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(71) Applicant: **Suntory Holdings Limited**
Kita-ku
Osaka-shi
Osaka 530-8203 (JP)

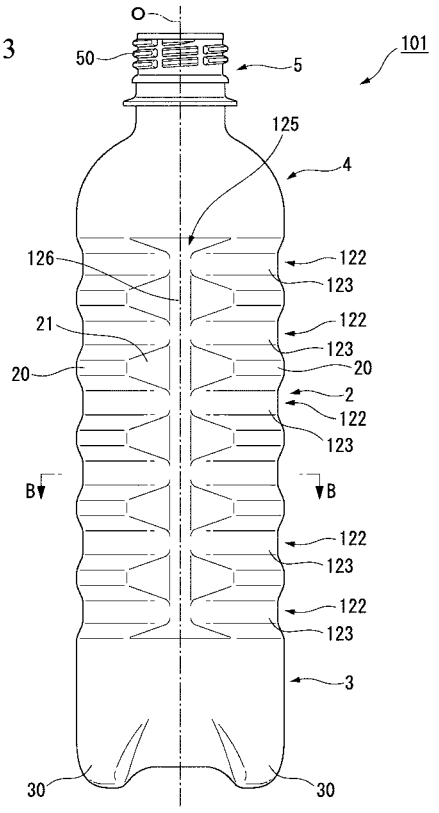
(72) Inventors:
- **MINAKUCHI Yoji**
Tokyo 135-8631 (JP)
- **MATSUDA Keishi**
Tokyo 135-8631 (JP)
- **IMAI Hiroaki**
Tokyo 136-8531 (JP)
- **SUZUKI Takanori**
Tokyo 136-8531 (JP)

(74) Representative: **Read, Matthew Charles et al**
Venner Shipley LLP
200 Aldersgate
London
EC1A 4HD (GB)

(54) **BOTTLE AND BOTTLE HAVING CONTENT**

(57) In a bottle (1) with a bottomed cylindrical shape including a body portion (2) having an approximately square cross section, a plurality of concave lateral ribs (122) extending in a periphery direction of the bottle are formed on the body portion with intervals interposed therebetween in an axial direction of the bottle, an innermost portion (123) of the lateral rib recessed to the interior of the body portion in a diameter direction is formed to have a circular cross section, and, in the body portion, a concave longitudinal rib (125) extending in the axial direction is formed on body portion surfaces (21) formed between four corner portions (20) of the body portion.

FIG. 3



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Description

Technical Field

[0001] The present invention relates to a bottle and a bottle having content. Priority is claimed on Japanese Patent Application No. 2009-296072, filed December 25, 2009, the content of which is incorporated herein by reference.

Background Art

[0002] In the related art, as this type of bottle, a positive-pressure bottle is known which has a positive pressure in the bottle as disclosed in Patent Document 1. Since carbonated drink is contained, or nitrogen gas is sealed together with the content in the positive-pressure bottle, for example, the content is sealed in the bottle in a state where the internal pressure of the bottle is higher than the atmospheric pressure. In such a positive-pressure bottle, a positive-pressure bottle having a circular cross section of a body portion is generally used to suppress a deformation (particularly, a deformation of swelling to the exterior of the body portion) caused by an increase of the internal pressure of the bottle.

[0003] On the other hand, with a demand for a variety of design, a positive-pressure bottle is recently proposed which has an elliptical or a rectangular cross section of the body portion as disclosed in the Patent Document 2 and Patent Document 3 below. In addition, a positive-pressure bottle is proposed which has concave-convex shaped lateral ribs in a periphery direction to improve performance of pressure resistance.

Citation List

Patent Document

[0004]

[Patent Document 1] Japanese Unexamined Patent Application, First Publication No. 10-264917
[Patent Document 2] Japanese Unexamined Patent Application, First Publication No. 2008-265838
[Patent Document 3] Japanese Unexamined Patent Application, First Publication No. 2008-7147

Summary of Invention

Problems to be solved by the Invention

[0005] However, when a shape of the cross section of the body portion regarding the positive-pressure bottle is formed in a non-circular shape (for example, square shape), the appearance configuration of the body portion may not be kept because of a deformation which is caused by the internal pressure of the bottle. For example, in a square bottle having a square cross section of a body portion, the four corner portions of the body portion are difficult to be deformed. Thus, if the internal pressure of the bottle acts, stress concentrates to body portion surfaces (particularly a center portion in a width direction) positioned between adjacent corner portions. Then, in a cross section of the body portion, the deformation amount caused by the internal pressure of the bottle to the exterior of the body portion in a diameter direction becomes maximum in the center portions of the body portion surfaces in the width direction (lateral direction), and it gradually becomes small toward the corner portions from the center portions. As a result, even if the body portion of the positive-pressure bottle is formed in a square shape, when the internal positive pressure of the bottle acts, the center portions of each body portion surface may swell to the exterior in the diameter direction and the cross section of the body portion may be formed in a circular shape or in an elliptic shape.

