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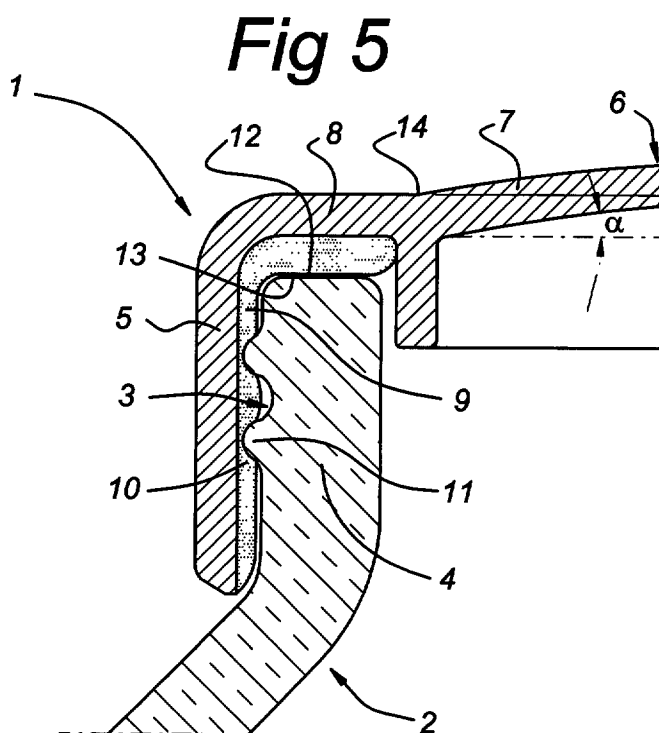
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(54) **Tamper evident closure**

(57) A tamper evident closure for a container (2) such as a jar, comprises a cap (1) and means (3) for connecting the cap (1) to a neck (4) or throat of said container (2), said cap (1) comprising a rim (5) and an end wall (6) which can be brought into two end shapes, one of said end shapes being mechanically stable and the other end shape being mechanically instable, wherein the end wall (6) can be held in its instable position under the influence of a pressure difference over

the inside and the outside when being connected to the container (2), and can be released towards its stable position by removing said pressure difference when being released from the container (2), said transfer from the instable to the stable position being accompanied by an audible sound. The cap (1) is essentially of a polymer material and comprises a central cap part (7) which, in the stable shape of which is defined by an outer surface which is spherically convex.



Description

[0001] The invention is related to a tamper evident closure for a container such as a jar, comprising a cap and means for connecting the cap to a neck or throat of said container, said cap comprising a rim and an end wall which can be brought into two end shapes, one of said end shapes being mechanically stable and the other end shape being mechanically instable, wherein the end wall can be held in its instable position under the influence of a pressure difference over the inside and the outside when being connected to the container, and can be released towards its stable position by removing said pressure difference when being released from the container, said transfer from the instable to the stable position being accompanied by an audible sound.

[0002] Such closures are for instance applied for containers with nutritional or pharmaceutical products. A typical process of manufacturing babyfood in glass jars comprises filling the jars with the contents at increased temperature and placing a cap on the jar by means of a "steamcapper" as is known in the art. Subsequently the jars are placed in a retort for sterilisation, as to guarantee an excellent microbiological quality for the product.

[0003] During and directly after the heat treatment process large changes in physical conditions (pressure, temperature) occur, which puts high demands on the closure with regard to tightness. The closure forms a tight seal which resists the normal forces that could occur during transport and distribution and shelf life.

[0004] In addition, it is of utmost importance to the consumer that the package has not been opened before. This would guarantee the consumer that no micro-organisms, chemicals, toxins etc. have been introduced in the product.

[0005] For this reason, closures have been developed which demonstrate a clear audible signal once the product is being opened. Reference is made to the well-known tin caps for closures of glass jars. On the inside, these caps are covered by a soft material (compound) that can withstand the conditions and allows a consistent closure of the jar. By pressing and twisting the cap can be removed. Once the vacuum, that was created during the cooling process, disappears the cap takes its original form and a "clicking sound" can be heard. Despite the good closure and tamper-evident properties the caps are expensive to produce and are difficult to modify (shape or printing) to give it a unique appearance. The latter disadvantage is more serious when many different products are sold in the same type of package. In addition high demands are put on the quality and nature of the inner compound of the cap, in order to ensure easy twisting of the cap and to prevent contamination of the contents of the jar.

