(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 025 991**
A1

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **80105619.3**

(51) Int. Cl.³: **B 65 D 41/34**

(22) Date of filing: **19.09.80**

(30) Priority: **21.09.79 US 77566**

(43) Date of publication of application:
01.04.81 Bulletin 81/13

(84) Designated Contracting States:
DE FR GB IT NL SE

(71) Applicant: **H-C Industries, Inc.**
P.O. Box 472 100 Harrison Street
Crawfordsville Indiana 47933(US)

(72) Inventor: **Wilde, Sheldon L.**
R.R.8
Crawfordsville Indiana 47933(US)

(72) Inventor: **McCandless, Thomas J.**
R.R.6
Crawfordsville Indiana 47933(US)

(72) Inventor: **Saunders, Robert M.**
R.R.2
Ladoga Indiana 47954(US)

(74) Representative: **Groening, Hans W., Dipl.-Ing.**
Siebertstrasse 4 Postfach 860 340
D-8000 München 86(DE)

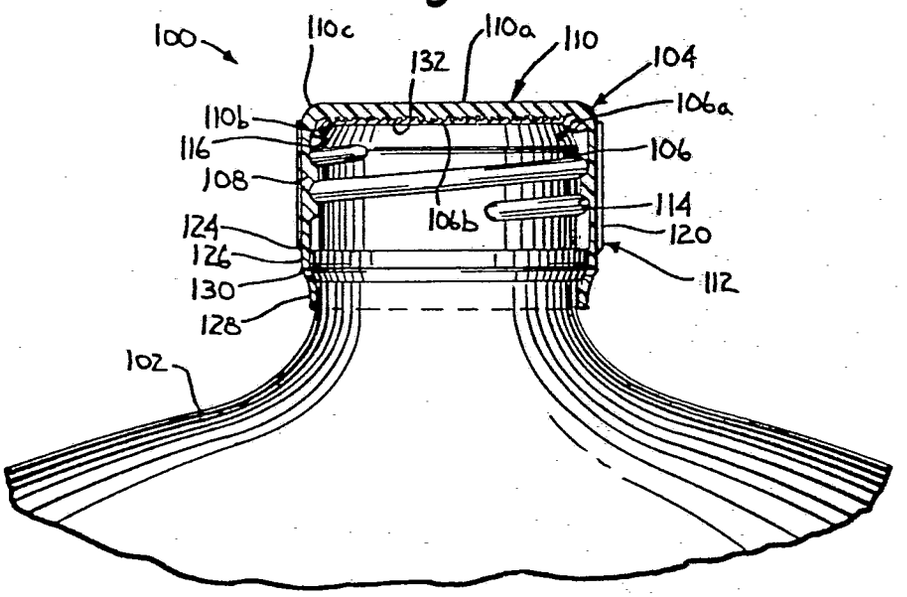
(54) **Composite closure.**

(57) A composite closure having a plastic cap (104) with specially configured pedestals (132;152;162) that are interconnected to a plastic liner (106). In one embodiment, the pedestals (132) each have an overhang (140), such as a mushroom-shaped head (138), to provide a mechanical interlock with the liner (106). In other embodiments, the pedestals (152;162) each have a fusible heat concentration zone that is fused to the liner (106) as the liner is compression molded and heated in the cap (104). In one embodiment, the fusible pedestals (152) are each cylindrical. In another embodiment, the fusible pedestals (162) are each in the shape of a pyramid.

EP 0 025 991 A1

./...

fig. 1


100
110c
132
110a
110
104
106a
110b
116
106
108
114
106b
124
120
126
112
130
128
102

COMPOSITE CLOSURE

BACKGROUND OF THE INVENTION

This invention relates to closures, and more particularly, to a composite plastic closure for bottles.

Over the years metal crowns have been lined with various materials such as cork, rubber, thermosetting plastic and thermoplastic. Representative of the many crowns lined with such material are those shown in U.S. Patent Nos. 1,486,937, 2,548,305, 2,654,913, 2,684,774, 2,688,776, 2,696,318, 2,823,422, 2,834,498, 2,840,858, 2,952,035, 3,183,144, 3,278,985 and 3,300,072. These prior art crowns have met with varying degrees of success.

