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(71) Applicant *(for AE, AG, AU, BB, BH, BW, BZ, CA, CY, EG, GB, GD, GH, GM, IE, IL, KE, KN, LC, LK, LS, MT, MW, MY, NA, NG, NZ, OM, PG, QA, RW, SC, SD, SG, SL, SZ, TT, TZ, UG, VC, ZA, ZM, ZW only)*: **UNILEVER PLC** [GB/GB]; Unilever House, 100 Victoria Embankment, London, Greater London, EC4Y 0DY (GB).

(71) Applicant *(for all designated States except AE, AG, AU, BB, BH, BW, BZ, CA, CY, EG, GB, GD, GH, GM, IE, IL, IN, KE, KN, LC, LK, LS, MT, MW, MY, NA, NG, NZ, OM, PG, QA, RW, SC, SD, SG, SL, SZ, TT, TZ, UG, US, VC, ZA, ZM, ZW)*: **UNILEVER N.V.** [NL/NL]; Weena 455, NL-3013 AL Rotterdam (NL).

(71) Applicant *(for IN only)*: **HINDUSTAN UNILEVER LIMITED** [IN/IN]; Unilever House, B.D. Sawant Marg Chakala Andheri (East), Mumbai, Maharashtra 400 099 (IN).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **BUNCE, Martin, Christopher** [GB/GB]; Tin Horse Design Limited, Pelham House, Pelham Court, London Road, Marlborough Wiltshire SN8 2AG (GB). **LAMB, John, David** [GB/GB]; Tin Horse Design Limited, Pelham House, Pelham Court, London Road, Marlborough Wiltshire SN8 2AG (GB).

(74) Agent: **CLARKE, Christopher, John**; Unilever PLC, Unilever Patent Group, Colworth House, Sharnbrook, Bedford Bedfordshire MK44 1LQ (GB).

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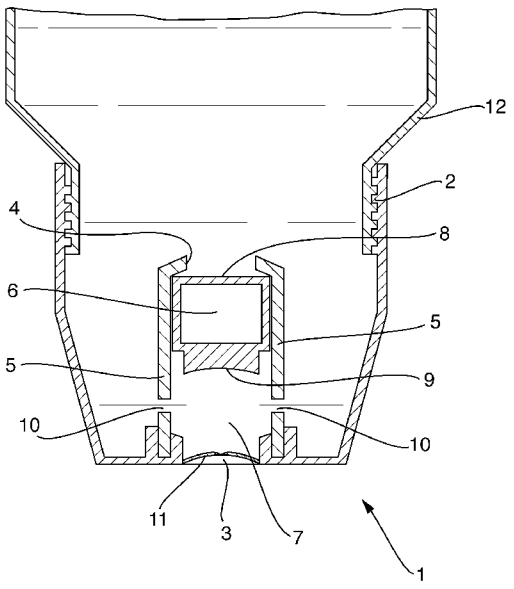
[Continued on next page]

(54) Title: DISPENSER CAP

Fig. 1



(57) Abstract: The present invention relates to a dispenser cap for a liquid container; the dispenser cap comprising a channel and a liquid outlet (3); the outlet requiring a difference in pressure to allow liquid to flow out of the outlet; the channel comprising a bore enclosed by channel walls (5), a first open end adjacent to the liquid outlet (3) and a second end adjacent to a stop (4); a moveable piston (6) being contained within the bore of the channel; the piston (6) being biased to a first position against the stop (4) whereby a dosing chamber (7) is defined by the piston (6), the channel walls (5) and the liquid outlet (3); the piston being moveable to a second position towards the liquid outlet (3) by forcing liquid between the stop (4) and the piston (6); the piston (6) sealing the liquid outlet (3) when it is in its second position; wherein the piston (6) is biased to its first position by a buoyant force and wherein the channel walls (5) comprise one or more inlet(s) (10) through which liquid can refill the dosing chamber (7).

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— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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DISPENSER CAP

TECHNICAL FIELD OF THE INVENTION

The present invention relates to a dispenser cap for a liquid container which can deliver a fixed dose of liquid in a reliable and simple manner.

BACKGROUND OF THE INVENTION

Certain liquid compositions are intended to be dispensed in specified quantities. One simple solution to this problem is to provide a separate measuring container with the liquid product. However, while this solution is simple, it suffers from the drawback that the measuring container may become lost or separated from the liquid container.

