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(54) **Finger operated spray pump**

Fingerbetätigte Zerstäuberpumpe

Pompe de pulvérisation actionné par un doigt

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Description

[0001] The invention is related to finger operated spray pumps for spraying aerosol products by means of an atomiser arrangement. In detail the invention has as a starting point a finger operated spray pump according to the generic part of claim 1. A spray pump according to the preamble of claim 1 is known from EP 0627 230.

[0002] Conventional aerosol finger operated spray pumps produce pressures of typically 4 bar by means of a cylinder/piston-arrangement. Those pumps operate a pressures of much less than 10 bar anyway and do not lend themselves to higher pressures, as the cylinder/piston-valve arrangement is moulded in thin plastics. However, in the prior art it is understood that higher pressures cannot be achieved anyway, because the average operating force provided by a finger on the hand of an operator will normally be around 10 N and will even in the extreme not exceed 30 N.

[0003] Because of the low pressure generated in the cylinder/piston-arrangement of prior art finger operated spray pumps the liquid to be atomised must be of low viscosity. This means that large quantities of solvent such as alcohol and water are required in the formulation of the liquid to lower the viscosity of the liquid. The high-level solvent formulations of liquid used in conventional aerosol finger operated spray pumps lead to sprays that are recognized by the user as "wet". Reducing the amount of solvent means that the liquid becomes more viscous and more difficult to be sprayed. In order to increase the pressure in the spray pump a mechanical advantage linkage is required so that the force of the finger which is available can be transferred to a higher pressure. This, however reduces the piston stroke in comparison with the stroke length of the finger itself.

[0004] The object of the present invention is to provide a finger operated spray pump system that is capable of atomising small doses of liquid in order to produce a "dry" spray of liquid, i. e. a spray of liquid using much less solvent than prior art aerosol finger operated spray pumps.

[0005] The above mentioned problem is met by a finger operated spray pump with the features of the generic part and in addition comprising the features of the characterizing part of claim 1. It has been realized according to the invention that a mechanical advantage linkage to increase the finger force can be avoided if the diameter of the cylinder/piston-system is reduced. A smaller diameter of the piston leads to a higher pressure which is obtainable by the spray pump. However, the nozzle-diameter of the atomiser must be adapted to the piston diameter which is done according to the corresponding feature of the main claim. Finally, the operating pressure above 10 bar can be obtained only if the parts of the spray pump are manufactured from materials and in a way to withstand those elevated operating pressures.

[0006] Preferred features of the finger operated spray pump can be obtained from the sub claims. The piston stroke according to claim 2 is adapted to the usual and comfortable stroke length of the original finger stroke of a person using the finger operated spray pump.

[0007] The liquid dose per spray stroke according to claim 3 is preferable for many kinds of applications like perfume application.

[0008] It is particularly advantageous that the piston be made as a hollow piston and thus having the passageway means formed into the hollow piston. This is advantageous for both variants with the piston fixedly attached to the liquid reservoir (claim 4) or fixedly attached to the actuator (claim 5). Preferred internal piston diameters are given in claim 6 and the preferred embodiment of the hollow piston as a metal capillary tube is the subject of claim 7. The use of a metal capillary tube as a hollow piston simultaneously forming the passageway means is perfectly adapted to a high viscosity perfume oil as a preferred liquid for such finger operated spray pump.

[0009] There are a number of optional features to be realized in the spray pump like a filter to protect the atomiser (claim 11), a second one way valve means to prevent air ingress into the cylinder (claim 12) and an air vent means on a rigid liquid reservoir to allow pressure equalization in the liquid reservoir (claim 14).

[0010] An interesting alternative to a rigid liquid reservoir may be a collapsible bag directly connected to the passageway means, perhaps within an outer more rigid protecting means (claim 15).

[0011] The present invention relates to a finger operated spray pump that generates aerosol sprays of low doses with relatively small particles. It is ideally suited for formulations of liquid with a substantially reduced amount of solvent. The sprays generated give a "dry" feeling. They are well suited for applications such as perfumes, bodysprays, hairsprays and other surface or space sprays.

