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

(11) EP 2 028 123 A1

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
**25.02.2009 Bulletin 2009/09**

(51) Int Cl.:
***B65D 50/04*** *(2006.01)*

(21) Application number: **08252318.4**

(22) Date of filing: **07.07.2008**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR**
Designated Extension States:
**AL BA MK RS**

(30) Priority: **16.08.2007 GB 0715983**

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(54) **A safety closure**

(57) A safety closure (10) for a container is provided. The closure comprises an inner cap (15) having engagement means (18) for engaging a container; and a force transmission member (23) operable to provide friction against an exterior surface of the inner cap upon application of an inwardly directed force. In use the force transmission member provides sufficient friction to disengage the inner cap engagement means and to enable indirect removal thereof from a container.

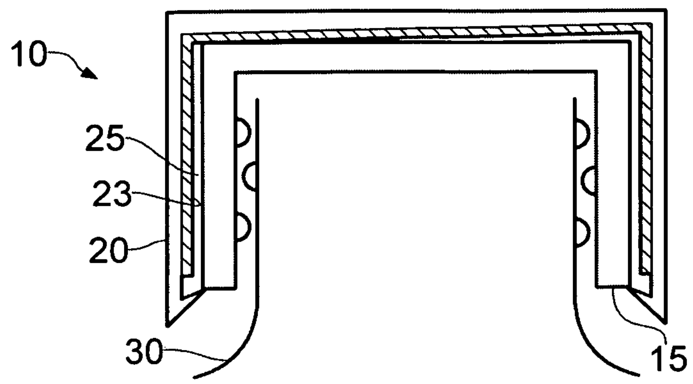


FIG. 3

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## Description

**[0001]** The present invention relates to the field of closures for containers, and more particularly to safety closures which can be applied and removed easily from a container with knowledge of its operation, but which is protected from removal by children.

**[0002]** In the packaging of many household commodities, such as medicines, it is highly desirable that the container be provided with a closure that cannot be removed by children, but which can be removed readily by those familiar with the manner of operation of the closure including, for example, the elderly or the handicapped.

**[0003]** Safety closures have been known for many years and generally comprise two component parts, namely an inner and outer shell. A typical safety closure is disclosed in GB1529707, which describes a safety closure cap for sealing a container, the cap comprising an outer shell, an inner shell and a ratchet arrangement. The ratchet arrangement couples the shells together when turned in a cap applying direction, and permits relative rotation between the shells in a cap-unscrewing direction. It is possible to unscrew the closure in response to a predetermined finger pressure directed radially inwards on the skirt of the outer shell, which for causes the shells to turn together so as to unscrew the inner shell from the container.

**[0004]** Other known safety closures generally require a downwardly directed pressure on the outer shell so as to activate the ratchet mechanism in conjunction with a rotation action in order to effect the removal of the said closure from the container. Such a removal, therefore, makes it necessary to apply force in two different directions together to remove the closure.

**[0005]** In many cases it would be desirable to use a metal closure to form the inner cap. However, standard metal closures tend not to have sharp edges against which an outer closure can bear to transmit an unscrewing force.

**[0006]** Whilst conventional safety closures provide adequate protection against inadvertent removal of a closure from a container, such as a medicine bottle, for example, they are, nevertheless, unnecessarily complicated by virtue of their reliance upon an interlocking mechanical engagement between the inner and outer shells to actuate the removal of the closure from the container. From the discussion that is to follow, it will become apparent how the safety closure formed in accordance with the present invention addresses the deficiencies associated with the prior art, whilst providing numerous additional advantages not hitherto contemplated or possible with prior art constructions.

**[0007]** According to a first aspect of the present invention, there is provided a safety closure for a container, the closure comprising: an inner cap having engagement means for engaging a container; and a force transmission member operable to provide friction against an exterior surface of the inner cap upon application of an inwardly directed force whereby in use the force transmission member provides sufficient friction to disengage the inner cap engagement means and to enable indirect removal thereof from a container.

**[0008]** In contrast to prior art constructions, a safety closure formed in accordance with the present invention utilises the frictional forces generated at the exterior of the inner cap.

**[0009]** The interaction between the force transmission member and the inner cap may be characterised by an absence of mechanical engagement. In other words, the force generated to remove the inner cap is achieved substantially entirely by frictional forces at the interface.

**[0010]** The closure may comprise an outer cap. In some embodiments the force transmission member comprises the outer cap.

**[0011]** The force transmission member may be formed as part of an outer cap. For example, the member may comprise one or more high friction pads which can be brought selectively into contact with the inner cap.

**[0012]** The force transmission member may be formed as a liner, coating or the like for the outer cap.

**[0013]** Alternatively or additionally at least part of the force transmission member may be formed as a coating on the inner cap.

**[0014]** It is possible for inner and outer caps to be provided and for both to include corresponding high friction components which can be brought into contact to enable the transmission of force.

**[0015]** Without the application of an inward force (such as pushing or squeezing) on the exterior surface of the outer cap, the outer cap may rotate freely about the inner cap imparting little, or no, frictional torque on the surface of the inner cap. This can result in a child-resistant closure which nevertheless still allows the elderly or handicapped to remove the inner cap.

**[0016]** The force transmission member may form at least part of the outer cap. The present invention envisages, therefore, that the member may be constituted by the material, for example, of the outer cap.

**[0017]** The member and outer cap may be formed integrally or formed as separate components.

**[0018]** Where the frictional medium is constituted by the material forming the outer cap, it would be the frictional force exerted by the surfaces of the inner and outer caps as they attempt to move relative to one another which would be of relevance.

**[0019]** It may be that the entire outer cap is formed from the friction medium. Alternatively, only certain regions of the outer cap may be formed from the member. This may be preferred where substantial savings in terms of expense can be made if the outer cap is formed as a composite comprising a less expensive material forming the majority of the outer cap and a more expensive member material making up a minority of the outer cap.

The force transmission member may be a separate component attached to the outer cap. It may be attached by way of adhesive, for example, or other attachment means. Having the member as a separate component may simplify the manufacturing process of the safety closure because the member may be attached to an outer cap of standard specification which is readily available. There is also the possibility of installing a member on pre-existing outer and/or inner caps to arrive at a safety closure formed in accordance with the present invention. This may be considered as a retro-fitting installation of the member as a separate component.

