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(54) **COLLAPSIBLE BOTTLE**

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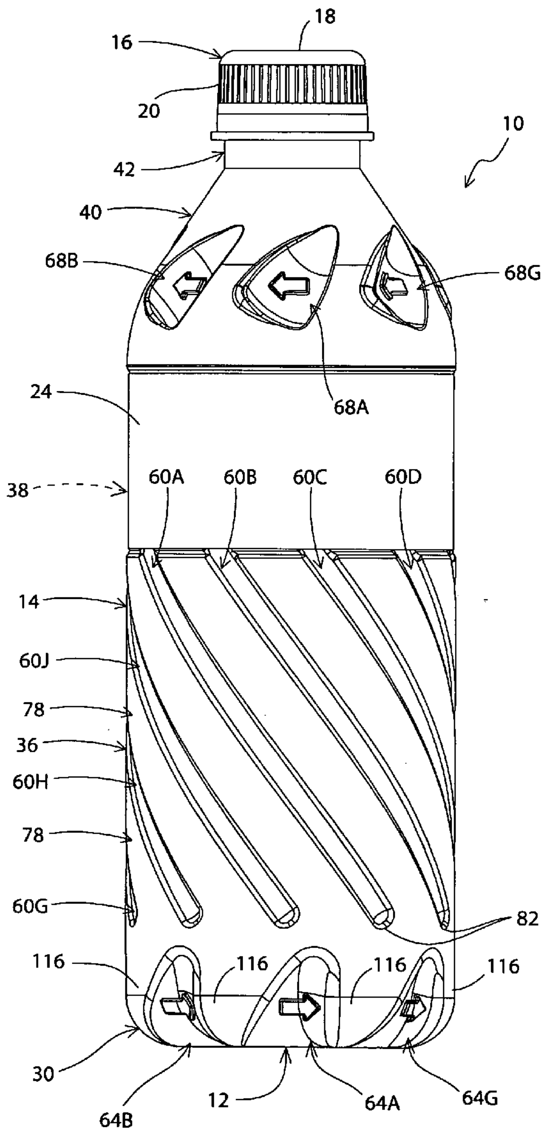
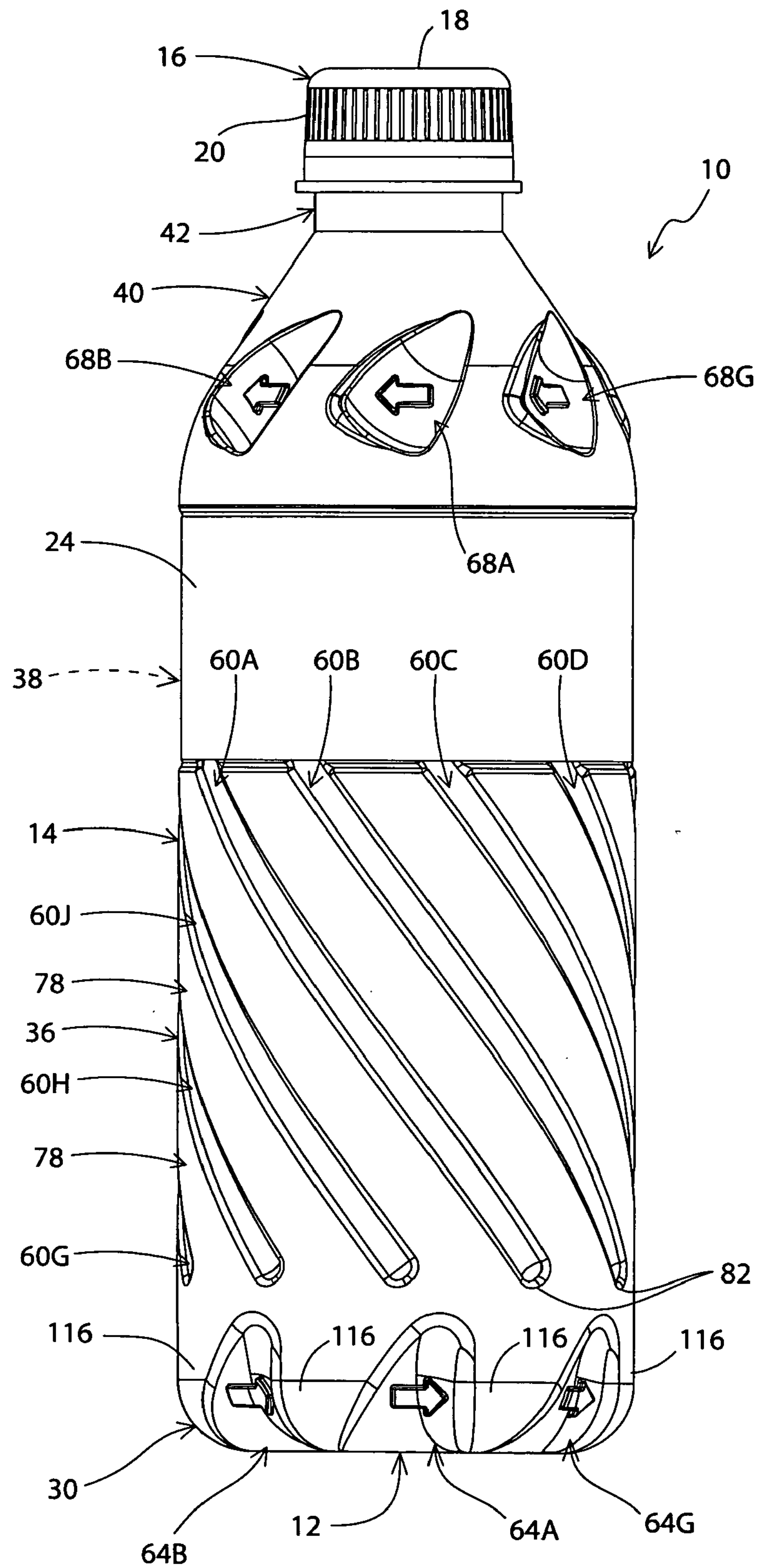
(57) **ABSTRACT**

A collapsible bottle is particularly useful as a beverage bottle such as a water bottle or soda bottle which can be collapsed after its contents are emptied in order to reduce its volume whereby the collapsed bottles take up less space in trash receptacles, recycling bins and so forth. Diagonal and typically spiraling grooves are formed in the bottle to facilitate its collapse. Visual indicators on the bottle are intended to suggest to the user the need to collapse the bottle. These visual indicators may include arrows. Fingertip indentations or other grip surfaces are typically provided for rotating the bottle to facilitate its collapse.

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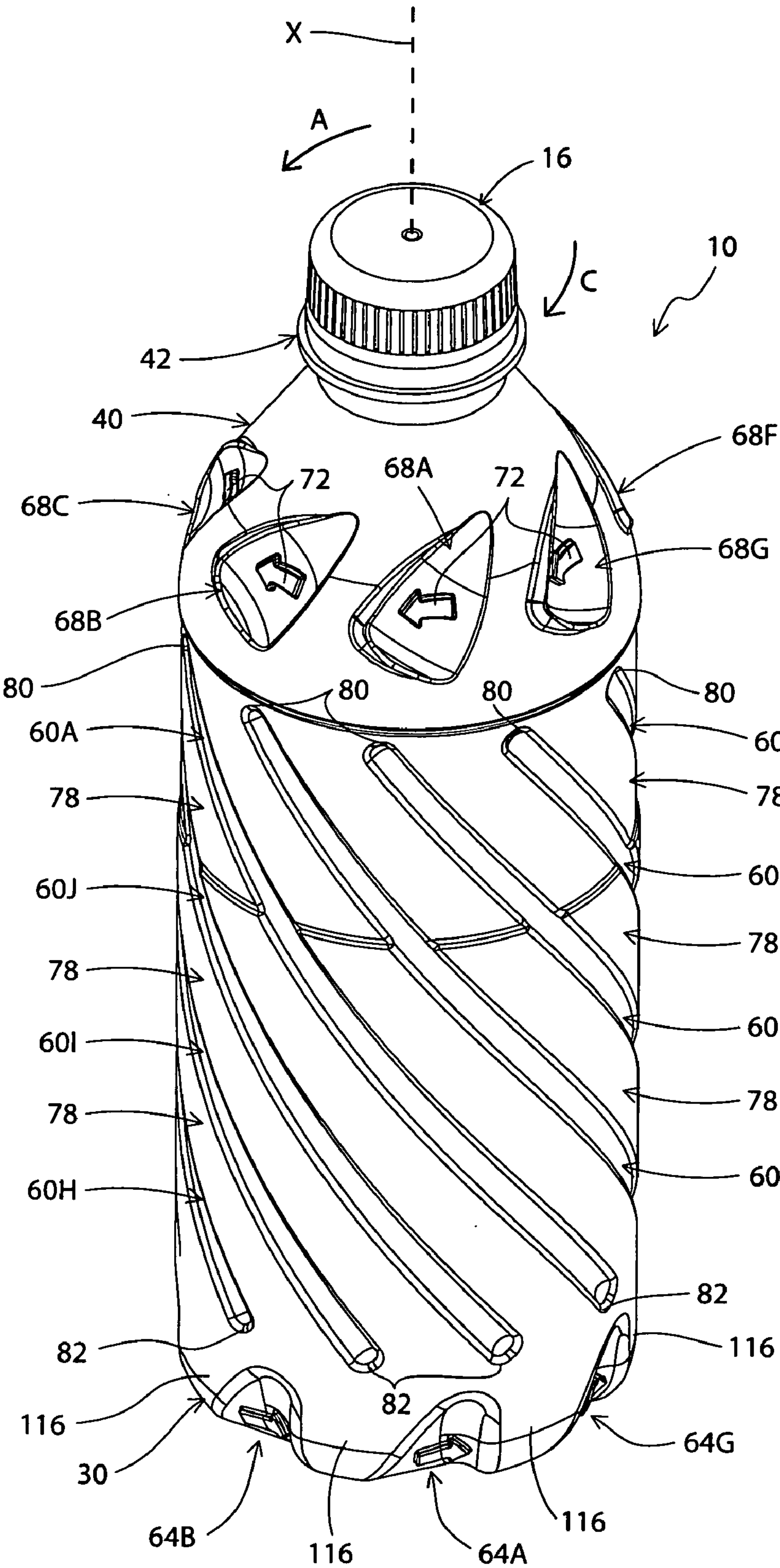
16
20
10
42
40
68B
68G
24
68A
38
60A
60B
60C
60D
14
60J
78
36
60H
78
60G
82
116
116
116
116
30
12
64B
64A
64G

FIG. 1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A
16
C
10
42
40
68F
72
68A
72
68C
68G
68B
80
80
80
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60A
60E
78
78
60D
60J
78
78
60C
78
60I
78
78
60B
60H
82
82
116
116
82
30
64G
64B
116
116
64A

