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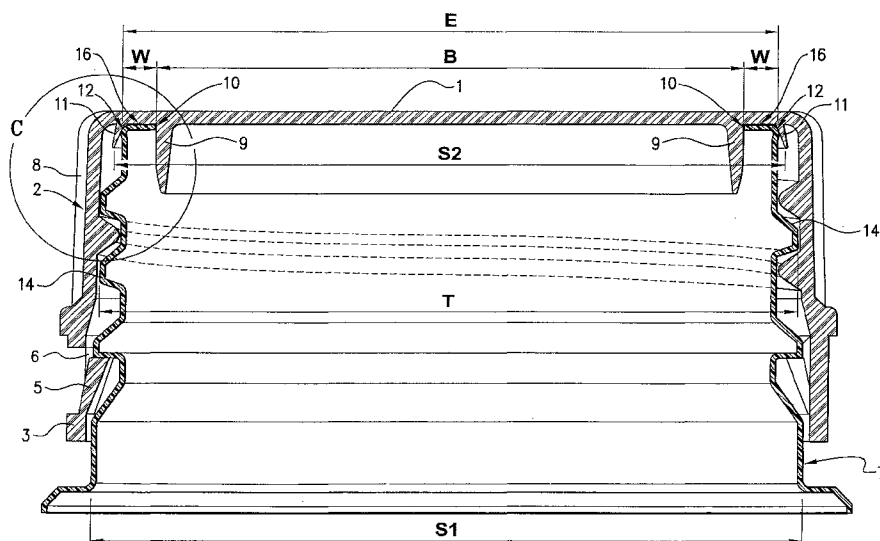
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(54) Title: A CLOSURE AND A BOTTLE NECK



(57) Abstract: A light weight closure and bottle neck assembly is disclosed. The assembly includes a closure that has a bore seal defined by inner and outer members such as two concentric skirts. The assembly further includes a bottle neck (7) that includes a flange (17) that is angled inwardly and upwardly at an angle of "theta" to the horizontal. The bottle neck and the closure are formed so that the flange can (a) deflect downwardly in response to an applied top load from the closure as the closure is being applied to the bottle neck and (b) be compressed when the closure is located on the bottle neck and can become wedged with an interference fit in the bore seal.

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A CLOSURE AND A BOTTLE NECK

BACKGROUND OF THE INVENTION

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The present invention relates to a closure that is formed from a polymeric material and is intended for use as a sealing system for a bottle that includes a light weight and relatively non-rigid neck finish.

10

The present invention also relates to an assembly of a closure and a bottle neck, where the bottle neck is made from a light weight and deformable material.

15

The present invention also relates to a bottle that includes the above bottle neck and the above closure applied to the bottle neck.

20

In the dairy industry in Australia and around the world, one common form of packaging for dairy products is the extrusion blow moulded high density polyethylene (HDPE) bottle. This bottle is particularly preferred in common 2, 3 and 4 litre serving sizes, as the bottle can be readily and economically formed with an integral handle to enhance handling of a large format package.

25

The incorporation of an integral handle in HDPE bottles contrasts such bottles with bottles made from the most common alternate material, polyethylene terephthalate (PET), where integral handles cannot be formed at low manufacturing cost. This effectively confines PET packaging to the less than 2 litre market, where handles are not usually required.

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A further advantage of the use of HDPE for the manufacture of dairy packaging is an ability to create a very light weight and hence low cost package, in

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comparison to the quantity of product being packed. This is a highly desirable attribute in the dairy industry, where the core product, white whole milk, is a staple and price driven commodity with little potential for value added manufacture.

A consequence of the extreme light weight of dairy packaging is a light weight bottle neck. A typical HDPE blow moulded bottle in the dairy industry has a neck diameter of 38mm for rapid filling, but a wall thickness of less than 1mm, commonly less than 0.5mm, and at the extreme less than 0.3mm. For technical reasons associated with extrusion blow moulding, a heavy neck on a light weight bottle is not commercially feasible.

HDPE bottles are commonly closed with a light weight closure. In the current art the seal between the closure and the bottle is not via a screw thread itself, but instead via a "bore seal". A bore seal is a cylindrical skirt (i.e. a ring or a lip) about 2mm long on the inside of a screw closure, which seals against the inside of the top of the screw thread in the neck of the bottle.

Typically, the light weight closure often also comprises a top panel providing an upper surface and a peripheral skirt comprising inwardly projecting threads designed to engage corresponding outwardly projecting threads on a bottle neck. The threads may be of any suitable design, pitch and depth, including traditional single spiral screw-on, multi-spiral screw-on, or multi-spiral snap-on/screw-off (SOSO) designs.

Many designs of bore seals are known in the art. It will be understood by those skilled in the art that the outer diameter of the cylindrical skirt of a bore seal is greater than the inner diameter of the bottle neck (bore

- 3 -

diameter) to provide an interference fit.

The term "interference fit" is used to describe the relationship of diameters. In any given situation, the degree of interference fit is determined by the experience of the designer and by actual practical tests.

Often the light weight closure further comprises a tamper evident means. Examples of tamper evident means are in the form of a band which locks onto a corresponding outwardly projecting bead or system on the neck of the bottle, and which is connected by frangible connectors (or bridges) to the lower edge of the peripheral skirt of the closure. The frangible bridges may be formed directly during closure moulding or be formed in a post moulding slitting operation.

A light weight bottle neck, typically but not exclusively formed from HDPE, comprises a wall section and a top edge or rim. The light weight bottle neck may further comprise a flange extending inwardly from the rim to increase strength. This flange may be nearly horizontal, but more typically is at an angle increasing in height as the flange progresses in toward the bore to enable trimming.

