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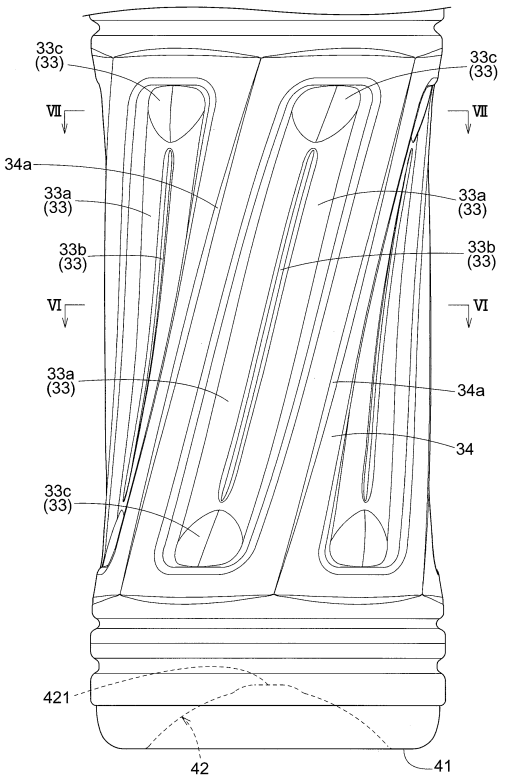
(54) **PLASTIC BOTTLE**

(57) A plastic bottle comprises: a body portion provided with a reduced pressure absorbing panel portion 33 and a body portion reference surface 34, wherein the reduced pressure absorbing panel portion 33 extends in an up-down direction of the body portion and is twisted in shape in a circumferential direction of the bottle with a central axis of the bottle as a center, a first depression 33a is in a direction from the body portion reference surface 34 toward inside the bottle, a second depression 33b is present at a circumferential center of the first depression 33a and is in a direction from the first depression 33a further inwardly, protrusions 33c are present respectively at opposite ends of the first depression 33a in the up-down direction and are each in a form of a curved surface that protrudes from the first depression 33a outwardly, and each of the protrusions 33c has a dimension in the up-down direction which dimension is smallest at circumferentially opposite ends and largest at a central portion.

Fig.5



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Description

Technical Field

[0001] The present invention relates to a plastic bottle including a body portion having at least one reduced pressure absorbing panel portion and a body portion reference surface surrounding the reduced pressure absorbing panel portion.

Background Art

[0002] During a process of producing a plastic bottle filled with a beverage, the plastic bottle may become filled with a heated beverage (so-called high-temperature filling). In such a case, after a plastic bottle becomes filled with a high-temperature beverage, and the mouth portion is then closed with a cap or the like, the internal pressure decreases as the beverage cools down. This may cause the plastic bottle to become disadvantageously depressed. To prevent such a disadvantage, a plastic bottle typically includes a body portion having a reduced pressure absorbing panel.

[0003] Patent Literature 1, for example, discloses a plastic bottle having (i) reduced pressure absorbing walls each formed of an inclined panel that is inclined relative to the axis of the plastic bottle and (ii) pillar walls arranged alternately with the reduced pressure absorbing walls. The plastic bottle not only has a reduced pressure absorbing function, but also is capable of being shaped easily by blow molding and withstanding an external impact force.

Citation List

Patent Literature

[0004] Patent Literature 1 Japanese Unexamined Patent Application Publication, *Tokukai,* No. 2013-95428

Summary of Invention

Technical Problem

[0005] The reduced pressure absorbing portion of the plastic bottle of Patent Literature 1 involves such strength issues as follows: The reduced pressure absorbing portion is easily depressed due to shrinkage (so-called shrink mark) when the bottle is molded and is easily deformable radially outwardly when the plastic bottle is pressurized to be filled with a beverage. Thus, the technique of Patent Literature 1 may, to prevent such inconveniences, require a restriction on production conditions for steps of molding plastic bottles and filling them with beverages. Such a restriction may decrease the efficiency in producing plastic bottles and beverages.

[0006] The above circumstances have led to a demand for a plastic bottle having both a reduced pressure absorbing function and a high strength.

Solution to Problem

[0007] A plastic bottle according to one or more embodiments of the present invention comprises: a body portion provided with at least one reduced pressure absorbing panel portion and at least one body portion reference surface surrounding the at least one reduced pressure absorbing panel portion, wherein the at least one reduced pressure absorbing panel portion extends in an up-down direction of the body portion and is twisted in shape in a circumferential direction of the plastic bottle with a central axis of the plastic bottle as a center, the at least one reduced pressure absorbing panel portion has a first depression, a second depression, and protrusions, the first depression is in a direction from the at least one body portion reference surface toward inside the plastic bottle, the second depression is present at a circumferential center of the first depression and is in a direction from the first depression further toward inside the plastic bottle, the protrusions are present respectively at opposite ends of the first depression in the up-down direction and are each in a form of a curved surface that extends over an entire circumferential width of the first depression and that protrudes from the first depression toward outside the plastic bottle, and each of the protrusions has a dimension in the up-down direction which dimension is smallest at circumferentially opposite ends of the protrusion and largest at a circumferentially central portion of the protrusion.

[0008] With the above arrangement, the first depression and the second depression function together for an improvement in the reduced pressure absorbing function, and the reduced pressure absorbing panel portion, which is twisted in shape, allows the plastic bottle to have a high strength in the up-down direction. Further, the reduced pressure absorbing panel portion, which has protrusions, reduces deformation of the first depression and the second depression, prevents shrink marks from occurring easily when the plastic bottle is molded, and prevents the plastic bottle from becoming easily deformed when pressurized to become filled with a beverage.

[0009] The description below deals with preferable embodiments of the present invention. The preferable embodiments described below as examples do not limit the scope of the present invention.

[0010] A plastic bottle as a preferable embodiment of the present invention is arranged such that the at least one reduced pressure absorbing panel portion includes two reduced pressure absorbing panel portions adjacent to each other, the at least one body portion reference surface includes two body portion reference surfaces extending respectively from the two reduced pressure absorbing panel portions, the two body portion reference surfaces join each other at a ridge portion, and the at least one body portion reference surface is apart from the central axis by a largest distance at the ridge portion.

