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

(11) **EP 3 604 160 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
05.02.2020 Bulletin 2020/06

(51) Int Cl.:
B65D 41/04 *(2006.01)* ***B65D 47/08*** *(2006.01)*
B65D 47/18 *(2006.01)*

(21) Application number: **18186315.0**

(22) Date of filing: **30.07.2018**

(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 MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **Sulzer Mixpac AG**
9469 Haag (Rheintal) (CH)

(72) Inventor: **Tiekenheinrich, Lars**
24149 Kiel (DE)

(74) Representative: **Manitz Finsterwald**
Patent- und Rechtsanwaltspartnerschaft mbB
Martin-Greif-Strasse 1
80336 München (DE)

(54) DROPPER BOTTLE AND METHOD OF SEALING A NOZZLE OF A DROPPER BOTTLE WITH A CAP

(57) The present invention relates to a dropper bottle for a metered dispensing of a liquid material, the dropper bottle comprising: a storage chamber for storing the liquid material, the storage chamber having an outlet (36), a nozzle (38) arranged at the outlet and configured for the metered dispensing of the liquid material; and a cap (12) for sealingly closing the nozzle, wherein the cap comprises a first contact section (33) and the nozzle comprises a second contact section (34), the first and the second contact sections being configured to sealingly contact each other when the cap is in a closed position, wherein the cap comprises a two-component injection moulded part.The invention further relates to a method of sealing a nozzle of a dropper bottle with a cap and to a method of making a two-component cap of a dropper bottle.

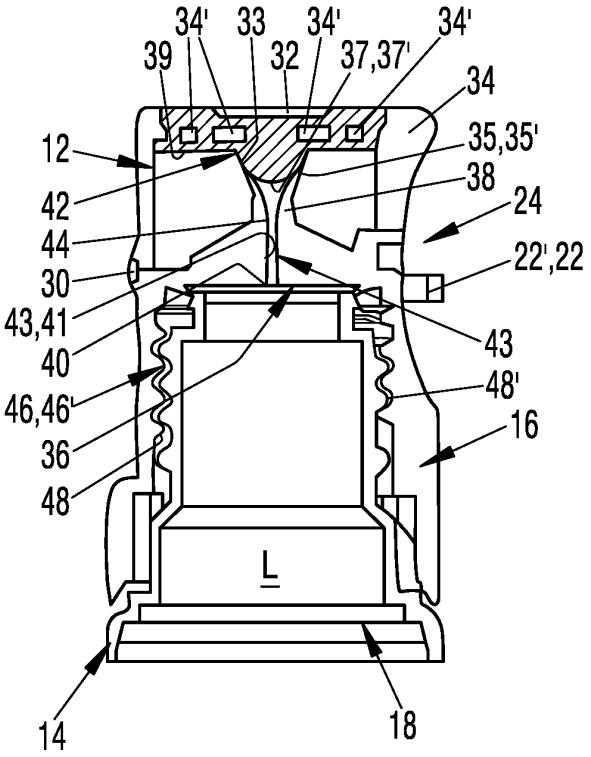

Fig.1b

EP 3 604 160 A1

Description

[0001] The present invention relates to a dropper bottle for a metered dispensing of a liquid material, the dropper bottle comprising: a storage chamber for storing the liquid material, the storage chamber having an outlet, a nozzle arranged at the outlet and configured for the metered dispensing of the liquid material; and a cap for sealingly closing the nozzle, wherein the cap comprises a first contact section and the nozzle comprises a second contact section, the first and the second contact sections being configured to sealingly contact each other when the cap is in a closed position. The invention further relates to a method of sealing a nozzle of a dropper bottle with a cap and to a method of making a two-component cap of a dropper bottle.

[0002] Dropper bottles are used for a wide range of applications in the medical field, the dental field, the veterinary field, the cosmetic field and the homeopathic field for the storage of medical liquids, dental liquids, veterinary liquids, cosmetic liquids, homeopathic liquids etc.

[0003] Depending on the precise application, the liquid material stored in the dropper bottle can be rather expensive and become degraded over time if it is exposed to air. In this connection prior art dropper bottles suffer from an inadequate seal which leads to unwanted spillage, a contamination on the outside of the dropper bottle and consequently to an undesired, comparatively large, waste volume.

[0004] Moreover, due to the inadequate seal the dropper bottles cannot be stored over longer periods of time once these have been opened, as the contents dries out and/or degrades leading to an increase in the waste volume and depending on the application also to environmental hazards as the liquids may not be easily biodegradable and hence the larger the waste volume is, the greater the amount of such liquids is that has to be disposed of.

[0005] In addition to this prior art dropper bottles also encounter the drawbacks of an inadequate drop formation, this means that there is an insufficient repeatability and reliability on the formation of drops of a certain size and volume.

[0006] For this reason it is an object of the present invention to provide a dropper bottle having an improved seal. It is a further object of the present invention to make available a dropper bottle having an improved nozzle for administering drops of more uniform size to ultimately increase the number of repeatable and reliable drops that can be administered with one and the same dropper bottle. It is yet a further object of the present invention to make available a dropper bottle that can be produced in a cost effective manner.

[0007] This object is satisfied by a dropper bottle having the features of claim 1.