**[0020]** The exterior surface of at least part of the inner cap may be substantially smooth. The interior surface of at least part of the force transmission member may be substantially smooth. In some embodiments the exterior surface of the inner cap and the interior surface of the transmission member are smooth at least in the areas over which frictional engagement will occur.

**[0021]** The inner cap engagement means may comprise screw thread formations. Accordingly a rotational movement accompanying the application of inward force could be used to unscrew the inner cap. Other engagement means such as clips and snap beads may also be used.

**[0022]** In embodiments where the force transmission member is pressed, or squeezed, against the inner cap, both elements may be rotated simultaneously as one unit about the container to effect the application or removal of the safety closure to/from the container. To this end, there is no requirement for any mechanical interengagement to provide a mechanism for turning; the frictional force that exists being sufficient to accomplish this objective. A clamping force between the force transmission member and the inner cap allows the inner cap to be indirectly removed from the container.

**[0023]** The inwardly directed force may include a radial component. Alternatively or additionally an axial component may be required.

**[0024]** The force transmission member may be biased to a non-contact position and urgable to a contact position with respect to the inner cap. Movement of the member may be caused by directly applying force to it, or by indirectly applying force, for example via an outer cap.

**[0025]** The force transmission member may be deformable.

**[0026]** At least part of the outer cap may be deformable. The outer cap may comprise a wall having selected regions of reduced thickness to facilitate deformation thereof.

**[0027]** The outer cap may be formed from plastics material such as polyethylene or polypropylene.

**[0028]** The inner cap may be formed from a variety of materials, such as metal or a plastics material, for example. In embodiments, the inner cap may be formed from aluminium, which has many desirable properties including it being lightweight, corrosion resistant, ductile, impermeable, and recyclable. The surface of aluminium also offers a significant co-efficient of friction when brought into contact with the surface of other materials, such as those materials which constitute the friction medium or from which the friction medium is formed.

**[0029]** The force transmission member may comprise or include a number of appropriate materials, such as a plastics material, a rubber material, a thermoplastic elastomeric material, and silicone. Materials of this nature are considered to exhibit a sufficient co-efficient friction for them to be utilised as part of a safety closure formed in accordance with the present invention.

**[0030]** The safety closure may further comprise tamper-evident means which make it possible to establish whether the contents of the container have remained secure before reaching and being used by the intended user.

According to an alternative aspect there is provided a safety closure for a container, comprising a threaded inner cap which engages the container, an outer cap which at least partially houses the said inner cap, and a friction medium associated with the said outer cap, the friction medium being operable to exhibit a co-efficient of friction between itself and an exterior surface of the inner cap sufficient to enable the inner and outer caps to be rotated simultaneously about the container upon bringing the friction medium into contact with the exterior surface of the inner cap by application of an inwardly radical force on an exterior surface of the outer cap.

**[0031]** According to a further aspect there is provided a container provided with a safety closure as described herein.

**[0032]** According to an alternative aspect of the present invention there is provided a force transmission member for a safety cap, comprising a force transmission as described herein.

**[0033]** The force transmission member may form part of an outer cap.

**[0034]** The present invention will now be more particularly described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a section of an inner and outer cap together forming a safety closure in accordance with the present invention;

Figure 2 is a section of the inner and outer caps of Figure 1 shown assembled into a safety closure and presented to a container neck;

Figure 3 is a section of the safety closure of Figure 2 shown assembled onto the container neck;

Figure 4 is a section of the safety closure of Figure 3 shown with the outer cap sidewall depressed towards the inner cap to facilitate the removal thereof;

Figure 5 is a section of a safety closure formed according to an alternative embodiment;

Figure 6 is a side elevation of a safety closure formed according to an alternative embodiment;

Figure 7 is an underplan view of the closure Figure 6;

Figure 8 is a plan view of the closure of Figure 6;

Figure 9 is a section of the closure of Figure 8 taken along line A-A;

Figure 10 is a perspective view of an outer cap part of the closure of Figure 6 shown with an accompanying dosing cap;

Figure 11 is a side elevation of a safety closure formed according to an alternative embodiment;

Figure 12 is an underplan view of the closure of Figure 11;

Figure 13 is a plan view of the closure of Figure 11;

Figure 14 is a section of the closure of Figure 13 taken along line B-B;

Figure 15 is a perspective view of an outer part of the closure of Figure 11 shown with an associated dosing cap;

Figure 16 is a side elevation of a safety closure formed according to an alternative embodiment;

Figure 17 is an underplan view of the closure of Figure 16;

Figure 18 is a plan view of the closure of Figure 16;

Figure 19 is a section of the closure of Figure 18 taken along line C-C; and

Figure 20 is a perspective view of the closure of Figure 16 shown with an associated dosing cap.

**[0035]** Referring first to Figure 1 there is shown the component parts of a safety closure generally indicated 10 and formed in accordance with the present invention.

**[0036]** The closure 10 comprises an aluminium inner cap 15 and a plastic outer cap 20.

**[0037]** The inner cap 15 comprises a disc-shape top plate 16 from the periphery of which depends a generally cylindrical side wall 17. The interior of the side wall 17 is provided with engagement means in the form of screw thread formations 18.

**[0038]** The outer cap 20 comprises a disc-shape top plate 21 from the periphery of which depends a generally cylindrical side wall 22. The interior of the cap 20 is provided with a force transmission member in the form of a liner 23. The liner 23 is formed from a thermoplastic elastomer material and accordingly has a high coefficient of friction. The liner 23 extends over the underside of the top plate 21 and around the interior of the side wall 22 and is secured by any suitable means such as adhesion or as a result of bi-injection moulding. The free end of the side wall 22 comprises an annular upturned flap 24 the purpose of which is described in more detail below.

**[0039]** Referring now to Figure 2 the inner and outer caps 15, 20 are shown assembled into the closure 10. The inner cap 15 is received into the outer cap 20 so that the free end of the side wall 17 engages above the flap 24 to hold the cap 15 firmly within the cap 20. Relative axial movement between the caps 15, 20 is thereby restricted but relative rotational movement is permitted by virtue of the clearance gap 25 between the caps 15,20.

