



(11)

EP 4 480 843 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
25.12.2024 Bulletin 2024/52

(51) International Patent Classification (IPC):
B65D 5/74 (2006.01)

(21) Application number: **24182455.6**

(52) Cooperative Patent Classification (CPC):
B65D 5/749; B65D 2251/0025; B65D 2251/0093

(22) Date of filing: **17.06.2024**

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

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(30) Priority: **22.06.2023 IT 202300012951**

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(54) **OPENING DEVICE FOR A PACKAGING FOR POURABLE PRODUCTS, PACKAGE THEREWITH AND METHODS FOR EVALUATING IF AN OPENING DEVICE HAS ALREADY BEEN OPENED AT LEAST ONCE**

(57) There is described an opening device (1) configured to be applied to a packaging (3) for pourable products, the opening device (1) comprises: a pouring spout (10) defining a pouring opening through which to pour, in use, the pourable product; a cap (12) configured to engage and disengage the pouring spout (10) to respectively close and open the pouring opening; a closing element (30) closing and/or sealing the pouring opening, formed in one piece with the pouring spout (10) and connected to the pouring spout (10) by a breakable connecting portion (31) configured to break during first opening of the opening device (1); the closing element (30) comprising a protruding portion (24) extending through the pouring opening and connected to the cap (12); and tamper-evidence ring (21) fitted to the pouring spout (10); wherein the cap (12) is hinged to the tamper-evidence ring (21) thereby being permanently tethered to the pouring spout (10).

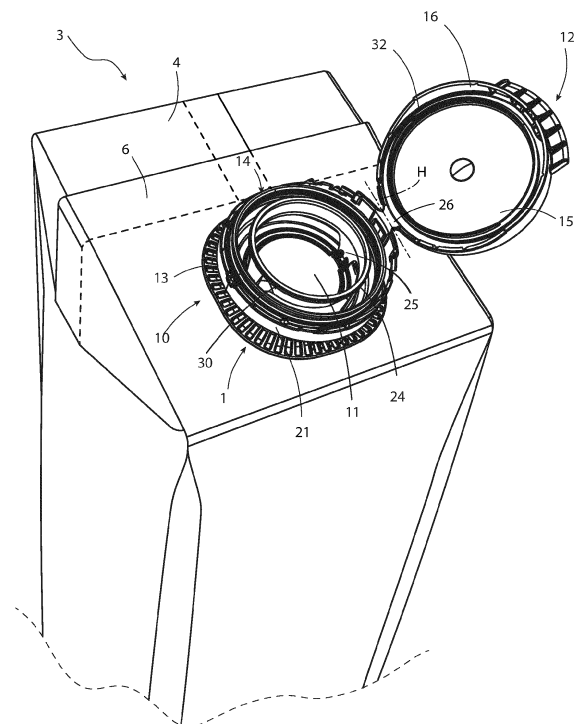


FIG.2

Description

TECHNICAL FIELD

[0001] The present invention relates to an opening device, in particular to a reclosable opening device, configured to be applied to a packaging for pourable products, in particular to a sheet packaging material for forming a package containing a pourable product, preferably a pourable food product.

[0002] More specifically, this invention relates to an opening device designed to be directly molded onto the sheet packaging material, in turn adapted to be folded, filled with the pourable product and sealed to form the package.

[0003] This invention also relates to a method for evaluating if an opening device has already been opened at least once.

BACKGROUND ART

[0004] As it is generally known, many pourable food products, such as fruit juice, UHT (ultra-high temperature-treated) milk, wine, tomato sauce, etc., are sold in packages made of sterilized packaging material.

[0005] A typical example is the parallelepiped-shaped package for pourable food products known as Tetra Brik Aseptic (registered trademark), which is made by folding and sealing a laminated sheet of packaging material.

[0006] In particular, the packaging material has a multi-layer structure substantially comprising a base layer for stiffness and strength, which may be made of fibrous material, e.g. paper or mineral-filled polypropylene material, and a number of lamination layers made of heat-seal plastic material, e.g. polyethylene films, covering both sides of the base layer.

[0007] In the case of aseptic packages for long-storage products, such as UHT milk or fruit juice, the packaging material also comprises a layer of gas-barrier material, e.g. aluminum foil or ethyl vinyl alcohol (EVOH) film, which is superimposed on a layer of heat-seal plastic material, and is in turn covered with another layer of heat-seal plastic material. This latter layer of plastic material forms the inner face of the package eventually contacting the pourable food product.

[0008] Packages of this sort are normally produced on fully automatic packaging machines, in which a continuous tube is formed from the sheet of packaging material.

[0009] Furthermore, the sheet of packaging material is sterilized in the packaging machine by applying a chemical sterilization agent, which is then removed after sterilization is completed.

[0010] Subsequently, the sheet of packaging material is maintained in a closed, sterile environment and is folded and sealed longitudinally to form the tube.

[0011] In order to complete the forming operations, the tube is filled from above, by means of a pipe, with the pourable food product and is formed, sealed and subse-

quently cut along equally spaced transversal cross sections.

[0012] Pillow packs are obtained thereby, which have a longitudinal sealing band, a top transversal sealing band and a bottom transversal sealing band, and which are then folded mechanically to form respective finished substantially parallelepiped-shaped packages.

[0013] Alternatively, the packaging material may be cut into blanks, which are formed into packages on forming spindles, and the resulting packages are filled with the food product and sealed. One example of such package is the so-called "gable top" package commonly known by the trade name Tetra Rex (registered trademark).

[0014] To open the packages described above, various solutions have been proposed, one of which involves the use of reclosable opening devices made of plastic material and substantially comprising a pouring spout, defining a through pouring opening and fitted over a hole or a pierceable or tear-off portion arranged onto a wall, typically a top wall, of the package.

[0015] According to a known solution, the pouring spout is fitted over a so-called prelaminated hole, i.e. a hole formed through the base layer only and covered, by means of a lamination process, by the other lamination layers of the packaging material, including the layer of gas-barrier material.

[0016] According to some solutions, the pouring spout is fitted, typically glued, onto the pierceable portion of the prelaminated hole, which is made of such lamination layers.

[0017] According to an alternative solution, the pierceable portion may be defined by a patch attached to the packaging material to close a hole formed, in this case, through the full thickness of the packaging material.

[0018] According to a known solution, the opening of the pouring spout is sealed by a plastic closing element connected integrally to the pouring spout and detachable from it along a smaller-section annular tearable membrane.

[0019] In particular, the pouring spout and the closing element are injection-molded in one piece directly on the pierceable portion formed in the packaging material.

[0020] The closing element extends substantially at the same level as the packaging material, so as to seal the hole obtained at the top wall of the package.

[0021] The closing element is configured to be removed during first opening of the opening device.

[0022] The opening devices of the above-mentioned type further comprise a removable cap (or lid), which is configured to be fitted to the pouring spout to outwardly closing the latter and allowing closure of the package after the first opening thereof, i.e. after removal of the closing element.

