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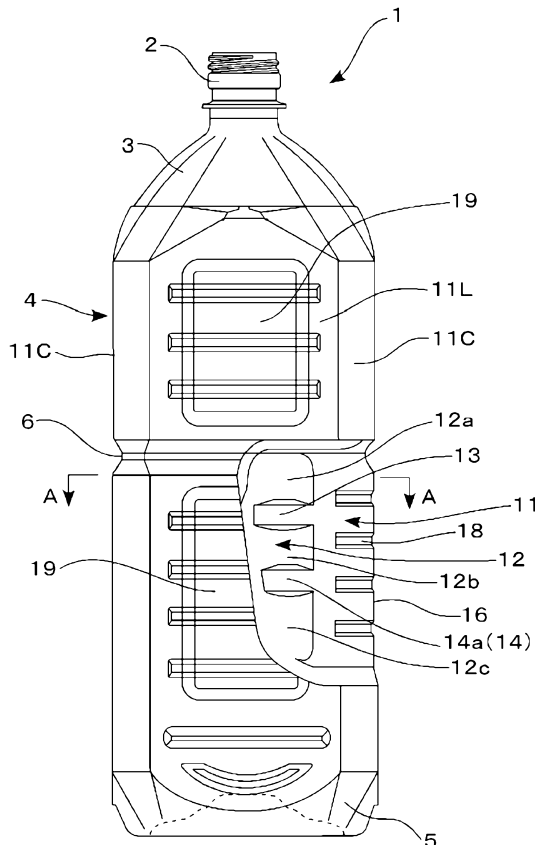
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[続葉有]

(54) Title: SYNTHETIC RESIN SQUARE BOTTLE BODY

(54) 発明の名称: 合成樹脂製角形壘体



(57) Abstract: A large sized square bottle body made of synthetic resin and having a grasp section at its barrel section. The grasp section provides the bottle body with sufficient graspability without a major change in the shape of the bottle body, which enables a user to use it with ease. The barrel section is oblong in cross section and has a circular groove-like waist at the middle of the height of the barrel section. A pair of recesses for receiving fingers is formed in predetermined regions positioned below the waist, in a pair of long-sided walls that form long-sided portions of the oblong shape, and the pair of recesses is formed such that fingers can be received in at least one of the pair. Thus, the grasp section for holding the bottle body is formed by the pair of recesses.

(57) 要約: 本願発明は、大型の角形壘体で、壘体の形状を大きく変更することなく胴部に十分に握持性を発揮できるための握持部分を形成することを課題とし、もって握持性に優れ、安心して使用できる合成樹脂製の角形壘体を提供することを目的とする。そしてその主たる解決手段は、平断面形状が長方形の胴部を有し、この胴部の中央高さ位置に周溝状のウエスト部を有する角形壘体において、長方形の長辺側を形成する一対の長辺側壁のウエスト部の下方に位置する所定領域部分に、指掛けのための一対の凹部を、この一対の凹部の少なくとも一方に複数の指先が指掛け可能な形に形成し、一対の凹部により壘体を握持するための握持部分を構成すること、にある。

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SYNTHETIC RESIN BOTTLE

TECHNICAL FIELD

[0001] This invention relates to a synthetic resin bottle having a pair of recessed portions in the body walls for the purpose of providing finger stops.

BACKGROUND

[0002] Synthetic resin bottles made of polyethylene terephthalate resins (hereinafter referred to as PET resins) are widely in use as the container for various drinks and foods. Bottles in a large size with a capacity of 2 L may be provided with a handle to hold the bottle firmly, depending on the purposes of use. In the case of square bottles, it is an ordinary method to form dents for use as finger stops in parts of the waist portion which is disposed at middle height of the body (See, for example, Fig. 1 of Patent Document 1).

[Patent Document 1] Published patent application JP2002-145233

OBJECT OF THE INVENTION

[0003] It is the object of the present invention to substantially overcome or ameliorate one or more of the disadvantages of the prior art, or at least provide a useful alternative.

SUMMARY OF THE INVENTION

[0004] According to an aspect of the present invention, there is provided a synthetic resin bottle comprising a body having a rectangular shape in a plane cross-section and a groove-like waist portion disposed at a almost half height of the bottle,

wherein a pair of vertically long recessed portions for use as finger stops are formed in respective long side walls of said rectangular body over a predetermined area ranging from said waist portion downward to ensure that a plural number of fingers can be placed in at least one recessed portion for a finger stop purpose, and wherein a grip for holding the bottle is formed from both the pair of recessed portions and the waist portion,

wherein the pair of recessed portions are formed in a state in which upper end areas thereof are connected integrally to the waist portion, and

wherein the grip for holding the bottle is formed from both the recessed portions and a side wall that connects these two recessed portions, while the grip is also integrally connected to the waist portion.

[0005] Preferably, the rectangular body comprises a pair of long side walls, a pair of short side walls, and four corner walls connecting a long side wall to an adjacent short side wall in a chamfered manner.

[0006] Preferably, a lateral raised rib is formed in each recessed portion to reinforce the recessed portion and to stabilize the state of fingers placed between the waist portion and said lateral raised rib.

[0007] Preferably, a reinforcing rib to reinforce each recessed portion is transversally formed inside the recessed portion.

[0008] Preferably, lateral width at the bases of both recessed portions is in a range of 55 to 70 mm, and wherein lateral width at or near upper end of the rear wall portion is in a range of 70 to 80 mm.

[0009] Preferably, the grip, starting from one recessed portion and ending at the other recessed portion by way of the rear wall portion, has a peripheral length in a range of 140 to 180 mm.

[0010] Preferably, the rear wall portion is formed in such a way that lateral width thereof widens downward.

[0011] Preferably, the rear wall portion is provided with lateral ribs extending to the right and the left.

[0012] Preferably, a vacuum-absorbing panel is formed below the waist portion of each long side wall in such a way that the panel is integrally connected to a recessed portion.

[0013] There is also disclosed a synthetic resin bottle comprising a body having a rectangular shape in a plane cross-section and a groove-like waist portion disposed at a middle height of the bottle,

wherein a pair of recessed portions for use as finger stops are formed in respective long side walls of said rectangular body over a predetermined area ranging from said waist portion downward to ensure that a plural number of fingers can be placed

in at least one recessed portion for a finger stop purpose, and wherein a grip for holding the bottle is formed from both the pair of recessed portions and the waist portion,

wherein vacuum-absorbing panels are formed in long side walls in a recessed state, surrounded by a slope, and are used as recessed portions.

[0014] Preferably, vertical raised ribs are disposed in each vacuum-absorbing panel.

[0015] Preferably, the vacuum-absorbing panels have an average depth (Dave) of dents ranging from 3% to 15% of short-side width of the rectangular body.

[0016] Preferably, the vertical raised ribs are disposed in a segmentalized state.

[0017] Preferably, a rib-free space between segments of vertical raised ribs has a longitudinal length corresponding to 30% or less of longitudinal length of each vacuum-absorbing panel.

[0018] Preferably, each vacuum-absorbing panel is shifted from horizontal center of a long side wall.

[0019] Preferably, each finger stop is formed by increasing depth of dent at or near either right or left end of a vacuum-absorbing panel.

[0020] Preferably, width between foets of corresponding slopes, from which a pair of finger stops is formed, is in a range of 50% to 90% of short-side width of the rectangular body, wherein each finger stop has a steep slope angle in a range of 30 to 90 degrees, and wherein the vacuum-absorbing panels have a gentle slope angle of 9 degrees or less, as measured against the long side wall, when the depth of dent for the vacuum-absorbing panels is increased linearly from either right or left end to the other end.

[0021] Preferably, a multitude of lateral ribs are disposed in a pair of short side walls of a rectangular body.

[0022] Preferably, the body comprises a pair of long side walls, a pair of short side walls, and four corner walls connecting a long side wall to an adjacent short side wall in a chamfered manner.

[0023] Preferably, each vacuum-absorbing panel has an area in a range of 30% to 90% of area of a long side wall disposed below the waist portion, in which the vacuum-absorbing panel is disposed.

[0024] Preferably, the vacuum-absorbing panels are disposed in such a way that upper edge portions are integrated with the waist portion.

[0025] Preferably, a lateral recessed zone to be used as a finger stop is formed in each vacuum-absorbing panel at a predetermined height position.

[0026] Preferably, the vacuum-absorbing panels are disposed below the waist portion in such a way that upper edge portions are integrated with the waist portion and wherein the lateral recessed zone is formed over entire width of each vacuum-absorbing panel.

[0027] Preferably, an embanked lateral rib is formed at a predetermined height position of each vacuum-absorbing panels by building an embankment that rises outward from a recessed surface of the panel and transversely crosses the panel.

[0028] Preferably, the vacuum-absorbing panels are disposed in such a way that upper end areas thereof are integrally connected to the waist portion.

[0029] Preferably, the lateral groove of the waist portion is further caved inward at areas connected to the vacuum-absorbing panels to form lateral deep holes for use as finger stops.

[0030] Preferably, the embanked lateral rib comprises a top flat surface and a pair of banks that connect this top flat surface to the recessed surfaces at a predetermined slope angle and wherein the top flat surface is on the same plane as the long side wall.

[0031] Preferably, dented vacuum-absorbing panels have an average depth of dents ranging from 3% to 15% of short-side width of the rectangular body.

[0032] Preferably, a finger stop is formed by increasing depth of dent at or near either right or left end of each vacuum-absorbing panel.

[0033] Preferably, the width between foets of corresponding slopes, from which a pair of finger stops is formed, is in a range of 60% to 95% of short-side width of the rectangular body, and wherein each slope used as a finger stop has a steep rising slope angle in a range of 30 to 90 degrees.

[0034] Preferably, the depth of recessed surfaces of the vacuum-absorbing panels is decreased gradually from either right or left end toward the other end.

[0035] Preferably, the embanked lateral rib comprises the top flat surface and the banks that connect this top flat surface to the recessed surfaces, wherein the top flat surface is on the same plane as the long side wall, and wherein angle of gradient of the banks is gradually changed from either right or left end of a vacuum-absorbing panel, where the depth of dent is largest, to the other shallow end so as to give the shallow end a low angle of gradient.

[0036] Preferably, the deformation of the vacuum-absorbing panels into a dented state, which occurs at the time of increased depressurization inside the bottle, is carried forward in a recoverable manner to a surrounding area, starting from the deformation at either right or left end of the embanked lateral rib disposed on the shallow side of the recessed surface of each vacuum-absorbing panel.

[0037] Preferably, at the time when the user gets hold of the body by putting the thumb and fingers on the vacuum-absorbing panels so as to squeeze the body, the resultant deformation of the vacuum-absorbing panels into a dented state is carried forward in a recoverable manner to a surrounding area, stating from the deformation at either right or left end of the embanked lateral rib disposed on the shallow side of the recessed surface of each vacuum-absorbing panel.

[0038] Preferably, the recessed surfaces of the vacuum-absorbing panels are provided with ridge segments having an anti-slip function to prevent slips in the lateral direction.

[0039] In at least a preferred embodiment, the user can get firm hold of a bottle by putting the tip of the thumb in the waist portion of one long side wall, while putting the tip of the index finger in the waist portion of the other long side wall, and in addition, putting the tips of the middle finger and the ring finger, or the tips of the middle finger, the ring finger, and the little finger, in a recessed portion. Thus, even in the case where the bottle is filled with the contents and weighs heavy, the user can carry the bottle with a hand or tilt the bottle to pour the contents from the mouth because the body can be held with an entire hand including all fingers and the palm.

[0040] In at least a preferred embodiment, the recessed portions for putting the thumb and fingers therein are formed in a state in which the upper end portion thereof is integrally connected to the waist portion. The grip for grasping the bottle is formed from both recessed portions and the rear wall portion disposed between the two recessed portions, and is integrally connected to the waist portion. As a result, the user can get hold of the bottle securely by interlocking the inner sides of the thumb and the index finger with the waist portion along the roughly entire length of these thumb and finger.

[0041] Thus, the grip is configured by being connected to the already existing waist portion. Because the existing waist portion is utilized, the grip including the recessed portions can be formed without making wall shape complicated and without giving large damage to the rigidity or buckling strength of the bottle.

[0042] In at least a preferred embodiment, the bottle can retain high levels of rigidity and buckling strength because the corner walls fulfill a function of pillars that support the bottle. The grip is configured by utilizing these corner walls. The user can grasp the body of the bottle with a hand more securely than ever.

[0043] In at least a preferred embodiment, the user can grasp the grip and get hold of the bottle securely with a hand, by allowing the side of the palm and the sides of fingers ranging from the tip of the thumb to the tip of the index finger to come in contact with the waist portion and interlocking fingers with the grip.

[0044] In at least a preferred embodiment, the raised rib formed transversely in each recessed portion can effectively prevent buckling from occurring. The user can maintain the finger stop state stably by fitting the tips of the thumb and the index finger in the space between the waist portion and this raised rib.

[0045] In at least a preferred embodiment, the reinforcing ribs enable the recessed portions to show a full reinforcing effect against buckling.

[0046] In at least a preferred embodiment, a good grip is obtained for many users by specifying the lateral width at the bases of both recessed portions in a range of 55 to 70 mm and the lateral width at or near the upper end of the rear wall portion in a range of 70 to 80 mm.

[0047] In at least a preferred embodiment, a good grip is obtained for many users by specifying the peripheral length of the grip in a range of 140 to 180 mm.

[0048] In at least a preferred embodiment, it would become easy for the users to get hold of a bottle if the rear wall portion is formed in such a way that lateral width thereof widens downward. The buckling strength is also improved.

[0049] In at least a preferred embodiment, lateral ribs extending to the right and the left prevent the rear wall portion from being distorted and deformed abnormally by the grasping force acting on the grip, or prevent the contents from bursting out due to the deformation of the rear wall portion.

[0050] In at least a preferred embodiment, the vacuum-absorbing panels are integrally connected to the recessed portions for putting fingers therein. Thus, the vacuum-absorbing function can be fully performed over a wide area including the recessed portions.

[0051] In at least a preferred embodiment, the grip is formed by utilizing vacuum-absorbing panels. There is no need to form a grip newly, and the grip can be formed without any large change in the shape of the bottle. In the case of large-size bottles, large areas can be utilized for the vacuum-absorbing panels. The user can get hold of the bottle

with an entire hand by putting the thumb on one vacuum-absorbing panel and putting the remaining fingers on the other vacuum-absorbing panel. Depending on the remaining volume of the contents, the user can pick out a suitable position of the grip by shifting the gripping position of the hand within the vacuum-absorbing panels.

[0052] In at least a preferred embodiment, the vertical raised ribs help the deformation of vacuum-absorbing panels to be kept constant so that bottle appearance cannot be spoiled at the time of pressure reduction. The raised ribs also provide a finger stop function for getting firm hold of the bottle.

[0053] In at least a preferred embodiment, the grip can exercise full performance without giving damage to the appearance of bottles, while securing a sufficient capacity, provided that the vacuum-absorbing panels have an average depth of dents ranging from 3% to 15% of short-side width of the rectangular body.

[0054] In at least a preferred embodiment, the vertical raised ribs disposed in a segmentalized state can help the vacuum-absorbing panels retain normal cave-in deformability at the time of pressure reduction.

[0055] In at least a preferred embodiment, the rib-free space between segments of vertical raised ribs can fulfill the finger stop function sufficiently if the longitudinal length of this space is set at a level corresponding to 30% or less of the longitudinal length of each vacuum-absorbing panel.

[0056] In at least a preferred embodiment, firm grip of the bottle can be obtained by shifting the panels from the horizontal center of the respective flat walls toward the right or the left, taking the grip function into consideration, if necessary.

[0057] In at least a preferred embodiment, a deep dent at one end is used as a finger stop. By putting the thumb and fingers of a hand in the dents, the user can get firm hold of the bottle stably.

[0058] In at least a preferred embodiment, the bottle can be provided with a pair of finger stops for firm grip of the bottle, even if the bottle is of a large size, while giving no

damage to appearance, securing a necessary capacity, and fulfilling the vacuum-absorbing function sufficiently.

[0059] In at least a preferred embodiment, a multitude of lateral ribs is disposed in a pair of short side walls. If the user holds a bottle with a hand from both sides of a pair of vacuum-absorbing panels, the body would not be flattened out, but remain stably held, with no contents bursting out.

[0060] In at least a preferred embodiment, the corner walls and the waist portion give a highly rigid bottle.

[0061] In at least a preferred embodiment, a vacuum-absorbing panel area specified in a range of 30% to 90% of the flat wall area below the waist portion allows the bottle to perform fully the vacuum-absorbing function without giving damage to bottle rigidity and to secure sufficient areas for the grip.

[0062] In at least a preferred embodiment, the user can hold the bottle in a state in which a part of the thumb and fingers are caught in the waist portion, allowing the user to hold the bottle more stably by preventing vertical slip of the bottle.

[0063] In at least a preferred embodiment, the user can stably get hold of the bottle in an upright, inverted, or inclined bottle position, by putting the tips of fingers in a lateral recessed zone.

[0064] In at least a preferred embodiment, the bottle in an upright, inverted, or inclined position can be held more securely and stably, for example, by putting the tip of the thumb in the waist portion integrated with one vacuum-absorbing panel, putting the tip of the index finger in the corresponding waist portion integrated with the other vacuum-absorbing panel, and in addition, putting the middle finger and/or the ring finger in the corresponding lateral recessed zone.

[0065] In at least a preferred embodiment, the embanked lateral rib is formed so as to cross each vacuum-absorbing panel. As such, it performs the function of preventing the corresponding vacuum-absorbing panel from being reversed in the other way and

deformed into a swollen state that often occurs during the period when the bottles are filled with the contents under a pressurized condition. The rib is also effective in vertically locking the fingers of the hand with which the bottle is held.