**[0040]** The closure 10 is shown presented to a container neck 30 having external screw thread formations 31.

**[0041]** Referring now to Figure 3 the closure 10 is shown applied to the container neck 30. In practice the closure may be applied either with the inner and outer caps 15, 20 assembled as shown, or in two stages i.e. the inner cap 15 is applied to the neck 30 first and the outer cap 20 is applied over the inner cap 15.

**[0042]** With the closure 10 applied the container neck is closed. If the outer cap 20 is rotated it spins freely on the inner cap because of the gap 25 and because the outer surface of the cap 15 is smooth. There is therefore little or no friction between the caps 15, 20.

**[0043]** In order to remove the inner cap 15 the side wall 22 must be inwardly deformed as shown in Figure 4. The inward deformation causes the liner 23 to be pressed against the side wall 17 at points X. In order to facilitate the deformation the side wall 17 can be provided with localised weakening or strengthening relative to the remainder of the side wall.

**[0044]** With the side wall 22 depressed the inner cap 15 can now be rotated using the outer cap 20, with the liner 23 acting as a torque transmission medium.

**[0045]** The closure 10 can be re-applied by reversing the above operation.

**[0046]** Referring now to Figure 5 there is shown a closure 110 formed according to an alternative embodiment.

**[0047]** The closure 110 comprises an inner cap 115 and an outer cap 120 and in this respect is similar to the closure 10 shown in Figure 2.

**[0048]** In this embodiment the inner cap 115 includes a cover 123 formed from a thermoplastic elastomer. The operation of the closure 110 is very similar to that of the closure 10. In this case when the side wall 122 is depressed the inner surface of the outer cap 120 is pressed against the cover 123. This creates friction between the inner and outer caps to allow the inner cap to be removed and replace by rotation.

**[0049]** Referring now to Figures 6 to 9 there is shown a closure 210 formed according to an alternative embodiment.

**[0050]** The closure 210 comprises a metal inner cap 215 and a plastics outer cap 220.

**[0051]** The outer cap 220 comprises a generally cylindrical upper portion 235 including the top plate 221 and a side wall 236 and a generally hexagonal lower skirt 240 depending therefrom. The skirt 240 is of greater diameter than the upper portion side wall 236 and is connected thereto by six radial spokes 237.

**[0052]** Three of the six sides of the skirt 240 include arcuate bulges 241 which press against the inner cap side wall 217 to prevent inward flexing and to brace the skirt 240 against the wall 217. The other three sides of the lower skirt 240 are provided with force transmission members 242 in a triangular configuration.

**[0053]** The members 242 have an interior and an exterior component. The interior component comprises a rectangular pad 243 and the exterior component comprises three spaced ribs 244. The members 242 are formed together as a single moulded unit which extends into the upper part as legs 245 each of which extend over the upper part side wall 236 and then under the top plate 221, where they terminate at a central disc 246 that projects through an aperture 247 in the top plate 221.

**[0054]** The sides of the skirt 240 which have the force transmission members 242 are not restricted by arcuate bulges and can therefore flex inwardly between adjacent spokes. In use the skirt 240 is gripped and inward pressure is applied at the three points defined by the ribs 244. Radially inward force pushes the skirt side inwards and consequently pushes the pads 243 against the inner cap side wall 217. Rotation movement of the outer cap 220 causes co-rotation of the inner cap 215.

**[0055]** In Figure 10 a generally frusto-conical dosing cap 250 is shown upturned and fitted onto the outer cap 220 (shown without the inner cap). The cap is fitted onto the upper portion 235. The open end of the cap 250 is shaped to fit tightly onto the portion 235 so that it can be retained during non-use.

**[0056]** Referring now to Figure 11 to 14 there is shown a closure 310 formed according to an alternative embodiment. The closure 310 is similar to the closure 210 with the following differences.

**[0057]** The skirt 340 is split into three arcuate segments 340a, 340b, 340c which are separated by three windows 355a, 355b, 355c. Each segment is connected to the upper part side wall 336 and at its free end has its own ledge 324 for retaining the inner cap 315.

**[0058]** A force transmission member is provided in the form of a one piece castellated moulded part 360.

**[0059]** The member 360 comprises three rectangular pads 361 a, 361 b, 361c which extend across the windows 355a, 355b, 355c. At the base of the pads are link arms 356a, 356b, 356c which allows the part to be moulded in one piece. The exterior of the pads include ribs 357 which help with grip.

**[0060]** The part is moulded from an elastomeric material with a high coefficient of friction. Accordingly, the pads can be flexed into the windows where they can contact the exterior surface of the inner cap 315. The operation of the closure is then identical to the closure 210 in that the pads are depressed and then the inner cap can be rotated.

**[0061]** Referring now to Figure 15 the outer part 320 is shown fitted with a dosing cap 350 which is identical to the cap 250 and also fits onto the upper portion 335.

**[0062]** Referring now to Figures 16 to 19 there is shown a closure 410 formed according to an alternative embodiment.

**[0063]** The closure comprises an inner cap 415 and an outer cap 460. In this embodiment there is no separate force transmission member because the outer cap 460 is the member; the cap is in effect an overcap. The cap 460 is formed from an elastomeric material and comprises a top plate 461 and a depending side wall 462 which terminates with a segmented annular ledge 424.

**[0064]** The inner cap 415 is identical to the caps 215, 315 and is received into the outer cap where it is retained by the ledge 424.

**[0065]** The cap 460 is oversized so that it can rotate free on the inner cap 415 in the absence of any inward force.

**[0066]** At the intersection of the top plate 461 and the side wall 462 five circumferentially spaced windows 463 are formed. The windows define five pressing regions on the side wall 462 and help to allow the regions to flex in use.

**[0067]** In use radially inward pressure is applied to the side wall 462 so that a clamping force is applied to the inner cap 415 by the outer cap 460. This allow the outer cap 460 to be used to remove the inner cap from a container (not shown).

**[0068]** Referring now also to Figure 20, the periphery of the top plate 461 is provided with five upstanding equally spaced pods 464. The pods 464 are arranged so that the mouth of a dosing cap 450 can be fitted over their peripheries to hold it firmly in place.