[0023] During the production of the opening device, the pierceable portion on which the pouring spout and the closing element are to be formed is placed between two molds in an open configuration. The molds are then displaced towards the packaging material to reach a

closed configuration, in which they cooperate with opposite faces of the packaging material and define a closed mold cavity housing the above-mentioned pierceable portion.

[0024] The injection molding operation is performed by injecting the molten plastic material into the mold cavity defined by the molds in the closed configuration. More specifically, the molten plastic material is forced to fill completely the mold cavity so as to form the pouring spout and the closing element.

[0025] In particular, the molten plastic material is injected onto the side of the pierceable portion which will face the inside of the finished package, thereby forming the closing element attached onto that side. Due to the molding pressure and to the particular geometry of the molds, the molten plastic material is then forced to pierce the pierceable portion and protrude from the other side thereof.

[0026] In this way, the pouring spout is formed integrally with the closing element and protruding from the other side of the pierceable portion. Hence, the pouring opening is closed, at one side thereof near the pierceable portion, by the closing element.

[0027] Subsequently, the cap, formed separately, is fitted to the pouring spout to close the pouring opening at another side thereof different from (opposite to) the one closed by the closing element.

[0028] It is known in the field the constantly growing need for reducing the environmental impact that comes along with packaging and bottling of foodstuff and non-foodstuff products. In particular, due care must be taken with regard to the plastic components of the packages, which can pollute aquatic and terrestrial environments.

[0029] Patent documents EP3715276, EP3892564, EP3892563, EP4159631, EP3892560, EP3984898 in the name of the Patentee disclose opening devices including a hinge element to prevent the cap from being dispersed in the environment after opening. These opening devices include a pouring spout, a cap configured to engage and disengage said pouring spout to respectively close and open the pouring opening, and a tamper-evidence ring initially connected to the cap by means of at least one breakable connecting bridge configured to break during first opening of said opening device.

[0030] Although the breakable connecting bridge provide an effective visual indication of whether the cap has already been opened at least once, the need is felt in the field to provide tamper evidence means that is not only of visual nature.

DISCLOSURE OF INVENTION

[0031] It is therefore an object of the present invention to provide an opening device configured to be applied to a packaging for pourable products, and a method for evaluating if an opening device has already been opened, which overcomes at least one of the above-mentioned drawbacks.

[0032] This object is achieved by an opening device and by a method for evaluating if an opening device has already been opened, as claimed in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a top portion of a sealed package for containing pourable products, onto which an opening device according to the present invention is fitted, wherein the opening device is arranged in a first closed configuration;

Figure 2 is a perspective view of the top portion of the sealed package of Figure 1, with the opening device arranged in an open configuration;

Figure 3 is a top view of the opening device of Figure 1, with a cap of the opening device being arranged in a first angular position, and

Figure 4 is a top view of the opening device of Figure 1, with the cap arranged in a second angular position indicative of the fact that the opening device is in a second closed configuration.

BEST MODE FOR CARRYING OUT THE INVENTION

[0034] With reference to Figure 1, number 1 indicates as a whole an opening device configured to be applied to a packaging for pourable products, preferably pourable food products.

[0035] In the example shown, the packaging is defined by a package 3 made of a multilayer sheet of packaging material, adapted to contain the pourable product, and having a wall, in particular a top wall 4, onto which opening device 1, preferably made of plastic material, is fitted. Preferably, top wall 4 includes a top transversal sealing band 6.

[0036] In particular, package 3 is adapted to contain a pourable food product, such as milk, water, fruit juice or the like.

[0037] In the example shown, opening device 1 is fitted to an opening area of packaging material, in turn folded, filled with the pourable product and sealed in a known manner to form package 3. The opening area is arranged in a region of packaging material which will form top wall 4 of package 3.

[0038] According to an alternative embodiment not shown, opening device 1 is fitted to the opening area after package 3 has been completely formed, in this case by conventional fixing means, such as adhesive substances, e.g. glue, or by means of welding technics, e.g. laser welding or microflame welding.

[0039] With reference to the embodiment shown, packaging material comprises a base layer for providing stiffness and strength, which may be made of fibrous

material, e.g. paper or mineral-filled polypropylene material, and a cover layer arrangement.

[0040] In detail, cover layer arrangement comprises a first covering layer and a second covering layer, both made of heat-seal plastic material, e.g. polyethylene film, and covering both sides of base layer.

[0041] Packaging material comprises, at the opening area, a pierceable portion (or opening portion) to which opening device 1 is fitted and which is configured to be detached, at least partially, from top wall 4 in order to allow, in use and after forming of package 3, the pourable product to exit package 3.

[0042] Therefore, pierceable portion defines the opening area to which opening device 1 is fitted.

[0043] In another embodiment not shown, opening area may be a through hole made in the packaging material, in particular in the portion of packaging material forming top wall 4.

[0044] In the present case, package 3 is an aseptic package for long-storage food products; accordingly, cover layer arrangement also comprises a barrier layer made of gas-barrier material, e.g. aluminum foil or ethyl vinyl alcohol (EVOH) film, which is superimposed on the second covering layer and is in turn covered with a third covering layer of cover layer arrangement, made of heat-seal plastic material.

[0045] In particular, third covering layer forms the inner face of package 3 eventually containing the pourable food product.

[0046] In other words, first covering layer, second covering layer, barrier layer and third covering layer define lamination layers applied, by a lamination process, to base layer when producing packaging material in the form of a continuous sheet, before cutting and folding it to form package 3.

[0047] Pierceable portion is defined by a through hole formed only through base layer and covered by first covering layer, second covering layer, barrier layer and third covering layer.

[0048] In practice, pierceable portion is made of the above-mentioned lamination layers and closes the through hole formed in base layer.

[0049] Preferably, pierceable portion is an integral part of cover layer arrangement.

[0050] According to an alternative embodiment not shown, pierceable portion may be made of only one or more of first covering layer, second covering layer, barrier layer and third covering layer. For example, pierceable portion may be made solely of barrier layer.

[0051] In a further alternative embodiment not shown, pierceable portion may be defined by a patch attached to packaging material to cover a hole formed, in this case, through the full thickness of packaging material.

[0052] Pierceable portion has an axis, preferably orthogonal relative to top wall 4, in particular vertical when package 3 stands on a bottom wall.

[0053] According to the non-limiting example shown, pierceable portion has a substantially circular shape

concentric to the axis of pierceable portion.

[0054] With reference to Figures 1 to 3, opening device 1 comprises:

- 5 - a pouring spout 10 fixed to top wall 4 - i.e. to packaging material - at pierceable portion and defining a through pouring opening, i.e. a passage 11, for the pourable product ending with an opening through which the pourable product is poured, in use;
- 10 - a closing element 30 closing and/or sealing passage 11 at one region of passage 11, in particular at the same level of packaging material, and integrally connected to spout 10 by a smaller-section annular membrane adapted to be easily torn during first opening of opening device 1; and
- 15 - a cap 12 configured to cooperate in contact with spout 10, in particular configured to engage spout 10 to close passage 11 at said opening, i.e. at a region of passage 11 different from (opposite to) that closed and/or sealed by closing element 30.

