

DESCRIPTION

PLASTIC BOTTLE

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TECHNICAL FIELD

[0001]

The present invention relates to a thin-walled plastic bottle which is filled with contents having fluidity such as a fluid, and relates particularly to a plastic bottle which, despite being thin-walled and lightweight, maintains good rigidity and has improved
10 attractiveness.

Priority is claimed on Japanese Patent Application No. 2011-258925, filed November 28, 2011, the content of which is incorporated herein by reference.

BACKGROUND ART

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[0002]

Conventionally, bottles formed from stretched polyethylene terephthalate known as PET bottles, and thin-walled plastic bottles formed from polyethylene or polypropylene (hereafter sometimes referred to as simply "bottles") are widely used as containers for filling with fluid contents such as shampoos, rinses and detergents. These
20 bottles are exposed to a variety of external forces, during storage and transport of the molded empty bottles, during filling with contents, during transport, storage and store display of the filled product, and during use by the consumer, and can sometimes undergo unrestorable deformation.

[0003]

In the bottles described above, reducing the thickness of the walls, and particularly the outer peripheral walls of the main body section, reduces the amount of plastic used and provides numerous benefits, but problems still remain in terms of the strength and rigidity. As a result, groove-shaped (hereafter also referred to as "gutter-shaped") ribs which encircle the main body section are often formed by subjecting the outer peripheral wall of the main body section of the bottle to partial bending or the like, with the rigidity of these ribs inhibiting deformation of the bottle. For example, in Patent Document 1, wave-shaped ribs which encircle the main body section of the bottle are formed in the outer peripheral wall, thereby suppressing swelling of the bottle more effectively than the case where horizontal ribs are formed in the outer peripheral wall, and thus optimizing the effect of the bottle in suppressing any change in the maximum fill volume (the volume when the bottle is totally filled with contents with no deformation of the bottle).

DOCUMENTS OF RELATED ART

PATENT DOCUMENTS

[0004]

Patent Document 1: Japanese Unexamined Patent Application, First Publication
No. Hei 9-240647

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0005]

However, in the structure described in the aforementioned Patent Document 1, although the effect of the bottle in suppressing change in the maximum fill volume is

superior to the case in which horizontal ribs are provided in the outer peripheral wall of the main body section, when a label is affixed to the outer peripheral surface of the main body section, the label develops a very wavy external appearance, which leaves considerable room for improvement in terms of attractiveness.

5 [0006]

The present invention has been developed in light of the above circumstances, and has an object of providing a thin-walled plastic bottle which is filled with fluid contents, wherein change in the maximum fill volume is suppressed and the attractiveness when a label is affixed is improved.

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MEANS TO SOLVE THE PROBLEMS

[0007]

In order to achieve the above object, a first aspect of the present invention provides a thin-walled plastic bottle which is filled with fluid contents, the bottle including a cylindrical main body section which extends along a single direction, a gutter-shaped rib which is formed in the outer peripheral wall of the main body section so as to extend in a straight line when viewed from outside the bottle and encircles the main body section, and a plurality of recesses (hereafter sometimes referred to as "dimples") which are formed in the outer peripheral wall of the main body section in alignment along the rib, wherein each recess is formed wider than the groove width of the rib across the width direction of the rib, protrudes beyond both sides of the rib in the width direction, and is also formed deeper than the groove depth of the rib in the depth direction of the rib.

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[0008]

A second aspect of the present invention is the first aspect described above, wherein a plurality of the ribs are formed along the direction of extension of the main body section, and a plurality of the recesses are formed in each of the plurality of ribs.

A third aspect of the present invention is the first aspect or the second aspect
5 described above, wherein the width of each recess in the width direction of the rib and the depth of each recess in the depth direction of the rib are set within a range from 1.2 to 1.8 times the groove width and the groove depth respectively of the rib.

A fourth aspect of the present invention is any one of the first to third aspects described above, wherein each recess is a hemispherical recess shape which appears
10 circular when viewed from in front.

A fifth aspect of the present invention is any one of the first to fourth aspects described above, wherein the center of each recess when viewed from in front is positioned on the centerline of the corresponding rib.