## Claims

1. A safety closure for a container, the closure comprising: an inner cap having engagement means for engaging a container; and a force transmission member operable to provide friction against an exterior surface of the inner cap upon application of an inwardly directed force, whereby in use the force transmission member provides sufficient friction to disengage the inner cap engagement means and to enable indirect removal thereof from a container.

2. A closure as claimed in Claim 1, in which the closure comprises an outer cap.

3. A closure as claimed in Claim 1 or Claim 2, wherein at least part of the outer cap is deformable by the inwardly directed force.

4. A safety closure as claimed in Claim 3, wherein the outer cap comprises a wall having selected regions of reduced thickness to facilitate deformation thereof.

5. A closure as claimed in any preceding claim, in which the outer cap is formed from plastics material.

6. A closure as claimed in Claim 2, in which the force transmission member comprises the outer cap.

7. A closure as claimed in any of Claims 2 to 5, in which the force transmission member is formed as part of the outer cap.

8. A closure as claimed in any of Claims 2 to 6, in which the force transmission member is formed as a liner for the outer cap.

9. A closure as claimed in Claim 1 or Claim 2, in which the force transmission member is formed as a coat-

ing on the inner cap.

**10.** A closure as claimed in any preceding claim, in which the exterior surface of at least part of the inner cap and/or the interior surface of at lest part of the force transmission member is substantially smooth.

**11.** A closure as claimed in any preceding claim, in which the inner cap engagement means comprise screw thread formations.

**12.** A safety closure as claimed in any preceding claim, wherein the inner cap is formed from metal.

**13.** A safety closure as claimed in any preceding claim, wherein the force transmission member comprises or includes a plastics material.

**14.** A safety closure as claimed in any preceding claim, wherein the force transmission member comprises or includes an elastomeric material.

**15.** A safety closure as claimed in any preceding claim, wherein the force transmission member comprises or includes a thermoplastic elastomeric material.