[0006] Further, even if the lateral ribs described above are formed on the square body portion of the positive-pressure bottle, in the lateral ribs with the innermost portion thereof (portion positioned innermost side in the diameter direction) having a square cross section, a deformation amount by the internal pressure of the bottle to the exterior in the diameter direction in the cross section of the lateral ribs becomes maximum in the center portions of each side, and it gradually becomes small toward the corner portions from the center portions. Thus, the deformation in the center portions of the body portion surfaces is not sufficiently suppressed so that the appearance configuration of the bottle may not be kept in a square shape.

[0007] The present invention has been made to address the aforementioned conventional problems and an object thereof is to provide a bottle and a bottle having content capable of keeping an appearance configuration of a body portion in a square shape, even if an internal pressure of the bottle becomes positive.

Means for Solving the Problem

[0008] A bottle according to the present invention is a bottle with a bottomed cylindrical shape including a body portion having an approximately square cross section. A plurality of concave lateral ribs extending in a periphery direction of the bottle are formed on the body portion with intervals interposed therebetween in an axial direction of the bottle. An innermost portion of the lateral rib recessed to the interior of the body portion in a diameter direction is formed to have a circular cross section. A concave longitudinal rib extending in the axial direction is formed on body portion surfaces formed between four corner portions of the body portion.

A bottle having content according to the present invention is a bottle having content in which content is hermetically sealed. The bottle is the bottle described in the present invention, and an internal pressure of the bottle is higher than the atmospheric pressure.

[0009] In the bottle according to the present invention, the innermost portion of the lateral rib has a circular cross section. Thus, when the internal pressure of the bottle becomes positive pressure, the lateral rib is slightly deformed over the entire periphery uniformly. That is, in the bottle according to the present invention, the deformation amount of the lateral rib which is a circular cross section of the innermost portion is small compared to the maximum deformation amount (deformation amount in the center portions of each side) of the lateral rib having a square cross section of the innermost portion. Accordingly, the deformation caused by the internal pressure of the bottle in each body portion surface of the body portion having the approximately square cross section is effectively suppressed by the lateral rib described above. In addition, the swell deformation on the body portion surface of the body portion in the diameter direction is suppressed by the longitudinal rib.

[0010] In addition, in the bottle according to the present invention, it is preferable that the four corner portions of the body portion are formed to have a convex arc shaped cross section to the exterior of the body portion in the diameter direction.

Accordingly, the stress concentration to the body portion surface of the body portion is relaxed, and the deformation amount in the center portions of each body portion surface of the body portion is suppressed in the cross section of the body portion. The difference between the deformation amount of the corner portions of the body portion and the deformation amount of the center portions of each body portion surface of the body portion becomes small.

[0011] In addition, in the bottle having content according to the present invention, the internal pressure of the bottle may be from 0.2 Mpa to 0.8 MPa.

As a result, the aforementioned effect can be achieved effectively.

Effects of the Invention

[0012] According to the bottle and the bottle having content according to the present invention, the deformation in the center portions of each body portion surface of the body portion having the approximately square cross section is effectively suppressed by the lateral rib having the circular cross section of the innermost portion. Therefore, even if the internal pressure of the bottle becomes positive pressure, the appearance configuration of the body portion can be kept in a square shape.

Brief Description of Drawings

[0013]

FIG. 1 is a side view of a bottle.

FIG. 2 is a cross sectional view taken along a line A-A shown in FIG. 1.

FIG. 3 is a side view of a bottle.

FIG. 4 is a cross sectional view taken along a line B-B shown in FIG. 3.

Description of Embodiments

[0014] First, a bottle 1 shown in FIGS. 1 and 2 will be described.

A dashed line O shown in FIG. 1 indicates a central axis line of the bottle 1 and hereinafter is referred to as "axis line O". A direction along the axis line O is referred to as an "axial direction", a direction perpendicular to the axis line O is referred to as a "diameter direction", and a direction around the axis line O is referred to as a "periphery direction". In addition, a mouth portion 5 side (upper side of the FIG. 1) in the axial direction is referred to as an "upper side", and the opposite side, that is, a bottom portion 3 side (lower side of the FIG. 1) in the axial direction is referred to as a "lower side".