[0012] Now, preferred embodiments of the invention will be described by way of examples with references to the drawings. In the drawings

- Fig. 1 shows schematically a first embodiment of a finger operated spray pump with a rigid liquid reservoir and a dip tube,
- Fig. 2 shows a modification of Fig. 1 with a one way valve means behind the atomiser,
- Fig. 3 shows the same spray pump as Fig. 1 now with a one way valve means and a filter behind the atomiser,
- Fig. 4 shows a second embodiment with a liquid reservoir in the form of a collapsible bag contained in an outer protective housing,
- Fig. 5 shows a third embodiment similar to the embodiment of Fig. 1, but the atomiser in line with the cylinder in the actuator,

Fig. 6 shows a fourth embodiment with a hollow piston attached to the actuator and a cylinder fixedly attached to the liquid reservoir.

[0013] Fig. 1 shows a first embodiment of the invention which is a finger operated spray pump. This finger operated spray pump is comprising a liquid reservoir 1, which here is in the form of a rigid container, intended to contain a supply of liquid 2. A cylinder 3 contains a pump volume 4 of liquid. The cylinder 3 is connected at one end to an atomiser 5 and is intended to contain a portion of liquid from the reservoir 1, a part of which is to be ejected through the atomiser 5 in a spray stroke.

[0014] The atomiser 5 may be of the swirl chamber type with a swirl chamber in front of the nozzle exit. However, it may be of a double jet impender type or of any other type realizing a mechanical brake up nozzle character. Ideas for such atomiser 5 can be found for example in DE 101 54 237 A1. However, the atomiser 5 may as well produce a jet of liquid if a specific requirement has to be met.

[0015] Fig. 1 shows that a piston 6 is sealingly mounted within the cylinder 3 and is movable within and relative to the cylinder 3 in the spray stroke. The volume within the cylinder 3 is reduced and a corresponding amount of the liquid in the pump volume 4 of the cylinder 3 is ejected through the atomiser 5. In a return stroke the piston 6 is movable within and relative to the cylinder 3 such that the volume within the cylinder 3 is increased and a corresponding amount of the liquid is drawn in from the liquid reservoir 1 into the cylinder 3. Fig. 1 shows the position of the parts of this embodiment at the end of the return stroke, eventually the beginning of the spray stroke.

[0016] A passageway means 7 is connecting the cylinder 3 with the supply of liquid 2 in the liquid reservoir 1. A one way valve means 8 at the passageway means 7 allows a flow of liquid only from the supply of liquid 2 into the cylinder 3 but not in the opposite direction. The actuator 9 has the atomiser 5 mounted at right angles to the cylinder 3 and connected to the cylinder 3 by way of a short connecting duct 3'.

[0017] A finger operated actuator 9 is indicated in Fig. 1 and a finger tip is schematically indicated there as well. By means of the force of the finger tip the actuator 9 is displaceable relative to the liquid reservoir 1 in the spray stroke, i. e. downwards in Fig. 1, and relative to the liquid reservoir 1 in an opposite direction in the return stroke (upwards in Fig. 1, Fig. 1 showing the end of the return stroke). The displacement of the actuator 9 induces the movement of the piston 6 relative to the cylinder 3 and, in the spray stroke, the ejection of the liquid 2 within the pump volume 4 through the atomiser 5. The return stroke is induced by a return spring force. In the embodiment of Fig. I the return spring force is provided by a return spring 10 displayed here as a coil spring.

[0018] The piston 6 is sealingly mounted within the cylinder 3 so that a pressure build up can take place in the cylinder 3 on the spray stroke. In Fig. 1 the seal is indicated as a ring seal 6' schematically. However, the seal between piston 6 an cylinder 3 may as well be a solid seal mounted at the piston 6 or a simple gap seal realized by an extremely small gap between piston 6 and cylinder 3 having a sealing characteristic for a liquid 2 of sufficient viscosity.

