

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
29 December 2005 (29.12.2005)

PCT

(10) International Publication Number  
**WO 2005/123517 A1**

(51) International Patent Classification<sup>7</sup>: **B65D 1/02**, 79/00

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(21) International Application Number:  
PCT/EP2005/052798

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(22) International Filing Date: 16 June 2005 (16.06.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
RM2004A000293 16 June 2004 (16.06.2004) IT

(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

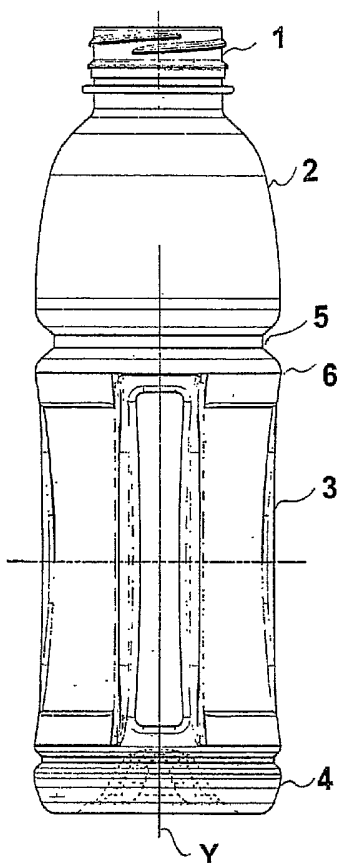
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(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH,

[Continued on next page]

(54) Title: NEW TYPE OF HOT-FILLABLE BOTTLE



(57) Abstract: A hot-fillable plastic bottle comprising a body portion (3) that has a hexagonal cross-section with three pairs of faces (7, 11), of which in each pair one face acts as a column section (7), providing greater flexural strength thanks to the incorporation of stiffening means in the form of two protuberances (8) parallel to the axis (Y), and one face acts as a panel section (11), having a shape that is capable of controllably absorbing deformations caused as a result of the reduction in internal pressure as the liquid inside the bottle cools down.

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GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**

- *with international search report*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

**Declaration under Rule 4.17:**

- *of inventorship (Rule 4.17(iv)) for US only*

*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.*

## NEW TYPE OF HOT-FILLABLE BOTTLE

Field of the invention

This invention relates to a blow-moulded plastic container, for example a bottle, in particular to a plastic bottle to be filled with non-carbonated and sugar-sweetened products.

Prior art

The production of bottles to be filled with non-carbonated and sugar-sweetened products, such as tea, juices, flavoured water, etc., may have to take into account the fact that the product is dispensed into the container while at a temperature above room temperature, up to and above 90°C, for heat-set applications. This is a means of ensuring the adequate sterilization of the product. After filling, the container is sealed or capped. As the product cools, a negative internal pressure forms within the sealed container due to the reduction in the volume of the product, as a result of the cooling process and/or due to oxygen consumption by the product. The negative internal pressure may cause the container to deform in unacceptable ways, both from an aesthetic and a performance perspective. Bottles must therefore be engineered bearing these problems in mind, in order to develop technical solutions capable of absorbing the vacuum that results from the reduction in product volume in the sealed bottle.

A first possible technical solution consists of producing a more robust bottle, by using more material to make the bottle and thus reduce the distortion caused by the vacuum. The drawbacks of this solution are that it clashes with market pressure in terms of weight limits.

Another solution consists of controlling the deformation caused by this negative internal pressure by limiting it to specific parts of the bottle. Said deformations do not occur in the parts of the bottle that have a spherical bowl shape. Said deformations mostly occur in the main part of the bottle, which is usually cylindrical in shape, called the body.

Document WO-A-0189934 proposes a solution to the problem of deformation by introducing the means to limit this phenomenon to specific parts of the bottle. This document describes a bottle comprising a neck portion, in which there is the opening; a part called the shoulder portion, the shape of which is similar to that of a spherical bowl; a main part, called the body, and finally a bottom portion that

acts as the base. The body portion of the bottle has a horizontal cross-section that is essentially oval with two axes of symmetry and has two opposing parts, called panel sections, in correspondence with the parts of the oval with the lesser curvature, and two other opposing parts, called column sections, in  
5 correspondence with the parts with a greater curvature.

