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**EP 2 018 328 B1**

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## Description

**[0001]** The present invention relates generally to a closure for a container. More specifically, the invention relates to a closure made of plastics material for sealing a package containing, for example, a liquid. The invention is concerned particularly, but not exclusively, with closures which are for closing the opening of beverage containers, for example the necks of bottles made of glass or plastics material such as polypropylene or polyethylene terephthalate.

**[0002]** Closure manufacturers have invested heavily in ongoing developments to provide closure designs which offer improved performance and/or reduced manufacturing costs. The main factors affecting closure performance include application and release torque, seal effectiveness and the reliability of tamper evidence.

**[0003]** It is known to provide closures made of plastics material for beverage containers. The use of plastics material for closures offers a number of advantages both in terms of manufacturing costs and closure performance, particularly in the area of sealing technology.

**[0004]** Plastic beverage closures generally feature four main components: a closure shell, a securing system, a sealing system and a tamper evidence system. The closure shell includes a circular top wall with a cylindrical side wall extending perpendicularly from the peripheral edge of the top wall. The securing system usually includes a snap on or screw thread design, both of which are known in the art, integrally formed with the cylindrical side wall on the inner surface thereof, which corresponds to a securing system adjacent to the container opening, for example the neck of a bottle. Several sealing system designs are known in the art and these will be discussed below. Several tamper evidence systems have also been developed, however, the most common design consists of a narrow band frangibly connected to the cylindrical side wall of the closure shell.

**[0005]** The first main difference between plastic beverage closure designs is related to the sealing technology, wherein the sealing system is either integrally formed with the closure shell or a separate sealing system is inserted into the closure shell. The former is known as a one-piece closure whilst the latter is a two-piece closure design.

**[0006]** An effective closure seal design must ensure that the neck portion is hermetically sealed whilst minimising the torque required to remove and re-apply the closure. It will be appreciated that two-piece closure designs provide more design flexibility in that the closure shell may be formed using a high strength plastics material while the separate sealing system may be formed using a highly flexible material for improved sealing performance. However, it will also be appreciated that this arrangement may require a secondary manufacturing process for assembling the closure.

**[0007]** One example of a two-piece closure design is disclosed in US 6,783,015 wherein a liner insert engages

the closure shell and provides a seal between the top wall and the end face of the container.

**[0008]** In an effort to simplify the manufacturing process, single piece closures have been developed to eliminate the need for the secondary process of inserting a separate liner. An early example of one such closure is disclosed in GB 2,013,635 which comprises an integrally formed inner seal member for sealing against an inner surface of the neck of the container and two integrally formed sealing rings protruding from the top wall for sealing against the top surface of the neck.

**[0009]** Single piece closure sealing technology is constantly under development. The use of a single material for the closure shell and sealing system gives rise to difficulties in establishing the balance between a structure which is strong enough to maintain the structural integrity of the shell whilst providing an effective seal in use. To this end, several closure designs have been developed in order to optimise the balance between these two factors.

**[0010]** For example, US 6,779,672 discloses a one-piece closure design including three integrally formed protrusions extending from the inner surface of the top wall. These protrusions include inner and outer sealing protrusions for sealing against an inner and outer surface of the neck of the container respectively and one annular sealing ridge between the inner and outer sealing protrusions for sealing against the top surface of the neck. The inner and outer protrusions are shaped and spaced such that application of the closure on the container results in an interference fit thereby to provide a hermetically sealed container. The area of each protrusion which contacts the neck of the container comprises a narrow band, thereby concentrating the preload created by the deformation of the protrusions. Despite the advantages of such an arrangement, the narrow bands of contact between the sealing system and the neck may result in a less effective seal if the neck of the container is damaged at the contact area, for example during manufacture or transport.

**[0011]** EP 0,529,383 discloses a one-piece closure design having a bead, which is integrally formed with the side wall and top wall, and an outer sealing protrusion extending from the top wall for sealing against the top and outer surfaces of the neck as well as the radiused transition therebetween. In use, application of the closure onto the container neck causes the outer sealing protrusion to deform to such an extent that the outer surface thereof contacts, and becomes contiguous with, the bead. This in turn causes the inner surface of the outer sealing protrusion to be urged against, and substantially take the shape of, the top and outer surfaces of the neck as well as the radiused transition therebetween. The bead provides rigidity to, and facilitates a large degree of plastic deformation of, the sealing protrusion. This arrangement provides a relatively large contact surface area, which mitigates the effect of any surface damage and improves resealability upon reapplication.

**[0012]** US 6,325,226 discloses a one-piece closure according to the preamble of claim 1, which utilises the outer sealing protrusion of EP 0,529,383 in conjunction with an inner sealing protrusion having a substantially olive cross section. Whilst this arrangement provides a sealing system which mitigates the issues discussed above in relation to US 6,779,672, the effectiveness and/or manufacturability of the sealing system could be improved.

**[0013]** A first aspect of the invention provides a one-piece closure for sealingly closing a neck opening of a container, the closure comprising a top wall, an annular side wall depending from the top wall and an annular seal having an inner surface and an outer surface facing the side wall, the annular side wall comprising a circular inner surface having a substantially constant diameter (d1) and extending from a lower end of the side wall to an upper end that connects with the top wall, the inner surface having securing features provided thereon for cooperably engaging features provided on the neck opening and the annular seal being deflectable by engagement between an inner surface thereof and the neck opening when, in use, the closure is fitted to the neck opening to a position in which the inner surface of the annular seal conforms to and is in close contact with the neck opening and the outer surface of the annular seal is pressed against the inner surface having a diameter (d1) by the neck opening. Preferably, the securing features extend inwardly from the diameter (d1). More preferably, the side wall has a substantially constant radial thickness.

**[0014]** The annular seal sealingly engages, in use, an outer surface of the neck opening whilst abutting the side wall.

**[0015]** The top wall may have an outer peripheral portion that provides a radiused connection to the upper end of the annular side wall. The annular seal may extend at least in part from the outer peripheral portion. Additionally or alternatively, the annular seal may extend at least in part from an inner surface of the top wall.

**[0016]** The annular seal may include an outer surface tapering away from the inner surface having a diameter (d1) and/or the annular seal may include a lead-in taper at the free end thereof.

**[0017]** The annular seal may be shaped and dimensioned to sealingly engage the outer surface of the neck opening across a band whose width is at least one third of the overall length of the annular seal. The width may be at least one half of the length of the annular seal.

**[0018]** The annular seal is preferably configured to deform to a greater extent, in use, in the region of the free end thereof than in the region thereof proximate to the top wall.

**[0019]** The closure may further comprise an inner annular seal depending from the top wall which may sealingly engage, in use, an inner surface of the neck opening. The inner annular seal is preferably shaped to sealingly engage, in use, with the inner surface of the neck portion opening across a band whose width is less than the band of the annular seal that sealingly engages the

outer surface of the neck opening.