[0015] The bottle 1 shown in FIG. 1 is a bottomed cylindrical container which contains content, and is a square bottle which is approximately square (comer portions is an arc shape) when seen from the top of the bottle. The bottle 1 is a member made of a resin configured of a synthetic resin such as polyethylene terephthalate (PET). Moreover, the bottle 1 is formed as a result of blow molding of a preform (not shown) which is formed by an injection molding.

Specifically, as shown in FIG. 1, the bottle 1 includes a cylindrical body portion 2 having an approximately square shape extending along the axis line O, a bottom portion 3 continuously formed at the lower end of the body portion 2, shoulder portion 4 continuously formed at the upper end of the body portion 2, and the mouth portion 5 formed erect at the upper end of the shoulder portion 4. The body portion 2, the bottom portion 3, the shoulder portion 4 and the mouth portion 5 are connected to each other and formed integrally.

[0016] As shown in FIGS. 1 and 2, the body portion 2 is a cylinder having an approximately square cross section and extends along the axial direction with the axis line O as a central axis line. That is, the body portion 2 includes corner portions 20 of four corners of the body portion 2 extending in the axial direction and four body portion surfaces 21 formed between the adjacent corner portions 20 and 20. The corner portions 20 of four corners of the body portion 2 are formed respectively to have a convex arc shape at a cross section of the body portion 2 to the exterior in the diameter direction. Moreover, the four body portion surfaces 21 are formed in a similar manner, respectively.

[0017] In addition, a plurality of concave lateral ribs 22 extending in a periphery direction of the bottle are formed on the body portion 2 in the axial direction of the body portion 2 with intervals interposed therebetween. The intervals are preferred to be equally spaced. The lateral ribs 22 are annular concave grooves recessed to the interior in the diameter direction and extending over the entire periphery. In addition, the cross section of the in-

nermost portion 23 of the lateral rib 22 is formed in circular. The outer diameter of the innermost portion 23 of the lateral rib 22 is same as the outer diameter of the center portion 24 of the body portion surface 21 of the body portion 2 in the width direction (lateral direction). Moreover, the outer surface of the innermost portion 23 of the lateral rib 22 is formed in the same surface as the outer surface of the center portion 24 of the body portion surface 21 of the body portion 2. That is, the lateral rib 22 has a cross section recessed to the interior in the diameter direction in the four corner portions of the body portion 2. A groove depth (amount of the recess) of the lateral rib 22 is maximum in the center portion of the corner portions 20 of the body portion 2, and gradually becomes small toward the center portion 24 of the body portion surface 21 from the center portion of the corner portions 20.

[0018] The bottom portion 3 is a bottomed cylinder having an approximately square cross section. Foot portions 30 swelling to lower side in the axial direction is respectively formed on the four corner portions of the lower end portion of the bottom portion 3.

The shoulder portion 4 is a tapered cylinder which has an approximately square cross section and of which the diameter decreases gradually toward the upper side. In addition, a longitudinal section of the shoulder portion 4 is formed in a convex arc shape to the exterior of the bottle.

The mouth portion 5 is an approximately circular cylinder projected to the upper side in the axial direction with the axis line O as the center axis line. An external screw 50 is formed on the outer periphery surface of the mouth portion 5 to screw a cap (not shown).

[0019] Next, the action of the bottle 1 of the above configuration will be described.

[0020] After the carbonated drink is filled or the nitrogen gas is sealed with the content in the bottle 1 described above, when the cap (not shown) is mounted on the mouth portion 5, the bottle having content hermetically sealed in the bottle 1 is obtained. At this time, the internal pressure of the bottle 1 increases higher than the atmosphere and becomes a positive pressure (for example, from 0.2 Mpa to 0.8 MPa). Then, the pressure (internal pressure) is applied to the body portion 2 of the bottle 1 from the interior of the body portion 2 to the exterior in the diameter direction. At that time, a swell deformation of the body portion surfaces 21 of the body portion 2 having an approximately square cross section to the exterior in the diameter direction is suppressed by the lateral rib 22. In particular, since the cross section of the innermost portion 23 of the lateral rib 22 is circular shape, the deformation in the lateral rib 22 is suppressed by the small pressure which is applied to the entire periphery of the lateral ribs 22 uniformly. Therefore, the deformation in the body portion surfaces 21 caused by the internal pressure of the bottle is effectively suppressed by the lateral rib 22 and the deformation amount of the center portion 24 of the body portion surface 21 becomes small.