FIG. 2

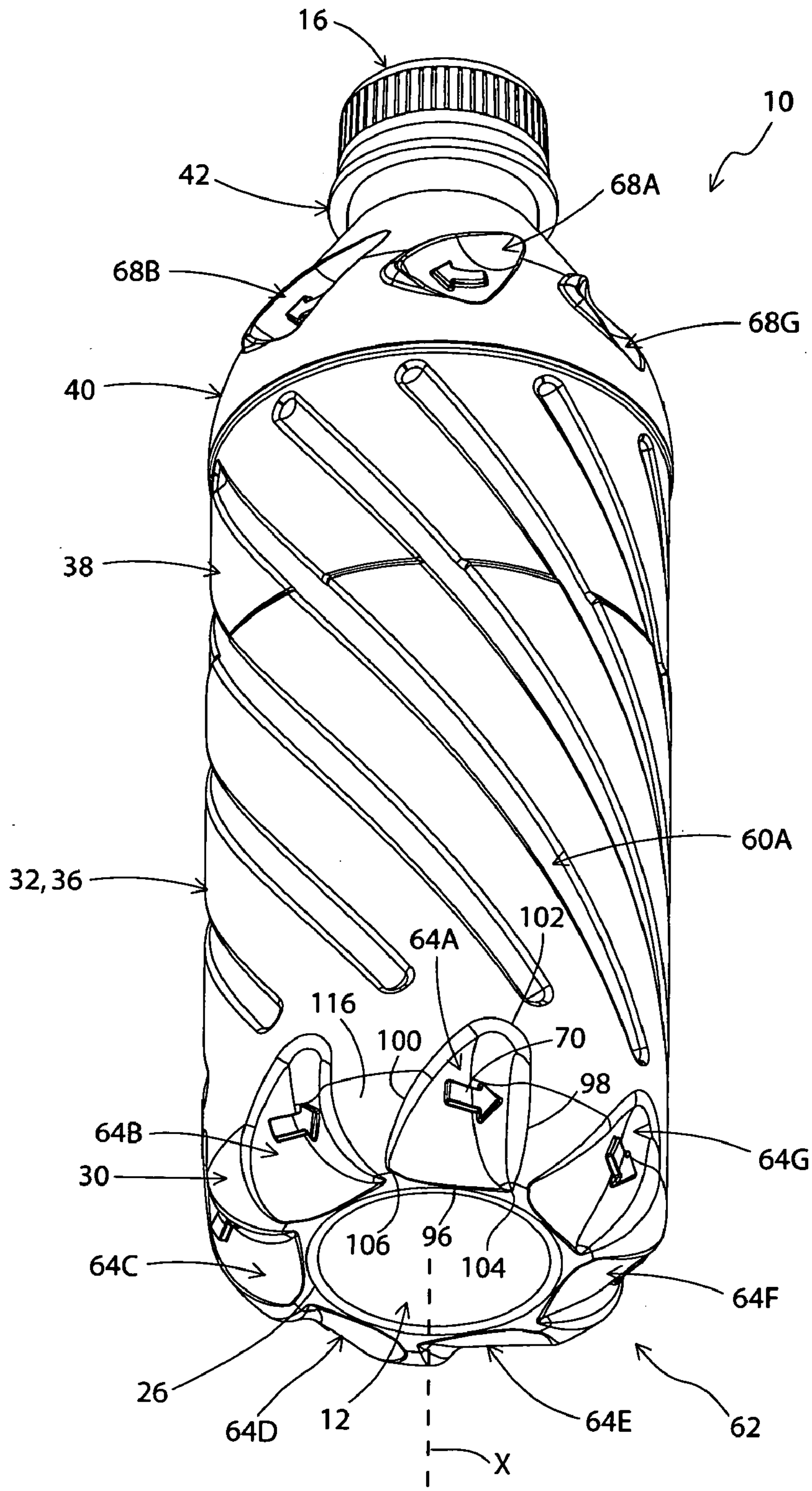
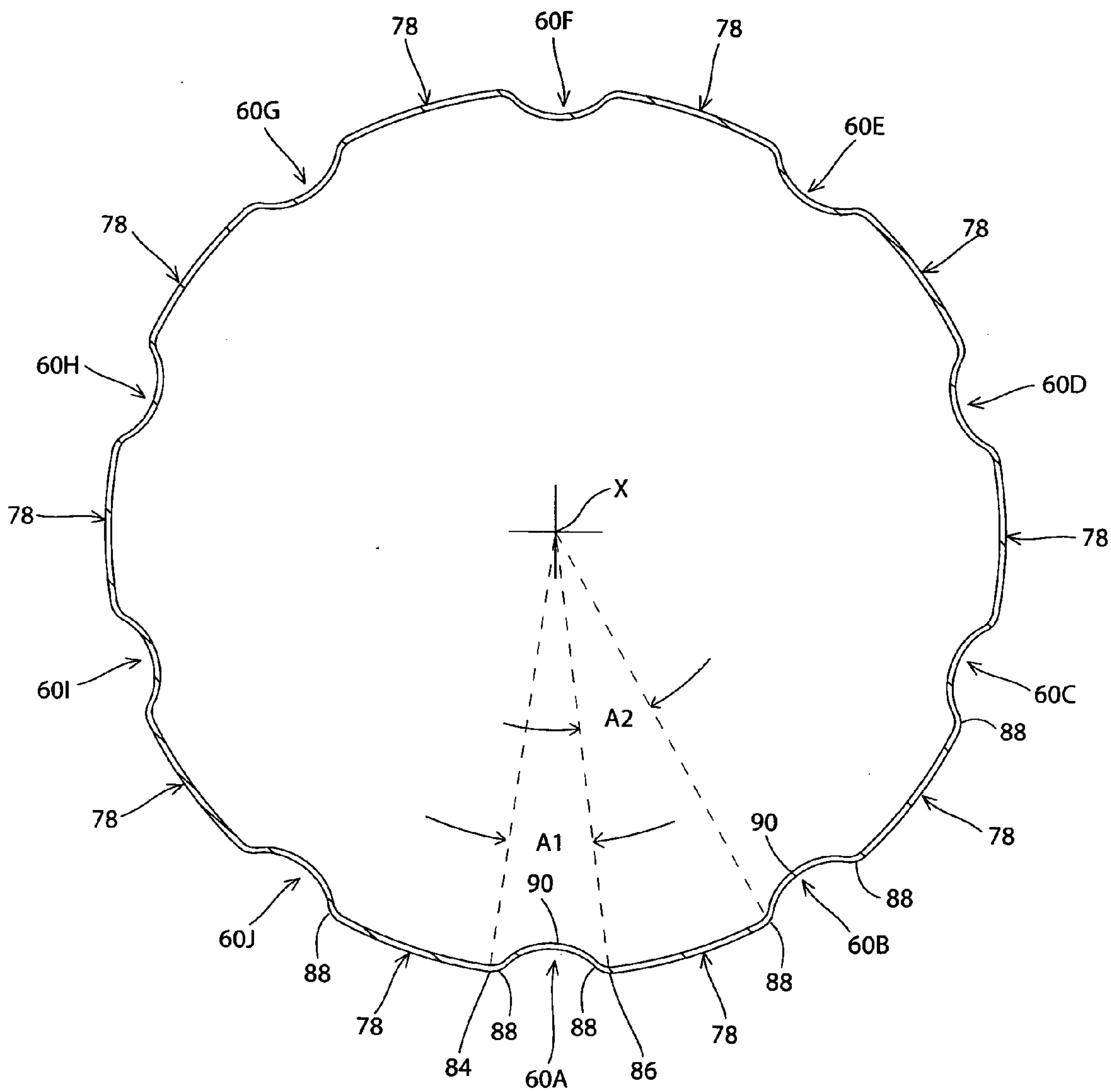

16
10
42
68A
68B
68G
40
38
60A
32, 36
102
64A
116
100
70
98
64B
64G
30
106
96
104
64C
64F
26
64D
12
64E
62
X

FIG. 3


78
60F
78
60G
60E
78
78
60H
60D
X
78
78
A2
60I
60C
88
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60J
60B
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78
88
78
84
60A
86

FIG. 3A

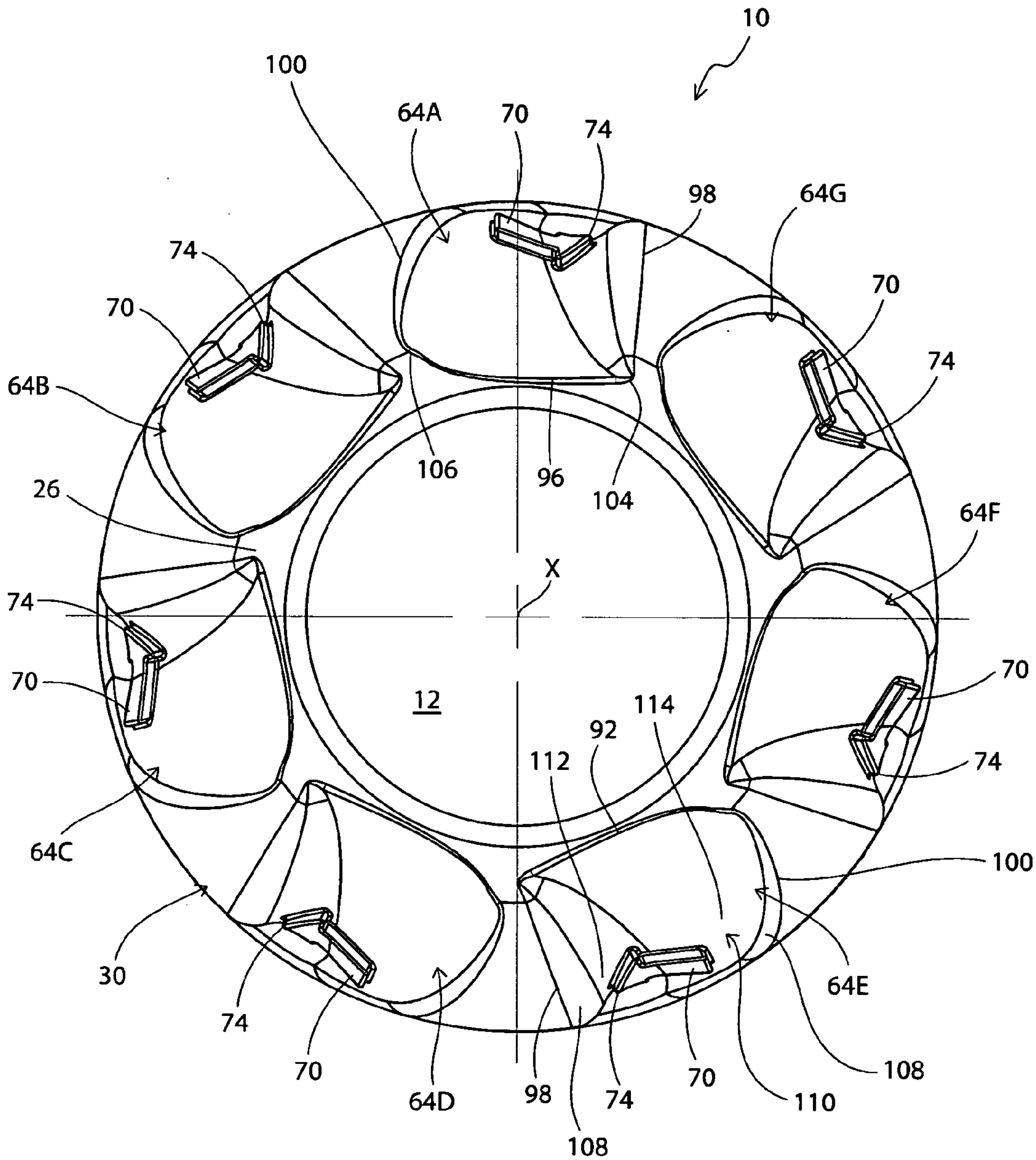

10
100
64A
70
74
98
64G
74
70
70
74
64B
106
96
104
26
64F
X
74
70
70
12
114
92
74
112
100
30
64C
64E
74
70
98
74
70
110
108
64D
108

FIG. 4

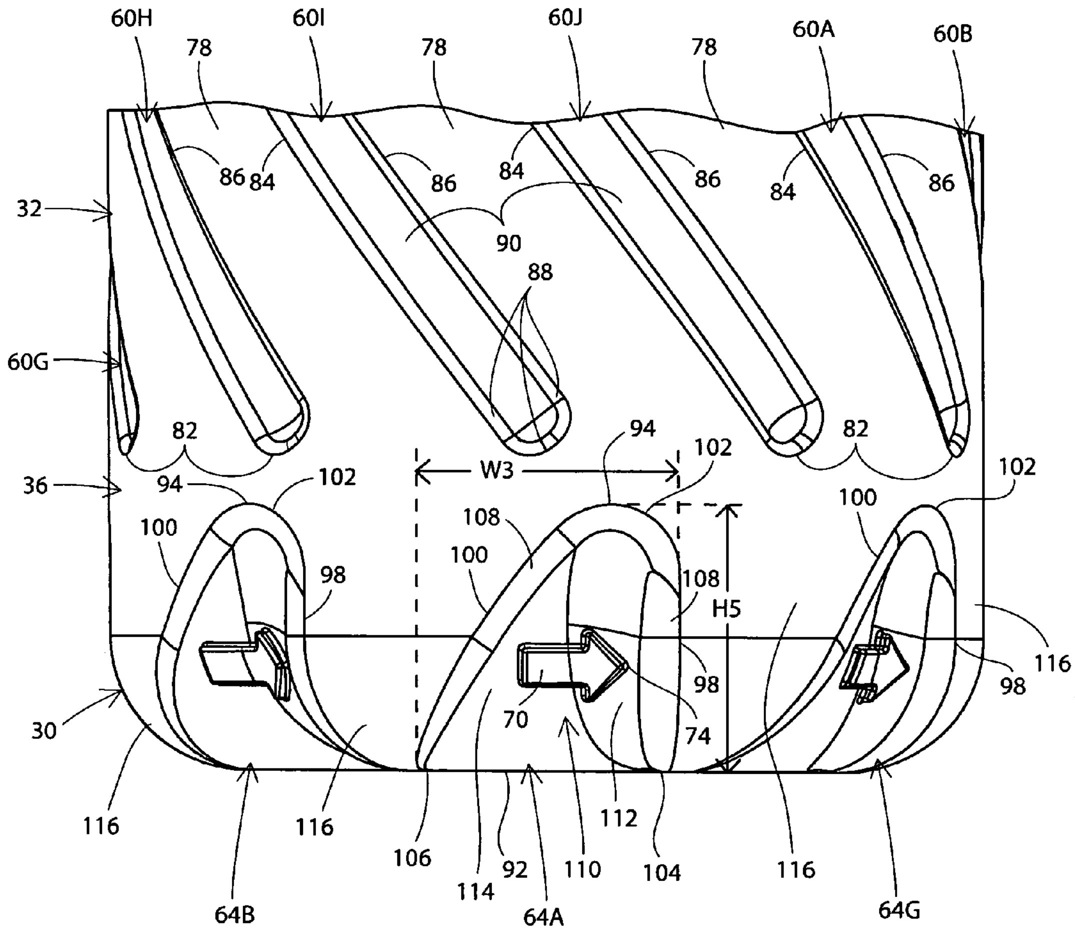

60H
78
60I
78
60J
78
60A
60B
86
84
86
84
86
84
86
32
90
88
60G
82
82
36
94
102
W3
94
102
102
100
108
100
100
98
108
H5
116
98
98
70
74
30
112
116
116
106
114
92
110
104
116
64B
64A
64G

