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

(11) EP 1 072 528 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
31.01.2001 Bulletin 2001/05

(51) Int Cl.[7]: **B65D 41/34**

(21) Application number: **00306252.8**

(22) Date of filing: **21.07.2000**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **22.07.1999 GB 9917236**

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(54) Tamper evident closure

(57) A tamper-evident, container closure cap (10), features a resiliently-deformable, inward retention lip (18), for co-operative interaction with an upstanding retention rim (32) upon a container neck (31); the lip being integrally moulded with a circumferential cap wall and reverse-fold, in-turned or inverted to create a resilient inward lip; a frangible inter-connection between lip and cap body utilises weakening, through localised reduction in wall thickness, leaving residual tabs (21). Cap removal requires severance of a lower depending, peripheral tamper strip (15), carrying the resilient inward retention lip, from the upper body (12) of the cap.

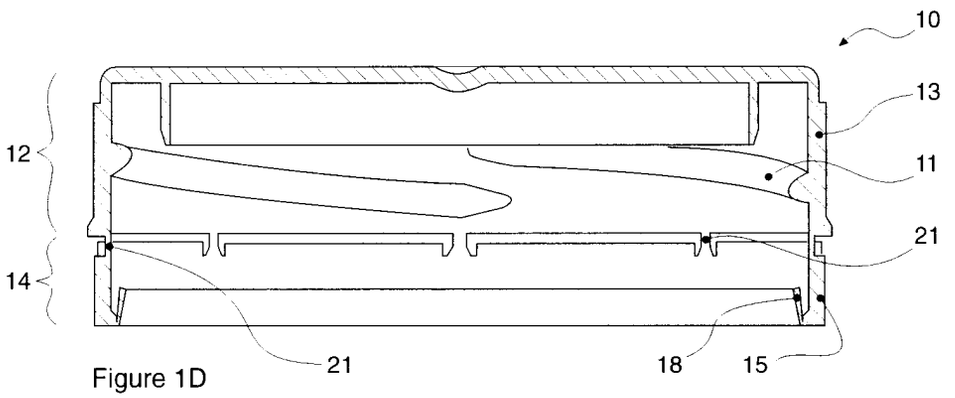

Figure 1D

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Description

[0001] This invention relates to container closures, and is particularly, but not exclusively, concerned with so called 'tamper-evident' closures.

[0002] The term 'closure' is used herein to embrace any form of cover, or termination, such as to a container access aperture, or mouth.

[0003] The term 'tamper-evident' is generally used to designate container closures, such as screw caps, which - once installed upon a container - cannot be removed, without some form or other of '(self-) evident', or apparent, visual indication.

[0004] Typically the indication is by the fracture, breakage, severance, removal, absence, or otherwise interference with, some part of the closure.

[0005] Tamper-evident closures may, or may not, also be 'tamper-resistant' - that is with some ancillary provision to deter casual opening, by the uninitiated, or unauthorised.

[0006] Thus, for example some non-intuitive action sequence may be required to preface opening.

[0007] Child-resistant containers, say, for pharmaceuticals, are a case in point.

[0008] Tamper-evident container closures provide some visible indication that the container may already have been opened, or that the contents have been accessed - after original filling and closure installation.

[0009] Contents access would generally be more feasible through the closure - ie by its (temporary) removal and replacement, or substitution - rather than, say, the container wall.

[0010] Consumable products, such as drinks, foodstuffs, and pharmaceuticals, are particularly vulnerable.

[0011] That said, consumer reassurance is engendered, over a disparate variety of products, by the visible presence of an unbroken, or intact, closure 'seal' - as signifying that the full, unadulterated, original contents remains intact.

[0012] A common tamper-evident implementation is configured as a peripheral, or boundary, strip seal, such as a part-closed, annular ring, with an end pull-tab - which is visible and readily apparent.

[0013] It is generally desirable for a closure to be initially entrained, or captured, with a container, to inhibit inadvertent dis-lodgement, loosening or removal.

[0014] One form of such entrainment is through the co-operative interaction of:

- on the one hand - a pronounced, (inward) retention lip, upon a lower inner edge of the cap; and
- on the other hand - an upstanding (outward) peripheral capture, or retention rim, or ridge, upon a container neck.

[0015] The cap retention lip may be carried by a removable tamper evident strip - itself connected to a closure body, by a locally weakened marginal periphery, of, say, reduced wall thickness.

[0016] Strip separation, by fracture of the weakened margin, allows a remaining upper portion of the cap to be removed, and the container to be opened.

Prior Art Acknowledgement

[0017] Tamper-evident (TE) container closure caps with retention bands or rings are known, but can prove (unduly) complex in form - with an inherent fragility in the mutual entrainment of retention ring and cap proper - and so difficult to manufacture, by say moulding.

[0018] Thus PCT WO 96/31404 (Crown Cork) employs a TE retention band of significantly reduced radial wall thickness or depth than an upper closure cap portion - with precariously fragile mutual entrainment. Moreover, a lower depending rim of the cap marginally overlies an upper rim of the TE band.