[0021] In addition, the corner portions 20 of four corners of the body portion 2 described above has a convex arc shaped cross section to the exterior of the body portion 2 in the diameter direction. Thus, when the positive internal pressure is applied to the body portion 2, the stress concentration to the body portion surface 21 is reduced. As a result, the deformation amount of the center portion 24 of the body portion surfaces 21 is suppressed. Moreover, the difference between the deformation amount of the corner portions 20 of the body portion 2 and the deformation amount of the center portion 24 of each body portion surface 21 of the body portion 2 becomes small.

[0022] According to the bottle 1 described above, the deformation of the center portion 24 of the body portion surfaces 21 of the body portion 2 having an approximately square cross section is effectively suppressed by the lateral ribs 22 having a circular cross section of the innermost portion 23. Thus, even if the internal pressure of the bottle becomes positive pressure, the appearance configuration of the body portion 2 is kept in a square shape.

[0023] Further, since the corner portions 20 of four corners of the body portion 2 are formed in an arc shape, the deformation amount of the center portion 24 of the body portion surfaces 21 is suppressed. Accordingly, even if the large positive internal pressure is applied to the body portion 2, the appearance configuration of the body portion 2 is reliably kept in a square shape.

Moreover, the aforementioned effect is effectively achieved when the internal pressure of the bottle 1 of the bottle having content is from 0.2 MPa to 0.8 MPa.

[0024] Next, a bottle 101 shown in FIGS. 3 and 4 will be described.

The same configurations of the bottle 1 shown in FIGS. 1 and 2 described above are represented by the same reference numerals and the description thereof will be omitted.

[0025] As shown in FIGS. 3 and 4, a plurality of concave lateral ribs 122 extending in a periphery direction of the bottle are formed on a body portion 2 with intervals interposed therebetween in the axial direction of the body portion 2. In addition, a concave longitudinal rib 125 extending in the axial direction of the body portion 2 is formed on the body portion 2.

[0026] The lateral ribs 122 are annular concave grooves recessed to the interior in the diameter direction and extending over the entire periphery. In addition, the cross section of the innermost portion 123 of the lateral rib 122 is formed in a circular. The innermost portion 123 of the lateral rib 122 is formed further to the inner side than the outer surface of body portion surfaces 21 in the diameter direction over the entire periphery.

[0027] A longitudinal rib 125 is a linear concave groove recessed to the interior in the diameter direction and extending along the axial direction. The longitudinal rib 125 is arranged at the center portion of the body portion surface 21 in a width direction. The longitudinal ribs 125 are

formed to be extended from the upper end of the body portion 2 (lower end of a shoulder portion 4) to the lower end of the body portion 2 (upper end of the bottom portion 3), and are formed on the four body portion surfaces 21 of the body portion 2, respectively. Further, the outer surface of the innermost portion 126 of the longitudinal rib 125 is positioned on the same plane as the outer surface of the innermost portion 123 of the lateral rib 122, at an intersecting portion with the lateral rib 122.

[0028] In the bottle 101 described above, the longitudinal ribs 125 are formed on the body portion surfaces 21 of the body portion 2. Thus, when the positive internal pressure is applied to the body portion surfaces 21 from the interior of the body portion 2, the deformation of the body portion surfaces 21 in the diameter direction is suppressed by the longitudinal ribs 125. As a result, even if the large positive internal pressure is applied to the body portion 2, the appearance configuration of the body portion 2 is reliably kept in a square shape.

[0029] Next, a verification test of the effect described above will be described.

The bottle 1 shown in FIGS. 1 and 2 is employed as a Comparative Example, the bottle 101 shown in FIGS. 3 and 4 is employed as an Example, and a bottle with no lateral ribs 22 on the body portion 2 in the bottle 1 of the Comparative Example is employed as a Conventional Example. Each bottle of the Comparative Example, the Example, and the Conventional Example are set to the size capable of filling content of 500 ml.

Then, an increasing rate of the outer diameter of the center portion of the body portion surface in the width direction (hereinafter, referred to as a front diameter change) and an increasing rate of the content volume of the bottle (hereinafter referred to as the volume change), when applying positive internal pressure of 0.5 Mpa to each bottle, are calculated by simulation.

As a result, the front diameter change in the Comparative Example was 4.0% (29.9% over the Conventional Example) and the front diameter change in the Example was 1.5% (11.2% over the Conventional Example) whereas the front diameter change in the Conventional Example was 13.4%. That is, it is confirmed that the front diameter changes in the bottles of Comparative Example and the Example are decreased compared to that in the bottle of the Conventional Example.