[0008] Such a dropper bottle for a metered dispensing of a liquid material, comprises:

a storage chamber for storing the liquid material, the storage chamber having an outlet,

a nozzle arranged at the outlet and configured for the metered dispensing of the liquid material; and

a cap for sealingly closing the nozzle,

wherein the cap comprises a first contact section and the nozzle comprises a second contact section, the first and the second contact sections being configured to sealingly contact each other when the cap is in a closed position, and wherein the cap comprises a two-component injection molding part, the first of the two components of the two-component injection molding part defining the first contact section and having a reduced hardness compared to the second of the two components of the two-component injection molding part and with the second contact section having a hardness different to that of the first contact section.

[0009] By forming the cap as a two-component injection molded part this can be produced in a cost effective manner in one injection mold using different inserts in one production cycle.

[0010] Moreover, such a cap can have a component - the second component - that is harder than the other component and that is capable of providing a rigid cap and protecting the outlet of the dropper bottle. The cap also comprises a softer component - the first component - that hence makes available a component that is more susceptible to deformation and thus provides a seal that can sealingly contact the nozzle, i.e. the second contact section thereof. This seal is particularly effective if the second contact section has a hardness that is either harder or softer than that of the first contact section as in this way the softer material can deform more reliably to match the shape of the harder material.

[0011] By designing the nozzle of the dropper bottle such that is configured for the metered dispensing of liquids one can manipulate the nozzle to reliably produce more uniform drops in size and shape than was previously possible.

[0012] A metered dispensing means that a dispensing of drops is possible that each have a size within a predefined size range, with the size varying only within very narrow pre-definable boundaries, with the size depending on the liquid and the size of the nozzle.

[0013] Further benefits and advantageous embodiments of the invention will become apparent from the dependent claims, from the description and from the accompanying drawings.

[0014] It should be noted that prior art dropper bottles, such as the one disclosed in WO2015/002110 A1 comprise caps that are made from only one material and indeed a material that is the same as the material of the outlet. Thus, the prior art has not realized that in order to improve the storage life of components stored in a dropper bottle, in particular an opened dropper bottle that one requires the presence of a seal at the outlet and that this

can be formed by the cap having a contact section that is made from a material having a hardness that is different to the hardness of the material of the contact section cooperating therewith.

[0015] The first component of the two-component cap, this means the component having a reduced hardness compared to the second of the two components of the two-component injection molding part, may be a soft plastic. In this way the cap can be formed with a sealing member directly formed at the cap, with the sealing member being able to be formed in a cost effective and simple manner.

[0016] In this connection it should be noted that a soft plastic may be a plastic having a hardness measured with the Shore A Durometer selected in the range of 20A to 95A and up to a hardness measured with the Shore D Durometer of 55D. A typical example of soft plastics are TPEs (thermoplastic elastomers or thermoplastic rubbers). TPEs typically have a hardness measured on the "A" scale from 20 Shore "A" to 95 Shore "A", with some harder TPE materials, i.e. materials harder than 90 Shore "A" typically being measured on the "D" scale up to a hardness of 55D.

[0017] The second component of the two-component cap, this means the component having an increased hardness compared to the first of the two components of the two-component injection molding part, may be a hard plastic. In this way the cap can also comprise a structural member that makes available a surface between which a seal in the form of the first component can be arranged between the nozzle and the cap with the structural member being able to be formed in a cost effective and simple manner.

[0018] Thus, the second component is typically made of a plastic having an increased hardness in comparison to that of the first component. A hard plastic may be a plastic having a hardness measured with the Shore D Durometer selected in the range of greater than 55D and less than or equal to 85D. A typical example of a hard plastic is PTFE (polytetrafluorethylene).

[0019] It should further be noted that the hard and soft plastics selected should be capable of being injection molded to form the 2K cap, with an overmolding, i.e. bonding, of one of the two-components to the other one of the two components taking place such that a melt connection is formed between the two components.

[0020] Preferably the first and the second contact sections are ring-shaped contact sections. By forming the contact sections as ring-shaped the surface area available for producing the seal between the nozzle and the cap is increased and the nozzle and the cap can come into more intimate contact with one another to increase the likelihood of maintaining the seal.

[0021] It should be noted that the first contact section may be provided on an outer surface of a protrusion of the cap, optionally wherein at least a part of the outer surface of the protrusion of the cap may project into the nozzle when the cap is in the closed position, in particular wherein the protrusion is formed at an inner surface of the cap. Forming the first contact section on an outwardly directed part of the cap, preferably at an inner surface of the cap, facilitates a reliable seal to be formed between the cap and the nozzle.

[0022] In this connection it should be noted that the second contact section may be provided on a funnel-shaped inner surface of the nozzle, preferably with the funnel-shaped inner surface of the nozzle having a stem portion pointing towards the storage chamber and a mouth portion projecting away from the storage chamber.

[0023] By forming the nozzle such that it comprises a funnel-shaped inner surface in a cross-section thereof a nozzle is formed by means of which small sized and large sized drops of uniform volume can be made available to enable a controlled and uniform metered dispensing of drops from the dropper bottle.

[0024] Moreover, by providing a funnel shaped nozzle the dropper bottle can produce uniform drops for various orientations of use of the dropper bottle both in vertical and angulated orientations. It has namely been found that prior art dropper bottles the size distribution achievable with the one and the same nozzle depends on the angle of dispensing from the dropper bottle. By forming the nozzle with a funnel shaped inner surface the dependency on the angle of dispensing is minimized and hence a more uniform drop size can be dispensed with the dropper bottle discussed herein.