Recently, the advantages of plastic crowns and closures have been recognized. The physical characteristics and nature of plastics, however, such as their melting and plastic deformation temperatures, and their resiliency, impact and compression strengths, at molding and refrigeration temperatures, present different structural problems in molding plastic closures than in metal closures.

In prior art plastic closures, for example, the wall thickness is confined to a limited range, i.e., the wall must be thin enough to permit axial removal and deflection of the threaded skirt of the closure from the plunger, but thick enough to support the necessary thread height and profile. The threads of conventional plastic closures are also limited to a certain amount of taper to permit deflection and removal of the threaded skirt from the plunger.

In conventional plastic closures, such as polypropylene closures, the closures have low impact strength and fail a drop test in the refrigeration range of 32-40 degrees F.

It is therefore desirable to provide an improved plastic closure which overcomes most, if not all, of the above disadvantages.

SUMMARY OF THE INVENTION

An improved composite plastic closure for bottles and other containers has a plastic cap with novel liner-engaging pedestals that are adapted to provide a secure mechanical or thermal interconnection with a plastic liner. The liner-engaging pedestals extend from the top wall of the cap in an area bounded by the closure-skirt. Portions of the pedestals are spaced apart from each other to define spaces that receive the plastic liner.

In one embodiment, each of the pedestals has at least one portion that provides an overhang to interlockingly engage the liner. In the preferred form, the overhang is mushroom-shaped.

In other embodiments the pedestal includes fusible pedestals with heat concentration zones that are fused to the liner.

In one embodiment, each of the fusible pedestals is cylindrical with a circular edge that defines part of the heat concentration zone.

In another embodiment, each of the fusible pedestals has an apex that defines part of the heat concentration zone. Preferably, such pedestals are pyramid-shaped.

In order to determine whether the seal between the container and closure has been opened, the closure is formed with an inwardly biased pilfer band that is detachably connected to the skirt.

A more detailed explanation of the invention is provided in the following description and appended claims taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a cross-sectional view of a composite plastic closure in accordance with principles of the present invention, that has been screwed onto a container to provide a fluid tight seal with its finish;

FIGURE 2 is a bottom plan view of the underside of the cap of the composite closure with greatly magnified portions broken away for ease of clarity and understanding;

FIGURE 3 is a greatly enlarged perspective view of some of the mushroom-shaped pedestals of the closure, with portions of the cap's top wall shown in cross-section;

FIGURE 4 is a cross-sectional view of some of the mushroom-shaped pedestals of the cap;

FIGURE 5 is a cross-sectional view similar to Figure 4, but showing the liner in interlocking engagement with the mushroom-shaped pedestals;

FIGURE 6 is an enlarged cross-sectional view of another composite plastic closure having fusible cylindrical pedestals in accordance with principles of the present invention;

FIGURE 7 is a greatly magnified perspective view of some of the fusible cylindrical pedestals of the composite closure of Figure 6; and

FIGURE 8 is a greatly magnified perspective view of some of the fusible pyramid-shaped pedestals of another composite plastic closure in accordance with principles of the present invention.

DETAILED DESCRIPTION OF THE ILLUSTRATIVE EMBODIMENT

Referring to Figure 1 of the drawings, a composite plastic closure 100 is provided to close and fluidly seal the finish of a threaded bottle 102 or other containers filled with a liquid, such as a

carbonated beverage. Composite closure has a resilient plastic cap 104, which is sometimes referred to as a shell or crown, and has a resilient fluid-impervious plastic liner or seal 106. Cap 104 is preferably made of moldable thermoplastic, such as polypropylene or polyethylene. Other materials can also be used. Liner 106 is preferably made of moldable thermoplastic, such as polyvinyl chloride (PVC). Other liner materials, such as ethylene vinyl acetate (EVA) can also be used.

In order to increase the strength of the cap, the cap has spun plastic portions that provide a spiral molecular orientation, i.e., spirally orientated molecules 108. The spiral orientation gives the cap greater hoop strength and crack resistance than plastic caps formed without spiral orientation. The spun plastic material provides good impact strength and enables the cap to pass a drop test in the refrigeration temperature range of 32-40 degrees F.