Further, the volume change in the Comparative Example was 3.8% (56.7% over the conventional example) and the volume change in the Example was 4.9% (73.1% over the conventional example) whereas the volume change in the Conventional Example was 6.7%. That is, it is confirmed that the volume changes in the bottles of the Comparative Example and the Example are suppressed compared to that in the bottle of the Conventional Example.

[0030] So far, the bottle 1 shown in FIGS. 1 and 2 and the bottle 101 shown in FIGS. 3 and 4 has been described, however the present invention is not limited to the above-described embodiments and may be modified without departing from the spirit of the invention.

For example, the outer surface of the innermost portion 23 of the lateral rib 22 and the outer surface of the center portion 24 of the body portion surface 21 of the body portion 2 are positioned on the same surface, in the bottle 1 shown in FIGS. 1 and 2 described above. However, in the present invention, the outer surface of the innermost portion 23 of the lateral rib 22 is positioned inner side than the outer surface of the center portion 24 of the body portion surface 21 of the body portion 2 in the diameter direction, and the lateral rib 22 may be formed to be recessed over the entire periphery of the bottle.

[0031] In addition, the longitudinal ribs 125 is arranged on the center portion of the body portion surfaces 21 in the width direction, in the bottle 101 shown in FIGS. 3 and 4 described above. However, in the present invention, the longitudinal ribs 125 may be formed on the position other than the center portion of the body portion surfaces 21 in the width direction. For example, in the present invention, the longitudinal ribs may be formed on both sides of the center portion of the body portion surfaces 21 in the width direction, respectively.

[0032] Further, the longitudinal ribs 125 are extended from the upper end of the body portion 2 (lower end of the shoulder portion 4) to the lower end of the body portion 2 (upper end of the bottom portion 3), in the bottle 101 shown in FIGS. 3 and 4 described above. However, the length of the longitudinal ribs 125 may be modified appropriately and longitudinal ribs may be formed only on a part of the body portion 2 in the axial direction. Alternatively, the upper end of the longitudinal ribs may be extended to the outer periphery surface of the shoulder portion 4. The lower end of the longitudinal ribs may also be extended to the outer periphery surface of the bottom portion 3. For example, if the upper end of the longitudinal rib is extended to the outer periphery surface of the shoulder portion 4 and the lower end of the longitudinal rib is extended to the outer periphery surface of the bottom portion 3, when the positive internal pressure is applied to the body portion 2, the deformation to the exterior of the body portion surface 21 in the diameter direction may further suppressed. The appearance configuration of the body portion 2 is reliably kept in a square shape.

[0033] Furthermore, the constituent elements in the embodiments described above may be appropriately changed to the well-known constituent elements without departing from the spirit of the present invention. In addition, the modification examples described above may be appropriately combined.

Industrial Applicability

[0034] In the bottle and the bottle having content according to the present invention, the deformation of the center portion of each body portion surface of the body portion having an approximately square cross section is effectively suppressed by the lateral rib having a circular cross section of the innermost portion. Therefore, accord-

ing to the bottle and the bottle having content of the present invention, even if the internal pressure of the bottle becomes positive pressure, the appearance configuration of the body portion can be kept in a square shape.

Reference Signs List

[0035]

1: bottle

2: body portion

20: corner portion

21: body portion surface

22: lateral rib

23: innermost portion

101: bottle

122: lateral rib

123: innermost portion

125: longitudinal rib

Claims

1. A bottle with a bottomed cylindrical shape comprising a body portion having an approximately square cross section,
wherein a plurality of concave lateral ribs extending in a periphery direction of the bottle are formed on the body portion with intervals interposed therebetween in an axial direction of the bottle,
an innermost portion of the lateral rib recessed to the interior of the body portion in a diameter direction is formed to have a circular cross section, and
in the body portion, a concave longitudinal rib extending in the axial direction is formed on body portion surfaces formed between corner portions of four corners of the body portion.

2. The bottle according to Claim 1,
wherein the corner portions of the four corners of the body portion are formed to have a convex arc shaped cross section to the exterior of the body portion in the diameter direction.

3. A bottle having content in which content is hermetically sealed,
wherein the bottle is the bottle according to Claim 1 or 2, and an internal pressure of the bottle is higher than the atmospheric pressure.

4. The bottle having content according to Claim 3, wherein the internal pressure of the bottle is from 0.2 Mpa to 0.8 MPa.