To address this problem, dispensing caps for liquid containers have been developed which are designed to deliver fixed quantities of liquid. As the dispensing cap is integral to the container, it cannot become detached and lost. However, most of these devices are complex to manufacture. For example, US 6,341,718 (Schilthuizen et al.) discloses a squeeze bottle for dispensing a liquid in a metered manner, wherein the metering chamber includes several moving parts. Thus it would be desirable to provide a dispensing cap with a more limited number of moving parts that is relatively simple to manufacture and/or is easy to assemble.

SUMMARY OF THE INVENTION

In a first aspect the invention relates to a dispenser cap for a liquid container; the cap comprising a channel and a liquid outlet; the outlet requiring a difference in pressure to allow liquid to flow out of the outlet; the channel comprising a bore enclosed by channel walls, a first open end adjacent to the liquid outlet, and a second end adjacent to a stop; a moveable piston being contained within the bore of the channel; the piston being biased to a first position against the stop whereby a dosing chamber is defined by the piston, the channel walls and the liquid outlet; the piston being moveable to a second position towards the liquid outlet by forcing liquid between the second end of the channel and the piston; the piston sealing the liquid outlet when it is in its second position; wherein the piston is biased to its first position by a buoyant force and wherein the channel walls comprise one or more inlet(s) through which liquid can refill the dosing chamber.

A dispenser cap with such an arrangement allows the delivery of a metered dose of a liquid and additionally or alternatively is easy to use and/or has a low manufacture cost.

In a second aspect, the invention relates to a container for holding a liquid comprising a dispenser cap according to the first aspect of the invention.

DEFINITIONS

As used herein the term "comprising" encompasses the terms "consisting essentially of" and "consisting of". It should be noted that in specifying any range of values or amounts, any particular upper value or amount can be associated with any particular lower value or amount. The disclosure of the invention as found herein is to be considered to cover all embodiments as found in the claims as being multiply dependent upon each other, irrespective of the fact that claims may be found with multiple dependency or redundancy.

Buoyant Force

The dispenser cap of the present invention allows the delivery of a metered dose of a liquid. One of the components of the dispenser cap is a moveable piston that is biased to a first position by a buoyant force. As used herein the term "buoyant force" refers to an upward acting force exerted by a liquid that opposes the weight of the piston. The liquid exerting the buoyant force is the liquid to be dispensed by the dispenser cap. The magnitude of the buoyant force depends on the relative densities of the piston and the liquid. In order for the piston to be buoyant, its density must be less than the density of the liquid. This is preferably achieved by providing a hollow piston.

A particular advantage of providing a dispenser cap wherein the moveable piston is biased to its first position by a buoyant force is that there is no need for an additional mechanical component (e.g. a spring) to return the piston to said first position. Thus, a dispenser cap according to the present invention has a simple mechanism and is likely to be relatively simple and/or cheap to manufacture. Moreover, a dispenser cap according to the present invention is relatively robust due to its simple configuration.

Buoyancy depends on volume, and as such the buoyancy of the piston will be reduced if it is compressed, therefore it is desirable that the piston is of a relatively rigid material. In a preferred embodiment, the piston comprises a rigid outer structure enclosing a cavity. The cavity preferably comprises a gas, more preferably air. Nevertheless, it is also envisaged that the cavity may contain a solid foam material.

DETAILED DESCRIPTION

By way of example, certain preferred embodiments of the invention are illustrated with reference to the following figures in which:

Figure 1 shows an axial cross-sectional view of a dispenser cap according to an embodiment of the invention.

Figures 2a to 2d are a series of axial cross-sectional views showing the operation of a dispenser cap according to an embodiment of the invention wherein the dispenser cap is attached to a liquid container.

A preferred embodiment of a dispenser cap according to the invention is shown in Figure 1. The dispenser cap **1** is shown in its rest position. Such a dispenser cap comprises a small number of moving components and is thus relatively robust.

In this preferred embodiment the dispenser cap **1** comprises a means for attachment **2** to a container, a channel and a liquid outlet **3**. The dispenser cap **1** may be attached to the container by any suitable means, for example by friction fit, gluing, snap-fitting or screwing. As such the means for attachment **2** to the container includes means such as a screw thread or snap ribs, however it is also envisaged that the dispenser cap need not require discrete fasteners. The dispenser cap is typically attached to the liquid container such that the liquid can be expelled from the container via the dispenser cap. In certain embodiments the dispenser cap is attached to the liquid container such that the channel projects into the container opening, e.g. the channel may project into the neck of the container. It should be noted that radial clearance between the exterior of the channel and the interior of the container opening is maintained so as not to impede the flow of liquid into the dispenser cap.