[0019] Cap installation requires flexing of a TE band inturned edge over a container neck retention ring - imposing stress upon the fragile mutual entrainment. Thus, the demands placed upon the mould tool and moulding process are severe. The cap remains vulnerable, so careful inspection would be required to ensure an intact cap structure before installation.

[0020] Similarly, PCT WO 98/22361 (Crown Cork) is concerned with a depending cap retention ring having a complex, multiple-concavity, profiled rim - with the intention of enhancing resistance to longitudinal pulling force in attempted cap removal without TE band fracture.

[0021] The profiled rim is in-turned from a thicker annular TE band, itself offset in relation to an upper cap portion. Again, mutual entrainment of cap and TE band is localised and fragile. The mould tooling required would be complex and costly to machine and the moulding process critical to achieve a clean product profile.

[0022] Diverse other examples of TE closures are shown in US 5775527 Crown Cork AG, PCT92/26122 Crown Cork AG, W097/3379 Crown Cork AG and EP 0827913 Japan Crown Cork.

Problem

[0023] A disadvantage of a conventional approach to tamper evidence is that moulding tolerances can allow a 'slack', loose or sloppy, inter-fit between a closure cap and a container neck.

[0024] Thus, for example, respective complementary threads, upon adjacent boundary walls, may not co-operatively inter-nest as snugly as they might.

[0025] This tolerance can be such that distortion of the cap (from, say, circular to oval section) - by say squeezing its sides upon manual gripping - is sufficient to allow a cap retention lip to ride (locally) over a retention rim upon the container neck.

[0026] Slight twisting of the cap upon the neck allows

a cap lip to over-ride the neck rim, enabling the cap to be prised (intact) from the neck.

[0027] Thus the 'rotational inhibiting' role of the cap portion beyond, or 'below' - and thus entrained by - the rim is obviated, or by-passed.

[0028] Thus 'forced' cap removal - and replacement - can be achieved, without disturbing a tamper-evident retention seal - undermining its very purpose.

Statement of Invention

[0029] According to one aspect of the invention;
a container closure cap,
incorporates a depending lower edge rim,
configured for co-operative interaction,
[and entrainment] with, [or capture by],
an upstanding retention rim,
upon a container neck,
upon in-turn, inversion, or reverse-folding,
[before or upon installation],
creating a (resiliently-deformable),
inwardly-protruding (locating and retention) lip.

[0030] A resilient cap (retention) lip so configured remains operative, even if the cap is distorted - say, by squeezing from opposite sides in a gripping action, between finger and thumb of the hand.

[0031] In practice, the lower cap edge can initially be moulded integrally in alignment with the peripheral cap wall - effectively as an edge extension lip, or rim, to a circumferential peripheral side wall.

[0032] This edge extension is then reverse-turned inwardly, as a follow-up step to the original moulding - for example by profiled (insertion) die tooling.

[0033] A fold line, of reduced local wall thickness, can be employed to facilitate in-turning of the cap wall edge.

[0034] Entrainment of a closure to a container is achieved by entrapment of the in-turned lip, 'beneath' a retention ridge or rim upon the container neck.

[0035] Moreover, upward pull applied to such an inverted or reversed edge closure, promotes inward splay of the inverted edge lip, into even closer conforming contact with the neck rim - thereby enhancing resistance to passage over and past it.

[0036] The inverted cap edge may be continuous or discontinuous.

[0037] Thus, for example, the edge could be segmented into a plurality of discrete tabs.

[0038] Such tabs could also selectively inter-fit with complementary grooves in the container neck - allowing the tabs to penetrate into the neck wall thickness and require even greater displacement for cap removal.

[0039] In particular,
a closure cap,
may be of generally even wall thickness or depth,
except for:
a marginal end rim,
deformable as an in-turned step,
and:
a marginal locally waisted portion,
of circumferentially-spaced recesses,
accommodating retention tabs or tongues,
as a division between cap portions.

[0040] Such a closure cap may embody
a (contiguous) inner wall,
along a common diameter,
between cap portions.

[0041] In particular,
a closure cap,
may incorporate a plurality of circumferentially-spaced recesses,
each with a stepped profile,
both in radial depth,
and circumferential extent or span,
to form an inset ledge,
with opposed lateral shoulders or abutments,
upon each side of an interconnecting tab or tongue,
spanning cap portions,
the shoulders being marginally spaced
from the tab,
to allow limited relative circumferential displacement,
upon relative twisting of cap portions,
until contact between abutment and tab
resists further lateral tongue flexing or distortion.