A major consequence of the extremely light weight neck is that it deforms easily and makes a poor contribution to the seal between the neck and its screw top closure. The thread form is too light to allow for force to be vertically applied on the bore seal region. Perhaps more importantly, the wall section is too thin to apply significant inwardly acting tensile forces on a bore seal. In particular, if the cylindrical skirt of the bore seal on the closure applies excessive outward force on the neck of the bottle in an attempt to achieve a tight seal, the neck of the bottle may not be strong enough to resist

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these outward forces and so moves outwards. As the inside of the neck of the bottle moves outwards, the seal is lost and the fluid contained in the bottles starts leaking. This leaking can happen immediately or the neck may creep
5 over time and lead to leaking at a later stage.

Bore seals are commonly used as the preferred seal system. However, leakage of product as it is transported through trade channels, and more importantly
10 in transport and storage by customers, remains an issue with up to 80% of some products leaking to differing degrees. In practical terms this can lead to milk leaking in distribution systems and retail outlets, or in cars and bags when being brought home (where the smell can be
15 difficult to dissipate), and in refrigerators at home if the bottles are laid flat during storage in the refrigerators.

In a modification to the above-mentioned bottle neck to improve seal effectiveness, the use of a bore seal
20 has been combined with a modified neck including an inwardly and upwardly angled strengthening flange at the top of the neck to resist the outward flexing of the neck of the bottle. This modification increases sealing
25 forces. However, the seal surface, being a trimmed edge, is imperfect, and leakage is not eliminated altogether.

In some markets, the use of induction seal foil inserts in closures has been adopted to largely eliminate
30 leakage. This is an effective solution, but not particularly cost effective, with the foil seal adding in excess of 25% to the cost of a closure assembly. Nonetheless, in some markets this has become the default sealing system due to customer demand.

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A low cost closure, and associated neck design, offering improved sealing performance is a desirable

- 5 -

product.

It is an objective of the present invention to provide an improved sealing system or at least to offer a
5 low cost alternative to current practice.

SUMMARY OF THE INVENTION

The present invention addresses the known
10 inadequacy of sealing in light weight systems by an improved design incorporating additional features at negligible additional cost.

The present invention is based on a realisation
15 that the light weight and therefore easily deformable bottle neck construction of the above-described known bottle necks can be utilised advantageously in the design of a closure and a closure and a bottle neck assembly.

20 More particularly, the present invention addresses the limitation in the seal quality by:

- (a) the creation of a multi-point seal in a closure/neck assembly,
- 25 (b) providing a closure to support a neck of a bottle to better resist deformation, and
- (c) preferably utilizing a top load applied to an
30 angled, inwardly projecting flange on the top of the bottle neck to flatten the flange, and effectively widen the flange in the horizontal vector to increase seal pressure as the closure bottoms.

35 In a preferred form the present invention provides a light weight closure and bottle neck

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assembly. The assembly includes a closure that has a bore seal defined by inner and outer members, such as two concentric skirts. The assembly further includes a bottle neck that includes a flange that is angled inwardly and upwardly at an angle of "theta" to the horizontal, as viewed when the bottle is in an upright position on a horizontal surface. The bottle neck and the closure are formed so that the flange can (a) deflect downwardly in response to an applied top load from the closure as the closure is being applied to the bottle neck and (b) be compressed when the closure is located on the bottle neck and can become wedged with an interference fit in the bore seal.

In more general terms, according to the present invention there is provided a light weight closure that includes:

- (a) a top panel;
- (b) a first member in the form of a peripheral skirt depending therefrom, the skirt including an inwardly projecting thread adapted to cooperate with an outwardly projecting thread on a bottle neck and thereby engage the closure on the bottle neck;
- (c) a second member in the form of an inner concentric skirt depending from the top panel and positioned inwardly of the peripheral skirt and designed to provide a primary bore seal and having an exterior diameter of "S1"; and
- (d) a third member positioned between the peripheral skirt and the inner skirt to contact an outside of a rim of the bottle neck and thereby provide a secondary bore seal and resistance to outward

- 7 -

flexing of the neck of the bottle.

Preferably the closure further includes a tamper evident member.

5

Optionally, the third member is in the form of an intermediate skirt that extends from the top panel and is concentric with the first and second members and is positioned between the peripheral skirt and the inner skirt to provide contact with an outside of the rim of the bottle neck after the bottle neck engages the primary bore seal and thereby provides the secondary bore seal and resistance to outward flexing of the neck of the bottle, and having an internal diameter of "S2".

15

Optionally, rather than an intermediate skirt, the third member may be in the form of a pressure block positioned inwardly of the peripheral skirt to provide contact with an outside of the rim of the bottle neck after the bore seal has engaged the bottle neck and thereby provide the secondary seal and resistance to outward flexing of the neck of the bottle.

20

Optionally, the closure may further include a seal structure on a contact surface of the top panel between the second skirt and the third skirt to provide enhanced top seal. The seal structure may be of any form known in the art.

25

Preferably the closure is formed from a polymeric material.

30

Preferably closure is formed from a polyethylene polymer.

35

More preferably the closure is formed from a high density polyethylene ("HDPE").

According to the present invention there is also provided a bottle neck that is suitable for use, by way of example, with the above-described closure that includes:

5

- (a) a vertical wall, forming a root of a thread, with a nominal external diameter "E", the wall having a top rim;
- 10 (b) a thread form projecting outwardly from the vertical wall, with a nominal diameter "T";
- (c) a bore, with a nominal diameter of "B"; and
- 15 (d) a flange that, when the bottle is viewed standing on a horizontal surface, extends from the top rim inwards and upwards to an inner edge that defines the bore.