The channel comprises a first open end adjacent to the liquid outlet **3**, a second end adjacent to a stop **4** and a bore enclosed by channel walls **5**. It should be noted that as used herein the term "channel walls" is intended to cover embodiments wherein the bore is enclosed by one or more channel walls. As such, certain embodiments may comprise a channel wall which curves so as to enclose the bore of the channel but which does not comprise any discrete vertices. Although the bore of the channel preferably has a circular cross-section, any other cross-section shape may nevertheless be used. Preferably the bore of the channel is a central bore. The stop **4** preferably extends circumferentially around the second end of the channel in a continuous or discontinuous manner. In a particularly preferred embodiment the second end of the channel is

open. In this preferred embodiment the stop **4** desirably comprises a lip that extends around the second end of the channel in a continuous manner.

A moveable piston **6** is contained within the bore of the channel. Said piston is movable along the longitudinal axis of the channel. The piston **6** is biased to a first position against the stop **4** by a buoyant force whereby a dosing chamber **7** is defined by the piston **6**, the channel walls **5** and the liquid outlet **3**. The piston **6** is fitted so as to be able, in response to pressure, to move from a first position in which the dosing chamber **7** has a maximum volume to a second position in which the dosing chamber **7** has a minimum volume. The piston preferably fits substantially into the bore of the channel (i.e. occupying nearly all the cross-section without being a tight fit), so as to be freely slidable within it. This arrangement has the advantage of minimising lateral movement of the piston within the channel so as to reduce the likelihood of the piston tilting and/or becoming wedged in the channel.

In a particularly preferred embodiment, a first surface **8** of the piston **6** is in communication with the interior of the liquid container and a second surface **9**, which is opposite the first surface **8**, is in communication with the dosing chamber **7**.

The channel walls **5** comprise one or more inlet(s) **10**. Preferably the channel walls **5** contain from 1 to 8 inlets, more preferably from 2 to 6 inlets. The inlet(s) **10** are arranged such that the dosing chamber is in fluid connection with the liquid container when the piston **6** is in its first position (i.e. when the first surface **8** of the piston **6** is butting against the stop **4**). Furthermore, the positioning of the inlet(s) **10** means that when the piston **6** is in its second position (i.e. when the second surface **9** of the piston **6** is adjacent to the liquid outlet **3**) the dosing chamber is isolated from the liquid container by virtue of the piston **6** closing off the inlet(s) **10**. As such the dosing chamber **7** is in selective communication with the liquid container via the inlet(s) **10**. Where multiple inlets are present, said inlets are preferably arranged around the circumference of the channel at a uniform distance from the liquid outlet. However, it is also envisaged that the inlets may be arranged in tiers. The precise number and arrangement of the inlet(s) may vary, as may the size of the inlet(s). For example, in order to provide a dispenser cap that is suitable for dispensing a viscous liquid, a higher number of inlets and/or a larger size of inlets may be necessary in order to avoid the inlets becoming clogged with product and impeding the function of the dispenser cap. However, each of the inlet(s) should nevertheless be smaller in size than the bore of the channel. Typically, each of the inlet(s) will be smaller in size than the liquid outlet and, in those preferred embodiments wherein the second end of the channel is an

open end, each of the outlet(s) will also be smaller in size than the second open end of the channel.

The liquid outlet **3** is preferably centred on the longitudinal axis of the channel. In certain embodiments of the invention, the liquid outlet **3** houses a valve **11**. The liquid outlet valve **11** is typically included in order to help prevent unwanted leakage of liquid when the dispenser cap **1** is not in use. The liquid outlet valve **11** is preferably a non-return valve. In a particularly preferred embodiment the liquid outlet valve **11** comprises an elastically deformable membrane having at least one slit (i.e. a so-called slit valve). The degree of closure of the slit may depend to a large extent on the viscosity of the liquid product. Most preferably, the liquid outlet valve **11** is resiliently biased to its closed condition.

In certain embodiments a cap (not shown) may be provided to reversibly cover the liquid outlet. This cap may desirably include a plug closure for the liquid outlet. In a particularly preferred embodiment the cap may be integrally hinged to the dispenser cap.

The dispenser cap is attached to a liquid container **12**. The type of container to which the dispenser cap may be attached is limited only in that said container is suitable for holding a liquid and should comprise an opening through which the liquid can be expelled from the container. Indeed, it is envisaged that the dispenser cap can be manufactured to fit containers having openings of standard sizes. However, it is also possible to form the dosing chamber **7** of the dispenser cap integrally with the container, for example as part of the neck of a bottle, if this is desired. Preferably the container is a hand-held container.