FIG. 1

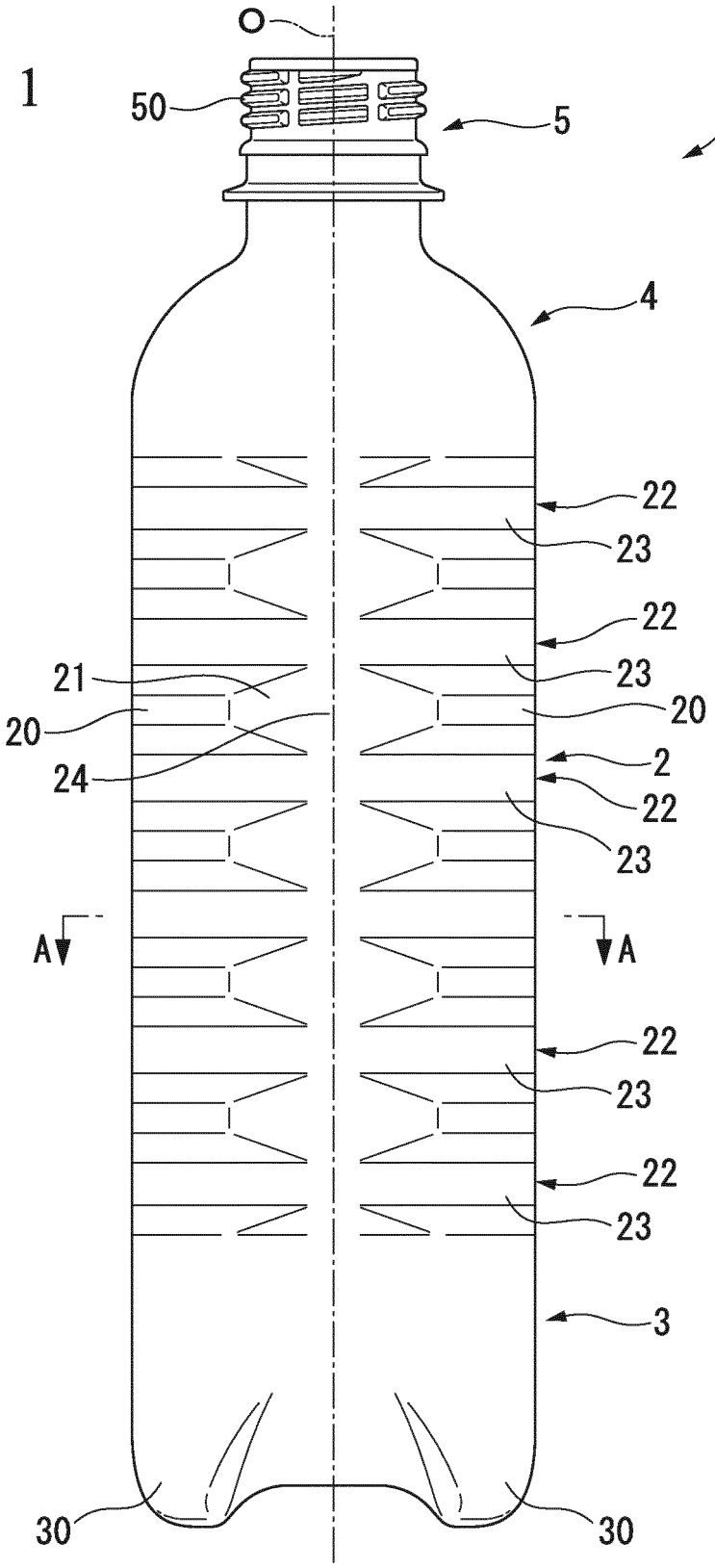

FIG. 2

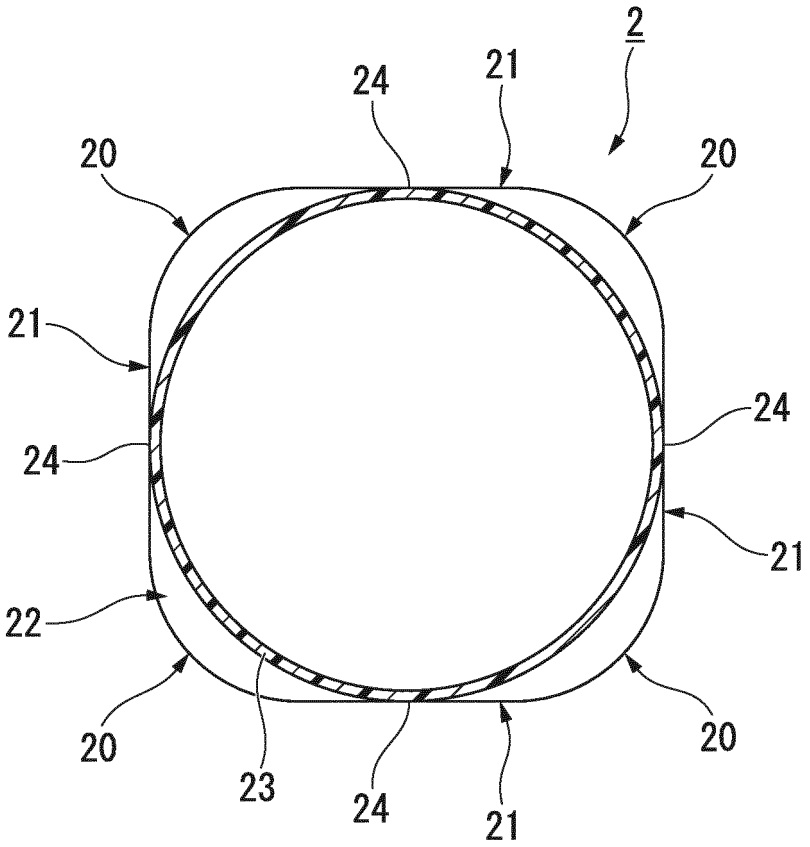

FIG. 3

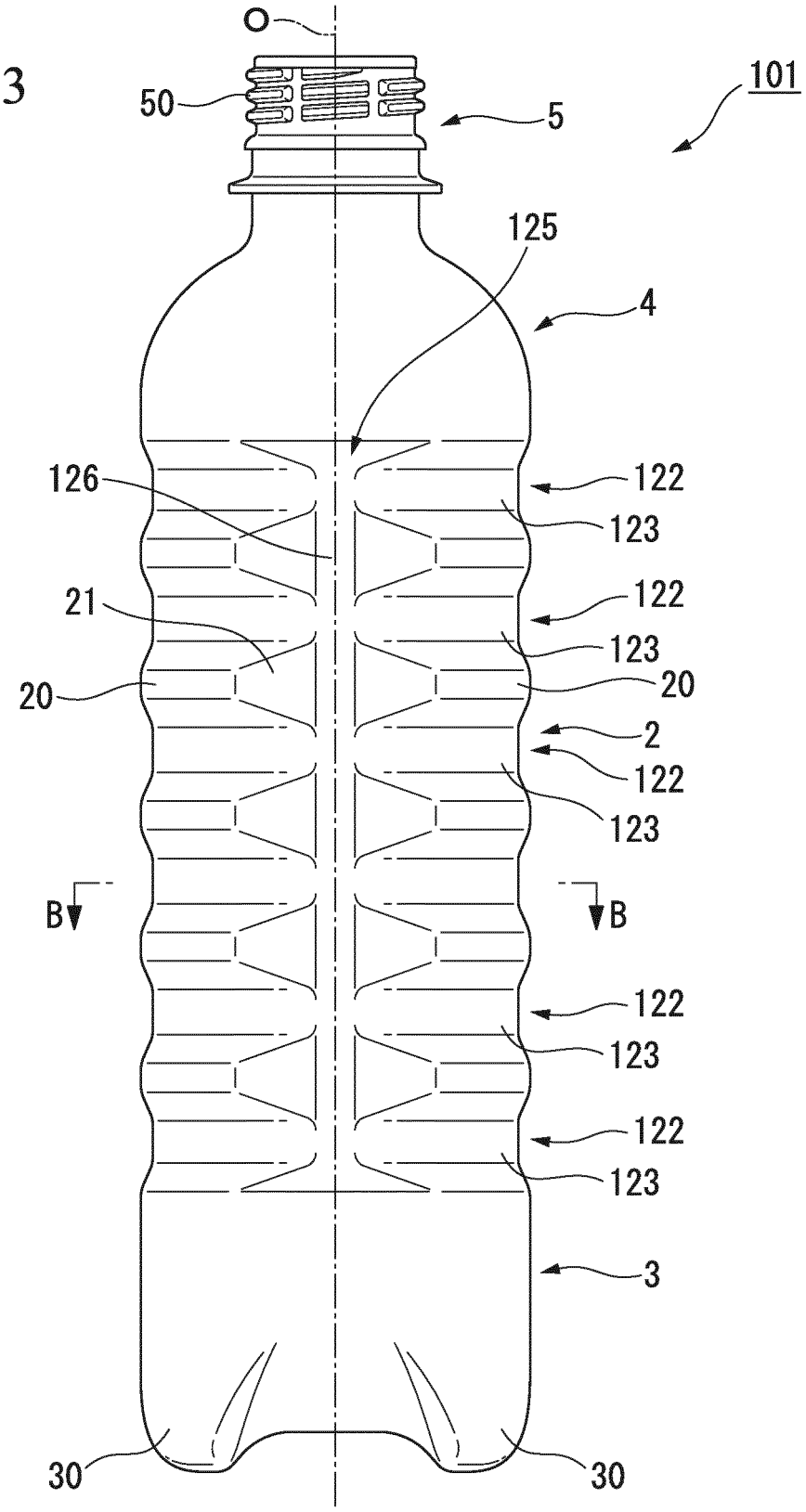
O