In the preferred embodiment, cap 104 is of a one-piece unitary construction and is made of a polypropylene homopolymer. All the parts and components of the plastic cap 104 are integrally connected to each other. The cap 104 has a top wall disc-shaped portion or surface 110 that is sometimes referred to as the "top," and an annular peripheral skirt 112 depending from the top 110. Top 110 has a generally flat outer surface 110a and an inner surface that provides an underside 110b. The circular edge or corner 110c formed by the intersection of the top and the skirt is rounded or chamfered.

As shown in Figure 6 skirt 112 has internal threads 114 and an internal annular lip 116 that

provides a retainer to retain and confine the annular bead portion 106a of liner 106 and serves to support and seal against a cylindrical sleeve during the liner-forming process. As explained later, annular bead portion 106a advantageously seals against the finish of the bottle to fluidly seal any irregularities, such as bumps or unevenness in the finish. Retainer 116 is inclined and converges radially inward away from top 110.

In the illustrative embodiment, the exterior surface of skirt 112 has circumferentially spaced vertical finger-gripping ribs 120 to facilitate gripping of the cap. The vertical ribs terminate in an outer rim 124 spaced below top 110. Rim 124 has an inwardly inclined annular shoulder 126 that provides the end skirt 112.

In order to indicate whether the closure 100 has been opened after the closure 100 has been inserted and screwed onto container 102, a heat-shrinkable detachable pilfer-band or tamper-proof band 128 is provided at the end of the skirt by a plurality of frangible members or bridges 130. When formed, pilfer-band 128 is biased radially inward from skirt 112 to provide a frusto-conical band having a minimum inside diameter that is less than the inside diameter of the skirt. The band is subsequently stretched, expanded and lifted to provide a circumferential or cylindrical portion having an inside diameter approximately equal to the inside diameter of the skirt 112 to enable the cap 104 to be inserted onto the container 102. The cylindrical band has a resilient memory and when reheated will assume its original frusto-conical shape.

After the composite plastic closure 100 has been inserted and screwed onto the container 102, pilfer-band 128 is heated to shrink about and engage the bottleneck. When closure 100 is unscrewed to open the bottle 102, pilfer-band 128 will fracture or break in selected areas. In the preferred embodiment, some of the frangible bridges 130 are thicker than others so that when the closure 100 is removed from the bottle, the pilfer-band will tear into one or more pieces and still be attached to the closure 100 by the thicker bridges. In some circumstances it may be desirable that the bridges 130 all have the same thickness and be only horizontally scored so that the pilfer-band 128 will remain on the bottle 102 when the closure 100 is removed.

In order to provide a secure mechanical interconnection between the liner 106 and the cap 104, the cap has a plurality of liner-engaging pedestals 132 that interlockingly engage liner 106. Pedestals 132 extend vertically from the underside 110b of cap-top 110 to a position above the cap's annular lip 116. As shown in Figures 2-5, the pedestals 132 are spaced apart from each other in a grid-like array or matrix in longitudinal parallel rows and lateral parallel rows to define a plurality of liner-receiving passageways, channels or spaces 134 therebetween to receive the liner-forming plastic 106. Liner-receiving spaces 134 and pedestals 132 are circumferentially bounded and surrounded by skirt 112 (Figure 1).

Each pedestal 132 (Figures 3-5) is formed with a generally upright, vertical body 136 extending in the upright (axial) direction. Pedestal-body 136 has a free end or head 138 that is spaced away from

the top 110 of cap 104. In the illustrative embodiment, pedestal-body 136 has a generally square cross-section.

In the process of forming the pedestals 132, the free end 138 (Figures 3-5) of pedestal-body 136 is upset, such as by compression and/or heating, to form a mushroom-shaped head 138 with an overhang 140 that extends outwardly of the body 136 in a direction generally transverse to the upright direction. Overhangs 140 provide a mechanical interlock between pedestals 132 and liner 106. The holding strength of the pedestals and the tear strength of the mechanical connection between the liner 106 and pedestals 132, is proportional to the diameter and extent of the overhang 140 of pedestals 132, the number of pedestals 132 and the spacing 134 between pedestals. For a given number of pedestals, increasing the diameter and extent of the overhang 140 of the mushroom-shaped head will increase the tear strength (peel strength) of the closure. Therefore, by varying the amount of the overhang, the peel strength of the pedestals can be varied to a desired amount, such as between 0,9 and 2,72 kg. This versatility is important because it permits the liner 106 to be detached or stripped from the pedestals 132 with a minimum amount of effort at a later time. The maximum bond and holding strength between the pedestals 132 and liner 106 occurs when the overhangs 140 of the pedestals contact each other.

