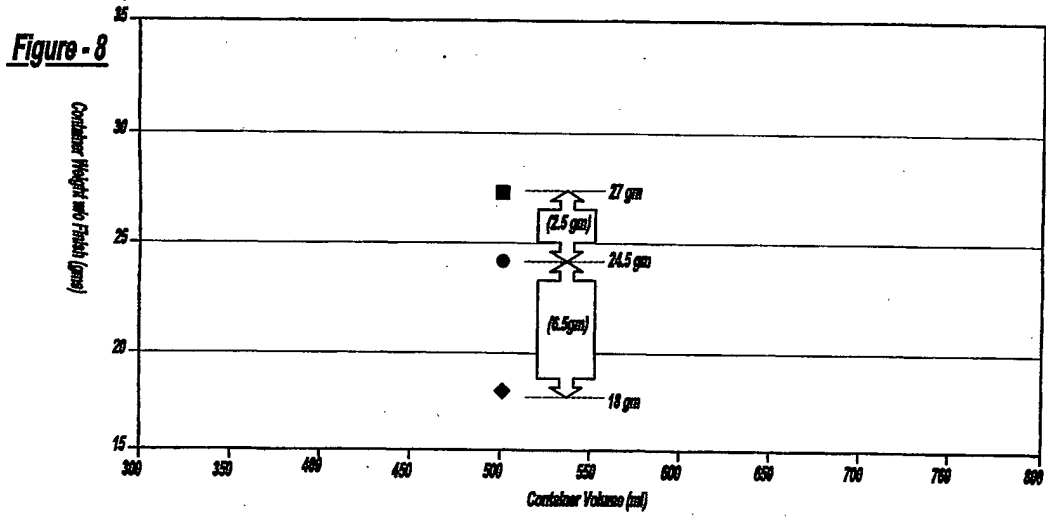


Figure - 9

Finish Weights
33mm finish = 4.5 gm
38mm finish = 9.5 gm
43mm finish = 10.0 gm

Container Weight w/finish		
Assignee Stock Round w/panels ■	Competitor's Stock Round w/panels ●	Present container ◆
31.5 gm	29.0 gm	22.5 gm
36.5 gm	34.0 gm	27.5 gm
37.0 gm	34.5 gm	28.0 gm

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(54) Title: HOT-FILLABLE GRIP CONTAINER

(57) Abstract: A hot-fillable container (10) having an opposed pair of collapse panels (32, 34) that move inwardly to accommodate vacuum-induced volumetric shrinkage of the container (10). The container (10) includes a sidewall (12) having front and rear label panels (24, 26) each of a predetermined radius of curvature (R_1) and each of the predetermined arcuate extend. A pair of arcuate collapse panels (32, 34) are located between said front and rear label panels (24, 26), and each has a predetermined arcuate extend and an inset grip region (48) affording facile handling of the container (10). Desirable structural parameters are disclosed.

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HOT-FILLABLE GRIP CONTAINER

Field of the Invention

The present invention relates to hot-fillable containers, and more particularly, the present invention relates to hot-fillable containers having collapse panels with integral grips.

Background of the Invention

In the early 1990s, Graham Packaging Company pioneered the development of a hot-fillable container that incorporated opposed collapse panels having grip regions that both accommodated the requisite vacuum absorption requirements of hot-fill processing and afforded facile handling of the container by the consumer. The commercialized container is disclosed in U. S. Patent Nos. 5,392,937; 5,598,941; and D.344,457.

While Graham's patented container has been a commercial success, there is a need for a grip container having enhanced functional and aesthetic features. There is also a need for a container configuration that can be molded readily. Moreover, container structural modifications that expand the processing window, such as permitting greater fluctuations in fill level, are highly desirable.

In the patented container, the grip region of the collapse panel is relatively narrow. This presents an adequate, but relatively small grip target. A desirable improvement would incorporate a larger grip target, particularly in a horizontal direction, to enable the consumer to have a more secure grip feeling when manipulating the filled container during lifting and pouring.

In the patented container, the front label panel is elongated vertically and has a relatively narrow peripheral extent. An improved container would have greater peripheral extent to afford greater latitude in label design.

High speed labeling equipment requires dimensionally stable container label panels. While the patented container

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functions well in such equipment, a more robust label panel would assure dimensional stability over a wider range of hot-fill processing conditions and enhance labeling efficiency.

5 While the patented container is straightforward to produce, it is desirable to provide improved performance with fewer rigid structural elements, as such elements complicate design, impede mold release, and detract from an aesthetically pleasing overall container appearance.

10 The present invention improves on Graham's patented container and other patented containers, such as those disclosed in U.S. Patent No. 5,141,120; U.S. Patent No. 5,141,121; and U.S. Patent No. 5,472,105, by utilizing a design approach that meets the aforementioned objectives in a novel manner.

15 Objects of the Invention

With the foregoing in mind, a primary object of the present invention is to provide a novel grip container for hot-fill applications that is an improvement over the aforementioned patented containers.

20 Another object of the present invention is to provide an improved grip container for hot fill applications that provides enhanced vacuum absorption capabilities with a minimum of structural elements such as ribs, grooves and the like which detract from production efficiency, as well as the
25 appearance of the container.

A further object of the present invention is to provide a unique grip container for hot-fill applications that has larger front label areas that are structurally robust and afford efficient labeling with high speed equipment.

30 Still a further object of the present invention is to provide a grip container for hot-fill applications that provides a larger window of hot-fill processing conditions.

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622Summary of the Invention

More specifically, the present invention provides a grip container for hot-fill applications that comprises a dome, a base, and a sidewall extending between the dome and the base. The sidewall has diametrically opposed front and rear label panels and opposed collapse panels disposed between the label panels. Each collapse panel has an inset grip region that affords facile gripping of the container by the consumer.

Each of the label panels has a predetermined transverse radius of curvature throughout its arcuate extent, and each of the collapse panels has, throughout its arcuate extent, a predetermined radius of curvature which is larger than the radius of curvature of the label panels. The upper and lower vertical extremities of the collapse panel extend along structural stiffeners, such as a groove below the dome and a label bumper above the base. Each of the collapse panels is bordered by vertical transitional zones located at the juncture of each collapse panel with the front and rear label panels. Preferably, the front label panel is provided with a series of horizontally extending grooves and lands that are intercepted by vertically disposed creases to prevent barreling of the container sidewall. The overall container is characterized by a minimum of structural elements that improve the container's appearance. Certain structural relations desirable to achieve these functions are disclosed.

Brief Description Of the Drawings

The foregoing and other objects, features and advantages of the present invention become apparent from the following description when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a left side elevational view of a container embodying the present invention;

FIG. 2 is a front elevational view of the container illustrated in FIG. 1;

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FIG. 3 is a rear elevational view of the container illustrated in FIG. 1;

FIG. 4 is a cross-sectional view of the container illustrated in FIG. 1 along the line 4-4,

5 FIG. 5 is a cross-sectional view of the container illustrated in FIG. 1 along the line 5-5; and

FIG. 6 is a fragmentary, developed view of a 180° section of the sidewall between the middle of the front and rear label panels.

10 Detailed Description of A Preferred Embodiment

The container 10 of the present invention illustrated in FIGS. 1-5 is particularly suited for hot-fill packaging of beverages, such as juice. The unique construction of the sidewall 12 of the container 10 enables the container to
15 accommodate vacuum-induced volumetric shrinkage caused by hot-filling while affording a consumer-friendly package that is easy to grip with one hand.

Structurally, container 10 has a dome 14 and a base 16 that extend integrally from opposite ends of the sidewall 12.
20 Preferably, dome 14 has an upstanding finish 18 with a peripheral flange 18a. Dome 14 is circular in transverse cross-section adjacent the sidewall 12, and interconnects with sidewall 12 via a peripheral groove 20 that extends inwardly below an upper label bumper 22a at the base of the
25 dome 14. Preferably, base 16 is coaxial with the dome 14, is circular in transverse cross-section adjacent the sidewall 12, and interconnects with sidewall 12 via a peripheral lower label bumper 22b. While a preferred dome and a preferred base are illustrated in the drawings, other dome and base
30 configurations can be utilized with the novel sidewall 12 of the present invention.

A unique aspect of the container 10 is that the sidewall 12 comprises different arcuate sections with different radii of curvature. To this end, the sidewall 12
35 has an arcuate front label panel 24 located opposite an

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arcuate rear label panel 26. The two label panels are interconnected by a pair of identical, arcuate unframed collapse panels, 32 and 34. These four panels are all generally rectangular and convex. Together the label and collapse panels form a continuous, integral circumferential sidewall 12. The label panels, 24 and 26, and the collapse panels, 32 and 34, have different radii of curvature. Thus, while the sidewall 12 may appear substantially cylindrical, the sidewall 12 is not actually circular in transverse cross-section. Rather, as illustrated in FIG 4, a cylindrical plane "P" passes only through the label panels 24 and 26, while the collapse panels 32 and 34 are inset from that plane.

The different arcuate sections of the sidewall 12 provide different functions. For instance, in response to hot-filling, the arcuate label panels, 24 and 26, resist deformation, while the arcuate unframed collapse panels, 32 and 34, are believed to move inward to accommodate volumetric shrinkage of the container 10. Additionally, the label panels provide support for labels affixed to the container, while the collapse panels support hand grips.

As illustrated in FIGs 2 and 3, the label panels, 24 and 26, extend continuously in a longitudinal direction from the groove 20 below the upper label bumper 22a to the lower label bumper 22b. As illustrated in FIG. 4, each label panel, 24 and 26, has a predetermined radius of curvature R_1 , throughout its arcuate extent. Preferably, the arcuate extent of the front label panel 24 is greater than the arcuate extent of the rear label panel 26, and the radius of curvature of each is the same. Preferably, both label panels, 24 and 26, have a plurality of vertically-spaced circumferential stiffening ribs 28 separated by horizontally elongate lands 30. The stiffening ribs 28 rigidify the label panels and resist barreling, also known as ovalization.

An inset grip region 48 is formed in each collapse panel, 32 and 34, to afford facile gripping of the container.

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Each grip 48 is substantially vertically centered on each collapse panel and is horizontally offset rearwardly on each collapse panel so as to be located closer to the rear label panel 26 than to the front label panel 24. Preferably, each

5 grip 48 includes an inset, trapezoidal-shaped, planar wall portion 50 surrounded by an integral rigid frame 52. Frame 52 includes a vertical rear post 54 that extends adjacent the juncture 44 between the rear label panel 26 and the collapse panel to form a part of a rear vertical transitional zone.

10 Frame 52 also includes a tapered inwardly extending wall portion 58 that extends around the frontal, upper and lower portions of planar wall portion 50 to connect it to the rest of the collapse panel 32, thereby causing the frame and grip to have a generally C-shaped configuration.

15 The arcuate collapse panels, 32 and 34, extend vertically from the groove 20 below the upper label bumper 22a to the lower label bumper 22b. As illustrated in FIG. 4, collapse panels 32 and 34 have a predetermined radius of curvature R_2 throughout their arcuate extents. The radius of

20 curvature R_2 of each collapse panel 32 and 34 is greater than the radius of curvature R_1 , of label panels 24 and 26. Thus in transverse cross-section, sidewall 12 does not have a circular shape due to the differences in the radii of curvature, R_1 , and R_2 . This is illustrated by the circular

25 dashed line in FIG. 4 and the distance "d" which represents the distance a vertical medial apogee 36 of the collapse panel 34 is inset from the imaginary cylindrical plane "P" passing through the label panels, 24 and 26.

Sidewall 12 is unique because there is little structure

30 associated with the collapse panels as is common with prior art collapse panel containers. See, e.g., United States patents 5,141,120, 5,141,121, 5,392,937, 5,472,105. The vertical margins of each of collapse panels 32 and 34 are indistinct because the radius of curvature of the bottle

35 sidewall transitions gradually from that of the label panel to that of the collapse panel. The junctures between the

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collapse and label panels and the container dome and base merge at right angles, as illustrated at location "C" where the junctures 42 & 44 meet the junctures 38 & 40, to form a rectangular panel.

5 Zones of transition provide a smooth and continuous change in the radius of curvature of the container wall between the collapse and label panels. As illustrated in FIG. 5, transitional zone 46 has a predetermined arcuate extent "W" located at the juncture 42 of the collapse panel
10 34 and the front label panel 24. A similar rear transitional zone, of somewhat lesser arcuate extent, is present at the rear label panel juncture 44 above and below the grip post 54.

As formed, collapse panels 32 and 34 are convex and
15 move inwardly toward a somewhat less convex shape in response to vacuum-induced volumetric shrinkage of the hot-filled container. Thus, the collapse panels 32 and 34 accommodate a portion of the volumetric shrinkage without distorting the bottle sidewall by inverting or denting, as in prior art
20 containers. See, eg. U.S. Patent Nos. 5,141,121 and 4,877,141.

To achieve the most desirable flexing function there are certain parameters that should be considered carefully, and certain ratios that are believed significant with respect
25 to the performance of the container 10. For instance, the grip, defined by the perimeter line "G" in FIG. 6 should occupy a fraction of the area of each collapse panel. Specifically, for a 64 oz. bottle, the grip area in the illustrated container $A(g)$ is 17.5 in², or about 66% of the
30 total 27 in², area of the collapse panels A_{cp} , thereby providing a Grip Ratio (GR) defined as the ratio of the total collapse panel area of the container (A_{cp}) divided by the area of the grip (A_g) i.e. $G.R. = (A_{cp}/A_g)$, of about 1.5: 1. The Grip Ratio for this embodiment should be in a range of about
35 1.3 : 1 to about 1.7 : 1.