FIG. 4A

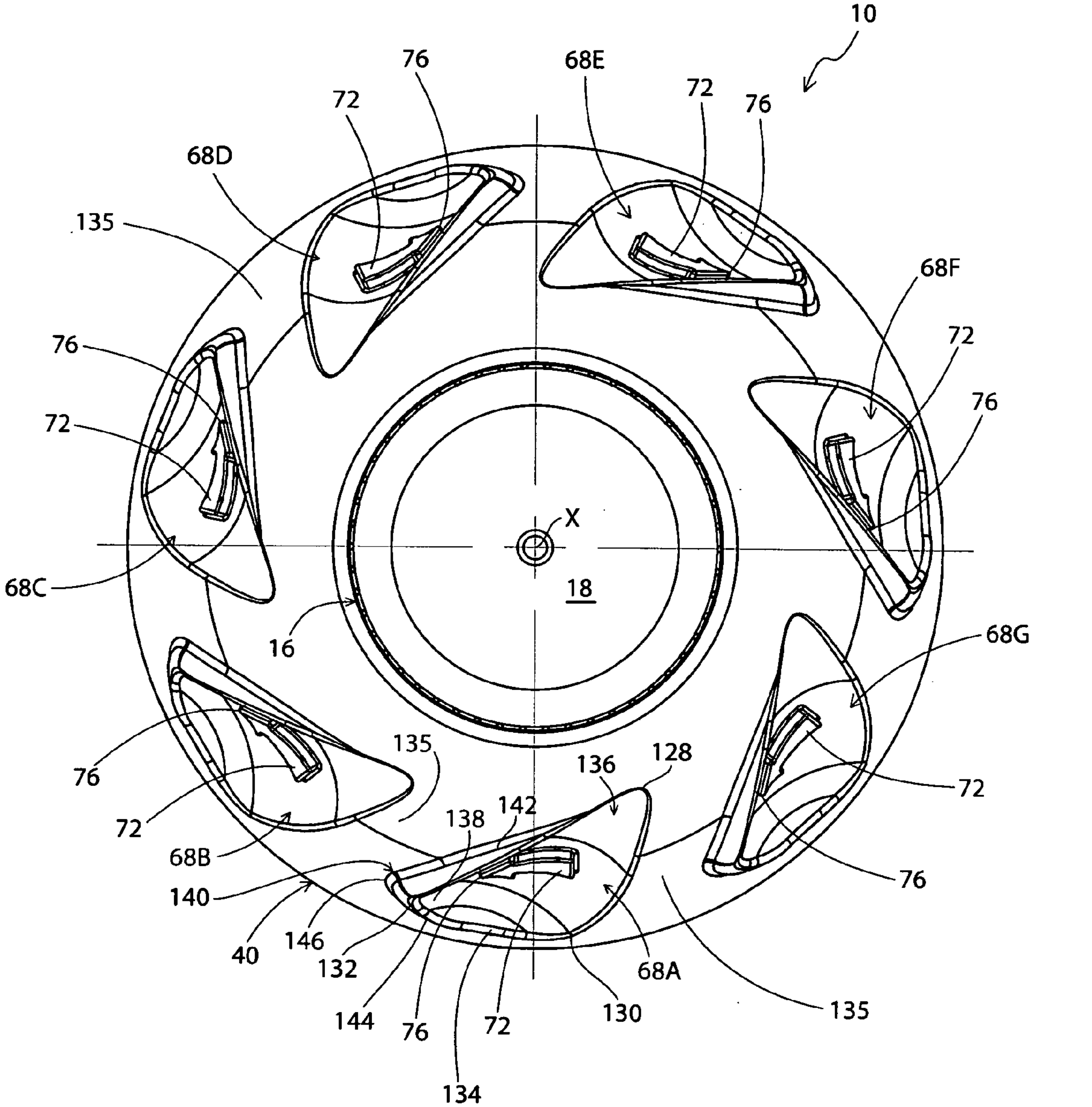

10
76
68E
72
76
72
68D
135
68F
72
76
76
72
X
18
68C
16
68G
135
128
136
142
138
76
72
72
68B
140
40
146
132
144
76
72
130
68A
135
134

FIG. 5

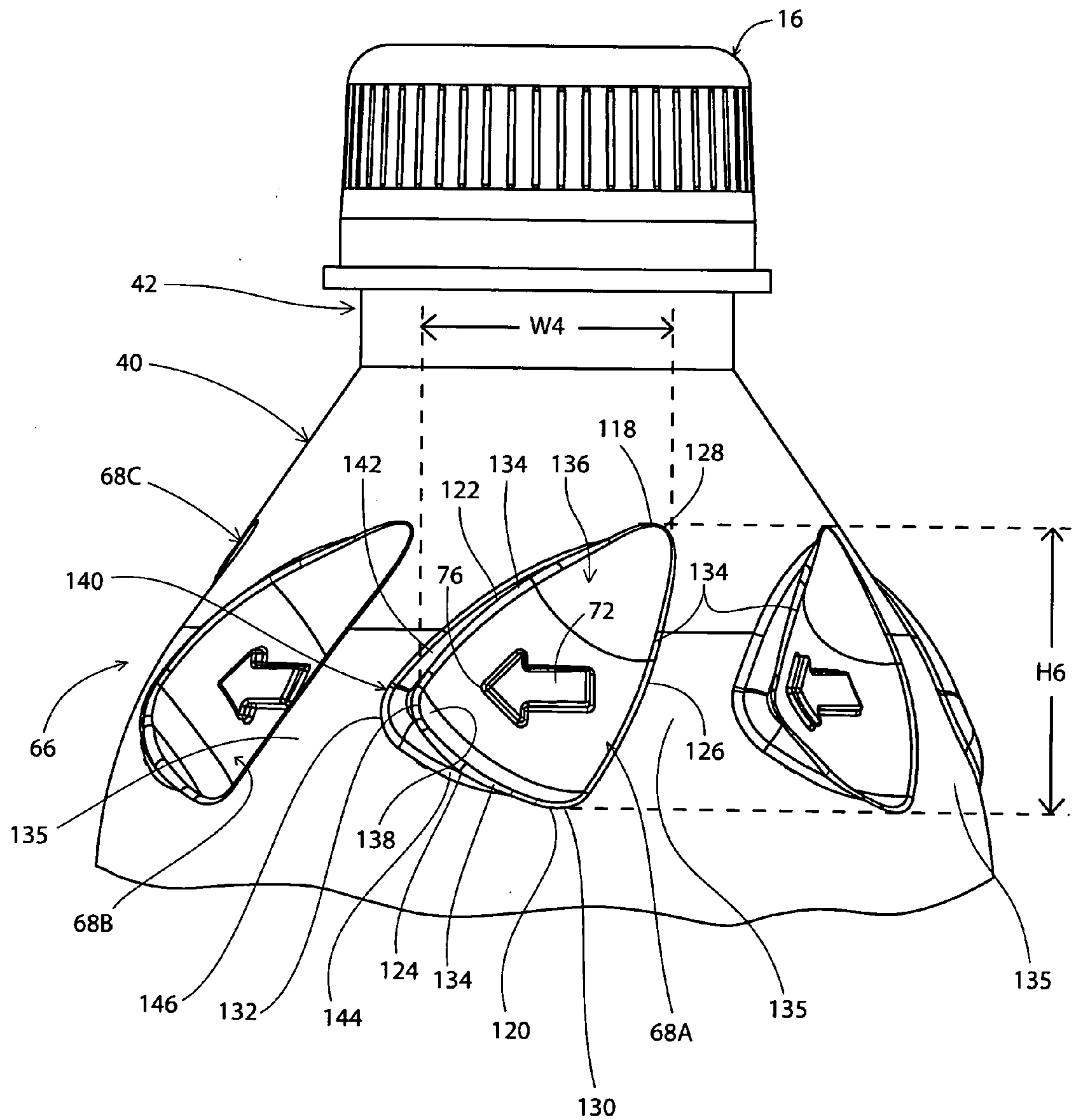

16
42
W4
40
118
142
134
136
128
68C
122
140
76
134
72
H6
66
126
135
138
68B
146
132
144
124
134
120
68A
135
135
130

FIG. 5A

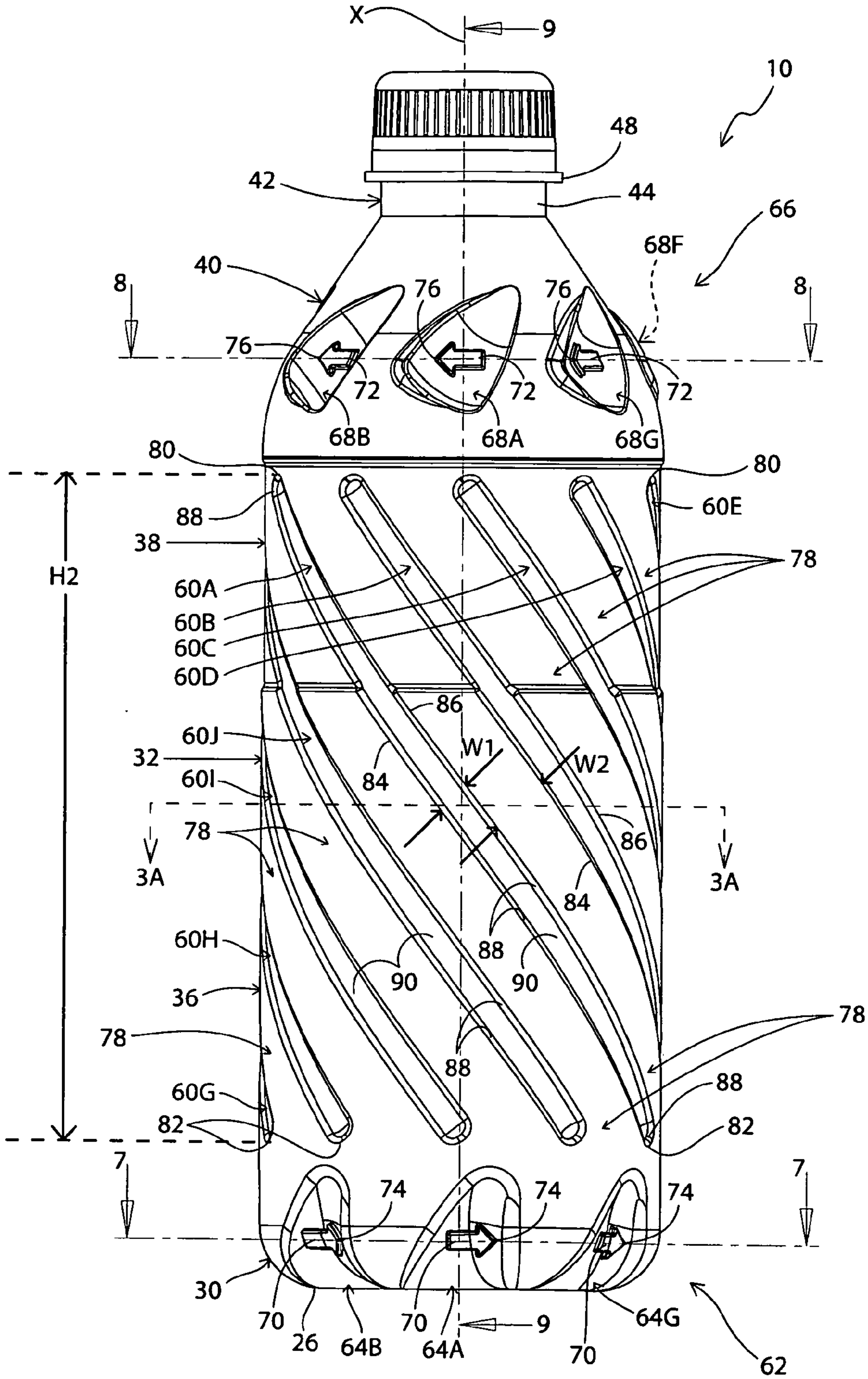

X
9
10
48
42
44
66
40
68F
8
76
76
76
8
76
72
72
72
68B
68A
68G
80
80
88
60E
38
78
60A
H2
60B
60C
60D
86
60J
32
84
W1
W2
60I
78
86
3A
84
3A
88
60H
90
90
36
78
78
88
60G
88
82
82
7
7
74
74
74
30
70
70
26
64B
64A
9
70
64G
62