Referring now to the plastic liner 106, the liner 106 has a centrally disposed circular disc-shaped portion or membrane 106b (Figure 1) that extends across and is connected to and circumscribed by an annular sealing bead 106a. Disc portion 106b engages the underside 110b of cap-top 110 and extends

to a position beneath the mushroom-shaped heads 138 to completely cover and overlie pedestals 132. Annular bead 106a is confined in the channel between top 110 and retainer 116. In the illustrative embodiment, the outer face of bead 106a has a rounded lower portion 142 (Figure 6) that is shaped complementary to the internal rounded corner that connects the top 110 to skirt 112, and has an outer upper frusto-conical portion 144 that is inclined and converges radially inward away from top 110, and engages retainer 116. The inner face of bead 106a has a vertical lower portion or shoulder 146 and an upper frusto-conical sealing portion 148 that is inclined and diverges radially outward from shoulder 146. Upper sealing portion 148 resiliently seals and seats against the finish and rim of the bottle to abut against and fluidly seal any irregularities, such as bumps or unevenness, in the finish.

When certain types of thermoplastic liners 106 are used, such as EVA liners, the liner 106 is thermally fused and bonded to pedestals 132 (Figure 5) as it is compression molded and heated during the liner-forming process. This provides a thermo-connection in addition to the mechanical interlock provided by the mushroom-shaped pedestals 132 (Figure 5). For other materials, such as PVC, the liner may not be fused to the pedestals when it is compression molded and heated, but it is still securely mechanically held by the mushroom-shaped pedestals 132.

Advantageously, the resultant secure mechanical interconnection between cap 104 and liner 106 attributable to the holding strength of the mushroom-shaped pedestals 132 permits the liner to be molded without heating the cap, or at least without

heating the non-pedestal portions of the cap, to its melting and plastic deformation temperature, thereby minimizing distortion of the cap when the liner is formed.

It will be appreciated that pedestals having heads or overhangs with other shapes could also be used to provide a mechanical interlock with the liner in accordance with principles of the present invention.

The composite plastic closure 150 shown in Figure 6 is identical to the composite closure 100 shown in Figure 1, except that the pedestals 152 are in the form of fusible cylindrical pedestals and do not have an overhang. Each of the pedestals 152 (Figure 7) has a generally planar or flat end 154 with a circular edge 156 that defines at least part of a fusible heat concentration zone, that becomes thermally fused to liner 106 (Figure 6) when liner 106 is compression molded and heated in cap 104 during the liner-forming process. The thermal bond between liner 106 and pedestals 152 provide a solid thermal interconnection between liner 106 and cap 104. Desirably, the shape and arrangement of the fusible pedestals 152 are such as to permit the pedestals to be heated to their melting and plastic deformation temperature for fusion with the liner 106, while the other portions of the cap 104 are kept cooler, thereby minimizing distortion of the cap when the liner is formed.

The composite plastic closure 160 shown in Figure 8 is identical to the composite closure 150 shown in Figures 6 and 7, except that the fusible pedestals 162 are pyramid-shaped and the bases 164 of the pyramids 162 in each lateral row 166 are contiguous. The apex or peak 168 of each pyramid 162

and the portions immediately adjacent thereto provides a fusible heat concentration zone 170 that becomes thermally fused to the molten liner-forming plastic as the liner is compression molded and heated in the cap during the liner-forming process. The fusible pyramid-shaped pedestals 162 also permit the pedestals to be heated to their melting and plastic deformation temperature for fusion to the liner 106, while the other portions of the cap are kept cooler so as to minimize distortion of the cap 104 when the liner is formed. Because of the shape, arrangement and high heat transfer capabilities of the pyramid-shaped pedestals 162, it is believed that the cap with pyramid-shaped pedestals 162 can be kept even cooler than a cap with cylindrical pedestals 152, when the liner is formed.