[0066] In at least a preferred embodiment, the grasping function and the vacuum-absorbing function can be performed in larger areas by connecting the upper end of the vacuum-absorbing panels integrally to the waist portion. The user can lock fingers in the waist portion by utilizing its groove-like shape and get hold of a bottle stably at a height position closer to the center of gravity.

[0067] In at least a preferred embodiment, a part of fingers can be put in the lateral deep holes formed in the waist portion for finger stop use. The user can get hold of a bottle more stably than ever at various bottle positions.

[0068] In at least a preferred embodiment, the embanked lateral rib with a sufficient height can fully perform the function of controlling swollen deformation and the finger locking function to prevent the slips in the vertical direction by utilizing the banks. Since the top flat surface of each embanked lateral rib is on the same plane as the corresponding flat wall, not only the heel portion but also this top flat surface can also be utilized as the guide on the production line.

[0069] In at least a preferred embodiment, the bottle can be held firmly without giving damage to the appearance of bottles, while securing a sufficient capacity, because the vacuum-absorbing panels have an average depth of dent specified in the range of 3% to 15% of short-side width of the rectangular body.

[0070] In at least a preferred embodiment, each dent deepened at one end is used as a finger stop. By putting the thumb and fingers of a hand in the deep dents caved in both flat walls, the user can get firm hold of the bottle stably.

[0071] In at least a preferred embodiment, the bottle is provided with a pair of finger stops for firm hold of the bottle, while giving no damage to appearance and securing a necessary capacity, even if the bottle is of a large size.

[0072] In at least a preferred embodiment, the slope is steep at the right or left end so as to ensure that the bottle can be held firmly. In contrast, at the other end of each recessed surface, the slope is gentle and short enough to smoothly carry forward the depressurization-induced deformation from the vacuum-absorbing panels to an adjacent flat wall area by way of this low-angle slope. As a result, it becomes possible to prevent above-described buckling deformation involved in the deformation caused by a reduced pressure.

[0073] In at least a preferred embodiment, the banks on both sides of the embanked lateral rib are formed so as to have small angle of gradient and become low in height at either right or left end of each recessed surface. Thus, the deformation caused by a reduced pressure can be effectively and smoothly carried forward from the vacuum-absorbing panels to the adjacent flat wall areas.

[0074] In at least a preferred embodiment, the end of the embanked lateral rib on the shallow side can be made prone to inflection and deformation into a dented state. When there is an increase in the depressurization inside the bottle, the deformation into a dented state is carried forward in a recoverable manner to a surrounding area, starting preferentially from the deformation at the rib end on the shallow side. In addition, even if the deformation is carried forward to the surrounding area, the bottle appearance is not damaged to a large extent, and all in all, a very good vacuum-absorbing function is performed.

[0075] In at least a preferred embodiment, the end of the embanked lateral rib on the shallow side is preferentially inflected and dented when the user gets hold of the body by putting the thumb and fingers on the vacuum-absorbing panels. Since the deformation starting from this rib end on the shallow side is smoothly carried forward to a surrounding area, any distorted deformation into a dented state can be effectively controlled in other portions of the body, and there is no large damage to the appearance of the bottle.

[0076] In at least a preferred embodiment, the ridge segments perform the anti-slip function in the lateral direction for the bottle-grasping fingers.

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BRIEF DESCRIPTION OF THE DRAWINGS

[00129] Preferred embodiments of the invention will be described hereinafter, by way of examples only, with reference to the accompanying drawings, wherein:

Fig. 1 is a side elevational view of the bottle in a first embodiment of this invention.

Fig. 2 is a rear elevation of the bottle shown in Fig. 1.

Fig. 3 is a front elevational view of the bottle shown in Fig. 1.

Fig. 4(a) is a plane cross-sectional view of the body, taken from line A-A shown in Fig. 1 and Fig. 4(b) in an explanatory diagram showing a hand grasping the grip.

Fig. 5 is a side elevational view of the bottle in a second embodiment of this invention.

Fig. 6 is a rear elevational view of the bottle shown in Fig. 5.

Fig. 7 is a side elevational view of the bottle in a third embodiment of this invention.

Fig. 8 is a front elevational view of the bottle shown in Fig. 7.

Fig. 9 is a top plan view of the bottle shown in Fig. 7.

Fig. 10 is plane cross-sectional view of the body, taken from line A-A shown in Fig. 7.

Fig. 11 is an explanatory diagram showing the bottle in Fig. 10 held with a hand.

Fig. 12 is a side elevational view of the bottle in the fourth embodiment of this invention.

Fig. 13 is a front elevational view of the bottle of Fig. 12.

Fig. 14(a) is a plane cross-sectional view taken from line B·B in Fig. 12; and Fig. 14(b) is a plane cross-sectional view taken from line C·C in Fig. 12.

Fig. 15 is a front elevational view of a bottle shown for reference in association with the bottle of Fig. 12

5 Fig. 16 is a side elevational view of the bottle in the fifth embodiment of this invention.

Fig. 17 is a front elevational view of the bottle shown in Fig. 16.

Fig. 18(a) and 18(b) are plane cross-sectional views of the body taken from lines A·A and B·B, respectively, in Fig. 16.

10 Fig. 19(a) is a plane cross-sectional view of the body taken from line C·C in Fig. 16, and Fig. 19(b) is an explanatory diagram showing a hand with which the bottle is held.

Fig. 20(a) is an enlarged front view of the vacuum-absorbing panel shown in Fig. 16, and Fig. 20(b) is a vertical section of the same panel taken from line F·

15 F in Fig. 20(a).

Figs. 21(a) and 21(b) are plane cross-sectional views taken from lines D·D and E·E, respectively, in Fig. 16.

Fig. 22 is the same front elevational view as Fig. 16 and is an explanatory diagram showing the area to be dented at the time of depressurization.

20 Fig. 23(a) is an enlarged front view of the vacuum-absorbing panel of the bottle in the sixth embodiment of this invention. Figs. 23(b) and 23(c) are vertical sections taken from lines I·I and J·J, respectively, in Fig. 23(a).

Figs. 24(a) and 24(b) are plane cross-sectional views taken from lines G·G and H·H, respectively, in Fig. 23(a).

25

EXPLANATION OF CODES

[0130]

1. Bottle

30 2. Neck

3. Shoulder

4. Body

5. Bottom

6. Waist portion

35 6a. Lateral deep hole in the waist portion

10 (10L, 10R). Slope

11. Side wall

11L. Long side wall

11S. Short side wall

40 11C. Corner wall

- 12. Recessed portion
- 12a, 12b, 12c. Small dent
- 13. Lateral raised rib
- 14. Reinforcing rib
- 5 14a. Raised reinforcing rib
- 14b. Grooved reinforcing rib
- 16. Rear wall portion
- 18. Lateral rib
- 19. Vacuum-absorbing panel
- 10 23. Vacuum-absorbing panel
- 24. Vertical raised rib
- 24a. Rib-free space
- 26. Lateral recessed zone
- 28. Lateral rib
- 15 29. Vacuum-absorbing panel
- 33. Vacuum-absorbing panel
- 33b. Recessed surface
- 34. Ridge segment
- 36. Embanked lateral rib
- 20 36t. Top flat surface
- 36s. Bank
- 37. Corner
- 38. Crescent ridge
- 39. Vacuum-absorbing panel
- 25 Wa. Lateral width of recessed portions at their bases
- Wb. Lateral width of the rear wall portion
- Lg. Peripheral length of the grip
- G. Grip
- H. Hand
- 30 F. Finger stop
- L1, L2. Length
- W1, W2, W3. Width
- Dave. Average depth of dent
- TH1, TH2. Angle
- 35 S1. Area
- P1, P2, P3. Rising slope angle
- h1, h2. Slope height
- E (ER, EL). End of embanked lateral rib
- R. Area of deformation into a dented state

PREFERRED EMBODIMENTS OF THE INVENTION

[0131] This invention is further described with respect to the embodiments, now referring to the drawings. Figs. 1-4 show the synthetic resin square bottle in a first embodiment of the invention. Fig. 1 is a side elevational view; Fig. 2, a rear elevation; Fig. 3, a front elevational view, Fig. 4(a), a cross-sectional view taken from line A-A in Fig. 1, and Fig. 4(b), an explanatory diagram showing the bottle grasped with a hand. This bottle 1 is a biaxially drawn, blow molded product made of a PET resin, and comprises a neck 2, a shoulder 3, a body 4, and a bottom 8. It is a square bottle having a nominal capacity of 2L.

[0132] The body 4 has a roughly rectangular cross-section (See Fig. 4(a)), and comprises a pair of long side walls 11L that form the long sides of a rectangle, a pair of short side walls 11S that form the short sides of the rectangle, and four corner walls 11C that connect a long side wall 11L to an adjacent short side wall 11S in a chamfered manner. The body 4 also comprises a waist portion 6 in the shape of a peripheral groove, which is disposed at an almost middle height of the body 4 to increase the rigidity of the bottle 1.

20

[0133] A pair of vertically long recessed portions 12 are formed in the long side walls 11L over a height range from the waist portion downward and at positions facing each other, but a little rearward from both long side walls 11L (right side in Fig. 1). A side wall 11 sandwiched between one recessed portion 12 and the other recessed portion 12 is recessed stepwise so as to form a rear wall portion 16 over a predetermined height range from upper end of the waist portion 6 downward. The grip G comprises both recessed portions 12 and the rear wall portion 16 (See outline arrow in Fig. 4(a)).

[0134] Inside each recessed portion 12, a lateral raised rib 13 and a raised reinforcing rib 14a are transversely disposed. The latter reinforcing rib 14a is a type of reinforcing ribs 14 and is disposed below the raised rib 13. These two ribs divide the recessed portion into small dents 12a, 12b, and 12c. The raised rib 13 and the raised reinforcing rib 14a perform a finger-positioning function in grasping the grip, a finger stop function that prevents the bottle from slipping off from the hand, and a reinforcing function that prevents the recessed portions 12 from buckling.

[0135] The rear wall portion 16 is provided with a plural number of lateral ribs 18 extending to the right and the left (four ribs in this embodiment).

40

These ribs prevent the rear wall portion 16 from being distorted and deformed abnormally by the grasping force acting on the grip G, or prevent the contents from bursting out due to the deformation of the rear wall portion 16. The rear wall portion 16 is formed in such a way that lateral width thereof widens
5 downward. Therefore, it should be easy for the user to grasp the grip, and in addition, buckling strength is improved.

[0136] Vacuum-absorbing panels 19 are formed in areas above and below the waist portion 6 in the long side walls 11L and below the waist portion 6 in the
10 short side walls 11S. In the areas below the waist portion 6, the vacuum-absorbing panels 19 are formed by being connected integrally to respective recessed portions 12, so that the recessed portions 12 would never give damage to the vacuum-absorbing function of these panels 19. In this way, it is ensured that the vacuum-absorbing function is performed in large areas including
15 respective recessed portions 12.

[0137] The square bottle in this embodiment has the following sizes, areas, and angles specified for various portions of the bottle:

- Bottle height: 305 mm
- 20 • Lateral long-side width of the body 4: 106 mm; and short-side width : 90 mm
- Lateral width W_a at the bases of both recessed portions: 62 mm
- Lateral width W_b at the upper end of the rear wall portion 16: 73 mm
- Peripheral length L_g of the grip 16: 145 mm
- 25 For W_a , W_b , and L_g , refer to Fig. 4(a).

[0138] In getting hold of the bottle 1 in this embodiment, the user can put the tip of the thumb of a hand in the small dent 12a of one recessed portion 12, while in the other recessed portion 12, putting the tip of the index finger in the
30 other small dent 12a of the other recessed portion 12, the tip of the middle finger in the small dent 12b, and the tips of the ring finger and the little finger in the small dent 12c of the other recessed portion 12 (See Fig. 1 and Fig. 4(a), (b)).

35 [0139] As shown in Fig. 4(b), the user can get hold of the bottle securely by grasping the grip G. When the user clenches his/her fist around the grip, the inner tip-to-base sides of the thumb and the index finger come in contact with the waist portion 6 from underside, and the fingers are interlocked firmly with the grip. In this state, the bottle 1 can be prevented reliably from slipping off
40 from the hand; or the fingers, from sliding upward from the grip. The raised

ribs 13 and the raised reinforcing ribs 14a can effectively prevent the bottle 1 from moving from the grasp or slipping out of the hand. When the user inclines the bottle 1 up to an almost inverted position to pour the contents, it is still possible for the user to get stable hold of the bottle with a hand.

5 Naturally, it should be understood here that positioning of the fingers among the small dents 12a, 12b, and 12c is not limited to that described above. Depending on the situation in which to use the bottle, the user is at liberty to select any finger positions consciously or mechanically.

10 [0140] Fig. 5 and Fig. 6 are a side elevational view and a rear elevation, respectively, of the synthetic resin square bottle in a second embodiment of the invention. This bottle 1 shows another example of reinforcing method to prevent buckling of the recessed portions 12 for the bottle 1 in the above-described first embodiment. In this second embodiment, a dented reinforcing
15 rib 14b is formed instead of the raised reinforcing rib 14a used in each recessed portion 12 of the first embodiment.

[0141] If two or more raised ribs are formed as in the case of the raised rib 13 and the raised reinforcing rib 14a of the first embodiment, then the fingers can
20 be positioned definitely inside the recessed portion 12. On the other hand, users may feel bothersome in placing fingers in the recessed portions 12 because there are individual physical differences, such as the difference in finger size. In this respect, a dented reinforcing rib 14b, rather than the raised reinforcing rib 14a, allows the users to put their fingers smoothly in the
25 recessed portions 12. Since the dented reinforcing rib 14b is not much effective in preventing the bottle 1 from slipping off the hand, as compared to the raised counterpart, it is preferred to leave the raised rib 13 as it is.

[0142] This invention is further described with respect to a preferred
30 embodiment, now referring to the drawings. Figs. 7-11 show the synthetic resin square bottle in a third embodiment of this invention. Fig. 7 is a side elevational view; Fig. 8, a front elevational view; Fig. 9, a plan view, and Fig. 10, a cross-sectional view taken from line A-A in Fig. 7. This bottle 1 is a biaxially drawn, blow molded product made of a PET resin, and comprises a
35 neck 2, a shoulder 3, a body 4, and a bottom 5. It is a square bottle having a nominal capacity of 2L. The body 4 is formed by a pair of long side walls 11L, a pair of short side walls 11S, and four corner walls 11C connecting an adjacent long side wall 11L to an adjacent short side wall 11S in a chamfered manner. As shown in Fig. 9 or 10, the plane cross-section of the body is in a

rectangular shape. The body 4 is provided with a groove-like waist portion 6 at an almost middle height of the body 4 to increase the rigidity of the bottle 1.

[0143] Vacuum-absorbing panels 23 to be used also utilized as a grip are
5 disposed below the waist portion 6 in the wide, long side walls 11L that form
the long sides of the body 4, and are recessed from the long side wall 11L and
surrounded by a slope 10. Ordinary vacuum-absorbing panels 29, which have
been utilized conventionally, are disposed above the waist portion 6. The lower
10 vacuum-absorbing panels 23 are available as a firm and stable grip to enable
the user to get firm hold of the bottle. As shown in the following four
paragraphs (1) to (4), the vacuum-absorbing panels 23 have construction
associated with characteristic shapes to fulfill their action and effect.

[0144]

15 (1) Four vertical raised ribs 24 are formed in a segmentalized state in each
vacuum-absorbing panel 23.

A rib-free space 24a is disposed in each vertical raised ribs 24 at a middle
height position.

Under this construction, the vertical raised ribs 24 help the deformation of
20 vacuum-absorbing panels to be kept constant so that bottle appearance cannot
be spoiled at the time of pressure reduction. The raised ribs 24 also provide a
finger stop function for the user to hold the bottle firmly. The segments of
vertical raised ribs 24, with the rib-free space 24a in between, allow the
vacuum-absorbing panels 23 to fulfill the vacuum-absorbing function
25 sufficiently without giving large damage to the normal cave-in deformability at
the time of pressure reduction. Since the vacuum-absorbing panels 23 have
relatively large areas, the user can pick out a suitable position of the grip by
changing the height of the grip within the vacuum-absorbing panels,
depending on the remaining volume of the contents. The number of vertical
30 raised ribs 24 is a matter of design that can be determined appropriately,
taking into account the size of bottle 1, the size of each vacuum-absorbing
panel 23, and the like. The rib-free space 24a is not limited to a space, but can
be two or more and can be determined by taking into account the balance
between normal deformability at the time of pressure reduction and vacuum-
35 absorbing property of the vacuum-absorbing panels 23.

[0145]

(2) The depth of dent is increased near either right or left end of each vacuum-
absorbing panel 23 (the left side in Fig. 7). The depth gradually becomes
40 shallow toward the other end (See also Fig. 10). Under this construction, a

deep dent is used as a finger stop F. By putting the thumb and fingers of a hand in the dents, the user can hold the bottle with a hand H firmly and stably, as shown in the explanatory diagram of Fig. 11. The user can also hold the body 4 of the bottle 1 firmly by grabbing the grip G with the palm of a hand.

- 5 Whether the vacuum-absorbing panels 23 have a constant depth of dent or whether the depth is increased at one end can be determined by taking into account the deformability of the panels and the size and weight of the bottle 1.