The areas of the body portion with a greater curvature afford partial resistance to deformation although this still occurs in the parts with a lesser curvature, which also constitute the largest area.

Furthermore, the oval shape of the body portion of the bottle, with one part that is  
10 wider and one part that is narrower in a transverse direction along the two axes, means the bottle is not easy to handle or grip.

#### Summary of the invention

One of the main purposes of this invention is to produce a container with areas that are capable of absorbing the deformations caused as a result of the reduction  
15 in the internal pressure as the liquid in the container cools down. This is achieved by directing the deformation, caused by the vacuum, to specific areas of the bottle, so that said deformation does not greatly alter the look of the container.

This invention thus aims to achieve the results described above with a container having the characteristics set forth in claim 1.

20 The container, having a body portion with a polygonal cross-section, can be said to be divided into different areas. Some of these areas have a flexural strength that is sufficient to resist the forces that are generated as the liquid cools and are not deformed; others are capable of absorbing the vacuum by means of controlled deformation.

25 In particular, with a hexagonal shape, obtained by cutting the corners of an equilateral triangular shape, the structure of the body portion of the container has three axes of symmetry and is more able to contrast deformations due to reduced internal pressure.

Other means are also used to increase the strength of the body portion of the  
30 bottle by altering the shape thereof. The dimensions of the structural elements of the bottle may vary as required and according to the type of liquid it must contain and the type of material used to make the bottle.

The claims describe preferred embodiments of the invention.

Brief description of the drawings.

Further characteristics and advantages of this invention will become clear from the following detailed description of a preferred, but not exclusive, embodiment of the invention that is merely illustrative and not limitative, with the help of the drawings

5 that are attached hereto, in which:

Fig.1 is a side view of a container according to this invention;

Fig.2 is a longitudinal section of a container according to this invention;

Fig.3 is a cross-section of a container according to this invention.

Detailed description of preferred embodiments of the invention

10 In this description, unless otherwise specified, cross-section means a section along a plane that is perpendicular to the longitudinal axis Y in Fig. 1, and longitudinal section means a section along a plane that contains said axis Y.

The bottle according to this invention has a body portion that is essentially polygonal in cross-section. Said polygon may, for instance, be obtained from a quadrangular shape by cutting off the corners. The corners are cut and replaced  
15 by faces that are essentially cylindrical in shape and either have a large radius or are flat. The cross-section of the body portion is thus octagonal. Figures 1 to 3 illustrate a configuration with a hexagonal cross-section. This was obtained by starting with a triangular shape and cutting off the corners.

20 With reference to Figure 1, a bottle is illustrated, said bottle having a longitudinal axis Y that, when the bottle is in the upright position, coincides with the vertical axis. Starting from the top and working down, the bottle has a neck portion 1 that is essentially cylindrical, delimited at the top by the mouth of the bottle. Beneath the lower part of said neck portion 1, there is a shoulder portion 2, having an  
25 essentially conical shape and becoming wider at the bottom, the generatrix preferably having a curved shape. The lower part of the shoulder portion 2 has a bigger cross-section and extends downwards into the body portion 3 of the bottle, which is usually elongated. The body portion 3 terminates in the bottom portion 4 of the bottle, which acts as the base thereof. Between the shoulder portion 2 and  
30 the body portion 3 the outer surface of the bottle is advantageously but not necessarily provided with a circular groove 5 beneath which there is a circular protuberance or rib 6 that is joined to the body 3 of the bottle. There may be several grooves to increase the stiffness of the bottle.

As illustrated in Figure 3, the body portion 3 of the bottle has an essentially hexagonal shape in cross-section, obtained by cutting off the corners of a triangle, preferably an equilateral triangle.