[0025] Preferably at least a part of the outer surface of the protrusion of the cap sealingly contacts at least a part of the funnel-shaped inner surface of the nozzle when the cap is in the closed position. In this way the seal is effected directly at the portion of the dropper bottle from which the liquid can be dispensed and hence the seal provided between these components is improved. Thereby one can minimize a contamination of the outside of the dropper bottle and consequently any waste that may have previously been associated with the dropper bottle.

[0026] Preferably the nozzle is formed from the same material as the second of the two components of the two-component injection molding part. In this way the nozzle and the cap can be formed in the same injection mold and the seal can be produced directly at the nozzle to further improve the seal on use of the dropper bottle.

[0027] In this connection the nozzle may be formed at a nozzle component that is separate from the outlet, preferably wherein the nozzle component covers at least a part of the outlet.

[0028] Forming the nozzle at a component separate from the storage chamber, on the one hand, facilitates the filling of the storage chamber and also makes available the possibility of storing the liquid e.g. in a glass vial. Moreover, by forming the nozzle component such that this could cover the outlet of the storage chamber also makes available a way in which the outlet from the storage chamber can be protected from being accessed from the outside and hence from being tampered with.

[0029] In this connection it should be noted that the

nozzle component may be connected to the outlet via a connection, with the connection preferably comprising a member selected form the group of members consisting of a threaded connection, a snap on connection, a plug and rotate type of connection, a bayonet type of connection, a plugged connection and combinations of the foregoing. These are advantageous ways of connecting a bottle containing the storage chamber to the nozzle component.

[0030] Preferably a sealing member is arranged between the nozzle component and the outlet. Such a sealing member advantageously avoids the liquid stored in the storage chamber from exiting the dropper bottle at an unwanted position.

[0031] Preferably the cap is either permanently connected to the nozzle component, e.g. via a film hinge, or is releasably connected to the nozzle component, e.g. via a plugged connection. Forming the connection between the nozzle component and the cap as permanent ensures that the cap may not accidentally be dropped on use of the dropper bottle and avoid unwanted contamination from the outside. Providing a releasably connected cap means that the dropper bottle can be used over a greater degree of angular orientations. In this connection a releasable connection is a connection that can be opened and closed without tools, i.e. by hand.

[0032] Moreover, a releasable connection is a connection that can be opened in a nondestructive manner, i.e. on releasing the connection between the cap and the nozzle, neither one of these is destroyed.

[0033] Preferably the storage chamber of the dropper bottle is filed with a liquid material, the liquid material being selected from the group of members consisting of a medical liquid, a dental liquid, a veterinary liquid, a cosmetic liquid, a homeopathic liquid, and combinations of the foregoing. In this way the dropper bottle can be used for a wide range of applications.

[0034] Preferably the dropper bottle further comprises a tamper-evident closure connecting the cap and the dropper bottle, in particular with the tamper-evident closure connecting the cap and the nozzle component; wherein the tamper-evident closure comprises a flap which is configured to be completely detachable from both, the cap and the dropper bottle, in particular with the flap being completely detachable from the cap and the nozzle component. In this way a dropper bottle is made available that comprises an originality closure by means of which a user can tell if he/she is using an unopened or an open dropper bottle.

[0035] According to a further aspect the present invention relates to a method of sealing a nozzle of a dropper bottle, in particular in accordance with the teaching presented herein, with a cap,

wherein the cap comprises a first contact section and the nozzle comprises a second contact section, the first and the second contact sections being configured to sealingly contact each other when the cap is in a closed position, and wherein the cap comprises a two-component injection molding part, the first of the two components of the two-component injection molding part defining the first contact section and having a reduced hardness compared to the second of the two components of the two-component injection molding part and with the second contact section having a hardness different to that of the first contact section, the method comprising the step of moving the cap into the closed position to bring the first contact section into sealing contact with the second contact section.

[0036] The advantages discussed in the foregoing in connection with the dropper bottle likewise hold true for the method according to the invention.

[0037] According to a further aspect the present invention relates to a method of making a two-component cap of a dropper bottle, preferably as taught herein, the method comprising the steps of:

- injection molding a first component of the two-component cap, the first component comprising a first contact section that is configured to sealingly contact a nozzle, and
- injection molding a second component of the two-component cap, with the second component forming a structural member of the cap, optionally wherein the step of injection molding the second component of the two-component cap comprises the injection molding of a nozzle component, with the nozzle component comprising a nozzle having a second contact section that is injection molded in contact with the first component of the two-component cap.

[0038] By forming a cap in an injection molding process this can be produced with a reliable seal and with repeatable manufacturing tolerances.

[0039] The invention will be explained in the following in detail by means of embodiments and with reference to the drawing. The drawing shows:

Fig. 1a a perspective view of a first type of dropper bottle;
Fig. 1b a cross-sectional view of the dropper bottle of Fig. 1a;
Fig. 2a a perspective view of a second type of dropper bottle and
Fig. 2b a cross-sectional view of the dropper bottle of Fig. 2a.

[0040] In the following the same reference numerals will be used for parts having the same or equivalent function. Any statements made having regard to the direction of a component are made relative to the position shown in the drawing and can naturally vary in the actual position of application.