[0146]

- 10 (3) The vacuum-absorbing panels 23 are shifted from the horizontal center of the respective flat walls toward the right or the left (In Fig. 7, the panel 23 is a little shifted to the right.) Under the construction of this embodiment, the user would feel it easy to keep the tips of the thumb and fingers of a hand hooked to the finger stops F. The layout of vacuum-absorbing panels 23 is a matter of
15 design. The panels 23 can be shifted to the left, or can remain at the centered position, depending on the existence or lack of finger stops F, the size of the bottle 1, and/or the size of the vacuum-absorbing panels 23. The finger stops F may not be used, and instead, the user can get hold of the bottle by putting the thumb and fingers on the vertical raised ribs 24, depending on the remaining
20 volume of the contents and the user's posture when holding the bottle.

[0147]

- (4) The vacuum-absorbing panels 23 are disposed in such a way that upper edge portions are integrated with the waist portion 6. Under this construction,
25 the user is allowed to put a part of the thumb and fingers on the slope of the waist portion 6. This prevents the bottle securely from slipping off from the hand in the vertical direction.

- [0148] A multitude of lateral ribs 28 are formed in a pair of short side walls
30 11S that forms the short sides of a rectangular body. These ribs 28 increase the surface rigidity of the short side walls 11S especially against a compressed load in the lateral direction. Owing to these lateral ribs 28, the body 4 is prevented from getting crushed when the user holds the body 4 of the bottle 1 by using a pair of vacuum-absorbing panels 23. If the body 4 got crushed,
35 stable gripping state would be damaged, and there would be inconvenient happenings, such as the contents bursting out of the bottle.

[0149] The square bottle in this embodiment has the following sizes, areas, and angles specified for various portions of the bottle:

- 40 • Bottle height: 305 mm

- Width W1 of long sides of the body: 106.5 mm; and width W2 of short sides : 90.5 mm
- Area S1 of a long side wall 11L below the waist portion 6 (the hatched area in Fig. 7): 7,740 mm²
- 5 • Area S2 of a vacuum-absorbing panel 23: 5,440 mm²
- Longitudinal length L1 of the vacuum-absorbing panel 23: 91.5 mm
- Average depth, Dave, of dents for the vacuum-absorbing panels 23: 6.3 mm
- Longitudinal length L2 of the rib-free space 24a accommodating a vertical raised rib 24: 11.5 mm
- 10 • Width W3 between foets of the slope 10 for forming a pair of finger stops F (See Fig. 10): 72 mm
- Steep slope angle TH1 of the slopes 10 for forming finger stops F (See Fig. 10): 60 degrees
- Gentle slope angle TH2 of the vacuum-absorbing panels 23 measured
- 15 against the long side wall 11L (See Fig. 10): 7.5 degrees

[0150] Among these dimensions, the bottle height and body width W1 and W2 are basic dimensions that can be determined once the capacity of a square bottle gets decided. As for other dimensions, areas, and angles can be

20 determined by conforming to the following points (1) to (6) of design guidelines, while taking into account that the bottle 1 must maintain a good shape as a square bottle, that the necessary capacity of the bottle can be secured, and that the vacuum-absorbing panels must have a sufficient vacuum-absorbing function, must not give damage to the rigidity of bottle 1, and must also

25 perform a function for firmly grasping the bottle:

- (1) The vacuum-absorbing panels 23 have an average depth, Dave, of dents ranging from 3% to 15% of short-side width W2 of the rectangular body 4. For the bottle 1 of this embodiment, Dave is 7%;
- (2) Rib-free space 24a between upper and lower segments of vertical raised ribs
- 30 24 has a longitudinal length L2 corresponding to 30% or less of longitudinal length L1 of each vacuum-absorbing panel 23. For the bottle 1 in the embodiment of this invention, the length L2 corresponds to 13%;
- (3) Width W3 between foets of corresponding slopes 10, from which a pair of finger stops F is formed, is in a range of 50% to 90% of short-side width W2 of
- 35 the rectangular body 4. For the bottle 1 of this embodiment, the width W3 corresponds to 80%;
- (4) Each slope for forming a finger stop F has a steep slope angle TH1 in a range of 30 to 90 degrees. For the bottle 1 of this embodiment, the slope angle TH1 is 60 degrees;

(5) The vacuum-absorbing panels 23 have a gentle slope angle TH2 of 9 degrees or less, as measured against the long side wall 11L. For the bottle 1 of this embodiment, the slope angle TH2 is 7.5 degrees; and

5 (6) The vacuum-absorbing panels 23 have an area (S2) in a range of 30% to 90% of area (S1) of a long side wall 11L disposed below the waist portion (6). For the bottle 1 of this embodiment, the area S2 corresponds to 70%; provided that all of these points need not necessarily be satisfied. Some of these points can be combined together to determine the shapes of various portions, taking bottle capacity and application of use into consideration.

10

[0151] Figs. 12-14 show the synthetic resin square bottle in the fourth embodiment of this invention. Fig. 12 is a side elevational view; Fig. 13, a front elevational view; Fig. 14(a), a plane cross-sectional view, taken from line B-B in Fig. 12; and Fig. 14(b), a plane cross-sectional view, taken from line C-C
15 in Fig. 12. The bottle 1 is a biaxially drawn, blow molded PET resin product having overall shape and dimensions similar to the bottle of the third embodiment, except for the shape of vacuum-absorbing panels 23 to be used also as grips, for the shape of other ordinary vacuum-absorbing panels 29, which are disposed above the waist portion 6 in the long side walls 11L and
20 also above and below the waist portion 6 in the short side lat walls 11S, and for the shape of the shoulder 3.

[0152] As for the vacuum-absorbing panels 23 to be used also as the grip, the bottle in the fourth embodiment is similar to the bottle of the third
25 embodiment in that the upper edges of these panels 23 are integrated with the waist portion 6, that the panels 23 are shifted from the horizontal center, and that the finger stops F are formed by increasing the depth of dents near either right or left end (the left side in Fig. 12) and decreasing the depth gradually toward the other end. The bottle of the fourth embodiment is characterized in
30 that a lateral recessed zone 26 for use as the finger stops is formed over the entire width of the vacuum-absorbing panels 23 at a roughly middle height position. Four segments of the vertical raised ribs 24 are disposed in the lateral recessed zone 26.

35 [0153] The bottle of the fourth embodiment is provided with a pair of lateral deep holes 6a which are disposed in the upper areas of the vacuum-absorbing panels 23 and are obtained by further deepening the waist portion 6 in the lateral groove shape (See Fig. 14(b)). For reference, Fig. 15 is a front elevational view of a bottle having no lateral deep hole 6a.

40

[0154] In other words, the bottle 1 in the fourth embodiment of this invention has the construction characterized in that the catching effect of the finger stops is strengthened by the above-described lateral recessed zone 26 and the lateral deep holes 6a. The bottle in an upright, inverted, or inclined position
5 can be held more securely and stably, for example, by putting the tip of the thumb in the waist portion integrated with one vacuum-absorbing panel 23, putting the tip of the index finger in the corresponding waist portion 6 integrated with the other vacuum-absorbing panel 23, and in addition, putting the middle finger and/or the ring finger in the lateral recessed zone 26.

10

[0155] This lateral recessed zone 26 prevents the vacuum-absorbing panels 23 from deforming into a swollen state, such as caused by the pressure applied at the time of filling the bottle with the contents or caused by an increase in internal pressure experienced when the contents are heated to a high
15 temperature for the purpose of pasteurizing or simply heating the contents under a sealed condition. The width, depth, cross-sectional shape, and height of the lateral recessed zone 26 are matters of design that can be suitably determined, taking into account the gripping function, the vacuum-absorbing function, and the control effect against swelling deformation. These design
20 matters have a variety of factors. The number of the lateral recessed zone 26 is not limited to only one, but plural zones can be formed, taking grip property into consideration.

[0156] This invention is further described with respect to preferred
25 embodiments, now referring to the drawings. Figs. 16-22 show the synthetic resin square bottle in a fifth embodiment of this invention. Fig. 16 is a side elevational view; Fig. 17, a front elevational view; Figs. 18(a),(b), plane cross-sectional views, taken from lines A-A and B-B, respectively, in Fig. 16; and Figs. 19(a), a plane cross-sectional view taken from line C-C and Fig. 19(b), an
30 explanatory diagram showing how the body is grasped with a hand. This bottle 1 is a biaxially drawn, blow molded product made of a PET resin, and comprises a neck 2, a shoulder 3, a body 4, and a bottom 5. It is a square bottle having a nominal capacity of 2L. The body 4 is formed by a pair of long side walls 11L, a pair of short side walls 11S, and four corner walls 11C
35 connecting an adjacent long side wall to an adjacent short side wall 11S in a chamfered manner. As shown in Figs. 18, the plane cross-section of the body is in a rectangular shape. A waist portion 6 in the shape of a peripheral groove is formed at a middle height of the body 4 to increase the rigidity of the bottle 1.

40

[0157] Vacuum-absorbing panels 33 are disposed surrounding by a slope 10 below the waist portion 6 in the long side walls 11L that form the long sides of the body 4, in a state in which upper end areas of the panels 33 are integrally connected to the waist portion 6, and are also utilized as the grip together with
5 the waist portion 6.

Ordinary vacuum-absorbing panels 39, which have been utilized conventionally, are disposed above the waist portion 6.

[0158] The vacuum-absorbing panels 33, which is also utilized as the grip, are
10 designed to ensure that the user can get steady and firm hold of the bottle 1 with a hand and to have characteristic configurations of (1), (2), and (3) and corresponding functions, as described below. Figs. 20 and 21 are enlarged views of a vacuum-absorbing panel 33 shown in Fig. 16. Fig. 20(a) is an enlarged front view, and Fig. 20(b) is a vertical section, taken from line F-F
15 shown in Fig. 20(a). Figs. 21(a) and 21(b) are plane cross-sectional views, taken from lines D-D and E-E, respectively, shown in Fig. 20(a).

[0159]

(1) The embanked lateral rib 36 is formed at a predetermined height position
20 of each vacuum-absorbing panel 33 by building an embankment that rises outward from recessed surface 33b of the panel 33 and transversely crosses the panel 33. The embanked lateral rib 36 comprises a top flat surface 36t and a pair of banks 36s that connect this top flat surface 36t to the recessed surfaces 33b at a predetermined slope angle (50 degrees in this embodiment), and the
25 top flat surface 36t is on the same plane as the long side wall 11L (See Figs 20(a) and 20(b)). The embanked lateral rib 36 fully functions as a lateral rib to control effectively the deformation of vacuum-absorbing panels 33 into a swollen state, which occurs with an increase in internal pressure at the time of a pressurized filling operation. Since the top flat surface 36t of each embanked
30 lateral rib 36 is on the same plane as the corresponding long side wall 11L, this top flat surface 36t can also be utilized as a guide on the production line.

[0160] The top flat surface 36t is on the same plane as the long side wall 11L in this embodiment to let the embanked lateral rib 36 fully perform the
35 function as a lateral rib. Although each vacuum-absorbing panel 33 has to be separated into upper and lower parts, the vacuum-absorbing function is performed by the entire vacuum-absorbing panel 33 including this embanked lateral rib 36.

[0161] The width, height, and cross-sectional shape of the embanked lateral rib 36, and its height position in a vacuum-absorbing panel 33 are matters of design, which can be determined suitably, by taking into consideration the function of controlling swollen deformation, the finger stop function, and the vacuum-absorbing function. These dimensions have many variations. The embanked lateral rib 36 is not limited to one for a panel, but a plural number of embanked lateral ribs 36 can be formed. It is also possible not to separate each vacuum-absorbing panel 33 into upper and lower parts. This can be done, for example, by denting the top flat surface 36t of the embanked lateral rib 36 only slightly from the long side wall 11L. In this case, there is a decrease in the function of controlling swollen deformation and the function as a guide described above, but the vacuum-absorbing function can be improved.

[0162]

(2) As shown in Fig. 19(a), Fig. 19(b), and Fig. 21(b), the slope 10L is long and steep at either right or left end of each vacuum-absorbing panel 33 (on the left end in these figures). At the other end, the slope 10R is gentle and short. Thus, the depth of each recessed surface 33b becomes shallow linearly from left to right. The recessed surfaces 33b of each vacuum-absorbing panel 33 are provided with ridge segments 34 having an anti-slip function to prevent slips in the lateral direction.

[0163] As described above, the slope 10L is long and steep at the left end of each vacuum-absorbing panel 33. The user can get firm hold of the bottle 1 with the palm of a hand by fixing fingers to the finger stop F at one end of the vacuum-absorbing panel 33 where the dent has been deepened, as shown in the explanatory diagram of Fig. 19(b). The user can also grasp the grip G in Fig. 19(b) with the palm of a hand to get hold of the bottle 1 more steadily. In the case of grasp as shown in Fig. 19(b), the width is smallest between a pair of recessed surfaces 33b on the sides where the body is grasped with fingers, as the wall portions comprising the vacuum-absorbing panels 33 are tapered from the right to the left. In such a case, fingers are prone to sideslip to the right. The ridge segments 34 projected from the recessed surfaces 33b are effective in stopping the sideslip.

[0164]

(3) The upper end areas of the vacuum-absorbing panels 33 are integrated with the waist portion 6. The groove-like waist portion 6 is further caved in to form lateral deep holes 6a for the finger stop use (See Fig. 18(b), Fig. 20(a), Fig. 20(b), and Fig. 21(a)). Under this construction, the user can put a part of

fingers in the lateral deep holes 6a of the waist portion 6 and the bottle 1 is prevented from slipping off vertically.

[0165] Fig. 19(b) shows a standard example of grasping the bottle 1 of this embodiment. The user fits the tip of the thumb in the lateral deep hole 6a that has been integrated with the waist portion 6 of one long side wall 11L, and puts the tip of the index finger in the corresponding lateral deep hole 6a disposed in the other long side wall 11L. In addition, the user puts the middle finger in the area upside of the embanked lateral rib 36, and puts the ring finger and the little finger in the area underside of the embanked lateral rib 36 of the vacuum-absorbing panel 33 disposed in the other long side wall 11L, while utilizing the banks 36s of the embanked lateral rib 36 as finger stops. In this manner, the bottle in various positions, including an upright, inverted, or inclined position, can be held more securely and stably than ever.

[0166] Of course, the way to grasp the bottle 1 is not limitative and has many variations, depending on the users and the remaining volume of the contents. Fig. 19(b) shows the bottle held by utilizing finger stops F from the left side, but if the users utilize the locking function of the embanked lateral ribs 36, they can grasp the bottle with a certain level of steadiness, without paying attention to the grasping direction or the height position. Depending on the side width of the body 4 and the size of the palm, the user may grasp the bottle better from the right side.

[0167] The square bottle of this embodiment has the following sizes, areas, and angles specified for various portions of the bottle:

- Bottle height: 303 mm
- Lateral long-side width, W1, of the body 4: 106 mm: and short-side width, W2 : 90 mm
- Depth of recessed surface of each vacuum-absorbing panel 13: 6.1 mm
- Width, W3, between foets of the slope 10L from which a pair of finger stops, F, is formed (See Fig. 19(a)): 72 mm
- Steep rising slope angle, TH, of each slope 10 used as a finger stop, F (See Fig. 19(a)): 60 degrees

[0168] Among these dimensions, the bottle height and width, W1 and W2, of the body are the basic dimensions that can be determined once the capacity of a square bottle gets decided. Other dimensions, areas, and angles can be determined by conforming to the following points (1) to (3) of design guidelines, while taking into account that the bottle 1 must maintain a good shape as a

square bottle, that the necessary capacity of the bottle can be secured, and that the vacuum-absorbing panels 33 must have a sufficient vacuum-absorbing function, must not give damage to the rigidity of the bottle 1, and must also fully perform a function for firmly grasping the bottle 1:

- 5 (1) The vacuum-absorbing panels 33 have an average depth of dents ranging from 3% to 15% of short-side width W_2 of the rectangular body 4. For the bottle 1 of this embodiment, the depth is 6.8%;
- (2) Width W_3 between foets of corresponding slopes 10L, from which a pair of finger stops F is formed, is in a range of 60% to 95% of short-side width W_2 of the rectangular body 4. For the bottle 1 of this embodiment, the width W_3 10 corresponds to 80%; and
- (3) Each slope 10L for forming a finger stop F has a steep slope angle TH1 in a range of 30 to 90 degrees. For the bottle 1 of this embodiment, the slope angle TH1 is 60 degrees;
- 15 provided that all these points need not necessarily be satisfied. Some of these points can be combined together to determine the shapes of various portions, taking bottle capacity and application of use into consideration.

[0169] The above bottle of the fifth embodiment is further described as to its 20 behavior at the time of deformation into a dented state, as experienced when there is an increase in depressurization inside the bottle, while referring to Fig. 22. Both ends E of the embanked lateral rib 36 are where this rib 36 butts, in a T-shaped configuration, against the panel-surrounding slope 10 on both right and left sides of the recessed surfaces 33b of each vacuum-absorbing panel 33.

25 At the rib end ER on the shallow side of the recessed surface 33b (the right side in Fig. 22), both the slope 10 and the embanked lateral rib 36 are low in height, and therefore, this rib end ER is prone to inflection and deformation into a dented state.

30 [0170] When the bottle is put under reduced pressure, at first the entire body wall is affected by deformation caused by reduced volume of the bottle. Then, if depressurization is further increased, the rib end ER having above configuration is preferentially inflected along the chain double-dashed line shown in Fig. 22, and is deformed into a dented state. The deformation 35 starting from this inflected rib end ER is carried forward to a surrounding area R (the hatched area in Fig. 22).