[0011] With the above arrangement, the plastic bottle has not only a reduced pressure absorbing panel portion twisted in shape but also a ridge portion twisted in shape. This allows the plastic bottle to have a higher strength in the up-down direction.

[0012] A plastic bottle as a preferable embodiment of the present invention is arranged such that the first depression has a planar shape.

[0013] The above arrangement allows for an improvement in the reduced pressure absorbing function of the first depression.

[0014] Additional features and advantages of the present invention will be made clearer by the description of the exemplary and non-limiting embodiments below, which are described with reference to the drawings.

Brief Description of Drawings

[0015]

Fig. 1 is a front view of a plastic bottle.
Fig. 2 is a frontal cross-sectional view of a plastic bottle.
Fig. 3 is a cross-sectional view taken along line III-III in Fig. 1.
Fig. 4 is a cross-sectional view taken along line IV-IV in Fig. 1.
Fig. 5 is an enlarged front view of a body portion of a plastic bottle.
Fig. 6 is a cross-sectional view taken along line VI-VI in Fig. 5.
Fig. 7 is a cross-sectional view taken along line VII-VII in Fig. 5.
Fig. 8 is a bottom view of a bottom portion of a plastic bottle.
Fig. 9 is an enlarged view of bottom portion depressions in a bottom portion of a plastic bottle.

Description of Embodiments

[0016] The description below deals with a plastic bottle as an embodiment of the present invention with reference to drawings. The present embodiment is a plastic bottle 100 including, as illustrated in Fig. 1, (i) a mouth portion 1 as a spout for liquid, (ii) a shoulder portion 2 continuous with the mouth portion 1 and having a diameter that gradually increases toward the bottom surface, (iii) a body portion 3 continuous with the shoulder portion 2 and having a cylindrical shape, and (iv) a bottom portion 4 as the bottom of the plastic bottle 100. In the description below, the "depth" of a structure at the surface of the plastic bottle 100 means how much the surface of the plastic bottle 100 is depressed inwardly.

[0017] The plastic bottle 100 as the present embodiment can be produced with a thermoplastic resin such as polyethylene, polypropylene, or polyethylene terephthalate as a main material and molded integrally by a stretching and molding method such as biaxial stretching blow molding. The plastic bottle 100 may have any capacity. The capacity may be approximately from 200 mL to 2 L such as 280 mL, 350 mL, or 500 mL, as of a common plastic bottle. The plastic bottle 100 may be filled with any liquid. Examples include (i) beverages such as drinking water, tea, fruit juice, coffee, cocoa, soft drink, alcoholic beverage, milk beverage, and soup and (ii) liquid seasonings such as Worcester sauce and soy sauce.

[Rib Structure]

[0018] The body portion 3 is provided with, in an upper region 3a thereof, a main circumferential rib 31 in the shape of a depression. The body portion 3 is also provided with, in the upper region 3a and a lower region 3c thereof, sub circumferential ribs 32 each in the shape of a depression. As illustrated in Fig. 2, the main circumferential rib 31 has a depth and a dimension in the up-down direction that are larger than those of each sub circumferential rib 32.

[0019] As illustrated in Fig. 3, the main circumferential rib 31 has a wavy horizontal cross-sectional shape with a depth that varies continuously in the circumferential direction of the plastic bottle 100. The depth has a maximum value of 4.5 mm and a minimum value of 3.5 mm. The main circumferential rib 31 has seven largest-depth points 31a and seven smallest-depth points 31b. The horizontal cross-sectional shape of the main circumferential rib 31 is a wavy shape formed by connecting the largest depth points 31a and the smallest depth points 31b smoothly and alternately one after another. The horizontal cross-sectional shape is, in other words, formed with a closed curve that protrudes toward outside the plastic bottle around each largest-depth point 31a, that protrudes toward inside the plastic bottle around each smallest-depth point 31b, and that has an inflection point between each largest-depth point 31a and each smallest-depth point 31b adjacent thereto.

[0020] The main circumferential rib 31 has a dimension in the up-down direction of (i) 8.0 mm at each largest-depth point 31a and (ii) 7.2 mm at each smallest-depth point 31b.

[0021] As illustrated in Figs. 1 and 2, the body portion 3 may be provided with a plurality of sub circumferential ribs 32. The present embodiment involves three sub circumferential ribs 32 in the upper region 3a and two sub circumferential ribs 32 in the lower region 3c. The present embodiment is arranged such that the sub circumferential ribs 32 each have a circular horizontal cross-sectional shape with a depth of 1.5 mm and a dimension in the up-down direction of 4.9 mm.

[0022] A horizontal load on the plastic bottle 100 may deform the plastic bottle 100 such that the horizontal cross-sectional shape becomes elliptical. However, the plastic bottle 100 as the present embodiment, which has a main circumferential rib 31 with a wavy horizontal cross-sectional shape, is structured such that a load on the plastic bottle 100 is not easily concentrated. The horizon-

tal load thus does not easily deform the plastic bottle 100.

[0023] A load on the plastic bottle 100 in the up-down direction may also deform the plastic bottle 100 in the up-down direction. However, the plastic bottle 100 as the present embodiment, which has a main circumferential rib 31 and sub circumferential ribs 32 with different depths and dimensions in the up-down direction, allows those ribs to function together as a spring to alleviate the load in the up-down direction. The load in the up-down direction thus does not easily deform the plastic bottle 100.

[Panel Structure]

[0024] The body portion 3 is provided with, in a middle region 3b thereof, a plurality of (for the present embodiment, six) panels 33 (which are an example "reduced pressure absorbing panel portion") that are sunk in the radial direction and that are arranged in the circumferential direction of the middle region 3b at even intervals. As illustrated in Fig. 5, the panels 33 are each shaped to extend in the up-down direction of the middle region 3b, and are each also twisted in shape in the circumferential direction of the plastic bottle 100 with the central axis of the plastic bottle 100 as the center. The panels 33 are each surrounded by a body portion reference surface 34.

[0025] As illustrated in Figs. 5 to 7, the panels 33 each include a first panel depression 33a (which is an example "first depression). a second panel depression 33b (which is an example "second depression"), and panel protrusions 33c (which is an example "protrusion"). The first panel depression 33a has a planar shape and is depressed from the body portion reference surface 34 toward inside the plastic bottle 100. The second panel depression 33b is present at the circumferential center of the first panel depression 33a and depressed in the direction from the first panel depression 33a further toward inside the plastic bottle 100.