FIG. 6

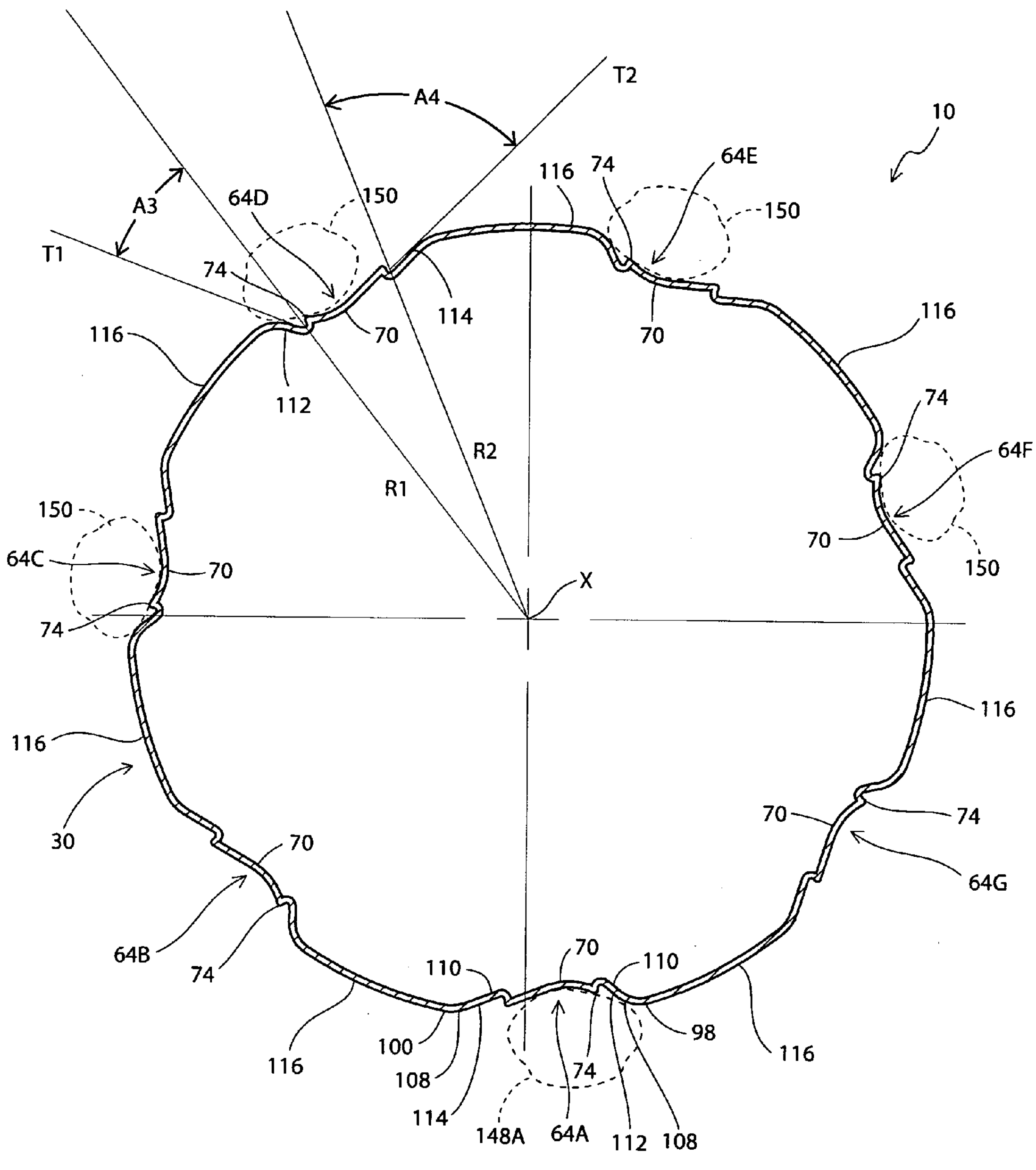

T2
A4
10
A3
T1
116
74
64E
150
64D
74
70
114
70
116
112
116
R2
R1
74
64F
150
64C
70
74
X
70
150
116
116
30
70
74
64G
70
64B
74
70
110
110
116
100
108
114
148A
64A
74
112
108
98
116

FIG. 7

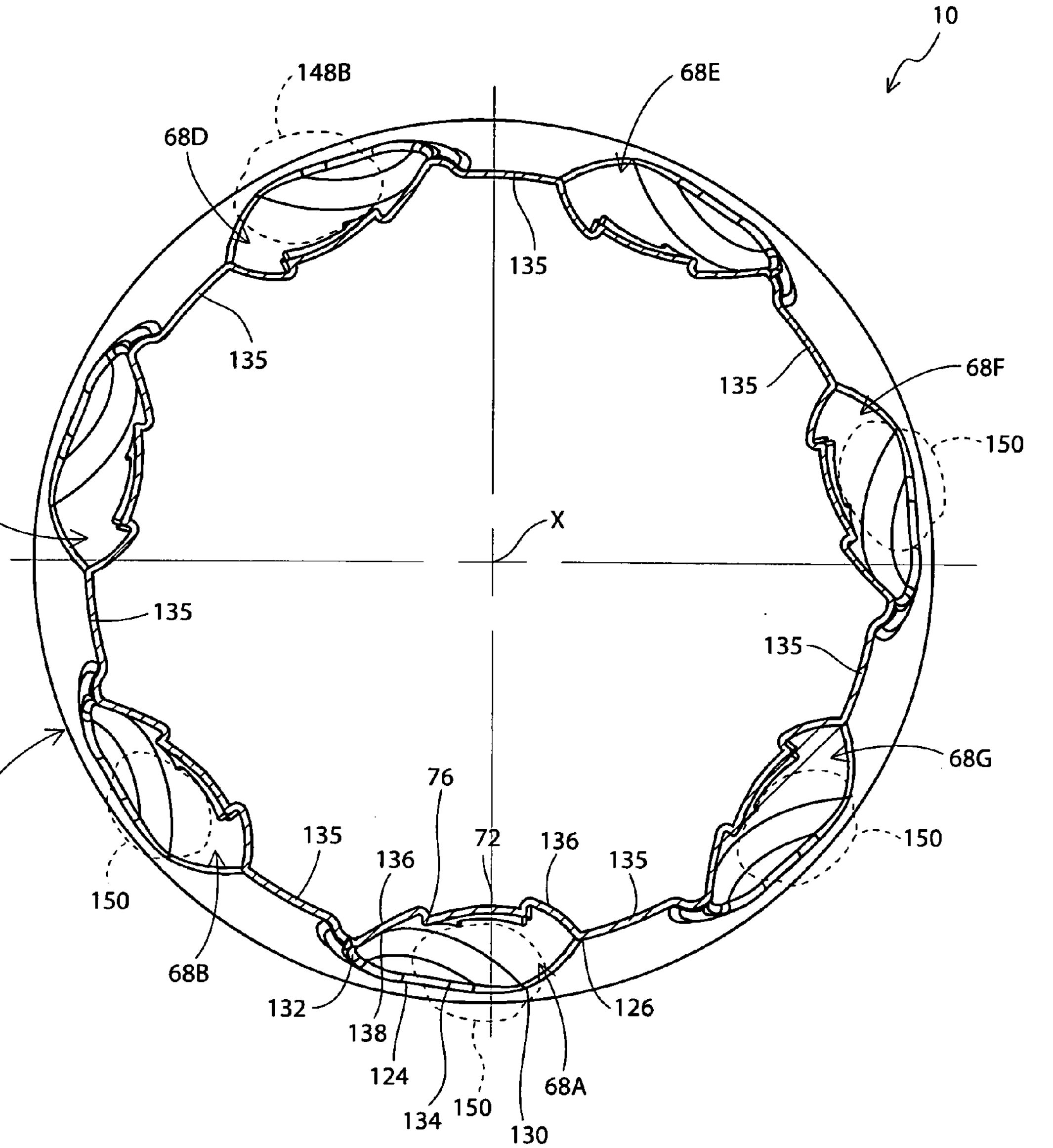

10
148B
68E
68D
135
135
135
68F
150
68C
X
135
135
40
68G
76
72
136
136
135
135
150
150
68B
132
138
124
134
150
130
68A
126