It was found that pyramids with a radius at the apex of approximately 0,05 mm had about the same adhesion (thermal connection strength) with a liner as 0,33 mm diameter cylindrical pedestals that were formed with a 50 mesh stainless steel screen. Prior art closures provided only about one-fifth the adhesion (holding strength) of the pyramids and cylinders.

It will be appreciated by those skilled in the art, that fusible pedestals having other configurations can be used in accordance with principles of the present invention.

Although embodiments of the invention have been shown ar described, it is to be understood that various modifications and substitutions can be made by those skilled in the art without departing from the novel spirit and scope of this invention.

Claims :

1. A composite closure (100, 150, 160) for a container (102), such as a bottle, comprising:

a plastic cap (104) having a top wall portion (110) with a plurality of liner-engaging pedestals (132; 152;162) extending therefrom, said liner-engaging pedestals having portions spaced from each other to define liner-receiving spaces (134) therebetween, each of said pedestals (132;152;162) having a free end (138;154;168) spaced from said top wall portion (110), and said plastic cap (104) having an annular skirt (112) depending from said top wall portion (110) and bounding said liner-engaging pedestals (132;152;162) and said liner-receiving spaces (134); and

a fusible substantially fluid-impervious plastic liner (106) disposed in said liner-receiving spaces (134) and fused to said pedestals (132;152;162) for engaging and fluidly sealing said container (102), said plastic liner (106) having an annular sealing portion (106a) adjacent said skirt (112) and a centrally disposed portion (106b) connected to said annular sealing portion (106a), said centrally disposed portion (106b) extending from a position adjacent said top wall portion (110) to a position spaced from the free ends (138;154;168) of said pedestals (132;152;162) in a direction generally away from said top wall portion (110) for overlying said pedestals (132;152;162).

2. A composite closure in accordance with claim 1 wherein each of said pedestals (132) has a generally upright body (136) extending in generally upright direction and has at least one portion extending outwardly of said body (136) adjacent said free end (138) in a direction generally transverse to said upright direction for providing an overhang (140) to

interlockingly engage said plastic liner (106).

3. A composite closure in accordance with claim 2 wherein said overhang (140) is mushroom-shaped.

4. A composite closure in accordance with claim 1 wherein said pedestals include fusible pedestals (154,162) thermally fused to said plastic liner (106).

5. A composite closure in accordance with claim 1 or 4, wherein each of said fusible pedestals (152) has a cylindrical configuration.

6. A composite closure in accordance with claim 1 or 5, wherein each of said fusible pedestals (162) has an apex (168).

7. A composite closure in accordance with claim 6, wherein each of said fusible pedestals (162) is pyramid-shaped.

8. A composite closure in accordance with one of claims 1 to 7 for a container, such as a bottle, wherein said cap (104) having a top wall portion (110) and an annular skirt (112) depending from said top wall portion (110), said cap having a plurality of liner-engaging pedestals (132;152;162) extending from said top wall portion (110) in an area bounded by said skirt (112), said liner-engaging pedestals (132;152;162) having portions spaced from each other to define liner-receiving spaces (134) therebetween; and a plastic substantially fluid-impervious liner (106) disposed in said liner-receiving spaces (134) and connected to said liner-engaging pedestals (132;152;162) of said cap (104) for engaging and

fluidly sealing said container (102).

9. A composite closure in accordance with one of claims 1 to 8 for a container, such as a bottle, having a neck and a finish about the mouth of said container, wherein

said plastic cap (104) having a top wall portion (110) with an underside (110b), an internally threaded annular skirt (112) depending from said top wall portion (110) and a heat shrinkable pilfer band (128) detachably connected to said skirt (112), said top wall portion (110) having a plurality of liner-engaging pedestals extending from its underside (110b) in an area bounded by said skirt (112), each of said pedestals having a free end (138;154;168) spaced from said top wall portion (110), said free ends (138;154;168) being spaced from each other to define liner-receiving spaces therebetween; and