[0026] In the panel protrusions 33c, the opposite ends of the first panel depression 33a in the up-down direction are each in the form of a curved surface that protrudes from the first panel depression 33a toward outside the plastic bottle 100 over the entire circumferential width of the first panel depression 33a. The panel protrusions 33c each have a dimension in the up-down direction which dimension is smallest at the circumferentially opposite ends of the panel protrusion 33c and largest at the circumferentially central portion of the panel protrusion 33c.

[0027] Two body portion reference surfaces 34 extending from two different first panel depressions 33a join each other at a ridge portion 34a. The body portion reference surfaces 34 are apart from the central axis of the plastic bottle 100 by the largest distance at the ridge portions 34a.

[0028] The plastic bottle 100 as the present embodiment includes panels 33 each reinforced with panel protrusions 33c. The plastic bottle 100 thus does not easily suffer from such deformation problems as (i) radially outward deformation caused when a bottle is pressurized to become filled with a beverage and (ii) depression caused by shrinkage (so-called shrink mark) when the bottle is molded.

[Bottom Portion Structure]

[0029] As illustrated in Figs. 5, 8, and 9, the bottom portion 4 includes (i) a ground portion 41 configured to come into contact with a placement surface of a table or the like and (ii) a dome portion 42 that is depressed toward inside the plastic bottle 100 (upward in Fig. 5) as it extends from the ground portion 41 radially inwardly. The dome portion 42 includes (i) at a central portion thereof a dome central portion 421 that is depressed further toward inside the plastic bottle 100 than the dome portion 42 and (ii) a plurality of bottom portion depressions 422 around the dome central portion 421.

[0030] As illustrated in Fig. 9, the bottom portion depressions 422 are, in a plan view, each in the shape of a concave hexagon (so-called bowtie shape) with four acute vertexes 422a each having an interior angle of 70° and two reentrant vertexes 422b each having an interior angle of 220°. Each acute vertex 422a is adjacent to another acute vertex 422a and a reentrant vertex 422b, whereas each reentrant vertex 422b is adjacent to two acute vertexes 422a. The concave hexagon has sides each measuring 3 mm, and has diagonals of which the longest are 6 mm long. The bottom portion depressions 422 each have a depth of 1.2 mm.

[0031] As illustrated in Figs. 8 and 9, the bottom portion depressions 422 form bottom portion depression rows 423 each made up of a plurality of bottom portion depressions 422 arranged in a row. The bottom portion depression rows 423 are each made up of a plurality of bottom portion depressions 422 adjacent to one another in such a manner that the respective central axes C_A of the plurality of bottom portion depressions 422 coincide with one another, the central axes C_A being each an extension of the center line C_L of the corresponding bottom portion depression 422, the center line C_L connecting the respective center points of two opposite sides of the corresponding bottom portion depression 422, each of the center points being present between two acute vertexes 422a.

[0032] As illustrated in Figs. 8 and 9, the plurality of bottom portion depression rows 423 have respective central axes C_A parallel to one another. Two adjacent bottom portion depression rows 423a and 423b are offset relative to each other along each central axis C_A, and the width of the offset is 2.6 mm, which is half the length (5.2 mm) of the center line C_L. The term "offset" as used herein means that a plurality of bottom portion depression rows 423 are shifted along each central axis C_A so that there is no coincidence between (i) a straight line connecting the two reentrant vertexes 422b of each bottom portion depression 422 included in a first bottom portion depression row 423a and (ii) a straight line connecting the two reentrant vertexes 422b of each bottom portion depres-

sion 422 included in a second bottom portion depression row 423b adjacent to the first bottom portion depression row 423a. The term "width of the offset" indicates the distance between such two straight lines.

[0033] Further, three bottom portion depressions 422 adjacent to one another are arranged in such a pattern that two acute vertexes 422a and one reentrant vertex 422b are close to one another. Stated differently, two respective acute vertexes 422a of two adjacent bottom portion depressions 422 included in the bottom portion depression row 423a which acute vertexes 422a are adjacent to each other are located, in a plan view, outside a reentrant vertex 422b of a bottom portion depression 422 included in the bottom portion depression row 423b in such a pattern that the acute vertexes 422a are fitted in the reentrant vertex 422b in a plan view (see part A in Fig. 9). Such a fitting arrangement is formed by any three bottom portion depressions 422 adjacent to one another.

[0034] Conventional plastic bottles may, when pressurized to be filled with beverages, be deformed such that the bottom portion is pushed out downward by an internal pressure. The plastic bottle 100 as the present embodiment, which has bottom portion depressions 422 with a mutually fitting arrangement as described above, reduces movement of the bottom portion depressions 422 along the bottom surface. This prevents the bottom portion 4 from being deformed. This allows the plastic bottle 100 to withstand a load that could otherwise cause deformation, and advantageously prevents the entire plastic bottle 100 from being deformed easily.

[Other Embodiments]

[0035] Finally, the description below deals with plastic bottles as other embodiments of the present invention. The arrangement disclosed for any embodiment below is combinable with the arrangement disclosed for any other embodiment unless such a combination causes any convenience.

[0036] The embodiment described above is an example arrangement including a single main circumferential rib 31. The present invention is, however, not limited to such an arrangement. The plastic bottle according to the present invention may alternatively include a plurality of circumferential ribs. For a better effect of alleviating a load in the up-down direction, the plastic bottle, as with the embodiment described above, preferably includes a single main circumferential rib, preferably includes at least one sub circumferential rib in addition to the main circumferential rib, more preferably includes at least five sub circumferential ribs in addition to the main circumferential rib.

[0037] The embodiment described above is an example arrangement in which the main circumferential rib 31 has seven largest-depth points 31a and seven smallest-depth points 31b. The present invention is, however, not limited to such an arrangement. The main circumferential rib may have any number of largest-depth points and any number of smallest-depth points as long as those numbers are equal to each other and are each two or more. For a better effect of preventing concentration of a horizontal load, the main circumferential rib preferably has six to nine largest-depth points and six to nine smallest-depth points.