[0055] Annular membrane defines a tear line along which to detach in use closing element 30 from spout 10.

[0056] According to this non-limiting preferred embodiment of the present invention, spout 10 and closing element 30 are formed integrally in one piece and fitted directly onto pierceable portion, whilst cap 12 is formed separately from spout 10 and closing element 30 and subsequently fitted to spout 10.

25 **[0057]** In particular, according to the solution disclosed hereby, spout 10 and closing element 30 are obtained by molding molten plastic material - in particular by an injection molding operation - on the packaging material before it is transformed into package 3.

30 **[0058]** More specifically, the molten plastic material is injected onto one side - i.e. the side eventually facing the inside of package - of pierceable portion placed in a known manner within a molding apparatus (known per se and not shown). In particular, the molten plastic material covers a first side up to an annular peripheral region thereof, so as to form, in this way, closing element 30 directly attached to pierceable portion. The molten plastic material is then forced to pierce pierceable portion at such annular peripheral region to form spout 10 projecting from an opposite side of pierceable portion. More in particular, spout 10 is connected to closing element 30 through annular membrane.

35 **[0059]** In this way, pierceable portion is first pierced and then re-sealed by the plastic material forming closing element 30.

40 **[0060]** Spout 10 comprises a base plate 13. Base plate 13 preferably is flat, molded to packaging material substantially parallel to top wall 4 of package 3 so as to surround pierceable portion and comprising closing element 30.

45 **[0061]** In particular, base plate 13 is molded onto the first side of pierceable portion. Therefore, closing element 30 and pierceable portion together define a sealing

portion sealing passage 11.

[0062] Closing element 30 substantially has a confetti portion and defines a substantially radial prolongation of base plate 13, transversally with respect to axis of spout 10.

[0063] In practice, closing element 30 initially closes and/or seals one axial end of the passage 11, whereas cap 12 closes, in use, the opposite axial end of the passage 11, i.e. opening.

[0064] Spout 10 further comprises a cylindrical collar 14 projecting transversally, in particular orthogonally, from base plate 13. Spout 10 extends about a longitudinal axis. The longitudinal axis coincides with to the axis of the collar. The longitudinal axis is coaxial, in use, to axis of the pierceable portion. The longitudinal axis is coaxial, in use, to axis of the cap 12 when the cap is arranged in the closed position. In particular, collar 14 coaxially defines the passage 11.

[0065] In practice, collar 14 of spout 10 extends through pierceable portion as a follow-on from the piercing thereof, so as to be arranged on both sides of pierceable portion.

[0066] As visible in Figures 1 and 2, cap 12 comprises a substantially flat circular portion 15 and a cylindrical portion 16, which projects from flat portion 15 along a longitudinal axis of cap 12 itself and which is configured to coaxially engage collar 14 in order to close the passage 11.

[0067] For this purpose, cap 12 is provided with an annular engaging portion 32 protruding from flat portion 15 in a direction substantially parallel to the axis of cap 12, from the same side cylindrical portion 16 protrudes from, and configured to engage collar 14 of spout 10 in order to close passage.

[0068] In detail, engaging portion 32 is arranged in a position radially closer to the axis of cap 12 than cylindrical portion 16 and is configured to engage collar 14 defining a snap-in coupling.

[0069] In greater detail, engaging portion 32 has a substantially hook-shaped cross section, with the concave inner part facing towards the axis of cap 12 and the convex outer part facing an internal lateral surface of cylindrical portion 16.

[0070] In use, cap 12 is moveable between:

- a closed position, in which cap 12 is engaged to collar 14 thereby closing the passage 11 and the opening; and
- an open position, in which cap 12 is disengaged from collar 14 and removed from spout 10.

[0071] When cap 12 is in the closed position, engaging portion 32 engages the passage 11 of collar 14. More specifically, the outer convex part cooperates in contact with an internal surface of collar 14, thereby defining the above-mentioned snap-in coupling between cap 12 and collar 14 and thereby slightly bending inwardly towards the axis of cap 12 (and, therefore, the axis of collar 14)

due to the pushing action of collar 14 thereon.

[0072] Opening device 1 further comprises a ring 21 (in particular, a tamper-evidence ring 21). Ring 21 is fitted to the pouring spout 10. Ring 21 is preferably formed integrally with cap 12, for example injection-molded together with cap 12. Preferably, tamper-evidence ring 21 is initially connected coaxially to an edge of cap 12 by means of a number of breakable connecting bridges.

[0073] In detail, cap 12 is engaged initially (before first opening) to collar 14 of spout 10 in the closed position, with edge and tamper-evidence ring 21 still connected to one another by the breakable connecting bridges.

[0074] According to this embodiment, tamper-evidence ring 21 is substantially axially fixed relatively to the axis of spout 10, and, once detached from cap 12, tamper-evidence ring 21 remains substantially axially fixed relatively to axis of spout 10.

[0075] To this end, collar 14 comprises an annular protrusion defining an axial abutment for a corresponding annular protrusion of tamper-evidence ring 21.

[0076] Conveniently, protrusion of collar radially protrudes outwards from collar 14 with respect to the axis of collar 14, whilst protrusion of tamper-evidence ring 21 radially protrudes inwardly with respect to the axis of collar 14, when tamper-evidence ring 21 is fitted to collar 14.

[0077] Once cap 12 is fitted onto spout 10, tamper-evidence ring 21 engages collar 14 so that protrusion of tamper-evidence ring 21 is arranged in an axial position closer to pierceable portion than protrusion of collar 14.

[0078] Once unsealed, cap 12 is moveable between the closed position and the open position.

[0079] During first disengagement of cap 12 from collar 14, that is during first movement of cap 12 from its closed position to its open position, the connecting bridges initially connecting tamper-evidence ring 21 and cap 12 break.

[0080] More specifically, after the first disengagement of cap 12 from collar 14, protrusion of tamper-evidence ring 21 axially abuts against protrusion of collar, which, as stated above, acts as an axial stop for such protrusion of tamper-evidence ring.

[0081] Due to the force applied to the connecting bridges, these latter break, thereby freeing cap 12 from tamper-evidence ring 21 and permitting the disengaging of the latter from collar 14.

[0082] It is known in the field that, after unsealing cap 12, i.e. after detaching cap 12 from tamper-evidence ring 21 and disengaging cap 12 from collar 14, closing element 30 and pierceable portion must also be removed in order to access the pourable product inside package 3.