The dispenser cap operates in response to a pressure increase to dispense a metered dose of the liquid product. Figures 2a to 2d show an embodiment of the dispenser cap in use according to the invention.

Figure 2a shows the dispenser cap in its rest position. The dispenser cap is attached to a liquid container **12**. The piston **6** is in its first position such that the dosing chamber **7** has a maximum volume.

As shown in Figure 2b, an increase in pressure in the container forces liquid between the second end of the channel and the first surface of the piston. The increase in pressure in the container may be achieved by any suitable means. In a preferred embodiment the container is squeezable

(e.g. by hand pressure) and hence the increase in pressure within the container may be induced by squeezing the container. The container preferably has deformable resilient sides, i.e. sides which deform when a force is applied thereto (e.g. by squeezing) and return to their original configuration when released. Preferably the container is a hand-held container.

As liquid is forced between the second end of the channel and the piston **6**, a force **F** is exerted on the piston. Once the force **F** is sufficient to overcome the buoyancy of the piston **6**, the piston slides in the direction of arrow **A**.

The movement of the piston **6** reduces the volume of the dosing chamber **7**, with a concomitant increase in pressure therein. This increase in pressure is sufficient to cause liquid to flow out of the liquid outlet **3**. In order to control the flow of liquid through the liquid outlet **3**, in a preferred embodiment the liquid outlet **3** houses a valve **11**. The valve **11** may by glued, snap-fitted, welded, or otherwise fastened around the liquid outlet **3**. The liquid outlet valve **11** may comprise an elastically deformable membrane. The membrane may include at least one slit, closed in the absence of pressure inside the dosing chamber **7** and capable of opening in response to an increase in pressure therein. Optionally, the membrane may be capable of occupying a concave profile with respect to the dosing chamber **7** (as shown, for example, in Figure 2b) in response to pressure exerted by the liquid product being expelled from the liquid outlet **3**.

The piston **6** continues to move in the direction of arrow **A** until the piston **6** reaches its second position as shown in Figure 2c. In this second position, the piston **6** seals the liquid outlet **3** such that there is substantially no leakage of the liquid product from the dispenser cap. The dispenser cap optionally comprises a seat **13** against which the piston abuts in order to seal the liquid outlet. Such a seat **13**, where present, is preferably positioned adjacent to the liquid outlet (**3**) and optimally extends circumferentially around the liquid outlet (**3**) in a continuous manner.

The flow of the liquid through the liquid outlet **3** is preferably cut off suddenly and completely with little or no subsequent dripping. As such, in a preferred embodiment the liquid outlet **3** houses a valve **11**, wherein said valve preferably allows the flow of liquid to be interrupted instantaneously.

The piston **6** restricts the flow of liquid from the container into the dosing chamber **7** when it is in its second position by closing off the inlet(s) **10**. It will be noted that when the piston **6** is in this second position the dosing chamber **7** has a minimum volume.

As shown in Figure 2d, once the force exerted on the container walls is released (e.g. by the user ceasing to squeeze the container), the resilient nature of the container walls means that they return to their original configuration, which in turn causes the container to expand to its original volume. Liquid is no longer forced between the second end of the channel and the piston and consequently force **F** is no longer exerted on the piston. The buoyancy of the piston **6** now urges it back towards its first position in the direction of arrow **B**. This movement of the piston **6** increases the volume of the dosing chamber **7**, with a concomitant decrease in pressure therein. At the same time, the movement of the piston exposes the inlet(s) **10**. Consequently the reduced pressure in the dosing chamber causes liquid to flow through the inlet(s) **10** and into the dosing chamber **7** as shown by arrows **C**.

The container is preferably fitted with an air admittance valve **14** which allows air to enter the container to replace the volume of product dispensed. The air admittance valve is a non-return valve which allows substantially no flow of liquid out of the liquid container, and in a particularly preferred embodiment it is a so-called duckbill valve. In the preferred embodiment illustrated in Figure 2d, the expansion of the liquid container to its original volume causes the air admittance valve to open and admit air as shown by arrow **D**.

In embodiments wherein the liquid outlet houses a liquid outlet valve **11** comprising an elastically deformable membrane, the reduced pressure in the dosing chamber may cause the membrane to return to a convex profile with respect to the dosing chamber **7** (as shown, for example, in Figure 2d). During this return of the membrane towards the inside of the dosing chamber **7**, it is preferably that there is substantially no backflow of air into the liquid container. In certain embodiments, however, there is a possibility that a small intake of air towards the container may occur.