[0038] The embodiment described above is an example arrangement in which the main circumferential rib 31 has a maximum depth of 4.5 mm and a minimum depth of 3.5 mm. The present invention is, however, not limited to such an arrangement. The main circumferential rib may have a maximum depth of 4.0 mm to 5.5 mm and a minimum depth that is 0.5 mm to 1.5 mm smaller than the maximum depth. The main circumferential rib has a maximum depth of preferably 4.1 mm to 5.2 mm, more preferably 4.2 mm to 5.0 mm. The main circumferential rib has a minimum depth that is preferably 0.6 mm to 1.4 mm smaller than the maximum depth, more preferably 0.7 mm to 1.3 mm smaller than the maximum depth.

[0039] The embodiment described above is an example arrangement in which the main circumferential rib 31 has a dimension in the up-down direction of 8.0 mm at each largest-depth point 31a and 7.2 mm at each smallest-depth point 31b. The present invention is, however, not limited to such an arrangement. The circumferential rib may have a dimension in the up-down direction of 6 mm to 9 mm. The main circumferential rib preferably has a dimension in the up-down direction of 6.2 mm to 8.8 mm, more preferably 6.5 mm to 8.5 mm.

[0040] The embodiment described above is an example arrangement in which two body portion reference surfaces 34 extending from two different first panel depressions 33a join each other at a ridge portion 34a. The present invention is, however, not limited to such an arrangement, and may be arranged, for instance, such that two body portion reference surfaces join each other in a region having a planar connection portion.

[0041] The embodiment described above is an example arrangement in which the first panel depressions 33a each have a planar shape. The present invention is, however, not limited to such an arrangement. The first depression may, for instance, have a rib for reduced pressure and absorption.

[0042] The embodiment described above is an example arrangement in which the acute vertexes 422a each have an interior angle of 70°, and the reentrant vertexes 422b each have an interior angle of 220°. The present invention is, however, not limited to such an arrangement. The acute vertex may have an interior angle of larger than 60° and not larger than 80°. The acute vertex preferably has an interior angle of not smaller than 63° and not larger than 87°, more preferably not smaller than 65° and not larger than 75°.

[0043] The embodiment described above is an example arrangement in which the concave hexagon has diagonals of which the longest are 6 mm long. The present invention is, however, not limited to such an arrangement. The longest diagonals may be 3 mm to 8 mm long.

The longest diagonals are preferably 4 mm to 7 mm long, more preferably 5 mm to 7 mm long.

[0044] The embodiment described above is an example arrangement in which the bottom portion depressions 422 each have a depth of 1.2 mm. The present invention is, however, not limited to such an arrangement. The bottom portion depression may have a depth of 0.6 mm to 2.4 mm. The bottom portion depression preferably has a depth of 0.5 mm to 2.5 mm, more preferably 0.7 mm to 2.3 mm.

[0045] The embodiment described above is an example arrangement in which the width of the offset between two bottom portion depression rows 423a and 423b adjacent to each other is 2.6 mm, which is half the length (5.2 mm) of the center line C_L. The present invention is, however, not limited to such an arrangement. The width of the offset may be 40% to 60% of the length of the center line. The width of the offset is preferably 45% to 55%, more preferably 48% to 52%, particularly preferably 50%, of the length of the center line.

[0046] Embodiments of any arrangement other than the above that is disclosed in the present specification are also mere examples in all respects, and do not limit the scope of the present invention. A person skilled in the art will easily understand that the embodiments may be modified as appropriate without departing from the object of the present invention. The present invention thus naturally covers in its scope any embodiment as modified without departing from the object of the present invention.

Industrial Applicability

[0047] The present invention is applicable to, for example, a container for a soft drink.

Reference Signs List

[0048]

100	Plastic bottle
1	Mouth portion
2	Shoulder portion
3	Body portion
3a	Upper region of the body portion
3b	Middle region of the body portion
3c	Lower region of the body portion
31	Main circumferential rib
32	Sub circumferential rib
33	Panel
33a	First panel depression
33b	Second panel depression
33c	Panel protrusion
34	Body portion reference surface
34a	Ridge portion
4	Bottom portion
41	Ground portion
42	Dome portion
421	Dome central portion
422	Bottom portion depression
422a	Acute vertex of the bottom portion depression
422b	Reentrant vertex of the bottom portion depression
423 (423a, 423b)	Bottom portion depression row
C_A	Central axis
C_L	Center line
A	Mutually fitting part of bottom portion depressions

Claims

1. A plastic bottle, comprising:

a body portion provided with at least one reduced pressure absorbing panel portion and at least one body portion reference surface surrounding the at least one reduced pressure absorbing panel portion, wherein
the at least one reduced pressure absorbing panel portion extends in an up-down direction of the body portion and is twisted in shape in a circumferential direction of the plastic bottle with a central axis of the plastic bottle as a center,
the at least one reduced pressure absorbing panel portion has a first depression, a second depression, and protrusions,
the first depression is in a direction from the at least one body portion reference surface toward inside the plastic bottle,
the second depression is present at a circumferential center of the first depression and is in a direction from the first depression further toward inside the plastic bottle,
the protrusions are present respectively at opposite ends of the first depression in the up-down direction and are each in a form of a curved surface that extends over an entire circumferential width of the first depression and that protrudes from the first depression toward outside the plastic bottle, and
each of the protrusions has a dimension in the up-down direction which dimension is smallest at circumferentially opposite ends of the protrusion and largest at a circumferentially central portion of the protrusion.

2. The plastic bottle according to claim 1, wherein
the at least one reduced pressure absorbing panel portion includes two reduced pressure absorbing panel portions adjacent to each other,
the at least one body portion reference surface includes two body portion reference surfaces extending respectively from the two reduced pressure absorbing panel portions,

the two body portion reference surfaces join each other at a ridge portion, and
the at least one body portion reference surface is apart from the central axis by a largest distance at the ridge portion.