20

Preferably the flange is angled inwardly and upwardly from the top rim at an angle of "theta" to the horizontal.

25

Preferably the flange has a width "W" which is greater than a radial gap between the inner skirt and the third member, (such as the intermediate skirt) of the closure, i.e. the difference between diameters E and B.

30

Typically, the angle theta is in a range of 3-45° to a horizontal plane, as viewed when the bottle is standing upright on a horizontal surface.

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Preferably the angle theta is in the range of 5-30°.

More preferably the angle theta is in the range of 5-20°.

- 9 -

Preferably the bottle neck and the closure are formed, for example as a consequence of the wall thickness and/or the materials selection and/or the construction of the bottle neck and the closure, so that the flange can
5 (a) deflect downwardly in response to an applied top load from the closure as the closure is being applied to the bottle neck and (b) be compressed when the closure is located on the bottle neck and can become wedged with an
10 interference fit in the bore seal, i.e. between the inner skirt and the third member (such as the intermediate skirt) of the closure.

Preferably the bottle neck is formed from a
15 readily deformable polymeric material.

Preferably bottle neck is formed from a polyethylene polymer.

20 More preferably the bottle neck is formed from a HDPE.

Preferably the bottle neck has a wall thickness of less than 1mm.

25 More preferably the bottle neck has a wall thickness of less than 0.5mm.

Typically, the bottle neck has a wall thickness
30 of less than 0.3mm.

Preferably the width W of the flange and the initial angle θ of the flange are selected having regard to the properties of the material from which the
35 bottle neck is made so that the flange is not permanently deformed when the flange is wedged with the interference fit in the bore seal and has sufficient hoop strength to

- 10 -

revert to the inwardly and upwardly extending profile when the closure is removed from the bottle neck.

In operation, during application of the closure
5 onto the bottle neck, three seals are formed between the closure and the bottle neck.

A first primary bore seal is formed by contact of
an outward surface of the inner skirt of the closure and
10 an inner surface of the bore of the bottle neck, with a contact force being controlled by the difference between diameters B and S1.

Support for the first seal is provided and a
15 second secondary bore seal is formed by contact between the third member (such as the intermediate skirt) and the outside rim of the bottle neck, with a contact force being controlled by the difference between diameters E and S2.

A third tertiary bore seal is formed by contact
20 between an upper surface of the bottle neck, more particularly an upper surface of the inwardly and upwardly angled flange of the bottle neck, and the under surface of the top panel of the closure at final application of the
25 closure on the bottle neck.

The inwardly and upwardly angled flange of the
bottle neck extends initially at angle theta, typically in
the range of 5-45°. The angle decreases as the closure is
30 applied to the bottle neck. This decrease in the angle effectively increases the horizontal component of the width W of the flange, and effectively increases the contact force at both horizontal seal contacts while creating the vertical seal contact. In effect, the
35 deformable flange is compressed into the gap between the inner skirt and the third member (such as the intermediate skirt) and forms the third seal as an interference fit.

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According to the present invention there is also provided a closure and a bottle neck assembly that includes the above-described bottle neck and the above-described closure positioned on the bottle neck.

According to the present invention there is provided a bottle that includes the above-described bottle neck and the above-described closure positioned on the bottle neck.

The present invention is further described by way of example with reference to the attached drawings.

DESCRIPTION OF DRAWINGS

Figure 1 shows the general appearance of one embodiment of an assembly of a closure and a bottle neck of the present invention;

20

Figure 2 shows a top view of the closure;

Figure 3 shows a sectional view of the closure and the bottle neck assembly;

25

Figure 4 shows a cut-away view of the closure and the bottle neck assembly for clarity;

Figures 5(a)-5(c) show detailed sectional views of the closure and the bottle neck assembly, in unapplied, partially applied, and fully applied conditions; and

30

Figure 6 shows optional and alternate embodiments of the closure of the present invention.

35

DETAILED DESCRIPTION OF THE DRAWINGS

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Figure 1 shows one embodiment of a closure of the present invention applied to a bottle neck 7 of a blow moulded HDPE bottle.

5 The closure and the bottle neck 7 shown in Figure 1 forms one embodiment of a closure and bottle neck assembly in accordance with the present invention.

10 As can be seen in Figure 1, the closure includes a top panel 1, a first member in the form of a peripheral cylindrical skirt 2 extending from the top panel 1, and a tamper evident member in the form of a tamper evident band 3 connected to a lower edge of the skirt 2 via connecting bridges 4.

15 The tamper evident band 3 includes a plurality of inwardly and upwardly extending petals 5 to engage a tamper bead 6 on the bottle neck 7. A knurled surface 8 is typical for such closures and may be of any convenient
20 design.

Figure 2 shows the closure of Figure 1 in top view.

25 Figure 3 is a cross-sectional view along the line A-A of Figure 2 and shows the embodiment of the closure and bottle neck assembly in a fully closed position with the closure applied to the bottle neck 7, with a seal being formed between the closure and the bottle neck 7.

30 As can be seen in Figure 3, the closure also includes a second member in the form of an inner cylindrical skirt 9 extending from the top panel 1 that provides a primary bore seal at a contact point 10
35 (Figures 5(b) and 5(c)). Depending on the circumstances, the inner skirt 9 may be rigid or deformable. Generally, the inner skirt 9 will be relatively rigid.