[0019] According to the invention the outer diameter of the piston 6 and the corresponding inner diameter of the cylinder 3 is between 0,5 mm and about 4,0 mm, preferably between about 1,0 mm and about 3,0 mm, most preferably between about 1,5 mm and about 2,5 mm. The nozzle-diameter of the atomiser 5 is between 15 μm and 150 μm, preferably between about 30 μm and about 100 μm. The operating pressure within the cylinder 3 during the spray stroke with average finger force is between 10 bar and 400 bar, preferably between about 40 bar and about 200 bar, most preferably between about 50 bar and about 100 bar. The atomiser 5, the cylinder 3, the piston 6 and the one way valve means 8 are manufactured from materials and in a way to withstand the elevated operating pressure.

[0020] In the present, and preferred, embodiment the piston stroke is between 2 and 30 mm, preferably between about 15 mm and about 20 mm, which is comfortably adapted to the usual stroke of a finger of a person using the spray pump.

[0021] As explained above, this finger operated spray pump has the advantage that low doses of high viscosity liquid with a low amount of solvent can be sprayed. Preferably the liquid dose per spray stroke is between 5 μl and 300 μl preferably between about 10 μl and about 100 μl, most preferably between about 20 μl and about 50 μl.

[0022] Fig. 1 shows a substantially preferred embodiment in that the piston 6 is fixedly attached to the liquid reservoir 1 and is made as a hollow piston simultaneously forming the passageway means 7 connected at one end directly or via a dip tube 11 to the supply of liquid 2 and at the other end to the cylinder 3. In fact the piston 6 is fixedly attached to the liquid reservoir 1 whereas the cylinder 3 and the atomiser 5 are arranged within the actuator 9. The actuator 9 with cylinder 3 and atomiser 5 in total is moved against the return spring force of the return spring 10 from the position in Fig. 1 downwards in the spray stroke towards the liquid reservoir 1. The passageway means 7 is integrated into the piston 6 itself, the piston 6 is a hollow piston.

[0023] In a preferred embodiment the internal diameter of the hollow piston 6 is between about 0,2 mm and about 3,0 mm, preferably between about 0,5 mm and about 1,0 mm. In a particularly advantageous embodiment the hollow piston 6 is made as a metal capillary tube.

[0024] In order to withstand the elevated operating pressures in a preferred embodiment the body of the actuator 9 is made from metal, preferably aluminium, or from highly pressure resistant plastic. Even the capillary tube may be made from a specifically selected plastic.

[0025] The one way valve means 8 in the embodiment

of Fig. 1 is mounted at the inlet end of the passageway means 7, i. e. in this embodiment the inlet end of the hollow piston 6. However, an alternative position may be the outlet end or a position between the inlet end and the outlet end. Specific positions of the one way valve means 8 for a high pressure spray pump can be obtained from DE 195 36 902 A1. As a conventional solution, however, the passageway means 7 can be equipped at its inlet end with an additional check valve (ball valve).

[0026] Fig. 6 shows an alternative embodiment of an otherwise very similar finger operated spray pump. The same parts of the spray pump as in Fig. 1 are identified with the same reference numbers and need no additional explanation. However, here the piston 6 is fixedly attached to the actuator 9 and is made as a hollow piston simultaneously forming connecting means 13 connecting the cylinder 3 with the atomiser 5. Here the cylinder 3 is fixedly attached to the liquid reservoir 1 and the piston 6 is fixedly attached to the actuator 9.

[0027] A third construction is not displayed in the drawings. In this the cylinder 3 is fixedly connected to the reservoir 1 via the passageway means 7 and the valve means 8. The cylinder 3 may be of T-form with three arms respectively connected to the reservoir 1, the atomiser 5 and the sealingly mounted piston 6. The actuator 9 has a solid piston 6 in addition to the return spring 10. This is more a traditional construction of such a cylinder-piston-assembly.

[0028] Fig. 2 shows the same spray pump as Fig. 1, but in addition shows that a filter 14 is provided between the cylinder 3 and the atomiser 5 to protect the atomiser 5.