FIG. 8

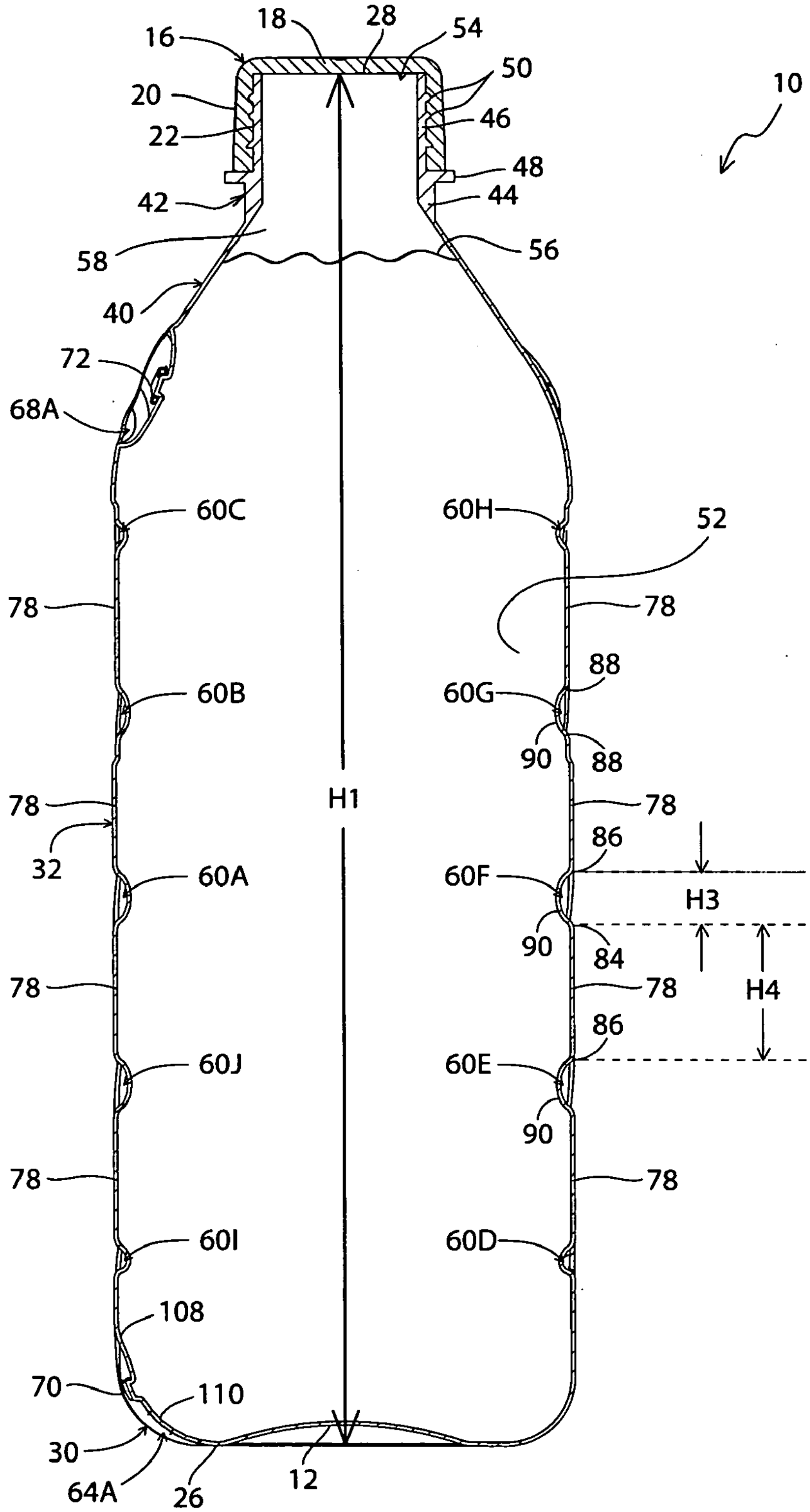
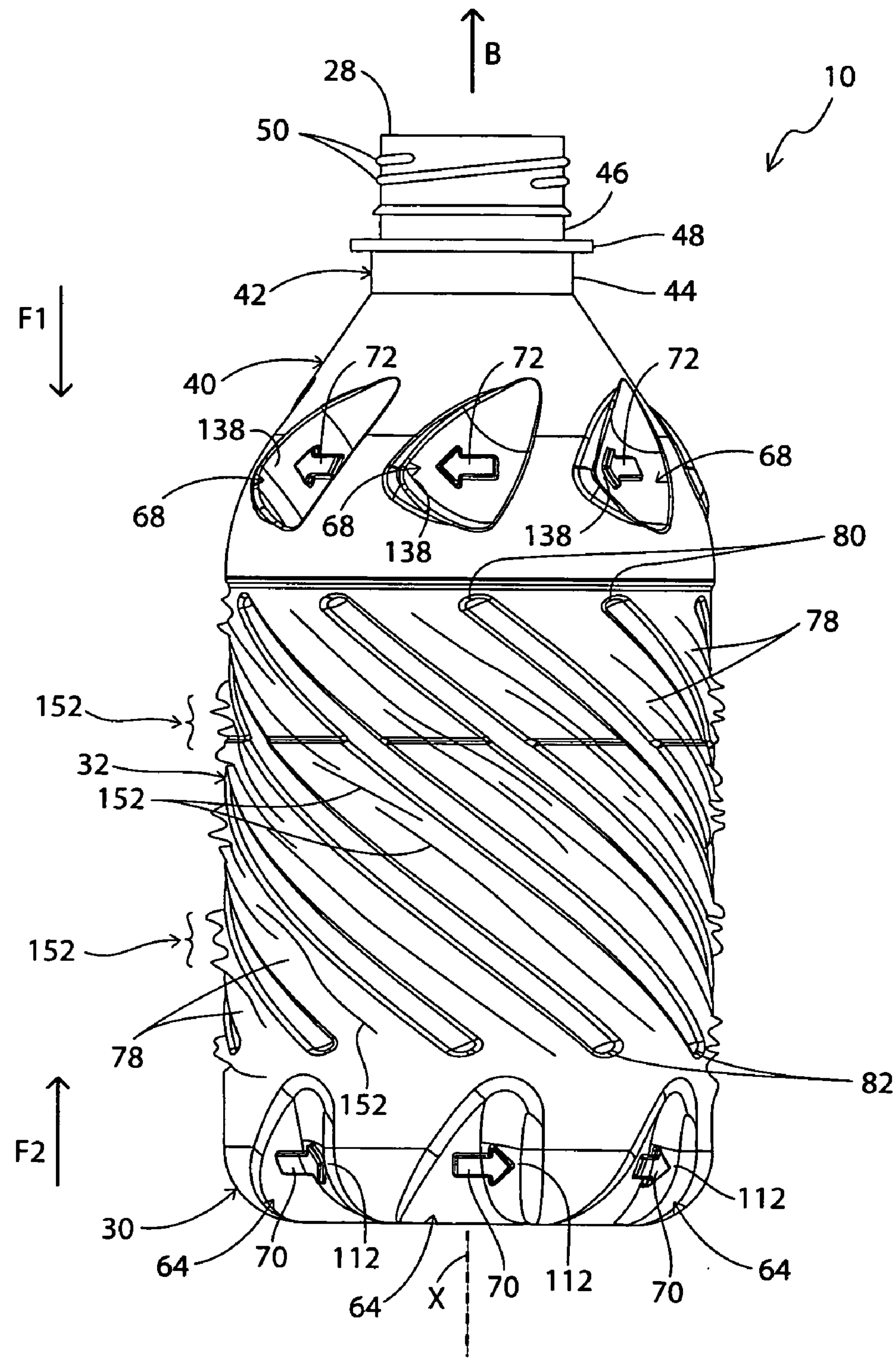

16
18
28
54
50
20
46
22
10
48
42
44
58
56
40
72
68A
60C
60H
52
78
78
88
60B
60G
90
88
78
H1
78
32
86
60A
60F
H3
90
84
78
H4
78
86
60J
60E
90
78
78
60I
60D
108
70
110
30
64A
26
12

FIG. 9


B
28
10
50
46
48
42
44
F1
40
72
72
72
138
68
68
68
68
138
138
80
78
152
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82
152
F2
112
30
64
70
112
64
X
70
112
70
64

FIG. 10

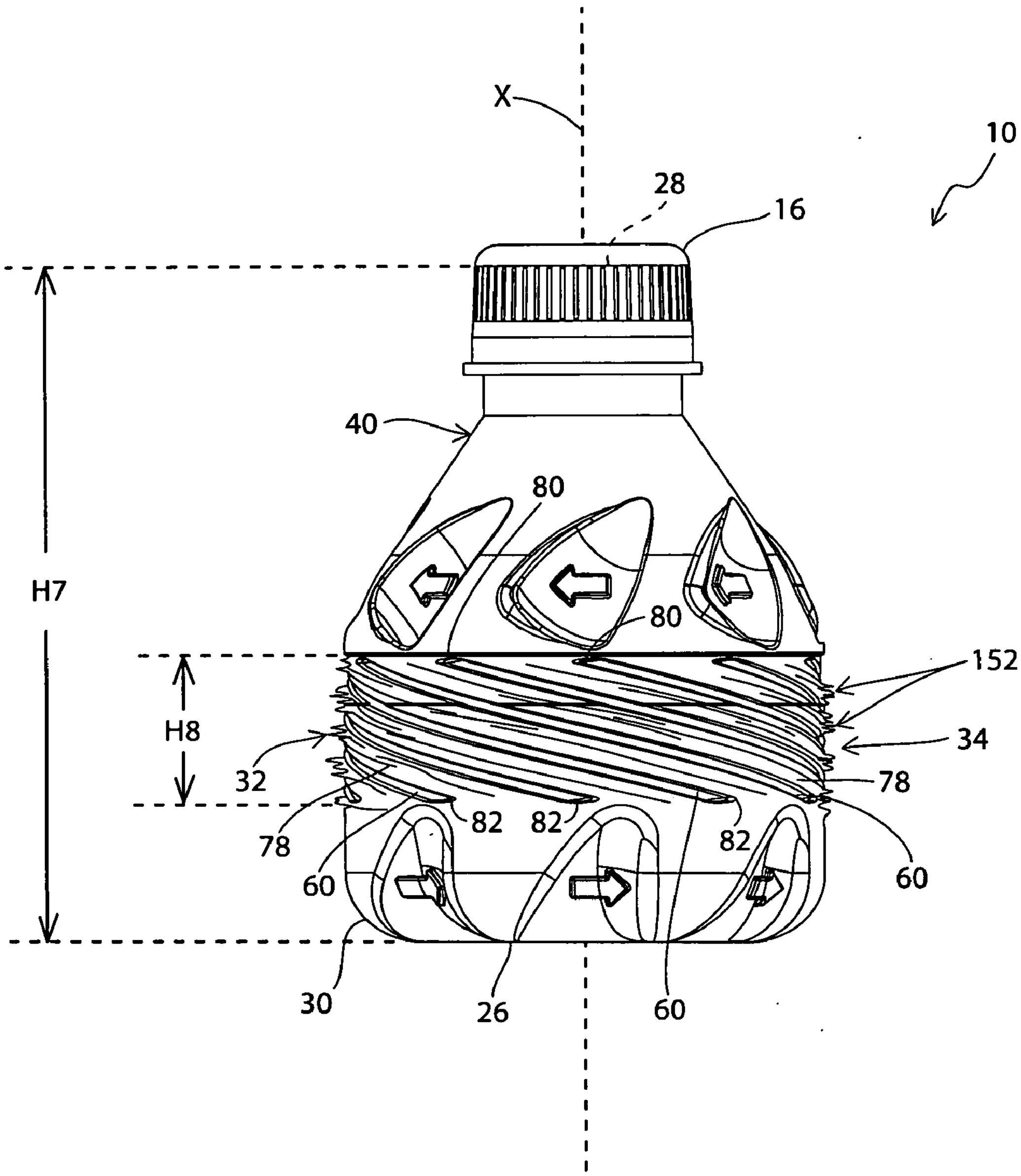

FIG. 11

COLLAPSIBLE BOTTLE

BACKGROUND OF THE INVENTION

[0001] 1. Technical Field

[0002] The present invention relates generally to collapsible bottles or containers. More particularly, the present invention relates to a collapsible bottle which utilizes spiraling grooves to facilitate its collapse. Specifically, the present invention relates to such a bottle which utilizes finger grips and rotational direction indicators which respectively facilitate and suggest twisting the bottle to its collapsed position.

[0003] 2. Background Information

[0004] In recent years, the use of personal water bottles has increased tremendously. In North America, the sales of bottled water have nearly tripled from 1998 to 2006. Most of these bottles are formed of recyclable plastic commonly in the form of polyethylene terephthalate, which has the common abbreviations PET, PETE, or the obsolete PETP or PET-P. PET is a thermoplastic polymer resin of the polyester family and is commonly used in synthetic fibers and for various other purposes. PET is one of the most readily recycled plastic materials available. Water bottles and soda bottles which are typically formed of PET or the like are commonly recycled but also often simply thrown out. In either case, these bottles take up a substantial amount of space due to the volume of air within the bottle when it is discarded. Thus, it would be desirable to use a collapsible bottle in order to reduce the amount of volume taken up when collapsed and discarded, so that storage and transportation of the bottles would be substantially more efficient. By way of example, a standard curbside recycling box typically holds somewhere on the order of 15 to 18 or 20 of these personal sized, 500 ml bottles. If these bottles could be collapsed to provide a volume reduction on the order of 2.0 to 1 or 2.5 to 1, somewhere on the order of 40 to 50 of these bottles would be able to fit within the same recycling box.

[0005] There are a variety of collapsible bottles and other containers known in the art. One type of collapsible container utilizes a bellows type side wall which may be formed of concentric alternating ridges and grooves or helical ridges and grooves. Collapsible containers of this nature are disclosed in U.S. Pat. No. 2,886,084 granted to Davison, which discloses a double walled collapsible container, U.S. Pat. No. 2,899,110 granted to Parker and U.S. Pat. No. 6,598,755 granted to Pedulla, et al. Also along these lines, U.S. Pat. No. 4,875,576 granted to Torgrimson et al. discloses a collapsible container which has a side wall of the bellows type configuration and which is specifically configured as a mixing kit.

[0006] Many of the collapsible containers are configured to move between the erect or expanded position and the collapsed position. The latter category includes containers which have side walls formed of a material which is sufficiently resilient to itself cause the side wall to spring back all the way to the expanded position. For example, U.S. Pat. No. 6,736,285 granted to Stewart-Stand discloses a collapsible container which utilizes a rubber or elastomeric side wall and also includes a cover and a base which are releasably connected to one another when the side wall is collapsed therebetween. U.S. Pat. No. 2,268,993 granted to Sanders discloses a collapsible container having a cylindrical side wall with a coil spring attached inside the side wall for the purpose of biasing the side wall to its expanded position. U.S. Pat. No. 2,723,779 granted to Parker et al. discloses a collapsible container which includes spiraling solid or channel type stiffening ribs which may facilitate the container returning to its expanded condition. The latter patent also provides an example of collapsible containers which are specifically configured when squeezed or collapsed to express the contents therefrom, wherein the contents are typically viscous or paste like materials such as whipped cream, cake topping or icing, peanut butter, ketchup and the like.