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A Collapse Panel Ratio (CPR), defined as the total surface area of the container below a finish flange (A_{tc}) divided by the area of the collapse panel (A_{cp}), i.e., $CPR = (A_{tc}) / (A_{cp})$. In the illustrated embodiment, A_{tc} is 198.8 in². Thus, the CPR is about 7.2: 1 in the preferred embodiment. It is believed that the Collapse Panel Ratio may vary from about 6:1 to 8:1.

According to the present invention, the optimal collapse panel motion is obtained when the radius of curvature of the collapse panels is about one-third larger than that of the label panels. A Collapse Panel Curvature Ratio (CPCR), defined as the radius of curvature R_2 of the collapse panel divided by the radius of curvature R_1 of a label panel, i.e., $CPCR = R_2 / R_1$, is about 1.4 : 1 in the preferred embodiment. The collapse panel ratio may range from about 1.25:1 to about 1.5:1.

The arcuate extent of each collapse panel 32 and 34 is also important in accommodating the vacuum following hot filling to avoid distortion of the container. The total collapse panel arcuate extent " θ " is the arcuate extent of its radius R_2 in radians, including the frontal transitional zone "W". In the preferred embodiment, the parameter " θ " is on the order of at least about one radian (i.e., an arc subtended by an included angle of about 57°).

The lateral dimension of the frontal zone of transition 46 is also believed to be important to the performance of the container. In the preferred embodiment, lateral dimension "W" of zone of transition 46 is less than about 0.5 inches in arcuate extent, and is most preferably about 0.32 inches in extent. The frontal zone of transition forms approximately one-eighth of the total peripheral extent of each of the collapse panels, which is 2.61 inches in the illustrated embodiment. Preferably, the collapse panels, 32 and 34, together, form at least about one-third of the total arcuate extent of sidewall 12.

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The area of the base is also believed important to the performance of the container. In the 64 oz. container illustrated, the area of the base, inside its standing ring "R" (FIG. 1), is preferably about 14 in², i.e., the base has a diameter of about 4 inches. The base push-up region, not shown, is of conventional radial-ribbed design, as well known in the art.

Another aspect of the present invention resides in the enhanced barreling resistance of the front label panel 24. To this end, creases 56 that extend vertically across lands 30 between several of the horizontal stiffening ribs 28 on the front label panel 24 are provided. As illustrated in FIG. 2, creases 56 are located adjacent the opposite ends of the lands 30 and are arranged in a staggered pattern such that the creases on every other land 30 are aligned vertically. Alternatively, the creases 56 may all be aligned vertically. The creases 56 and ribs 28 are preferably concave and extend inward to a similar depth, but the creases do not, themselves, form a continuous vertical groove. It has been found that this rib and crease arrangement ensures that the front label panel 24, and the label attached thereto, remains in a desired arcuate shape and does not flex, barrel or otherwise distort to any undesirable extent.

The present invention provides a hot-fillable and grippable blow-molded container which has fewer structural elements, thereby making it more efficient to mold. The container provides a larger processing window to properly accommodate volumetric shrinkage and yet provide an acceptable aesthetic appearance. The container provides a wider front label panel, a grip that provides a better sense of gripability for the consumers, and better labelability.

Various modifications to the container are contemplated. For instance, the shape and location of the inset grip regions can be modified as well as the shapes of the dome and base. The container can be made smaller or larger, and it can be made of PET or like thermoplastic.

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material. In addition, while the groove 20 and lower label bumper 22_b provide peripheral stiffening structures, stiffening structures other than the horizontal groove 20 and lower label bumper 22_b providing an equivalent function at similar locations may be used.

More importantly, it is believed that the dimensions provided for a 64 oz. jug style container will scale. That is, provided that the ratios of all the dimensions, one to another, remain constant, it is believed that larger or smaller containers will behave similarly.

EXAMPLE

By way of example, and not by way of limitation, one embodiment of the invention provides a container 10 with a capacity of sixty-four fluid ounces. The container 10 is illustrated at 80% of full scale in the drawings. The dimensional specifications recited below and illustrated in the drawings apply to the as-formed, empty container condition, i.e., after blow-molding but before hot-filling, and in the absence of any internal or external applied forces.

The radius of curvature R_1 , of each of the label panels 24 and 26 is about 2.3 inches. The radius of curvature R_2 of each of the collapse panels 32 and 34 is about 3.2 inches. Sidewall 12 is approximately 4.5 inches in height. Since the height of each label panel and collapse panel is constant, the area of each is essentially determined by its arcuate extent. Each collapse panel has an arcuate extent " θ " as illustrated on FIG. 4 of about 66° , i.e., greater than about 1.0 radian.

The rear label panel 26 comprises about 25% of the arcuate extent of the sidewall 12. The front label panel 24 comprises about 37% of the arcuate extent of the sidewall 12. The collapse panels 32 and 34 combine to comprise about 38% of the arcuate extent of the sidewall 12. Preferably, the

collapse panels, 32 and 34, including the grips 48, have a combined surface area of about 27 in², and the front label panel 24 has a surface area of about 25 in².

5 The distance "d" that the medial apogee of collapse panel 34 is inset from the imaginary cylindrical plane "P" through the label panels, 24 and 26, is about 0.12 inch, or about 5% of the radius of curvature R_1 of the label panels, 24 and 26. Preferably, the distance "d" is substantially constant throughout the vertical extent of the collapse panel
10 except at the grip 48. The predetermined arcuate extent of the front transitional zone "W" is about one-eighth of the total arcuate extent of the collapse panel.

15 While the aforementioned dimensional relations have proven to function satisfactorily, it is believed that some modifications may be possible without significantly adversely affecting the desired performance. Thus, the following ranges may be permissible for the stated parameters:

TABLE 1

	Parameter	Range
20	R_1	2.2 - 2.4 in.
	R_2	3.0 - 3.3 in.
	t	1 - 1.2 radians
	d	0.110 - 0.200 in.
	W	0.100 - 0.500 in.
25	CPR	6 - 8:1
	GR	1.3 - 1.7:1
	CPCR	1.25 - 1.50:1

30 While a preferred embodiment of a hot-fillable, grippable container has been described, various modifications, alterations, and changes may be made without departing from the spirit and scope of the present invention as defined in the appended claims.

Claims

1. A hot-fillable grip container (10), comprising: a dome (14) having a lower portion with a circular transverse cross-section;

a base (16) having an upper portion with a circular transverse cross-section located below said dome (14) and coaxially therewith,

a sidewall (12) extending between said dome (14) and base (16) portions, said sidewall (12) having diametrically opposed front and rear label panels (24, 26) and opposed collapse panels (32, 34) disposed between said label panels (24, 26), each collapse panel (32, 34) having an inset grip region (48) affording facile gripping of the container (10);

each of said label panels (24, 26) having a predetermined transverse radius of curvature (R_1) throughout its arcuate extent;

each of said collapse panels (32, 34) having throughout its arcuate extent a predetermined radius of curvature (R_2) greater than either of said label panels (24, 26);

the lateral extent each of said collapse panels (32, 34) being defined by a front transitional zone (46) located at the juncture of said front label panel (24) and said collapse panel radii of curvature (R_1 , R_2) and by a rear vertical transitional zone;

the vertical extent each of said collapse panels (32, 34) being defined by arcuate upper and lower peripheral stiffeners (20, 22b);

said collapse panel (32, 34) moving inward in response to forces developed in the container (10) in response to hot-filling with a liquid, capping and cooling.

2. A container (10) according to claim 1, wherein each frontal transitional zone (46) has a predetermined arcuate extent which is less than about one-eighth of the total arcuate extent of the collapse panel (32, 34).

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3. A container (10) according to claim 1, wherein each frontal transitional zone (46) has a predetermined arcuate extent of about one-eighth collapse panel radian.

4. A container (10) according to claim 1, wherein each of said collapse panels (34, 34) has a vertical media apogee (36) inset from an imaginary cylindrical plane extending vertically through both front and rear label panels (24, 26).

5. A container (10) according to claim 4, wherein said collapse panel vertical medial apogee (36) is inset radially about 5.0 percent of the radius of curvature (R_1) of said cylindrical plane.

6. A container (10) according to claim 5, wherein the magnitude of inset of said vertical medial apogee (36) is substantially constant throughout its vertical extent and is less than about one-eighth inch.

7. A container (10) according to claim 1, wherein said grip region (48) is offset rearwardly in its collapse panel (32, 34) so as to be located closer to said rear label panel (26) than to said front label panel (24), and wherein said front transitional zones (46) merge into said front label panel (24) without any intervening stiffeners to form a wide generally C-shaped, inwardly-concave smooth wall portion extending around a substantial portion of said grip region (48).

8. A container (10) according to claim 7, wherein each of said grip regions (48) has a planar wall portion (50) of generally trapezoidal shape with a base (54) extending vertically contiguous with said rear label panel (26) for substantially less than the vertical distance between said upper and lower stiffeners (20, 22b) with the remaining

vertical distance being provided by said rear transitional zone which is smaller in arcuate extent than said front marginal zone (46).

9. A container (10) according to claim 1, wherein said upper peripheral stiffener (20) includes a peripheral groove subjacent said dome (14), and said lower peripheral stiffener (22b) includes a lower label bumper superadjacent said base (16).

10. A container (10) according to claim 1, wherein at least said front label panel (24) has a plurality of vertically-spaced horizontally extending grooves (28) with similarly extending lands (30) therebetween, and wherein selected ones of said lands (30) have vertically-disposed creases (56) to enhance barreling resistance of said label panel (24).

11. A grippable sidewall (12) for a hot-fill container (10) having a dome (14) above the sidewall (12) and a base (16) below the sidewall (12), said sidewall (12) having front and rear label panels (26, 26) each of a predetermined radius of curvature (R_1) and each of a predetermined arcuate extent, said sidewall (12) also having a pair of collapse panels (32, 34) located between said front and rear label panels (24, 26) and each being of a predetermined arcuate extent, each collapse panel (32, 34) having an inset grip region (48) affording facile handling of the container (10), said radius of curvature (R_2) of each collapse panel (32, 34) being at least about 1/3 larger than said front label panel radius (R_1), and said arcuate extent of each collapse panel (32, 34) being at least about 1/6 of the total arcuate extent of said sidewall (12), whereby the collapse panels (32, 34) readily flex inwardly to accommodate vacuum-induced volumetric shrinkage.

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12. A grippable sidewall (12) according to claim 11, wherein each grip (48) has an area that is about $2/3$ of the total area of its associated collapse panel (32, 34).

13. A grippable sidewall (12) according to claim 11, including a front marginal transitional zone (46) located between said grip (48) and said front label panel (24) and being less than about $1/8$ of the total arcuate extent of the collapse panel (32, 34).

14. A grippable sidewall (12) according to claim 11, wherein said container (10) has a predetermined total surface area, and said total collapse panel surface area of both collapse panels (32, 34) constitutes above about $1/8$ of said total container surface area.

15. A grippable sidewall (12) according to claim 11, wherein said grip (48) has an area which is in a range of about 60% to about 70% of the total area of its associated collapse panel (32, 34), said sidewall (12) has a front transitional zone (46) of less than about 0.5 inch and each collapse panel (32, 34) has a total surface area in a range of about 6% to about 7% of the total surface area of the container (10).

16. A grippable sidewall (12) according to claim 11, wherein said collapse panel radius of curvature (R_2) is in a range of about 1.25 to about 1.5 times larger than the radius of curvature (R_1) of said front label panel (24).

17. A grippable sidewall (12) according to claim 11, wherein each collapse panel (32, 34) has a total arcuate extent of at least about 1.0 radian.

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18. A grippable sidewall (12) according to claim 11, wherein said container (10) has a peripheral groove (20) subjacent said dome (14) and a shoulder (22b) superadjacent said base (16), and said sidewall (12) has a front marginal transitional zone (46) extending between said frontal grip edge and said front label panel (24) and merging with the front label panel (24) by a smooth concave wall providing less than about 1/8 of the total arcuate extent of said collapse panel (32, 34).

19. A grippable sidewall (12) according to claim 11, having a collapse panel ratio (CPR) in a range of about 6:1 to about 8:1.

20. A grippable sidewall (12) according to claim 11, having a grip ratio (GR) in a range of about 1.3:1 to about 1.7:1.

21. A grippable sidewall (12) according to claim 11, having a collapse panel curvature ratio (CPCR) in a range of about 1.25:1 to about 1.5:1.

22. A grippable sidewall (12) according to claim 11, having a collapse panel ratio (CPR) in a range of about 6:1 to about 8:1, a grip ratio (GR) in a range of about 1.3:1 to about 1.7:1, and a collapse panel curvature ratio (CPCR) in a range of about 1.25:1 to about 1.5:1.

23. A grippable sidewall (12) according to claim 11, having the parameters as set forth in Table 1.

24. A grippable sidewall (12) according to claim 11, having an R_1 of about 2.3 in., an R_2 of about 3.2 in., a "W" of about 0.32 in., an "t" of about 2.6 in., and a height of about 4.5 in.