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With further reference to Figure 3, the closure also includes a third member in the form of an intermediate skirt 11 extending from the top panel 1 that provides a second seal point 12 (Figure 5(c)) that forms a secondary bore seal and increases the contact force at the bore seal point 10. Depending on the circumstances, the intermediate skirt 11 may be rigid or deformable. Generally, the intermediate skirt 11 will have a small degree of flexibility to ensure that the overall seal that is formed when the closure is applied to the bottle neck 7 is not too tight.

The bottle neck 7 includes a thread form 14 and a tamper bead 6.

The bottle neck 7 further includes an inwardly and upwardly angled top flange 17 that, as is described further hereinafter, cooperates with the inner skirt 9 and the intermediate skirt 11 of the closure to provide (a) the two above-mentioned seal points 10, 12 (which apply horizontally acting forces as viewed in the drawings) and (b) a further contact seal at point 16 (which applies a vertically acting force as viewed in the drawings) that forms a tertiary bore seal. The width W of the flange 17 is selected to be greater than the radial gap between the inner skirt 9 and the intermediate skirt 11. In any given situation, the difference between these dimensions will be a function of the deformability of the flange 17 and can be determined having regard to factors such as (but not limited to) the properties of the materials from which the bottle neck 7 and the closure are made and the wall thickness of the bottle neck 7.

Figure 4 shows a perspective view of the closure and the bottle neck assembly in section.

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Figures 5(a)-(c) show the critical seal area in region C of Figure 3 in greater detail and illustrate conceptually how the embodiment of the seal of the present invention operates.

5

In Figure 5(a), the inner skirt 9 is about to contact the inner edge 19 of the flange 17 on the bottle neck 7. The flange 17 is arranged at an angle θ , typically in a range of 5-45° and preferably 10°, to the horizontal, as shown in the Figure. The intermediate skirt 11 is desirably shorter than the inner skirt 9 as shown, but this is not necessary to the operation of the invention. The bottle neck wall section 18 - which is thin-walled (typically less than 0.5mm) - is visible in the Figure. It will be understood by those skilled in the art that the contact force between the inner edge of the flange 17 and the outer face of the inner skirt 9 will be low due to the flexibility of HDPE (and other commonly used plastics materials).

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In Figure 5(b), contact between the flange 17 and the inner skirt 9 has occurred at the seal point 10, but the intermediate skirt 11 is yet to seal the outside of the bottle neck 7. The flange 17 remains substantially at the original angle θ to the horizontal at this stage.

25

Figure 5(c) illustrates the core of the concept of the present invention as it is applied to the embodiment of the closure and bottle neck assembly of the present invention shown in the drawing. As the inner edge 19 of the flange 17 contacts the underside of the top panel 1, a vertical seal contact is made between the flange 17 and the top panel 1. Progressively, as the closure continues to be applied to the bottle neck 7, the flange 17 deflects downwardly in response to the top load and the angle of the flange 17 to the horizontal reduces from θ towards zero. Consequently, the effective

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- 15 -

horizontal width across the flange 17 increases from $W \cos(\theta)$ to W as the flange 17 approaches the horizontal. This results in the flange 17 being tightly wedged between the inner skirt 9 and the intermediate skirt 11 and therefore forming an interference fit and thus obtaining increased contact force from a light weight neck.

It is evident from the above that the present invention takes advantage of the light weight and therefore deformable bottle neck construction of the above-described known bottle necks - which is a negative characteristic of known closures and closure and bottle neck assemblies.

Figure 6 illustrates further embodiments of the closure of the present invention.

With reference to Figure 6, a first alternate embodiment of the external contact structure (the third member) is the use of a pressure block 20 as a substitute for the intermediate skirt 11. This structure successfully provides seal contact, but at a higher cost than the discrete skirt structure.

With reference to Figure 6, an optional seal structure 21 in the form of two concentric protruding rings is shown on the top seal contact surface of the cap.

Many modifications may be made to the embodiments of this invention described above without departing from the spirit and scope of the invention.

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CLAIMS

1. A light weight closure that includes:
 - 5 (a) a top panel;
 - (b) a first member in the form of a peripheral skirt depending therefrom, the skirt including an inwardly projecting thread adapted to cooperate with an outwardly projecting thread on a bottle neck and thereby engage the closure on the bottle neck;
 - 10 (c) a second member in the form of an inner concentric skirt depending from the top panel and positioned inwardly of the peripheral skirt and designed to provide a primary bore seal and having an exterior diameter of "S1"; and
 - 15 (d) a third member positioned between the peripheral skirt and the inner skirt to provide contact with an outside of a rim of the bottle neck and thereby provide a secondary bore seal and resistance to outward flexing of the neck of the bottle.
 - 20
 - 25
2. The closure defined in claim 1 wherein the third member is in the form of an intermediate skirt that extends from the top panel and is concentric with the first and second members and is positioned between the peripheral skirt and the inner skirt to contact an outside of the rim of the bottle neck after the bottle neck engages the primary bore seal and thereby provides the secondary bore seal and resistance to outward flexing of the neck of the bottle.
- 30
- 35
3. The closure defined in claim 1 wherein the third

- 17 -

member is in the form of a pressure block positioned inwardly of the peripheral skirt to provide contact with an outside of the rim of the bottle neck after the bore seal has engaged the bottle neck and thereby provide the secondary seal and resistance to outward flexing of the neck of the bottle.

4. A bottle neck that is suitable for use with the closure defined in any one of the preceding claims that includes:

- (a) a vertical wall, forming a root of a thread, the wall having a top rim;
- (b) a thread form projecting outwardly from the vertical wall;
- (c) a bore; and
- (d) a flange that, when the bottle is viewed standing on a horizontal surface, extends from the top rim inwards and upwards to an inner edge that defines the bore.