**[0020]** A portion of the inner annular seal proximate the free end thereof may comprise a substantially triangular cross-section whose apex faces the side wall. The apex may form the band that sealingly engages, in use, the inner surface of the neck opening.

**[0021]** Alternatively, the free end of the inner annular seal may have a substantially olive shaped cross section.

**[0022]** The closure may further comprise an annular sealing ridge depending from the top wall. The annular sealing ridge may be located between the outer and inner seals. The annular sealing ridge preferably sealingly engages, in use, a top surface of the neck opening. The annular sealing ridge may include an apex which sealingly engages, in use, the top surface of the neck opening. Optionally, the annular sealing ridge is joined to the annular seal by a web portion.

**[0023]** The securing features preferably protrude from an inner surface of the closure, for example from the side wall. The securing features may comprise at least one helical protrusion, for example a multi-start thread. The securing features may comprise interruptions therein.

**[0024]** Alternatively, the securing features may further comprise a ridge for engaging a further ridge on the container, thereby to provide a snap fit.

**[0025]** The closure may further comprise tamper evidence means, which may comprise a portion of the closure which is separated therefrom. For example, the tamper evidence means may comprise a tamper evidence band and bridging elements which connect the tamper evidence band to the side wall of the closure. The closure may be sized and dimensioned such that, in use, the tamper evidence means cooperates with the neck opening such that the separable portion is separated from the closure, for example wherein the bridging elements are stressed and broken, as the annular seal disengages with the neck opening.

**[0026]** The side wall preferably has an outer surface that has grip features provided thereon.

**[0027]** The securing features may include anti slip members and portions of the annular seal engage the anti slip members when the annular seal is pressed against the inner surface having a diameter (d1).

**[0028]** The closure may comprise tamper evidence means.

**[0029]** A further aspect of the invention provides a container having a neck opening in combination with a closure according to the first, aspect of the invention.

**[0030]** A further aspect of the invention provides a package comprising a container in combination with a closure according to the first and further aspects of the invention, wherein the container contains a liquid and is sealed by the closure.

**[0031]** The closure of the invention may be designed such that it resembles a crown closure. It is also envisaged that the closure may be removed by similar means to a crown closure.

**[0032]** Exemplary embodiments of the invention will

now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a perspective view showing the side and top of a closure;

Figure 2 is a perspective view showing the side and bottom of the closure of Figure 1;

Figure 3 is a cross-sectional view of the closure of Figure 1 through the centre of the closure showing the sealing system;

Figure 4 is a perspective view of the top and side of the neck opening of a container for use with the closure of Figure 1;

Figure 5 is a side view of the neck portion of the container of Figure 4;

Figure 6 is a cross-sectional view of the closure of Figure 1 applied to the neck portion of Figure 4 showing the deformation of the sealing system.

**[0033]** Figures 1, 2 and 3 show a one-piece closure 1 including a top wall 2, a side wall 3, an outer peripheral portion 6, a tamper evidence band 4 and a sealing system 23, 24, 25. This embodiment of the invention is preferably injection moulded using high strength plastics material with sufficient flexibility for the sealing system to deform and function effectively. The plastics material may be, for example, high density polyethylene. It will be appreciated by those skilled in the art that the appearance of the closure of Figures 1 to 3 resembles substantially that of a "crown" closure.

**[0034]** In the preferred embodiment the top wall 2 is a circular disc of substantially constant wall thickness and includes an injection point 21 and a stiffening structure 22. The injection point 21, which results from the injection moulding process, is a substantially frusto-conical protrusion which protrudes from the top surface the top wall 2 at the centre thereof. The stiffening structure 22 includes a plurality of stiffening ribs, for example three ribs 22a, 22b, 22c, having a substantially dome shaped longitudinal cross-section, as shown in Figure 3. The stiffening ribs 22a, 22b, 22c are joined at their centres and are equiangularly spaced to provide the apexes of hexagram which protrudes from the inner surface of the top wall 2 at the centre thereof and opposite the injection point.

**[0035]** The side wall 3 is a generally annular wall having a thickness that is substantially constant. The side wall 3 has an inner circular surface 30 that extends from the lower end of the side wall 3 to the upper end of the side wall 3. The surface 30 has a substantially constant diameter d1. A plurality of equispaced ribs 31 are integrally formed with the side wall 3. The ribs 31 protrude from the outer surface of the side wall 3 and extend in the axial direction thereof. An integrally formed securing means 32, 33 protrudes from the inner surface 30 of the side wall 3 and includes a plurality of interrupted helical protrusions 32 and anti-slip protrusions 33. The helical protrusions 32 form internal threads 32 having a common

axis with the side wall 3 and have a substantially dome shaped axial cross-section as shown in Figure 3. In the preferred embodiment, the threads 32 comprise a two-start thread arrangement. The anti-slip protrusions 33 extend axially along the side wall 3 and have a substantially dome shaped lateral cross-section. The width and depth of the anti-slip protrusions 33 both increase along the length thereof, the reasons for which are known in the art.

**[0036]** In this embodiment, the outer peripheral portion 6 is a cylindrical fillet segment defined by the outer periphery of the top wall 2. As shown in Figure 3, the outer peripheral portion 6 has radial cross-section that provides a substantially orthogonal bend leading to the upper end of the side wall 3. The outer peripheral portion 6 has a plurality of equispaced rib extensions 31a provided on its outer surface. The spacing, width and depth of the rib extensions 31 a at the axially facing terminal edge of the bend are substantially the same as the spacing, width and depth of the ribs 31 which protrude from the side wall 3. The width and depth of the rib extensions 31 a both decrease toward the radially facing terminal edge of the bend to merge with the thickness of the fillet segment.

**[0037]** In this embodiment, the tamper evidence band 4 includes a substantially cylindrical wall 40, bridging elements 41 and retaining elements 42. The bridging elements 41 provide a frangible connection between the tamper evidence band 4 and the lower end of the side wall 3. The cylindrical wall 40 has an internal diameter which is substantially the same as the diameter d1 of the inner circular surface of the side wall 3 and a wall thickness which is less than that of the side wall 3. The bridging elements 41 extend from the axial upper edge of the cylindrical wall 40 of the tamper evidence band 4 to the lower end of the side wall 3 and have a wall thickness which is less than the thickness of the cylindrical wall 40. In this embodiment the retaining elements 42 protrude from the inner surface of the cylindrical wall 40 of the tamper evidence band 4 and are skewed in one direction, the reasons for which are known in the art. In this embodiment, the sealing system 23, 24, 25 includes an annular seal 24 an inner annular seal 23 and an annular sealing ridge 25.