[0041] Fig. 1a shows a perspective view of a first type of dropper bottle 10. The dropper bottle 10 is configured for a metered dispensing of a liquid material L (see Fig. 1b). The dropper bottle 10 more specifically a storage

chamber 18 (see Fig. 1b) of the dropper bottle 10 is filed with a liquid material L, the liquid material L typically being selected from the group of members consisting of a medical liquid, a dental liquid, a veterinary liquid, a cosmetic liquid, a homeopathic liquid, and combinations of the foregoing.

[0042] The size of the dropper bottle 10 can be varied such that the storage chamber 18 can store a variety of volumes of liquid material L ranging from 5 mm to 100 mm.

[0043] The dropper bottle 10 comprises a cap 12 and a bottle 14 connected to a nozzle component 16. The cap 12 is connected to the nozzle component 16 via a tamper-evident closure 20. The tamper-evident closure 20 comprises a flap 22 which is configured to be completely detachable from both, the cap 12 and the nozzle component 16. An end 22' of the flap 22 is present at an indentation 24 of the dropper bottle 10.

[0044] The indentation 24 is provided such that a user (not shown) can rest his or her finger on the dropper bottle 10 and open the cap 12 with one finger.

[0045] The flap 22 also comprises a cap connecting section 26 which is connected to the cap 12 by breakable connection means 26' and a nozzle engagement section 28 which is connected to the nozzle component via further breakable connection means 28'.

[0046] On opening the dropper bottle 10 a user can hold the end 22' of the flap 22 and tear away the flap 22 to separate the cap 12 from the nozzle component 16 by respectively breaking the breakable connection means 26' and the further breakable connection means 28'.

[0047] The cap 12 is pivotably connected to the nozzle component 16. For this purpose a film hinge 30 is provided that integrally connects the cap 12 and the nozzle component 16 as indicated in the cross-sectional view of the dropper bottle of Fig. 1b.

[0048] The cap 12 is a two-component cap 12 formed by an injection molding part. The first 32 of the two components of the two-component injection molding part defining a first contact section 33 and having a reduced hardness compared to the second 34 of the two components of the two-component injection molding part. The first component 32 is for example formed from a soft plastic and the second component 34 is for example formed from a hard plastic.

[0049] The first contact section 33 is provided on an outer surface 37' of a protrusion 37 of the cap 12. The protrusion 37 projects from an inner surface 39 of the cap 12 into a nozzle 38 when the cap 12 is in the closed position.

[0050] The bottle 14 comprises the storage chamber 18 for storing the liquid material L. The storage chamber 18 has an outlet 36. The nozzle 38 is arranged at the outlet 36 and is configured for the metered dispensing of the liquid material L.

[0051] The nozzle component 16 is attachable to the bottle 14 in the region of its outlet 36. The nozzle component 16 comprises the nozzle 38 via which a drop (not shown) can be dispensed and an inlet 40 connected to the outlet 36. A passage 41 connects a mouth 42 of the nozzle 38 to the inlet 40. The passage 41 is configured to allow a flow of the liquid material L from the storage chamber 18 to the nozzle 38.

[0052] The nozzle 38 is a part of the nozzle component 16. The first contact section 33 of the cap can sealingly contact a second contact section 35 provided at the nozzle 38 when the cap 12 is in a closed position.

[0053] The second contact section 35 has a hardness different to that of the first contact section 33. Due to the difference in hardness between the first and second contact sections 33, 35 one of these components can deform more readily relative to the other one of these components and thereby a seal is effected between the first and second contact sections 33, 35. Hence the cap 12 is configured to sealingly close the nozzle 38.

[0054] By way of example the first contact section 33 can have a reduced hardness in comparison to that of the second contact section 35 and is, for example, formed from a soft plastic.

[0055] A soft plastic is, for example, a plastic having a hardness measured with the Shore A Durometer selected in the range of 20A to 95A and up to a hardness measured with the Shore D Durometer of 55D.

[0056] The second contact section 35, i.e. the component having an increased hardness compared to the first contact section 33 may be a hard plastic.

[0057] A hard plastic is, for example, a plastic having a hardness measured with the Shore D Durometer selected in the range of greater than 55D and less than or equal to 85D.

[0058] It should be noted in this connection that the material of the second contact section 35 may be selected identical to the material of the second component 34.

[0059] The second contact section 35 is provided on a funnel-shaped inner surface 35 ' of the nozzle 38. In addition to the funnel-shaped inner surface 35', the passage 41 between the mouth 42 and the inlet 40 comprises a stem portion 43 connecting the inlet 40 to the part of the nozzle having the funnel shaped inner surface 35'. In this way the mouth 42 of the nozzle projects away from the storage chamber 18.

[0060] The stem portion 43 has an at least generally cylindrically shaped part that may be arranged at a transition 44 to the funnel-shaped inner surface 35'.

[0061] The provision of a funnel shaped inner surface 35' makes available a nozzle design having an improved drop formation in comparison to prior art nozzles that allows a more uniform drop volume to be dispensed at different angles of dispensing.

[0062] When the cap 12 is in the closed position a part of the outer surface 37' of the protrusion 37 sealingly contacts part of the funnel-shaped inner surface 35' of the nozzle 38. By forming the seal between the nozzle 38 and the cap 12 directly between the nozzle 38 and the cap 12, a seal is provided directly between the components where a seal should be effected. Thereby un-

necessary leaks can be avoided leading to the reduction in waste associated with a faulty seal.