[0007] U.S. Pat. No. 4,865,211 granted to Hollingsworth discloses a collapsible container wherein a portion of a side wall turns inside out to fold over on itself in order to move to the collapsed position. The prior art also includes metal cans which have grooved side walls such as disclosed in U.S. Pat. No. 2,139,143 granted to Wiswell. A hydraulic or pneumatic press is used to collapse the metal can. While the prior art thus includes a variety of collapsible containers, there is still a need in the art for a collapsible bottle which can be manually collapsed and which provides strong visual indicators that the bottle should be collapsed after its use.

BRIEF SUMMARY OF THE INVENTION

[0008] The present invention provides a collapsible plastic bottle comprising a plastic bottom wall; a plastic annular sidewall which has a top and a bottom, which circumscribes a vertical axis, which is connected at its bottom to the bottom wall and extends upwardly therefrom, and which has expanded and collapsed positions; an interior chamber defined by the bottom wall and sidewall; a top entrance opening of the interior chamber defined by the top of the sidewall; a plurality of diagonal grooves formed in the sidewall each having an upper end and a lower end; wherein the grooves facilitate movement of the sidewall from the expanded position to the collapsed position in response to a first manual force applied to the sidewall in a first rotational direction about the vertical axis to cause relative rotation between the top and bottom of the sidewall; and a visual indicator on the bottle suggestive of a need to apply the first manual rotational force.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0009] A preferred embodiment of the invention, illustrated of the best mode in which Applicant contemplates applying the principles, is set forth in the following description and is shown in the drawings and is particularly and distinctly pointed out and set forth in the appended claims.

[0010] FIG. **1** is a side elevational view of the collapsible bottle of the present invention with its label attached.

[0011] FIG. **2** is perspective view of the bottle as seen from above and from the side of the bottle with the label removed.

[0012] FIG. **3** is a perspective view of the bottle as seen from below and from the side of the bottle with the label removed.

[0013] FIG. **3**A is a sectional view taken on line **3**A-**3**A of FIG. **6**.

[0014] FIG. **4** is an enlarged bottom plan view of the bottle.

[0015] FIG. **4**A is an enlarged side elevational view of the lower portion of the bottle.

[0016] FIG. **5** is an enlarged top plan view of the bottle.

[0017] FIG. **5**A is an enlarged side elevational view of the top portion of the bottle.

[0018] FIG. **6** is a side elevational view of the bottle with the label removed.

[0019] FIG. **7** is an enlarged sectional view taken on line **7-7** of FIG. **6**.

[0020] FIG. **8** is an enlarged sectional view taken on line **8-8** of FIG. **6**.

[0021] FIG. **9** is a sectional view taken on line **9-9** of FIG. **6**.

[0022] FIG. **10** is a side elevational view of the bottle with its cap removed at a stage of partial collapse.

[0023] FIG. **11** is similar to FIG. **10** and shows the bottle in its fully collapsed state with its cap reattached.

[0024] Similar numbers refer to similar parts throughout the drawings.

DETAILED DESCRIPTION OF THE INVENTION

[0025] The collapsible bottle of the present invention is generally shown at **10** in FIG. **1** with its label attached and in FIGS. **2**, **3** and **6** with its label removed. Bottle **10** includes a circular and generally flat bottom wall **12**, an annular and generally circular side wall **14** connected and extending upwardly from bottom wall **12**, and a cap **16** which is removably secured to the top of side wall **14**. Cap **16** includes a circular flat top wall **18** and an annular substantially cylindrical side wall **20** secured thereto and extending downwardly therefrom with internal threads **22** (FIG. **9**). Bottle **10** has an expanded position shown in FIGS. **1-3**, **6** and **9**, and a collapsed position shown in FIG. **11**. Bottle **10** is substantially radially symmetrical about a central vertical axis X. Side wall **14** is generally concentric about axis X. Bottom wall **12** and side wall **14** are formed of a suitable thermoplastic material which in the exemplary embodiment is polyethylene terephthalate (PET) although other suitable plastic materials may be used. In the exemplary embodiment, bottom wall **12** and side wall **14** are blow molded whereby the two walls are formed as a integral one-piece member. A label **24** is connected to and circumscribes a portion of side wall **14**. Label **24** is typically formed of a thin sheet of flexible material such as paper or plastic and is typically glued or adhered to itself and/or side wall **14** to connect label **24** to side wall **14**.

[0026] Bottle **10** is most typically sized for the purpose of holding about 500 ml of liquid, such as water or a carbonated liquid or beverage. However, bottle **10** may also be configured in other sizes, such as the standard 1 liter, 1.5 liter, or 2 liter bottles. It may also be configured as a 12 ounce, 16 ounce, 24 ounce, 32 ounce, or other commonly sized beverage container. While the common 500 ml water bottles have relatively thin walls, the bottles which are used for carbonated beverages typically have walls which are somewhat thicker although still relatively thin, and must typically be configured to withstand up to 90 pounds per square inch internal pressure which can occur in the containment of such carbonated liquids.

[0027] Side wall **14** has a bottom **26** which serves as the bottom of bottle **10** and which is secured to the outer perimeter of bottom wall **12** and extends upwardly therefrom to a top **28** (FIG. **9**). Bottom **26** and top **28** define therebetween a vertical height H1 (FIG. **9**) of side wall **14** in its expanded position, which is nearly the total height of bottle **10**, which further includes the thickness of top wall **18** of cap **16**. Side wall **14** includes an annular bottom arcuate transition section **30** which extends from bottom **26** upwardly a short distance and has a convexly curved outer surface which curves radially outwardly and upwardly. Side wall **14** further includes a substantially cylindrical section **32** and a grooved section **34** which takes up most of cylindrical section **32**. Cylindrical section **32** includes a lower cylindrical section **36** which is connected to and extends upwardly from the top of transition section **30** and has the largest diameter of any portion of side wall **14**. Cylindrical section **32** also includes an upper cylindrical label section **38** which is connected to the top of lower section **36** and extends upwardly therefrom. Label section **38** steps inwardly slightly from lower section **36** and thus forms a slightly recessed annular area circumscribing section **38** for receiving therein label **24**. Label section **38** thus has a slightly smaller diameter than lower section **36**. Side wall **14** further includes a tapered shoulder section **40** which is connected to and extends upwardly from the top of label section **38**. Shoulder section **40** at its lower end steps outward slightly from label section **30** whereby the lower end of shoulder section **40** has a diameter which is substantially the same as that of lower cylindrical section **36**. Shoulder section **40** then tapers upwardly and inwardly and has a generally frustoconical shape. Side wall **14** further includes a neck section **42** which is connected to and extends upwardly from the top of shoulder section **40**. Neck section **42** includes a thicker lower section **44**, a thinner upper section **46** and an annular flange **48** which is connected to the top of lower section **44** and the bottom of upper section **46** and extends radially outwardly therefrom. External threads **50** are formed along the outer periphery of upper section **46** to provide a threaded engagement with internal threads **22** of cap **16**. As shown in FIG. **9**, lower section **44** of side wall **14** has a thickness which is greater than that of upper section **46**, both of which are thicker than bottom wall **12** and the remainder of side wall **14** which extends below lower section **44**. The thickness of bottom wall **12** and sections **30**, **32** and **40** of side wall **14** are substantially the same.

[0028] Bottom wall **12** and side wall **14** define therewithin an interior chamber **52** (FIG. **9**) having a top entrance opening **54**. Entrance opening **54** serves as the sole entrance or exit opening of interior chamber **52** through which material may enter or exit chamber **52**, such as water or liquid **56** and air or other gas **58** which are shown as the contents of bottle **10** in FIG. **9**. Top wall **18** of cap **16** and top **28** of the upper threaded portion of side wall **14** form a water tight and gas tight seal therebetween when cap **16** is sufficiently tightened via its threaded engagement with external threads **50** of upper section **46**. Thus, when this gas tight, watertight seal is formed, no water or other liquid or air or other gas may pass into or out of interior chamber **52** from or to atmosphere external to bottle **10**. Cap **16** may be unthreaded and removed from neck section **42** in order to provide access to entrance opening **54** whereby these various materials may enter or exit interior chamber **52**. Under normal production circumstances, interior chamber **52** is filled with water or another liquid such as carbonated water or soda through entrance opening **54** when cap **16** is removed. Cap **16** is subsequently attached to form the seal with the top of side wall **14** in order to keep the contents of bottle **10** therein during shipping, handling and so forth.

[0029] In accordance with several features of the invention, ten diagonal grooves **60**A-J are formed in cylindrical section **32** of side wall **14**, a lower set **62** of seven fingertip grips or indentations **64**A-G are formed in side wall **14** adjacent bottom **26**, and an upper set **66** of seven fingertip grips or indentations **68**A-G are formed in tapered shoulder section **40** of side wall **14**. Several visual rotation indicators or twist indicators are provided to suggest to the user that the upper and lower portions of bottle **10** should be rotated or twisted respectively in opposite directions about vertical axis X to effect the collapse of bottle **10**. These visual rotational or twist indicators include indentations **64** and **68**, a lower set of arrows **70** which are respectively associated with lower fingertip grips **64**A-G, and an upper set of arrows **72** which are respectively associated with upper fingertip grips **68**A-G. In the exemplary embodiment, each lower arrow **70** includes a substantially rectangular rear portion or tail and a forward triangular portion or head having a sharp V-shaped point or pointing tip **74** which points to the right as viewed from the side (FIG. **6**) and clockwise about axis X when viewed from the bottom (FIG. **4**), thereby suggesting rotation of the bottom portion of bottle **10** in said clockwise direction about axis X. Likewise, upper arrows **72** have a rectangular tail and a triangular head having a V-shaped point or pointing tip **76** whereby each of arrows **72** points in the opposite circumferential or rotational direction in which the top of side wall **14** is to be rotated about axis X in order to effect the collapse of the side wall.

[0030] With primary reference to FIGS. **3**A and **6**, grooved section **34** is described in greater detail. As previously noted, ten diagonal grooves **60**A-J are formed in side wall **14**. In the exemplary embodiment, each groove **60** is a spiraling groove which angles upwardly and circumferentially along the outer periphery of sidewall **14** so that each groove spirals about vertical axis X. Each adjacent pair of grooves **60** is spaced from one another by a respective spiraling bridge section **78** which angles or spirals upwardly parallel to the corresponding adjacent pair of grooves **60**. Grooves **60** and bridge sections **78** thus alternate around the circumference of side wall **14**. Each groove **60** has an arcuate top end **80** and an arcuate bottom end **82** with spiraling opposed side edges **84** and **86** extending therebetween. The upper portion of each groove **60** extends under label **24**, which thus covers said upper portion including upper end **80**. A periphery transition wall **88** bounds each groove **60** and curves radially inwardly from side edges **84** and **86** and from top and bottom ends **80** and **82** to form a convexly curved surface along the entire outer periphery of the respective groove **60**. A U-shaped wall **90** is secured to transition wall **88** and extends radially inwardly therefrom to form a concavely curved surface bounding each respective groove **60** and communicating with the convexly curved surface of transition wall **88**.

[0031] Top and bottom ends **80** and **82** of each groove **60** define therebetween a vertical height H**2** (FIG. **6**) of the respective grooves in the expanded position. Inasmuch as each bridge section **78** extends the same length as each groove **60**, height H**2** is also representative of the vertical height of the bridge sections in the expanded position. Each groove **60** also has a length as measured along its spiraling configuration between ends **80** and **82** which is greater than height H**2**. Vertical height H**2** makes up the vast majority of the height of cylindrical section **32** and in the exemplary embodiment is about **90** percent thereof. Although each groove **60** in the exemplary embodiment extends from adjacent section **30** and the lower end of section **32** upwardly to adjacent the upper end of section **32** and shoulder section **40**, more than one set of shorter grooves may be used as well. For example, a first set of diagonal and typically spiraling grooves which are about half the height of grooves **60** may be positioned above a second set of grooves which are also half the height of grooves **60** whereby the two sets may overlap one another or be vertically separated from one another. In this case, the height analagous to vertical height H**2** would be from the bottom of the lower set to the top of the upper set of grooves. The side edges **84** and **86** of a respective groove **60** define therebetween a width W**1** (FIG. **6**) of the groove which is perpendicular to the elongated direction of the groove. The side edge **84** of one groove also serves as the side edge of the adjoining bridge section **78** while the side edge **86** of an adjacent groove **60** also serves as the side edge of said bridge section **78**. Thus, the side edges **84** and **86** of a given bridge section **78** define therebetween a width W**2** taken perpendicular to the elongated direction of the bridge section. In the exemplary embodiment, width W**2** is greater than width W**1** and more particularly on the order of about 1.5 times that of width W**1**. However, width W**2** may be the same as or less than width W**1**.