[0029] Fig. 3 shows the same spray pump as Fig. 2, but in addition that a second one way valve means 15 is provided between the atomiser 5 and the cylinder 3 preventing air in grass via the atomiser 5 into the cylinder 3 during the return stroke.

[0030] All Fig. 1, 2, 3 show the liquid reservoir 1 as a rigid bottle with the passageway means 7 / piston 6 fixedly connected thereto, in particular to a closure 12 of the reservoir 1 which is schematically shown in Fig. 1, 2, 3.

[0031] An air vent means 16 is disclosed for the embodiment with rigid reservoir 1 as shown in Fig. 1, 2, 3 as a valve with flexible lip means. Also the closure 12 of the reservoir 1 can integrate some means that allow air to enter for pressure equalization in the liquid reservoir 1. The air vent means 16 may be a mechanically operated one way valve opened by a corresponding operating formation on the actuator 9 during the last leg of the spray stroke.

[0032] Fig. 4 shows a different embodiment which is otherwise similar to Fig. 3, but with a liquid reservoir 1 which is not a rigid bottle but is a collapsible bag directly connected to the passageway means 7. This collapsible bag as liquid reservoir 1 as such is mounted within an outer protective housing 17 which itself is closed by a closure 12, the closure 12 again carrying the passageway means 7 / piston 6.

[0033] The outer protective housing 17 has an air vent means 16 which allows entry of air into the outer protective housing 17 following the strokewise emptying of the collapsible bag.

[0034] The liquid reservoir 1 in the form of a collapsible bag may be of a laminated type to prevent unwanted ingress of air (oxygen). A rigid reservoir 1 may be a long tube small enough in diameter to prevent air bubbles forming within the liquid.

[0035] Fig. 5 shows a finger operated spray pump otherwise similar to Fig. 1 but with the atomiser 5 in line with the cylinder 3 and its pump volume 4. Finger pads 18 can be seen at the sides of the atomiser 5.

[0036] The finger operated spray pump may be used upside down even with a rigid reservoir 1 so that no dip tube 11 and only a short passageway means 7 is necessary.

[0037] To operate the finger operated spray pump according to the invention, explained with regard to Fig. 1, finger pressure is applied to the top of the actuator 9. Liquid within the pump volume 4 of the cylinder 3 is forced under pressure through the connecting duct 3' and the atomiser 5 creating a spray outside of the atomiser 5. The mass mean particle diameter of the spray produced like this is between 5 and 100 μm.

[0038] The one way valve means 8 prevents liquid from returning to the reservoir 1 during spraying. When the finger pressure is removed from the actuator 9 the return spring 10 returns the actuator 9 to its normal position (this is the return stroke). In doing so liquid 2 is sucked up from the liquid reservoir 1 through the dip tube 11 and the passageway means 7 into the pump volume 4 in the cylinder 3. Another spray stroke is prepared and can be initiated immediately.

[0039] If a spray stroke is intended only with a fresh volume of liquid 2 in the cylinder 3, there may be a fixing means 19 fixing the actuator 9 on the reservoir 1 in its lower position (at the end of the spray stroke). Before activating the finger operated spray pump this must be released for a first return stroke. Fig. 6 shows such fixing means 19 as a holding clip.

Claims

1. Finger operated spray pump comprising:

a liquid reservoir (1) intended to contain a supply of liquid (2);
a cylinder (3) connected at one end to an atomiser (5) and intended to contain a portion of liquid from the reservoir (1), a part of which is to be ejected through the atomiser (5);
a piston (6) sealingly mounted within the cylinder (3) and movable within and relative to the cylinder (3) in a spray stroke such that the volume within the cylinder (3) is reduced and a corresponding amount of the liquid in the cylinder (3) is ejected through the atomiser (5), and in a re-

turn stroke such that the volume within the cylinder (3) is increased and a corresponding amount of the liquid is drawn from the supply of liquid (2) into the cylinder (3);
a passageway means (7) connecting the cylinder (3) with the supply of liquid (2) in the liquid reservoir (1);
a one way valve means (8) at the passageway means (7) allowing a flow of liquid only from the supply of liquid (2) into the cylinder (3); and
a finger operated actuator (9) displaceable by finger pressure relative to the liquid reservoir (1);