**[0038]** The inner annular seal 23 includes a cylindrical wall which extends downwardly from, and is integrally formed with, the top wall 2. The inner annular seal 23 has an outwardly facing protrusion 26 proximate the free end thereof. But for the protrusions, the cross-sectional thickness of the inner annular seal 23 is substantially constant. The protrusion 26 has a substantially triangular cross-section with an outwardly facing apex, the reasons for which will be described below.

**[0039]** The annular seal 24 includes a cylindrical wall which extends downwardly from, and is integrally formed with, the outer peripheral portion 6 and includes an outer surface which tapers away from the inner surface 30 of the side wall 3. The cross-sectional thickness of the annular seal 24 is substantially constant except that proxi-

mate the free end thereof it decreases to provide a lead-in taper 27, the reason for which will be explained below.

**[0040]** The annular sealing ridge 25 is substantially triangular in cross-section with a downwardly facing apex. The annular sealing ridge 25 is located radially inwardly of the annular seal 24 and integrally formed therewith by a web portion 28. The annular sealing ridge 25 is adjacent the radially facing terminal edge of the outer peripheral portion 6. The reason for the shape and position of the annular sealing ridge 25 and the web portion 28 will be explained below.

**[0041]** The side wall 3 is connected to, and integrally formed with, the outer peripheral portion 6 of the top wall 2 along the axially facing terminal edge of the outer peripheral portion 6 such that the rib extensions 31 coincide with the ribs 31 so as to provide an uninterrupted extension thereof. The outer peripheral portion 6 provides a smooth transition between the top wall 2 and the side wall 3. The tamper evidence band 4 is frangibly connected to the bottom of the side wall 3 by the bridging elements 41, which are integrally formed therewith.

**[0042]** Figures 4 and 5 show the neck portion 5 of a container for use with the closure 1 of Figures 1 to 3. The neck portion 5 includes a substantially cylindrical body, an outer sealing rim 51, a plurality of interrupted helical protrusions 52, a tamper evidence ring 53 and a neck support ring 54.

**[0043]** The cylindrical body includes a top sealing surface 55 and an inner sealing surface 56. The outer sealing rim 51 is an annular ring which has substantially constant width and depth and protrudes from the outer surface of the cylindrical body adjacent the top sealing surface 55 and blended therewith by a fillet segment 57. The helical protrusions 52 have a substantially dome shaped axial cross section and protrude from the outer surface of the cylindrical body below the outer sealing rim 51. The helical protrusions 52 form external threads 52 having a common axis with the cylindrical body.

**[0044]** The tamper evidence ring 53 has an arcuate axial cross-section with a flat bottom surface, a geometry which is known in the art. The tamper evidence ring 53 protrudes from the outer surface of the cylindrical body of the neck portion 5 below the external threads 52. The neck support ring 54 is substantially frusto-conical in shape with a flat bottom surface, a geometry which is also known in the art. The neck support ring 54 protrudes from the outer surface of the cylindrical body of the neck portion 5 below the tamper evidence ring 53.

**[0045]** Referring particularly to Figure 6, in use and on application of the closure 1 to the neck portion 5, clockwise rotation of the closure 1 (as seen from the top thereof) causes the internal threads 32 of the closure 1 to mesh with the external threads 52 of the neck portion 5. This, in turn, drives the top wall 2 of the closure 1 toward the top sealing surface 55 of the neck portion 5 causing the sealing system 23, 24, 25 to engage the neck portion 5.

**[0046]** As the top wall 2 approaches the top sealing surface 55 of the neck portion 5, a lower portion of the

triangular protrusion 26 of the inner annular seal 23 contacts the radiused corner between the top sealing surface 55 and the inner sealing surface 56 of the neck portion 5. Further rotation of the closure 1 causes the inner annular seal 23 to deflect inwardly until the apex of the triangular protrusion 26 comes into close contact with the inner sealing surface 56 of the neck portion 5. This arrangement results in a resilient engagement with the neck portion 5 providing an inner seal over a narrow band which corresponds to the deformed apex of the triangular protrusion 26.

**[0047]** As the closure 1 is rotated further, the lead-in taper 27 of the annular seal 24 contacts the fillet segment 57 between the top sealing surface 55 and the outer sealing rim 51 of the neck portion 5. Further rotation of the closure 1 causes the annular seal 24 to deflect outwardly until a lower portion thereof contacts the inner circular surface 30 of the side wall 3. This arrangement forces the annular seal 24 to deform such that a substantial portion of the inner surface thereof conforms to, and is in close contact with, the outer sealing rim 51 and a substantial portion of the outer surface thereof conforms to the inner circular surface 30 of the side wall 3. This arrangement results in an outer seal over a relatively wide band which corresponds to a substantial portion of the length of the annular seal 24, for example more than one third thereof.

**[0048]** Further rotation of the closure 1 causes the apex of the annular sealing ridge 25 to come into close contact with the top sealing surface 55 and deform thereby to provide a top seal. This arrangement results in a top seal over a narrow band which corresponds to the deformed apex of the annular sealing ridge 25.

**[0049]** Applying the closure 1 to the container also causes the retaining elements 42 of the tamper evidence band 4 to engage the tamper evidence ring 53 of the neck portion 5. As the closure 1 is applied, the retaining elements 42 contact the upper arcuate surface of the tamper evidence ring 53 of the neck portion 5. Further rotation of the closure 1 causes the tamper evidence band 4 to deflect outwardly until the retaining elements 42 pass over the tamper evidence ring 53 and the tamper evidence band 4 reverts to its original shape.

**[0050]** On removal of the closure 1, counter-clockwise rotation thereof causes the threads 32, 52 to separate the top wall 2 of the closure 1 from the top sealing surface 55 of the neck portion 5. This results in the disengagement of the sealing system 23, 24, 25 with the neck portion 5, corresponding substantially to the reverse of the steps outlined above.

**[0051]** Removal of the closure 1 also causes the retaining elements 42 to contact the lower generally horizontal underside 60 of the tamper evidence ring 53. Further rotation of the closure causes the bridging elements 41 to be stressed and broken thereby separating the tamper evidence band 4 from the side wall 3. The separation of the tamper evidence band 4 from the closure provides a positive indication that the seal has been com-

promised.

**[0052]** The stressing and breaking of the bridging elements 41 and the disengagement of the sealing system 23, 24, 25 with the neck portion 5 occur at substantially the same time. This feature is particularly useful in cases where the contents of the container are pressurised in that the bridging elements 41 help to retain the closure 1 on the neck portion 5 as the contents start to vent whilst still providing a reliable indicator of tamper evidence. In such a case, venting is facilitated by the aforementioned interruptions in the threads 32, 52. At the same time, by having the bridging elements break as the venting occurs, rather than having venting occur ahead of breaking of the tamper evidence band, it is possible to reduce the height of the closure, thereby reducing the material requirements for the manufacture of the closure.