[0006] Furthermore, homogeneous plastic caps have been developed which can resist retorting conditions. However, they appeared not to be able to produce an audible signal. Thus, additional tamper-evident mem-

bers such as a paper or plastic sealing were required. These are however less practical to the consumer.

[0007] Also caps were developed which consisted of two parts: one plastic part which was used for closing the jar and which has a circular opening above the opening of the jar, and a second part that consists of a circular shaped tin plate which fits in this opening and which produces the audible signal when the cap is twisted off. These caps are even more expensive to produce and have more limitations with regard to the possibilities to introduce modifications in the shape of the cap with regard to printing.

[0008] The object of the invention is to provide a closure which does not have these disadvantages, instead the closure should be relatively cheap and should be able to produce an audible sound upon opening. This object is achieved in that the cap is essentially of a polymer material and comprises a central cap part, the stable shape of which is defined by an outer surface which is spherically convex.

[0009] It appears that a cap of a polymer material having a spherically convex stable shape is able to produce an audible signal, upon changing the instable shape into the stable shape. The polymer material in question should be of a certain stiffness for producing such sound, and therefore preference is given to a propylene material. Furthermore, good results are obtained in case at least a part of the cap is of a composite polymer material, e.g. containing fibres.

[0010] Also, the polymer material (compound) can resist the conditions that result from the heating or cooling process. It forms consistently an air tight closure, experiences less problems with lubrication, contamination or discoloration (browning of compound), allows large flexibility with regard to shape or colour of the cap and possibility for printing.

[0011] The loudness of the audible signal can be further improved by selecting an appropriate design of the cap. Preferably, between the central cap part and the rim a ring shaped cap part is provided, the central cap part in its stable shape and said ring shaped cap part intersecting each other according to a non-zero intersecting angle in a radial cross-section of the closure.

[0012] In order to ascertain a proper, tight sealing of the closure, it is preferred that the point of intersection between the central cap part and the ring shaped part, in a radial cross-section of the closure, has a distance to the outside of the rim which is at least equal to the thickness of said rim. In case the inner surface of the rim is coated, the point of intersection has a distance to the outside of the rim which is at least equal to the sum of the thickness of said rim and the thickness of said coating. Good results can be obtained in case the point of intersection has a distance to the outside of the rim which is at least equal to the sum of the thickness of said rim and the thickness of the neck or throat of the jar.

[0013] The transfer between the instable and stable position of the cap can be promoted by introducing a

switch area which has a smaller thickness than the remainder of the cap, said switch area enabling the transfer between the instable and stable positions of the cap. This switch area may have a thickness which is 0,1 - 0,9 times the thickness of the remainder of the cap; preferably the switch area has a thickness which is 0,2 - 0,8 times the thickness of the remainder of the cap.

[0014] Said switch area may be situated at the position of the point of intersection. It can take the form of a continuous ring, but is may also be constituted by a series of spots.

[0015] The intersecting angle α between the central cap part and the ring may be comprised in the range of 2° - 30° ; preferably the intersecting angle α is comprised in the range of 4° - 15° .

[0016] The invention will now be described further with reference to an embodiment of the closure shown in the figures.

[0017] Fig. 1 shows a jar comprising a closure according to the invention.

[0018] Fig. 2 shows an axial cross section through the jar and closure according to fig. 1.

[0019] Fig. 3 shows a view in perspective.

[0020] Fig. 4 shows a view in perspective of the inside of the cap of the closure according to the invention.

[0021] Fig. 5 shows an enlarged detail of the further embodiment of the closure, in axial cross section.

[0022] As shown in the figures 1 - 5, a jar 2, e.g. of glass, is provided with a cap 1 according to the invention. This cap 1 has a rim 5 which comprises a screw thread 10 on the inside. The neck 4 of the jar comprises a corresponding screw thread 11 on the outside. By screwing the cap 1 on the jar 2, a tight seal can be obtained between the upper surface 12 of the neck 4, and the lower surface 13 of the ring shaped cap part 8. This lower side 13 is defined by a coating 9, which stretches over the rim 5 and the ring shaped cap part 8.

[0023] The central cap part 7 is spherically convex, and has a stable dome shaped indicated by with full lines in fig. 5, as well as an instable, almost flat shape indicated with dotted lines in said fig. 5.