wherein the displacement of the actuator (9) induces the movement of the piston (6) relative to the cylinder (3),
wherein the outer diameter of the piston (6) and the corresponding inner diameter of the cylinder (3) is between about 0,5 mm and about 4,0 mm,
wherein the nozzle-diameter(s) of the atomiser (5) is between 15 μm and 150 μm,
wherein the operating pressure within the cylinder (3) during the spray stroke is between 10 bar and 400 bar,
characterized in
that the actuator (9) is displaceable by finger pressure relative to the liquid reservoir (1) in the spray stroke and is displaceable by a return spring force relative to the liquid reservoir (1) in an opposite direction in the return stroke.

2. Finger pump according to claim 1, **characterized in that** the piston stroke is between 2 and 30 mm, preferably between about 15 mm and about 20 mm.

3. Finger pump according to claim 1 or 2, **characterized in that** the liquid dose per spray stroke is between 5 μl and 300 μl preferably between about 10 μl and about 100 μl, most preferably between about 20 μl and about 50 μl.

4. Finger pump according to any one of the claims 1 to 3, **characterized in that** the piston (6) is fixedly attached to the liquid reservoir (1) and is made as a hollow piston simultaneously forming the passageway means (7) connected at one end directly or via a dip tube (11) to the supply of liquid (2) and at the other end to the cylinder (3), wherein, preferably, the internal diameter of the hollow piston (6) is between about 0,2 mm and about 3,0 mm, preferably between about 0,5 mm and about 1,0 mm, and/or the hollow piston (6) is made as a metal capillary tube.

5. Finger pump according to any one of the claims 1 to 3, **characterized in that** the piston (6) is fixedly attached to the actuator (9) and is made as a hollow piston simultaneously forming connecting means (13) connecting the cylinder (3) with the atomiser (5), wherein, preferably, the internal diameter of the hollow piston (6) is between about 0,2 mm and about 3,0 mm, preferably between about 0,5 mm and about 1,0 mm, and/or the hollow piston (6) is made as a metal capillary tube.

6. Finger pump according to any one of the claims 1 to 5, **characterized in that** the body of the actuator (9) is made from metal, preferably from aluminium or from highly pressure resistant plastic.

7. Finger pump according to any one of the preceding claims except claim 5, **characterized in that** the piston (6) is fixedly attached to the liquid reservoir (1) and the cylinder (3) and the atomiser (5) are arranged within or as part of the actuator (9).

8. Finger pump according to any one of the preceding claims except claim 4, **characterized in that** the cylinder (3) is fixedly attached to the liquid reservoir (1) and the piston (6) is fixedly attached to the actuator (9).

9. Finger pump according to any one of the preceding claims, **characterized in that** a filter (14) is provided between the cylinder (3) and the atomiser (5) to protect the atomiser (5), and/or a second one way valve means (15) is provided between the atomiser (5) and the cylinder (3) preventing air ingress via the atomiser (5) into the cylinder (3) during the return stroke.

10. Finger pump according to any one of the preceding claims, **characterized in that** the liquid reservoir (1) is a rigid bottle with the passageway means (7) fixedly connected thereto, wherein, preferably, the rigid liquid reservoir (1) is provided with an air vent means (16) to allow pressure equalization in the liquid reservoir (1).

11. Finger pump according to any one of the claims 1 to 9, **characterized in that** the liquid reservoir (1) is a collapsible bag directly connected to the passageway means (7).

12. Finger pump according to any one of the claims 1 to 11, **characterized in that** there is provided a fixing means (19) fixing the actuator (9) on the reservoir (1) in its lower position and being releasable for a first return stroke before activating the spray pump.