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25. A grippable sidewall (12) for a hot-fill container (10) having a dome (14) above the sidewall (12), and a base (16) below the sidewall (12), said sidewall (12) having front and rear label panels (24, 26) each of a predetermined radius of curvature (R_1) and each of a predetermined arcuate extent, said sidewall (12) also having a pair of collapse panels (32, 34) located between said front and rear label panels (24, 26) and each being of a predetermined arcuate extent, each collapse panel (32, 34) having an inset grip region (48) affording facile handling of the container (10), said container (10) having a collapse panel ratio (CPR) in a range of about 6:1 to about 8:1.

26. A grippable sidewall (12) according to claim 25, wherein said collapse panel ratio (CPR) is about 7.15:1.

27. A grippable sidewall (12) for a hot-fill container (10) having a dome (14) above the sidewall (12) and a base (16) below the sidewall (12), said sidewall (12) having front and rear label panels (24, 26) each of a predetermined radius of curvature R_1 and each of a predetermined arcuate extent, said sidewall (12) also having a pair of collapse panels (32, 34) located between said front and rear label panels (24, 26) and each being of a predetermined arcuate extent, each collapse panel (32, 34) having an inset grip region (48) affording facile handling of the container (10), said container (10) having a grip ratio (GR) in a range of about 1.3:1 to about 1.7:1.

28. A grippable sidewall (12) according to claim 27, wherein said grip ratio is about 1.5:1.

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29. A grippable sidewall (12) for a hot-fill container (10) having a dome (14) above the sidewall (12) and a base (16) below the sidewall (12), said sidewall (12) having front and rear label panels (24, 26) each of a predetermined radius of curvature (R_1) and each of a predetermined arcuate extent, said sidewall (12) also having a pair of collapse panels (32, 34) located between said front and rear label panels (24, 26) and each being of a predetermined arcuate extent, each collapse panel (32, 34) having an inset grip region (48) affording facile handling of the container (10), said container (10) having a collapse panel curvature ratio (CPCR) in a range of about 1.25:1 to about 1.5:1.

30. A grippable sidewall (12) according to claim 29, wherein said collapse panel curvature ratio (CPCR) is about 1.4:1.

31. A grippable sidewall (12) for a hot-fill container (10) having a dome (14) above the sidewall (12) and a base (16) below the sidewall (12), said sidewall (12) having front and rear label panels (24, 26) each of a predetermined radius of curvature (R_1) and each of a predetermined arcuate extent, said sidewall (12) also having a pair of collapse panels (32, 34) located between said front and rear label panels (24, 26) and each being of a predetermined arcuate extent, each collapse panel (32, 34) having an inset grip region (48) affording facile handling of the container (10), said container (10) having a collapse panel ratio (CPR) in a range of about 6:1 to about 8:1, a grip ratio (GR) in a range of about 1.3:1 to about 1.7:1, and a collapse panel curvature ratio (CPCR) in a range of about 1.25:1 to about 1.5:1.

32. A blow-molded, plastic container (10) having a sidewall (12) with a grip (48) and at least one label panel (24), said label panel (24) having a plurality of vertically-spaced horizontally extending grooves (28) with similarly extending lands (30) therebetween, and wherein selected ones of said lands (30) have vertically-disposed creases (56) to enhance barreling resistance of said label panel (24).

33. A container (10) according to claim 32, wherein said creases (56) extend substantially the full depth of the grooves (28).

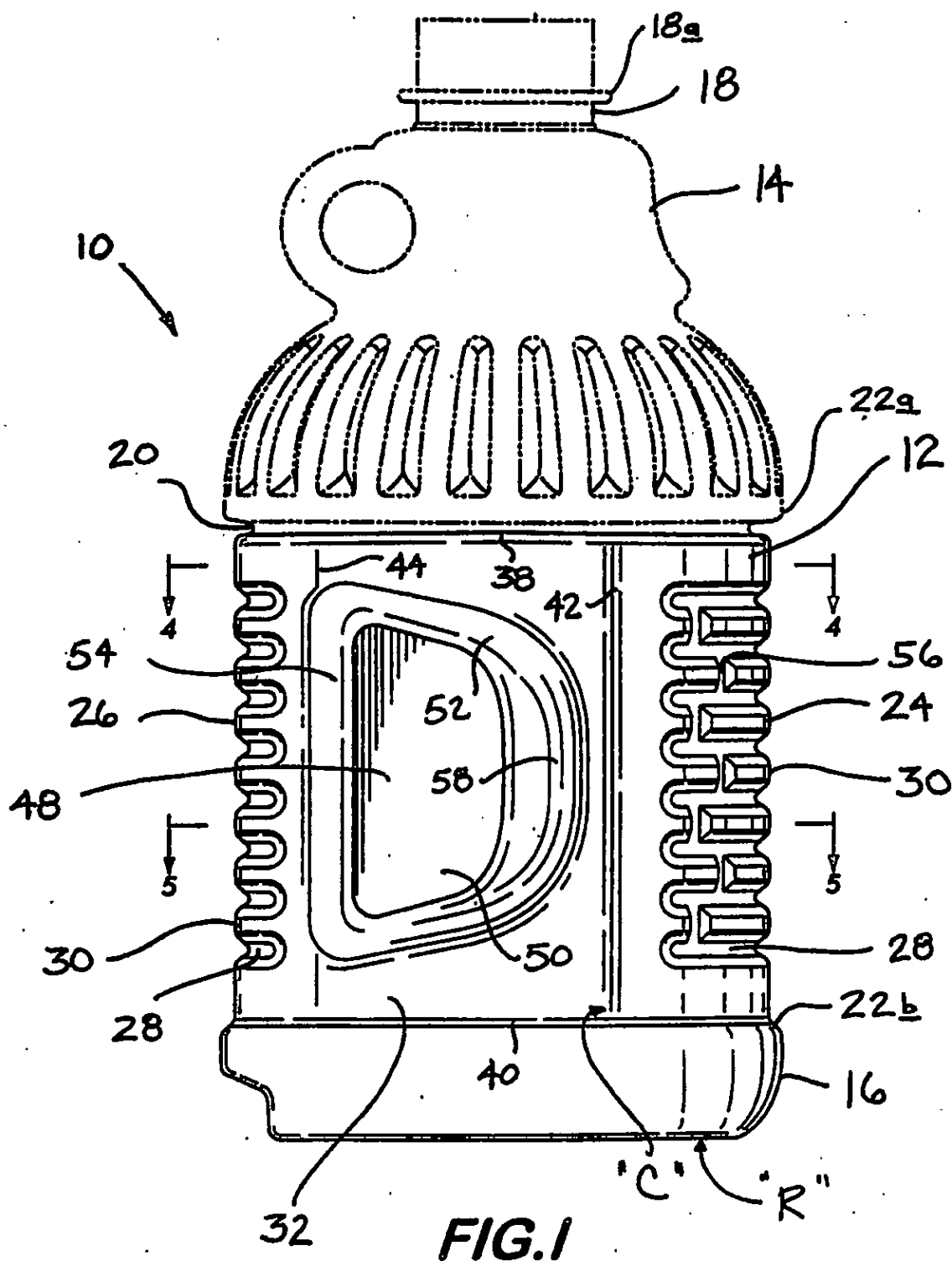
34. A container (10) according to claim 32, wherein said creases (56) are aligned vertically with one another.

35. A container (10) according to claim 32, wherein said creases (56) are located in at least medial ones of said lands (30).

36. A container (10) according to claim 32, wherein said lands (30) and creases (56) are outwardly concave.

37. A container (10) according to claim 32, wherein said creases (56) are located adjacent the ends of the lands (30).

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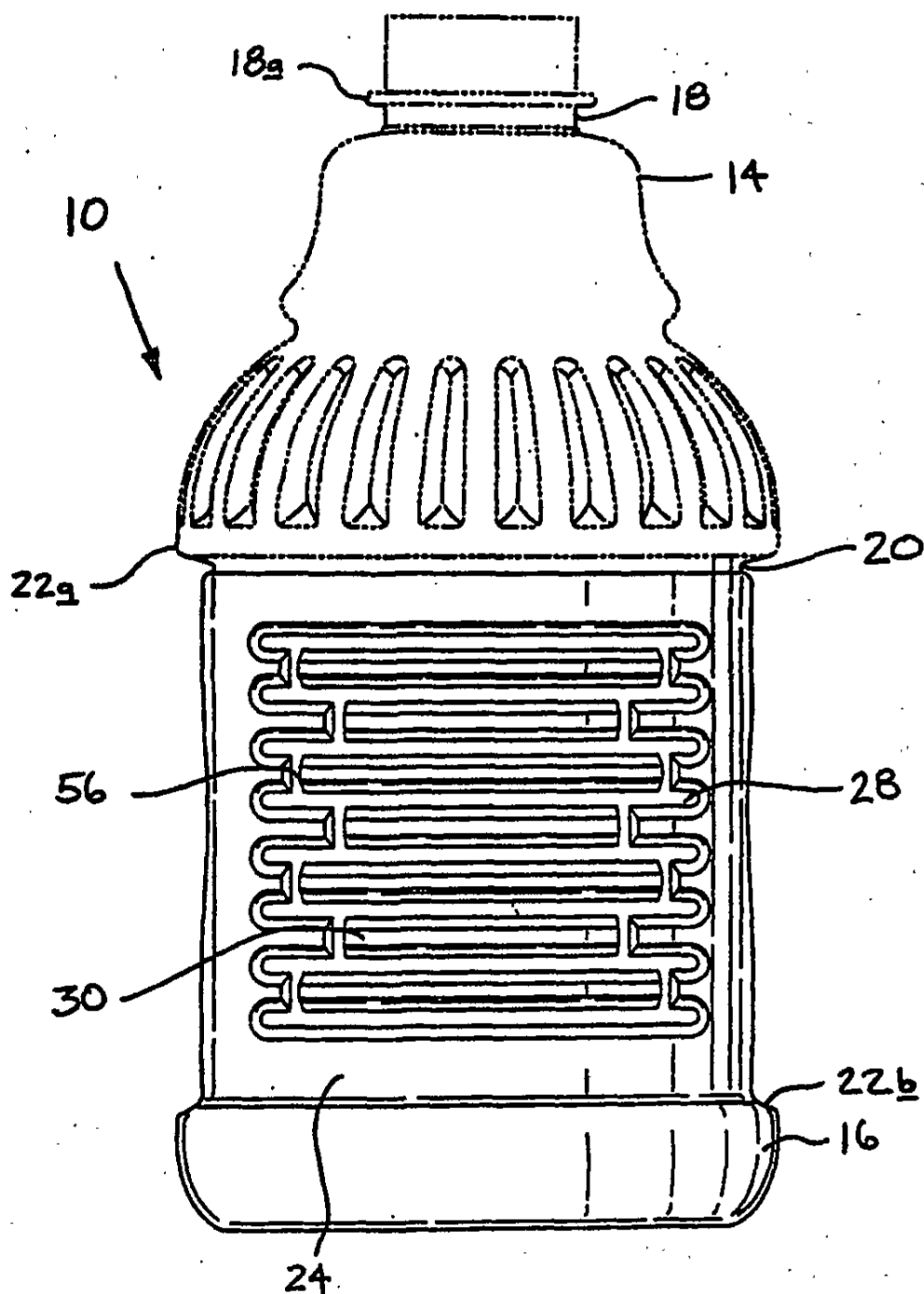