[0063] In the example shown in Fig. 1a and 1b, the nozzle component 16 and the second component 34 of the cap 12 are formed from the same material and are generally formed in the same injection mold, with the tamper-evident closure 20 and the film hinge 30 being integrally molded with the nozzle component 16 and the second component 34 of the cap 12.

[0064] The integrally formed nozzle component 16 and the cap 12 can then be attached to the bottle 14 via a connection 46 to form the dropper bottle 10. The nozzle component 16 is thus a component that is separate from the bottle 14.

[0065] The connection 46 may comprise a member selected form the group of members consisting of a threaded connection, a snap on connection, a plug and rotate type of connection, a bayonet type of connection, a plugged connection and combinations of the foregoing. In the example of Fig. 1b a threaded connection 46' is shown.

[0066] On attaching the nozzle component 16 to the bottle 14 part of the nozzle component 16 is arranged to cover the outlet 36. This is done such that an internal thread 48 of the nozzle component 16 engages an external thread 48' of the bottle 14.

[0067] On forming the cap 12 and the nozzle component 16 these are injection molded in one and the same mold (not shown), with different inserts being insertable into the mold to initially mold the first component 32 of the two-component cap 12. The insert comprises webs of material around which the first component 32 is molded. Once the first component 32 has been molded these inserts are retracted leaving gaps within the first component 32.

[0068] Once the inserts for the final cap 12 are introduced into the mold these gaps remain free and the second component 34 is injection molded around the first component 32 and the gaps are filled with webs 34' of material of the second component 34.

[0069] Thus the cap 12 comprises webs 34' of material at the protrusion 37 that are configured to reinforce the part of the cap 12 at which the protrusion 37 is formed, i.e. the cap 12 comprises structural members supporting the protrusion 37 and enhancing the seal integrated within the cap 12.

[0070] On injection molding the cap 12, the first component 32 is formed having the first contact section 33 that is configured to sealingly contact the nozzle 38. As indicated in Fig. 1a and 1b, the nozzle component 16 and the cap 12 can be integrally formed.

[0071] In this case, the step of injection molding the second component 34 of the two-component cap 12 comprises the injection molding of the nozzle component 16. The nozzle component 16 comprises the second contact section 35 that is then injection molded such that it is in contact with the first component 32 of the two-component cap 34 in order to enhance the sealing contact between the two components.

[0072] Fig. 2a shows a perspective view of a second type of dropper bottle 10. In this design the cap 12 is releasably connected to the nozzle component 16, e.g. via a plugged connection as shown in the drawings.

[0073] Fig. 2b shows a cross-sectional view of the dropper bottle 10 of Fig. 2a. A sealing member 50 is arranged between the nozzle component 16 and the outlet 36. For this purpose each of the outlet and the inlet comprises a contact section 52, 52', the contact sections 52, 52' being configured to sealingly contact each other when the nozzle component 16 is connected to the bottle 14.

[0074] In a manner similar to the construction of the cap 12, the sealing member 50 may be injection molded together with the nozzle component 16. Thus, the nozzle component 16 may also comprise a two-component injection molding part, the first of the two components defining the respective contact section 52' and having a reduced hardness compared to the second of the two components.

[0075] In this connection it should be noted that a sealing member 50 may also be included in the dropper bottle 10 depicted in Figs. 1a and 1b.

[0076] In contrast to the design depicted in Fig. 1a and 1b, the inlet 40 is not directly adjacent the generally cylindrical passage of the stem portion 43 of the nozzle 38, but the inlet 40 is formed of a further generally cylindrical passage 58 having a diameter larger than that of the stem portion 43 and which merges into the stem portion via a conically shaped portion 60.

[0077] The passage 58 is provided so that the nozzle component has a wall 62 which can be engaged by the cap 12 by means of e.g. a frictional engagement, such that one can ensure that the cap 12 is no easily removable from the nozzle component 16.

[0078] Locking means (not shown) can also be provided to lock the cap 12 to the nozzle component 16 to prevent the cap 12 from disengaging the wall 62. Such locking means could comprise snap-lock features or the like.

[0079] The conically shaped portion 60 is provided so that on dispensing the liquid material L from the dropper bottle 10, the liquid material L can be uniformly guided to the passage 41 for the metered dispensing thereof.

[0080] As is also visible in Fig. 2b, the cap 12 comprises a cover layer 64 that covers the second component 34 of the two-component cap 12. This cover layer 64 can be added such that the cap 12 has an outer surface that has an increased friction with respect to the second component 34 so that the cap 12 can be engaged more easily with the cover layer 64 than without the cover layer 64.

[0081] In the region of the mouth 42 at the end disposed opposite of the passage 58, the first and the second contact sections 33, 35 of the cap 12 and of the nozzle component 16 of Fig. 2b are generally ring-shaped contact sections 33, 35. More specifically, the protrusion 37 of Fig. 1b comprises a recess 54 which is configured to receive an outer end 56 of the nozzle 38. In this way a seal via the first contact section 33 can be made available

that seals on both sides of the outer end 56 of the nozzle 38.

[0082] On use of the dropper bottle 10 shown herein, the cap is removed from the nozzle component 16 to open the seal between the nozzle 38 and the cap and permit a dispensing of the liquid L from the storage chamber by turning the nozzle 38 such that a drop can leave the dropper bottle 10 under the influence of gravity. For this purpose the liquid flows from the storage chamber 18 via the inlet 40 to the mouth 42.