[0083] For this purpose, closing element 30 comprises, in particular is formed in one piece with, a protruding portion 24 initially extending (before first opening) through the passage 11 and configured to be connected, in particular welded, to cap 12, in particular to flat portion 15, once cap 12 has been fitted to spout 10.

[0084] During fitting of cap 12 to spout 10, protruding

portion 24 is connected (fixed), in particular welded, to flat portion 15 according to a manner known and not described in detail.

[0085] As shown in Figure 2, protruding portion 24 comprises at least two legs 25 axially protruding from closing element 30 and connecting closing element 30 with flat portion 15, once cap 12 has been fitted to spout 10.

[0086] In particular, legs 25 are formed in one piece with closing element 30 and spout 10 during injection of the molten plastic material at pierceable portion, as described above.

[0087] During first opening of opening device 1, cap 12 is pulled up by the user. Consequently, cap 12 is disengaged from collar 14 and legs 25, welded to flat portion 15, exert a pulling action on closing element 30. Accordingly, closing element 30 is torn from base plate 13 of spout 10 along annular membrane.

[0088] In particular, the tearing starts at a given point of annular membrane, which acts as a weakened region of base plate 13, and then propagates to the rest of membrane until it causes a complete detachment of closing element 30 from spout 10, and, therefore, of pierceable portion from packaging material and top wall 4.

[0089] According to an aspect of the present invention, cap 12 is connected to tamper-evidence ring 21, thereby being permanently tethered to spout 10, once cap 12 is fitted thereto. Preferably, cap 12 is hinged to tamper-evidence ring 21.

[0090] In detail, opening device 1 comprises a hinge element, preferably defined by a plastic hinge 26, permanently hinging cap 12 to ring 21 (in particular, tamper-evidence 21).

[0091] Hence, hinge 26 is so configured as to allow cap 12 to be disengaged from collar 14 and to prevent cap 12 from being detached (and in particular disposed of separately) from spout 10, i.e. from packaging material and/or package 3.

[0092] Preferably, before first opening, hinge 26 is angularly fixed relatively to axis of cap and/or collar.

[0093] In detail, hinge 26 comprises a first end portion fitted to cap 12, a second end portion fitted to tamper-evidence ring 21 and a connection portion connecting first end portion and second end portion 28 to one another.

[0094] In more detail, first end portion is fitted to cylindrical portion 16 of cap 12, and second end portion is fitted to an external lateral surface of tamper-evidence ring.

[0095] In this specific example, first end portion, second end portion and connection portion are formed integrally in one piece.

[0096] Preferably, cap 12 and hinge 26 are formed integrally in one piece.

[0097] Even more preferably, cap 12, hinge 26 and tamper-evidence ring 21 are formed integrally in one piece, and subsequently fitted to spout 10, as described above. The hinge element 26 defines a hinge axis H. The hinge axis H is perpendicular to the longitudinal axis (i.e.

axis of the spout 10 and/or of the cap 12 when being in the closed position). The opening device 1 is configured to be opened and/or closed by a purely rotational movement of the cap 12 about the hinge axis H, in particular by effect of the pulling action exerted by the user on the cap 12. Hence, the opening device 1 is of so called "flip-type", opposite to so called "screw-type". In particular, screw-type caps while rotating about the longitudinal axis are also translated along the longitudinal axis, due to a helical thread in the spout coupled to a helical thread in the cap. On the contrary, the cap 12 when being rotated about the longitudinal axis (i.e. axis of the spout 10 and/or of the cap 12 when being in the closed position) does not move along the longitudinal axis. So, rotation of the cap 12 about the longitudinal axis does not cause opening; in order to open the cap 12 one needs to rotate it about the hinge axis H.

[0098] Preferably, the cap 12 comprises a lifting portion 27 configured to be pulled by a user to open the pouring opening. In particular, the lifting portion 27 extends parallel to the flat portion 15 and radially protrudes out of the cylindrical portion 16. Preferably, lifting portion 27 is positioned, with respect to the axis of cap 12, opposite to hinge element 26. The lifting portion 27, before the first opening, is in a first angular position with respect to the longitudinal axis (illustrated in Figure 3).

[0099] According to an aspect of the present invention, the opening device 1, before the first opening, is arranged in a first closed configuration. In said first closed configuration, the cap 12 engages with the pouring spout 10 to close the pouring opening (i.e. is in the closed position). Also, in said first closed configuration, the cap 12 is prevented from rotating about the longitudinal axis (i.e. axis of spout 10), at least under a force that can be exerted by a user. In particular, in said first closed configuration, closing element 30 is attached to spout 10 by the breakable connecting portion (i.e. annular membrane) and is also attached to cap 12 through the protruding portion 24. As a consequence, the cap 12 is connected to the spout 10 and/or to the package 3 and cannot rotate with respect to the spout 10 and/or package 3. In particular, due to the geometry of the cap 12, the closing element 30 and the annular membrane, if the user before the first opening tries to rotate the cap 12 about the longitudinal axis (i.e. axis of the spout 10), he cannot obtain such a rotation. In fact, the force that would be required is too high for a human user relaying on his hands.

[0100] After the first opening, the opening device 1 is arrangeable and/or arranged in a second closed configuration. In said closed configuration, said cap 12 engages with the pouring spout 10 to close the pouring opening (i.e. is in the closed position). However, with the opening device 1 being in the second closed configuration, the cap 12 is rotatable in a plurality of different angular positions about the longitudinal axis i.e. the axis of the spout 10 and/or the axis of the cap 12. In particular, the cap 12 being in the second closed configuration is

arrangeable both in the first angular position (illustrated in Figure 3) and in a second angular position different from the first angular position (illustrated in Figure 4).

[0101] In fact, during first opening, the user pulls the cap 12 so that it rotates about the hinge axis H and frees the pouring opening. The closing element 30 is raised together with the cap 12 and the breakable connecting portion (i.e. annular membrane) is broken by the pulling action exerted by the user. Hence, after the first opening, the cap 12 is not connected to the spout 10 and/or to the package 3 anymore, and can rotate with respect to the spout 10 and/or package 3. In particular, in said second closed configuration, the cap 12 is freely rotatable around the longitudinal axis i.e. axis of the spout 10 and/or axis of the cap 12 (apart from frictions that are easily overcome by the user).

[0102] Therefore, the user can recognize whether the first opening has already occurred or not, by trying to rotate the cap 12 around the longitudinal axis: if the cap is prevented from rotating, the user gets an indication that the first opening has not occurred, while if the cap is free to rotate (under the rotation force imparted by the user), the user gets an indication that the first opening has already occurred. As a result, the present disclosure provides a tamper-evidence or tamper-evident feature based on the possibility to rotate the cap about the longitudinal axis.

[0103] Clearly, also blind users, or people in a dark ambient with very limited light (i.e. during the night or in a dark room), may try to rotate the cap to understand if it has already been opened at least once. Hence, an effective tamper-evidence feature is provided, which can be effectively exploited by blind users and not blind users in particular when being in a dark ambient. In contrast, recognizing by a tactile feeling whether the breakable connecting bridges have been broken is quite hard. However, the above explained tamper-evidence feature (of tactile nature) can be provided in addition or in alternative to the breakable connecting bridges, which define a tamper-evidence feature of visual nature.