[0171] The deformation showing the above-described behavior is a type of 40 deformation in which the entire vacuum-absorbing panel 33, along with the embanked lateral rib 36, is pushed inward as if a door is forcibly pushed

inward, with the rib end EL on the deep side of the recessed surface acting as a fixed end (an axis). The internal volume of the bottle 1 can be effectively decreased in this manner. And despite a considerable decrease in the internal volume, the bottle appearance is not damaged to a large extent, and a very good vacuum-absorbing function is performed even if the deformation is carried forward from the shallow-side rib end ER to the surrounding area. This is because the embanked lateral rib 36 and the slope 10 near this rib end ER are made low in height.

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10 [0172] In the case of the above-described bottle of the fifth embodiment, the end ER of the embanked lateral rib 36 on the shallow side is prone to inflection and deformation into a dented state. Thus, when the user gets hold of the body 4 by putting fingertips on the vacuum-absorbing panels 33, the rib end ER is preferentially inflected and dented, and such deformation starting from this rib end ER is smoothly carried forward to the surrounding area. The deformation into the dented state that proceeds in the above-described manner is enough to decrease the internal volume substantially and to effectively protect other portions of the bottle against any distorted deformation into a dented state.

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20 [0173] If the user happens to grasp the body 4 from the right side of the bottle, the rib end ER is preferentially inflected and deformed into a dented state, and the deformation starting from this inflected rib end ER is carried forward to the surrounding area R. Since the embanked lateral rib 36, a nearby slope 10, and an adjacent long side wall portion 11L are deformed in the above-described manner by the squeeze with the fingers in contact with respective portions, the body of the bottle well fits in with the palm of the hand with which the bottle is held.

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30 [0174] Fig. 23(a) is an enlarged front view of the vacuum-absorbing panel 33 in the sixth embodiment, and Figs. 23(b) and 23(c) are vertical sections of important parts thereof, used for the synthetic resin square bottle in the sixth embodiment of this invention. Figs. 24(a) and 24(b) are plane cross-sectional views of important parts in the vacuum-absorbing panel 33. The bottle in the sixth embodiment shows a variation in the shape of the vacuum-absorbing panel 33 from the bottle in the fifth embodiment described above. Fig. 23(a) is an enlarged front view of the vacuum-absorbing panel 33; Fig. 23(b), a vertical section taken from line I-I in Fig. 23(a); and Fig. 23(c), a vertical section taken from line J-J in Fig. 23(a). Figs. 24(a) and 24(b) are plane cross-sectional views taken from lines G-G and H-H, respectively, in Fig. 23(a).

[0175] Since it is intended in the bottle of this invention that the vacuum-absorbing panels 33 are also utilized as the grip, the slopes 10 are formed so as to reach a relatively large depth. Because of this depth, it is relatively difficult to carry forward the deformation smoothly to a nearby long side wall 11L when the vacuum-absorbing panels 33 is deformed into a dented state due to a decrease in the contents of the bottle 1 under reduced pressure. Reversed buckling deformation tends to occur especially in areas ranging from the long side walls 11L on the shallow sides of the vacuum-absorbing panels 33 to the corresponding corner walls 11C. With the vacuum-absorbing panel 33 shown in Figs. 23 and 24, it is intended to prevent buckling deformation caused by an increase in decompression, by allowing the vacuum-absorbing function of the panel 33 to be performed more effectively.

[0176] The configuration of the vacuum-absorbing panels 33 used in the bottle 1 of the sixth embodiment is characterized by the following three points (1), (2), and (3):

(1) The right slope 10R has a height h_2 as low as 1.5 mm and a rising slope angle of 43 degrees (See Fig. 24(b)). In the case of the vacuum-absorbing panel 33 used in the fifth embodiment, the slope 10R has a height h_1 of 3 mm and a rising slope angle of 62 degrees (See Fig. 21(b));

(2) The banks 36s of the embanked lateral rib 36 have a rising slope angle of 57 degrees on the left side of the vacuum-absorbing panel 33. This angle is gradually decreased to 18 degrees from the left toward the right of the panel 33 (See the angles P2 and P3 in Figs. 23(b) and 23(c)). By comparison, in the case of the vacuum-absorbing panel 33 used in the fifth embodiment, the banks 36s have a constant slope angle P1 of 50 degrees (See Fig. 20(b)); and

(3) A crescent-shaped ridge 38 is formed by folding each bank 36s at the corner 37 of the bank 36s and the slope 10R (See Figs. 23(a) and 23(c)).

[0177] When the action and effect of the above constructive requirements (1), (2), and (3) are correlatively at work, the deformation of the vacuum-absorbing panels 33 into a dented state, as caused by a decrease in the contents of the bottle 1 under reduced pressure, can be smoothly carried forward to adjacent long side walls 11L by way of the slope 10 on the right side of the panel 33. As a result, the vacuum-absorbing function of the panel 33 can be performed more effectively.

[0178] More particularly, when the vacuum-absorbing panels 33 is deformed into a dented state due to a decrease in the contents of the bottle 1 under

reduced pressure, this deformation is carried forward smoothly to the long side wall 11L disposed next to the slope 10R, by way of this slope 10R on the right side of the panel 33, where the slope is low in height and angle. Thus, under the constructive requirement (1), the vacuum-absorbing function can be effectively performed. According to the constructive requirement (2), the banks 36s at the right end have a small rising slope angle and are low in height. Therefore, the deforming force can be smoothly carried forward from the corner 37 to the long side wall 11L, thus effectively preventing the buckling deformation from occurring at or near this corner 37. According to the constructive requirement (3), the crescent-shaped ridge 38 at the corner 37 is stretched so that the action and effect of (2), above, can be reliably achieved.

[0179] This invention has been described with respect to preferred embodiments and their action and effects. However, this invention should not be construed as limitative to these embodiments. For example, this invention can be applied to the bottles made of synthetic resins other than the PET resin. Furthermore, this invention is not limited to the bottle with a capacity of 2L, but can be applied to the bottles of a larger size than 2L, while making it easy for the user to get firm hold of the bottle.

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[0180] There are many variations in the shape of the lateral deep hole associated with the grip of this invention and in the position in which this lateral deep hole is formed. In the case of the bottle larger than 2L, a good grip can be secured by shifting the position of lateral deep holes toward the rear of the bottle. The above embodiments have been described by taking an example of vacuum-absorbing panels that are integrally connected to the waist portion. However, the vacuum-absorbing panels for use as a grip can also be separated from the waist portion.

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INDUSTRIAL APPLICABILITY

[0181] As obvious from the foregoing description, it is ensured that a large size square bottle of this invention is provided with drastically strengthened grip. And this can be done by utilizing the vacuum-absorbing panels as the grip, without giving damage to bottle appearance. As such, wide applications of use are expected especially in the field of large-size square bottles.

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The claims defining the invention are as follows:

1. A synthetic resin bottle comprising a body having a rectangular shape in a plane cross-section and a groove-like waist portion disposed at a almost half height of the bottle,

wherein a pair of vertically long recessed portions for use as finger stops are formed in respective long side walls of said rectangular body over a predetermined area ranging from said waist portion downward to ensure that a plural number of fingers can be placed in at least one recessed portion for a finger stop purpose, and wherein a grip for holding the bottle is formed from both the pair of recessed portions and the waist portion,

wherein the pair of recessed portions are formed in a state in which upper end areas thereof are connected integrally to the waist portion, and

wherein the grip for holding the bottle is formed from both the recessed portions and a side wall that connects these two recessed portions, while the grip is also integrally connected to the waist portion.

2. The synthetic resin bottle according to claim 1, wherein the rectangular body comprises a pair of long side walls, a pair of short side walls, and four corner walls connecting a long side wall to an adjacent short side wall in a chamfered manner.

3. The synthetic resin bottle according to claim 2, wherein a lateral raised rib is formed in each recessed portion to reinforce the recessed portion and to stabilize the state of fingers placed between the waist portion and said lateral raised rib.

4. The synthetic resin bottle according to claim 2 or 3, wherein a reinforcing rib to reinforce each recessed portion is transversally formed inside the recessed portion.

5. The synthetic resin bottle according to claim 3 or 4, wherein lateral width at the bases of both recessed portions is in a range of 55 to 70 mm, and wherein lateral width at or near upper end of the rear wall portion is in a range of 70 to 80 mm.

6. The synthetic resin bottle according to any one of claims 3 to 5, wherein the grip, starting from one recessed portion and ending at the other recessed portion by way of the rear wall portion, has a peripheral length in a range of 140 to 180 mm.

7. The synthetic resin bottle according to any one of claims 3 to 6, wherein the rear wall portion is formed in such a way that lateral width thereof widens downward.

8. The synthetic resin bottle according to any one of claims 3 to 7, wherein the rear wall portion is provided with lateral ribs extending to the right and the left.

9. The synthetic resin bottle according to any one of claims 2 to 8, wherein a vacuum-absorbing panel is formed below the waist portion of each long side wall in such a way that the panel is integrally connected to a recessed portion.

10. A synthetic resin bottle substantially as hereinbefore described with reference to the accompanying drawings.

Dated 12 April 2012

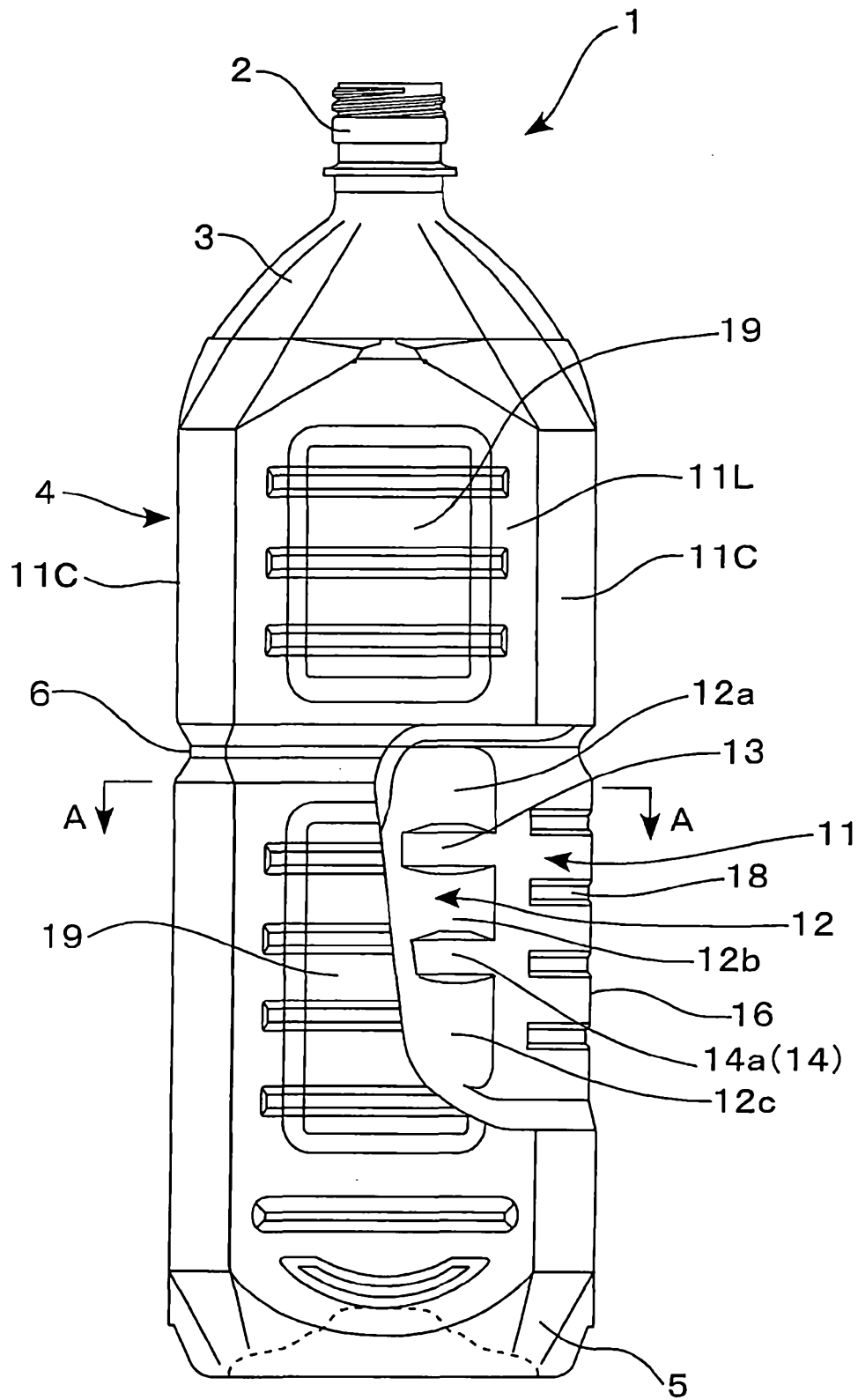
Yoshino Kogyosho Co., Ltd

Patent Attorneys for the Applicant/Nominated Person

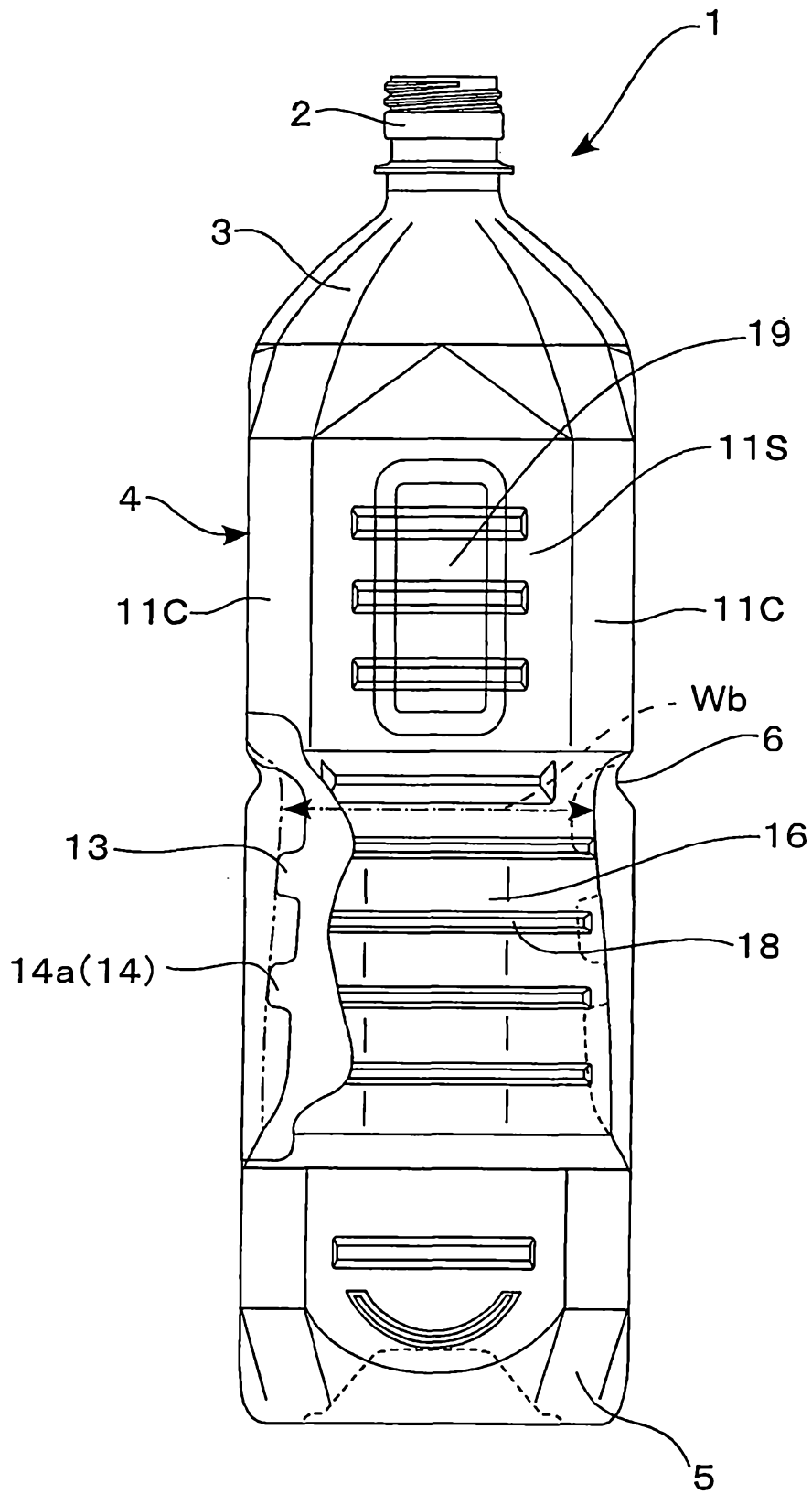
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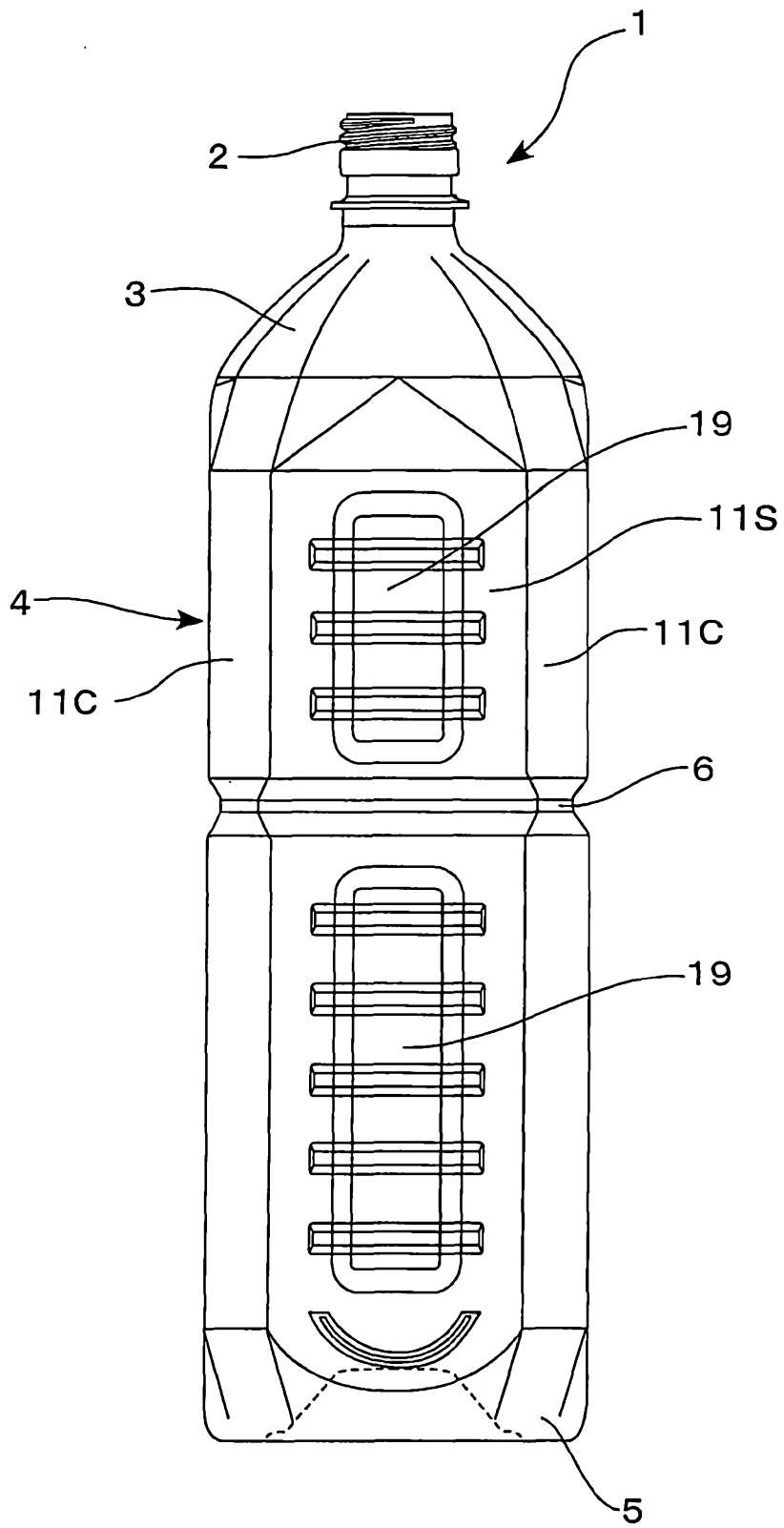
[Fig.1]