3. The plastic bottle according to claim 1 or 2, wherein the first depression has a planar shape.

Fig.1

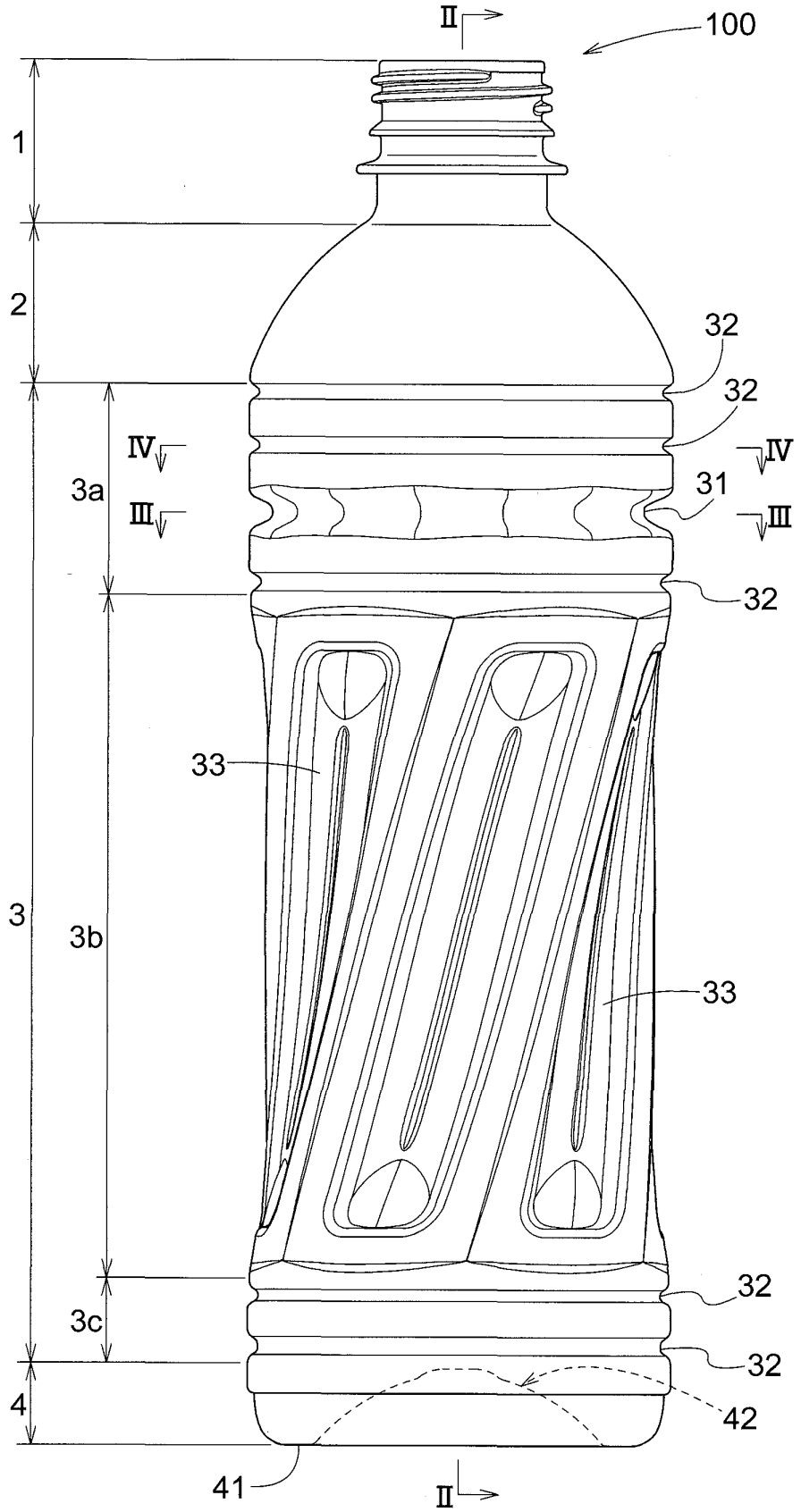

Fig.2

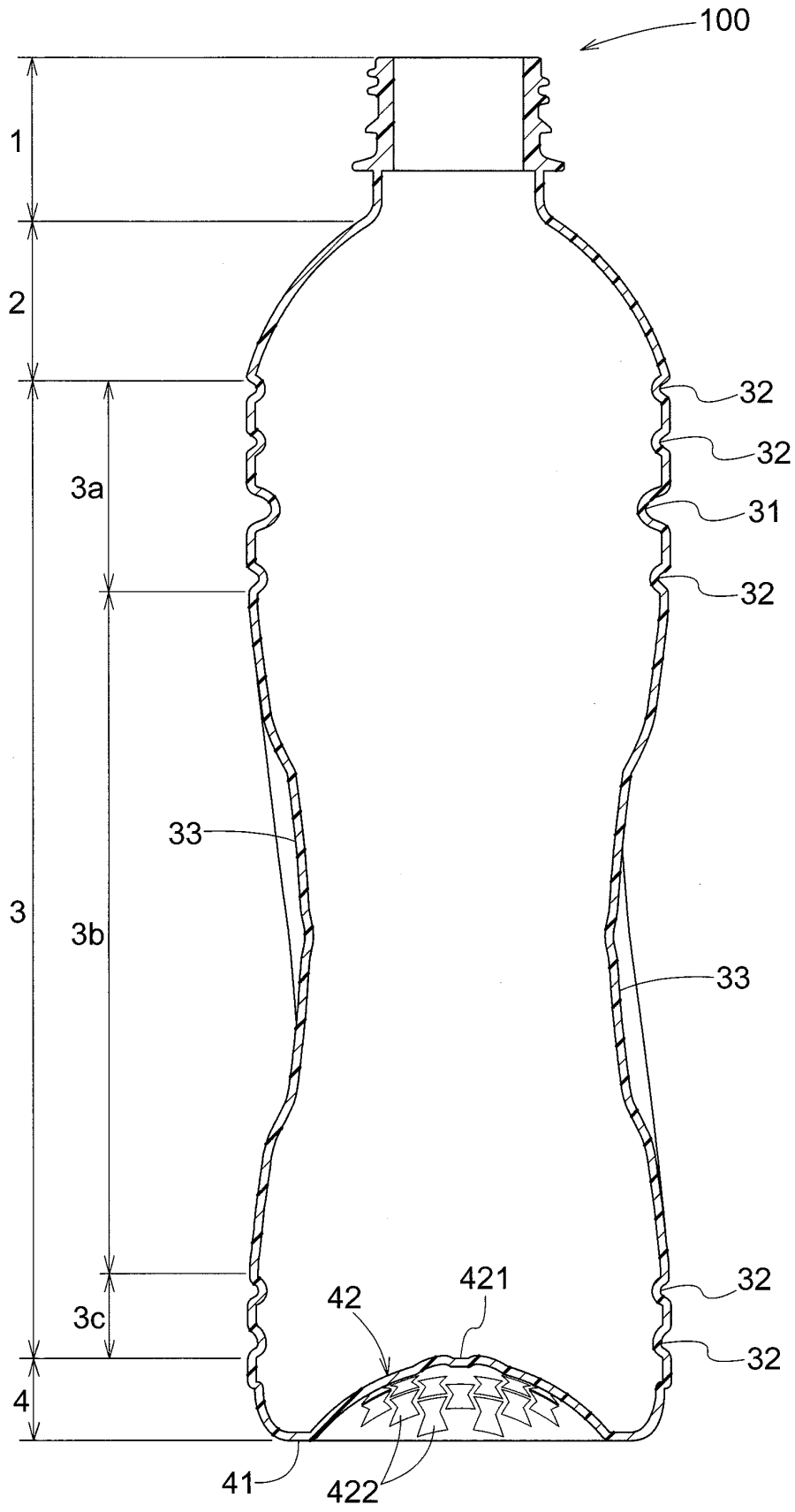

Fig.3