[0083] More specifically, the liquid flows from the inlet 40 via the passage 41 to the funnel-shaped inner surface 35'. Due to the increase in diameter at the transition 44 between the passage 41 and the funnel-shaped inner surface 35', the surface tension acting on the liquid material L causes the liquid material L to collect in a drop and stay connected to the nozzle 38 at the transition 44. Once the drop exceeds a certain size the force the drop experiences due to gravity is larger than the surface tension acting between the drop and the nozzle 38.

[0084] This increase in force due to gravity causes the drop to detach itself from the nozzle 38. The falling liquid material L is also a drop held together by gravity. The size of the drop primarily depends on the diameter of the passage 41 and on the viscosity of the liquid material L that is dispensed. By selecting the appropriate diameter and the desired application, uniform drops ranging between 0.015 and 2 ml in size can be dispensed from the dropper bottle 10 discussed in the foregoing.

List of reference numerals

[0085]

10 dropper bottle
12 cap
14 bottle
16 nozzle component
18 storage chamber
20 tamper-evident closure
22, 22' flap, end of flap
24 indentation
26, 26' cap connecting section, breakable connection means
28, 28' nozzle engagement section, breakable connection means
30 film hinge
32 first component
33 first contact section
34, 34' second component, web of material
35, 35' second contact section, funnel-shaped inner surface
36 outlet
37, 37' protrusion, outer surface
38 nozzle
40 inlet
41 passage
42 mouth
43 stem portion
44 transition
46, 46' connection, threaded connection
48, 48' internal thread, external thread
50 sealing member
52, 52' contact section of 36, contact section of 40
54 recess
56 outer end of 38
58 passage
60 conical portion
62 wall
64 cover layer
L Liquid material

Claims

1. A dropper bottle (10) for a metered dispensing of a liquid material (L), the dropper bottle (10) comprising:

   a storage chamber (18) for storing the liquid material (L), the storage chamber (18) having an outlet (36),
   a nozzle (38) arranged at the outlet (36) and configured for the metered dispensing of the liquid material (L); and
   a cap (12) for sealingly closing the nozzle (38), wherein the cap (12) comprises a first contact section (33) and the nozzle (38) comprises a second contact section (35), the first and the second contact sections (33, 35) being configured to sealingly contact each other when the cap (12) is in a closed position, and
   wherein the cap (12) comprises a two-component injection molding part, the first (32) of the two components of the two-component injection molding part defining the first contact section (33) and having a reduced hardness compared to the second (34) of the two components of the two-component injection molding part and with the second contact section (35) having a hardness different to that of the first contact section (33).

2. The dropper bottle (10) according to claim 1, wherein the first component (32), i.e. the component having a reduced hardness compared to the second (34) of the two components of the two-component injection molding part, is a soft plastic, wherein a soft plastic is a plastic, for example, having a hardness measured with the Shore A Durometer selected in the range of 20A to 95A and up to a hardness measured with the Shore D Durometer of 55D.

3. The dropper bottle (10) according to claim 1 or 2, in particular according to claim 2, wherein the second component (34), i.e. the component having an increased hardness compared to

the first (32) of the two components of the two-component injection molding part, is a hard plastic, in particular wherein the second component (34) is made of a plastic having an increased hardness in comparison to that of the first component (32), wherein a hard plastic is a plastic, for example, having a hardness measured with the Shore D Durometer selected in the range of greater than 55D and less than or equal to 85D.

4. The dropper bottle (10) according to any of the preceding claims,
wherein the first and the second contact sections (33, 35) are ring-shaped contact sections.

5. The dropper bottle (10) according to any of the preceding claims,
wherein the first contact section (33) is provided on an outer surface (37') of a protrusion (37) of the cap (12), optionally wherein at least a part of the outer surface (37') of the protrusion (37) of the cap (12) projects into the nozzle (38) when the cap (12) is in the closed position, in particular wherein the protrusion (37) is formed at an inner surface of the cap (12).

6. The dropper bottle (10) according to any of the preceding claims,
wherein the second contact section (35) is provided on a funnel-shaped inner surface (35') of the nozzle (38), preferably with the funnel-shaped inner surface (35') of the nozzle (38) having a stem portion (43) pointing towards the storage chamber (18) and a mouth portion (42) projecting away from the storage chamber (18).

7. The dropper bottle (10) in accordance with claim 5 and claim 6,
wherein at least a part of the outer surface (37') of the protrusion (37) of the cap (12) sealingly contacts at least a part of the funnel-shaped inner surface (35') of the nozzle (38) when the cap (12) is in the closed position.

8. The dropper bottle (10) according to any of the preceding claims,
wherein the nozzle (38) is formed from the same material as the second (34) of the two components of the two-component injection molding part.

9. The dropper bottle (10) according to any of the preceding claims,
wherein the nozzle (38) is formed at a nozzle component (16) that is separate from the outlet (36), preferably wherein the nozzle component (16) covers at least a part of the outlet (36).

10. The dropper bottle (10) according to claim 9,
wherein the nozzle component (16) is connected to the outlet (36) via a connection (46), with the connection (46) preferably comprising a member selected form the group of members consisting of a threaded connection (46'), a snap on connection, a plug and rotate type of connection, a bayonet type of connection, a plugged connection and combinations of the foregoing.