[0042] Thus, for example, a container closure cap,
may be of generally cylindrical form,
with a curved peripheral wall,
depending from a flat top or cap,
the wall incorporating a peripheral waisted portion,
of locally reduced radial depth,
and dividing the cap into upper and lower portions,
the upper portion having an internal thread,
the lower portion being unthreaded,
a plurality of circumferentially-spaced tongues,
mutually entraining the portions,
the tongues being disposed in recesses,
profiled to allow limited lateral tab displacement,
until contacting an abutment at the recess edge,
which inhibits lateral tab displacement,
so that further twisting severs the tongue,
and uncouples the upper and lower portions .

[0043] Locating, or embedding, the tabs linking the (upper and lower) cap elements, in a recess, with a marginal clearance therebetween:

- protects the tabs from inadvertent (contact) damage;
- allows longitudinal loads to be transferred directly between elements;
- limits lateral tab displacement, upon relative twisting of cap elements; and
- in turn, promotes tab severance when intended (for removal).

Embodiments

[0044] There now follows a description of some particular embodiments of closures according to the invention, by way of example only, with reference to the accompanying diagrammatic and schematic drawings, in which:

[0045] Figures 1A through 1F show a (screw) closure cap, for a container (not shown), incorporating a resiliently deformable, reverse-fold, in-turned retention lip, according to the invention;

[0046] Thus, more specifically:

Figure 1A shows a perspective upper and side view of a closure cap;

Figure 1B shows a side elevation of the closure cap of Figure 1A;

Figure 1C shows an upper plan view of the closure cap of Figures 1A and 1B;

Figure 1D shows a diametral sectional view of the closure cap of Figures 1A through 1C, taken along the line D-D' in Figure 1C;

Figure 1E is an enlarged version of Figure 1A, showing the bespoke profiled circumferential wall profile;

Figure 1F shows a fragmentary enlargement detail of part of the cap edge profile of Figure 1E, at a region of localised weakening;

Figure 2A shows a sectional view of the cap of Figures 1A through 1F, in an initial stage of moulding formation, with a marginal circumferential retention lip ready for reverse-fold, in-turning, to form, or be (re-) deployed as, a resiliently deformable inward retention lip;

Figure 2B shows a sectional view of the cap of Figure 2A, after reverse-fold, in-turning of the retention lip;

Figure 3A shows a variant of Figure 2A, with a fragmented, segmented, or discontinuous, rather than continuous, retention edge, pre-folding;

Figure 3B shows the variant of Figure 3A upon reverse-fold, in-turning of the fragmented retention lip;

Figure 4A shows a sectional view of the cap of Figures 1A through 1F and 2A, 2B, installed upon the neck of a container (such as a bottle or jar), with its resiliently-deformable, inward retention lip captured 'beneath' or beyond an upstanding circumferential retention rim upon the container neck;

Figure 4B shows an initial stage in removal of the mutually-entrained cap and container neck of Figure 4A, with a marginal peripheral edge rim separated from the circumferential side wall of the upper body of the cap, upon applying an unscrewing or unthreading rotary motion to the cap relative to the neck;

Figure 4C shows a final stage of cap removal, following on from Figures 4A and 4B, with a circumferential, tamper-evident strip left in place upon a container neck;

Figures 5A through 5C show the variant of Figures 3A and 3B installed upon a container neck, in the manner of Figure 4A;

[0047] Thus, more specifically:

Figure 5A shows a section view of a closure cap with fragmented peripheral retention ring profile located beneath or beyond a retention rim upon a container neck;

Figure 5B shows an upper plan view of the cap of Figure 5A;

Figure 5C shows a sectional view, taken along the line C-C' in Figure 5B, showing the location of rim tabs in a complementary, multiple-grooved, or slotted, container neck profile.

[0048] Referring to the drawings, a tamper-evident closure, is configured as a generally cylindrical, open ended, (screw) cap 10.

[0049] The cap 10 has a serrated, or multiple-ribbed, outer circumferential wall 13, to facilitate manual gripping - for rotary threading upon installation and removal.

[0050] The inner cap wall carries an integral thread 11, for co-operative inter-fit with a complementary thread 19 upon a cylindrical neck 31 of a container 30.

[0051] Generally, the cap 10 is divided into a mutually-severable (upper) portion 12 - with the serrated rim 13, and internal thread 11, and a lower portion 14 carrying an inward retention lip 18.

[0052] The cap retention lip 18 is configured for co-operative interaction with an (in this example continuous) upstanding retention ridge, ledge or rim 32, upon the outer circumference of the container neck 31.

[0053] The upper cap portion 12 is configured as a cylinder, with one end closed - and so, when fitted to the container neck 31, covers the otherwise open mouth of the neck.

[0054] A separate seal (not shown) may be located between cap and neck rim, to inhibit contents leakage.

[0055] [Alternatively, reliance may be placed upon the

softness of the inner cap material, and a snug inter-fit with the rim of the container neck, through the tightness of the respective screw thread interaction.]

[0056] The lower cap portion 14 is configured as an open annular ring, and effectively constitutes a peripheral tamper-evident strip 15.