[0024] The central cap part 6 joins the ring shaped cap part 8 through a line of intersection 14, which in the embodiment shown is a continuous line. Alternatively, the intersection will also be discontinuous.

[0025] At the spot of the line of intersection 14, a switch area is defined, which switch area may also have a reduced thickness with respect to the remainder of the cap (not shown). For instance, the switch area may have the thickness of 0,1 - 0,9 times the thickness of the remainder of the cap, or preferably 0,2 - 0,8 times.

[0026] At said line of intersection 14, an angle α is defined, in the axial cross section shown in fig. 2, between the ring shaped cap part 8 and the central cap part 7, which angle can range from 2° to 30° . Preferably, the intersecting angle α is comprised in the range of 4° - 15° .

[0027] The distance w between the line of intersection 14 and the outer circumference of the ring, is preferably

at least equal to the sum of the thickness of said ring, the thickness of the coating 9, and the thickness of the neck 4.

Claims

1. Tamper evident closure for a container (2) such as a jar, comprising a cap (1) and means (3) for connecting the cap (1) to a neck (4) or throat of said container (2), said cap (1) comprising a rim (5) and an end wall (6) which can be brought into two end shapes, one of said end shapes being mechanically stable and the other end shape being mechanically instable, wherein the end wall (6) can be held in its instable position under the influence of a pressure difference over the inside and the outside when being connected to the container (2), and can be released towards its stable position by removing said pressure difference when being released from the container (2), said transfer from the instable to the stable position being accompanied by an audible sound, **characterised in that** the cap (1) is essentially of a polymer material and comprises a central cap part (7) which, in the stable shape of which is defined by an outer surface which is spherically convex.
2. Container according to claim 1, wherein between the central cap part (7) and the rim (5) a ring shaped cap part (8) is provided, the central cap part in its stable shape and said ring shaped cap part (8) intersecting each other according to a non-zero intersecting angle in a radial cross-section of the closure.
3. Container according to claim 2, wherein the intersecting angle α is comprised in the range of 2° - 30° .
4. Container according to claim 3, wherein the intersecting angle α is comprised in the range of 4° - 15° .
5. Container according to claim 2, 3 or 4, wherein the point of intersection between the central cap part (7) and the ring shaped part (8), in a radial cross-section of the closure, has a distance to the outside of the rim (5) which is at least equal to the thickness of said rim (5).
6. Container according to claim 5, wherein the inner surface of the rim (5) is coated, the point of intersection having a distance to the outside of the rim (5) which is at least equal to the sum of the thickness of said rim (5) and the thickness of said coating (9).
7. Container according to claim 5 or 6, wherein the point of intersection has a distance to the outside of the rim (5) which is at least equal to the sum of the

thickness of said rim (5) and the thickness of said neck (4) or throat.

8. Container according to any of the preceding claims, wherein the cap (1) has at least one switch area which has a smaller thickness than the remainder of the cap, said at least one switch area enabling the transfer between the instable and stable positions of the cap (1). 5 10
9. Container according to claim 8, wherein the switch area has a thickness which is 0,1 - 0,9 times the thickness of the remainder of the cap.
10. Container according to claim 9, wherein the switch area has a thickness which is 0,2 - 0,8 times the thickness of the remainder of the cap. 15
11. Container according to any of claims 2 - 10, wherein the switch area is at the position of the point of intersection. 20
12. Container according to claim 8, 9, 10 or 11 wherein the switch area is a continuous ring. 25
13. Container according to claim 8, 9, 10 or 11, wherein the switch area is constituted by a series of spots.
14. Container according to any of the preceding claims, wherein the cap (1) is of a propylene polymer. 30
15. Container according to claim 14, wherein the cap (1) is of a composite polymer material.
16. Container according to claim 15, wherein at least one part of the cap (1) is of a composite polymer material containing fibres. 35
17. Container according to any of the preceding claims 1 - 13, wherein the coating is of a polyethylene polymer. 40
18. Cap (1) for a closure according to any of the preceding claims. 45