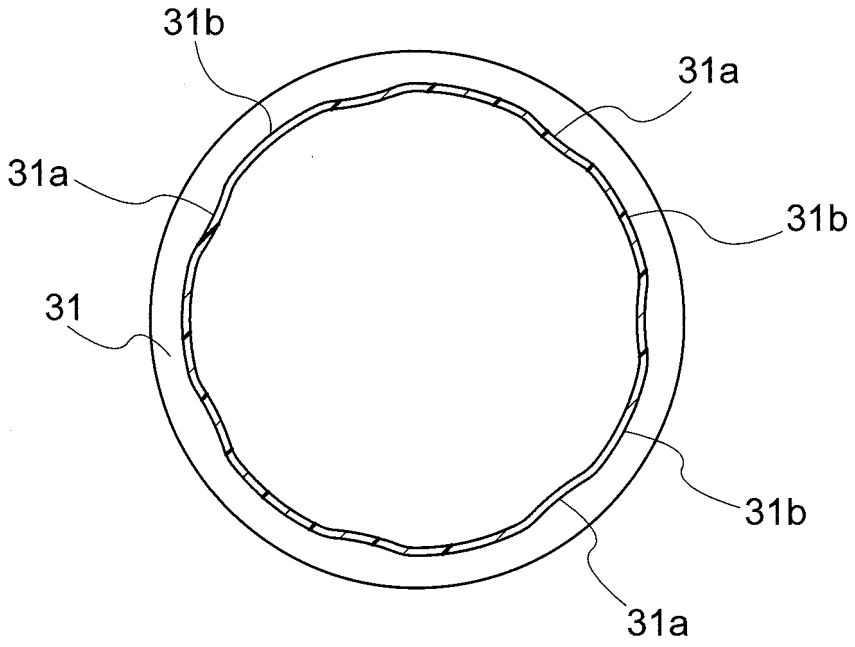

Fig.4

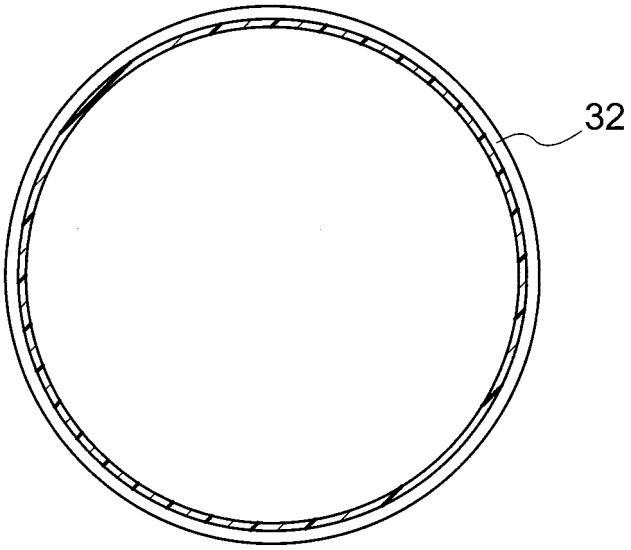

Fig.5

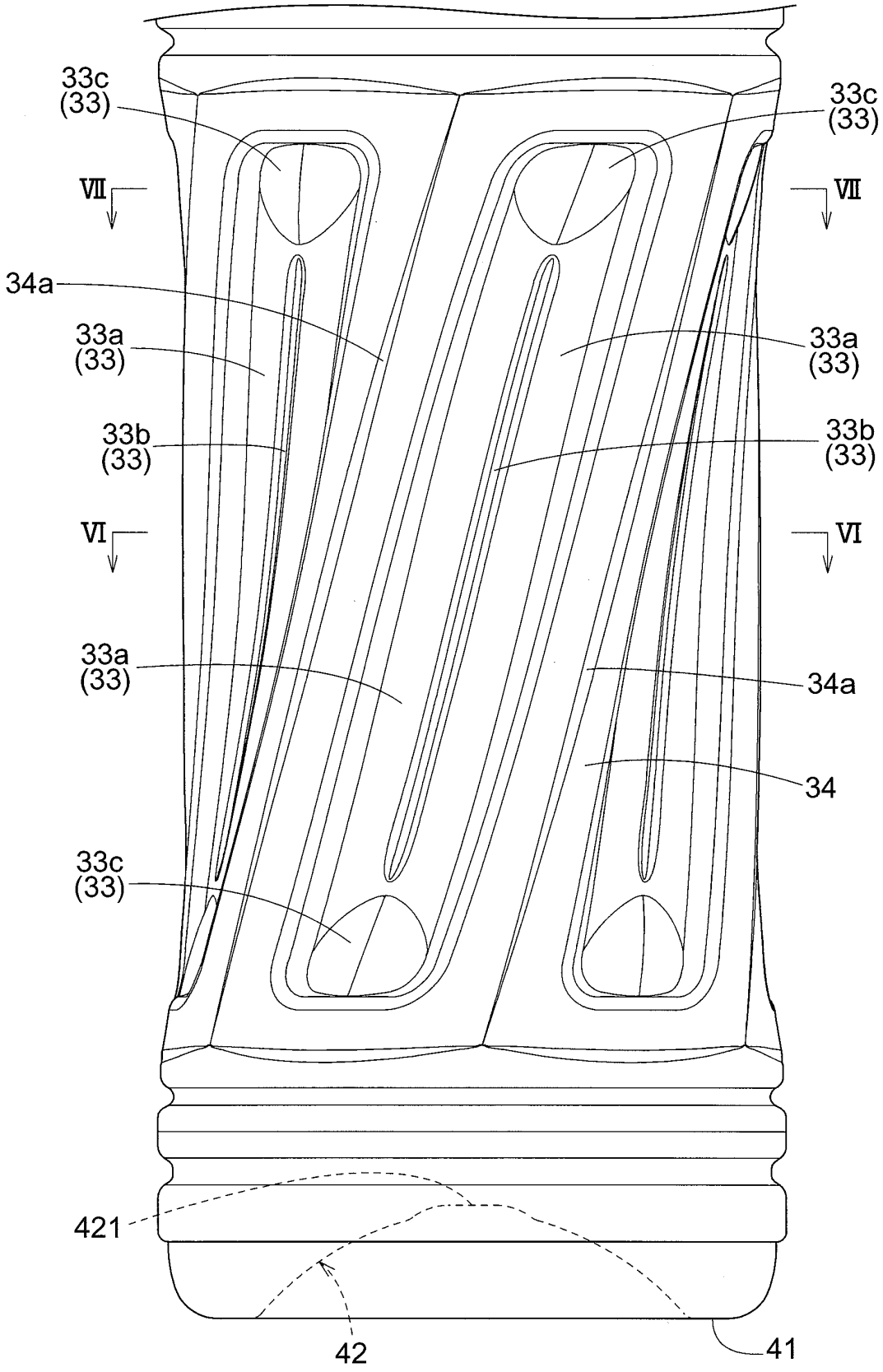
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Fig.6