[0032] As shown in FIG. **3**A, each groove **60** has a circumferential width represented by angle A**1**, which is defined between the intersection of a horizontal plane and side edges **84** and **86** of the respective groove **60**. FIG. **3**A also illustrates that each bridge section **78** has a circumferential width represented by angle A**2** as measured between edges **84** and **86** of the bridge section **78** along a horizontal plane. In the exemplary embodiment, angle A**2** is greater than angle A**1** although this may vary such that A**2** is the same as or less than angle A**1**. FIG. **3**A also illustrates that each bridge section **78** along the horizontal plane forms an arc of a common circle which is concentric about axis X.

[0033] A vertical cross section of bridge sections **78** and groove **60** is represented in FIG. **9**, which illustrates that each bridge section **78** in the exemplary embodiment is substantially straight and vertical. FIG. **9** also illustrates that each groove **60** has a vertical height H3 defined between side edges **84** and **86** along a vertical plane. FIG. **9** also illustrates that each bridge section **78** has a vertical height H**4** defined between its side edges **84** and **86** along a vertical plane. Height H**4** in the exemplary embodiment is greater than height H**3** and more particularly is more than two times of that of height H**3**. Although this may vary, height H**4** is most typically greater than height H**3**.

[0034] With primary reference to FIGS. **3**, **4**, **4**A and **7**, fingertip indentations **64** and the lower portion of bottle **10** are described in greater detail. Each indentation **64** is formed partially in transition section **30** and the lower portion of cylindrical section **36** below the bottom ends **82** of grooves **60**. Each indentation **64** extends upwardly from or adjacent bottom **26** and has a generally triangular configuration which is wider adjacent its bottom **92** than its top **94**. The triangular configuration is bounded by a bottom generally horizontal side or edge **96**, a generally vertical leading edge **98** which may be referred to as a right edge as viewed from the side of the bottle, and a trailing side or edge **100** which may be referred to as a left edge as viewed from the side of the bottle. Trailing edge **100** angles upwardly and to the right from bottom edge **96**. Leading and trailing edges **98** and **100** adjacent their upper ends intersect at a top rounded corner **102**. Bottom edge **96** adjacent its leading or right end intersects leading edge **98** at its bottom end at a leading bottom rounded corner **104**. Bottom edge **96** at its trailing or left end intersects trailing edge **100** at its bottom end at a trailing bottom rounded corner **106**.

[0035] A periphery transitional wall **108** which has a generally inverted U-shaped or inverted V-shaped configuration curves radially inwardly from leading edge **98** toward the left, from trailing edge **100** towards the right and from top corner **102** downwardly. Transitional wall **108** has a convexly curved outer surface which transitions to a recessed wall **110** which is recessed radially inwardly of the circular outer surfaces of bottom arcuate transition section **30** and the lower portion of lower cylindrical section **36**. Recessed wall **110** has a right or leading surface **112** which serves as the primary fingertip gripping surface used to rotate the bottom end of the bottle about axis X. A portion of leading or gripping surface **112** is disposed directly to the right of tip **74** of arrow **70** whereby tip **74** points directly to said portion of gripping portion **112**. Recessed wall **110** also includes trailing surface **114**, a portion of which is to the left of arrow **70**. Leading surface **112** faces radially outwardly and to the left toward trailing edge **100** and trailing surface **114** while trailing surface **114** faces radially outwardly and to the right toward leading edge **98** and leading surface **112**.

[0036] Each adjacent pair of indentations **64** is circumferentially spaced by a respective generally triangular bridge section **116** which is part of transition section **30** and the lower portion of lower cylindrical side wall **36** and which is wider adjacent its top than its bottom. Each bridge section **116** extends circumferentially from the leading edge **98** of one indentation **64** to the trailing edge **100** of an adjacent indentation **64** and is secured to the respective leading and trailing portions of the periphery transition walls **108** bounding the respective adjacent pair of indentations **64**. Each bridge section **116** extends upwardly from the leading and trailing bottom rounded corners **104** and **106** of an adjacent pair of indentations **64** upwardly to the corresponding top rounded corners **102** or tops **94** of the respective adjacent pair of indentations **64**. The outer surfaces of bridge sections **116** form respective horizontal arcs of a common circle which is concentric about axis X.

[0037] As shown in FIG. **7**, each leading surface **112** angles radially inwardly at a sharper angle from the circular outer surface of the adjacent bridge section **116** than does trailing surface **114** from the bridge section **116** to which surface **114** is adjacent. Leading surface **112** thus provides a better gripping surface for rotating the bottom of bottle **10** in the direction indicated by arrows **70** than it does trailing surface **114** for rotating the bottom of bottle **10** in the opposite direction. One way of representing this distinction between leading and trailing surfaces **112** and **114** is illustrated by angles A**3** and A**4** in FIG. **7**. Angles A**3** and A**4** are defined using a first radius R**1**, a second radius R**2**, a first tangent T**1** and a second tangent T**2**. Radii R**1** and R**2**, tangent T**1** and T**2** and angles A**3** and A**4** all lie within the horizontal plane along which FIG. **7** is taken. Radius R**1** intersects leading edge **112**. Tangent T**1** is a tangent to leading surface **112** and extends generally radially outwardly therefrom whereby angle A**3** is defined between radius R**1** and tangent T**1**. Likewise, radius R**2** intersects trailing edge **114**, and tangent T**2** is a tangent to trailing surface **114** whereby angle A**4** is defined therebetween. As is readily apparent from FIG. **7**, angle A**3** is substantially less than angle A**4**. In the exemplary embodiment, angle A**3** is on the order of about 30 degrees and angle A**4** is on the order of about 65 degrees whereby angle A**4** is more than twice that of angle A**3**. Preferably, angle A**4** is at least 15 or 20 degrees greater than angle A**3** and even more preferably at least 25 or 30 degrees greater. Generally, the greater the difference between angle A**4** and A**3**, the easier it is to visually discern which of surfaces **114** and **112** is to be used as the fingertip gripping surface to which a rotational force is applied about axis X in order to effect the collapse of bottle **10**. If this difference is sufficiently pronounced, it can serve as (or as part of) a visual indicator or suggestion to the user about which direction the bottom of bottle **10** should be rotated even without the use of arrows **70**.

[0038] There are several aspects of indentations **64** which facilitate their use as visual rotation or twisting indicators in addition to providing the fingertip pushing surfaces to rotate the bottom of bottle **10**. Each indentation **64** is not bilaterally symmetrical about a plane cutting through it in any direction (i.e., a vertical plane, a horizontal plane or otherwise). Thus, for instance, the upper half and lower half of each indentation **64** are different from one another and are not mirror images of one another. Likewise, the leading half and trailing half of each indentation **64** are different from one another and are not mirror images of one another. Leading edge **98** and trailing edge **100** angle upwardly at different angles and such that they are not mirror images of one another about a vertical plane. This is likewise true of the leading and trailing portions of transition wall **108**. Leading and trailing surfaces **112** and **114** have different shapes as viewed from the side or as viewed from below. Surfaces **112** and **114** also angle radially differently, as discussed above. Other distinctions are also evident from the Figures.

[0039] Bottom **92** and top **94** of each indentation **64** defines therebetween its vertical height H**5**, which is substantially longer than width W**1** of groove **60**, typically twice or three times width W**1**. Height H**5** is far less than vertical height H**2** of grooves **60**. Height H**2** may easily be three, four or five times that of height H**5**. Height H**5** in the exemplary embodiment is also greater than width W**2** of bridge section **78**. Each indentation **64** also has a width W**3** as measured horizontally from left to right which in the exemplary embodiment is from adjacent bottom trailing corner **106** to leading edge **98**. Width W**3** in the exemplary embodiment is approximately the same as height H**5** and thus has similar ratios with respect to width W**1**, width W**2** and height H**2**.

[0040] With primary reference to FIGS. **5**, **5**A and **8**, the upper portion of bottle **10** including upper set **66** of indentations **68** is now described in greater detail. Each indentation **68** has a top **118** and a bottom **120** defining therebetween a height H**6** which is the same or nearly the same as height H**5** and thus has the same ratios with respect to width W**1**, width W**2**, height H**2** and so forth. Each indentation **68** has an upper leading edge **122** which angles upwardly and to the right as viewed from the side, a lower leading edge **124** which angles downwardly and to the right as viewed from the side, and a trailing edge **126** which extends generally vertically and angles upwardly and to the right. Upper leading edge **122** and trailing edge **126** at the upper ends intersect to form a top rounded corner **128**. The bottom of trailing edge **126** and the right or trailing end of lower leading edge **124** intersect to form a bottom rounded corner **130**. The leading ends of upper and lower leading edges **122** and **124** intersect to form a leading rounded corner **132**. Each indentation **68** thus has a substantially triangular configuration. The left or leading end of indentation **68**, here represented by leading rounded corner **132**, and the trailing or right end of indentation **68** represented adjacent top corner **28**, define therebetween a width W**4** which is similar to height H**6** and thus provides similar ratios with respect to the measurements as discussed previously. A generally triangular periphery transition wall **134** curves radially inwardly from upper and lower leading edges **122** and **124** and trailing edge **126** to provide a convexly curved surface along each of said edges.

[0041] A generally triangular recessed bowl-shaped wall **136** is secured to and extends radially inwardly from periphery transition wall **134** and generally provides a substantially triangular concavely curved surface which bounds indentation **68** and curves radially inwardly from all portions of transition wall **134** to adjacent arrow **72**, which projects radially outwardly therefrom, whereby arrow **72** is disposed within or bounds indentation **68**. Wall **136** includes a leading fingertip gripping surface **138** at least a portion of which is disposed between corner **132** and tip **76** of arrow **72**. Arrow **72** thus points directly toward said portion of surface **138**. Wall **136** has a trailing surface a portion of which is behind arrow **72** and which angle less sharply radially than leading surface **138**, as described above regarding leading and trailing surfaces **112** and **114** of indentations **64**. While most of indentation **68** is disposed radially inward of the outer frustoconical surface of shoulder portion **40**, a small leading portion adjacent leading surface **138** is disposed radially outwardly of said outer surface. This is due to the fact that the left or leading portion of indentation **68** is defined by an L-shaped or V-shaped ridge **140** which projects radially outwardly of the circular or frustoconical outer surface of shoulder section **40**.

[0042] Ridge **140** includes an upper leg **142** which angles upwardly and to the right and includes the portion of transition wall **134** extending along upper leading edge **122**. Ridge **140** also includes a lower leg **144** which angles downwardly and to the right and includes the portion of transition wall **134** which extends along lower leading edge **124**. Legs **142** and **144** intersect at a rounded tip or point **146**. Ridge **146** thus provides an additional visual rotation indicator or twist indicator inasmuch as it projects outwardly from the outer surface of section **40** and also includes rounded point **146** which points in the same rotational direction as arrows **72**. In contrast, there is no such ridge extending along trailing edge **126** which projects radially outwardly from the outer surface of shoulder section **40**.

[0043] Each adjacent pair of indentations **68** is circumferentially spaced from one another and joined to one another by a generally L-shaped bridge section **135** which defines respective portions of the frustoconical outer surface of shoulder section **40**. Each bridge section **135** extends circumferentially from the trailing edge **126** of one indentation **68** to the upper and lower legs **142** and **144** of V-shaped ridge **140** of the adjacent indentation **68** and thus to adjacent upper and lower leading edges **122** and **124** of said adjacent indentation **68**. As illustrated in FIG. **8**, bridge sections **135** along a horizontal plane form respective arcs of a common circle which is concentric about axis X. V-shaped ridges **140** project radially outwardly from the outer surface of respective bridge sections **135**.