[0104] Also, it is noted that while the breakable connecting bridges provide an indication of whether the cap has been partially opened (i.e. the cap has been partially moved with respect to the spout), the tamper-evidence feature of the present invention provides an indication of whether the cap has been fully opened (i.e. the cap has been fully detached from the spout so to completely free the pouring opening).

[0105] Furthermore, as in the second closed configuration the cap 12 is arrangeable in a plurality of different angular positions, it is possible that the user recognizes that the first opening has occurred by observing that the cap 12 is in a position different from a first predetermined angular position that it has before the first opening. In particular, in said first predetermined angular position, the hinge axis H is perpendicular to the top transversal sealing band 6 (even more in particular, an imaginary line connecting a lifting portion 27 and the hinge element 26

lies parallel to the top transversal sealing band 6). If the user sees (or feels with his hands) that the cap 12 is not in such a first predetermined angular position, he can recognize that the first opening has already occurred, even without trying to rotate the cap 12 further.

[0106] It is noted that the tamper-evidence feature which is object of the present invention is particularly advantageous in an opening device 1 that is configured to be opened by a purely rotational movement about the hinge axis (i.e. so called "flip-type" opening device). In fact, when the user tries to rotate the cap 12 to check if the first opening has occurred, the cap 12 remains in the closed position and the opening device 1 is not even partially opened. As a result, both if the opening device 1 is in the first closed configuration or second closed configuration, tightness or sealing functionality are not affected by the attempt of the user to rotate the cap. In contrast, in "screw-type" opening devices, an attempt to rotate the cap would result in partially opening the opening device, so compromising its tightness or sealing functionality.

[0107] As already mentioned, the spout 10 comprises a base plate 13 configured to couple the opening device 1 to the package 3. In each angular position of said plurality of angular positions (that the cap 12 may have in the second closed configuration), a distance of the cap 12 from the base plate 13 is unchanged with respect to the other angular positions of said plurality of angular positions. In other words, after the first opening, the cap 12 being in the closed position is rotatable around the longitudinal axis without moving parallel to the longitudinal axis. As a consequence, in said plurality of different angular positions the cap 12 closes the pouring opening in an equally effective way.

[0108] Preferably, with the opening device 1 being in the second closed configuration, the cap 12 is freely rotatable about the longitudinal axis for a portion of circumference (i.e. less than 360°) or for the entire circumference (i.e. 360°) while remaining engaged with the pouring spout 10 to close the pouring opening.

[0109] According to a preferred embodiment, with the opening device 1 being in the first closed configuration, the ring 21 is prevented from rotating about the longitudinal axis and, with the opening device 1 being the second closing configuration, also the ring 21 is freely rotatable about the longitudinal axis. In fact, due to the hinge element 26 connecting the ring 21 to the cap 12, the ring 21 rotates together with the cap 12.

[0110] In particular, the pouring spout 10 has an outer surface and the cylindrical portion 16 of the cap 12 has an inner surface configured to engage with the outer surface of the pouring spout 10. The outer surface of the pouring spout 10 and the inner surface of the cylindrical portion 16 of the cap 12 are free from any blocking protrusion that would hinder rotation of the cap 12 with respect to the pouring spout 10 in the second closed configuration. In particular, the tamper-evidence ring 21 has an inner surface configured to engage with the outer surface of

the pouring spout 10. Preferably, the inner surface of the tamper-evidence ring 21 is free from any blocking protrusion that would hinder rotation of the tamper-evidence ring 21 with respect to the pouring spout 10.

[0111] Preferably, the outer surface of the pouring spout 10 is symmetrical all about the longitudinal axis. In particular, a first cross section of the outer surface of the pouring spout 10, along a first intersection plane containing the longitudinal axis, and a second cross section of the outer surface of the pouring spout 10, along a second intersection plane containing the longitudinal axis, are superposed irrespective of an angular displacement of the first intersection plane and second intersection plane about the longitudinal axis (i.e. irrespective of the choice of the first intersection plane and second intersection plane).

[0112] The present disclosure also regards a method for evaluating if an opening device 1 has already been opened at least once (i.e. if the first opening has already occurred). In particular, the method allows to evaluate if the opening device 1 has been fully or completely opened, i.e. the cap 12 has been moved away from the spout so to free the pouring opening. The opening device 1 is according to one or more aspects of the present disclosure.

[0113] In particular, the lifting portion 27, before first opening, is in a first angular position with respect to the longitudinal axis. Said first angular position is a predetermined position known and recognizable by the user. In particular, in said first angular position, the hinge axis H is perpendicular to the top transversal sealing band 6 of package 3 and/or an imaginary line connecting the lifting portion 27 and the hinge element 26 lies parallel to the top transversal sealing band 6 of package 3. As said above, the cap 12 is prevented from rotating before the first opening, whereby the cap 12 is forced to remain in the first angular position before the first opening.

[0114] The method comprising a step of checking if the lifting portion is in the first angular position. In particular, said check may be either visual or tactile. If the lifting portion is not in the first position, then the method comprises a step of concluding that the first opening of the opening device 1 has already occurred. In fact, the position of the cap 12 out of the first angular position is a clear indication that the first opening has occurred. In other words, if the cap 12 is in a position different from its original position (i.e. first angular position) it can be clearly visible that the cap has been already fully opened and previously rotated. In contrast, the position of the cap in the first angular position is not indicative of whether the first opening has occurred or not.

[0115] If the lifting portion is in the first angular position, the method comprising the following further steps:

- trying to rotate the cap 12 about the longitudinal axis out of the first angular position (said try is done by the user holding the package 3 with one hand and the cap 12 with the other hand);

- if the cap 12 is prevented from rotating about the longitudinal axis out of the first angular position (without exerting an undue force), concluding that the opening device 1 has never been opened;
- if, conversely, the cap 12 is free to rotate about the longitudinal axis with respect to the pouring spout 10, for at least a portion of circumference, concluding that the first opening of the opening device 1 has already occurred.

[0116] The present disclosure provides also an alternative method for evaluating if an opening device 1 has already been opened at least once. The alternative method comprises the following steps:

- trying to rotate the cap 12 about the longitudinal axis relative to the pouring spout 10;
- if the cap 12 is prevented from rotating about the longitudinal axis relative to the pouring spout 10, concluding that the opening device 1 has never been opened;
- if the cap 12 is free to rotate about the longitudinal axis B relative to the pouring spout 10, for at least a portion of circumference, concluding that the first opening of the opening device 1 has already occurred.

[0117] This alternative method differs from the firstly mentioned method in said the user directly tries to rotate the cap, without firstly checking if it is positioned in the first angular position.