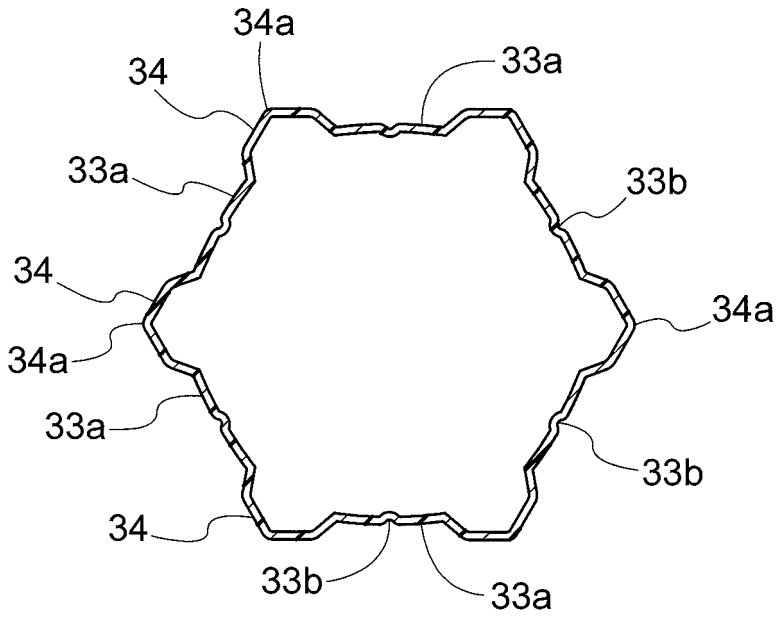
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Fig.7

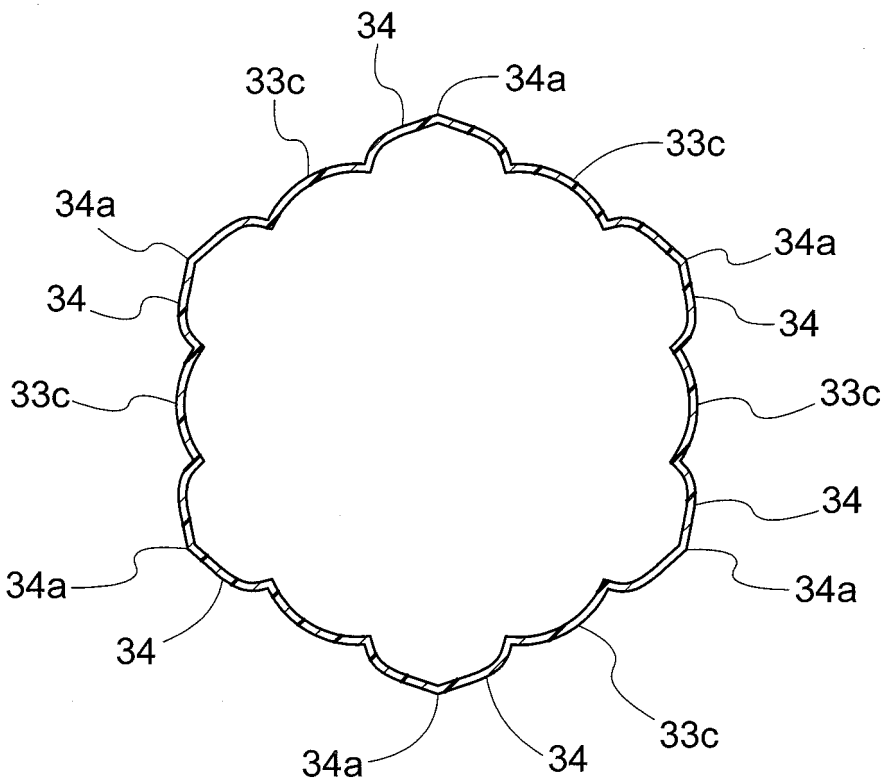
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Fig.8