[0057] The upper and lower cap portions 12, 14 are mutually entrained, in an assembled cap condition, by a series of frangible tabs 21, more readily discernible from the enlarged views of Figures 1E and 1F.

[0058] The tabs 21 are sufficiently robust to withstand:

- an axial push for cap installation, by insertion of a neck into the open mouth at the cap underside; or
- attempted forced removal of the cap by pulling from a container neck 31, once installed.

[0059] The tabs 21 must be fractured or broken, once the cap 10 is installed upon the container neck 31, for separation from the upper portion 12.

[0060] A lateral recess 23 in the cap wall, more apparent from Figure 1F, allows a certain circumferential movement - and stretching to ultimate yield failure - of an associated tab 21.

[0061] The recess 23 partially enshrouds the tabs 21 and protects them from inadvertent contact damage

[0062] Opposed lateral abutments or shoulders 24, bounding the recess 23, at each side of the tabs 21, serve as reaction, leverage or fulcrum points, for tab contact upon lateral displacement - and eventual fracture and severance - upon cap twisting, or rather relative rotation of (upper and lower) cap closure elements 12, 14.

[0063] The close juxtaposition or marginal spacing of (upper and lower) cap closure elements 12, 14- or more specifically, the cap 12 in relation to the TE retention ring or strip 15 - allows direct transfer of longitudinal compression loads, with minimal tab 21 loading and attendant bending or distortion.

[0064] Profiling, such as radiusing and waisting of the tab 21 and lateral shoulders 24, promotes the requisite (progressive) lateral displacement and eventual severance action.

[0065] The localised reduction in (radial) wall thickness or depth at the tabs 21 and at attendant recesses 23 facilitates cap separation, whilst preserving the TE strip or ring 14 radial thickness or depth - in turn inhibiting distortion and removal of the strip or ring 14, without fracturing the contiguity of cap elements 12, 14.

[0066] Once separated from the lower portion 14, by tab 21 severance, the upper cap portion 12 is freely rotatably - in one direction, away from the retention rim 32.

[0067] This allows cap 10 unthreading - as shown in Figure 4B, and ultimately removal - as shown in Figure 4C.

[0068] Overall, once the cap 10 has been installed upon the container neck 31, the 'tamper-evident' strip 15 remains 'permanently' in place, entrained by the retention rim 32-albeit not necessarily still attached to the upper cap portion 12.

Component list

[0069]

10 tamper-evident closure
11 internal cap thread
12 upper cap portion
13 serrated/ribbed outer circumference
14 lower cap portion
15 peripheral tamper-evident strip
18 inward retention lip
19 container neck thread

21 tab
23 lateral recess
24 shoulder

30 container
31 container neck
32 retention ridge/rim

Claims

1. A container closure cap (10),
incorporating a depending lower edge rim (14),
configured for co-operative interaction,
[and entrainment] with, [or capture by],
an upstanding retention rim (32),
upon a container neck (31),
upon in-turn, inversion, or reverse-folding,
[before or upon installation],
creating a (resiliently-deformable),
inwardly-protruding (locating and retention) lip (18).

2. A closure cap,
as claimed in Claim 1,
of generally even wall thickness or depth,
except for a marginal end rim,
deformable as an in-turned step.

3. A closure cap,
as claimed in either of the preceding claims,
with a marginal, locally-waisted portion,
of circumferentially-spaced recesses,
accommodating retention tabs, or tongues,
as a division between cap portions.

4. A closure cap,
as claimed in any of the preceding claims,
with a (contiguous) inner wall,
along a common diameter,
between cap portions.

5. A closure cap,
as claimed in any of the preceding claims,
incorporating a plurality of circumferentially-spaced recesses,
each with a stepped profile,
both in radial depth,
and circumferential extent or span,
to form an inset ledge,
with opposed lateral shoulders or abutments,
upon each side of an interconnecting tab or tongue,
spanning cap portions,
the shoulders being marginally spaced from the tab,
to allow limited relative circumferential displacement,
upon relative twisting of cap portions,
until contact between abutment and tab
resists further lateral tongue flexing or distortion.

6. A container closure cap,
as claimed in any of the preceding claims,
of generally cylindrical form,
with a curved peripheral wall,
depending from a flat top or cap,
the wall incorporating a peripheral waisted portion,
of locally reduced radial depth,
and dividing the cap into upper and lower portions,
the upper portion having an internal thread,
the lower portion being unthreaded,
a plurality of circumferentially-spaced tongues,
mutually entraining the portions,
the tongues being disposed in recesses,
profiled to allow limited lateral tab displacement,
until contacting an abutment at the recess edge,
which inhibits lateral tab displacement,
so that further twisting severs the tongue,
and uncouples the upper and lower portions ...