5. The bottle neck defined in claim 4 wherein the flange is angled inwardly and upwardly from the top rim at an angle of "theta" to the horizontal.

6. The bottle neck defined in claim 5 wherein the flange has a width "W" which is greater than a radial gap between the inner skirt and the third member, (such as the intermediate skirt) of the closure.

7. The bottle neck defined in claim 5 or claim 6 wherein the angle theta is in a range of 3-45° to a horizontal plane, as viewed when the bottle is standing upright on a horizontal surface.

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8. The bottle neck defined in any one of the preceding claims wherein the bottle neck and the closure are formed, for example as a consequence of the wall thickness and/or the materials selection and/or the construction of the bottle neck and the closure, so that the flange can (a) deflect downwardly in response to an applied top load from the closure as the closure is being applied to the bottle neck and (b) be compressed when the closure is located on the bottle neck and can become wedged with an interference fit in the bore seal, i.e. between the inner skirt and the third member (such as the intermediate skirt) of the closure.
9. The bottle neck defined in any one of claims 4 to 8 formed from a readily deformable polymeric material.
10. The bottle neck defined in claim 9 formed from a polyethylene polymer.
11. The bottle neck defined in claim 9 formed from a high density polyethylene.
12. The bottle neck defined in any one of claims 4 to 11 having a wall thickness of less than 1mm.
13. The bottle neck defined in claim 12 having a wall thickness of less than 0.5mm.
14. The bottle neck defined in claim 12 having a wall thickness of less than 0.3mm.
15. The bottle neck defined in any one of claims 5 to 14 wherein the width W of the flange and the initial angle θ of the flange are selected having regard to the properties of the material from which the bottle neck is made so that the flange is not permanently deformed when

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the flange is wedged with the interference fit in the bore seal and has sufficient hoop strength to revert to the inwardly and upwardly extending profile when the closure is removed from the bottle neck.

5

16. A closure and a bottle neck assembly that includes the bottle neck defined in any one of claims 4 to 15 and the closure defined in any one of claims 1 to 3 positioned on the bottle neck.

10

17. A bottle that includes the the bottle neck defined in any one of claims 4 to 15 and the closure defined in any one of claims 1 to 3 positioned on the bottle neck.