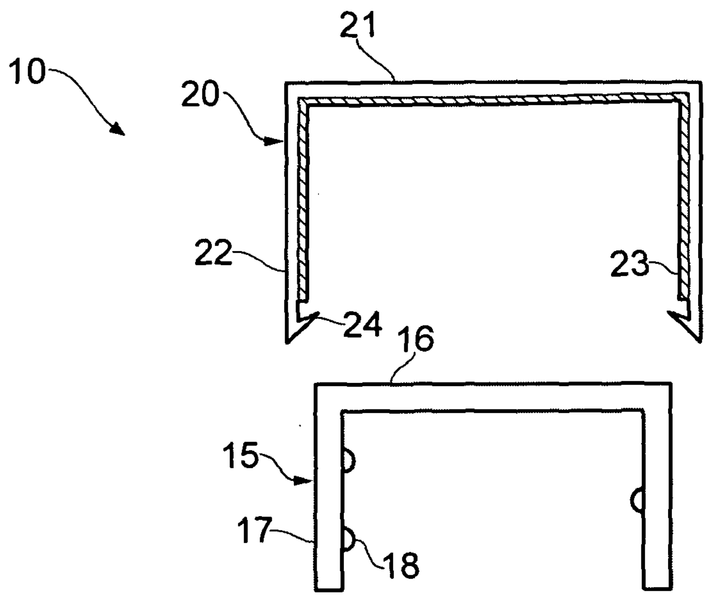


FIG. 1

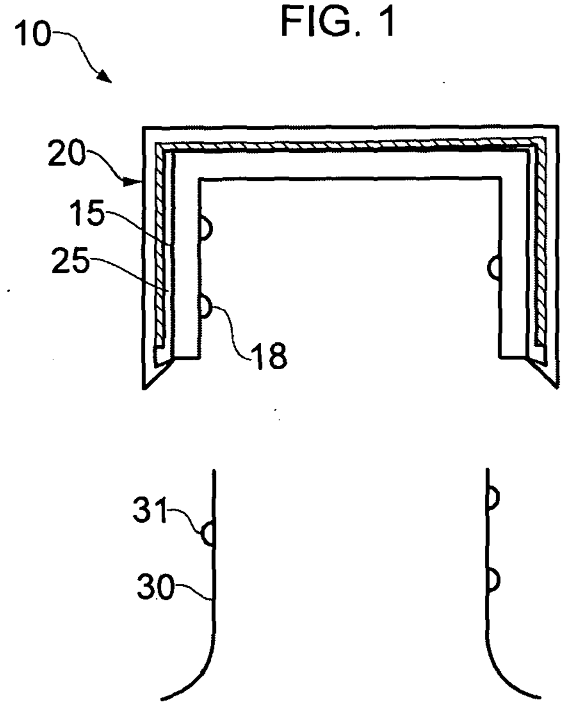


FIG. 2

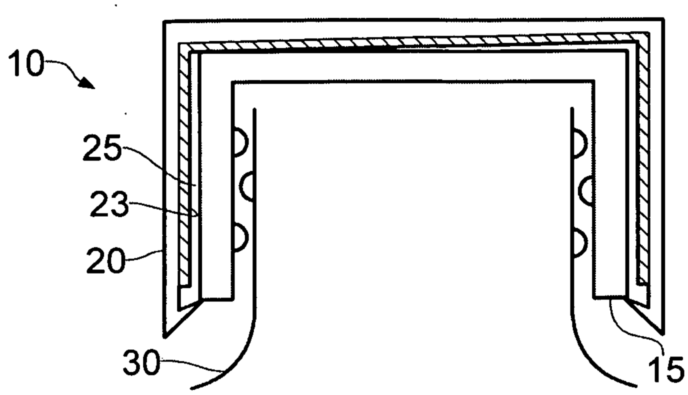


FIG. 3

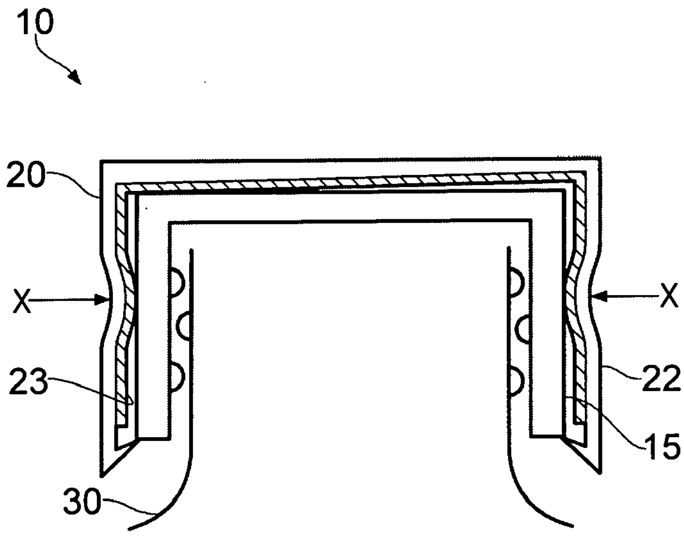


FIG. 4

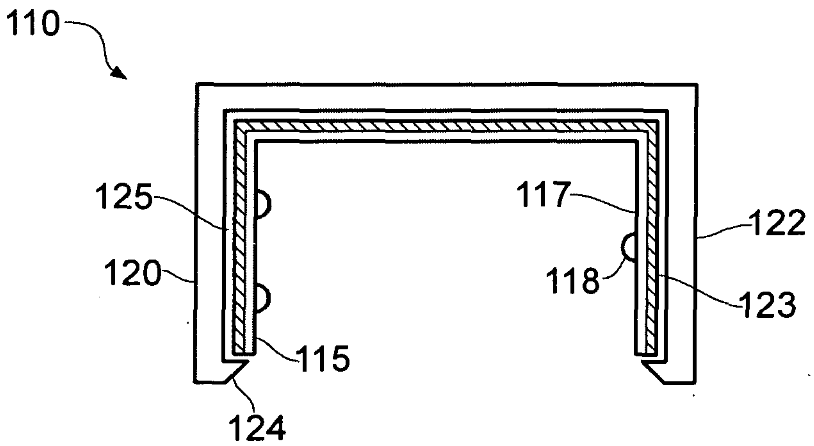


FIG. 5

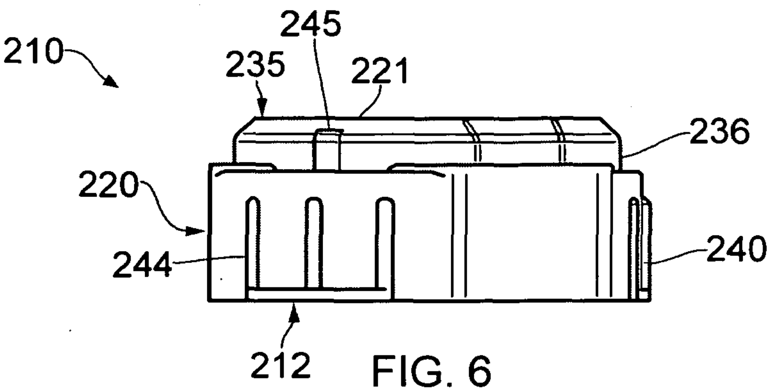