The hexagonal plan of the body portion 3 of the bottle is made up of three pairs of  
5 faces 7, 11. The faces 7, called column sections, have sufficient flexural strength  
to resist the forces generated as the liquid cools down and/or as the liquid  
consumes the oxygen inside the bottle, while the faces 11, called panel sections,  
are shaped so as to be capable of controllably accommodating the deformation  
caused as a result of the reduction in pressure inside the container. The column  
10 sections 7, in correspondence with the corners of the original triangle shape, are  
usually smaller in size than the panel sections 11 but they may also be the same  
size, in which case the cross-section that is obtained is in the shape of a regular  
polygon. Each column section is provided with two longitudinal protuberances or  
ribs 8, having the shape of a portion of circumference in plan, joined by an  
15 intermediate part 9, called a depression. This specific configuration is designed to  
stiffen the actual column section. Other configurations with flexural stiffening  
means are possible. The depression 9 lies inside the ideal envelope plane through  
which the longitudinal protuberances 8 pass. Said recess may have a depth, in  
cross-section, of between approximately 0.2 mm and approximately 5 mm. The  
20 profile of the depression 9, in the longitudinal or vertical section, may be flat or  
concave. If the profile is concave said profile may be recessed by between 0 mm  
and 7 mm in relation to the circular protuberance 6. In another advantageous  
alternative embodiment, the profile of the depression 9 may also be flat or  
concave also in the cross-section in relation to the longitudinal axis Y.

25 At the sides of each column section 7 there are two lateral channels 10 that  
extend, longitudinally, along the entire length of the actual column section.

The panel sections 11 of the body portion of the bottle are joined to the column  
sections 7 in correspondence with the sides of the original triangle. The panel  
sections 11 may be flat or curved. If curved, they may comprise surfaces curved in  
30 two planes. Figure 3 illustrates the panel sections 11 with a surface that is convex  
in a transverse direction. Figure 2 illustrates these with a surface that is concave  
in a longitudinal direction. In cross-section said profiles have a convexity of

between 0 mm and 10 mm. In longitudinal section the concavity is between 0 mm and 25 mm.

The specific embodiments described in this document are not limitative and this patent application covers all the alternative embodiments of the invention as set

5 forth in the claims.

References

neck portion **1**

shoulder portion **2**

body portion **3**

10 bottom portion **4**

circular groove **5**

circular protuberance (or rib) **6**

column sections **7**

longitudinal protuberance (or rib) **8**

15 depression **9**

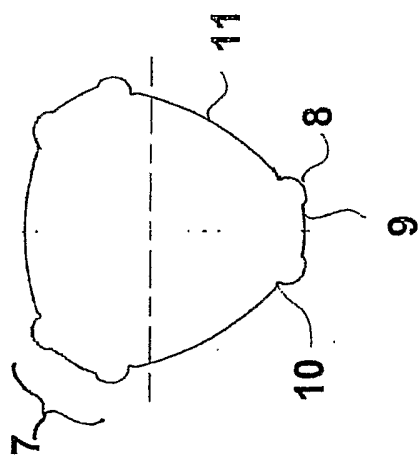
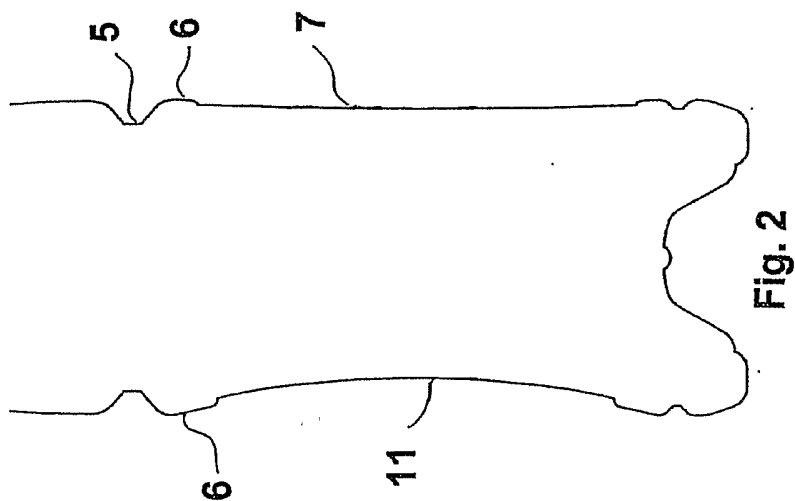
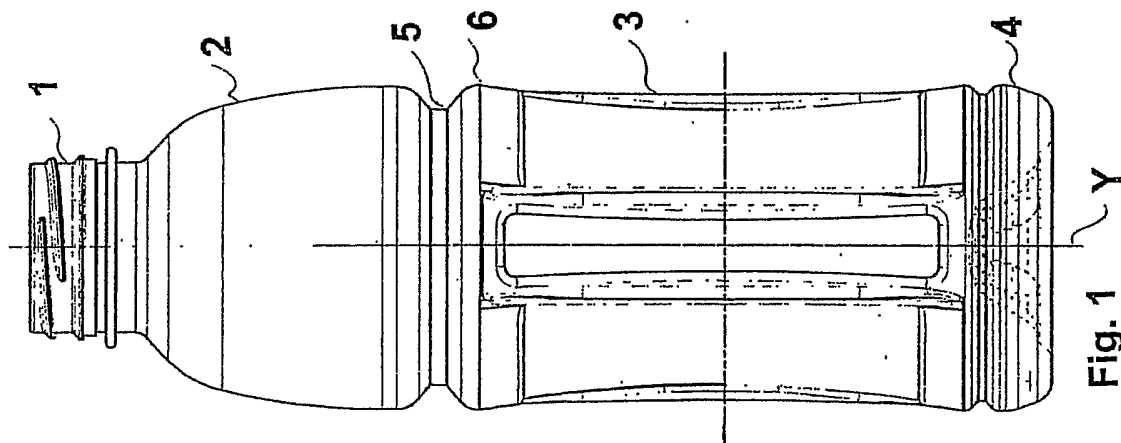
lateral channel **10**