15

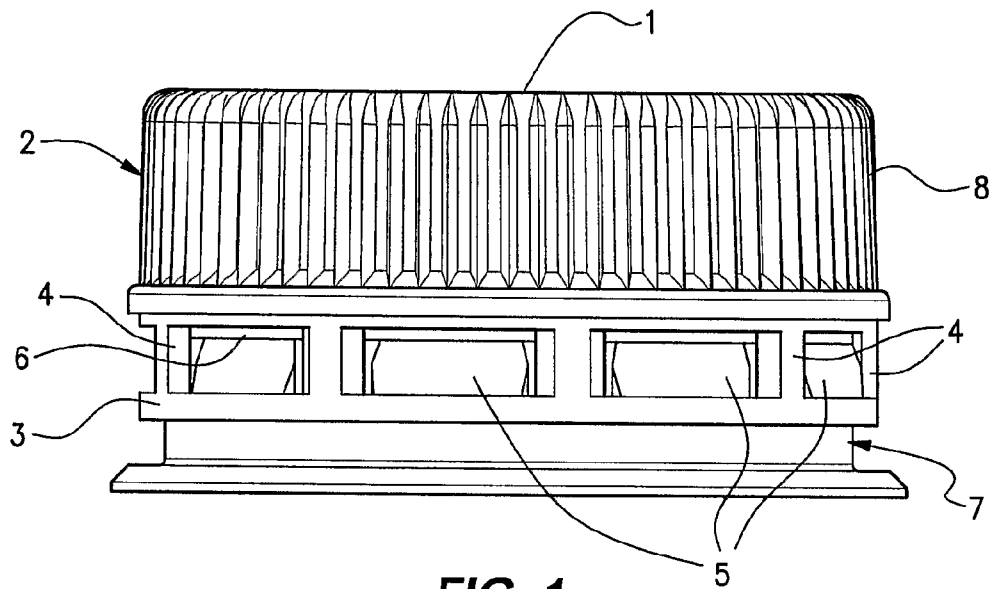


FIG. 1

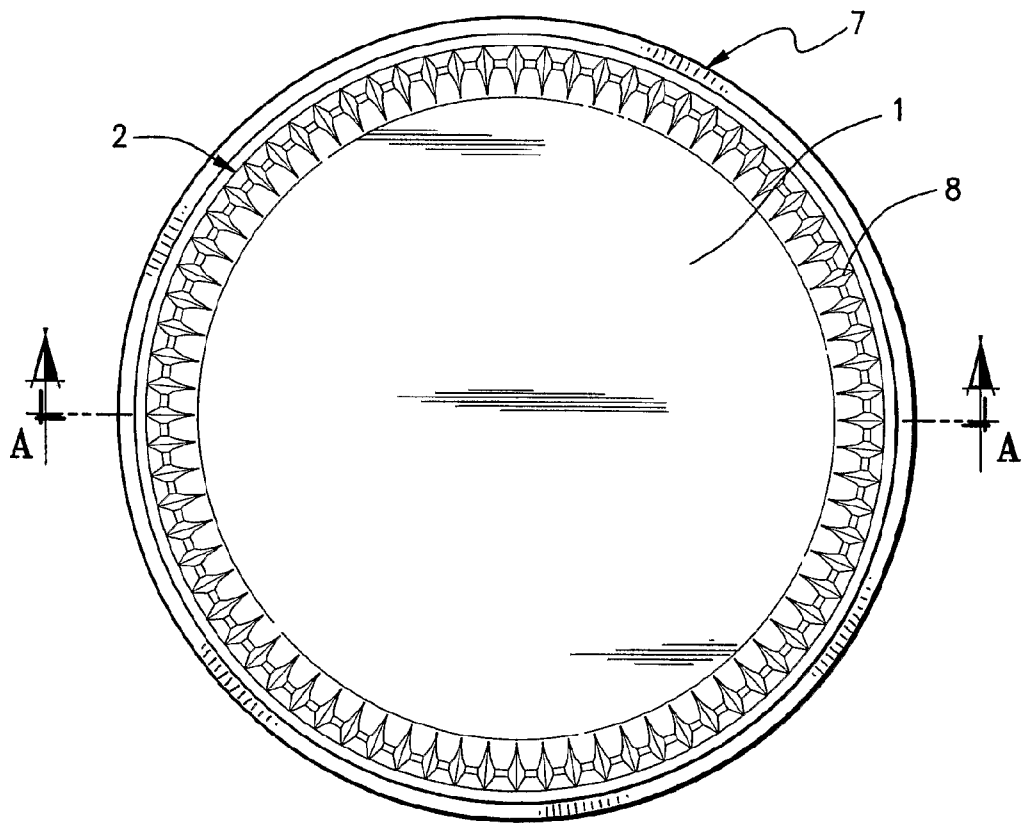


FIG. 2

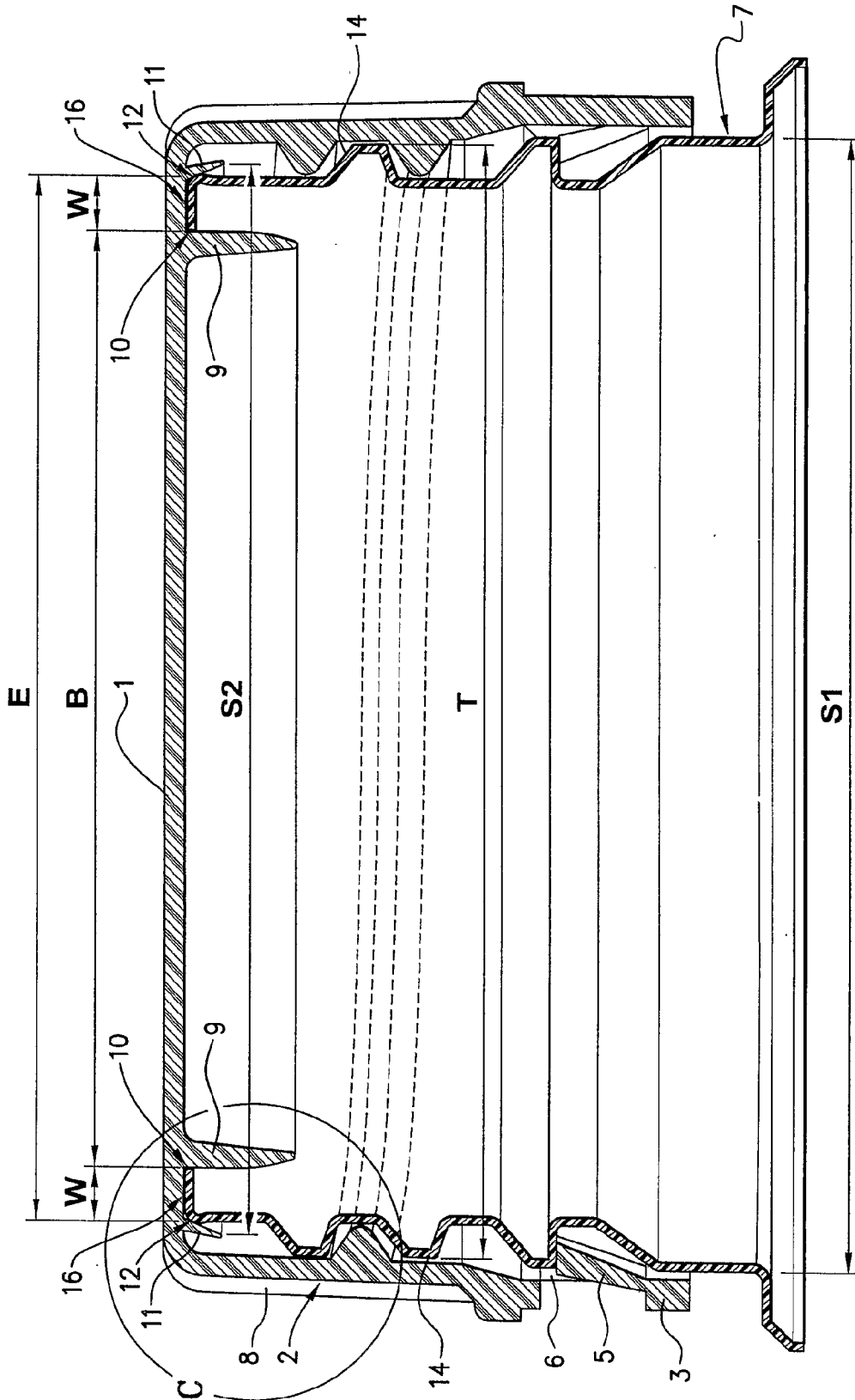