**[0053]** The resilient nature of the plastics material, high density polyethylene in the case of this embodiment, causes the sealing system 23, 24, 25 to revert substantially to its original shape. The large degree of deformation of the annular seal 24, which ensures an effective seal, will result in some plastic deformation thus precluding it from reverting to its exact original shape. The design and position of the sealing system 23, 24, 25 relative to the side wall 3 ensures the seal is effective on subsequent application of the closure. The result is a closure design with good resealability, allowing the container to be hermetically sealed upon repeated application and removal of the closure 1 to the neck portion 5.

**[0054]** It will be appreciated that the arrangement disclosed herein provides an effective and reliable sealing structure. Several aspects of the closure design contribute to this including, but not limited to, the position of the annular seal 24 causing it to abut an inner surface of the side wall 3 on application of the closure; the fact that the annular seal 24 extends from the outer peripheral portion 6; the presence of the web portion 28 which joins the annular seal 24 and the annular sealing ridge 25 and other aspects which are apparent from the above disclosure, some of which are included in the claims. These aspects result in a reinforced structure having sufficient flexibility to provide an effective seal both on initial application and further reapplication of the closure.

**[0055]** Furthermore, it will be appreciated that the two-start thread arrangement requires less torque for application and removal of the closure.

**[0056]** It will also be appreciated by those skilled in the art that the configuration of the closure 1 allows for a mould design that is simpler and less conducive to wear and/or damage during production than many prior art closure designs. In particular, the substantially constant wall thickness of the side wall 3 adjacent the outer peripheral portion 6 and/or the absence of thickening protrusions on the inner surface 30 of the side wall facilitates cooling during the moulding process. Moreover, the sealing system design reduces the need to thin regions of mould cores as compared with known comparable closure designs.

**[0057]** Further embodiments are envisaged without departing from the scope of the invention. For example, the annular seal 24 may be formed in part on the generally planar underside of the top wall 2 and in part on the inner surface of the outer peripheral portion 6. The length and geometry of the outer sealing protrusion 24 may be altered, for example by tapering outwardly instead of inwardly toward the terminal edge thereof, or it may be lengthened or shortened as required for a given application. The web portion 28 may be thicker, thinner or dispensed with. The injection point 21 may be located in a recess on the top surface of the top wall 2. The geometry of the contact surfaces may be modified to provide a wider or narrower band than that shown in the drawings, for example the inner annular seal 23 may comprise an end portion which is substantially olive in shape.

**[0058]** The anti-slip protrusions 33 are optional and may not be desirable for certain applications. The securing means 32 may be replaced with any suitable arrangement for retaining the closure on a container. For example a snap-on type securing means may be used. Moreover, it is envisaged that the securing means may be incorporated into the sealing system without departing from the scope of the invention, for example by providing a recessed inner sealing surface which retains the inner annular seal 23. Alternatively, the securing means may protrude from an outer surface of the side wall 3.

**[0059]** The closure may be sized and dimensioned such that it may be removed with crown closure removal means known in the art, for example a bottle opener. For example, the securing means may be in the form of a snap on finish and the overall height of the closure reduced to allow for removal using, for example, a bottle opener.

**[0060]** The closure may be manufactured using a compression moulding process, for example with a secondary process of slitting the perforations which define the frangible connection between the cylindrical side wall 3 and the tamper evidence band.

**[0061]** It will be understood that various features of the closure provide the possibility of reducing the amount of material required to manufacture of the closure as compared with known closures. As noted above, by having the sealing system arranged to break the seal with the neck of the container at substantially the same time as the tamper evidence band breaks, it is possible to reduce amount of controlled movement the means securing the closure to the container must provide, so allowing the overall height of the closure and neck portion to be reduced. Furthermore, by arranging for the outer annular seal of the closure to deflect and engage the start, it is possible to reduce the thickness of the seal, since it is supported by the side wall 3 when providing the seal. By having the outer annular seal directly engage the side wall 3 rather than providing a bead or other contact protrusions provided on the side wall 3, further material savings can be made.

## Claims

1. A one-piece closure (1) for sealingly closing a neck opening of a container, the closure (1) comprising a top wall (2), an annular side wall (3) depending from the top wall (2) and an annular seal (24) having an inner surface and an outer surface facing the side wall (3), the annular side wall (3) comprising a circular inner surface having a substantially constant diameter (d1) and extending from a lower end of the side wall (3) to an upper end that connects with the top wall (2), the inner surface having securing features (32,33) provided thereon for cooperably engaging features (52) provided on the neck opening and the annular seal (24) being deflectable by engagement between an inner surface thereof and the neck opening when, in use, the closure (1) is fitted to the neck opening to a position in which the inner surface of the annular seal (24) conforms to and is in close contact with the neck opening **characterised in that** the outer surface of the annular seal (24) is pressed against the inner surface having the said substantially constant diameter (d1) by the neck opening.
2. A closure (1) as claimed in Claim 1, wherein the securing features (32,33) extend inwardly from the inner surface having the substantially constant diameter (d1).
3. A closure (1) as claimed in Claim 1 or Claim 2, wherein the side wall (3) has a substantially constant radial thickness.
4. A closure (1) as claimed in any preceding Claim, wherein the top wall (2) has an outer peripheral portion that provides a radiused connection to the upper end of the annular side wall (3).
5. A closure (1) as claimed in Claim 4, wherein the annular seal (24) extends at least in part from the outer peripheral portion.
6. A closure (1) as claimed in any preceding Claim, wherein the annular seal (24) extends at least in part from an inner surface of the top wall (2).
7. A closure (1) as claimed in any preceding Claim, wherein the annular seal (24) includes an outer surface tapering away from the inner surface having a diameter (d1).
8. A closure (1) as claimed in any preceding Claim, wherein the annular seal (24) includes a lead-in taper (27) at the free end thereof.
9. A closure (1) as claimed in any preceding Claim, further comprising an inner annular seal (23) de-

pending from the top wall (2), which inner annular seal (23) preferably engages, in use, an inner surface of the neck opening.

10. A closure (1) as claimed in any preceding Claim, further comprising an annular sealing ridge (25) depending from the top wall (2), wherein the annular sealing ridge (25) preferably includes an apex which sealingly engages, in use, the top surface of the neck opening.
11. A closure (1) as claimed in Claim 10, wherein the annular sealing ridge (25) is joined to the annular seal by a web portion (28).
12. A closure (1) as claimed in any preceding Claim, further comprising tamper evidence means (4) which preferably comprises a portion of the closure (1) which is separable therefrom.
13. A container having a neck opening in combination with a closure (1) as claimed in any one of the preceding Claims.
14. A container in combination with a closure (1) as claimed in Claim 12 and 13, wherein the closure (1) is sized and dimensioned such that, in use the tamper evidence means (4) cooperates with the neck opening such that the separable portion (4) is separated from the closure (1) as the annular seal (24) disengages from the neck opening.
15. A package comprising a container in combination with a closure (1) as claimed in Claim 13 or Claim 14, wherein the container contains a liquid and is sealed by the closure (1).