15 EFFECTS OF THE INVENTION

[0009]

According to the first aspect of the present invention, by providing a plurality of recesses that are wider and deeper than the total width and depth of the straight line-shaped rib, each recess functions as reinforcement that inhibits swelling (expansion) or
20 shrinkage in the width direction of the rib, and can therefore enhance the rigidity of the rib relative to swelling and shrinkage. As a result, the rigidity of the main body section is increased relative to pressure from inside the bottle when the bottle is filled with fluid contents, and pressure from outside the bottle when the bottle is grasped, meaning changes in the maximum fill volume caused by swelling of the main body section and
25 buckling deformation and the like of the main body section can be inhibited. Further, by

appropriately limiting the width and depth of each recess so that the appearance of each rib when viewed from outside the bottle is maintained as a straight line, a label is less likely to adopt a very wavy external appearance when affixed to the outer peripheral surface of the main body section, and therefore compared with a bottle in which wave-shaped ribs are formed in the main body section, not only can changes in the maximum fill volume of the bottle be suppressed, but the attractiveness of the bottle when a label is affixed can be improved, thus improving the marketability.

[0010]

According to the second aspect of the present invention, the rigidity of the main body section can be maintained in both the direction of extension (the axial direction) and the entire circumferential direction.

According to the third aspect of the present invention, by limiting the width and the depth of each recess to a value within a prescribed ratio range relative to the groove width and the groove depth of the rib, the appearance of the rib when viewed from outside the bottle can be maintained as a straight line, and the attractiveness of the bottle when a label is affixed can be improved.

According to the fourth aspect of the present invention, swelling and shrinkage in the width direction of the corresponding rib can be effectively inhibited.

According to a fifth aspect of the present invention, uneven protrusion of the recess beyond one side of the corresponding rib in the width direction can be limited.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

FIG. 1 is a front view of a plastic bottle according to an embodiment of the present invention.

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

FIG. 3 is a cross-sectional view along B-B in FIG. 1.

FIG. 4 is an enlarged view of a section C in FIG. 1.

FIG. 5 is a cross-sectional view along D-D in FIG. 4.

5 FIG. 6 is a cross-sectional view along E-E in FIG. 4.

FIG. 7 is a plan view of the main sections when the outer peripheral wall of the main body section of the above plastic bottle is spread out along a flat plane.

FIG. 8 is a front view corresponding with FIG. 1, illustrating a modification of the above plastic bottle.

10 FIG. 9 is a front view corresponding with FIG. 1, illustrating another modification of the above plastic bottle.

FIG. 10 is an enlarged view corresponding with FIG. 4, illustrating a modification of the ribs and dimples of the above plastic bottle.

FIG. 11 is a cross-sectional view along F-F in FIG. 10.

15 FIG. 12 is a cross-sectional view along G-G in FIG. 10.

FIG. 13 is an enlarged view corresponding with FIG. 4, illustrating another modification of the ribs and dimples of the above plastic bottle.

FIG. 14 is a cross-sectional view along H-H in FIG. 13.

FIG. 15 is a cross-sectional view along I-I in FIG. 14.

20 FIG. 16 is a plan view corresponding with a portion of FIG. 7, illustrating a modification of the relative positioning of the ribs and dimples.

EMBODIMENTS FOR CARRYING OUT THE INVENTION

[0012]

Embodiments of the present invention are described below with reference to the drawings.

A plastic bottle (hereafter referred to as simply "the bottle") 1 of the present embodiment illustrated in FIG. 1, when in the upright state illustrated in the figure, is composed of, in sequence from the top, a spout section 2, a neck section 3, a main body section 4 and a bottom section 5, and is integrally molded by blow molding or the like. The bottle 1 is a thin-walled plastic bottle having a maximum fill volume (the volume when the bottle is totally filled with contents with no deformation of the bottle 1) of 430 ml, and is used, for example, as a refill container for a shampoo, rinse, or clothing detergent or the like.

[0013]

The spout section 2 is a circular cylindrical tube used for pouring the contents out of the bottle 1, and a screw 2a for affixing a cap is formed on the outer peripheral surface of the spout section 2.

The neck section 3 extends outward and downward from the base of the spout section 2 while gradually expanding to form a convex curved shape on the outside of the bottle. The bottom edge of the neck section 3 is connected to the top edge of an upper maximum external dimension section 4a of the main body section 4. In the figure, the reference sign 3a indicates a ridgeline along the bottom edge of the neck section 3 and the top edge of the upper maximum external dimension section 4a.