[0118] The advantages of opening device 1 according to the present invention will be clear from the foregoing description.

[0119] In particular, the opening device according to the present disclosure has a tamper-evidence feature which can be recognized even by users with a poor eyesight and/or blind users and/or users in a dark ambient, that cannot see whether breakable connecting bridges have been broken or not.

[0120] Clearly, changes may be made to opening device 1 as described herein without, however, departing from the scope of protection as defined in the accompanying claims.

Claims

1. An opening device (1) configured to be applied to a packaging (2, 3) for pourable products, said opening device (1) comprising:

- a pouring spout (10) defining a pouring opening through which to pour, in use, said pourable product; said pouring spout (10) extending about a longitudinal axis;
- a cap (12) configured to engage and disengage said pouring spout (10) to respectively close and

open said pouring opening;

- a closing element (30) closing and/or sealing said pouring opening, formed in one piece with said pouring spout (10) and connected to said pouring spout (10) by a breakable connecting portion configured to break during first opening of said opening device (1); said closing element (30) comprising a protruding portion (24) extending through said pouring opening and connected to said cap (12); and
- a tamper-evidence ring (21) fitted to said pouring spout (10);

wherein said cap (12) is connected to said tamper-evidence ring (21) thereby being permanently tethered to said pouring spout (10),
wherein:

- before the first opening, the opening device (1) is in a first closed configuration, in which said cap (12) engages with the pouring spout (10) to close the pouring opening and is prevented from rotating about the longitudinal axis;
- after the first opening, the opening device (1) is arrangeable in a second closed configuration, in which said cap (12) engages with the pouring spout (10) to close the pouring opening,

wherein when the opening device (1) is in the second closed configuration, the cap (12) is rotatable in a plurality of different angular positions about the longitudinal axis.

2. The opening device (1) according to claim 1, wherein the pouring spout (10) comprises a base plate (13) configured to couple the opening device (1) to the package (3); wherein in each angular position of said plurality of angular positions a distance of the cap (12) from the base plate (13) is unchanged with respect to the other angular positions of said plurality of angular positions.
3. The opening device (1) according to claim 1 or 2, with the opening device (1) being in the second closed configuration, the cap (12) is freely rotatable about the longitudinal axis for at least a portion of circumference while remaining engaged with the pouring spout (10) to close the pouring opening.
4. The opening device (1) according to any one of the previous claims, wherein, with the opening device (1) being in the first closed configuration, also the tamper-evidence ring (21) is prevented from rotating

about the longitudinal axis and, with the opening device (1) being in the second closing configuration, also the tamper-evidence ring (21) is freely rotatable about the longitudinal axis.

5. The opening device (1) according to any one of the previous claims, wherein the pouring spout (10) has an outer surface and wherein the cap (12) comprises a flat portion (15) and a cylindrical portion (16) which projects from the flat portion (15), wherein the cylindrical portion (16) has an inner surface configured to engage with the outer surface of the pouring spout (10), wherein the outer surface of the pouring spout (10) and the inner surface of the cylindrical portion (16) of the cap (12) are free from any blocking protrusion that would hinder rotation of the cap (12) with respect to the pouring spout (10) in the second closed configuration.
6. The opening device (1) according to claim 5, wherein the tamper-evidence ring (21) has an inner surface configured to engage with the outer surface of the pouring spout (10), wherein said inner surface of the tamper-evidence ring (21) is free from any blocking protrusion that would hinder rotation of the tamper-evidence ring (21) with respect to the pouring spout (10).
7. The opening device (1) according to claim 5 or 6, wherein the outer surface of the pouring spout (10) is symmetrical all about the longitudinal axis.
8. The opening device (1) according to any one of claims 5 to 7, wherein a first cross section of the outer surface of the pouring spout (10), along a first intersection plane containing the longitudinal axis, and a second cross section of the outer surface of the pouring spout (10), along a second intersection plane containing the longitudinal axis, are superposed irrespective of an angular displacement of the first intersection plane and second intersection plane about the longitudinal axis.
9. The opening device (1) according to any one of the previous claims, comprising a hinge element (26) permanently hinging the cap (12) to the tamper-evidence ring (21), said hinge element (26) defining a hinge axis (H), wherein the cap (12) is configured to be opened and/or closed by a purely rotational movement about the hinge axis (H), wherein the package (3) has a top wall (4) onto which opening device (1) is applied, the top wall (4) including a top transversal sealing band (6), wherein in the first angular position, the lifting portion (27) and the hinge element (26) are aligned along a direction substantially parallel to the top transversal sealing band (6).

10. The opening device (1) according to any one of the previous claims, wherein the tamper-evidence ring (21) is initially connected to said cap (12) by means of at least one breakable connecting bridge configured to break during first opening of said opening device (1).

11. A package (3) containing a pourable product and obtained from a sheet of packaging material having an opening portion; said package (3) comprising an opening device (1) as claimed in any one of the foregoing claims and fitted at said opening portion.

12. The package (3) according to claim 11, wherein the pouring spout (10) is molded onto the sheet of packaging material, around the opening portion.

13. A method for evaluating if an opening device (1) has already been opened at least once,

wherein the opening device (1) is applied to a package (3) for pourable products, said opening device (1) comprising:

- a pouring spout (10) defining a pouring opening; said pouring spout (10) extending about a longitudinal axis;
- a cap (12) configured to engage and disengage said pouring spout (10) to respectively close and open said pouring opening;
- a closing element (30) closing and/or sealing said pouring opening, formed in one piece with said pouring spout (10) and connected to said pouring spout (10) by a breakable connecting portion (31) configured to break during first opening of said opening device (1); said closing element (30) comprising a protruding portion (24) extending through said pouring opening and connected to said cap (12); and
- a tamper-evidence ring (21) fitted to said pouring spout (10),

wherein said cap (12) is connected to said tamper-evidence ring (21) thereby being permanently tethered to said pouring spout (10), wherein the cap (12) comprises a lifting portion (27) configured to be pulled by a user to open said pouring opening, wherein the lifting portion (27), before first opening, is in a first angular position with respect to the longitudinal axis, the method comprising the following steps:

- checking if the lifting portion (27) is in the first angular position;
- if the lifting portion (27) is not in the first position, concluding that the first opening of

the opening device (1) has already occurred;

14. The method according to claim 13, wherein if the lifting portion (27) is in the first angular position, the method comprising the following further steps:

- trying to rotate the cap (12) about the longitudinal axis out of the first angular position;
- if the cap (12) is prevented from rotating about the longitudinal axis out of the first angular position, concluding that the opening device (1) has never been opened;
- if the cap (12) is free to rotate about the longitudinal axis with respect to the pouring spout (10), for at least a portion of circumference, concluding that the first opening of the opening device (1) has already occurred.