11. The dropper bottle (10) according to claim 9 or claim 10,
wherein a sealing member (50) is arranged between the nozzle component (16) and the outlet (36).

12. The dropper bottle (10) according to any of the preceding claims 9 to 11,
wherein the cap (12) is either permanently connected to the nozzle component (16), e.g. via a film hinge (30), or is releasably connected to the nozzle component (16), e.g. via a plugged connection.

13. The dropper bottle (10) according to any of the preceding claims,
wherein the storage chamber (18) of the dropper bottle (10) is filed with a liquid material (L), the liquid material (L) being selected from the group of members consisting of a medical liquid, a dental liquid, a veterinary liquid, a cosmetic liquid, a homeopathic liquid, and combinations of the foregoing.

14. The dropper bottle (10) according to any of the preceding claims, in particular in accordance with one of the claims 9 to 13,
further comprising a tamper-evident closure (20) connecting the cap (12) and the dropper bottle (10), in particular with the tamper-evident closure (20) connecting the cap (12) and the nozzle component (16);
wherein the tamper-evident closure (20) comprises a flap (22) which is configured to be completely detachable from both, the cap (12) and the dropper bottle (10), in particular with the flap (22) being completely detachable from the cap (12) and the nozzle component (16).

15. A method of sealing a nozzle (38) of a dropper bottle (10), in particular in accordance with any one of the preceding claims, with a cap (12),
wherein the cap (12) comprises a first contact section (33) and the nozzle (38) comprises a second contact section (35), the first and the second contact sections (33, 35) being configured to sealingly contact each other when the cap (12) is in a closed position, and wherein the cap (12) comprises a two-component injection molding part, the first (32) of the two components of the two-component injection molding part defining the first contact section (33) and having a reduced hardness compared to the second (34) of the two components of the two-component injection

molding part and with the second contact section (35) having a hardness different to that of the first contact section (33), the method comprising the step of moving the cap (12) into the closed position to bring the first contact section (33) into sealing contact with the second contact section (35).

16. A method of making a two-component cap (12) of a dropper bottle (10), in particular a dropper bottle (10) in accordance with one of the claims 1 to 14, the method comprising the steps of:

- injection molding a first component (32) of the two-component cap (12), the first component (32) comprising a first contact section (33) that is configured to sealingly contact a nozzle (38), and
- injection molding a second component (34) of the two-component cap (12), with the second component (34) forming a structural member of the cap (12), optionally wherein the step of injection molding the second component (34) of the two-component cap (12) comprises the injection molding of a nozzle component (16), with the nozzle component (16) comprising the nozzle (38) having a second contact section (35) that is injection molded in contact with the first component (32) of the two-component cap (12).

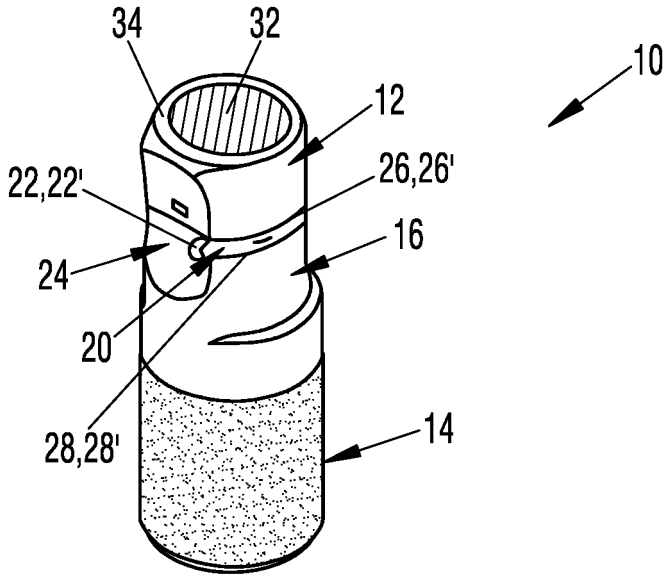
34
32
10
12
22,22'
26,26'
16
24
20
28,28'
14

Fig.1a

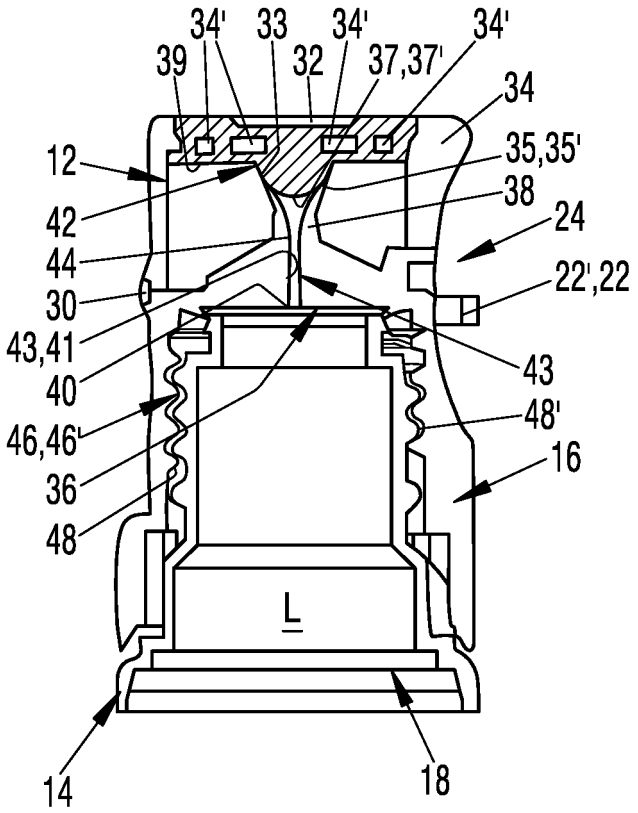
34'
33
34'
34'
39
32
37,37'
34
35,35'
12
38
42
24
44
22',22
30
43,41
43
40
48'
46,46'
16
36
48
L
14
18