7. A closure,
substantially as hereinbefore described,
with reference to, and as shown in,
the accompanying drawings.

8. A container, with a neck fitted with a closure cap,
as claimed in any of the preceding claims.

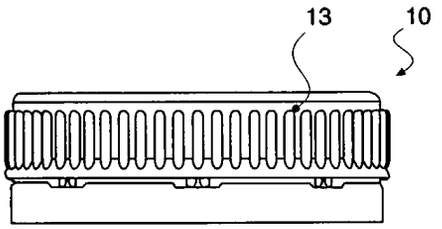

Figure 1B

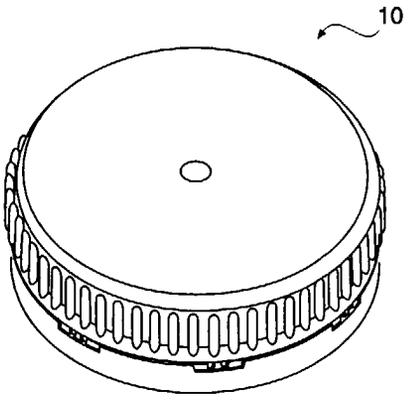

Figure 1A

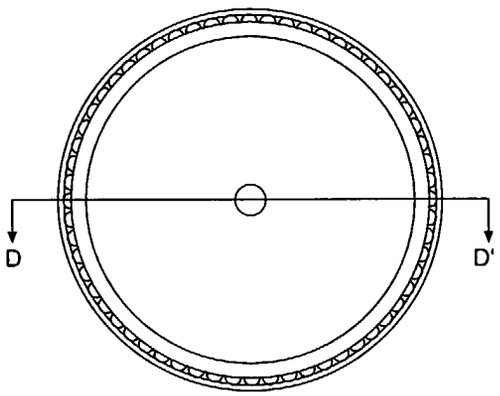

Figure 1C

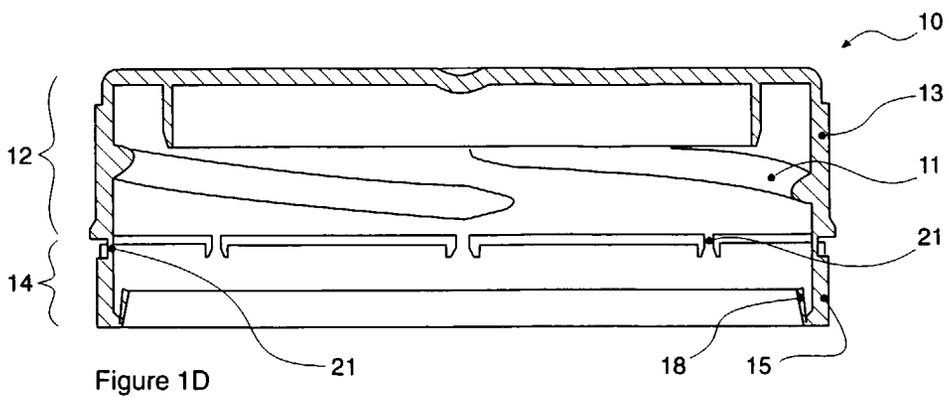

Figure 1D

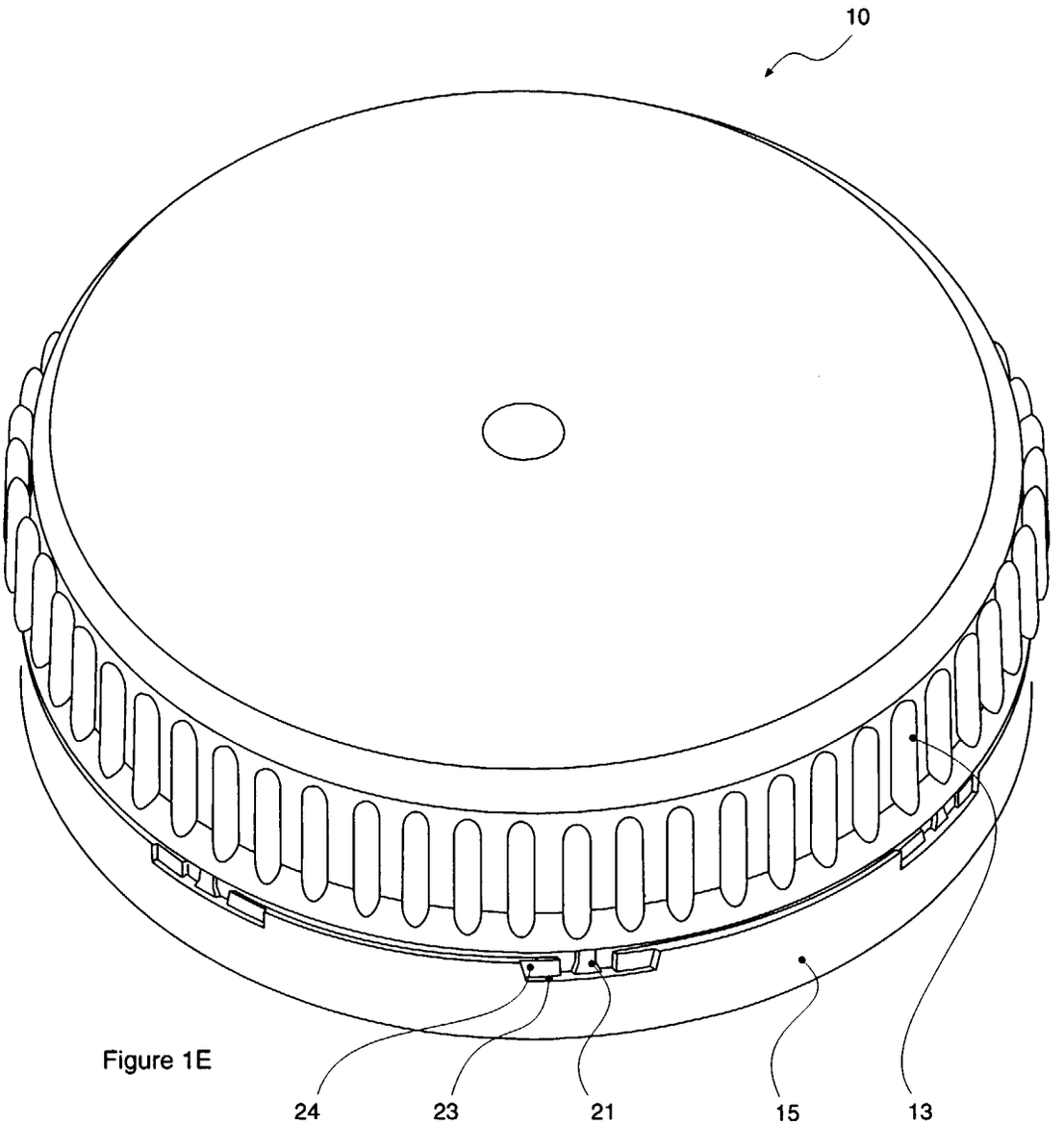