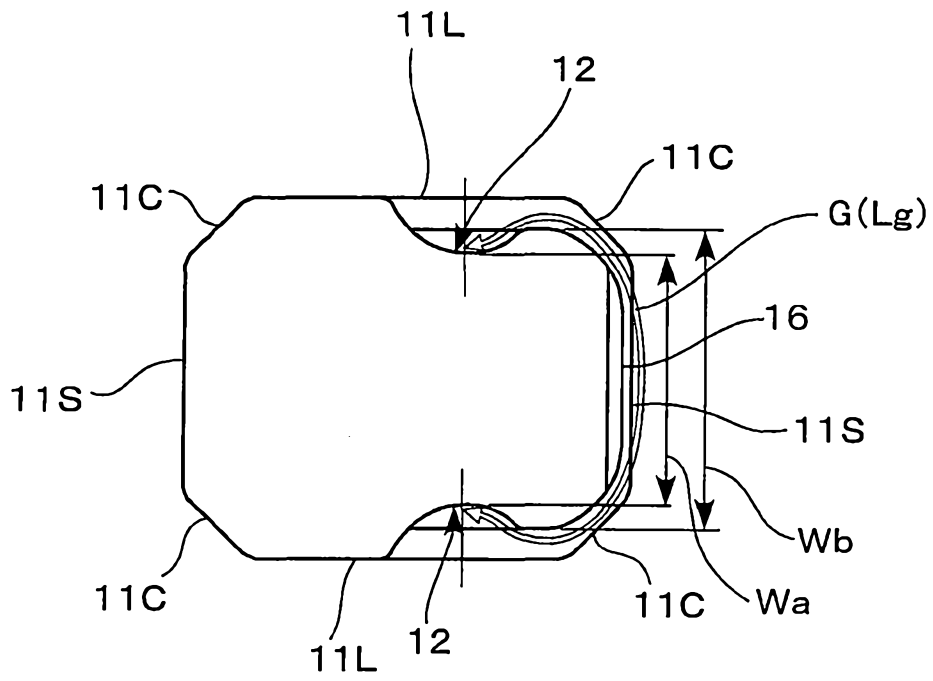
[Fig.2]



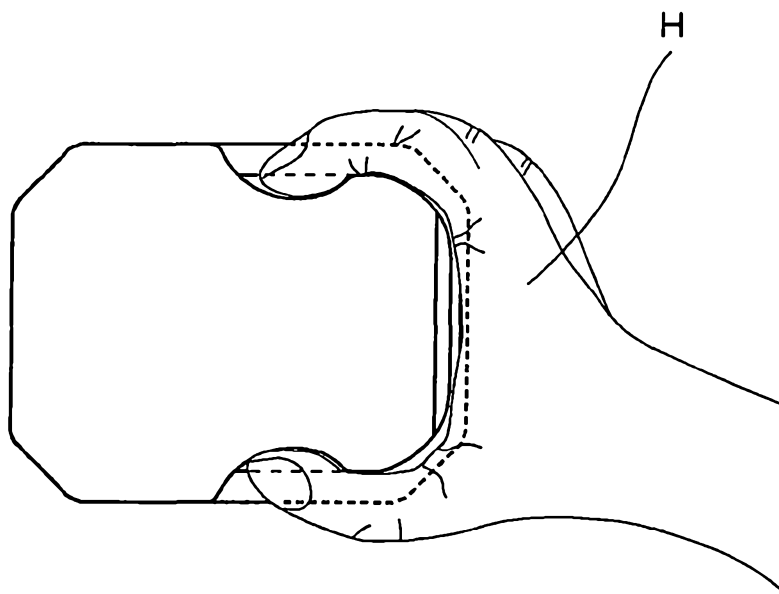
[Fig.3]



[Fig.4]

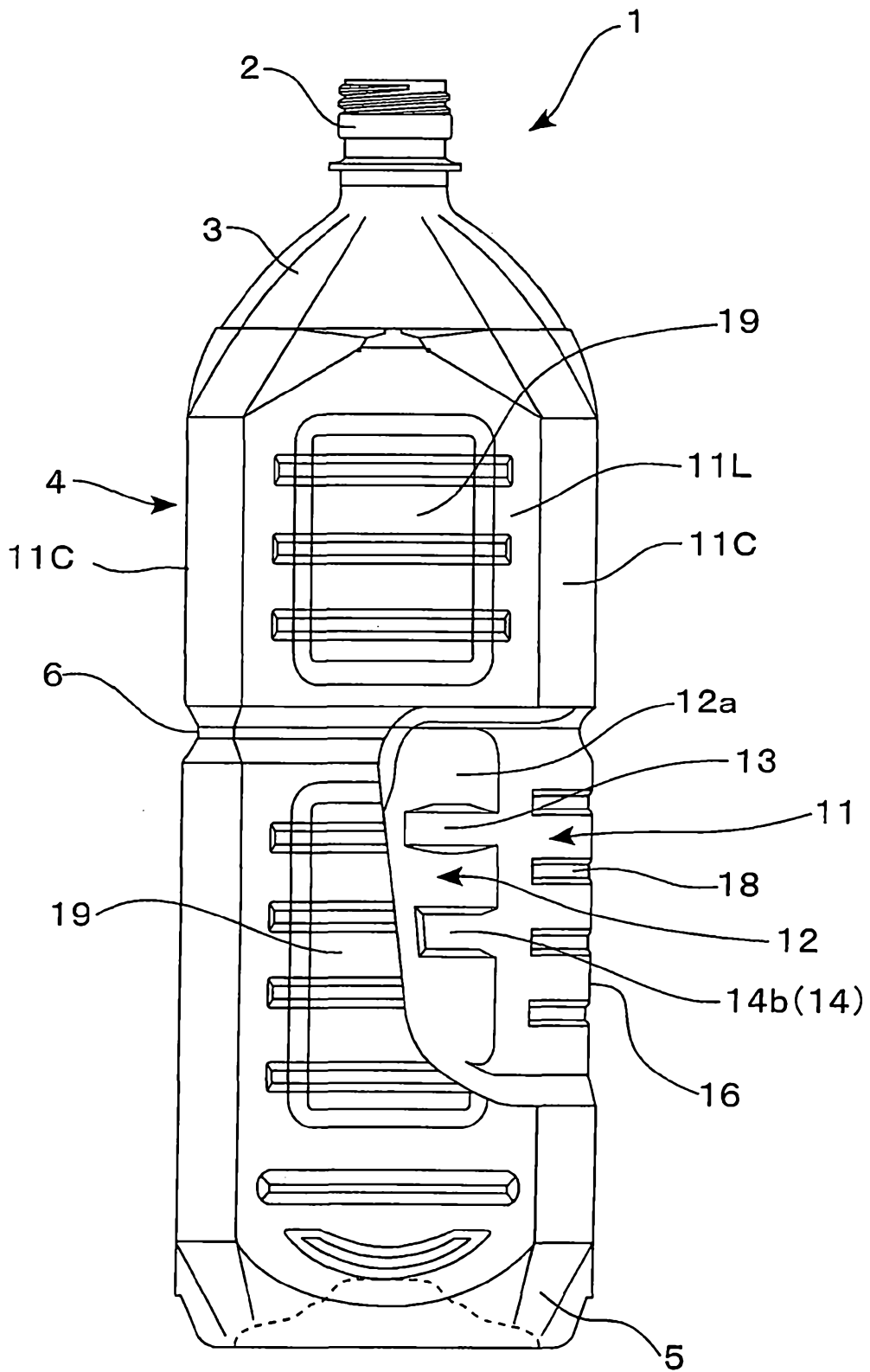


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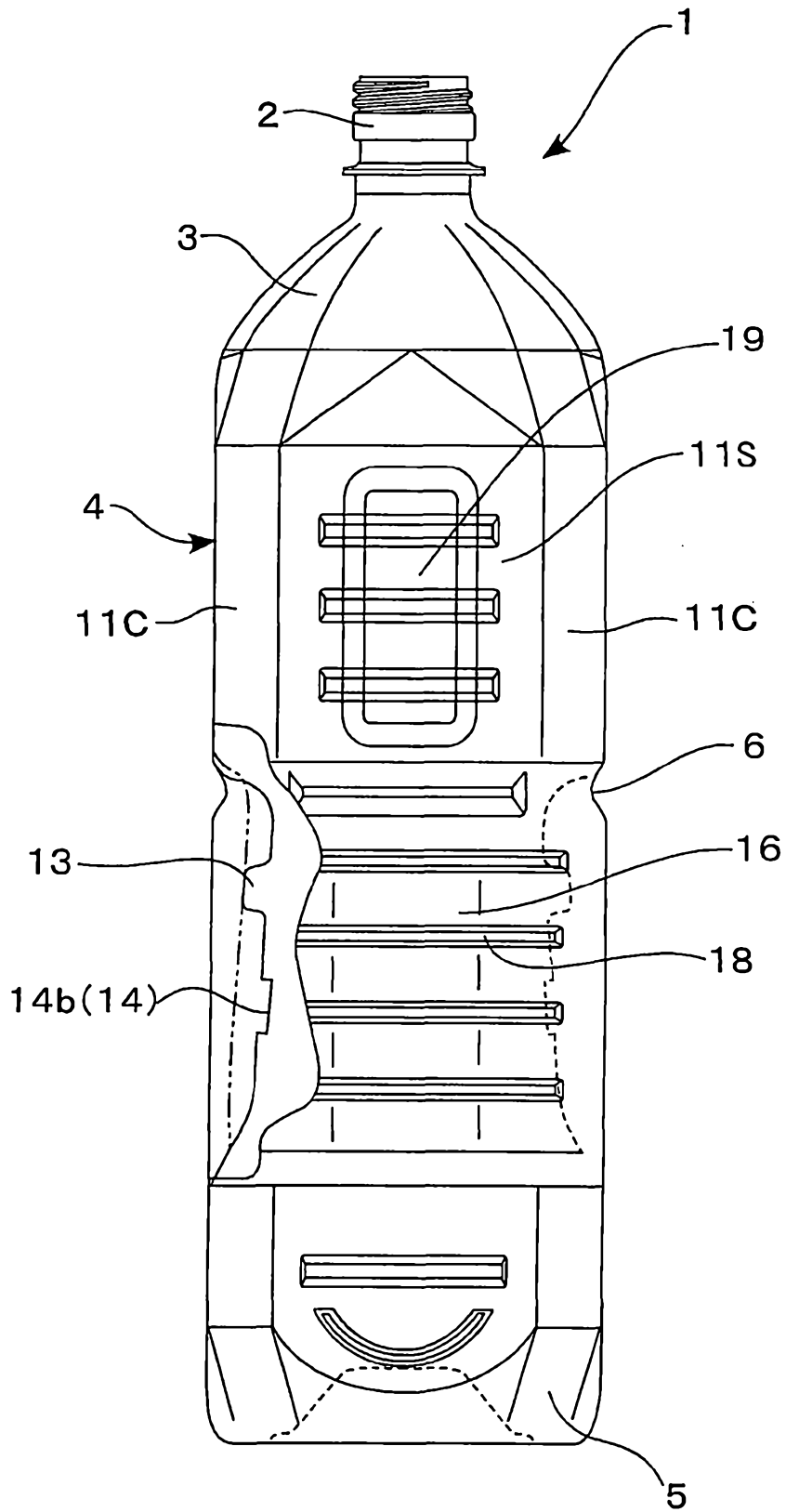


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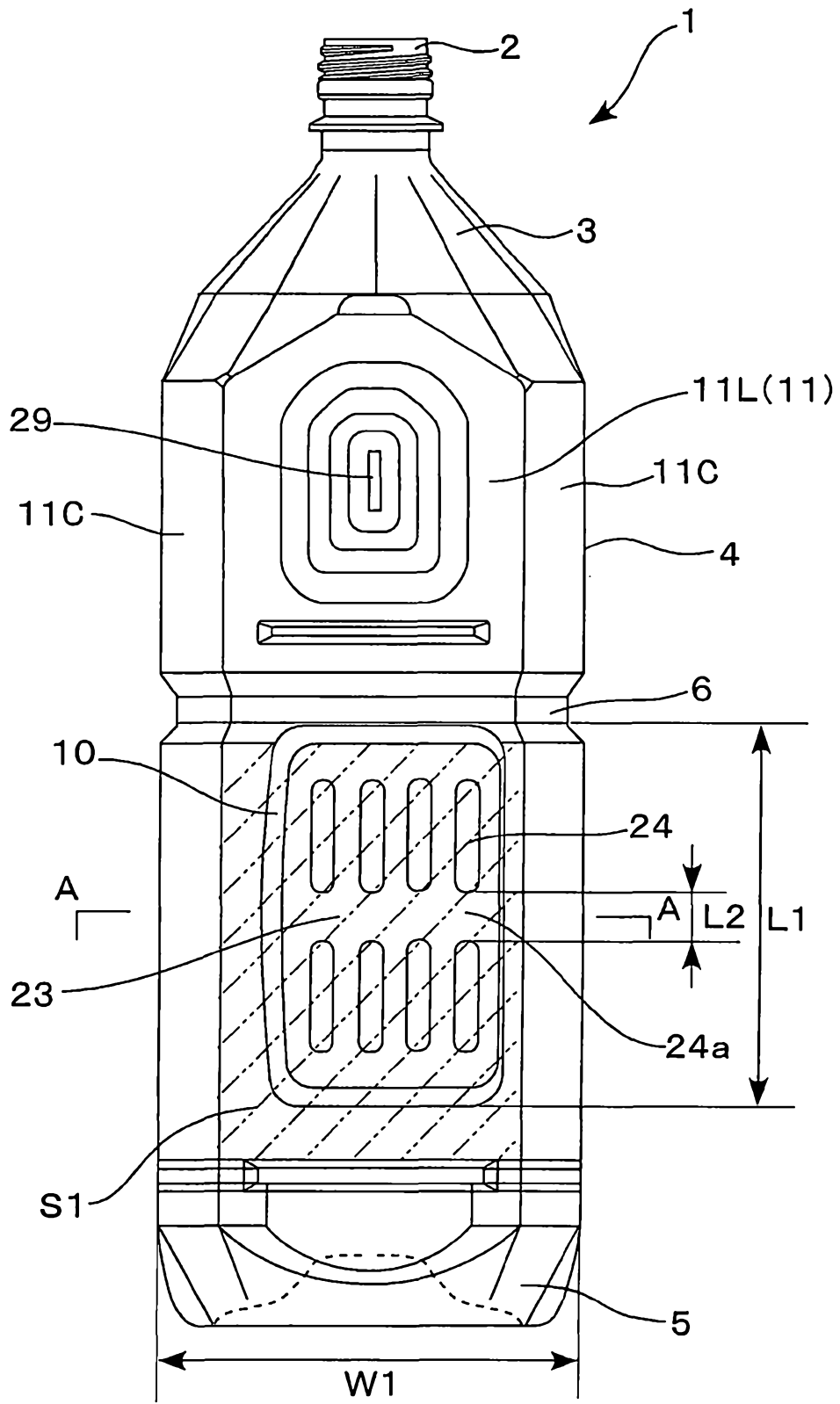
[Fig.5]