[0014]

Referring jointly to FIG. 2, the main body section 4 extends vertically with an oval cross-sectional shape that is longer across the left-right direction. The main body section 4 has a label affixing section 4b which extends vertically with the aforementioned oval cross-sectional shape maintained substantially constantly, the upper maximum

external dimension section 4a which connects to the top of the label affixing section 4b via an upper small step section 4d and has a cross-sectional shape that is expanded by 0.2 to 0.5 mm, and a lower maximum external dimension section 4c which connects to the bottom of the label affixing section 4b via a lower small step section 4e and has a cross-sectional shape that is expanded by 0.5 to 1.0 mm. An outer peripheral wall 6 of the label affixing section 4b forms an outer peripheral surface 7 (see FIG. 5) which extends linearly in the vertical direction in order to enable a product label such as a shrink label to be affixed. In the figures, the reference sign CO indicates the centerline of the bottle along the direction of extension (the vertical direction) of the main body section 4.

10 [0015]

Referring jointly to FIG. 3, the bottom section 5 connects to the bottom edge of the lower maximum external dimension section 4c of the main body section 4, and by expanding the external dimensions outward from top to bottom to generate a left-right pair of front corners 5a and a left-right pair of rear corners 5a, gradually changes to a rounded rectangular cross-sectional shape which is longer across the left-right direction. The bottom section 5 and the main body section 4 have substantially the same left-right width X0, but the front-back width Y1 of the lower portion of the bottom section 5 is preferably 5 to 6 mm larger, more preferably 5.2 to 5.8 mm larger, and most preferably 5.6 mm larger, than the front-back width Y0 of the main body section 4. The bottom edge of the bottom section 5 folds around in an arc-like manner from the outer periphery toward the inner periphery to form a grounding edge 5b, and then forms an upwardly curved convex bottom surface 5c on the inner peripheral side of the grounding edge 5b.

[0016]

The material of the bottle 1 is a plastic such as polyethylene terephthalate (PET), low-density polyethylene (LDPE), high-density polyethylene (HDPE), polypropylene

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(PP) or polyvinyl chloride (PVC), and the elastic modulus (Young's modulus) is preferably within a range from 500 MPA to 3,500 MPa.

The bottle 1 is an ultra thin-walled plastic bottle for which the ratio represented by resin amount/maximum fill volume (g/ml) is approximately 0.030 to 0.015, and the
5 wall thickness of the outer peripheral wall 6 of the main body section 4 is preferably within a range from 0.1 to 0.2 mm (an average wall thickness across the entire bottle of 0.1 to 0.3 mm).

The method used for measuring the average wall thickness involves creating a molded item sample, and determining the volumes of the nozzle section 2, the body
10 section 6 and the inside of raised bottom section 5a. The surface area of the molded sample is determined from shape data modeled using a computer-aided design tool (also referred to as CAD), the average wall thickness for each region is determined by dividing the volumes determined from the molded item sample, and the average wall thickness across the entire bottle is calculated by dividing the volume of the entire sample by the
15 total surface area of the bottle as determined by CAD.

In the plastic bottle of the present invention, a height H0 from the grounding edge
5b of the bottle 1 to the top edge of the spout section 2 is, for example, from 180 to 200 mm, preferably from 185 to 195 mm, and most preferably approximately 190 mm, the left-right width (the left-right width X0 of the upper maximum external dimension
20 section 4a, the lower maximum external dimension section 4c and the bottom section 5) is typically from 60 to 75 mm, preferably from 65 to 70 mm, and most preferably approximately 68 mm, the front-back width (the front-back width Y1 of the bottom section 5) is typically from 50 to 60 mm, preferably from 54 to 58 mm, and most preferably approximately 56 mm, a vertical height H1 from the top edge of the spout
25 section 2 of the bottle 1 to the top edge of the label affixing section 4b is typically from

40 to 60 mm, preferably from 45 to 55 mm, and most preferably approximately 50 mm, a vertical height H2 of the label affixing section 4b is typically from 70 to 90 mm, preferably from 75 to 85 mm, and most preferably approximately 80 mm, and a vertical height H3 from the bottom edge of the label affixing section 4b to the grounding edge 5b is typically from 50 to 70 mm, preferably from 55 to 65 mm, and most preferably approximately 60 mm.