Figure 1E

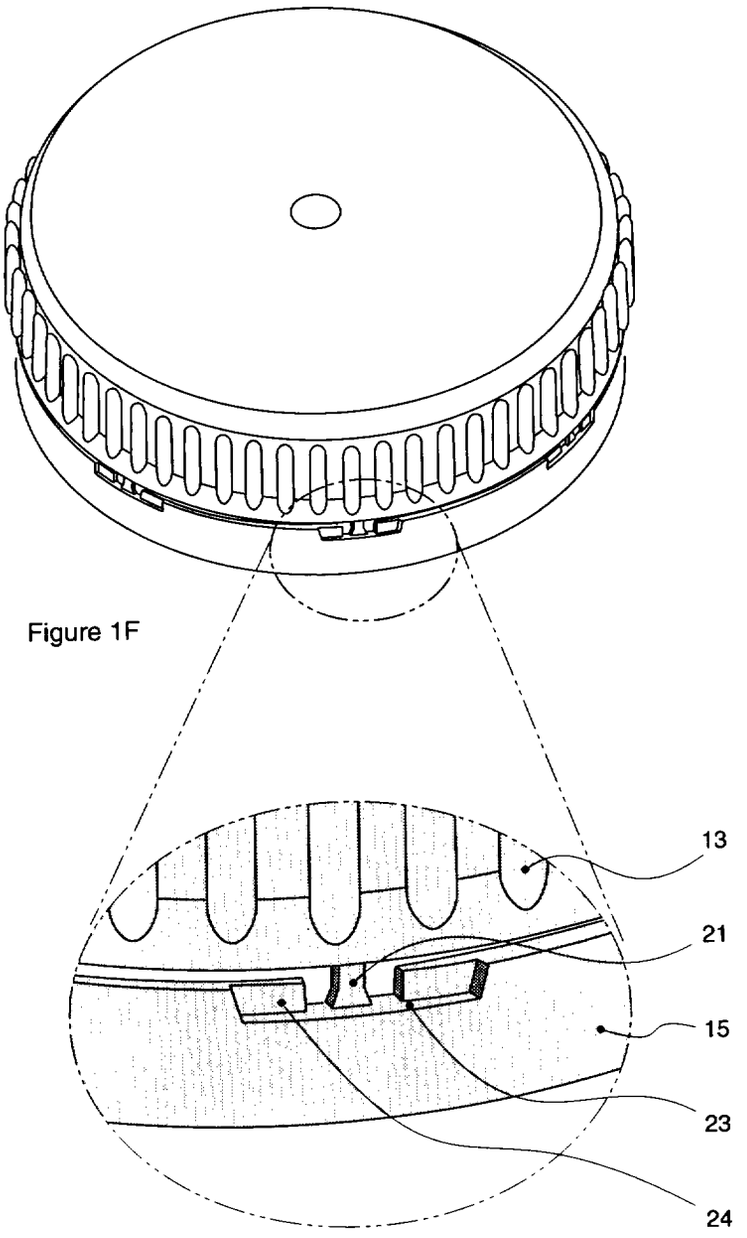

Figure 1F

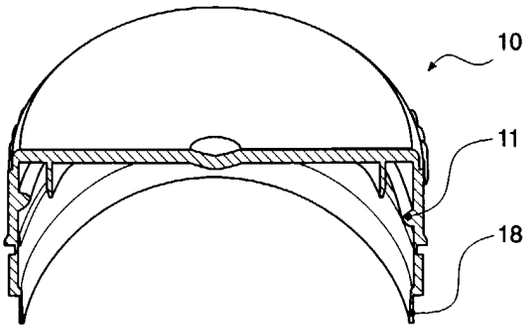

Figure 2A

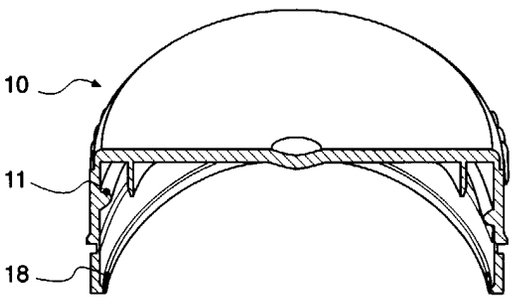

Figure 2B

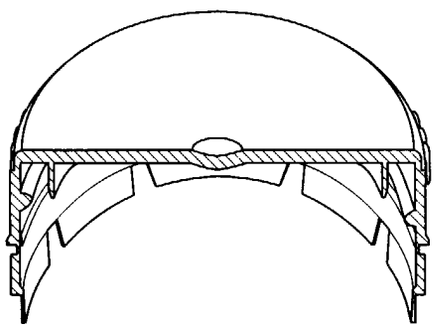

Figure 3A

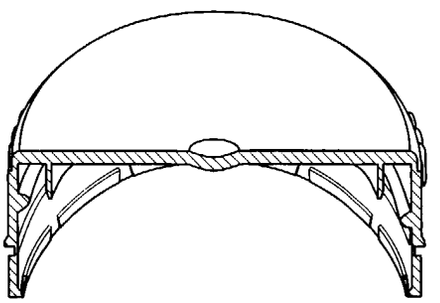

Figure 3B

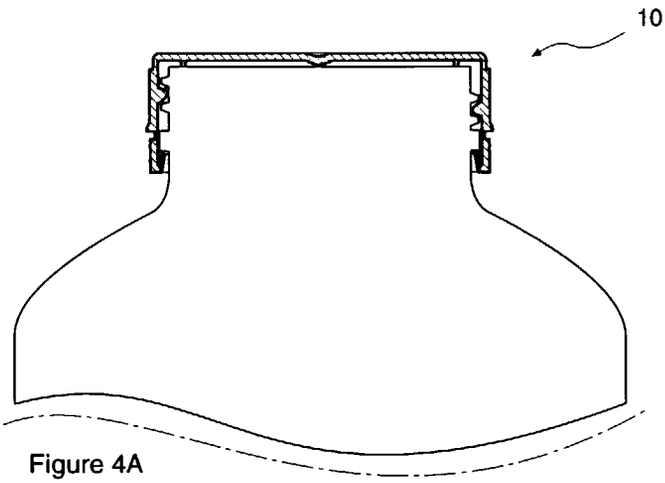

Figure 4A

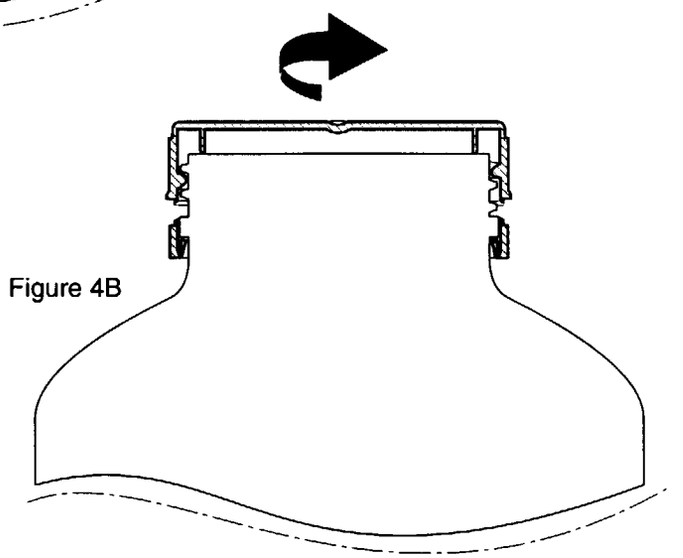

Figure 4B

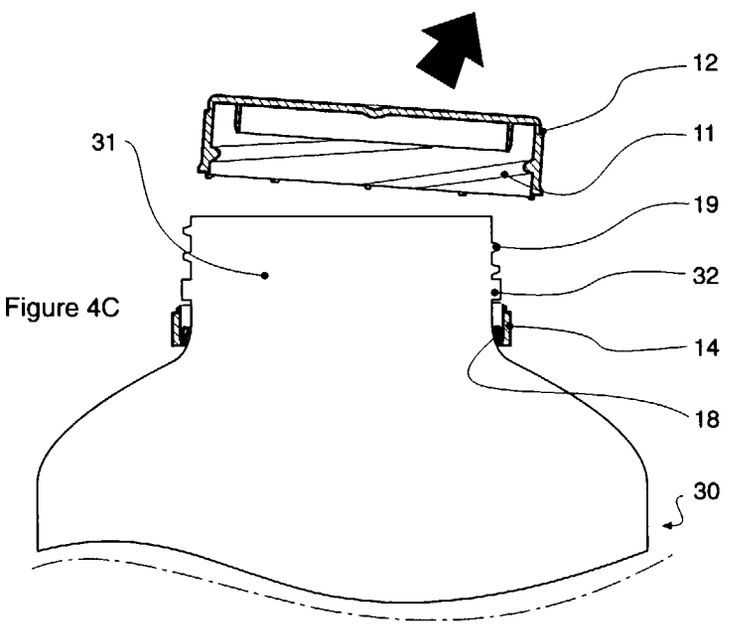

Figure 4C