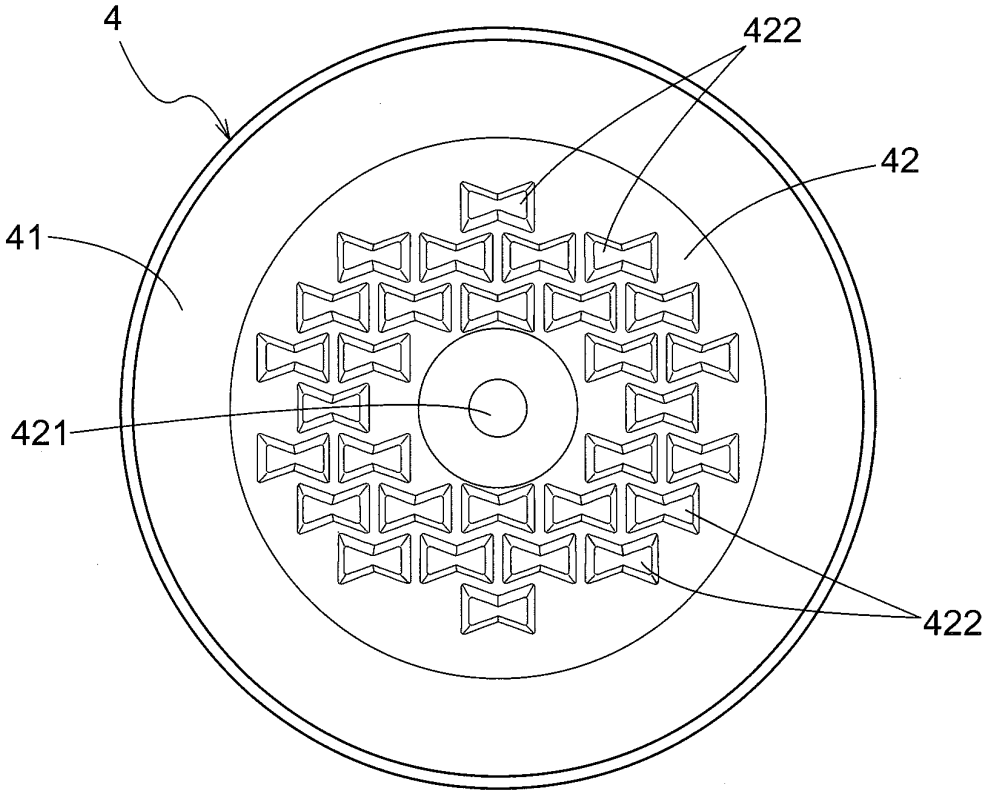
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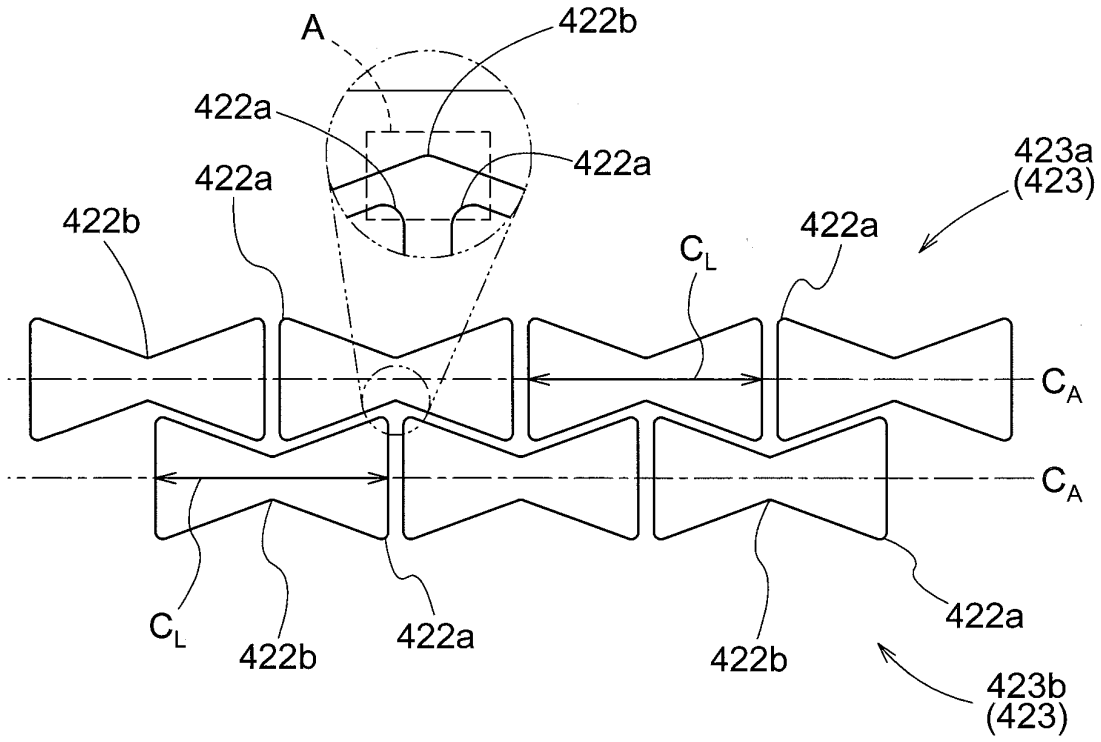
Fig.9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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/001892

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. B65D1/02(2006.01)i, B65D1/42(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)
Int.Cl. B65D1/00-1/48, B65D79/00

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

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2019
Registered utility model specifications of Japan	1996-2019
Published registered utility model applications of Japan	1994-2019

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.
A	JP 2016-11156 A (YOSHINO KOGYOSHO CO., LTD.) 21 January 2016, entire text, all drawings (Family: none)	1-3
A	JP 2007-314216 A (YOSHINO KOGYOSHO CO., LTD.) 06 December 2007, entire text, all drawings (Family: none)	1-3
A	JP 2017-119543 A (YOSHINO KOGYOSHO CO., LTD.) 06 July 2017, entire text, all drawings & US 2017/0183138 A1 & CA 2950488 A1	1-3
A	JP 2016-210436 A (YOSHINO KOGYOSHO CO., LTD.) 15 December 2016, entire text, all drawings & US 2018/0093789 A1 & WO 2016/174831 A1 & EP 3290345 A1 & CN 107531353 A	1-3

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 April 2019 (15.04.2019)	23 April 2019 (23.04.2019)

Name and mailing address of the ISA/	Authorized officer
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Form PCT/ISA/210 (second sheet) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2013095428 A **[0004]**