15. The method according to claim 13 or 14, wherein the package (3) has a top wall (4) onto which opening device (1) is applied, the top wall (4) including a top transversal sealing band (6), wherein the cap (12) is hinged to said tamper-evidence ring (21) through a hinge element (26), wherein in the first angular position, the lifting portion (27) and the hinge element (26) are aligned along a direction substantially parallel to the top transversal sealing band (6).

16. A method for evaluating if an opening device

(1) has already been opened at least once,

wherein the opening device (1) is applied to a package (3) for pourable products, said opening device (1) comprising:

- a pouring spout (10) defining a pouring opening (10); said pouring spout (10) extending about a longitudinal axis;
- a cap (12) configured to engage and disengage said pouring spout (10) to respectively close and open said pouring opening;
- a closing element (30) closing and/or sealing said pouring opening, formed in one piece with said pouring spout (10) and connected to said pouring spout (10) by a breakable connecting portion (31) configured to break during first opening of said opening device (1); said closing element (30) comprising a protruding portion (24) extending through said pouring opening and connected to said cap (12); and
- a tamper-evidence ring (21) fitted to said pouring spout (10),

wherein said cap (12) is hinged to said tamper-evidence ring (21) thereby being permanently tethered to said pouring spout (10),

the method comprising the following steps: 5

- trying to rotate the cap (12) about the longitudinal axis relative to the pouring spout (10) ;
- if the cap (12) is prevented from rotating about the longitudinal axis relative to the pouring spout (10), concluding that the opening device (1) has never been opened; 10
- if the cap (12) is free to rotate about the longitudinal axis relative to the pouring spout (10), for at least a portion of circumference, concluding that the first opening of the opening device (1) has already occurred. 20

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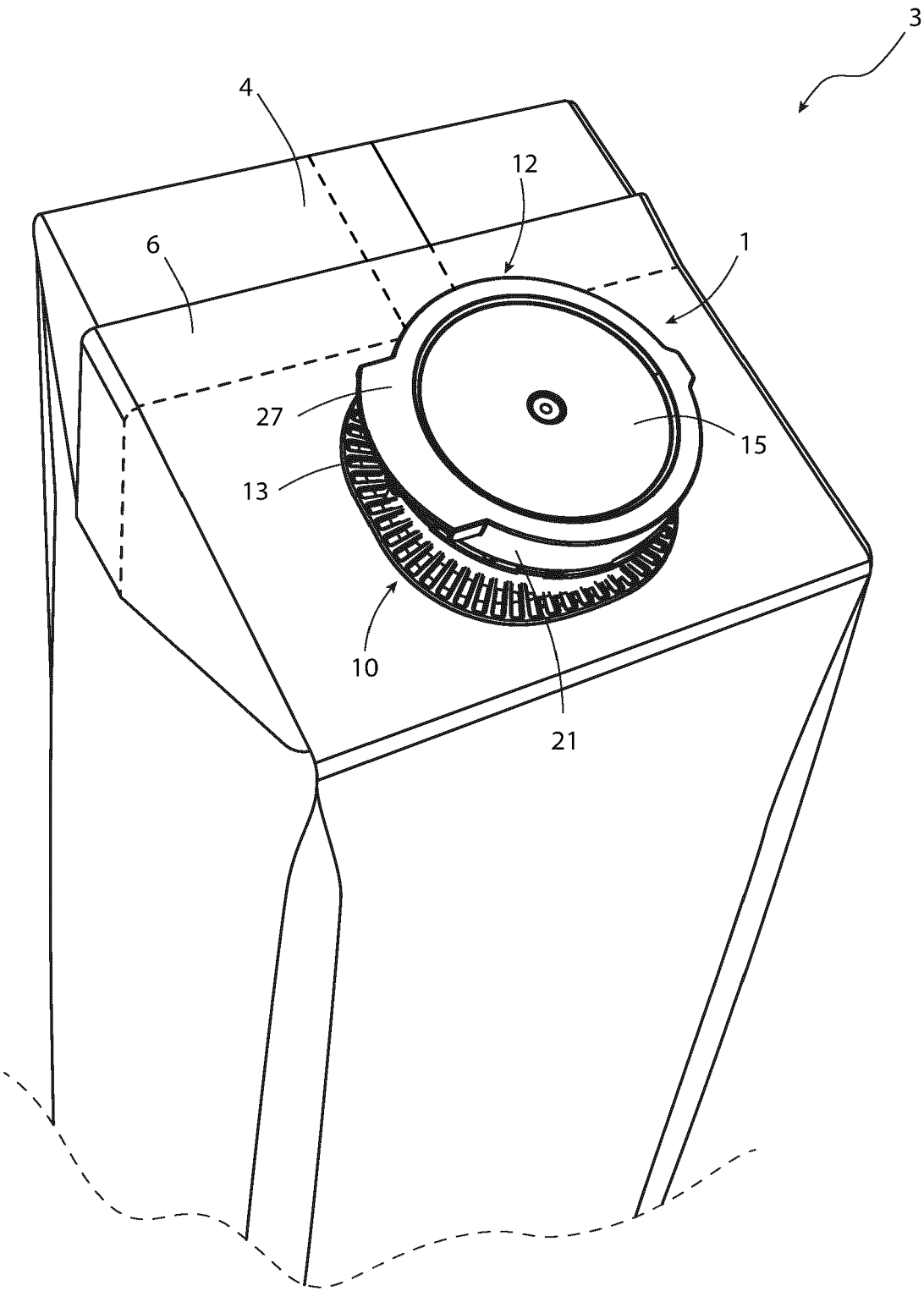