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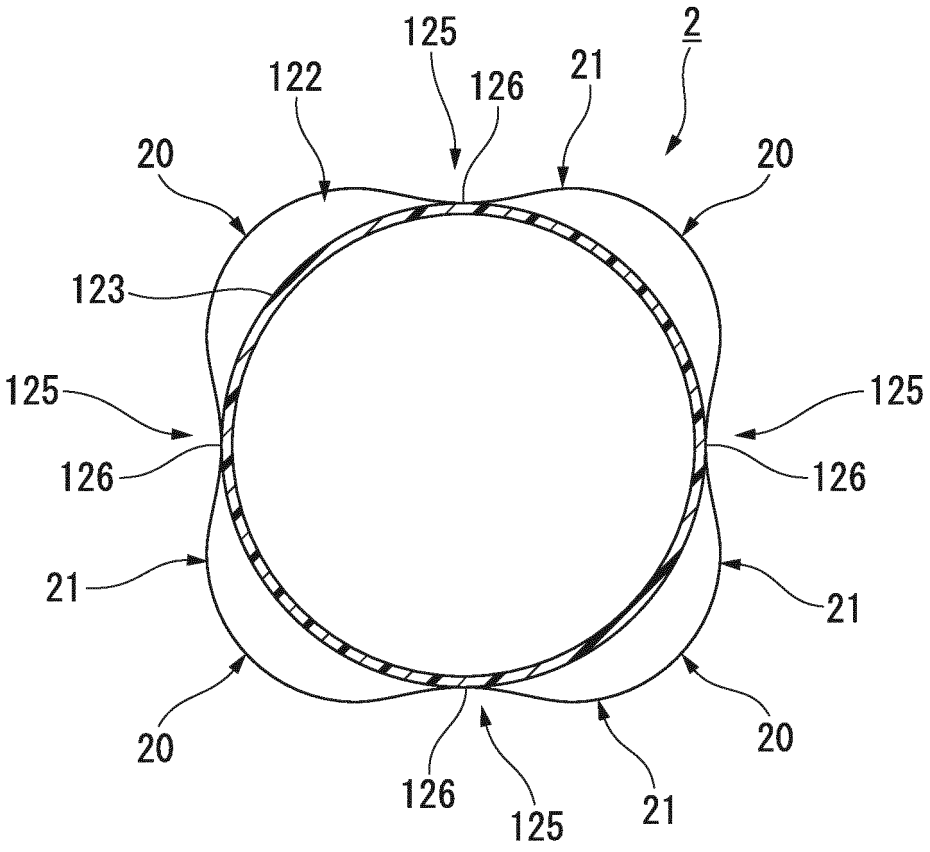
FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2010/073223