FIG. 2

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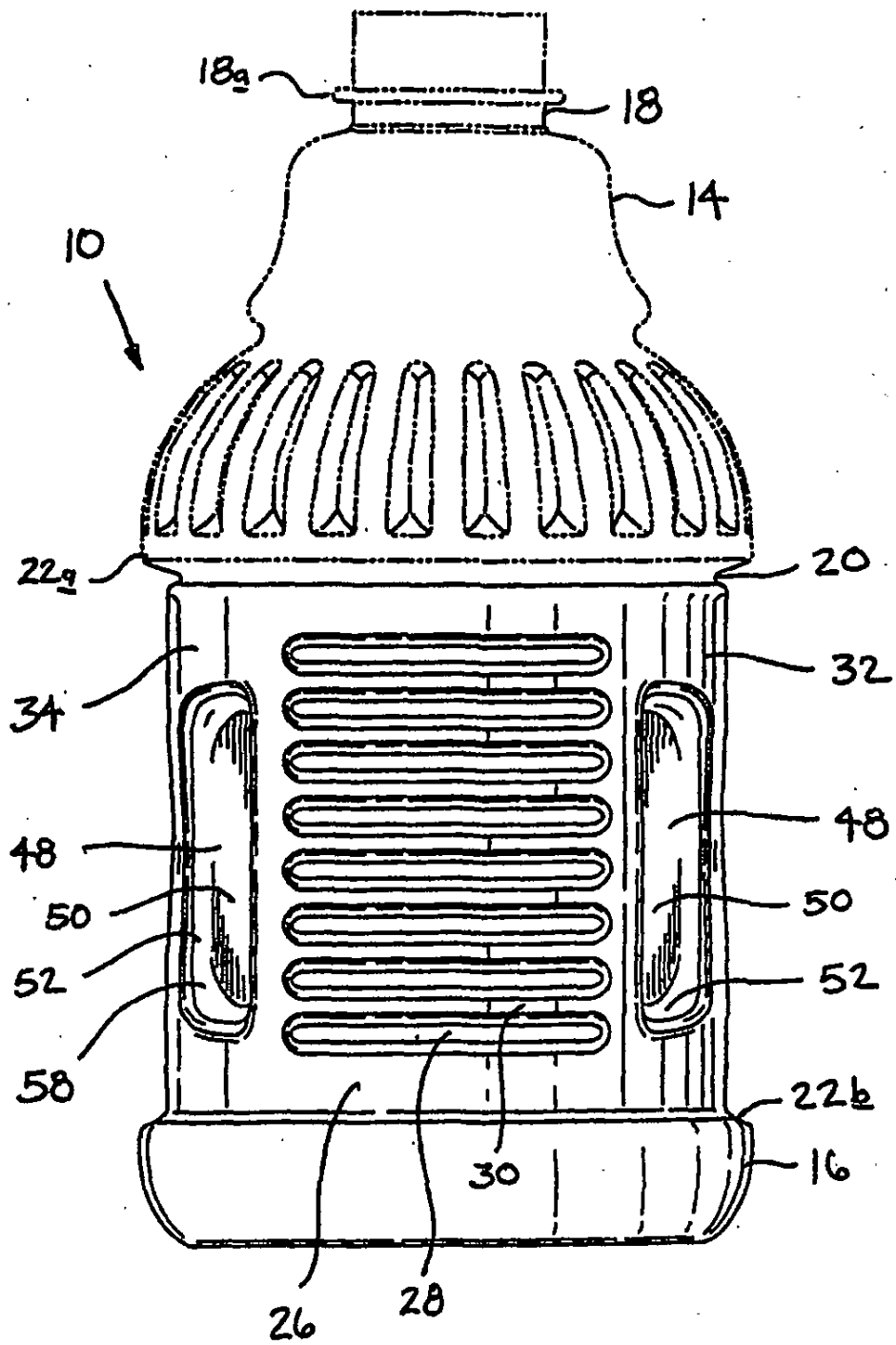
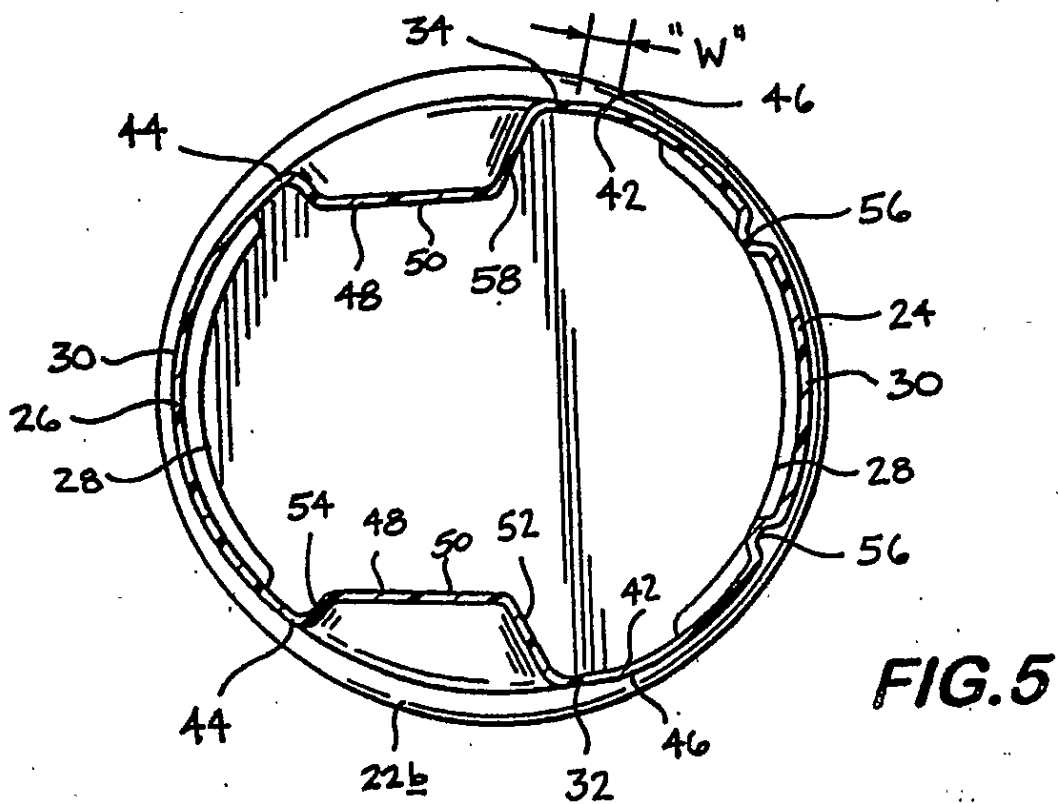
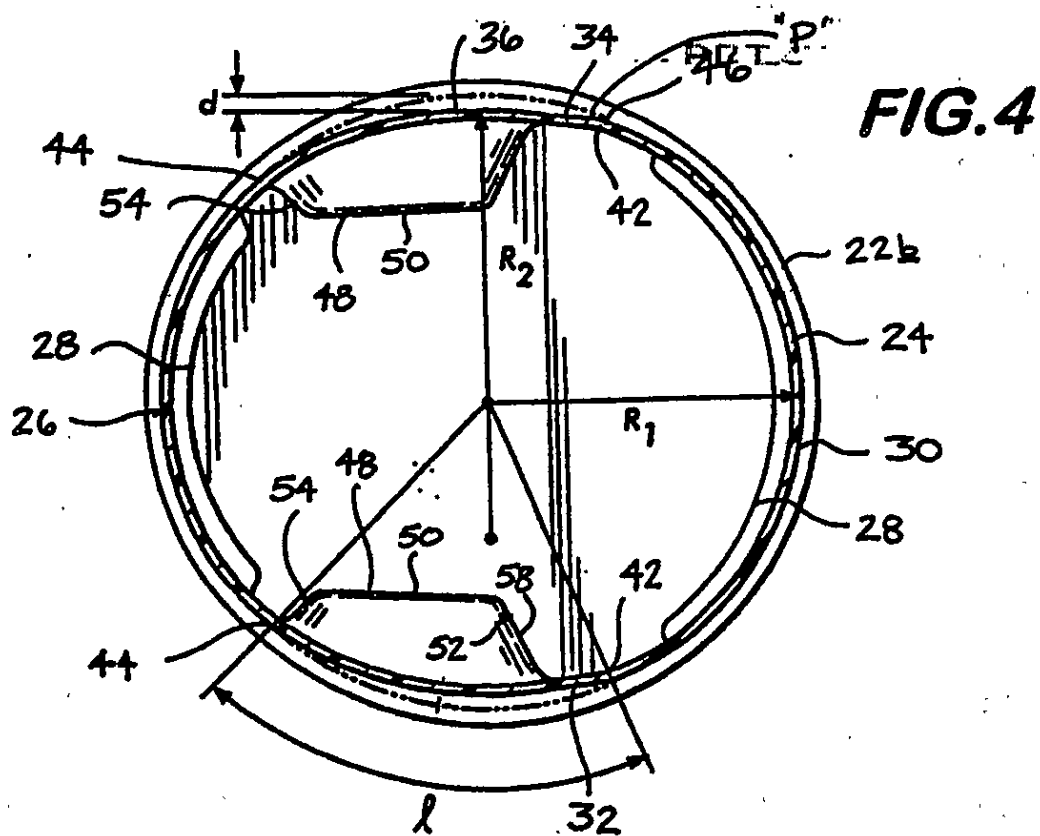
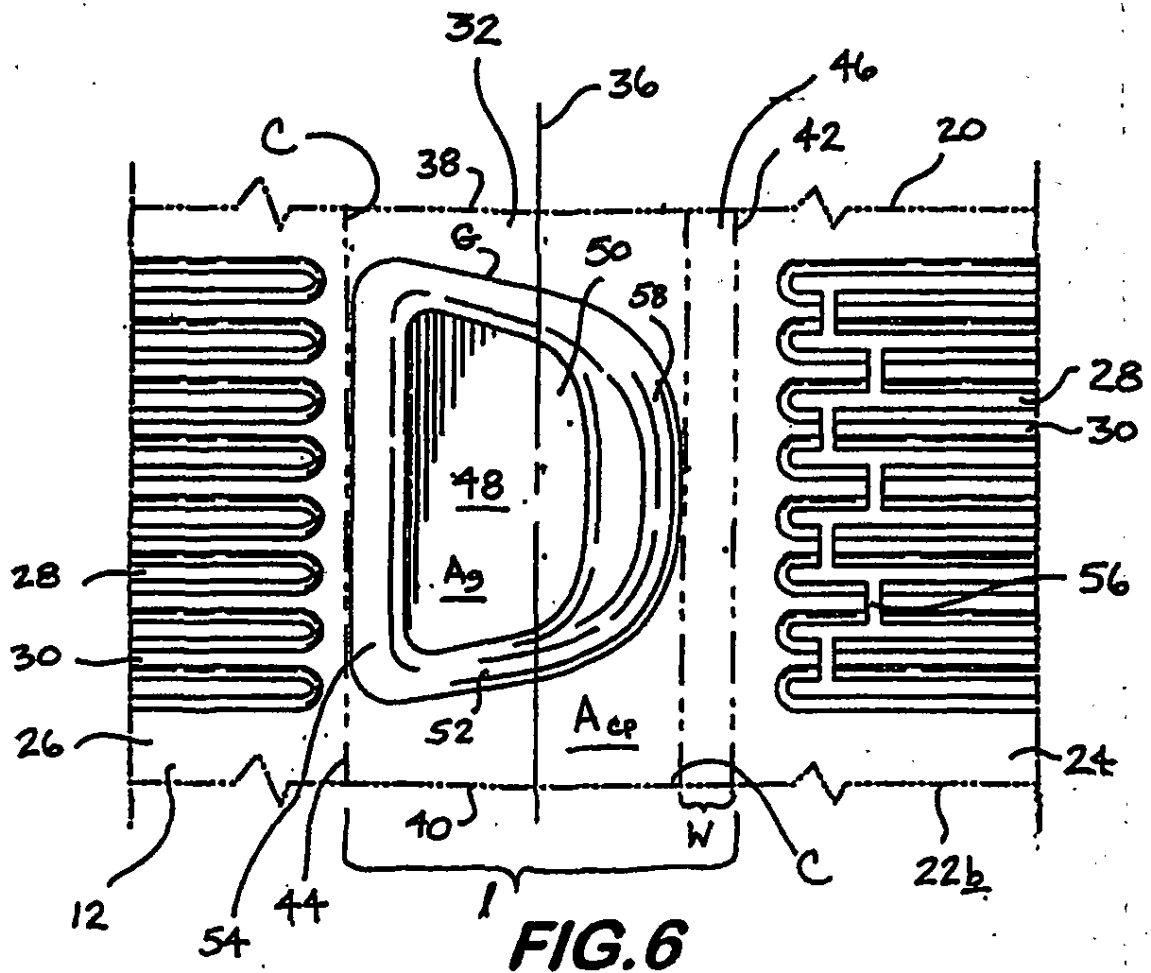


FIG. 3

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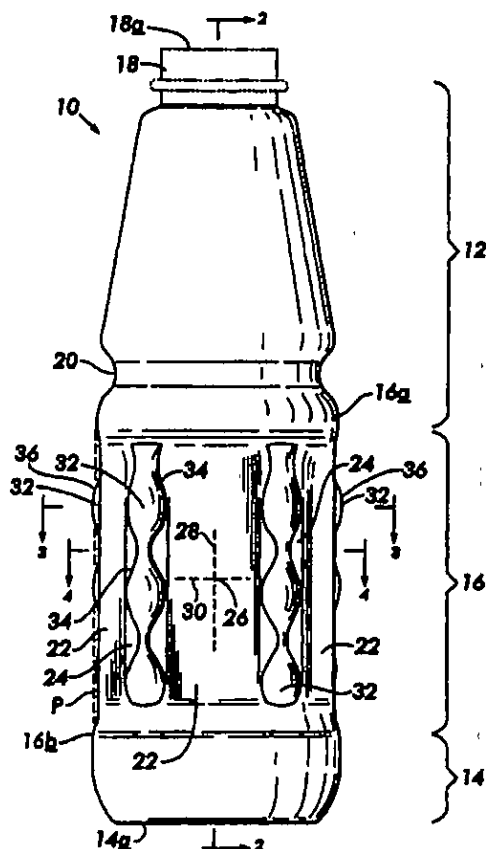
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(21) International Application Number: PCT/US00/12625 (22) International Filing Date: 9 May 2000 (09.05.00) (30) Priority Data: 60/133,618 11 May 1999 (11.05.99) US (71) Applicant (for all designated States except US): GRAHAM PACKAGING COMPANY, L.P. [US/US]; 2401 Pleasant Valley Road, York, PA 17402 (US). (72) Inventor; and (75) Inventor/Applicant (for US only): OGG, Richard, K. [US/US]; 464 Locust Lane, Littlestown, PA 17340 (US). (74) Agents: BAK, William et al.; Howson and Howson, Spring House Corporate Center, P.O. Box 457, Spring House, PA 19477 (US).		(81) Designated States: AU, BR, CA, HU, JP, MX, NZ, PL, TR, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published With international search report.

(54) Title: BLOW MOLDED BOTTLE WITH UNFRAMED FLEX PANELS

(57) Abstract

A hot-fillable, slender, blow-molded plastic bottle (10, 110, 210) for use in containing hot-filled beverages. The bottle (10, 110, 210) has a sidewall (16, 116, 216) with various interactive zones of function. For example, some of the zones are primarily responsible for accommodating vacuum absorption, while other zones are primarily intended to rigidify the container (10, 110, 210) such as by providing post strength to improve container top loading capability. Although each zone may have a primary function, each zone also aids adjacent zones in providing their functions. Thus, the entire sidewall (16, 116, 216), and not merely selected locations, reacts to the forces generated by the hot-fill process on the container (10, 110, 210).