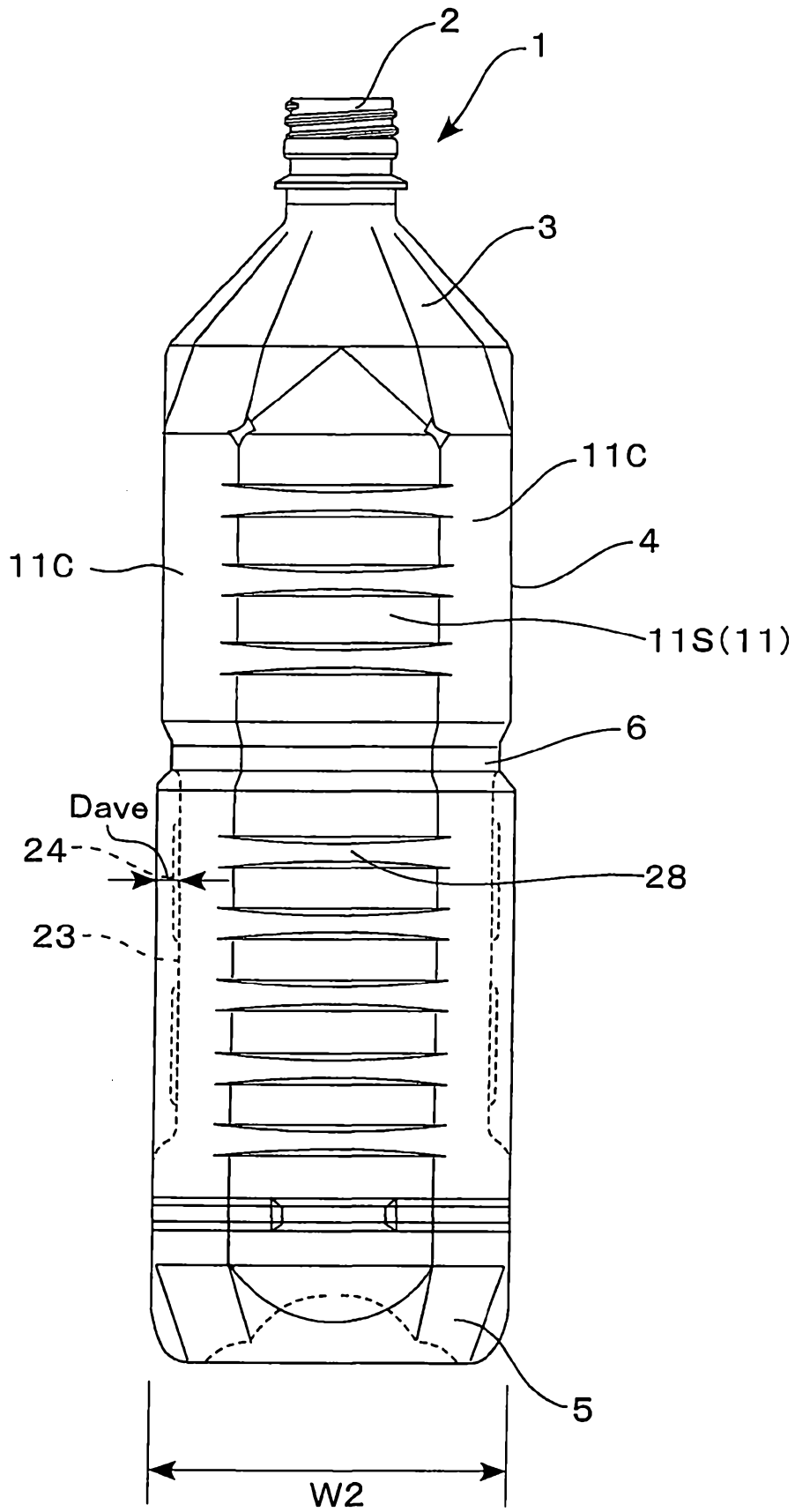
[Fig.6]



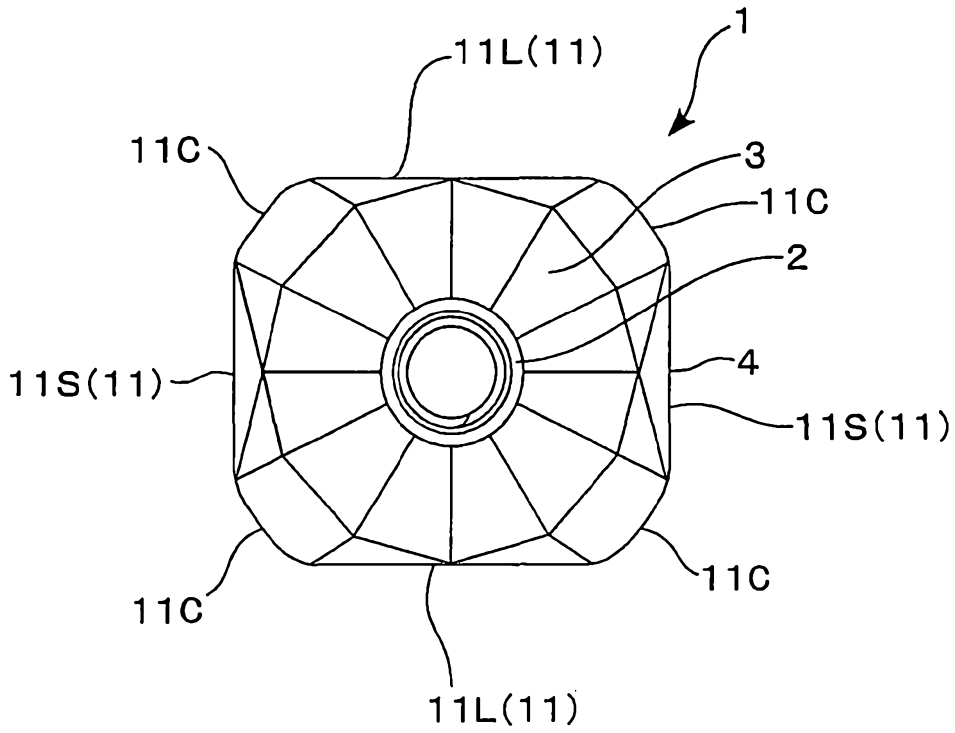
[Fig.7]



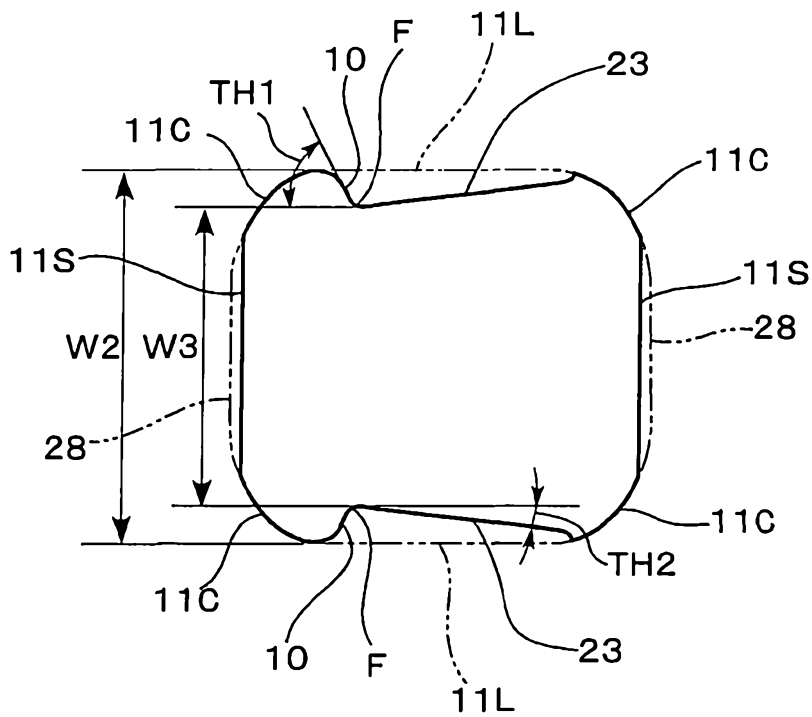
[Fig.8]



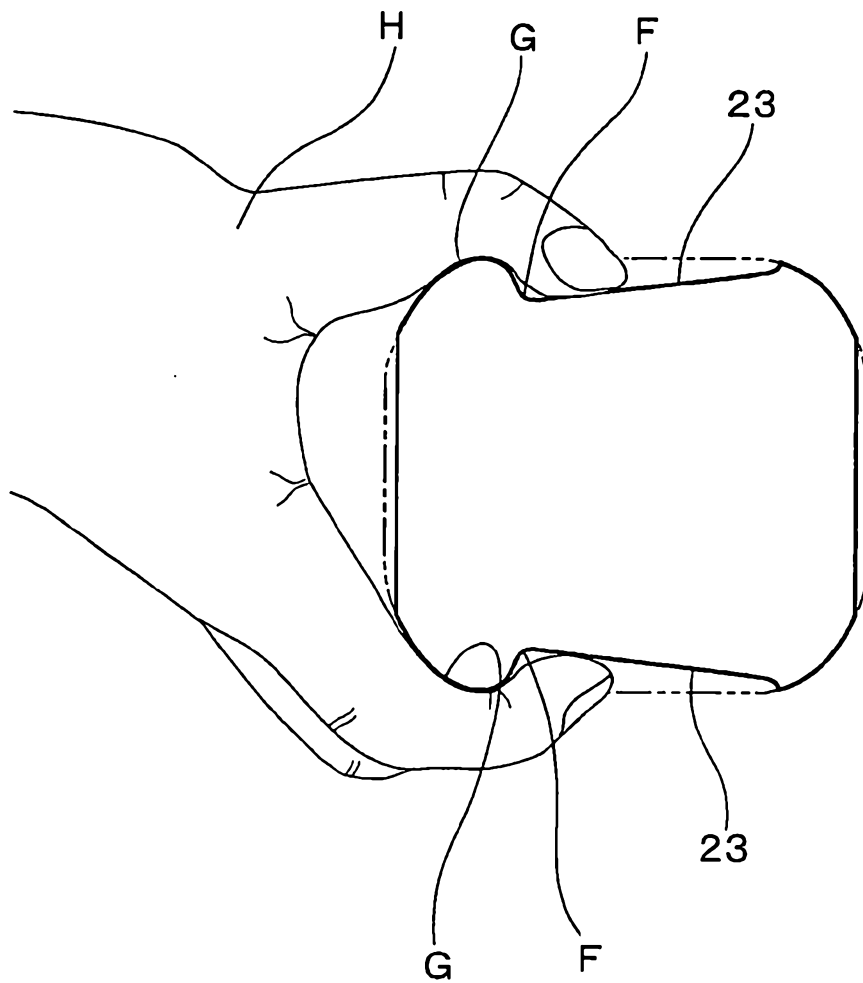
[Fig.9]



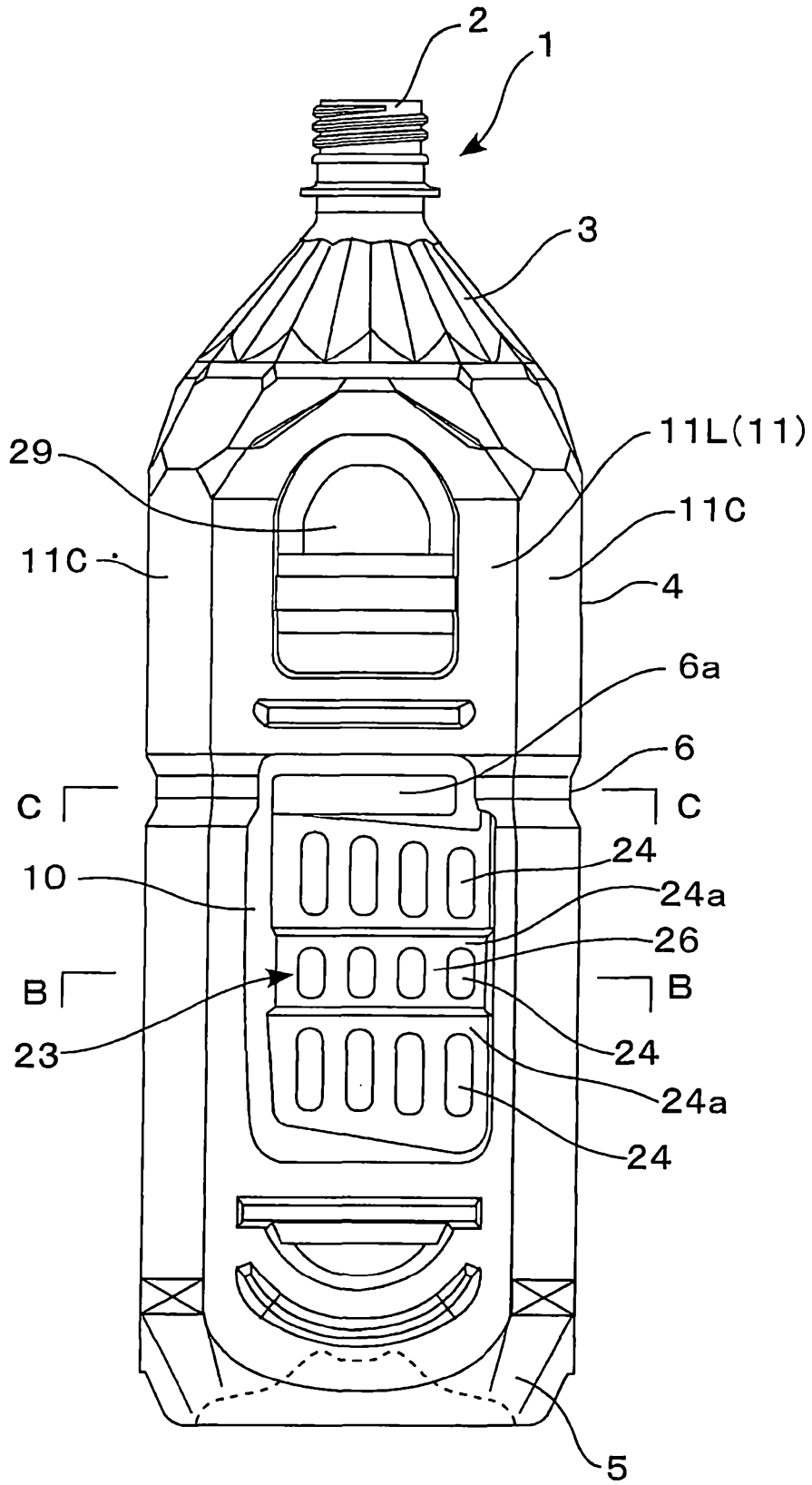
[Fig.10]



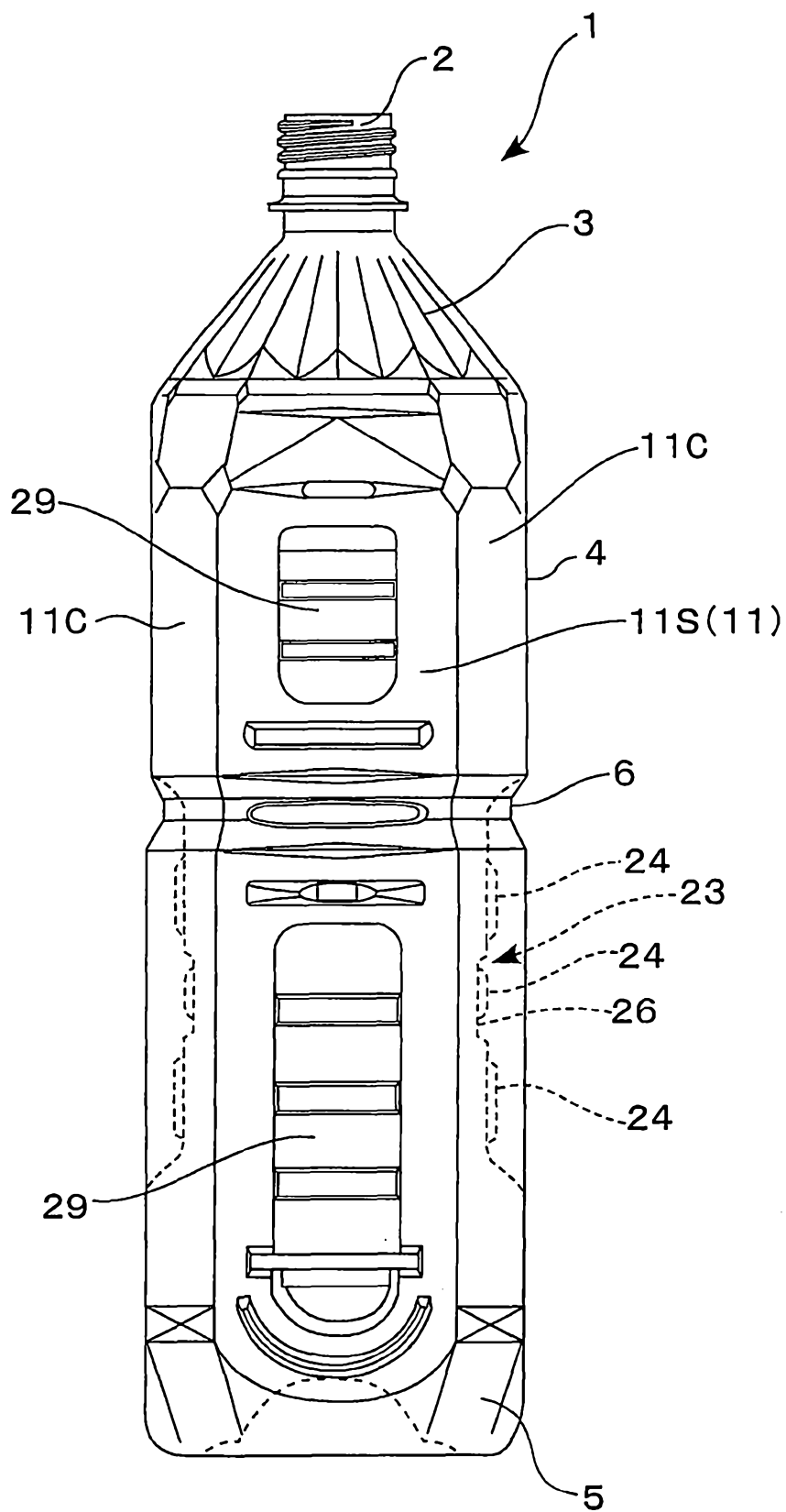
[Fig.11]