FIG. 6

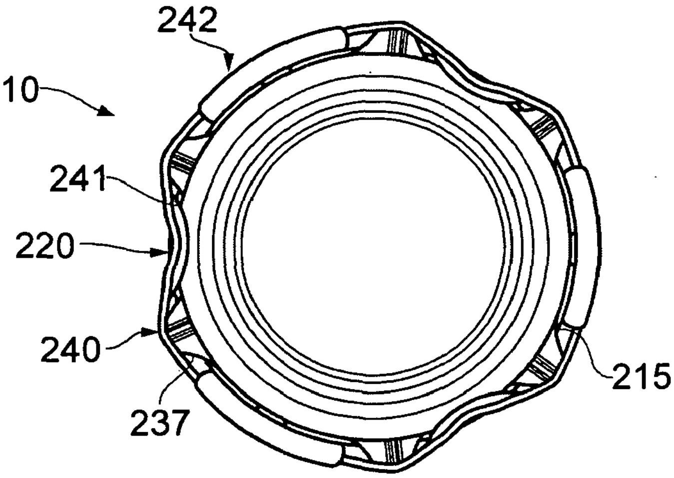


FIG. 7

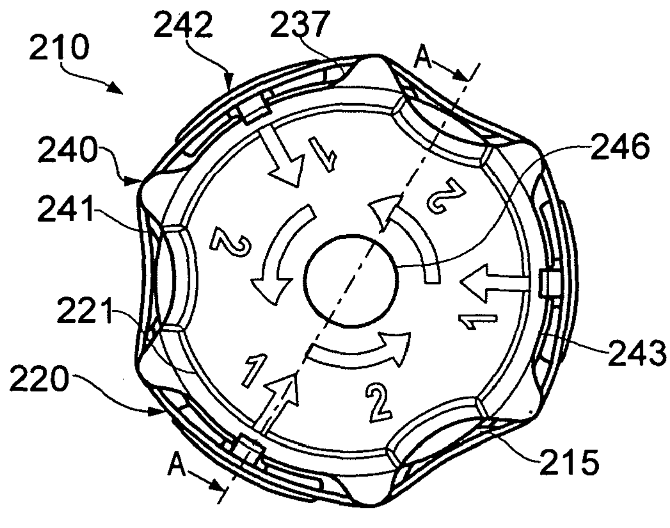


FIG. 8

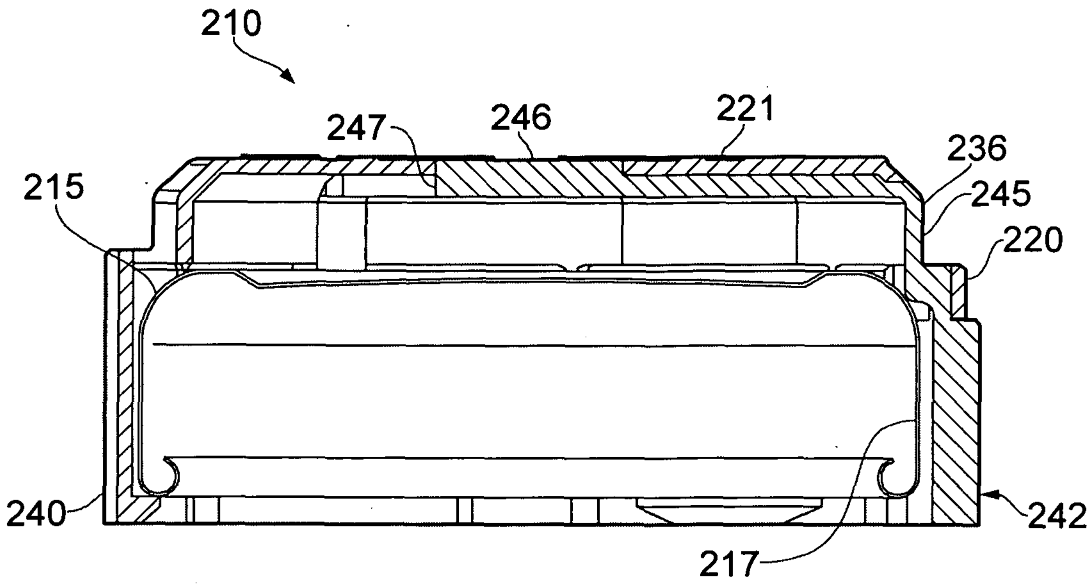
210
247
246
221
236
215
245
220
240
242
217

FIG. 9

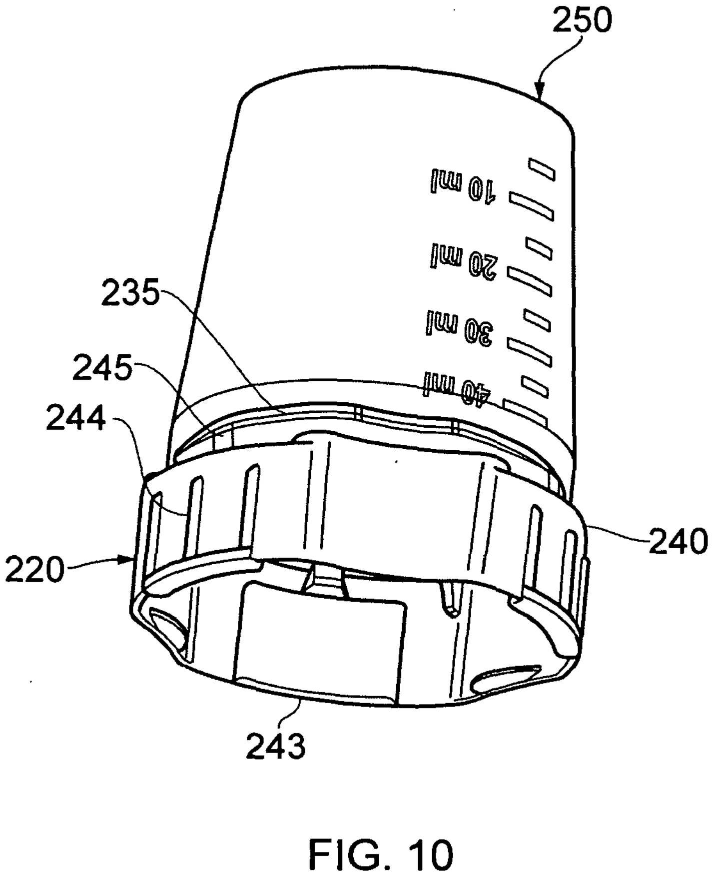
250
10 ml
20 ml
30 ml
40 ml
235
245
244
240
220
243