FIG. 3

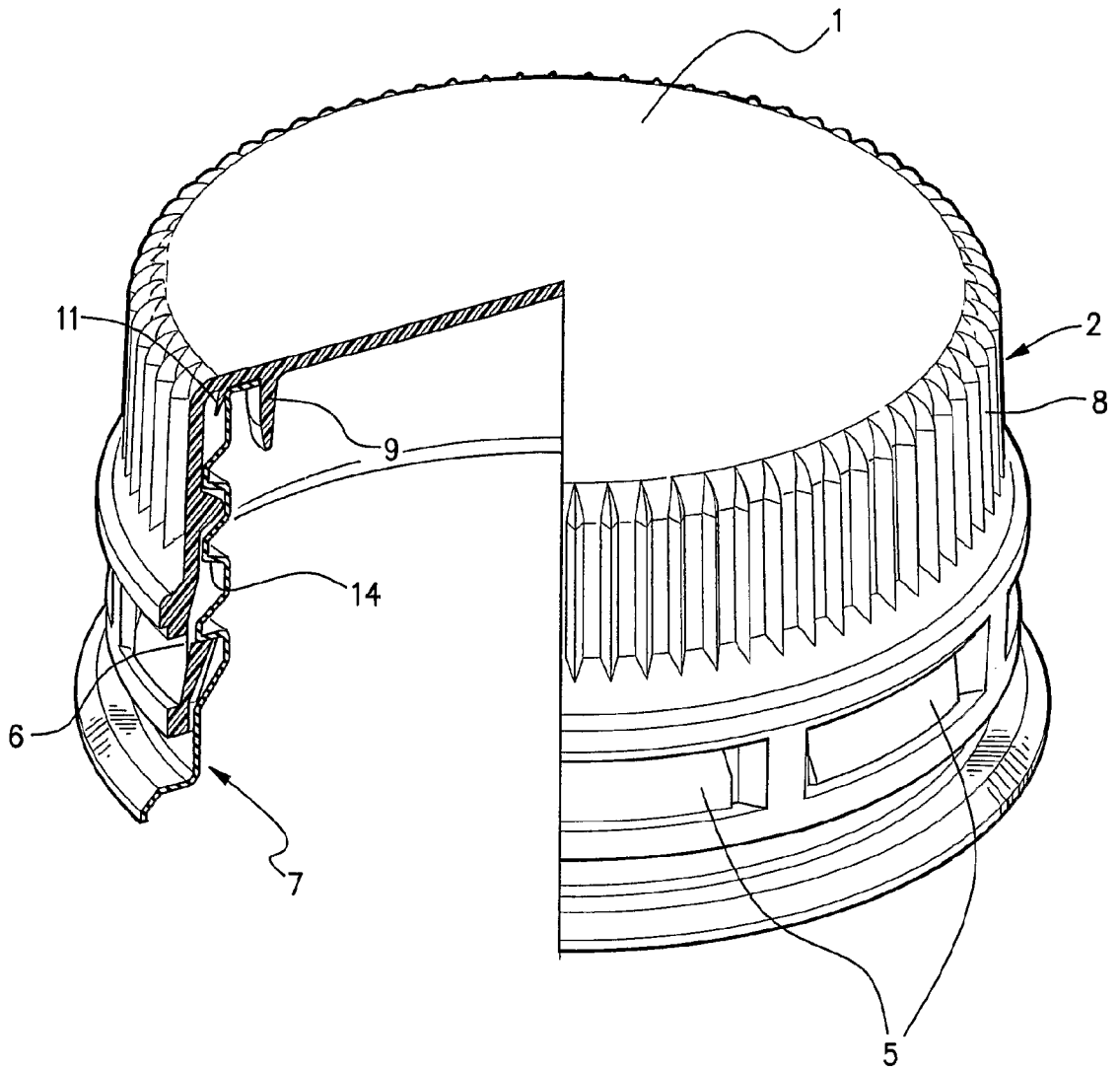


FIG. 4

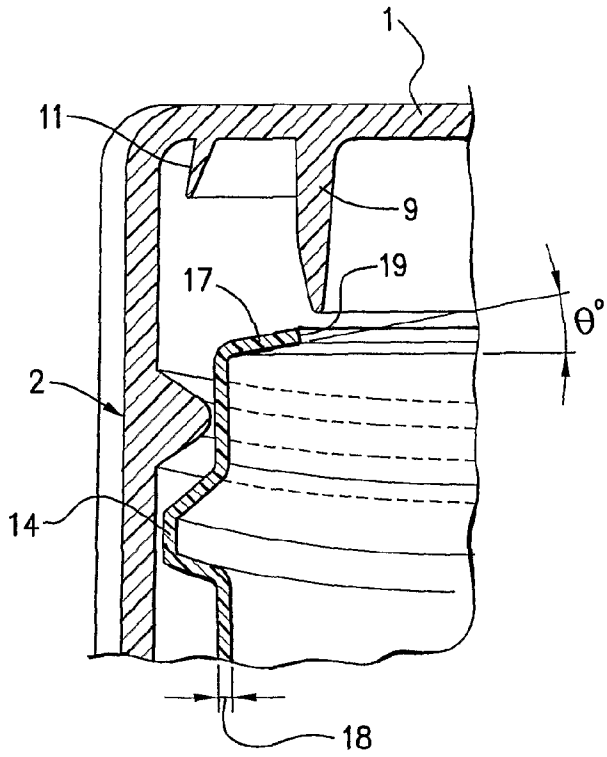


FIG. 5(a)