## Patentansprüche

1. Einstückiger Verschluss (1) zum abdichtenden Verschließen einer Halsöffnung eines Behälters, wobei der Verschluss (1) eine obere Wand (2) umfasst, eine von der oberen Wand (2) abhängige ringförmige Seitenwand (3), sowie eine ringförmige Dichtung (24) mit einer inneren und eine äußeren Oberfläche, die der Seitenwand (3) gegenüber liegt, wobei die ringförmige Seitenwand (3) eine kreisförmige Innenfläche mit einem im Wesentlichen konstanten Durchmesser (d1) hat und sich vom unteren Ende der Seitenwand (3) zum mit der oberen Wand (2) verbundenen oberen Ende erstreckt, wobei auf der Innenfläche Befestigungselementen (32, 33) angeordnet sind, die mit Eingreifeinrichtungen (52) zusammenwirken, die an der Halsöffnung und der ringförmigen Dichtung (24) durch Eingriff zwischen deren Innenfläche und der Halsöffnung ablenkbar sind, wenn der Verschluss (1) bei der Verwendung in einer Position

- an die Halsöffnung angepasst wird, in der die Innenfläche der ringförmigen Dichtung (24) dieser entspricht und in engem Kontakt mit der Halsöffnung steht, **dadurch gekennzeichnet, dass** die Außenfläche der ringförmigen Dichtung (24) durch die Halsöffnung gegen die Innenfläche gedrückt wird, welche den genannten im Wesentlichen konstanten Durchmesser (d1) aufweist.
2. Verschluss (1) nach Anspruch 1, bei dem die sich von der Innenfläche nach Innen erstreckenden Befestigungselemente (32, 33) einen im wesentlichen konstanten Durchmesser (d1) aufweisen.
  3. Verschluss (1) nach Anspruch 1 oder 2, bei dem die Seitenwand (3) eine im Wesentlichen konstante radiale Dicke aufweist.
  4. Verschluss (1) nach einem der vorhergehenden Ansprüche, bei dem die obere Wand (2) einen äußeren Umfangsbereich umfasst, der eine abgerundete Verbindung zum oberen Ende der ringförmigen Seitenwand (3) bereitstellt.
  5. Verschluss (1) nach Anspruch 4, bei dem die ringförmige Dichtung (24) sich wenigstens teilweise von dem äußeren Umfangsbereich erstreckt.
  6. Verschluss (1) nach einem der vorhergehenden Ansprüche, bei dem die ringförmige Dichtung (24) sich wenigstens teilweise von einer Innenfläche der oberen Wand (2) erstreckt.
  7. Verschluss (1) nach einem der vorhergehenden Ansprüche, bei dem die ringförmige Dichtung eine in Richtung von der Innenfläche weg abgeschrägte Außenfläche mit einem Durchmesser (d1) umfasst.
  8. Verschluss (1) nach einem der vorhergehenden Ansprüche, bei dem die ringförmige Dichtung (24) an ihrem freien Ende einen Einführkonus (27) umfasst.
  9. Verschluss (1) nach einem der vorhergehenden Ansprüche, der weiterhin eine innere ringförmige, von der oberen Wand (2) abhängige Dichtung (23) aufweist, wobei die innere ringförmige Dichtung (23) bei der Verwendung vorzugsweise in die Innenfläche der Halsöffnung eingreift.
  10. Verschluss (1) nach einem der vorangehenden Ansprüche, der weiterhin eine von der oberen Wand (2) abhängige ringförmige Dichtungskante (25) aufweist, die vorzugsweise eine Leiste umfasst, die bei der Verwendung dichtend in die Oberfläche der Halsöffnung eingreift.
  11. Verschluss (1) nach Anspruch 10, bei dem die ringförmige Dichtungskante (25) durch einen Stegbe-  
reich (28) mit der ringförmigen Dichtung verbunden ist.
  12. Verschluss (1) nach einem der vorangehenden Ansprüche, der weiterhin ein Mittel zum Nachweis von Manipulation (4) umfasst, das vorzugsweise aus einem Teil des Verschlusses (1) besteht, der von diesem abtrennbar ist.
  13. Behälter mit einer Halsöffnung in Verbindung mit einem Verschluss (1) nach einem der vorangehenden Ansprüche.
  14. Behälter in Verbindung mit einem Verschluss (1) nach Anspruch 12 und 13, wobei der Verschluss (1) so groß und dimensioniert ist, das bei der Verwendung das Mittel zum Nachweis von Manipulationen (4) mit der Halsöffnung in der Weise kooperiert, dass der abtrennbare Bereich (4) von dem Verschluss (1) getrennt wird, wenn die ringförmige Dichtung (24) von der Halsöffnung gelöst wird.
  15. Verpackung, die einen Behälter in Verbindung mit einem Verschluss (1) nach Anspruch 13 oder 14 umfasst, wobei der Behälter eine Flüssigkeit enthält und durch den Verschluss (1) abgedichtet ist.

#### Revendications

1. Fermeture d'une seule pièce (1) pour fermer hermétiquement l'ouverture à collet d'un contenant, la fermeture (1) comprenant une paroi supérieure (2), une paroi latérale annulaire pendant de la paroi supérieure (2) et un joint annulaire (24) ayant une surface interne et une surface externe en regard de la paroi latérale (3), la paroi latérale annulaire (3) comprenant une surface interne circulaire ayant un diamètre (d1) sensiblement constant et s'étendant d'une extrémité inférieure de la paroi latérale (3) à une extrémité supérieure qui se raccorde à la paroi supérieure (2), la surface interne ayant des caractéristiques de fixation (32, 33) pour s'engager en coopération sur des caractéristiques (52) aménagées sur l'ouverture à collet et le joint annulaire (24) pouvant être dévié par engagement entre sa surface interne et l'ouverture à collet lorsque, à l'usage, la fermeture (1) est ajustée sur l'ouverture à collet dans une position dans laquelle la surface interne du joint annulaire (24) se conforme à l'ouverture à collet et est en contact étroit avec elle, **caractérisée en ce que** la surface externe du joint annulaire (24) est pressée contre la surface interne ayant ledit diamètre sensiblement constant (d1) par l'ouverture à collet.
2. Fermeture (1) selon la revendication 1, dans laquelle les caractéristiques de fixation (32, 33) s'étendent vers l'intérieur depuis la surface interne ayant ledit