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BLOW MOLDED BOTTLE WITH UNFRAMED FLEX PANELS**Field of the Invention**

The present invention relates to a slender bottle which integrates aesthetic and functional features without clearly segregating such features from one another. More particularly, the present invention relates to a slender blow-molded plastic bottle
5 which is useful in packaging a hot-filled beverage.

Background of the Invention

In the packaging of beverages, especially juice, blow-molded plastic containers made from, for instance, PET, are used in the so-called "hot-fill" process in which containers are filled with a beverage at an elevated temperature. The hot-filled
10 containers are promptly sealed and are permitted to cool resulting in internal pressure and temperature changes that reduce the volume of the sealed container.

It is known to provide hot-fillable containers with a series of well-defined, spaced-apart vacuum flex panels to compensate for the internal volume reduction. The vacuum flex panels provide a sufficient amount of flexure without adversely
15 affecting the structural integrity and aesthetic appearance of the hot-filled container. The adjacent portions of the container, such as the so-called lands, or columns, which are located between, above, and below the flex panels, are intended to resist any deformations which would otherwise be caused by hot-fill processing. Wall thickness variations, or geometric structures, such as ribs, projections and the like, can be
20 utilized to prevent unwanted distortion. Generally, the typical hot-fillable container structure is provided with certain pre-defined areas which flex to accommodate volumetric changes and certain other pre-defined areas which remain unchanged.

An example of a hot-fillable container having a plurality of flex-panels is illustrated in U.S. Design Patent No. D.366,416 which is owned by the assignee of the
25 present application. The hot-fill bottle has well-defined flex panels which are distinctly visually apparent prior to filling and which accommodate vacuum induced distortions after filling, capping and cooling. The container also has other geometric structures which are completely segregated from the flex panels, which are distinctly

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visually apparent prior to filling, and which resist structural change caused by volume reduction. Typically, all of these structures are framed about their entire peripheries and are completely separated from the bottle's aesthetic features which are usually limited to the dome of the container. For example, flex panels are often indented from
5 adjacent vertically disposed lands and from circumferential upper and lower label mount regions. Conventionally, the indented panels merge into the adjacent lands via various stepped-shaped walls, grooves, projections or like structures.

Other examples of container sidewalls having flexible panels are disclosed in U.S. Patent No. 4,749,092 issued to Sugiura et al.; U.S. Patent No. 3,923,178 issued
10 to Welker III; U.S. Patent No. 4,497,855 issued to Agrawal et al.; U.S. Patent No. 5,740,934 issued to Brady; and U.S. Patent No. 5,704,504 issued to Bueno. The Sugiura, Welker and Agrawal patents disclose inwardly deflecting vacuum flex panels which are located between substantially planar lands; the Bueno patent discloses inwardly deflecting panels which are located between spiral-shaped grooves; and the
15 Brady patent discloses outwardly deflecting panels which intersect at vertically disposed corners.

Although various ones of the above referenced containers may function satisfactorily for their intended purposes, there is a need for a hot-fillable blow molded bottle which integrates functional and aesthetic components in such a manner as to
20 provide a package having enhanced visual interest. Such a package is particularly desirable in single-serve sizes wherein slenderness and single-handed gripability are desirable features.

Objects of the Invention

With the foregoing in mind, a primary object of the present invention is to
25 provide a hot-fillable bottle which integrates vacuum absorption, structural reinforcement, and other functional features with aesthetic and ergonomic properties by providing various interactive functional zones in the container structure.

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Another object of the present invention is to provide a bottle having a plurality of alternating non-framed flex panels and non-framed lands, or columns, which laterally merge together directly and which are jointly reactive to hot-fill process forces acting thereon.

- 5 A further object is to provide a blow-molded, plastic, slender bottle having a grip structure which both enhances the structural integrity of the container and the visual appearance of the container.

Summary of the Invention

- 10 More specifically, the present invention provides a blow-molded plastic container having a neck with an upstanding threaded finish, a close-ended base, and a tubular sidewall located between the base and the neck. The sidewall includes, in an alternating pattern, a plurality of circumferentially-spaced, vertically-elongate columns and a plurality of circumferentially-spaced substantially smooth-surfaced panels. Each of the columns, as formed, is outwardly convex in horizontal cross section, and each
15 of the panels, as formed, is inwardly concave in horizontal cross section such that each of the panels extends laterally between and directly connects to an adjacent pair of the columns. In addition, each of the columns, as formed, is outwardly convex in vertical cross-section, and each of the panels, as formed, is inwardly concave in vertical cross section such that each of the columns and panels have opposite ends which merge
20 directly into adjacent portions of the container.

- Functionally, each of the panels flexes outwardly to expand the volume of the container during hot-filling, and each of the panels flexes inwardly in response to a reduction in internal volume when the container is capped and permitted to cool. The inward deflection of the panels interactively increases the horizontal cross-sectional
25 convexity of each column and decreases the vertical cross-sectional convexity of each column. The vertical straightening of each column and the lateral pinching of each column combine to structurally strengthen the container.

The aforescribed structure is particularly suited for slender, single-serve size bottles.

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In a preferred embodiment, a plurality of vertically-aligned finger alignment projections are formed integrally on each of the columns to define finger grip locations, to structurally reinforce the columns, and to provide points of visual interest.

5 **Brief Description of the Drawings**

The foregoing and other objects, features and advantages of the present invention should become apparent from the following description when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is an elevational view of a container embodying the present invention;

10 FIG. 2 is a vertical cross-sectional view taken along line 2--2 of the container illustrated in FIG. 1;

FIG. 3 is a horizontal cross-sectional view taken along line 3--3 of the container illustrated in FIG. 1;

15 FIG. 4 is a horizontal cross-sectional view taken along line 4--4 of the container illustrated in FIG. 1;

FIG. 5 is an elevational view of a second embodiment of a container according to the present invention;

FIG. 6 is a vertical cross-sectional view taken along line 6--6 of the container illustrated in FIG. 5;

20 FIG. 7 is a horizontal cross-sectional view taken along line 7--7 of the container illustrated in FIG. 5;

FIG. 8 is a horizontal cross-sectional view taken along line 8--8 of the container illustrated in FIG. 5;

25 FIG. 9 is a horizontal cross-sectional view taken along line 9--9 of the container illustrated in FIG. 5;

FIG. 10 is an elevational view of a third embodiment of a container according to the present invention; and

FIG. 11 is an elevational view of the container illustrated in FIG. 10 rotated 30° about a vertical axis extending centrally through the container.

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Detailed Description of the Preferred Embodiments

One embodiment of a slender bottle, or container, 10 according to the present invention is illustrated in FIG. 1. The container 10 has a dome 12, a close ended base 14 and a sidewall 16 located between the dome and base. An upper portion of the dome 12 includes an upstanding threaded finish 18 to which a closure, such as a cap, (not shown) can be attached. A lower portion of the dome 12 includes a circumferential groove, or waist, 20 which provides hoop strength to the bottle to resist ovalization distortion which may otherwise result due to hot-filling and to stiffen the transition between the lower portion of the dome and the sidewall. Optionally, a label can be mounted on the dome 12 between the finish 18 and the groove 20.

Certain novel aspects of the illustrated preferred embodiment are located in the sidewall 16 which is inset between an upper bumper 16a and a lower bumper 16b and lies entirely within an imaginary cylindrical plane "P" tangent to the outer surface of both. Functionally, the sidewall 16 is capable of expanding when the bottle is filled and is capable of accommodating vacuum absorption when the hot-filled bottle is capped and permitted to cool. In addition, the sidewall 16 is provided with structure which enhances grip-ability of the container 10 and the aesthetic visual appearance of the container 10.

The sidewall 16 is provided with various interactive zones of function. For example, some of the zones are primarily responsible for accommodating vacuum absorption, while other zones are primarily intended to rigidify the container such as by providing post strength to improve container top loading capability. Although each zone may have a primary function, each zone also aids adjacent zones in providing their functions. Thus, the entire sidewall 16, and not merely selected locations, reacts to the forces generated by the hot-fill process on the container 10.

To this end, a plurality of unframed and substantially smooth-surfaced flex panels 22 are provided on the sidewall 16 in an alternating pattern with a plurality of vertically elongate columns 24. The panels 22 provide zones of expansion and vacuum absorption, and the columns 24 provide structural reinforcement zones. Both the panels 22 and the columns 24 react to the forces created by hot-fill processing.

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In the "as-formed" condition, ie. after blow-molding but before hot-filling, and in the absence of any internal or external applied forces, the panels 22 are slightly inwardly concave. This is best illustrated in the vertical cross-section of the right hand side of FIG. 2, and in the horizontal cross sections illustrated in FIGs. 3 and 4. The deepest inset portion 26 of each panel 22 is located at the intersection of its vertical centerline 28 and its horizontal centerline 30. In the embodiment illustrated in FIGs. 1-4, each panel 22 is substantially rectangular and is not surrounded by any framing structure such as a stepped wall portion. Rather, all the peripheral edges of each panel 22 merge directly into the adjacent portions of the container as will be discussed.

In the as-formed condition, the columns 24 are slightly outwardly convex. This is best illustrated in the vertical cross-section of the left hand side of FIG. 2, and in the horizontal cross sections illustrated in FIGs. 3 and 4. Each column 24 is substantially rectangular and is not surrounded by any distinct framing structure, such as a stepped wall. Rather, each column 24 merges smoothly and directly into the adjacent portions of the container. For example, the lateral edges of each panel 22 merge directly into the side edges of an adjacent pair of columns 24. The juncture of the panels 22 and columns 24 are not delineated by other structure; rather, they smoothly transition directly into one another. As best illustrated in FIGs. 1 and 2, the upper and lower edges of the panels 22 and the columns 24 also merge directly into the upper and lower bumpers 16a and 16b, respectively.

Preferably, the deepest inset portion 26 of each panel 22 is inset into the container 10 an equal pre-determined distance to the most outwardly projecting portion of each column. For example, if each panel 22 is inset approximately 2 mm from an imaginary container datum plane "D" as-formed, then each column projects 2 mm from the container datum plane "D" as-formed. The "container datum plane 'D'" is defined as an imaginary cylindrical plane about which the panels bow inwardly and about which the columns bow outwardly. See the dashed line "D" in FIG 4.

In another embodiment, which provides certain additional structural and functional advantages over the first-described embodiment, is illustrated in FIGs. 5-9.

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The container 110 includes a base 114, a sidewall 116 and a dome 112 having a finish 118. In this embodiment, each column, such as the column 124, has an hourglass-shape in vertical elevation, with its narrowest region located at the vertical median of the sidewall 116 as determined by section line 7--7. From there, the column flares outwardly in both upward and downward directions. Each panel 122 between adjacent columns 124 is complementary and has its widest portion at the sidewall median and narrows therefrom in both upward and downward directions. Both the columns and the panels merge smoothly outwardly with the upper and lower bumpers 116a and 116b, respectively.

10 In this embodiment, each of the finger grip protrusions 132, as discussed below, is of equal size, shape and radial extent providing better grip-ability without sacrificing flexural performance.

When the containers 10, 110 are hot-filled with a beverage, each panel 22, 122 initially deflects outwardly slightly, as best shown for container 110 exaggerated in dot-dash line in FIG. 6, to increase the volume of the containers 10, 110. After the
15 containers 10 and 110 are hot-filled, capped and permitted to cool, each panel 22, 122 deflects inwardly to effectively reduce the volume of each container 10 and 110, as best illustrated greatly exaggerated for container 110 by the dashed lines in FIGs. 6 and 7-9.

20 Each of the columns 24, 124 also reacts to the forces created in the hot-filled, capped and cooled containers 10 and 110. In horizontal cross-section, the convexity of each column 24, 124 increases due to the lateral pinching of the inwardly deflecting adjacent panels 22, 122. In vertical cross-section, each column 24, 124 straightens. The combination of the lateral pinching and the vertical straightening creates more
25 column structure as more vacuum develops in the container. The increase in column structure increases the post strength provided by the columns 24, 124 and provides the filled and capped containers 10 and 110 with increased top loading capability. The intended altered shape of the columns 24, 124 also aids in resisting unwanted container distortion and provides enhanced visual aesthetic interest in the container.

30 Note the deflection relative to the container datum plane "D" in FIG. 7.

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Preferably, each column 24, 124 is provided with a plurality of vertically aligned protrusions 32, 132 on about one inch centers. In vertical elevation, the protrusions are defined by laterally undulating lines of inflection 34, 134 and radially undulating surfaces 36, 136. The outward extent of the radially-undulating surfaces 36 may vary in radial extent, from maximum at the top to minimum at the bottom, such as illustrated in FIG. 1, or may be of equal extent such as illustrated in the embodiment of FIG. 5. The outward protrusions 32, 132 define therebetween valleys 38, 138 affording finger placement locations to improve gripability of the container. The pattern of protrusions 32, 132 also provides visual interest and structurally reinforces the columns 24, 124 at certain desired locations while affording the desired flexure at certain other desired locations.

The present invention is particularly suited for use in slender bottles, ie. bottles having a predetermined slenderness ratio. Slenderness ratio as used herein is the length of the bottle 10, of FIG. 1, measured axially from the upper edge 18a of the finish 18 to the bottom of the standing ring 14a of the base 14 divided by the mean diameter of the sidewall 16, or body portion, located between the bottom of the dome 12 and the base 14. In the illustrated bottle 10, the slenderness ratio is 3.3:1. The bottle 10 is drawn to full scale. It has an overall length of about 22.9 cm (9 inches) and a 0.7 liter (24 ounce) filled capacity.