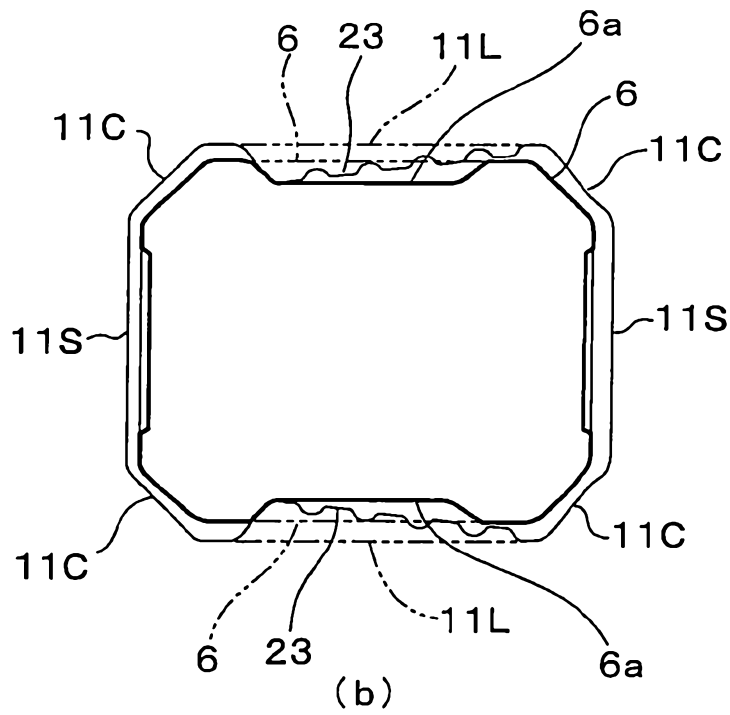
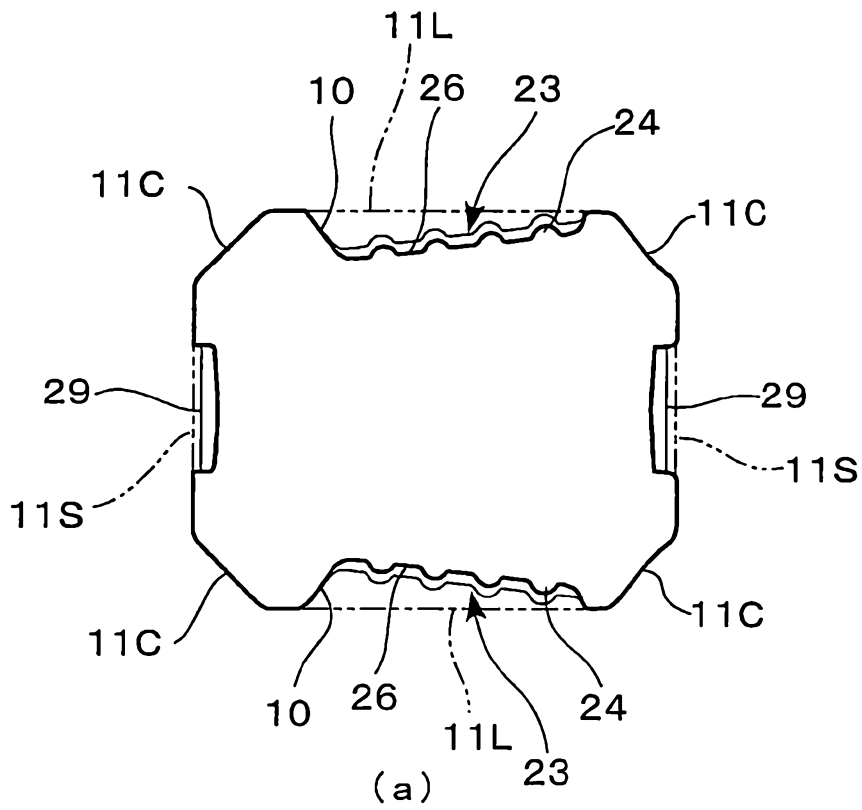
[Fig.12]



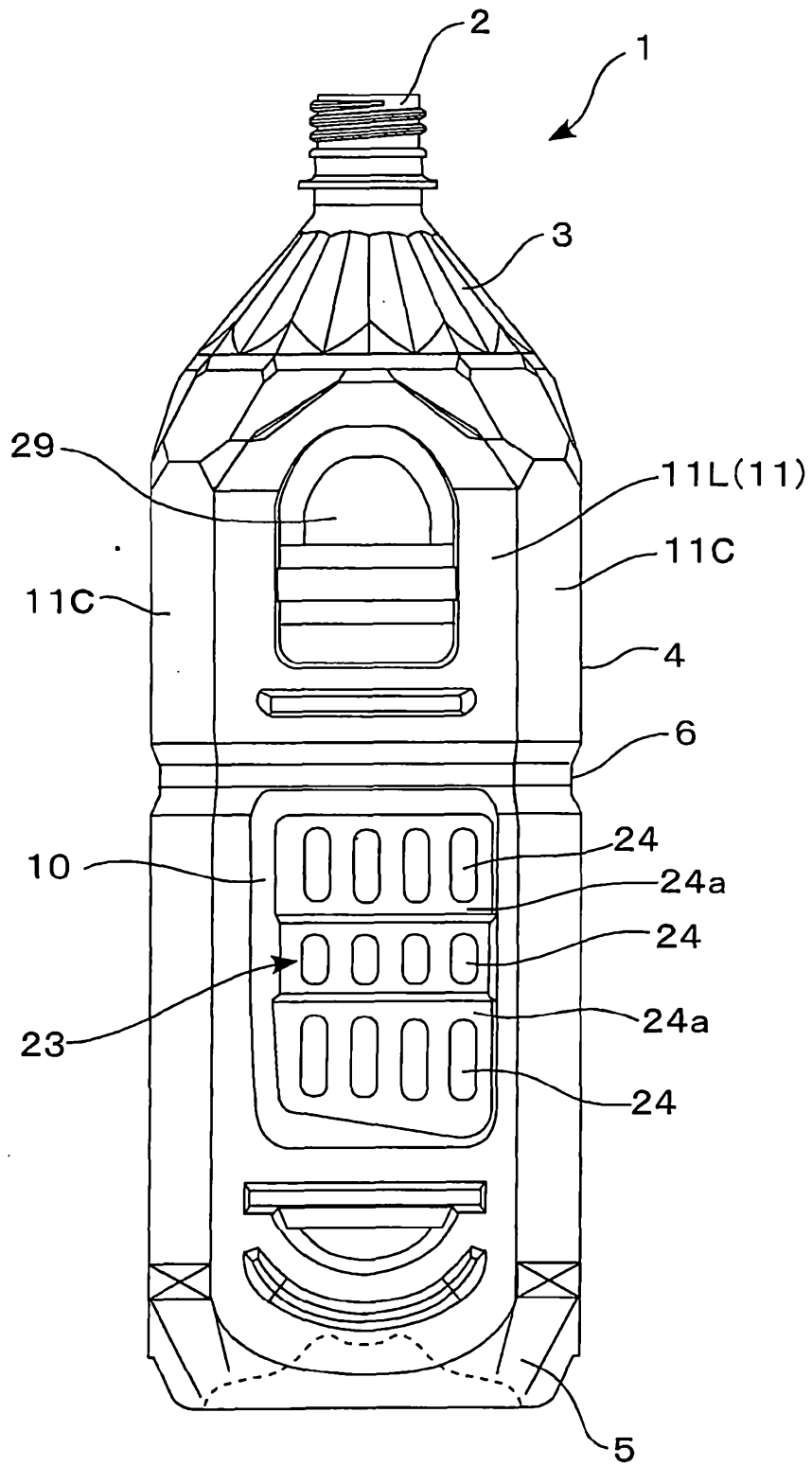
[Fig. 13]



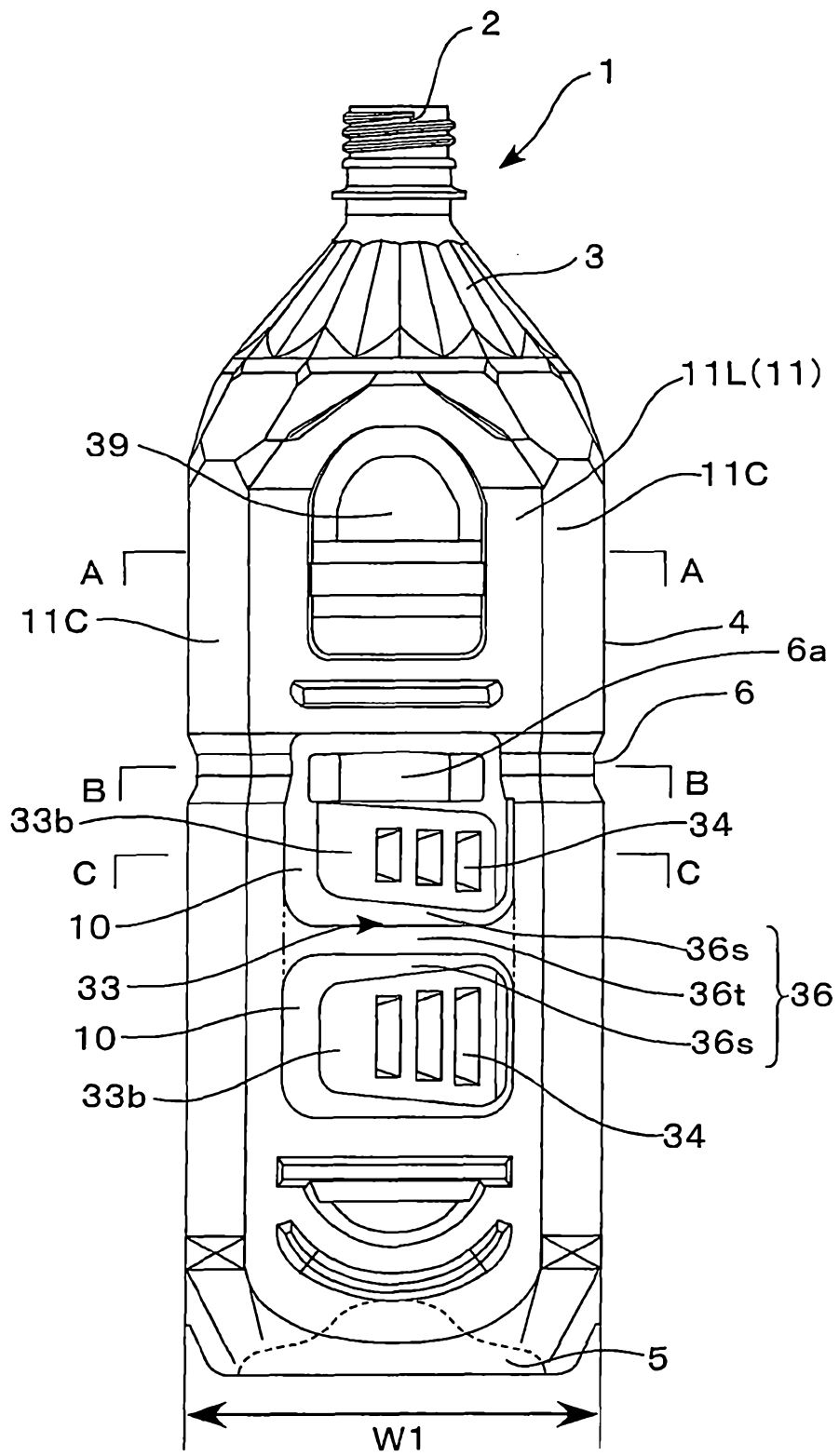
[Fig.14]



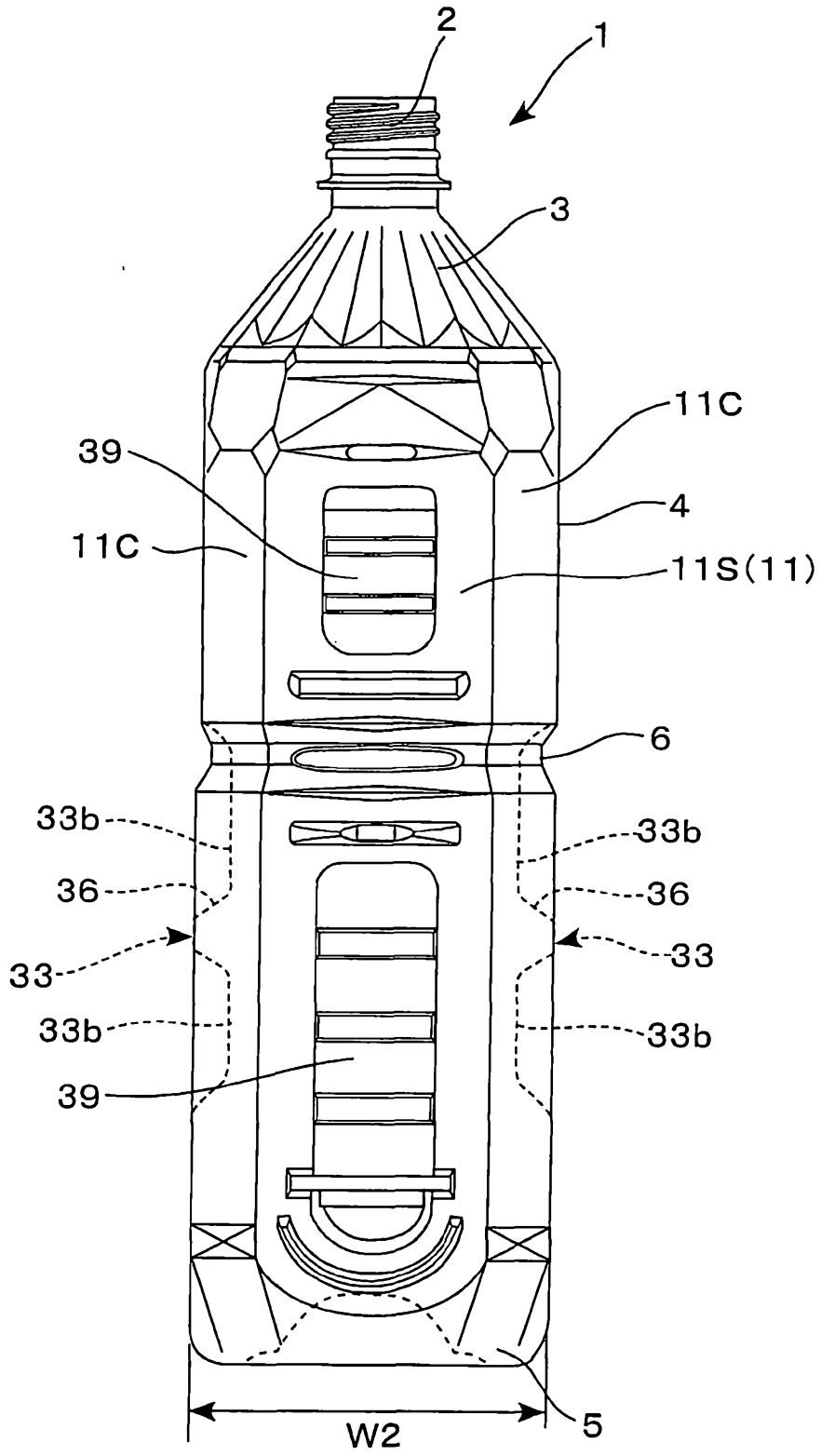
[Fig.15]



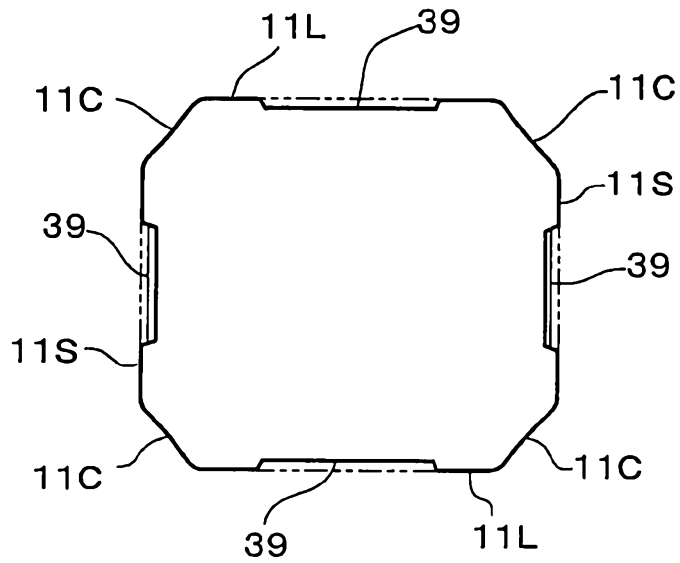
[Fig.16]