FIG.1

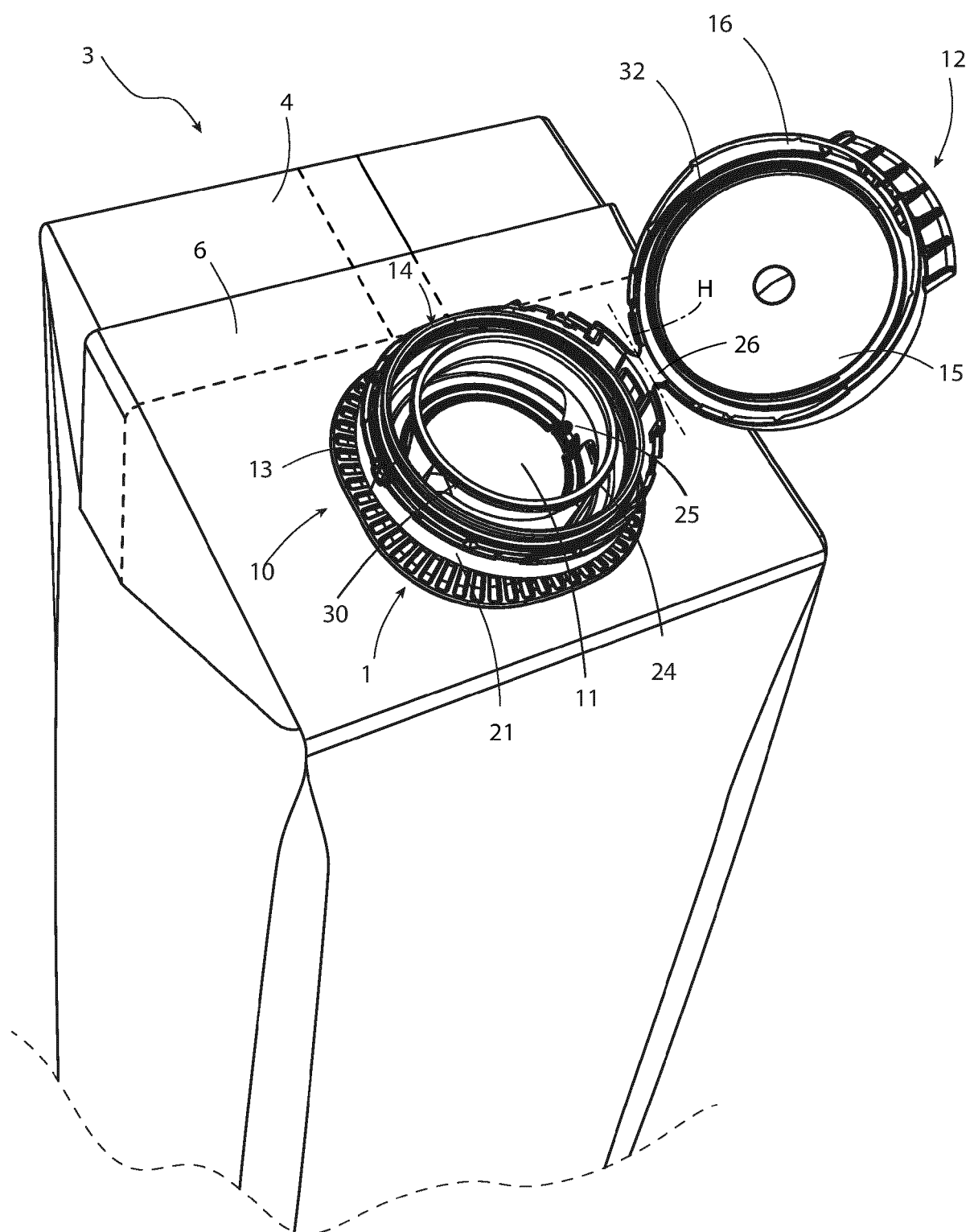
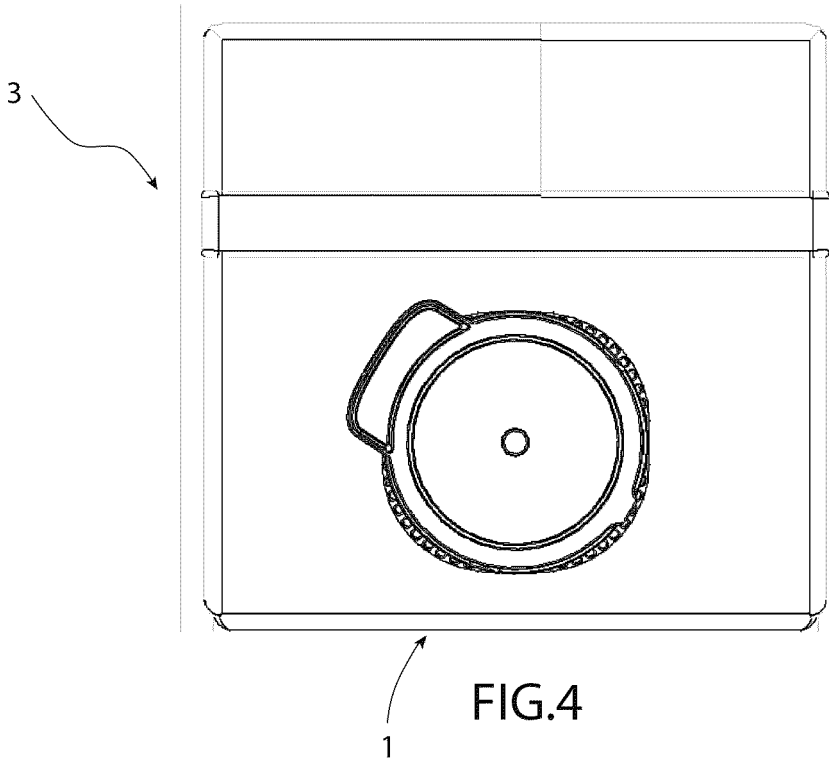
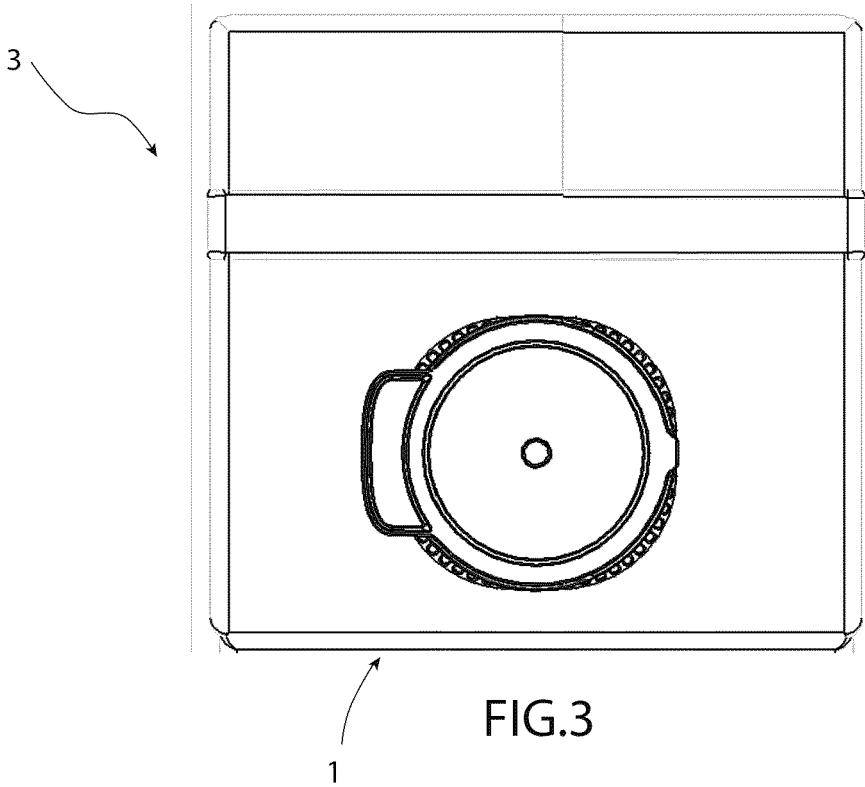


FIG.2





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Place of search Munich		Date of completion of the search 18 October 2024	Examiner Piolat, Olivier
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