By way of example, and not by way of limitation, each bottle, such as the bottle 10, may be designed to contain between about 0.2 liters (about 8 ounces) to about 1.9 liters (about 64 ounces) of a beverage. The sidewall 16 may include any number of panels 22, 122 and columns 24, 124, such as in a range of two through ten. The deepest inset portion 26 of each panel in the as-formed condition of the container relative to the container datum plane "D" is about 1 to about 4 mm. The circumferential groove 20 in the dome 12 is approximately 6 to 7 mm in depth and approximately 4 to 5 mm in height. The filled and capped containers 10 are capable of being packed and shipped in an efficient amount of space because the panels 22 of one container's sidewall interdigitate with the columns 24 of the adjacent containers to minimize packing volume.

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A third embodiment of the present invention is provided by container 210 as illustrated in FIGs. 10 and 11. The hot-fillable plastic container 210 has a dome 212 with a finish 218, a lower sidewall 216 adjacent a base 214, and a substantially cylindrical intermediate sidewall 234 to which a label (not shown) can be secured.

- 5 The lower sidewall 216 includes six vertically- elongate unframed flex panels 222 in an alternating array with six vertically-elongate columns 224 which, when hot-filled, function similar to the unframed flex panels and columns as disclosed above for containers 10 and 110.

10 Thus, the present invention provides a hot-fillable container which integrates various functional and aesthetic features without clearly segregating the features. Unframed panels and columns interact to provide vacuum absorption functions and structural reinforcement functions. As more vacuum develops in the container, greater structural functions develop in the container sidewall to provide a container which is functional, structurally strong and visually aesthetic.

- 15 Various modifications to the container are contemplated. For instance, such modifications may include the use of an odd or an even number of panels, vacuum absorption and structural zones located in the dome of the container, and finger grips provided by indentations instead of protrusions.

20 While preferred embodiments of containers having a sidewall with unframed flex panels have been described, various modifications, alterations, and changes may be made without departing from the spirit and scope of the present invention as defined in the appended claims.

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Claims:

1. A blow-molded plastic bottle (10, 110, 210) having a dome (12, 112, 212) with an upstanding finish (18, 118, 218), a base (14, 114, 214), and a substantially tubular sidewall (16, 116, 216) between the base (14, 114, 214) and the dome (12, 112, 212), said sidewall (16, 116, 216) comprising:

an alternating pattern of a plurality of circumferentially-spaced vertically-elongate columns (24, 124, 224) and a plurality of circumferentially-spaced substantially smooth-surfaced panels (22, 122, 222);

each of said columns (24, 124, 224), as formed, being outwardly convex in horizontal cross section and each of said panels (22, 122, 222), as formed, being inwardly concave in horizontal cross section with each of said panels (22, 122, 222) extending laterally between and connecting directly to an adjacent pair of said columns (24, 124, 224); and

each of said columns (24, 124, 224), as formed, being outwardly convex in vertical cross section and each of said panels (22, 122, 222), as formed, being inwardly concave in vertical cross section with each of said columns (24, 124, 224) and panels (22, 122, 222) having opposite ends merging directly into adjacent portions of the bottle (10, 110, 210).

2. A blow-molded plastic bottle (10, 110, 210) according to claim 1, wherein each of said panels (22, 122, 222) flexes outwardly during hot-filling and inwardly in response to a reduction in internal volume when the bottle (10, 110, 210) is capped and permitted to cool; and wherein said inward deflection of said panels (22, 122, 222) increases the horizontal cross-sectional convexity of each of said columns (24, 124, 224), whereby said increased horizontal cross-sectional convexity structurally enhances bottle strength.

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3. A blow-molded plastic bottle (10, 110, 210) according to claim 2, wherein each of said as-formed outwardly convex vertical cross-sections of each column (24, 124, 224) straightens in response to the reduction in internal volume when the bottle (10, 110, 210) is hot-filled, capped and permitted to cool; and wherein said vertical straightening structurally enhances the strength of the bottle (10, 110, 210).

4. A blow-molded plastic bottle (10, 110) according to claim 3, further comprising a plurality of vertically-aligned finger alignment protrusions (32, 132) formed integrally on each of said columns (24, 124).

5. A blow-molded plastic bottle (10, 110) according to claim 4, wherein said sidewall (16, 116) has a number of said panels (22, 122) in a range of two through ten and an equal number of said columns (24, 124).

6. A blow-molded plastic bottle (10, 110) according to claim 5, wherein said sidewall (16, 116) has five of said panels (22, 122) and five of said columns (24, 124) affording side-by-side packing with like bottles (10, 110) in a minimum of space with said columns (24, 124) of one bottle (10, 110) interdigitating with said panels (22, 122) of adjacent bottles (10, 110).

7. A slender blow-molded plastic bottle (10, 110, 210) comprising:
an upper portion with a dome (12, 112, 212) having an upstanding
finish (18, 118, 218) capable of being sealed with a closure;
a lower portion having a base (14, 114, 214); and
a generally tubular intermediate sidewall portion (16, 116, 216)
between said upper and lower portions, said sidewall portion
(16, 116, 216) being formed with a plurality of
circumferentially-spaced vertically-elongate columns (24, 124,
224) in an alternating pattern with a plurality of

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4.73

circumferentially-spaced substantially smooth-surfaced panels (22, 122, 222);

each of said columns (24, 124, 224), as formed, being outwardly convex in horizontal cross section and each of said panels (22, 122, 222), as formed, being inwardly concave in horizontal cross section such that each of said panels (22, 122, 222) extends laterally between and connects directly to an adjacent pair of said columns (24, 124, 224);

each of said columns (24, 124, 224), as formed, being outwardly convex in vertical cross section and each of said panels (22, 122, 222), as formed, being inwardly concave in vertical cross section such that each of said columns (24, 124, 224) and panels (22, 122, 222) has opposite ends which merge directly into adjacent portions of the bottle (10, 110, 210);

each of said panels (22, 122, 222) flexing outwardly to expand the volume of the bottle (10, 110, 210) during hot-filling and each of said panels (22, 122, 222) flexing inwardly in response to a reduction in internal volume after the bottle (10, 110, 210) is capped and permitted to cool; and

said inward deflection of said panels (22, 122, 222) functioning to increase the horizontal cross-sectional convexity of each of said columns (24, 124, 224) and of decreasing the vertical cross-section convexity of each of said columns (24, 124, 224).

8. A slender blow-molded plastic bottle (10, 110) according to claim 7, further comprising a plurality of vertically-aligned finger alignment protrusions (32, 132) formed integrally on each of said columns (24, 124) to define therebetween finger grip locations and to structurally reinforce said columns (24, 124) at desired locations.

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9. A slender blow-molded plastic bottle (10, 110) according to claim 7, wherein each of said panels (22, 122) has a vertical center line and a pair of lateral side edges, and each of said columns (24, 124) has a vertical center line and a pair of lateral side edges; wherein, in the as-formed condition of the bottle (10, 110), each of said panels (22, 122) at said panel center line extends radially inward a pre-determined distance relative to said panel side edges and each of said columns (24, 124) at said column center line extends radially outward a pre-determined distance relative to said column side edges; wherein said column and panel side edges lie on a cylindrical datum plane (D); and wherein said pre-determined distances of said panels and columns are substantially equal.

10. A slender blow molded plastic bottle (10, 110) according to claim 9, wherein said pre-determined distances of said panels (22, 122) and said columns (24, 124) are in the range of about 1 to about 4 mm.

11. A slender blow-molded plastic bottle (10) according to claim 7, wherein each of said columns (24) has a substantially rectangular periphery.

12. A slender blow molded plastic bottle (110) according to claim 7, wherein each of said columns (124) has an hourglass-shaped configuration with a minimum peripheral extent at about a vertical median of the sidewall (116).

13. A slender blow-molded plastic bottle (10, 110) according to claim 7, wherein each of said panels (22, 122) and each of said columns (24, 124) has upper peripheral edges positioned in an end-to-end array having a substantially circular horizontal cross-sectional shape; and wherein each of said panels (22, 122) and each of said columns (24, 124) have lower peripheral edges positioned in an end-to-end array having a substantially circular horizontal cross-sectional shape.

14. A slender blow-molded plastic bottle (10, 110) according to claim 13, wherein said sidewall portion (16, 116) has two to ten of said panels (22, 122) and an equal number of said columns (24, 124).

15. A blow-molded slender plastic bottle (10, 110) comprising:

a dome (12, 112) having an upper portion with an upstanding sealable finish (18, 118) and a lower portion with a circumferential groove providing a waist (20);

a base (14, 114); and

a tubular sidewall (16, 116) between said dome (12, 112) and said base (14, 114), said sidewall (16, 116) being formed with a plurality of circumferentially-spaced vertically-elongate columns (24, 124) disposed in an alternating pattern with a plurality of circumferentially-spaced substantially smooth-surfaced panels (22, 122);

each of said columns (24, 124), as formed, being outwardly convex in horizontal cross section and each of said panels (22, 122), as formed, being inwardly concave in horizontal cross section such that each of said panels (22, 122) extends laterally between and merges directly with an adjacent pair of said columns (24, 124);

each of said columns (24, 124), as formed, being outwardly convex in vertical cross section and each of said panels (22, 122), as formed, being inwardly concave in vertical cross section such that each of said columns (24, 124) and panels (22, 122) has opposite ends which merge directly into said dome (12, 112) and base (14, 114) of the bottle (10, 110);

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each of said panels (22, 122) flexing outwardly to expand the volume of the bottle (10, 110) during hot-filling and each of said panels (22, 122) flexing inwardly in response to a reduction in internal volume when the bottle (10, 110) is capped and permitted to cool; and

said inward deflection of said panels (22, 122) increasing the horizontal cross-sectional convexity and decreasing the vertical cross-sectional convexity of each of said columns (24, 124) for structurally enhancing bottle top loading strength.

16. A blow-molded slender plastic bottle (10, 110) according to claim 15, further comprising a plurality of vertically-aligned outwardly protruding finger alignment protrusions (32, 132) formed integrally on each of said columns (24, 124) to define finger grip locations and to structurally modify the strength of said columns (24, 124) at desired locations.

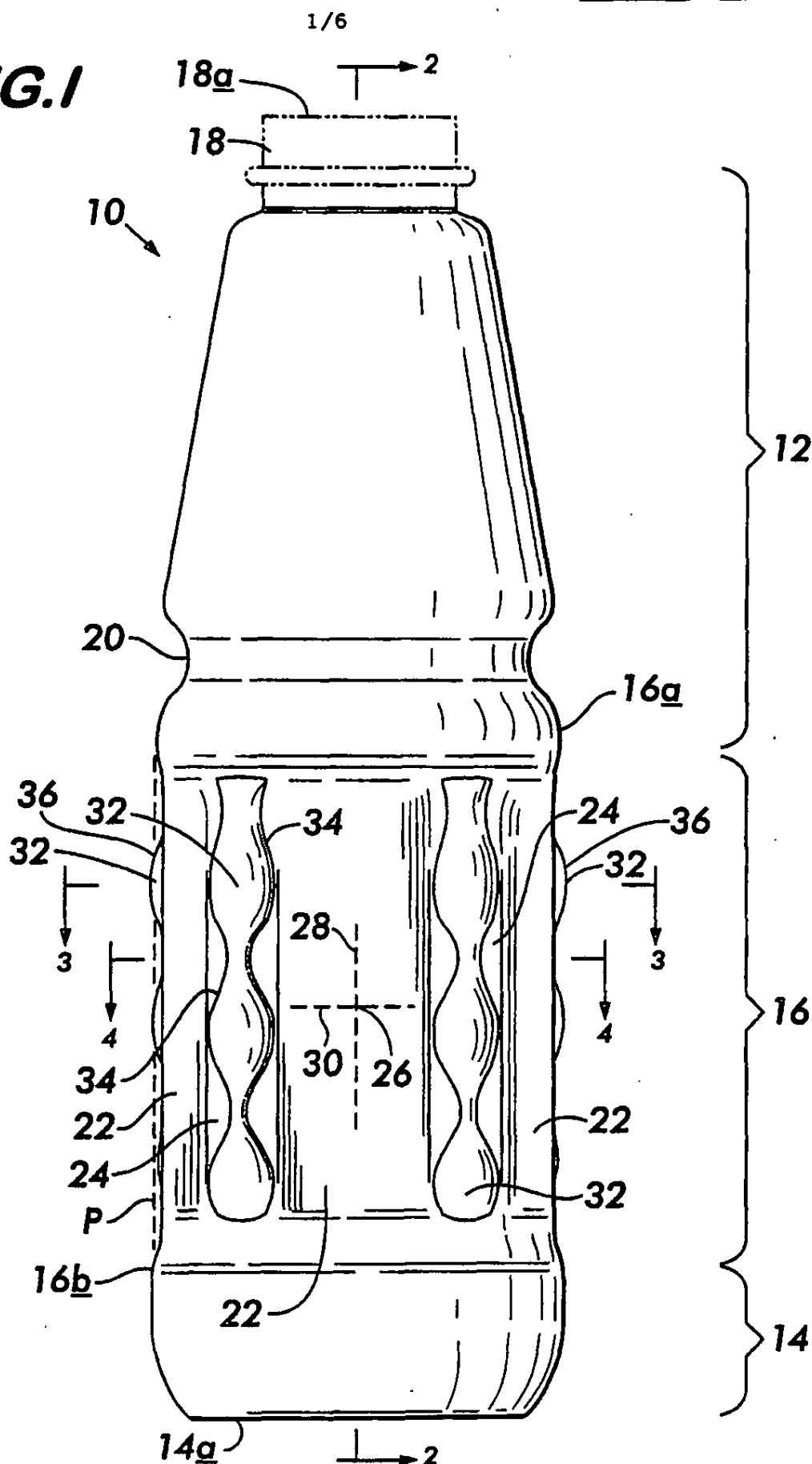
17. A blow-molded slender plastic bottle (10, 110) according to claim 15, wherein each of said panels (22, 122) has a central portion with a periphery, and each of said columns (24, 124) has a central portion with a periphery; wherein, in the as-formed condition of the bottle (10, 110), each of said panels (22, 122) at said central portion extends radially inward a pre-determined distance relative to said panel periphery and each of said columns (24, 124) at said column central portion extends radially outward a pre-determined distance relative to said column periphery; and wherein said pre-determined distances of said panels (22, 122) and columns (24, 124) are substantially equal.