[0017]

Specifically, in the embodiment of FIG. 1, it is preferable that the height H0 from the grounding edge 5b of the bottle 1 to the top edge of the spout section 2 is approximately 190 mm, the left-right width (the left-right width X0 of the upper maximum external dimension section 4a, the lower maximum external dimension section 4c and the bottom section 5) is approximately 68 mm, the front-back width (the front-back width Y1 of the bottom section 5) is approximately 56 mm, the vertical height H1 from the top edge of the spout section 2 of the bottle 1 to the top edge of the label affixing section 4b is approximately 50 mm, the vertical height H2 of the label affixing section 4b is approximately 80 mm, and the vertical height H3 from the bottom edge of the label affixing section 4b to the grounding edge 5b is approximately 60 mm.

[0018]

Referring to FIG. 1 and FIG. 5, a plurality of annular ribs 11 which encircle the label affixing section 4b are formed in the outer peripheral wall 6 of the label affixing section 4b in a direction parallel with the plane (horizontal plane) contacted by the grounding edge 5b, with an equal vertical spacing between the ribs.

There are no particular numerical limitations on the "plurality" of these ribs 11, but a number of at least 3 but not more than 10 is preferable, a number of at least 4 but not more than 9 is more preferable, and 5 ribs is most preferable.

The ribs 11 are formed by partially bending and curving the outer peripheral wall 6 of the label affixing section 4b toward the inside of the bottle, and are formed with a groove shape (gutter shape) having a dome-shaped semicircular cross-sectional shape that protrudes inside the bottle when viewed in a cross-section orthogonal to the circumferential direction of the label affixing section 4b (hereafter referred to as the bottle circumferential direction). In the figures, the reference sign C1 indicates the position on the outer peripheral surface 7 notched by the rib 11 corresponding with the widthwise centerline of the rib 11.

[0019]

A groove width (vertical width) H4 of the ribs 11 is, for example, from 1.5 to 4.5 mm, preferably from 2 to 4 mm, and most preferably approximately 3 mm, and a groove depth Y4 is typically from 0.5 to 2.0 mm, preferably from 0.8 to 1.7 mm, and most preferably approximately 1.2 mm. A distance H6 between the groove width centerlines C1 of adjacent ribs 11 (namely, the pitch between adjacent ribs 11, see FIG. 7) is, for example, from 8 to 20 mm, preferably from 9 to 16 mm, and most preferably approximately 15 mm. The distance between the top edge of the label affixing section 4b and the groove width centerline C1 of the uppermost rib 11, and the distance between the bottom edge of the label affixing section 4b and the groove width centerline C1 of the lowermost rib 11 are each typically from 8 to 11 mm, preferably from 8.5 to 10.5 mm, and most preferably approximately 9.5 mm.

[0020]

Specifically, in the embodiment of FIG. 1, it is preferable that the groove width (vertical width) H4 of the ribs 11 is approximately 3 mm, and the groove depth Y4 is approximately 1.2 mm. Further, the distance H6 between the groove width centerlines C1 of adjacent ribs 11 (namely, the pitch between adjacent ribs 11, see FIG. 7) is

preferably approximately 15 mm. Moreover, the distance between the top edge of the label affixing section 4b and the groove width centerline C1 of the uppermost rib 11, and the distance between the bottom edge of the label affixing section 4b and the groove width centerline C1 of the lowermost rib 11 are each preferably approximately 9.5 mm.

5 [0021]

A plurality of dimples (recesses) 12 are formed in the outer peripheral wall 6 of the label affixing section 4b in alignment along each of the ribs 11.

Referring to FIG. 4 to FIG. 7, the dimples 12 have, for example, a circular shape with a radius of 1.5 to 4.0 mm when viewed in the front view illustrated in FIG. 4 and
10 FIG. 7 (namely, when viewed along a normal line direction of the outer peripheral surface 7 of the main body section 4), and preferably have a circular shape with a radius of 1.75 to 3.75 mm, and most preferably a circular shape with a radius of approximately 2.5 mm. Moreover, the dimples are hemispherical recesses in which the depth from the outer peripheral surface 7 to the deepest portion inside the bottle is typically from 0.6 to
15 3.0 mm, preferably from 1.0 to 2.7 mm, and most preferably approximately 1.5 mm.