Fig.1b

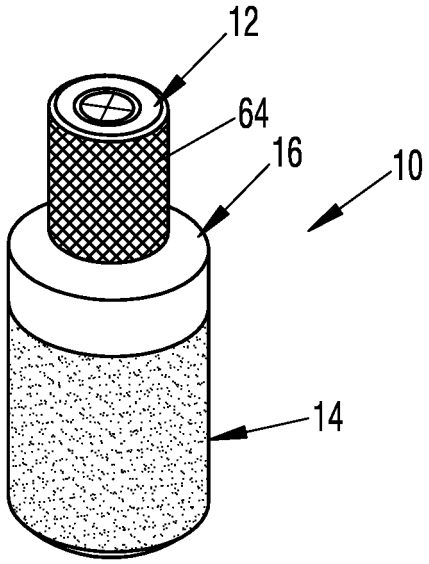
12
64
16
10
14

Fig.2a

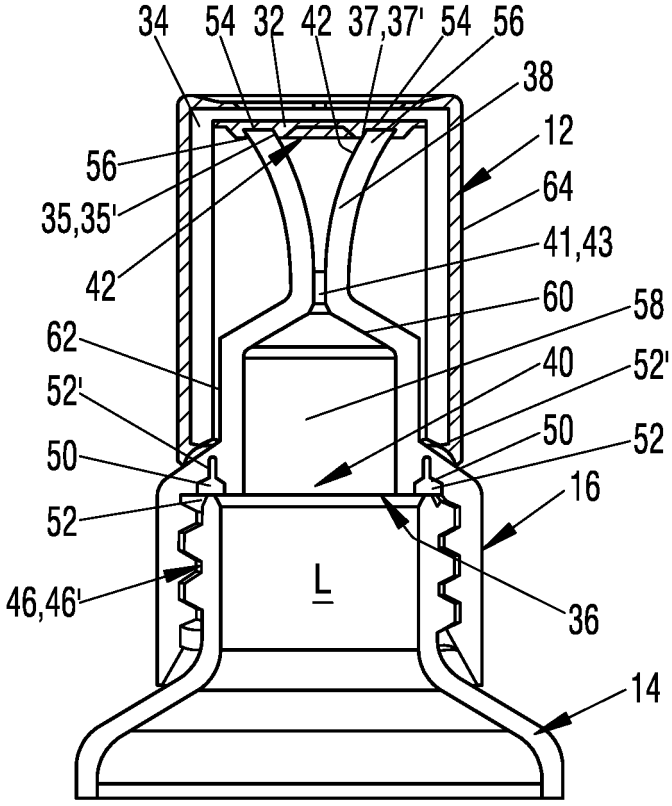
34
54
32
42
37,37'
54
56
38
12
56
35,35'
64
42
41,43
60
58
62
40
52'
52'
50
50
52
52
16
46,46'
L
36
14

Fig.2b

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 18 18 6315

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 5 328 058 A (LEONCAVALLO RICHARD A [US] ET AL) 12 July 1994 (1994-07-12) * column 1, line 26 - line 32 * * page 5, line 29 - line 60 * * page 7, line 58 - page 8, line 5 * * figure 4 *	1-16	INV. B65D41/04 B65D47/08 B65D47/18
Y	CH 464 721 A (CIBA GEIGY [CH]) 31 October 1968 (1968-10-31) * column 1, line 1 - line 27; figures *	1-16	
Y	US 2010/102021 A1 (GUGLIELMINI BERNARD [FR] ET AL) 29 April 2010 (2010-04-29) * paragraph [0034] * * paragraph [0046] * * figures 1-2 *	8,14	
A	FR 2 593 148 A1 (RETIEF CHARLES [ZA]) 24 July 1987 (1987-07-24) * claim 8; figures 1-2 *	1,16	
			TECHNICAL FIELDS SEARCHED (IPC) B65D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	8 February 2019	Bridault, Alain

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 18 6315

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

08-02-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5328058 A	12-07-1994	AU 7681194 A	27-03-1995
		US 5328058 A	12-07-1994
		WO 9507223 A2	16-03-1995
CH 464721 A	31-10-1968	NONE	
US 2010102021 A1	29-04-2010	US 2010102021 A1	29-04-2010
		US 2011283665 A1	24-11-2011
FR 2593148 A1	24-07-1987	AU 6757187 A	23-07-1987
		BR 8700368 A	08-12-1987
		DE 3701197 A1	30-07-1987
		ES 2005855 A6	01-04-1989
		FR 2593148 A1	24-07-1987
		GB 2190902 A	02-12-1987
		IT 1210553 B	14-09-1989
		JP S62182059 A	10-08-1987
		US 4754892 A	05-07-1988

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2015002110 A1 **[0014]**