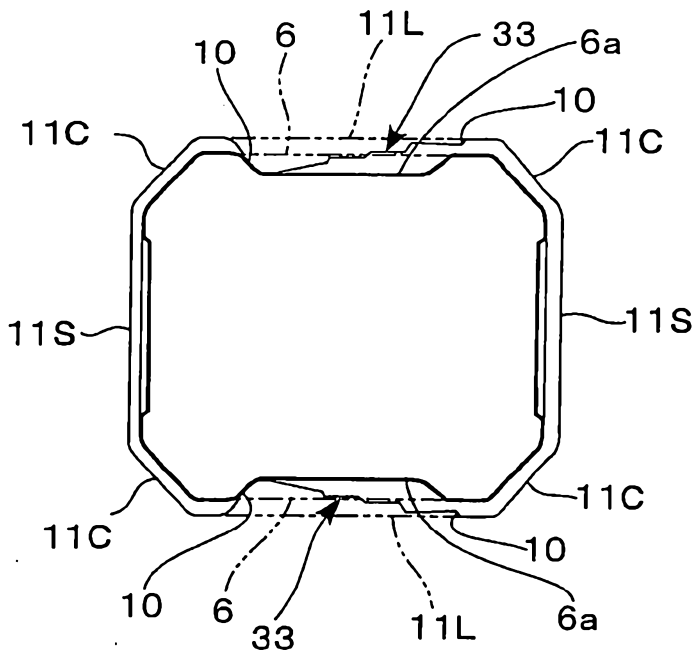
[Fig.17]



[Fig.18]

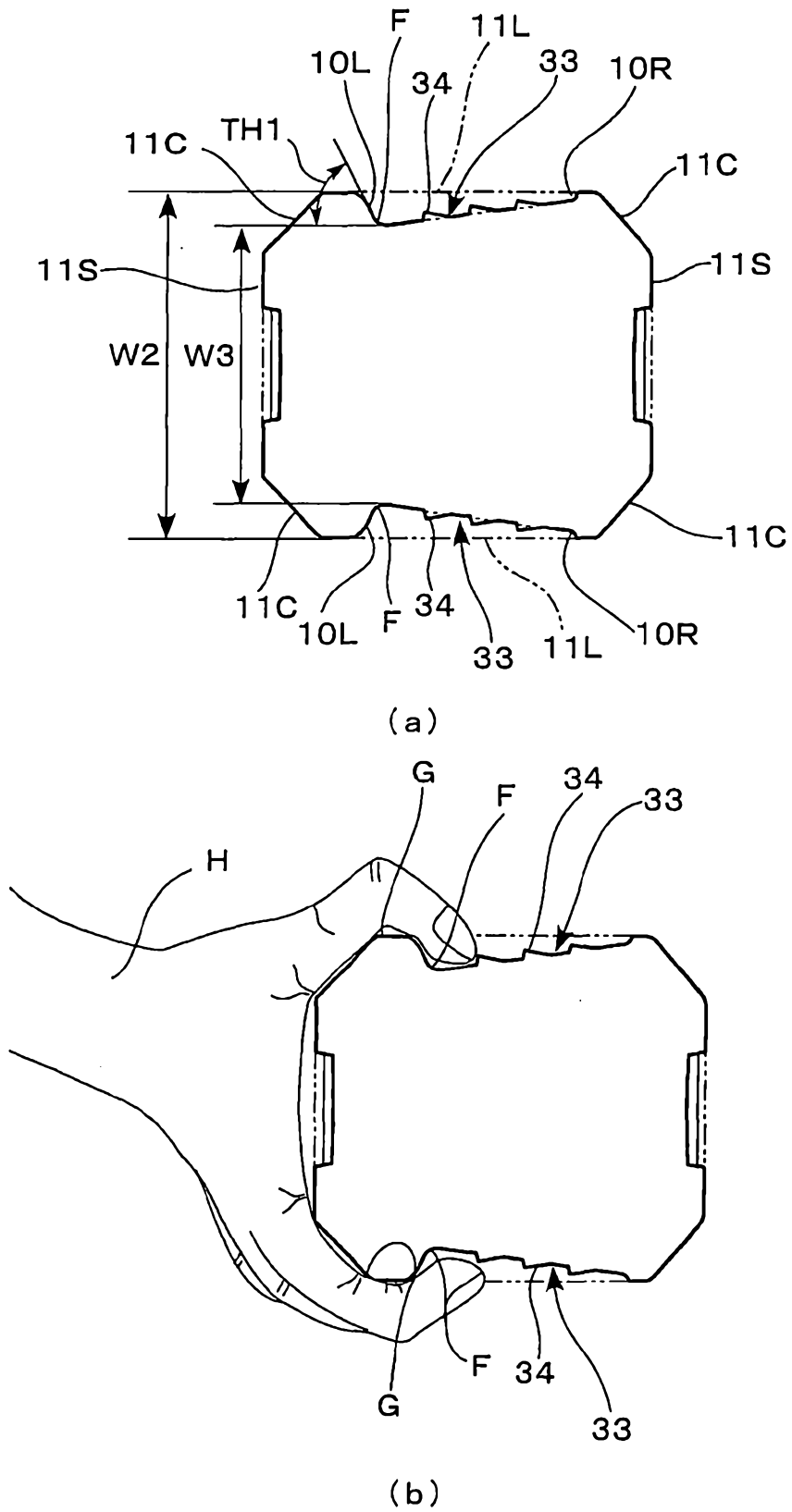


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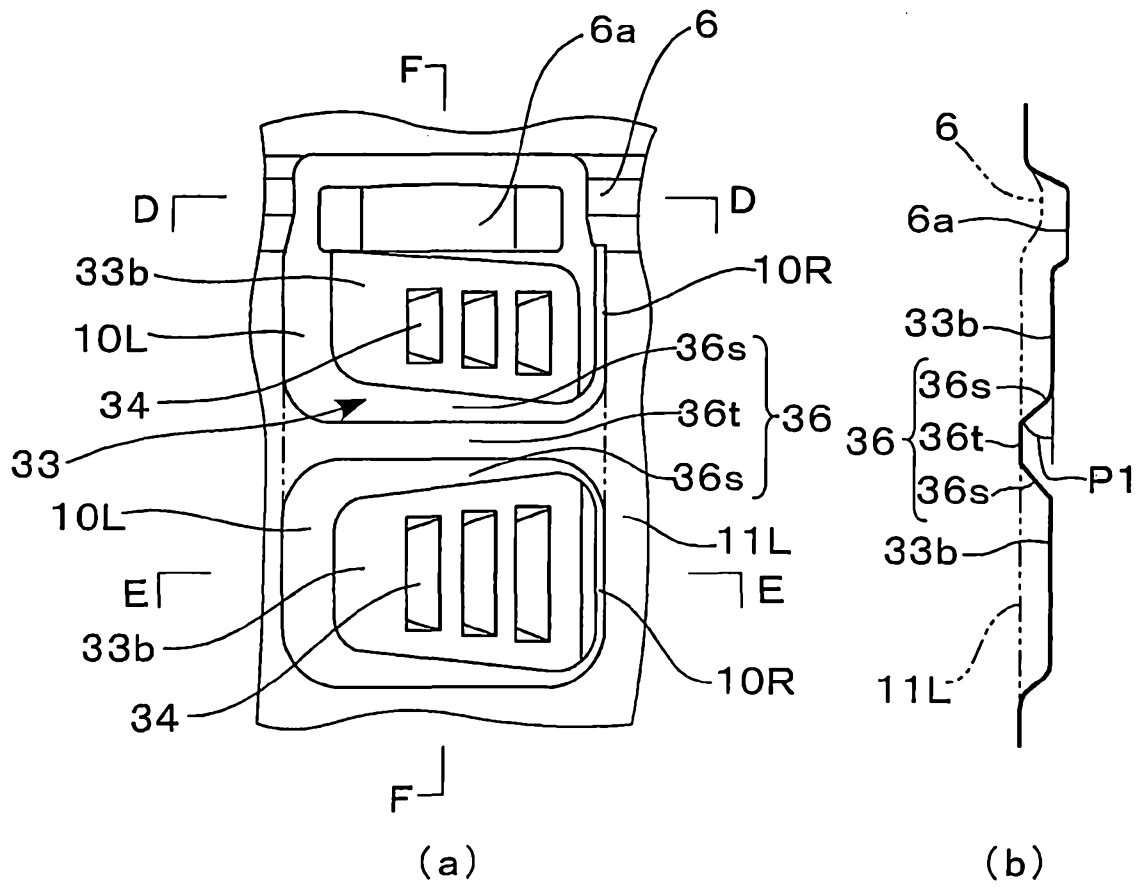


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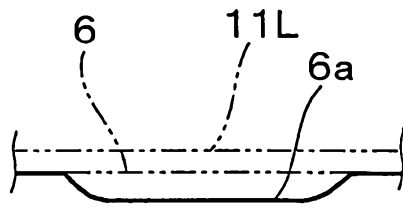
[Fig.19]



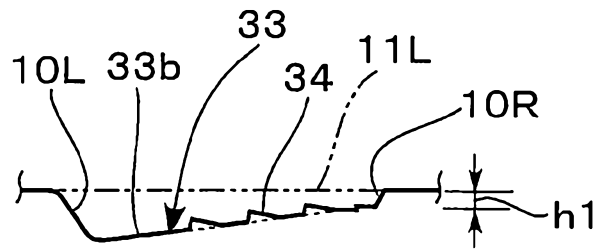
[Fig.20]



[Fig.21]

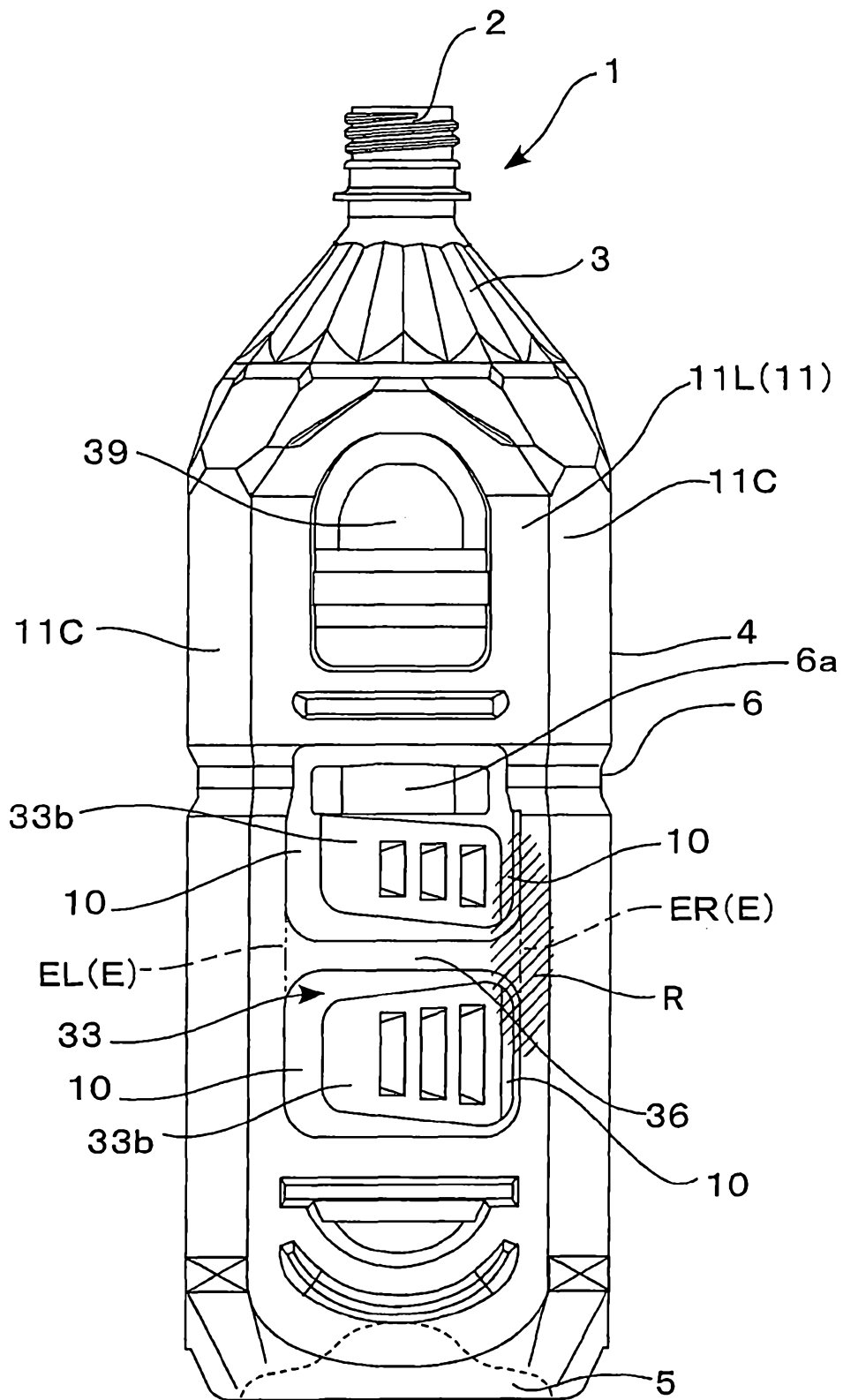


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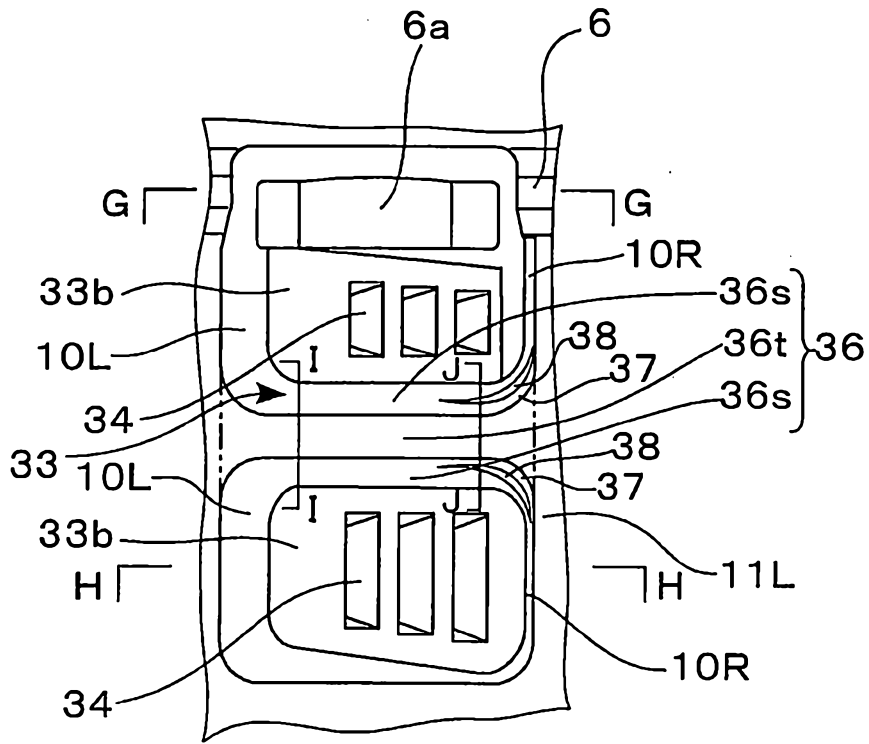


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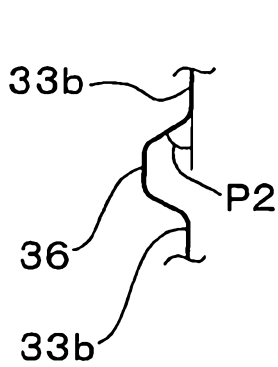
[Fig.22]



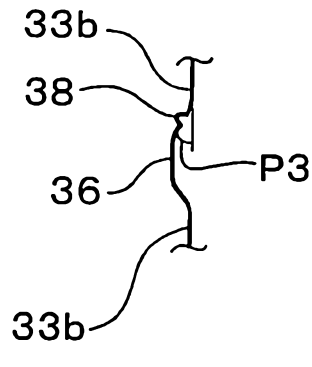
[Fig.23]



(a)

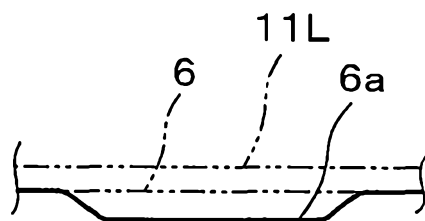


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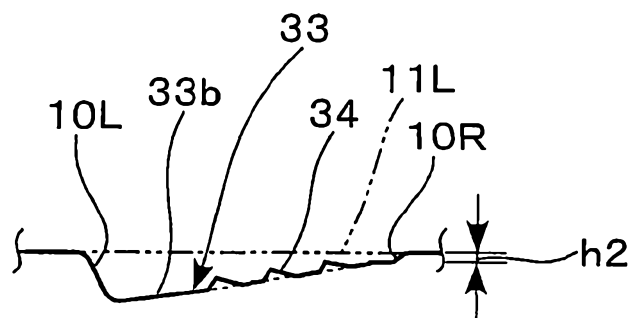


(c)

[Fig.24]



(a)



(b)