[0022]

Specifically, in the embodiment of FIG. 4 to FIG. 7, it is preferable that each dimple 12 is a circular shape with a radius of approximately 2.5 mm when viewed in the front view (namely, when viewed along a normal line direction of the outer peripheral
20 surface 7 of the main body section 4). Further, the dimple 12 is preferably a hemispherical recess in which the depth from the outer peripheral surface 7 to the deepest portion inside the bottle is approximately 1.5 mm.

[0023]

In other words, compared with the corresponding rib 11, the dimples 12 are
25 preferably formed so that a width H5 across the width direction is wider than the

approximately 1.5 to 4.5 mm groove width H4 of the rib 11, with the width H5 being equivalent to a diameter of approximately 2 to 8 mm and having a value approximately 1.2 to 1.8 times that of the groove width H4, and so that a depth Y5 in the depth direction of the corresponding rib 11 is approximately 0.6 to 3.6 mm, which is deeper than the approximately 0.5 to 2.0 mm groove depth Y4 of the rib 11 and is approximately 1.2 to 1.8 times the groove depth Y4.

[0024]

Specifically, in the embodiment of FIG. 4 to FIG. 7, it is preferable that the dimple 12 is formed so that the width H5 across the width direction of the corresponding rib 11 is wider than the approximately 3 mm groove width H4 of the rib 11, with the width H5 being equivalent to a diameter of approximately 5 mm and having a value approximately 1.7 times that of the groove width H4, and so that the depth Y5 in the depth direction of the corresponding rib 11 is approximately 1.5 mm, which is deeper than the approximately 1.2 mm groove depth Y4 of the rib 11 and is approximately 1.3 times the groove depth Y4.

[0025]

In a front view of the dimple 12, the center position (front view center) C2 of the dimple 12 lies on the groove width centerline C1 of the corresponding rib 11. Accordingly, the dimple 12 protrudes uniformly above and below the corresponding rib 11 (from both sides in the width direction) when viewed in front view.

[0026]

By forming the dimples 12 so as to partially cut out and span the inner peripheral surface of the corresponding rib 11, swelling (expansion) or shrinkage in the width direction of the rib 11 is inhibited. In other words, by intersecting and spanning the corresponding rib 11, the dimples 12 function as short ribs that reinforce the rib structure.

As a result, even if a force is applied that attempts to widen or shrink each rib 11 in the width direction, either as a result of the effects of internal pressure inside the bottle 1 or the effects of a grasping force or the like applied to the bottle 1, because each rib 11 is reinforced by a plurality of dimples 12 in the manner described above, swelling or shrinkage of each of the ribs 11, and therefore swelling or shrinkage of the label affixing section 4b, can be suppressed.

[0027]

From the viewpoint of the attractiveness of the bottle when a product label is affixed to the outer peripheral surface 7 of the label affixing section 4b, the dimensions of the dimples 12 are appropriately restricted so that when the bottle is viewed from a front view (namely, when viewed along a normal line direction of the outer peripheral surface 7 of the main body section 4) from a distance separated at least 50 cm from the outside the bottle, the ribs 11 appear to maintain their straight line form. Specifically, the height H5 of the dimples 12 in the width direction of the ribs 11 is preferably within a range from 1.2 to 1.8 times the groove width H4 of the ribs 11. Similarly, the depth Y5 of the dimples 12 in the depth direction of the ribs 11 is preferably within a range from 1.2 to 1.8 times the groove depth Y4 of the ribs 11.

[0028]

Further, in order to ensure that the dimples 12 of vertically adjacent ribs 11 do not approach too close to one another, the pitch H6 between vertically adjacent ribs 11 is typically set within a range from 8 mm to 20 mm, and preferably from 9 mm to 16 mm.

[0029]

The number of dimples 12 provided around the lengthwise direction (bottle circumferential direction) of each rib 11 may be any number from 12 to 24, is preferably from 16 to 24, and is most preferably 16. At this time, a pitch S1 between the front view

centers C2 of adjacent dimples 12 in the bottle circumferential direction is typically from 7 to 15 mm, and preferably from 7 to 11 mm in the present embodiment, and the dimples 12 of vertically adjacent ribs 11 are staggered in the bottle circumferential direction by an amount equal to half of the pitch S1. In other words, the dimples are positioned in a zigzag arrangement in the vertical direction.