The moveable piston **6** continues to move in the direction of arrow **B** until it has returned to its first position, hence the components assume the same position shown in Figure 2a and the next dose may be dispensed.

To facilitate dosing of the liquid product in a relatively precise manner it is preferred that the moveable piston **6** has a fixed stroke. Furthermore, it is desirable that the channel walls **5** and/or the moveable piston **6** are of a relatively rigid material so as to ensure that any pressure increase does not deform these components. In certain embodiment it may be desirable to limit the number of inlet(s) **10** so as not to impact the structural integrity of the channel walls **5**.

CLAIMS

1. A dispenser cap for a liquid container; the dispenser cap comprising a channel and a liquid outlet (**3**); the outlet requiring a difference in pressure to allow liquid to flow out of the outlet; the channel comprising a bore enclosed by channel walls (**5**), a first open end adjacent to the liquid outlet (**3**) and a second end adjacent to a stop (**4**); a moveable piston (**6**) being contained within the bore of the channel; the piston (**6**) being biased to a first position against the stop (**4**) whereby a dosing chamber (**7**) is defined by the piston (**6**), the channel walls (**5**) and the liquid outlet (**3**); the piston being moveable to a second position towards the liquid outlet (**3**) by forcing liquid between the stop (**4**) and the piston (**6**); the piston (**6**) sealing the liquid outlet (**3**) when it is in its second position; wherein the piston (**6**) is biased to its first position by a buoyant force and wherein the channel walls (**5**) comprise one or more inlet(s) (**10**) through which liquid can refill the dosing chamber (**7**).

2. A dispenser cap as claimed in claim 1 wherein the piston (**6**) restricts the flow of liquid from the container into the dosing chamber (**7**) when it is in its second position.

3. A dispenser cap as claimed in claim 1 or claim 2 wherein the second end of the channel adjacent to the stop (**4**) is an open end.

4. A dispenser cap as claimed in any one of the preceding claims wherein the stop (**4**) extends circumferentially around the second end of the channel.

5. A dispenser cap as claimed in any one of the preceding claims wherein the piston (**6**) fits substantially into the bore of the channel.

6. A dispenser cap as claimed in any one of the preceding claims wherein the piston (**6**) is hollow.

7. A dispenser cap as claimed in any one of the preceding claims wherein the channel walls (**5**) contain from 1 to 8 inlets (**10**), preferably from 2 to 6 inlets (**10**).

8. A dispenser cap as claimed in any one of the preceding claims wherein the liquid outlet (**3**) comprises a liquid outlet valve (**11**), preferably a non-return valve allowing only flow of liquid out of the container and substantially no backflow of air into the liquid container.

9. A dispenser cap as claimed in claim 8 wherein the liquid outlet valve (**11**) comprises an elastically deformable membrane having at least one slit.

10. A dispenser cap as claimed in any one of the preceding claims wherein the bore of the channel has a circular cross-section.

11. A dispenser cap as claimed in any one of the preceding claims wherein the dispenser cap additionally comprises a means for attachment (**2**) to the liquid container.

12. A container for holding a liquid comprising a dispenser cap according to any one of claims 1 to 10.

13. A container as claimed in or claim 12 wherein the container comprises an air admittance valve (**14**) allowing flow of air into the container.