[0044] Like lower indentations **64**, there are several aspects of upper indentations **68** which facilitate their use as visual rotation or twisting indicators in addition to providing the fingertip pushing surfaces to rotate the top of bottle **10**. Each indentation **68** is not bilaterally symmetrical about a plane cutting through it in any direction (i.e., a vertical plane, a horizontal plane or otherwise). Thus, for instance, the upper half and lower half of each indentation **68** are different from one another and are not mirror images of one another. Likewise, the leading half and trailing half of each indentation **68** are different from one another and are not mirror images of one another. Each of upper and lower leading edges **122** and **124** and trailing edge **126** angle upwardly at different angles and such that they are not mirror images of one another about a vertical plane or any other plane. This likewise true of the leading and trailing portions of transition wall **134**. Other distinctions are also evident from the Figures.

[0045] The collapsing operation of bottle **10** is now described with primary reference to FIGS. **10** and **11**. First, cap **16** is unthreaded by rotation relative to side wall **14** (arrow A in FIG. **2**) in order to either simply break the gas tight, water tight seal or to additionally completely remove cap **16** (FIG. **10**). Then, the upper portion of bottle **10** including neck section **42** and shoulder section **40** are manually rotated about axis X in the direction indicated by arrows **72** while the bottom of bottle **10** is manually rotated in the opposite direction indicated by arrows **70**. more particularly, the fingers of one hand are positioned within indentations **64** to apply rotational force against fingertip gripping surfaces **112** while the fingertips of the other hand are positioned within indentations **68** to apply rotational force against fingertip gripping surfaces **138** to provide the counter rotating motion of the bottom and top portions of bottle **10** relative to one another.

[0046] The positioning of the fingertips in the respective indentations is represented in FIGS. **7** and **8**, the fingertips being shown in dashed lines. More particularly, the thumb **148**A of one hand is shown positioned in indentation **64**A with the fingertips **150** of the other fingers of the same hand positioned respectively in indentations **64**C-F. Likewise, FIG. **8** shows thumb **148**B of the other hand positioned in indentation **68**D with the fingertips **150** of the other four fingers positioned respectively in indentations **68**F, **68**G, **68**A, and **68**B. Each of FIGS. **7** and **8** thus illustrate the rationale for utilizing seven indentations **64** and seven indentations **68**. When either hand is moved to a grasping or gripping position, the thumb is generally opposed to the other four fingers so that the other four fingers are generally circumferentially evenly spaced from one another while there is a larger space between the thumb and index finger and between the thumb and pinkie finger. The use of seven indentations which are equally spaced circumferentially about the upper portion and lower portion of the bottle allows the thumb to fit within one indentation with the index finger positioned in another indentation with one of the indentations left free therebetween and with the pinkie finger in another indentation with one of the indentations left free between the thumb and pinkie finger. Indentations **64** and **68** are thus ergonomically configured for a normal grip and/or grasping configuration of the hand. FIGS. **7** and **8** also illustrate one typical initial positioning of the right and left hands in the respective indentations so that the thumbs are generally circumferentially opposed to allow for a greater degree of twisting in a single twisting action of the opposed hands.

[0047] The counter rotating motion of the top and bottom of bottle **10** thus causes bottle **10** to begin collapsing as illustrated in FIG. **10**. As the bottle is collapsed, air exits the interior chamber as indicated at arrow B in FIG. **10**. The rotational force applied by one hand to the upper portion of the bottle via indentations **68** is accompanied by an axial downward force (arrow F**1** in FIG. **10**) along axis X while the opposite rotational force applied by the other hand to the bottom of the bottle via indentations **64** is accompanied by an opposed upward axial force (arrow F**2**) whereby the manually applied rotational and axial forces thus applied force bottle **10** to collapse. Grooves **60** are configured to facilitate this collapsing effect in response to the relative rotation between the upper and lower ends of side wall **14**. During the collapsing process, grooves **60** move closer to one another. Due to the plastic material of which side wall **14** is formed, the twisting of side wall **14** produces strains primarily within cylindrical section **32** which crinkle or crumple portions of section **32**. This occurs in bridge sections **78** and along the portions of the side wall defining grooves **60**, such as U-shaped wall **90** and so forth. This crumpling process thus creates irregular wrinkles or creases **152** along side wall **14** primarily within section **32**. Creases **152** are permanently formed in side wall **14**. The manual twisting is continued until the bottle reaches its fully collapsed state shown in FIG. **11**. Once cylindrical section **32** is fully collapsed, cap **16** is rotated (arrow C in FIG. **2**) back onto threaded neck section **46** in order to form the gas tight, water tight seal previously discussed so that air will not reenter the interior chamber of bottle **10**. Such air reentry would allow for some degree of expansion to a volume greater than that of the fully collapsed position due to the fact that the plastic material forming side wall **14** does have some resilient characteristics although not enough to cause it to move back to its fully expanded position.

[0048] In the fully collapsed position shown in FIG. **11** with cap **16** attached to form the gas tight, water tight seal, side wall **14** has a collapsed height H7 defined between bottom **26** and top **28** and grooves **60** have a collapsed vertical height H**8** defined between top and bottom ends **80** and **82**. The reduction in the height of the bottle or side wall **14** as shown in the figures is due solely to or substantially to the reduction in height of grooves **60** or grooved section **34** although the crumpling or crinkling of side wall **14** may extend above and/or below that shown in FIG. **11**. Additional height reduction and volume reduction may also be achieved by additional vertical compression of bottle **10** by continuing to push the opposed hands together with or without additional twisting force so that a portion of shoulder section **40** and/or portions of lower section **30** and the lower section of the cylindrical portion **32** adjacent section **30** may be crushed or otherwise deformed. This is especially true of the typical water bottles which have rather thin side walls. This may also be feasible with some of the soda bottles or the like which nonetheless have thicker side walls in order to withstand the internal pressure from carbonated drinks.

[0049] Preferably, the ratio of the collapsed height H**7** of side wall **14** to the expanded height H1 is preferably no greater than 0.50 and the more preferably no more than 0.45, 0.40, 0.35 or 0.30. The ratio of collapsed height H**8** of grooves **60** or section **34** to the expanded height H2 thereof is preferably no more than 0.35 and even more preferably no more than 0.30, 0.25 or 0.20. The volume reduction of bottom **11** may be quite substantial, whether measured as the reduction the internal volume of interior chamber **52** or the external volume as defined by the entire outer surface of bottle **10**. Preferably, the ratio of the collapsed volume to the expanded volume is no greater than 0.50 and more preferably no more than 0.45, 0.40, 0.35, 0.30 or 0.25.

[0050] As previously noted, the plastic material of which side wall **14** is formed does not have sufficient resilient characteristics to cause side wall **14** to move back to its fully expanded position although it may move toward the expanded position to a relatively limited degree. Inasmuch as the irregular creases **152** formed during the collapsing process are permanent, bottle **10** is incapable of returning to its original expanded configuration even if reverse rotational and axial forces are applied to the upper and lower portions of the bottle to stretch it out once again. That is, such forces may return bottle **10** to its fully expanded height, but would not be able to repair the deformation represented primarily by creases **152**.

[0051] It is further noted that bottle **10** in the preferred embodiment is free of several aspects known in the prior art as discussed in the Background section of the present application. For example, bottle **10** does not include spring members such as coil springs or stiffening ribs which act as spring members capable of causing the side wall of the bottle to move from its collapsed position to its fully expanded position. In addition, bottle **10** preferably avoids the use of the bellows style helical grooves formed between helical folding sections such that each adjacent pair of grooves meets at a substantially pointed or V-shaped ridge. In addition, bottle **10** does not utilize a cover attached to the top of the collapsible side wall and a base connected to the bottom of the side wall wherein a latching mechanism releasably connects the cover and base to one another in the collapsed position by to hold the collapsed side wall therebetween so that upon release of the connection between the cover and base, the side wall may be expanded to its fully expanded position. Bottle **10** may also avoid the use of other prior art concepts the lack of which may distinguish the present invention and which Applicant reserves the right to subsequently claim.

[0052] In the foregoing description, certain terms have been used for brevity, clearness, and understanding. No unnecessary limitations are to be implied therefrom beyond the requirement of the prior art because such terms are used for descriptive purposes and are intended to be broadly construed.

[0053] Moreover, the description and illustration of the invention is an example and the invention is not limited to the exact details shown or described.

[0054] In the foregoing description, certain terms have been used for brevity, clearness, and understanding. No unnecessary limitations are to be implied therefrom beyond the requirement of the prior art because such terms are used for descriptive purposes and are intended to be broadly construed.

[0055] Moreover, the description and illustration of the invention are an example and the invention is not limited to the exact details shown or described.

1. A collapsible plastic bottle comprising:

a plastic bottom wall;

a plastic annular sidewall which has a top and a bottom, which circumscribes a vertical axis, which is connected at its bottom to the bottom wall and extends upwardly therefrom, and which has expanded and collapsed positions;

an interior chamber defined by the bottom wall and sidewall;

a top entrance opening of the interior chamber defined by the top of the sidewall;

a plurality of diagonal grooves formed in the sidewall each having an upper end and a lower end; wherein the grooves facilitate movement of the sidewall from the expanded position to the collapsed position in response to a first manual force applied to the sidewall in a first rotational direction about the vertical axis to cause relative rotation between the top and bottom of the sidewall; and

a visual indicator on the bottle suggestive of a need to apply the first manual rotational force.

2. The bottle of claim **1** wherein the visual indicator comprises a first arrow which is adjacent one of the top and bottom of the sidewall and which points in the first rotational direction.

3. The bottle of claim **2** wherein the visual indicator comprises a second arrow on the sidewall which is adjacent the other of the top and bottom of the sidewall and points in a second rotational direction opposite the first rotational direction.

4. The bottle of claim **1** wherein the visual indicator comprises a set of circumferentially spaced fingertip indentations which are formed in the sidewall and sized to receive therein a fingertip.

5. The bottle of claim **4** wherein the fingertip indentations are disposed above the upper ends of the grooves.

6. The bottle of claim **4** wherein each groove has an elongated direction and a first width measured perpendicular to the elongated direction; and each fingertip indentation has a second width measured horizontally which is greater than the first width.

7. The bottle of claim **4** wherein each groove has an elongated direction and a first width measured perpendicular to the elongated direction; and each fingertip indentation has a height which is greater than the first width.

8. The bottle of claim **4** wherein each fingertip indentation has circumferentially spaced leading and trailing edges; each fingertip indentation is bounded by a leading surface which extends from adjacent the leading edge toward the trailing edge and against which the first manual force is to be applied; each fingertip indentation has a trailing surface which extends from adjacent the trailing edge toward the leading surface; and each leading surface extends radially inwardly adjacent the leading edge at a sharper angle than does the trailing surface adjacent the trailing edge.

9. The bottle of claim **4** wherein each fingertip indentation has a leading half and a trailing half which is different from the leading half.

10. The bottle of claim **1** wherein the visual indicator comprises a set of circumferentially spaced radially extending concavely curved fingertip grip surfaces on the sidewall.

11. The bottle of claim **10** wherein the sidewall adjacent its top comprises a shoulder section which tapers downwardly and outwardly; and the fingertip grip surfaces are disposed on the shoulder section.

12. The bottle of claim **11** wherein the sidewall adjacent its top comprises a neck section adapted for releasably attaching thereto a cap; and wherein the shoulder section tapers downwardly and outwardly from the neck section.

13. The bottle of claim **12** wherein the neck section comprises a threaded portion adapted for threadably engaging the cap.

14. The bottle of claim **1** wherein the visual indicator is disposed above the upper ends of the grooves.

15. The bottle of claim **1** wherein the sidewall adjacent its top comprises a shoulder section which tapers downwardly and outwardly; and the visual indicator is disposed on the shoulder section.

16. The bottle of claim **1** wherein the sidewall has a circular outer surface; and the visual indicator comprises a ridge projecting radially outwardly from the circular outer surface.

17. The bottle of claim **16** wherein the ridge is substantially V-shaped.

18. The bottle of claim **1** further comprising a label connected to the sidewall and covering a portion of the grooves.

19. The bottle of claim **1** further comprising a plurality of permanent irregular creases formed in the sidewall in response to movement of the sidewall from the expanded position to the collapsed position.

20. The bottle of claim **1** further comprising a cap which is removably attached to the sidewall and forms an airtight and watertight seal therewith between the interior chamber and atmosphere external to the bottle.

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