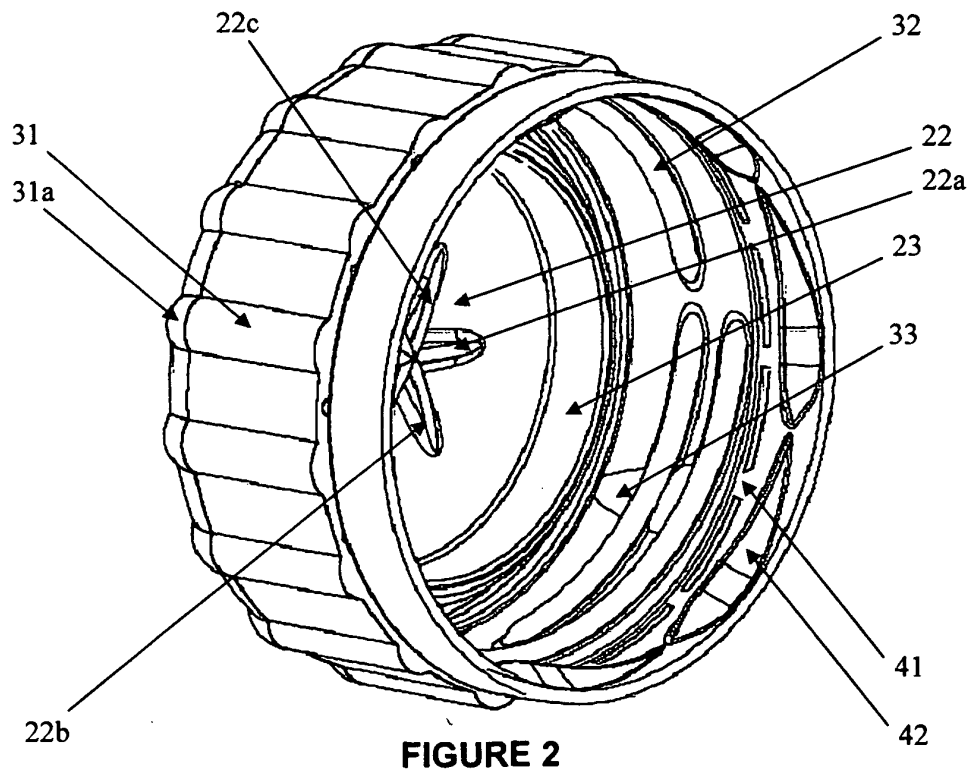
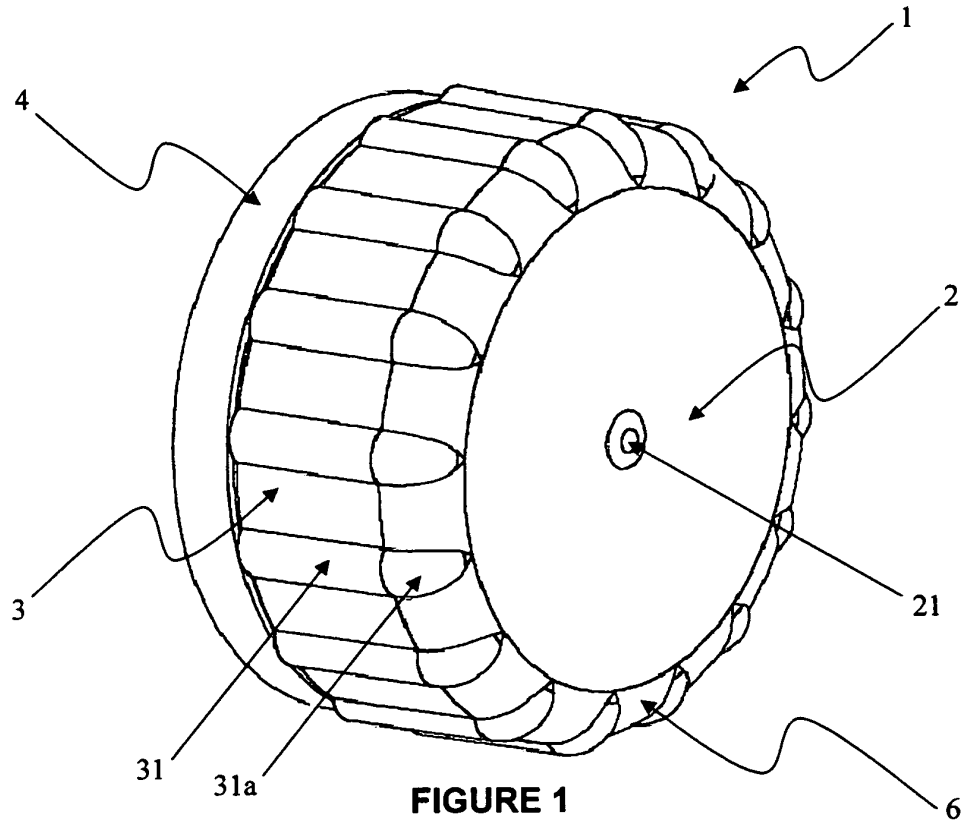


diamètre (d1) sensiblement constant.

3. Fermeture (1) selon la revendication 1 ou la revendication 2, dans laquelle la paroi latérale (3) a une épaisseur radiale sensiblement constante. 5
4. Fermeture (1) selon l'une quelconque des revendications précédentes, dans laquelle la paroi supérieure (2) a une portion périphérique externe qui assure un raccordement arrondi avec l'extrémité supérieure de la paroi latérale annulaire (3). 10
5. Fermeture (1) selon la revendication 4, dans laquelle le joint annulaire (24) s'étend au moins en partie de la portion périphérique externe. 15
6. Fermeture (1) selon l'une quelconque des revendications précédentes, dans laquelle le joint annulaire (24) s'étend au moins en partie d'une surface interne de la paroi supérieure (2). 20
7. Fermeture (1) selon l'une quelconque des revendications précédentes, dans laquelle le joint annulaire (24) comprend une surface externe s'amincissant depuis la surface interne ayant un diamètre (d1). 25
8. Fermeture (1) selon l'une quelconque des revendications précédentes, dans laquelle le joint annulaire (24) comprend une partie conique d'entrée (27) à son extrémité libre. 30
9. Fermeture (1) selon l'une quelconque des revendications précédentes, comprenant en outre un joint annulaire interne (23) pendant de la paroi supérieure (2), lequel joint annulaire interne (23) s'engage de préférence, à l'usage, sur une surface interne de l'ouverture à collet. 35
10. Fermeture (1) selon l'une quelconque des revendications précédentes, comprenant en outre une nervure d'étanchéité annulaire (25) pendant de la paroi supérieure (2), dans laquelle la nervure d'étanchéité annulaire (25) comprend de préférence un sommet qui s'engage de manière étanche, à l'usage, sur la surface supérieure de l'ouverture à collet. 40 45
11. Fermeture (1) selon la revendication 10, dans laquelle la nervure d'étanchéité annulaire (25) est jointe au joint annulaire par une portion de nervure (28). 50
12. Fermeture (1) selon l'une quelconque des revendications précédentes, comprenant en outre un moyen de preuve de manipulation (4) qui comprend de préférence une portion de la fermeture (1) qui en est séparable. 55
13. Contenant ayant une ouverture à collet en combinaison avec une fermeture (1) selon l'une quelcon-

que des revendications précédentes.