A. CLASSIFICATION OF SUBJECT MATTER
B65D1/02(2006.01)i

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)
B65D1/00-1/48

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2011
Kokai Jitsuyo Shinan Koho 1971-2011 Toroku Jitsuyo Shinan Koho 1994-2011

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.
Y	JP 2008-007147 A (Frontier, Inc.), 17 January 2008 (17.01.2008), paragraphs [0016] to [0025], [0029]; fig. 1 to 2 (Family: none)	1-4
Y	JP 2007-290762 A (Yoshino Kogyosho Co., Ltd.), 08 November 2007 (08.11.2007), paragraphs [0032] to [0033]; fig. 1, 4 to 5, 7 (Family: none)	1-4
A	JP 07-021510 U (Toyo Seikan Kaisha, Ltd.), 18 April 1995 (18.04.1995), (Family: none)	1-4

☒ 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
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"P" document published prior to the international filing date but later than the priority date claimed
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"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
03 March, 2011 (03.03.11)	15 March, 2011 (15.03.11)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2010/073223

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2009/028571 A1 (Toyo Seikan Kaisha, Ltd.), 05 March 2009 (05.03.2009), & US 2010/0163515 A & CN 101790482 A & KR 10-2010-0049559 A	1-4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2009296072 A **[0001]**
- JP 10264917 A **[0004]**
- JP 2008265838 A **[0004]**
- JP 2008007147 A **[0004]**