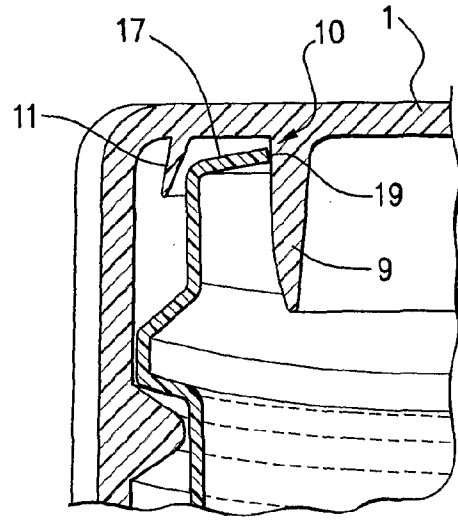


FIG. 5(b)

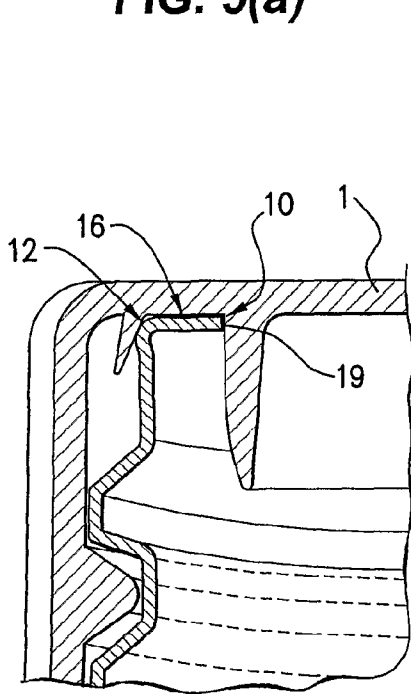


FIG. 5(c)

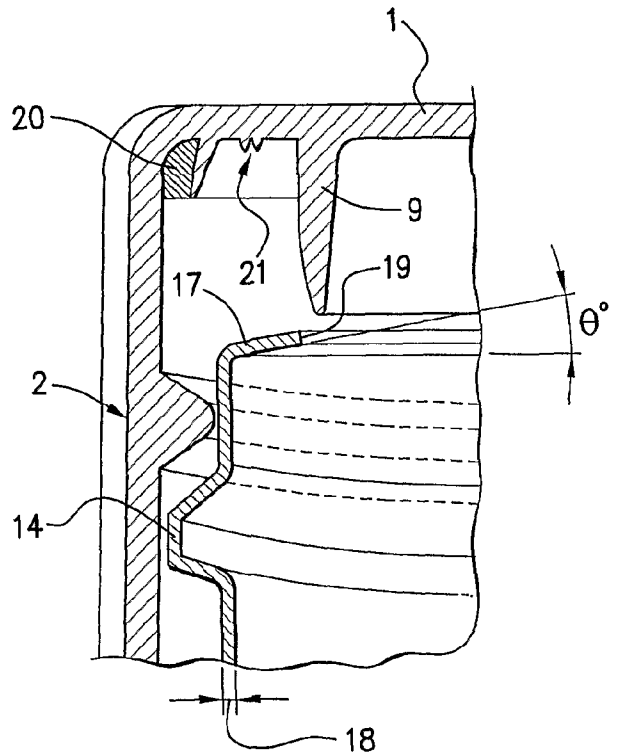


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2007/000857

A. CLASSIFICATION OF SUBJECT MATTER		
Int. Cl.		
B65D 41/04 (2006.01) B65D 1/02 (2006.01)		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) Refer Electronic Database consulted below.		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) Derwent World Patent Index: B65D, B67B, and keywords: BOTTLE+, (CLOSUR+ OR TOP+ OR CAP+), (SEAL+ OR FLANG+ OR RIM+), (SCREW+ OR TWIST+ OR THREAD+), FLEX+		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4498597 A (BASHOUR) 12 February 1985	1 - 17
Y	See the whole document, particularly in reference to items 16, 23, 25, 26 in Fig. 3	1 - 17
X	US 4177906 A (VON HAGEL) 11 December 1979	1 - 17
Y	See the whole document	1 - 17
X	US 3901404 A (FELDMAN) 26 August 1975	1 - 17
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X	US 5673809 A (OHMI et al.) 7 October 1997	1 - 3
Y	See the whole document, particularly in reference to items 36, 38	1 - 17
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 26 July 2007		Date of mailing of the international search report - 1 AUG 2007
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929		Authorized officer C. NGUYEN-KIM AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No : (02) 6283 2121

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2007/000857

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	GB 2369114 A (BEESON AND SONS LIMITED) 22 May 2002	
X	See the whole document, particularly in reference to items 8, 10, 11, 14	1 - 3
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	US 4560077 A (DUTT) 24 December 1985	
X	See the whole document, particularly in reference to items 30, 32	1 - 2
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	US 4114775 A (SHINOZAKI) 19 September 1978	
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	WO 2000/006454 A (KERR GROUP, INC.) 10 February 2000	
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	WO 2002/098755 A (WHITE CAP, INC.) 12 December 2002	
X	See the whole document, particularly in reference to items 22, 25 - 27	4
Y	See the whole document, particularly in reference to items 22, 25 - 27	1 - 17
	US 4098419 A (VIROG, Jr. et al.) 4 July 1978	
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Y	See the whole document, particularly in reference to items 7, 11 of the drawings	1 - 17

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU2007/000857

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Member		
US 4498597			
US 4177906	US 4301937		
US 3901404	CA 1029685	JP 50027674	US 3812994
US 5673809	CN 1113201	EP 0669261	JP 7237646
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US 4531649			
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.			
END OF ANNEX			