[0030]

The bottle 1 of the present embodiment, a base shape bottle in which the ribs 11 and the dimples 12 have been removed from the bottle 1, a horizontal rib bottle in which only the dimples 12 have been removed from the bottle 1, and a wave-shaped rib bottle in which the ribs 11 and the dimples 12 have been removed from the bottle 1 and wave-shaped ribs have been formed encircling the label affixing section 4b were evaluated for "rigidity", "restorability", "label wrinkling" and "change in maximum fill volume". The results are shown in Table 1. In Table 1, "Example" refers to the bottle 1, "Base" refers to the base shape bottle, "Horizontal rib" refers to the horizontal rib bottle, and "Wave-shaped rib" refers to the wave-shaped rib bottle. In each of the cells of Table 1, "O" indicates a passing grade, and "×" indicates a failing grade.

[0031]

[Table 1]

Shape	Example	Base	Horizontal rib	Wave-shaped rib
Rigidity	O	×	O	O
Restorability	O	O	O	O
Label wrinkling	O	O	O	×
Change in maximum fill volume	O	O	×	O

The aforementioned "rigidity" is judged by filling each bottle with a prescribed volume of contents, evacuating the bottle from the spout to achieve a state of reduced pressure, and evaluating the size of the reduction in volume when the bottle loses its external appearance (such as the occurrence of a dimple-shaped deformation).

5 Further, the "rigidity" is also judged by laying each bottle on an examining table so that the main body section of the bottle is horizontal, pressing down on the upper central portion of the main body section from above using an attachment fitted with a load cell, and measuring the size of the pressing force (reactive force) when the main body section has displaced a prescribed amount.

10 [0033]

The aforementioned "restorability" is judged by laying each bottle on an examining table so that the main body section of the bottle is horizontal, pressing down on the upper central portion of the main body section from above using an attachment fitted with a load cell to form a buckling deformation in the main body section, and then
15 assessing the restored state of the deformation when the attachment is returned to its position prior to pressing.

[0034]

The aforementioned "label wrinkling" is judged by affixing a shrink label to the main body section and performing heating, and following tight wrapping of the shrink
20 label onto the main body section, evaluating the attractiveness of the shrink label including the occurrence of wrinkles.

[0035]

The aforementioned "change in maximum fill volume" is judged by measuring the weight of each bottle when filled with water while immersed in a water tank,
25 measuring the weight of the bottle when placed on the floor surface and filled with water

using a typical filling method, and based on these measured values, determining the maximum fill volume of the bottle when filled with water in the former state in which there are no effects from the weight and the like of the contents, and the maximum fill volume of the bottle when filled with water in the latter state in which there are effects
5 from the weight and the like of the contents, and then evaluating the size of the difference in the maximum fill volume in the former state and the maximum fill volume in the latter state.

[0036]

Based on the evaluation results shown in Table 1, it was evident that the bottle 1
10 of the present embodiment exhibited a superior result to each of the comparative examples for each of the items of "rigidity", "restorability", "label wrinkling" and "change in maximum fill volume".

[0037]

Next, bottles 1 of the present embodiment were prepared in which the number of
15 the dimples 12 on each rib 11 was set to 24, 20, 16 or 12, and each bottle was evaluated based on the change in the reactive force relative to a displacement of the main body section 4 and the attractiveness of the bottle when a label was affixed.

The results revealed that provided the number of the dimples 12 on each rib 11 was 16 or greater, the reactive force relative to displacement of the main body section 4 was substantially equal, whereas when the number of the dimples 12 on each rib 11 was
20 12, the reactive force relative to displacement of the main body section 4 decreased.

[0038]

On the other hand, if adjacent dimples 12 in the bottle circumferential direction contact one another and merge, then a wider rib is essentially formed, and label wrinkling
25 tends to become more noticeable, and therefore the number of the dimples 12 on each rib

11 is preferably at least 12 but not more than 24. In the bottle 1, the number of the dimples 12 on each rib 11 is preferably at least 12 but not more than 20, and is most preferably 16. In this case, the pitch S1 between the front view centers C2 of adjacent dimples 12 in the bottle circumferential direction on each rib 11 is from 10 to 12 mm.