14. Contenant en combinaison avec une fermeture (1) selon les revendications 12 et 13, dans lequel la fermeture (1) est dimensionnée de sorte que, en service, le moyen de preuve de manipulation (4) coopère avec l'ouverture à collet de sorte que la portion séparable (4) soit séparée de la fermeture (1) lorsque le joint annulaire (24) se dégage de l'ouverture à collet.
15. Emballage comprenant un contenant en combinaison avec une fermeture (1) selon la revendication 13 ou la revendication 14, dans lequel le contenant contient un liquide et est fermé hermétiquement par la fermeture (1).



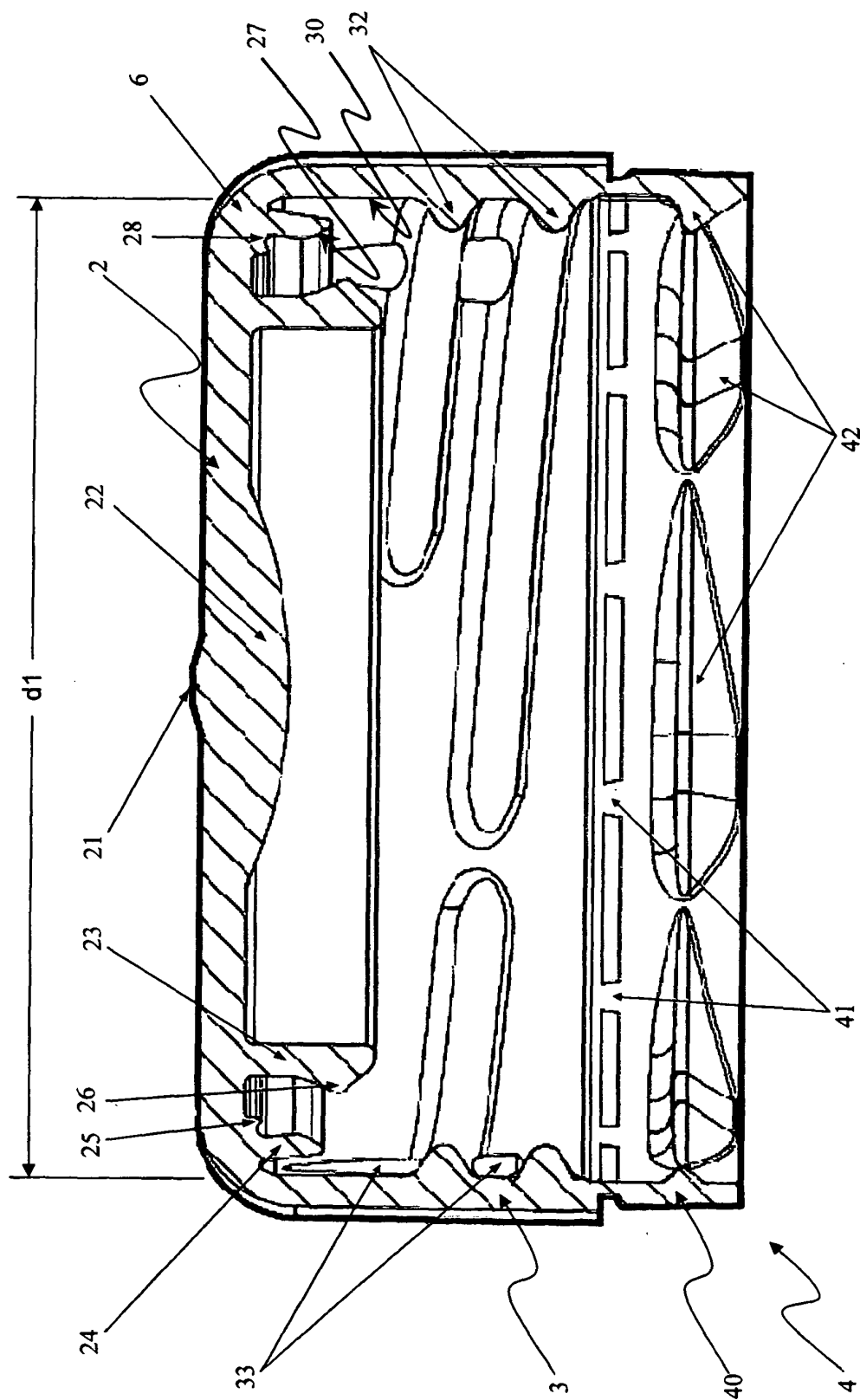


FIGURE 3

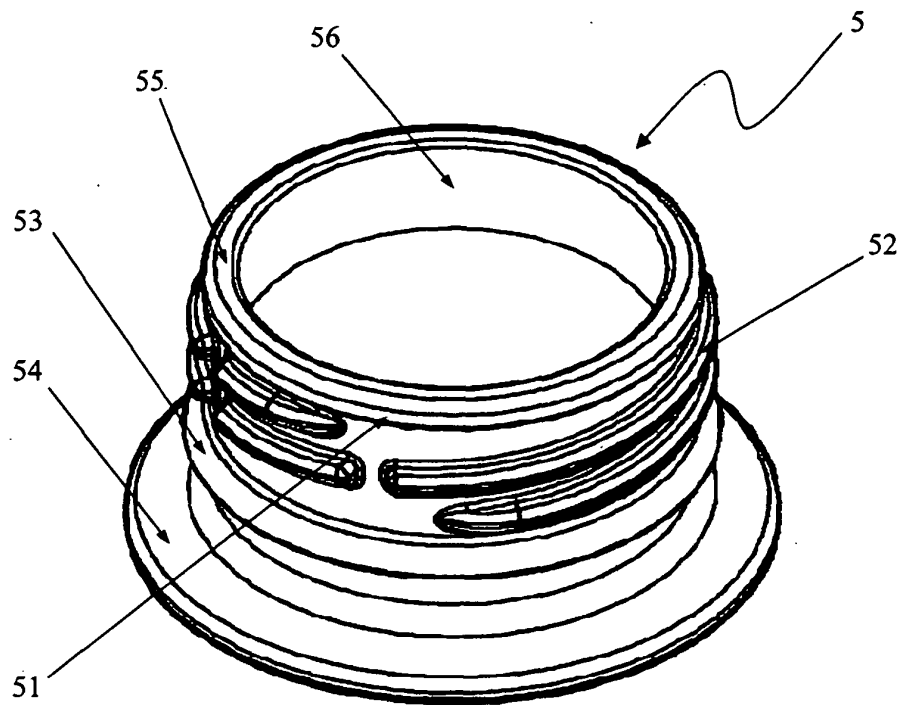


FIGURE 4

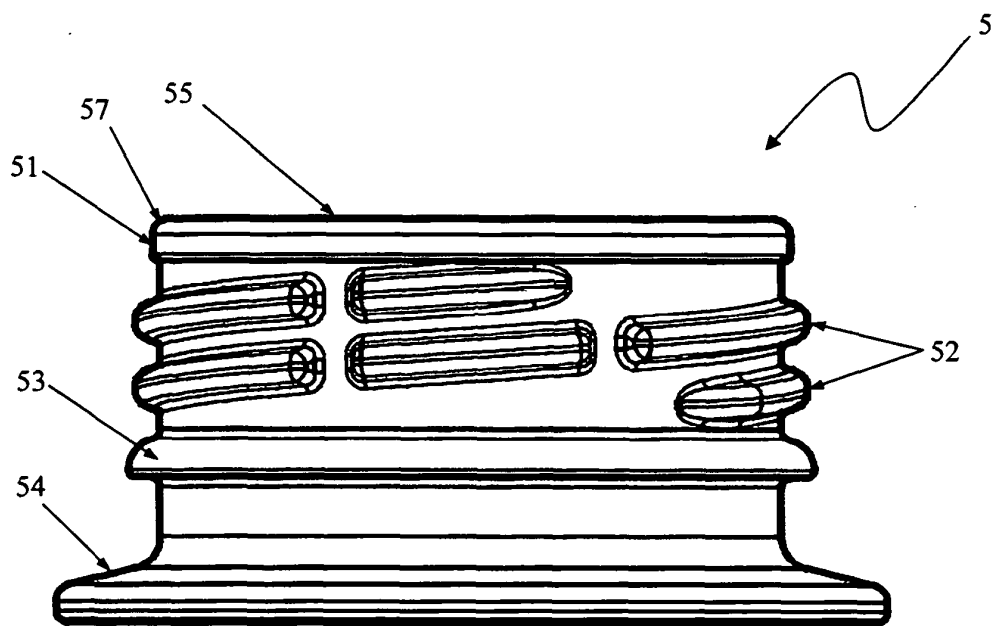


FIGURE 5

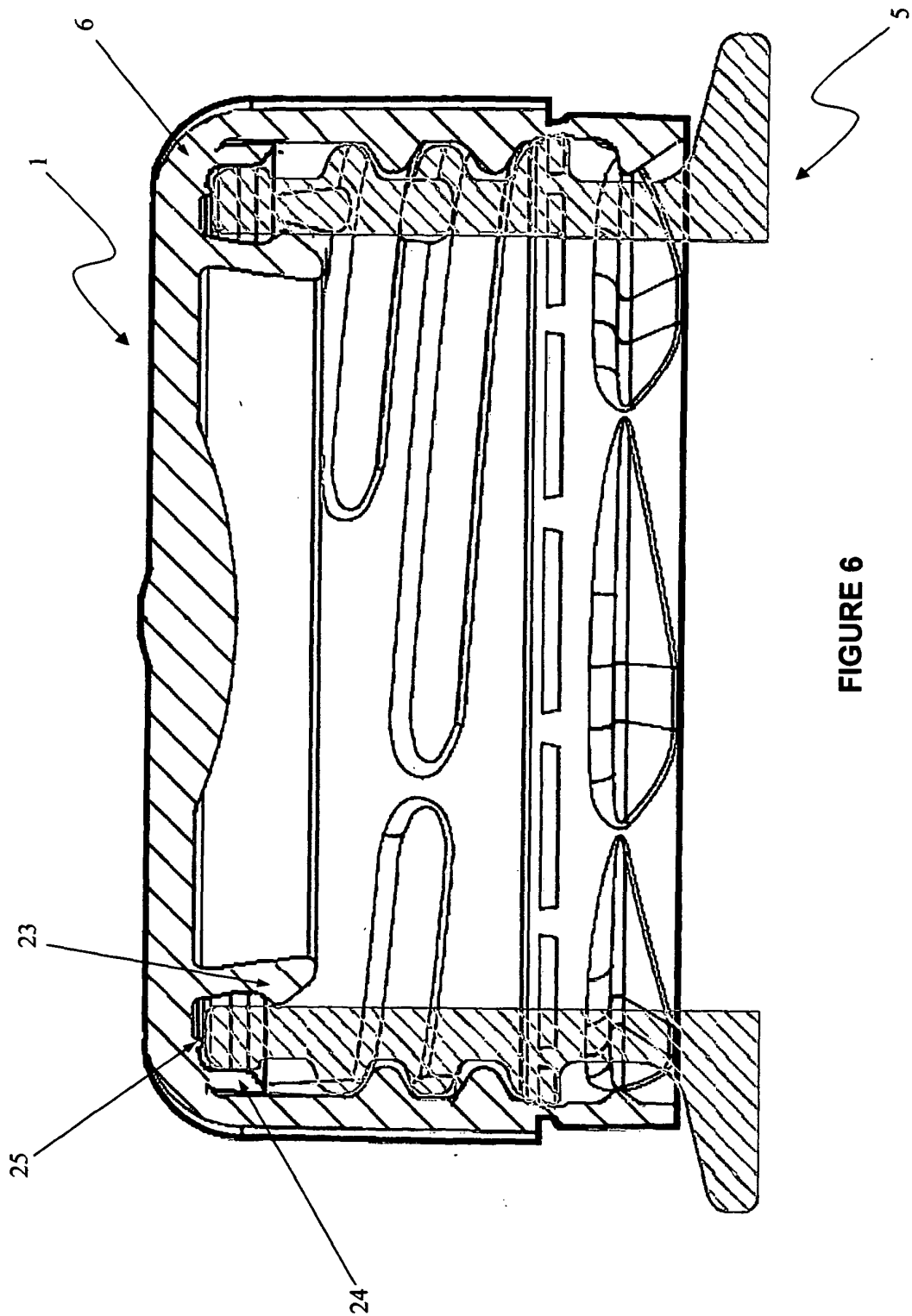


FIGURE 6

**REFERENCES CITED IN THE DESCRIPTION**

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