14. A container as claimed in claim 12 or claim 13 wherein the container is squeezable.

15. A container as claimed in any one of claims 12 to 14 wherein the container has resilient flexible sides.

Fig. 1

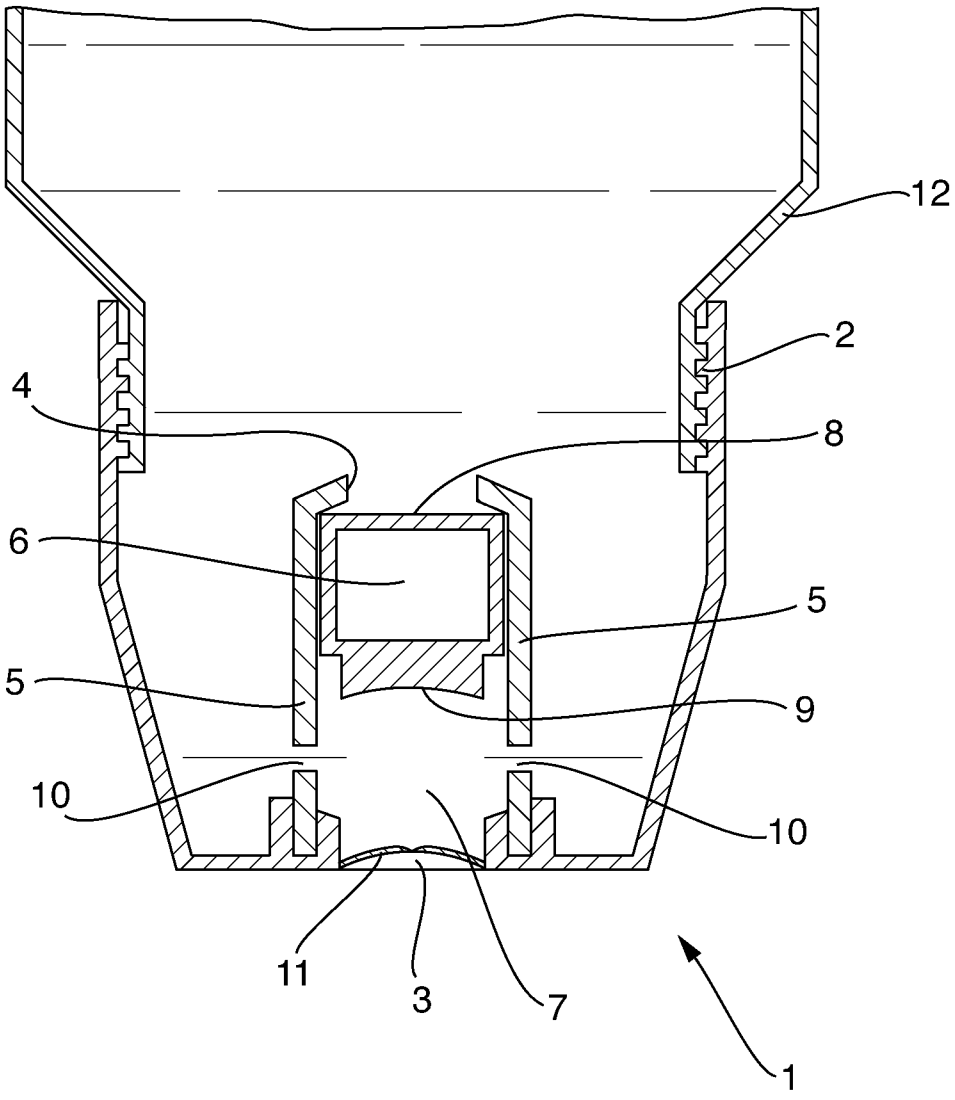


Fig. 2a

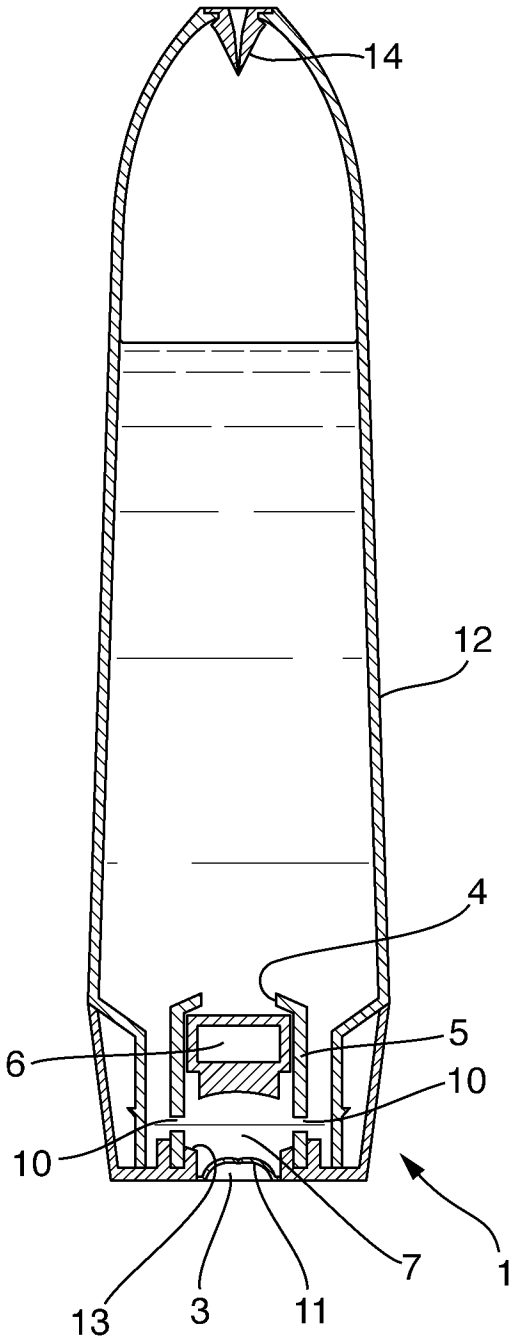


Fig. 2b

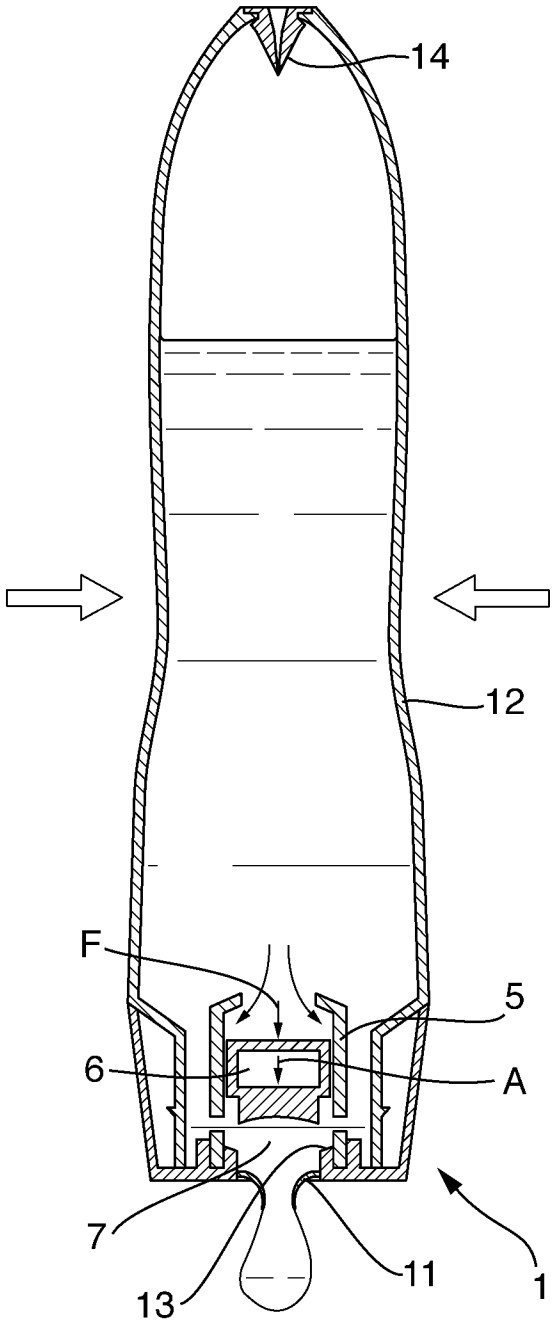


Fig. 2c

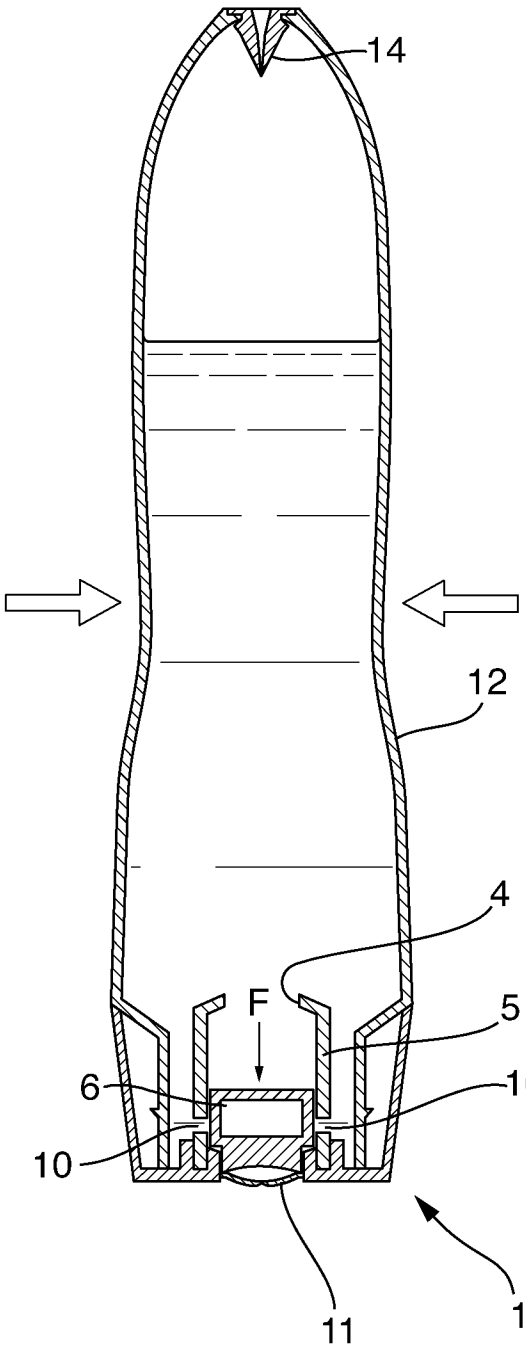
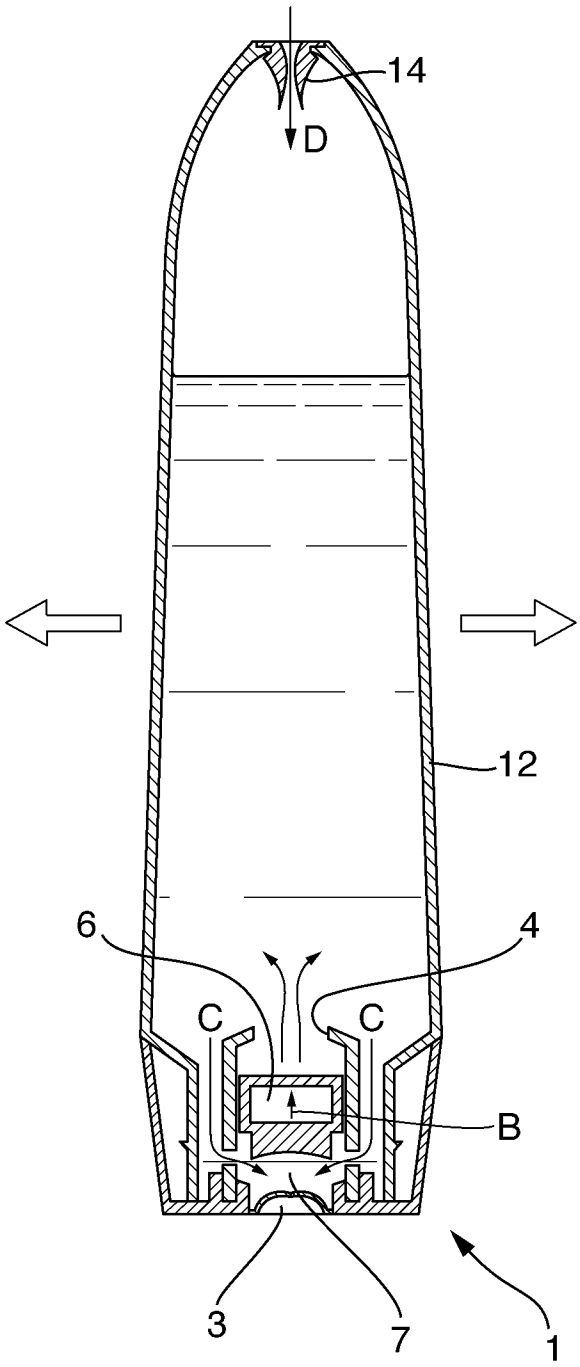


Fig. 2d



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/057957

A. CLASSIFICATION OF SUBJECT MATTER
INV. G01F11/04 G01F11/28
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G01F B05B A47K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2010/052390 A1 (WOZNA PATRICK [FR]) 14 May 2010 (2010-05-14) page 1, line 4 - line 21 page 6, line 29 - page 7, line 10 page 8, line 14 - line 28 page 12, line 28 - page 13, line 20; figures 5, 5b page 11, line 18 - page 12, line 26; figure 4	1-12,14, 15
A	US 3 567 079 A (WEIGAND CLEONE H) 2 March 1971 (1971-03-02) column 2, line 44 - line 52; figures	1
A	US 4 728 011 A (SCHUSTER WILHELM [DE] ET AL) 1 March 1988 (1988-03-01) column 4, line 42 - line 61; figures	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

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Date of the actual completion of the international search	Date of mailing of the international search report
30 July 2012	06/08/2012

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Endrizzi, Silvio

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2012/057957

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