5 [0039]

As described above, the bottle 1 according to the aforementioned embodiment is a thin-walled plastic bottle which is filled with fluid contents, the bottle including a cylindrical main body section 4 which extends along a single direction, gutter-shaped ribs 12 which are formed in the outer peripheral wall 6 of the main body section 4 so as to extend in straight lines when viewed from outside the bottle and encircle the main body section 4, and a plurality of dimples 12 which are formed in the outer peripheral wall 6 of the main body section 4 in alignment along the ribs 11, wherein each dimple 12 is formed wider than the groove width H4 of the rib 11 across the width direction of the rib 11, protrudes beyond both sides of the rib 11 in the width direction, and is also formed deeper than the groove depth Y4 of the rib 11 in the depth direction of the rib 11.

Further, there are no particular limitations on the "fluid contents" provided they are composed of a liquid substance, and even liquid substances containing a portion of solid components are acceptable provided the overall substance has fluidity. In the present invention, the fluid contents are preferably a liquid substance such as a shampoo, a rinse or a detergent.

[0040]

According to the structure described above, by providing a plurality of dimples 12 (depressions) in each straight line-shaped rib 11 that are wider and deeper than the total width and depth of the rib, each dimple 12 functions as reinforcement that inhibits swelling (expansion) or shrinkage in the width direction of the rib 11, and can therefore

enhance the rigidity of the rib 11 relative to swelling and shrinkage. As a result, the rigidity of the main body section 4 is increased relative to pressure from inside the bottle when the bottle 1 is filled with fluid contents, and pressure from outside the bottle when the bottle 1 is grasped, meaning changes in the maximum fill volume caused by swelling
5 of the main body section 4 and buckling deformation and the like of the main body section 4 can be inhibited.

Further, by appropriately limiting the width and depth of each dimple 12 so that the appearance of each rib 11 when viewed from outside the bottle is maintained as a straight line, when a label is affixed to the outer peripheral surface 7 of the main body
10 section 4, the label is less likely to adopt a very wavy external appearance, and therefore compared with the case in which wave-shaped ribs 11 are formed in the main body section 4, not only can changes in the maximum fill volume of the bottle 1 be suppressed, but the attractiveness of the bottle 1 when a label is affixed can be improved, thus improving the marketability.

15 [0041]

Furthermore, by forming a plurality of the ribs 11 along the direction of extension of the main body section 4, and forming a plurality of the aforementioned dimples 12 in each of the plurality of ribs 11, the rigidity of the main body section 4 can be maintained in both the direction of extension (the axial direction) and the entire circumferential
20 direction.

[0042]

Further, in the bottle 1, by setting the width H5 of each dimple 12 in the width direction of the rib 11 and the depth Y5 of each dimple 12 in the depth direction of the rib 11 within a range from 1.2 to 1.8 times the groove width H4 and the groove depth Y4
25 respectively of the rib 11, the appearance of the rib 11 when viewed from outside the

bottle can be maintained as a straight line, and the attractiveness of the bottle 1 when a label is affixed can be improved.

[0043]

Furthermore, in the bottle 1, by forming each dimple 12 as a hemispherical recess
5 which appears circular when viewed from in front, swelling and shrinkage in the width
direction of the corresponding rib 11 can be effectively inhibited, and by positioning the
front view center C2 of each dimple 12 on the groove width centerline C1 of the
corresponding rib 11, uneven protrusion of the dimple 12 beyond one side of the
corresponding rib 11 in the width direction can be limited.

10 [0044]

The present invention is not limited to the embodiment described above, and for
example as shown on a bottle 1' illustrated in FIG. 8, the dimples 12 may be positioned in
alignment along the vertical direction.

When the aforementioned evaluations of "rigidity" and "restorability" were
15 performed for the bottle 1 in which, as described above, the dimples 12 were positioned
in a zigzag arrangement in the vertical direction, and the bottle 1' in which, as illustrated
in FIG. 8, the dimples 12 were positioned in alignment along the vertical direction, it was
found that little difference existed between these bottles.