FIG. 10

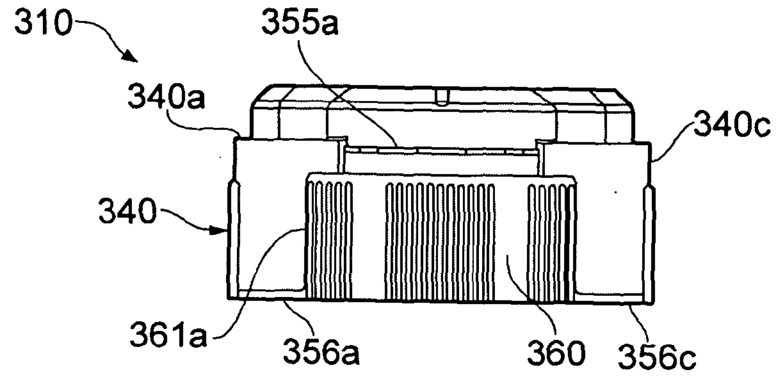


FIG. 11

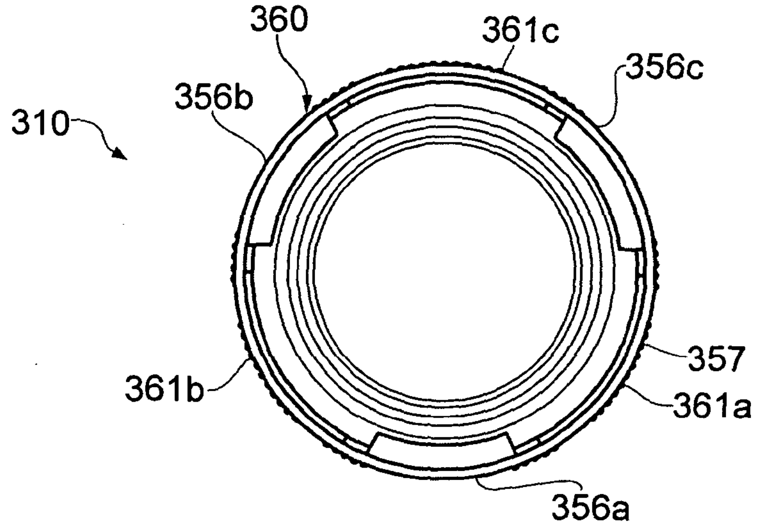


FIG. 12

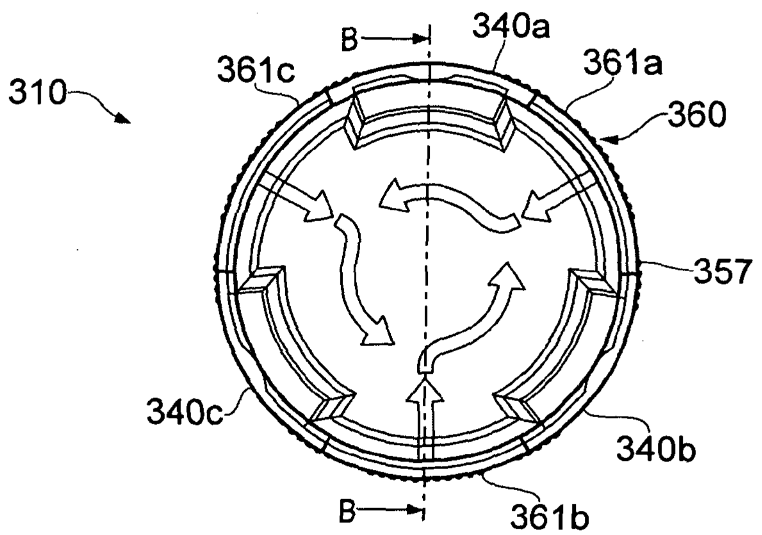


FIG. 13

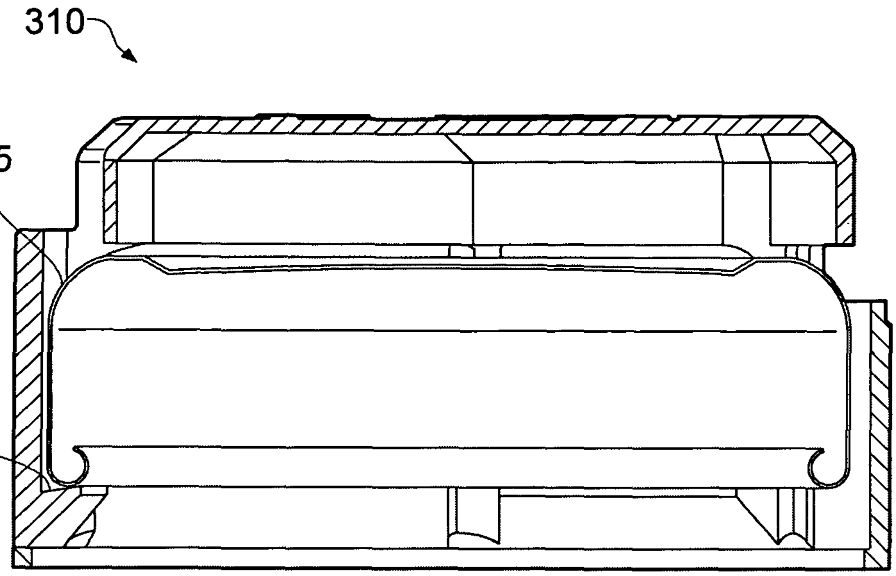
310
315
324

FIG. 14

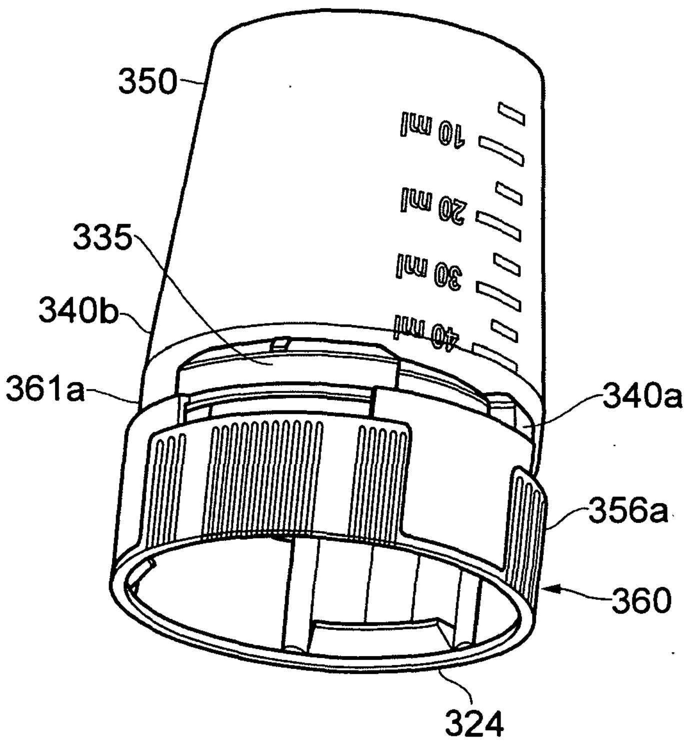
350
10 ml
20 ml
30 ml
40 ml
335
340b
361a
340a
356a
360
324