panel section **11**

longitudinal axis **y**

## CLAIMS

1. Plastic container for fluids having a body portion (3), defining a longitudinal axis (Y), characterized in that it has a section, on a plane transversal to the longitudinal axis (Y), having a polygonal shape with a plurality of pairs of faces (7, 11), a first face, called the column section (7), having a substantial flexural strength and the other face, called the panel section (11), having a shape that is capable of controllably absorbing deformations caused by a reduction in internal pressure due, in particular, to the cooling of a fluid.
2. Plastic container, in particular according to claim 1, in which said section, perpendicular to the longitudinal axis (Y), is essentially hexagonal in shape.
3. Plastic container according to one of the previous claims in which said column sections (7) are provided with stiffening means (8).
4. Plastic container according to one of the previous claims in which said stiffening means comprise at least two protuberances (8) essentially parallel to the longitudinal axis (Y), having the shape of a portion of circumference in plan, joined by an intermediate part (9) called a depression.
5. Plastic container according to one of the previous claims in which the surface of the depression (9) is flat on a plane transversal to the longitudinal axis (Y).
6. Plastic container according to one of the previous claims in which the surface of the depression (9) is concave on a plane transversal to the longitudinal axis (Y).
7. Plastic container according to one of the previous claims in which said panel sections (11) have flat surfaces.
8. Plastic container according to one of the previous claims in which said panel sections (11) have curved surfaces.
9. Plastic container according to one of the previous claims in which said panel sections (11) have a convexly curved shape in the transverse direction and a concavely curved shape in the longitudinal direction.



# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/EP2005/052798

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC 7 B65D1/02 B65D79/00				
According to International Patent Classification (IPC) or to both national classification and IPC				
<b>B. FIELDS SEARCHED</b>				
Minimum documentation searched (classification system followed by classification symbols) 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				
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>				
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
X	WO 00/68095 A (GRAHAM PACKAGING CY) 16 November 2000 (2000-11-16) page 5, line 2 - page 6, line 28 page 7, line 13 - page 8, line 11; figures 1-4	1,3,8		
X	US 2001/030166 A1 (OZAWA) 18 October 2001 (2001-10-18) paragraph '0016! - paragraph '0036!; figures 1-3	1,7,8		
X	US 2001/035392 A1 (OTA) 1 November 2001 (2001-11-01) the whole document	1,7		
X	US 3 923 178 A (WELKER) 2 December 1975 (1975-12-02) the whole document	1,7		
<input type="checkbox"/> Further documents are listed in the continuation of box C.				
<input checked="" type="checkbox"/> Patent family members are listed in annex.				
° Special categories of cited documents :				
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;">                     *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                      *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 style="width: 50%; border: none; vertical-align: top;">                     *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.                      *&amp;* document member of the same patent family                 </td> </tr> </table>			*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 *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
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Date of the actual completion of the international search  <p style="text-align: center;">29 September 2005</p>	Date of mailing of the international search report  <p style="text-align: center;">31/10/2005</p>			
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer  <p style="text-align: center;">SERRANO GALARRAGA, J</p>			

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PCT/EP2005/052798

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