[0045]

20 Further, as shown by a bottle 1" illustrated in FIG. 9, the ribs 11 may encircle the
label affixing section 4b at an inclination relative to the grounding edge 5b (horizontal
plane). Specifically, FIG. 9 illustrates a structure in which the ribs 11 form continuous
spiral shapes. Inclined ribs and horizontal ribs may also be combined as appropriate, and
the plurality of ribs may be formed in parallel or may intersect, but are preferably formed
25 in parallel.

[0046]

Furthermore, there are various possible forms for the ribs and recesses formed in the label affixing section 4b, and ribs in which the cross-sectional shape in a cross-section orthogonal to the bottle circumferential direction is a trapezoidal shape recessed into the bottle, such as ribs 11' illustrated in FIG. 10 to FIG. 12, or ribs in which the cross-sectional shape in a cross-section orthogonal to the bottle circumferential direction is a triangular shape recessed into the bottle, such as ribs 11" illustrated in FIG. 13 to FIG. 15, may also be used.

[0047]

Further, recesses composed of a truncated pyramid shape (or truncated cone shape) recessed into the bottle, such as recesses 12' illustrated in FIG. 10 to FIG. 12, or recesses composed of a pyramid (or cone) shape recessed into the bottle, such as recesses 12" illustrated in FIG. 13 to FIG. 15, may also be used.

[0048]

In addition, the front view shape of the recesses 12 may be any of various polygonal shapes including triangular and square shapes, or a free shape other than a geometric shape, such as an animal shape or the like, but a shape that is formed of continuous curves with no sharp corners is preferable. Examples of shapes composed of continuous curves with no sharp corners include circles, ovals, and track-shaped ovals (rounded rectangles).

Furthermore, the groove width of the ribs 11 and the vertical pitch between ribs and the like may be uniform, or may be changed appropriately between ribs, and similarly, the size and circumferential pitch and the like of the recesses 12 may be uniform or may be changed as appropriate.

[0049]

Moreover, as illustrated in FIG. 16, when viewed in front view, the front view centers C2 of the recesses 12 may be offset relative to the groove width centerline C1 of the corresponding rib 11. However, this offset must still enable the recesses 12 to protrude beyond both sides of the corresponding rib 11 in the width direction.

5 Further, the ribs 11 need not necessarily be formed in a continuous manner around the bottle circumferential direction (and may be interrupted). The number of ribs 11 and the positions in which the ribs are formed may be set as appropriate in accordance with the design, the intended use, and the container volume and the like.

10 The structures in the embodiments described above are merely examples of the present invention, and various modifications are possible without departing from the scope of the invention.

INDUSTRIAL APPLICABILITY

[0050]

15 The present invention can be used in the field of plastic bottles used as refill containers for shampoos, rinses and clothing detergents and the like.

DESCRIPTION OF THE REFERENCE SIGNS

[0051]

20 1, 1', 1'': Plastic bottle
 4: Main body section
 6: Outer peripheral wall
 11, 11', 11'': Rib
 H4: Groove width
 25 Y4: Groove depth

C1: Groove width centerline (centerline)

12: Dimple (recess)

12', 12": Recess

H5: Width

5 Y5: Depth

C2: Front view center

CLAIMS

1. A thin-walled plastic bottle which is filled with fluid contents, the bottle comprising:

5 a cylindrical main body section which extends along a single direction,
a gutter-shaped rib which is formed in an outer peripheral wall of the main body section so as to extend in a straight line when viewed from outside the bottle, and encircles the main body section, and

a plurality of recesses which are formed in the outer peripheral wall of the main
10 body section in alignment along the rib, wherein

each recess is formed wider than a groove width of the rib across a width direction of the rib, protrudes beyond both sides of the rib in the width direction, and is also formed deeper than a groove depth of the rib in a depth direction of the rib.

15 2. The plastic bottle according to claim 1, wherein a plurality of the ribs are formed along a direction of extension of the main body section, and a plurality of the recesses are formed in each of the plurality of ribs.

3. The plastic bottle according to claim 1, wherein a width of each recess in the
20 width direction of the rib and a depth of each recess in the depth direction of the rib are set within a range from 1.2 to 1.8 times the groove width and the groove depth respectively of the rib.

4. The plastic bottle according to claim 1, wherein each recess is a hemispherical
25 recess shape which appears circular when viewed from in front.

5. The plastic bottle according to claim 1, wherein a center of each recess when viewed from in front is positioned on a centerline of the corresponding rib.