a plastic liner (106) disposed in said liner-receiving spaces (134) and connected to said pedestals (132;152;162), said plastic liner (106) having a resilient annular sealing bead (106a) adjacent said skirt (112) for resiliently sealing against the finish of said container (102) and a centrally disposed disc-shaped portion (106b) extending substantially across and connected to said annular sealing bead (106a), said centrally disposed disc-shaped portion (106b) extending from a position adjacent said top wall portion (110) to a position spaced from the free ends (138;154;168) of said pedestals (132;152;162) in a direction generally away from said top wall portion (110),

said disc-shaped portion (106b) providing a generally planar surface overlying said pedestals (132;152;162) for substantially covering the mouth of said container (102).

10. A composite closure in accordance with claim 9 wherein said skirt (112) has an internal annular lip (116) spaced from said top wall (110) and providing a retainer for retaining said plastic liner bead (106a) during the liner-forming process.

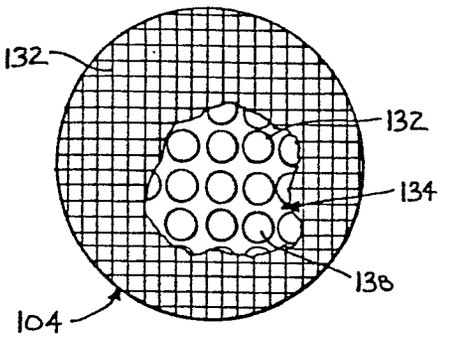


fig. 2

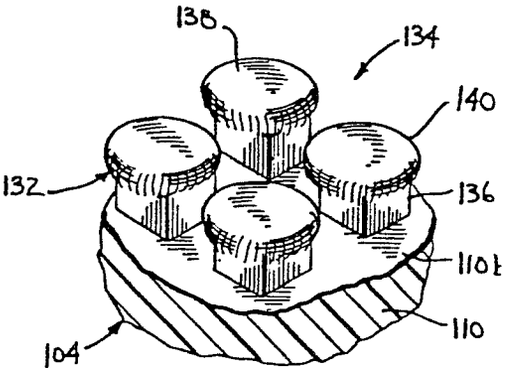


fig. 3

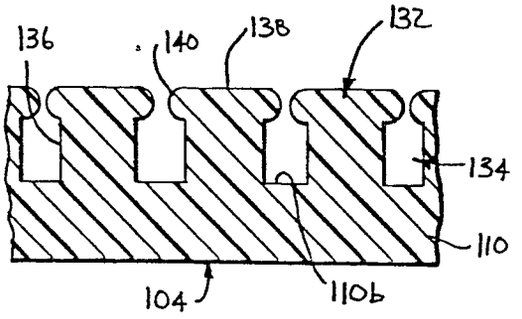


fig. 4

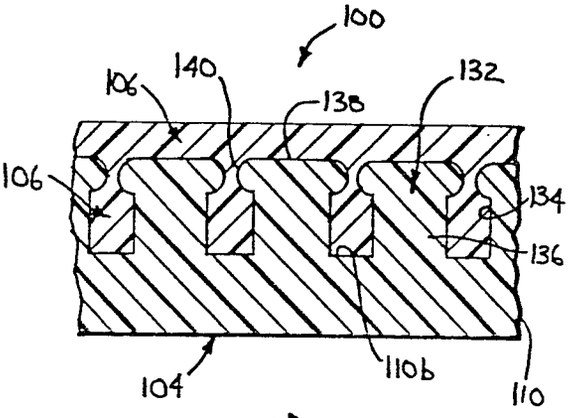


fig. 5

fig. 1

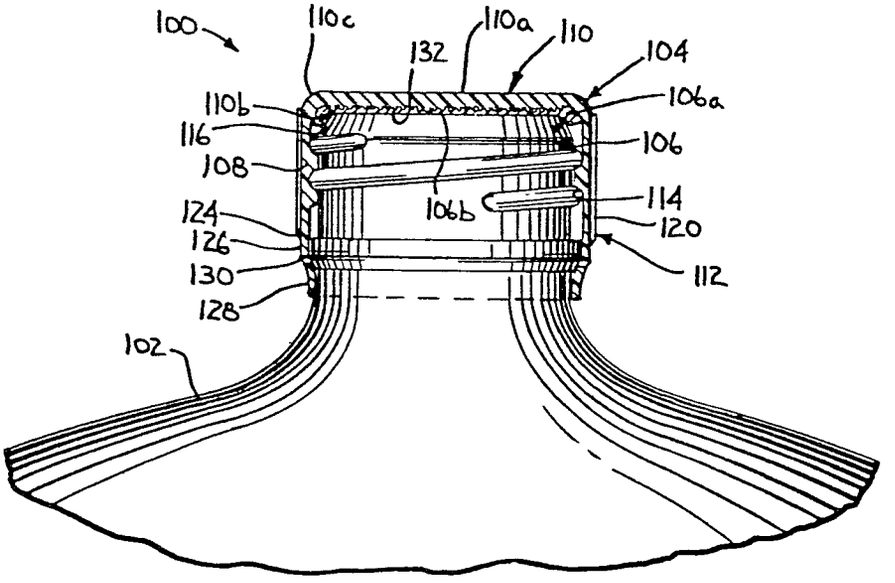
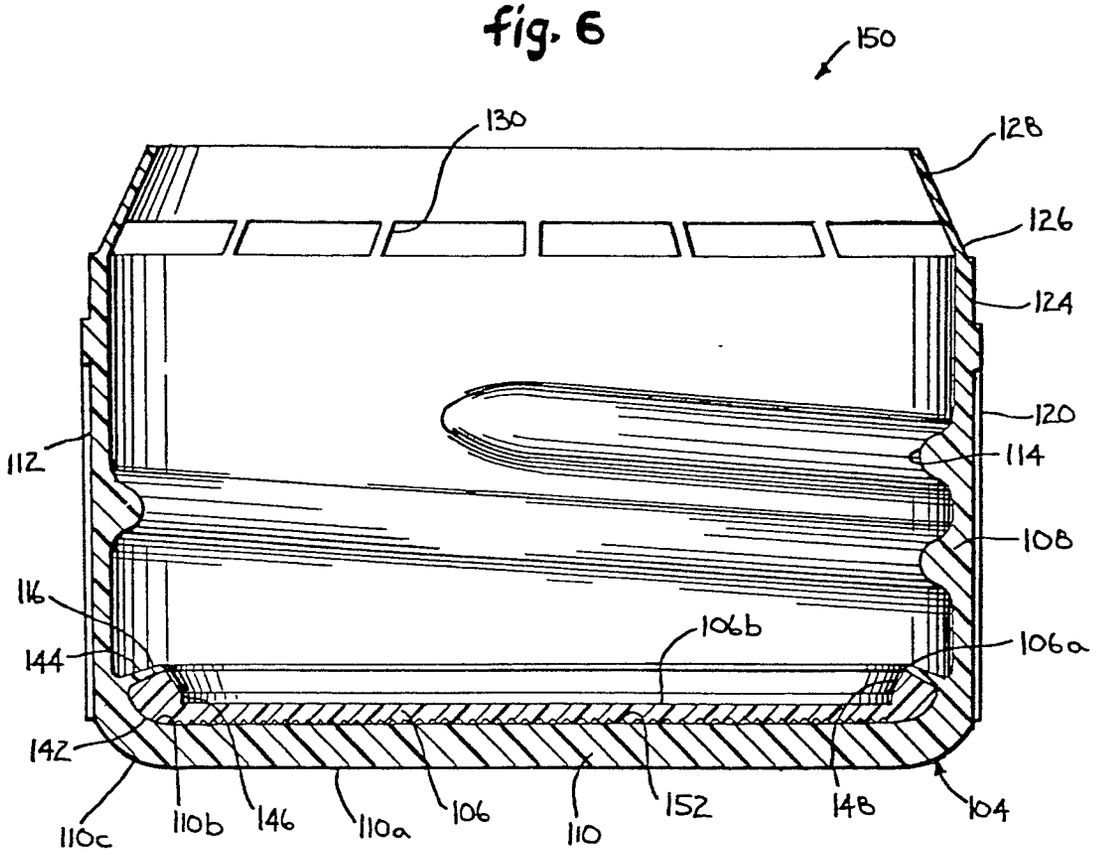