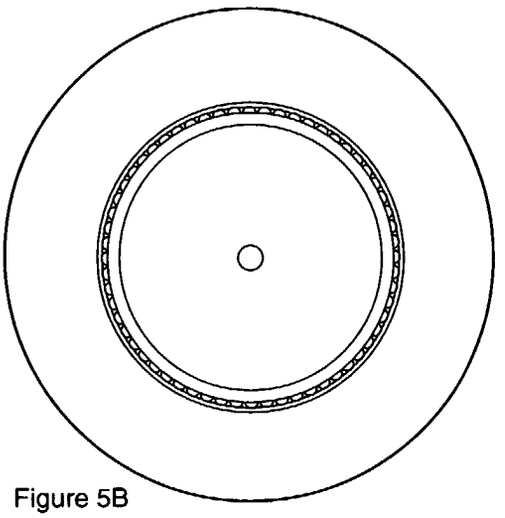

Figure 5B

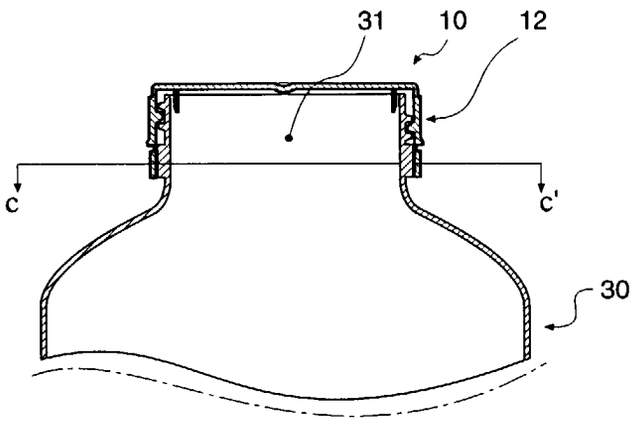

Figure 5A

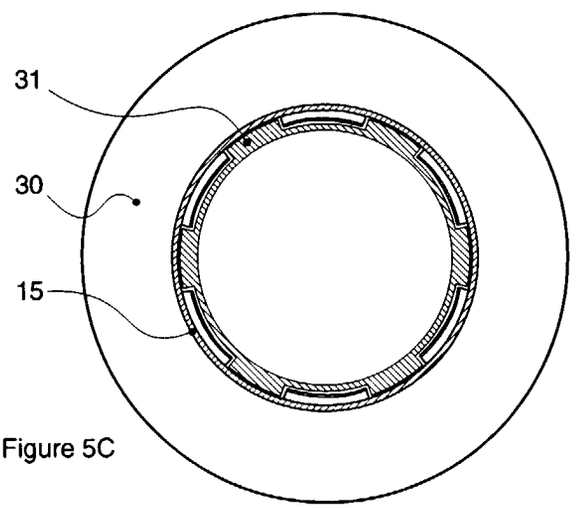

Figure 5C

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 30 6252

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 4 664 278 A (BARRIAC JACQUES J) 12 May 1987 (1987-05-12)	1,2,7,8	B65D41/34
A	* abstract; figures * * column 4, line 23 - column 5, line 25 *	3-6	
X	US 5 397 009 A (RACINE JEAN-PATRICE ET AL) 14 March 1995 (1995-03-14)	1,2,7,8	
A	* abstract; figures *	3-6	
P,X	FR 2 782 699 A (CROWN CORK & SEAL TECH CORP) 3 March 2000 (2000-03-03)	1,2,7,8	
A	* page 4, line 20 - page 5, line 22; figures *	3-6	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B65D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	13 November 2000	SERRANO GALARRAGA, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 00 30 6252

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