18. A blow-molded slender plastic bottle (10, 110) according to claim 15, having a slenderness ratio of about 3.3:1.

19. A blow-molded slender plastic bottle (10, 110) according to claim 15, having upper and lower bumpers (16a, 16b, 116a, 116b) above and below said sidewall (16, 116), and wherein said columns (24, 124), in said bottle as-formed condition, lie within a cylindrical plane (P) tangent to said bumpers (16a, 16b, 116a, 116b).

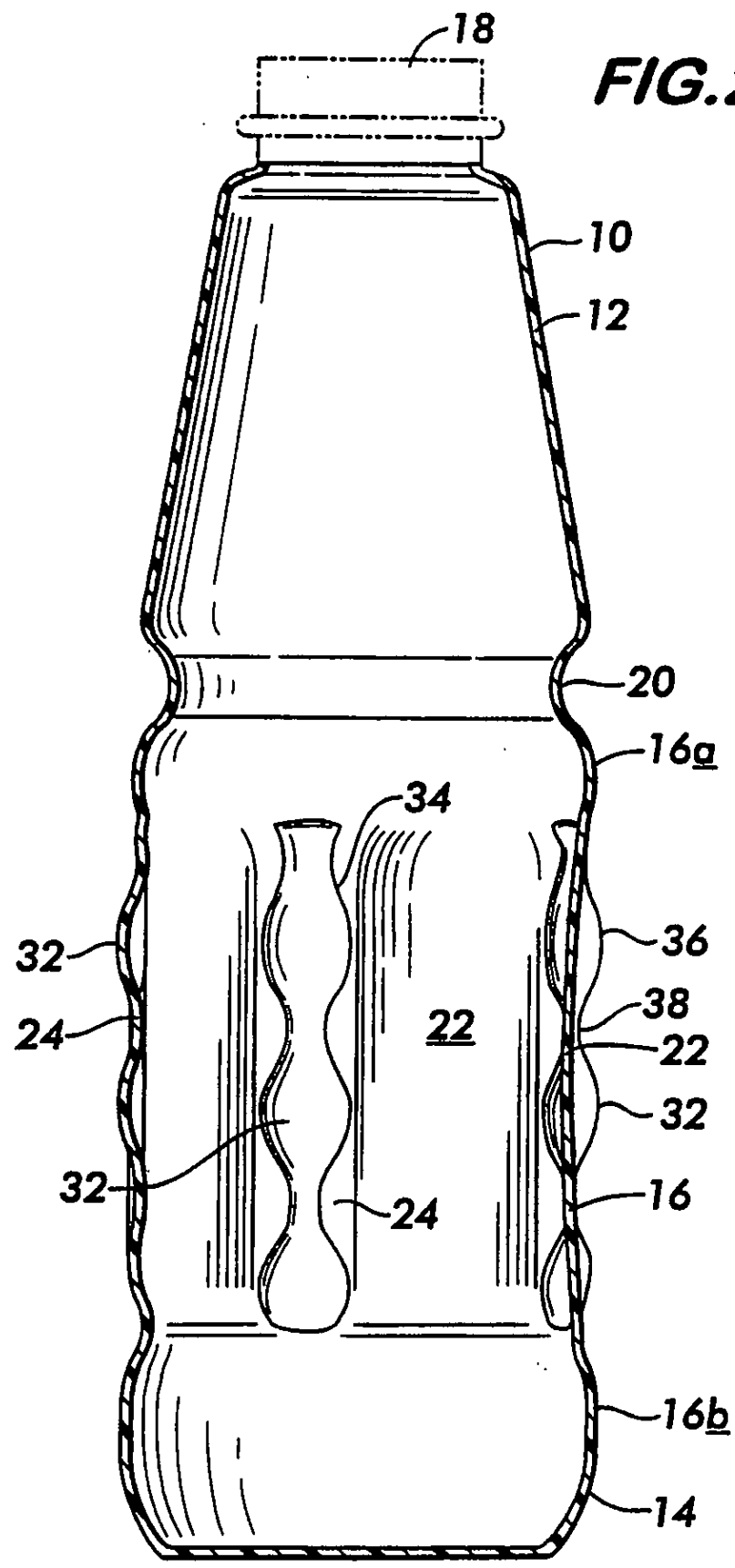
20. A blow-molded slender plastic bottle (10, 110) according to claim 19, having a cylindrical datum plane (D) coaxial with said first-mentioned cylindrical plane (P) and located inwardly thereof, said cylindrical datum plane (D) at said sidewall vertical median defining a reference with respect to which said columns (24, 124) and said panels (22, 122) flex.

FIG. 1



SUBSTITUTE SHEET (RULE 26)

FIG. 2



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FIG.3

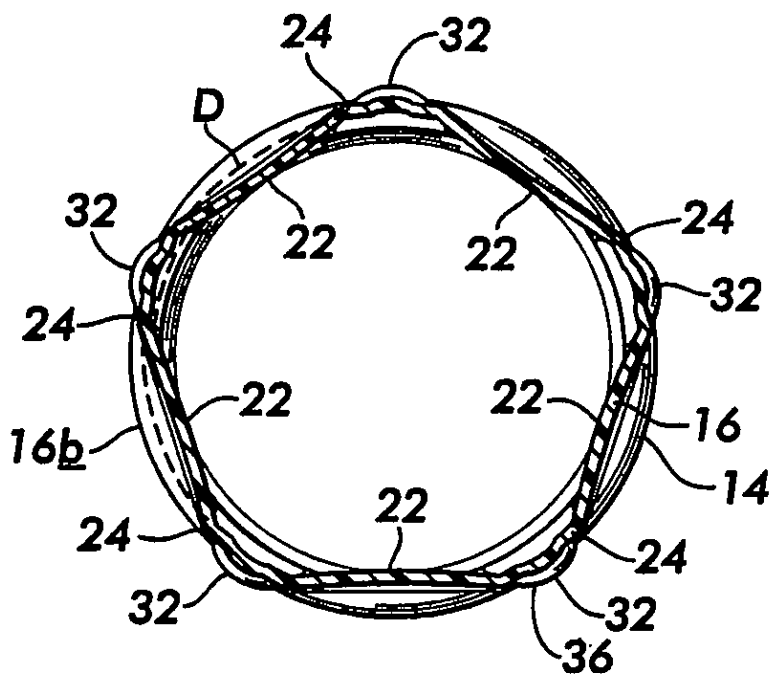
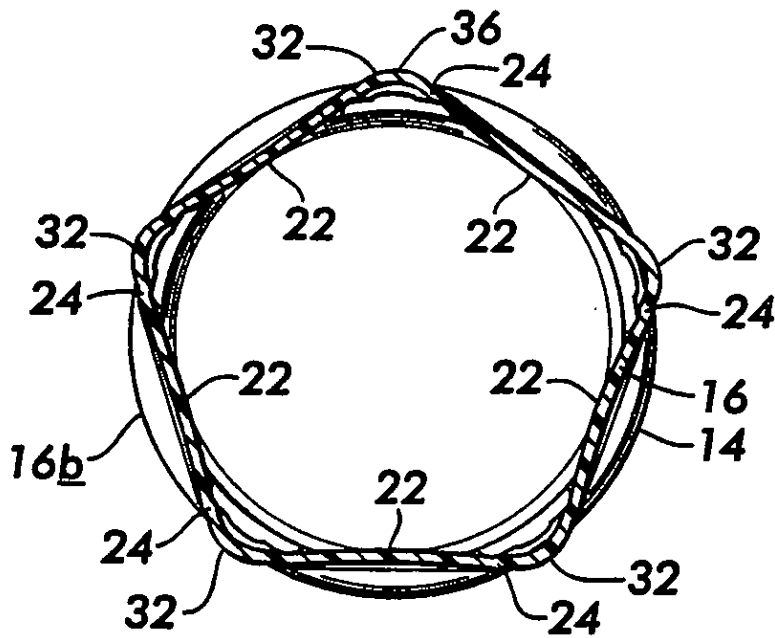