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Fig 1

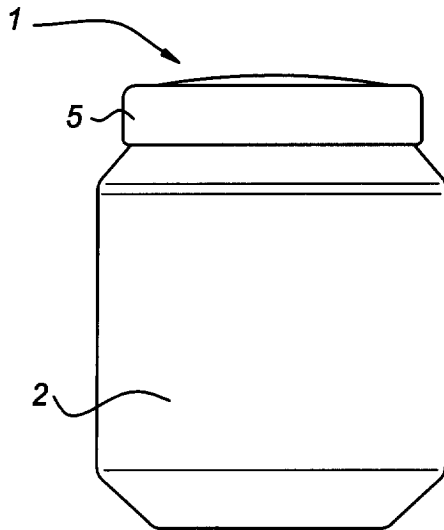


Fig 2

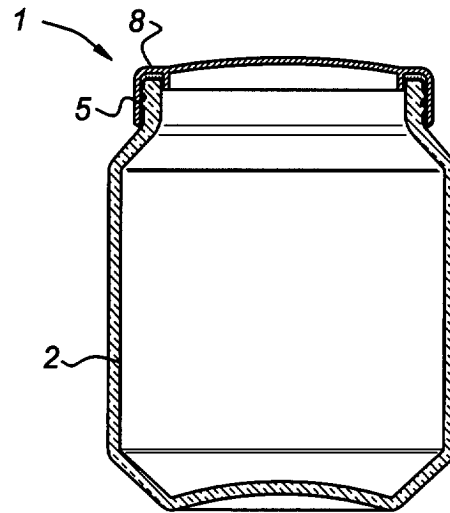


Fig 3

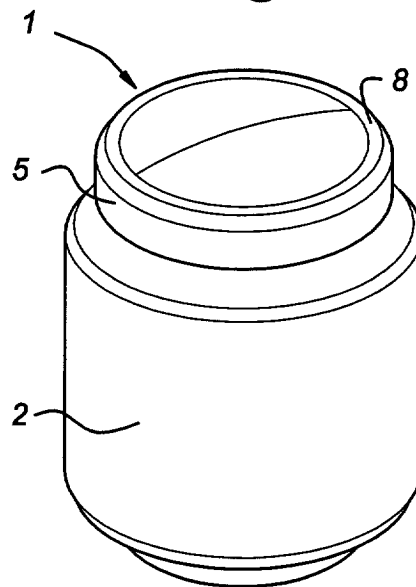


Fig 4

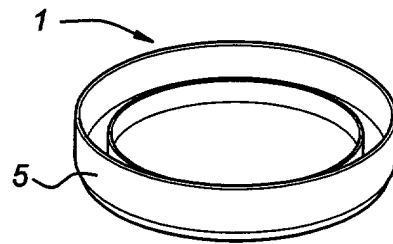
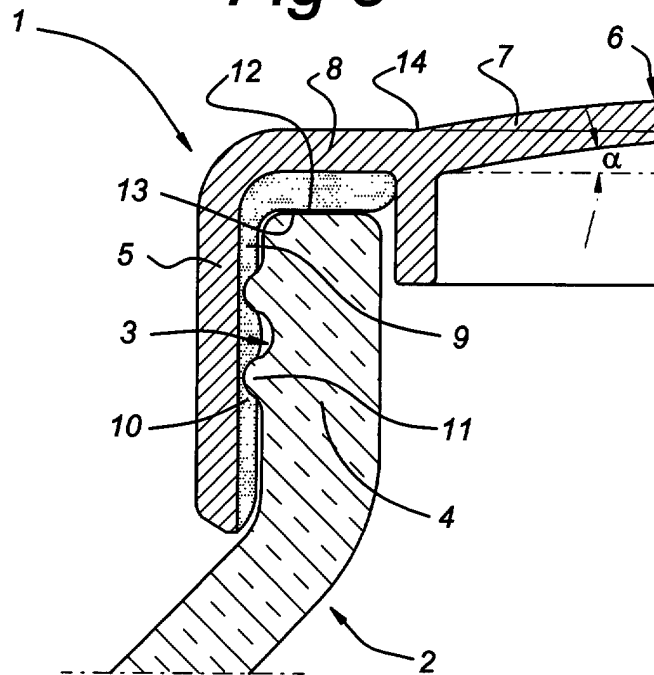


Fig 5





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EUROPEAN SEARCH REPORT

Application Number
EP 01 20 0651

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X	EP 0 179 199 A (ANCHOR HOCKING CORP) 30 April 1986 (1986-04-30) * page 1, paragraph 1 - paragraph 3 * * page 4, line 15 - line 23 * * page 5, line 11 - line 18; figures 1-4 *	1-7,18	B65D51/24
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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
BERLIN		9 August 2001	Spettel, J
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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