FIG. 15

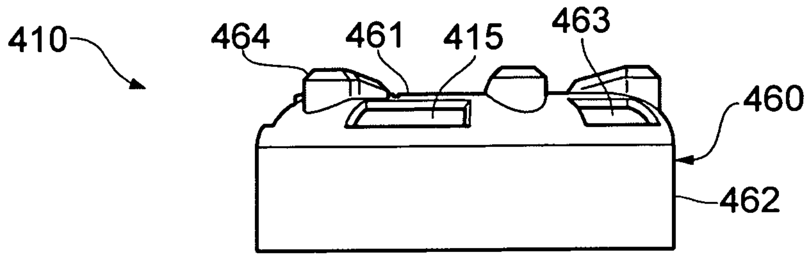


FIG. 16

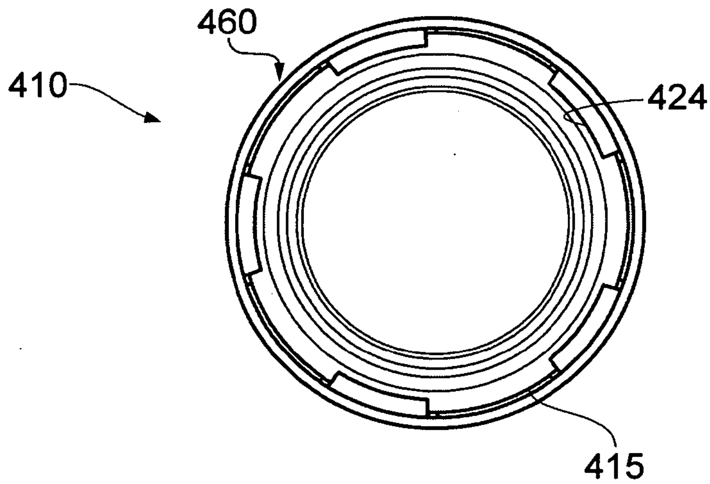


FIG. 17

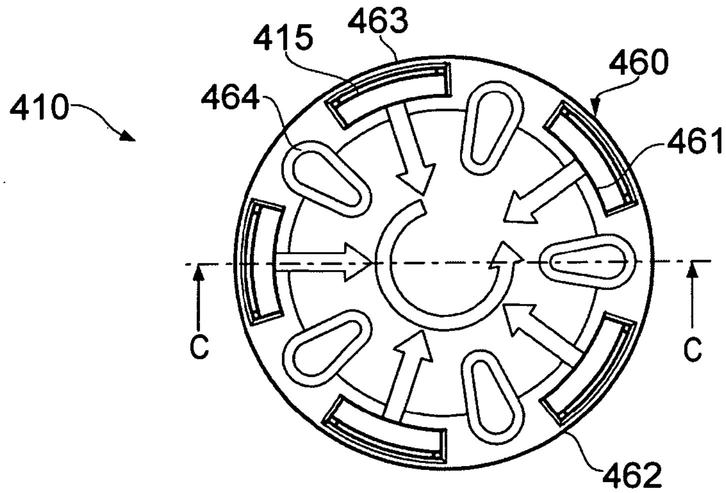


FIG. 18

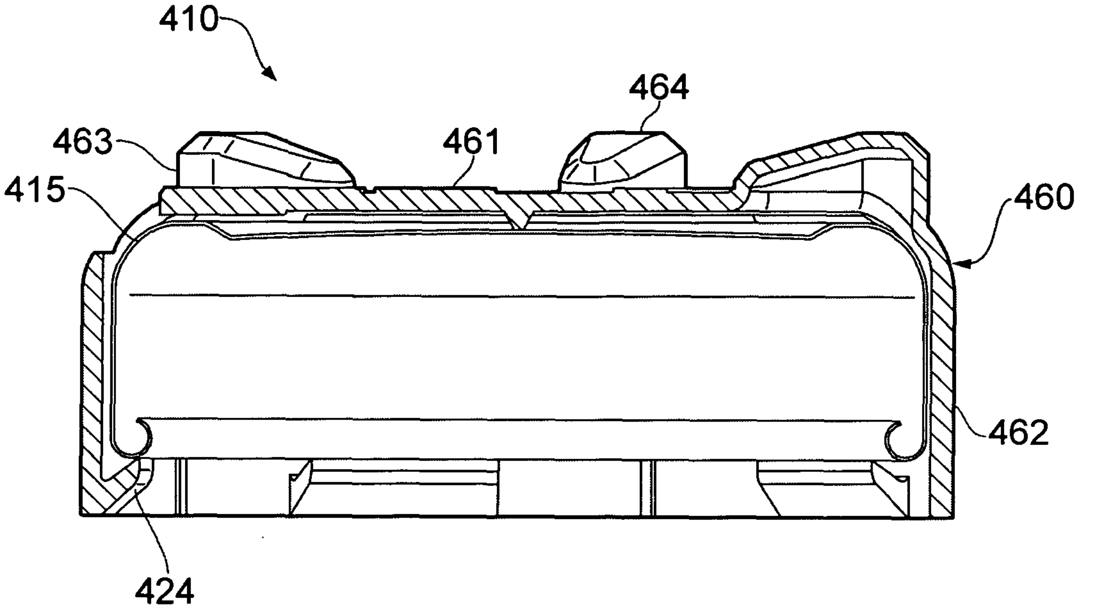


FIG. 19

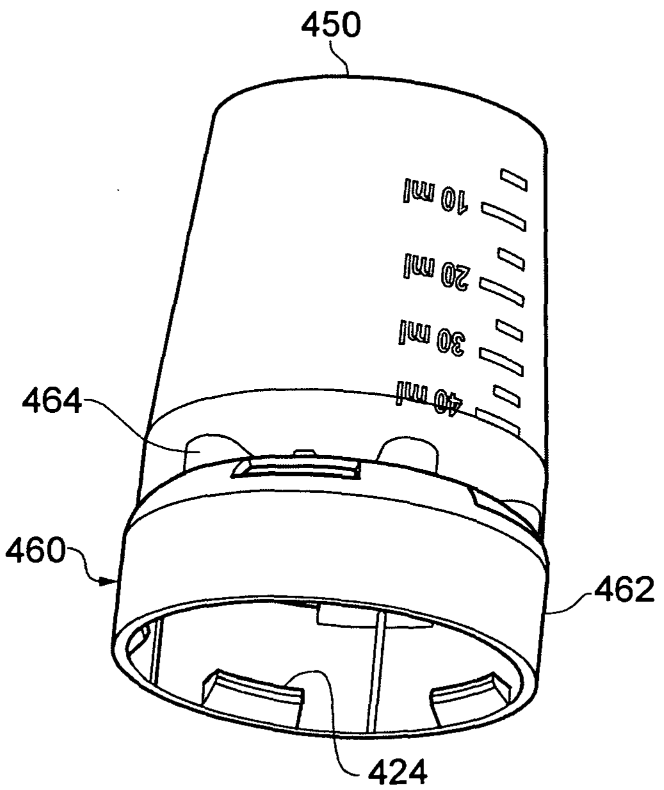


FIG. 20

Europäisches Patentamt
European Patent Office
Office européen des brevets

# EUROPEAN SEARCH REPORT

Application Number
EP 08 25 2318

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| X | US 2 881 934 A (RHODES GILBERT L) 14 April 1959 (1959-04-14) * column 2, line 45 - line 56; figures 1,2 * | 1-15 | INV. B65D50/04 |
| X | CH 571 980 A5 (KAISER ERNST) 30 January 1976 (1976-01-30) * column 2, line 52 - column 4, line 14; figure 1 * | 1-15 | |
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