FIG.4

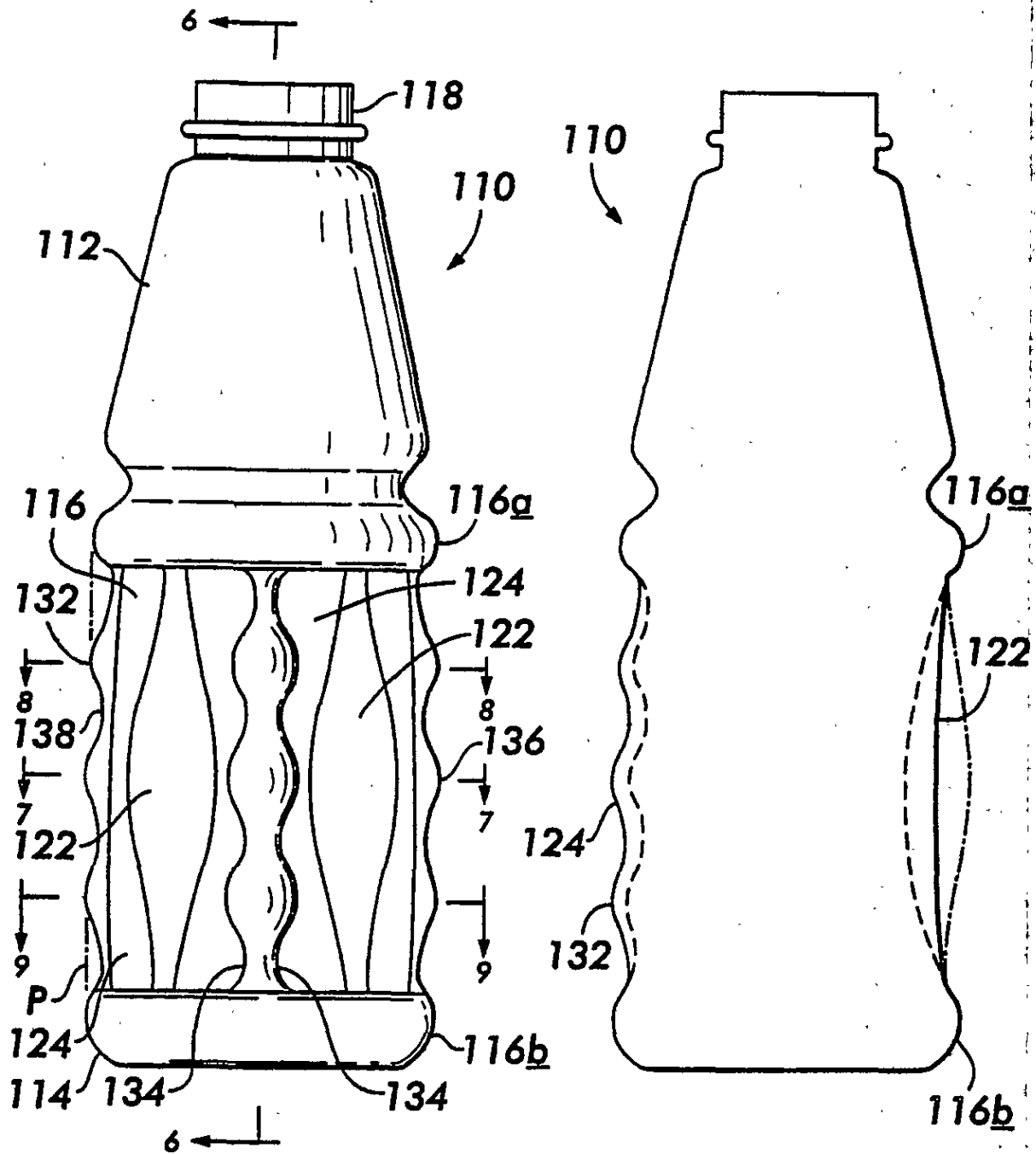


FIG.5

FIG.6

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FIG. 7

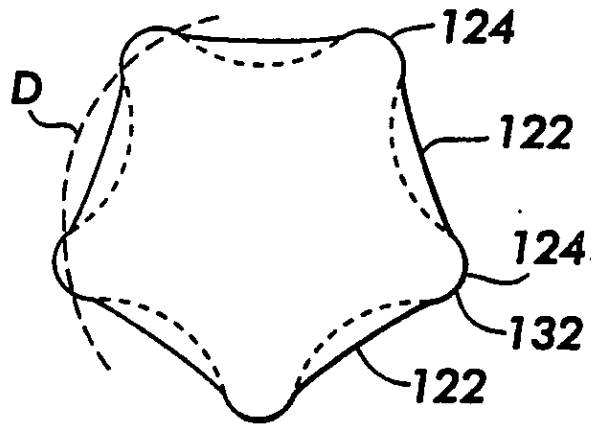


FIG. 8

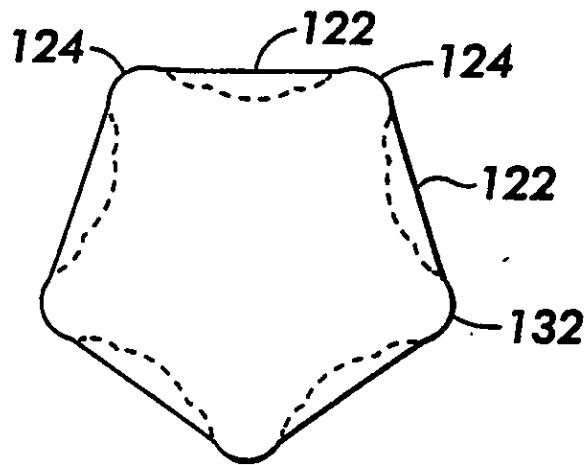
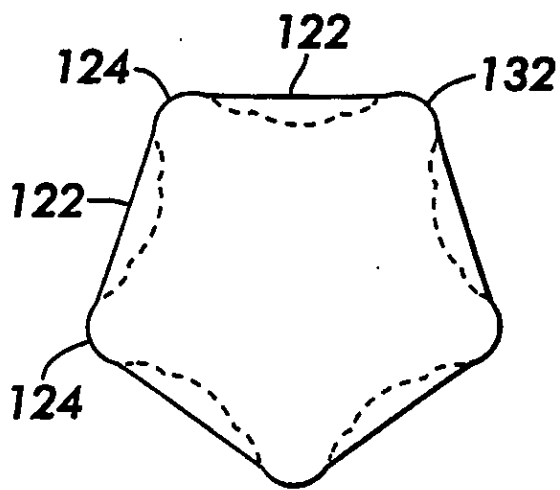


FIG. 9



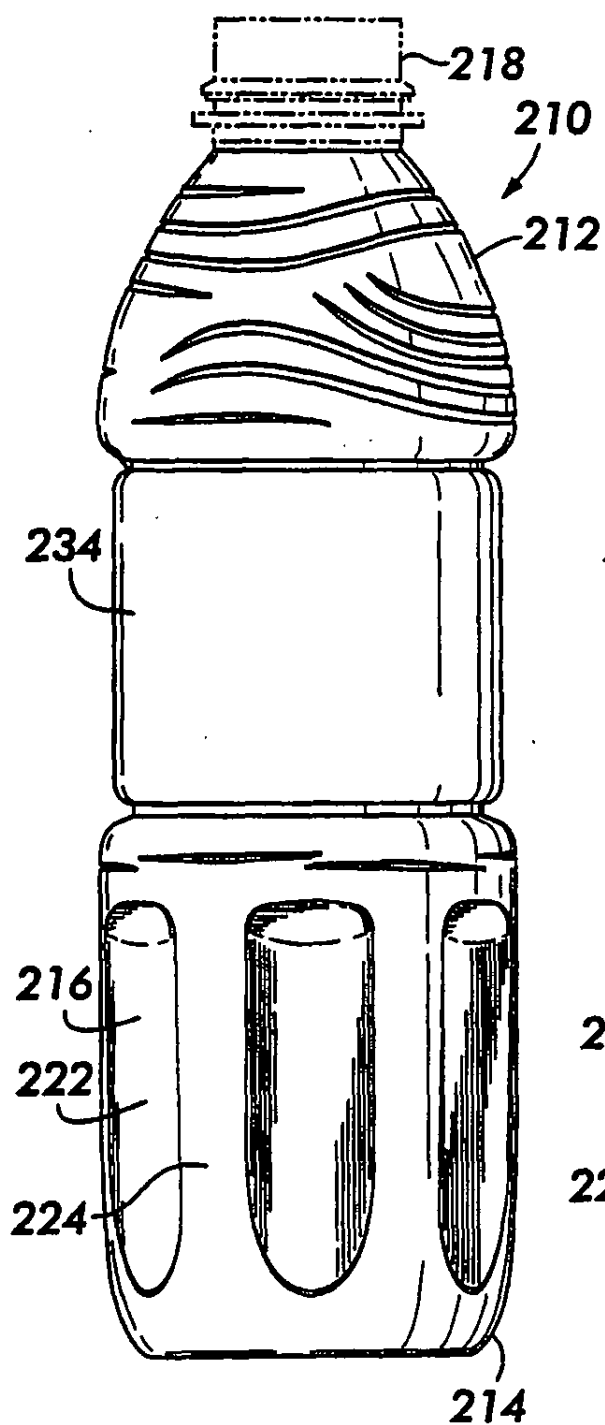


FIG. 10

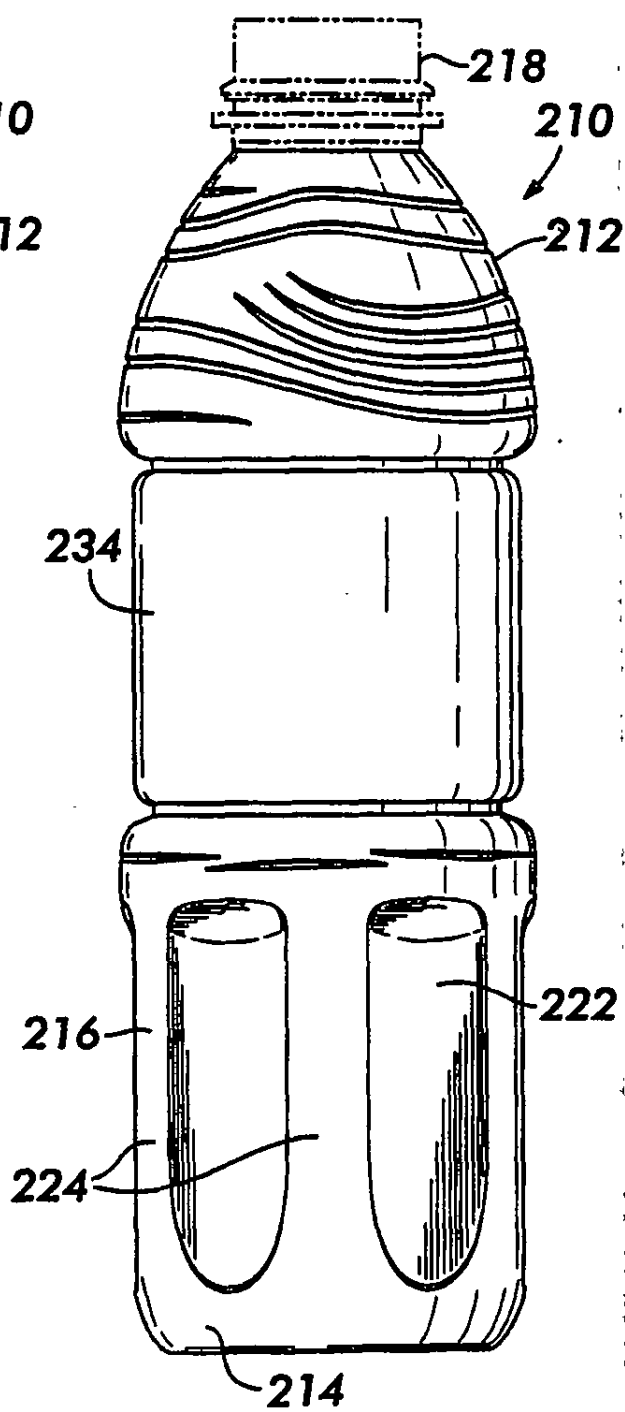


FIG. 11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/12625

A. CLASSIFICATION OF SUBJECT MATTER IPC(7) :B65D 1/02, B65D 1/42 US CL :215/382; 220/669,670,673,675 According to International Patent Classification (IPC) or to both national classification and IPC																				
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) U.S. : 215/382; 220/669,670,673,674,675 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)																				
C. DOCUMENTS CONSIDERED TO BE RELEVANT																				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.																		
X	US 5,690,244 A (<i>DARR</i>) 25 NOVEMBER 1997, SEE THE ENTIRE DOCUMENT	1-20																		
X	US 5,407,086 A (<i>OTA et al.</i>) 18 APRIL 1995, SEE THE ENTIRE DOCUMENT	1-20																		
X	US 5,178,289 A (<i>KRISHNAKUMAR et al.</i>) 12 JANUARY 1993, SEE THE ENTIRE DOCUMENT	1-20																		
Y	US 3,335,902 A (<i>JAVORIK</i>) 15 AUGUST 1967, SEE THE ENTIRE DOCUMENT	1-20																		
A	US 5,303,834 A (<i>KRISHNAKUMAR et al.</i>) 19 APRIL 1994																			
A	US 5,381,910 A (<i>SUGIURA et al.</i>) 17 JANUARY 1995																			
A	US 5,833,115 A (<i>EITEN</i>) 10 NOVEMBER 1998																			
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.																				
<table border="0"><tr><td>* Special categories of cited documents:</td><td>"T"</td><td>later document published after the international filing date or priority date and not in conflict with the application but cited to understate the principle or theory underlying the invention</td></tr><tr><td>"A" document defining the general state of the art which is not considered to be of particular relevance</td><td>"X"</td><td>document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</td></tr><tr><td>"E" earlier document published on or after the international filing date</td><td>"Y"</td><td>document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</td></tr><tr><td>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</td><td>"A"</td><td>document member of the same patent family</td></tr><tr><td>"O" document referring to an oral disclosure, use, exhibition or other means</td><td></td><td></td></tr><tr><td>"P" document published prior to the international filing date but later than the priority date claimed</td><td></td><td></td></tr></table>			* Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understate the principle or theory underlying the invention	"A" document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	"E" earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"A"	document member of the same patent family	"O" document referring to an oral disclosure, use, exhibition or other means			"P" document published prior to the international filing date but later than the priority date claimed		
* Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understate the principle or theory underlying the invention																		
"A" document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone																		
"E" earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art																		
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"A"	document member of the same patent family																		
"O" document referring to an oral disclosure, use, exhibition or other means																				
"P" document published prior to the international filing date but later than the priority date claimed																				
Date of the actual completion of the international search 09 AUGUST 2000		Date of mailing of the international search report 23 AUG 2000																		
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230		Authorized officer JOSEPH M. MOY Telephone No. (703) 308-1145 <i>Shella Vanez</i> <i>Patent Specialist</i> <i>Technology Center 5700</i>																		

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ANEXO

Referencia: Pruebas
Patente: Estructura de recipiente para eliminación de presión de vacío
Exp. No.: 05 -28.045
Solicitante: CO 2 PAC LIMITED.

Yo, MÓNICA WOLF WASSERMAN, mayor de edad, domiciliada en esta ciudad, e identificada con Cedula de Ciudadanía No. 51.711.267 de Bogotá y Tarjeta Profesional No. 46.034 expedida por el Consejo Superior de la Judicatura, actuando como apoderada de la sociedad **Plásticos desechables de Colombia Plasdecol S.A.**, por medio del presente escrito y dentro del termino legal me permito allegar las correspondientes pruebas a efectos de demostrar que la patente en mención no es una solución innovadora ni novedosa y la misma carece de nivel inventivo.

Para tal efecto, me permito adjuntar catorce (14) búsquedas realizadas en la OMPI, que obedecen a una fecha anterior a la de la patente presentada.

De acuerdo a lo anterior, respetuosamente solicito se tengan en cuenta las pruebas aportadas y que como consecuencia de ello se declare fundada la presente oposición y se niegue el registro de la patente citada en la referencia.

NOTIFICACIONES

Recibiré notificaciones ante ese Despacho o en mi oficina, Diag 83A No 23-90 de esta ciudad.

Del Señor Jefe,

Atentamente,

MÓNICA WOLF WASSERMAN
CC No. 51.711.267 de Bogotá
T.P. No. 46034 C. S. de la J.

2020
Bogotá, D.C.,

Doctor:
Álvaro Correa Ordoñez
Apoderado

Oficio N°: 9714

ASUNTO:	Radicación PCT N°	05-28045
	Trámite	011
	Evento	379
	Actuación	440
	Folios	338

Con fundamento en lo previsto por el artículo 43 de la Decisión 486 de la Comisión de la Comunidad Andina, se le comunica que la oposición presentada por la doctora Mónica Wolf Wasserman, en su calidad de apoderada de Plásticos Desechables de Colombia S.A. Plasdecol S.A., reúne los requisitos formales exigidos por la ley al momento de su presentación.

En cumplimiento de lo dispuesto en la citada norma, se le concede el término de sesenta (60) días hábiles siguientes a la fecha de notificación del presente oficio, para que haga valer sus argumentaciones y presente pruebas.

Notifíquese el presente oficio conforme a lo dispuesto en el numeral 5.2, literal e), del capítulo quinto del título primero de la Circular Única N° 10 de 2001.



ALIX CARMENZA CESPEDES DE VERGEL
Jefe de la División de Nuevas Creaciones.

10 AGO. 2007

El anterior oficio fue notificado por fijación en lista de fecha, _____.

202021



LIBRO CAPITAL
ADMINISTRATIVO