fig. 6



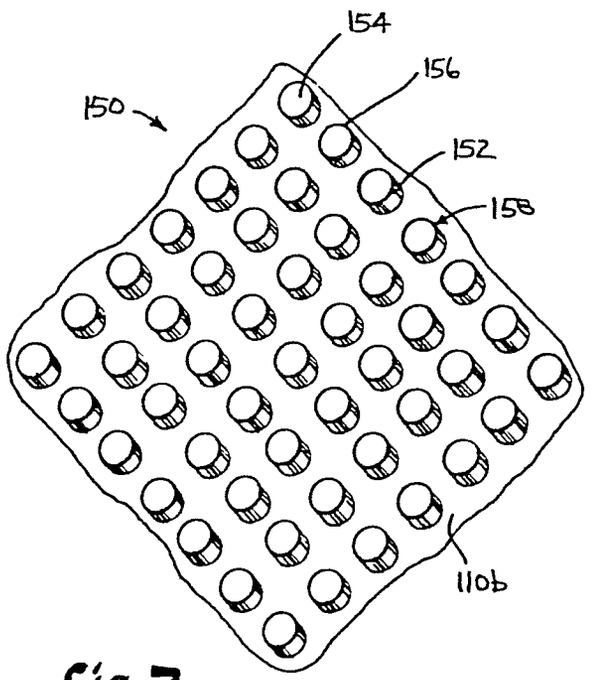


fig.7

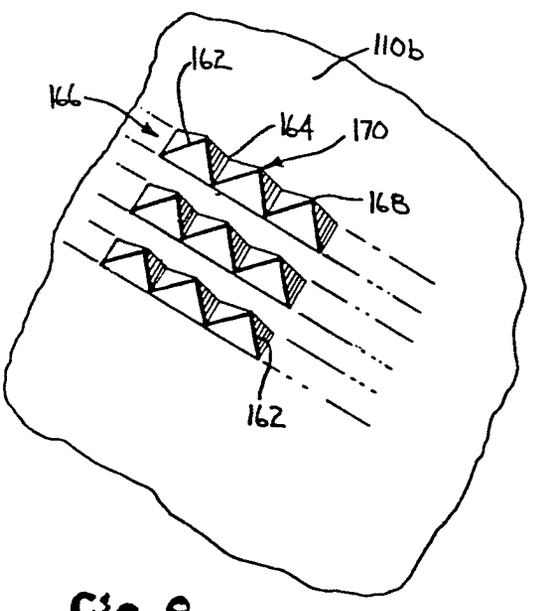


fig.8

European Patent Office

EUROPEAN SEARCH REPORT

Application number EP 80 10 5619

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	CH - A - 464 721 (CIBA) * The whole document *	1-5,8, 9	B 65 D 41/34
	GB - A - 1 384 370 (UNITED GLASS LTD) * Page 2, lines 73-85; figure 2 *	9	
	GB - A - 283 447 (CARR) * Page 1, lines 76-86; figures 2-4 *	10	TECHNICAL FIELDS SEARCHED (Int. Cl.³) B 65 D
AD	US - A - 1 486 937 (TALIAFERRO)	1	
AD	US - A - 2 548 305 (GORA)	1	
AD	US - A - 2 654 913 (MAIER)	1	
AD	US - A - 2 684 774 (AICHEILE)	1	
AD	US - A - 2 688 776 (EVANS)	1	
AD	US - A - 2 696 318 (KIHM)	1	
AD	US - A - 2 823 422 (SCHNEIDER)	1	CATEGORY OF CITED DOCUMENTS
AD	US - A - 2 834 498 (OLT)	1	X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
AD	US - A - 2 840 858 (RAINER)	1	
AD	US - A - 2 952 035 (GORA)	1	
AD	US - A - 3 183 144 (CAVIGLIA)	1	
AD	US - A - 3 278 985 (EVERETT)	1	
AD	US - A - 3 300 072 (CAVIGLIA)	1	
	----		&: member of the same patent family, corresponding document

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	12-12-1980	BAERT

EPO Form 1503.1 06.78