Patentansprüche

1. Fingerbetätigte Sprühpumpe, aufweisend:

ein Flüssigkeitsreservoir (1), das einen Vorrat einer Flüssigkeit (2) enthalten soll,
einen Zylinder (3), der an einem Ende mit einem

Zerstäuber (5) verbunden ist und eine Flüssigkeitsportion aus dem Reservoir (1) enthalten soll, wovon ein Teil durch den Zerstäuber (5) ausgestoßen werden soll,
einen Kolben (6), der dicht im Zylinder (3) montiert und im und in Bezug auf den Zylinder (3) beweglich ist in einem Sprühhub, so dass das Volumen im Zylinder (3) verringert und eine entsprechende Menge der Flüssigkeit im Zylinder (3) durch den Zerstäuber (5) ausgestoßen wird, und in einem Rückhub, so dass das Volumen im Zylinder (3) vergrößert und eine entsprechende Flüssigkeitsmenge aus dem Vorrat von Flüssigkeit (2) in den Zylinder (3) eingezogen bzw. eingesaugt wird,
ein Durchgangsmittel (7), das den Zylinder (3) mit dem Vorrat an Flüssigkeit (2) im Flüssigkeitsreservoir (1) verbindet,
ein Einwegeventilmittel (8) am Durchgangsmittel (7), das nur eine Flüssigkeitsströmung vom Vorrat an Flüssigkeit (2) in den Zylinder (3) gestattet, und
ein fingerbetätigtes Betätigungsglied (9), das durch Fingerdruck relativ zu dem Flüssigkeitsreservoir (1) verschiebbar ist,

wobei die Verschiebung des Betätigungsglieds (9) die Bewegung des Kolbens (6) bezüglich des Zylinders (3) bewirkt,
wobei der Außendurchmesser des Kolbens (6) und der entsprechende Innendurchmesser des Zylinders (3) zwischen etwa 0,5 mm und etwa 4,0 mm liegen,
wobei der/die Düsendurchmesser des Zerstäubers (5) zwischen 15 μm und 150 μm liegt/liegen,
wobei der Betriebsdruck im Zylinder (3) während des Sprühhubs zwischen 10 bar und 400 bar beträgt,
dadurch gekennzeichnet,
dass das Betätigungsglied (9) beim Sprühhub mittels Fingerdruck relativ zum Flüssigkeitsreservoir (1) und beim Rückhub mittels einer Rückstellfederkraft bezüglich des Flüssigkeitsreservoirs (1) in einer entgegengesetzten Richtung verschiebbar ist.

2. Fingerpumpe nach Anspruch 1, **dadurch gekennzeichnet, dass** der Kolbenhub zwischen 2 und 30 mm, vorzugsweise zwischen etwa 15 mm und etwa 20 mm liegt.

3. Fingerpumpe nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Flüssigkeitsdosis pro Sprühhub zwischen 5 μl und 300 μl, vorzugsweise zwischen etwa 10 μl und etwa 100 μl, besonders bevorzugt zwischen etwa 20 μl, und etwa 50 μl liegt.

4. Fingerpumpe nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** der Kolben (6) fest am Flüssigkeitsreservoir (1) angebracht und als ein hohler Kolben ausgebildet ist, der gleichzeitig das Durchgangsmittel (7) bildet, das an einem Ende direkt oder über ein Tauchrohr (11) mit dem Vorrat an Flüssigkeit (2) und am anderen Ende mit dem Zylinder (3) verbunden ist, wobei vorzugsweise der Innendurchmesser des hohlen Kolbens (6) zwischen etwa 0,2 mm und etwa 3,0 mm, vorzugsweise zwischen etwa 0,5 mm und etwa 1,0 mm liegt und/oder der hohle Kolben (6) als eine Kapillarröhre aus Metall ausgebildet ist.

5. Fingerpumpe nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** der Kolben (6) fest am Betätigungsglied (9) angebracht und als hohler Kolben ausgebildet ist, der gleichzeitig das Verbindungsmittel (13) bildet, das den Zylinder (3) mit dem Zerstäuber (5) verbindet, wobei vorzugsweise der Innendurchmesser des hohlen Kolbens (6) zwischen etwa 0,2 mm und etwa 3,0 mm, vorzugsweise zwischen etwa 0,5 mm und etwa 1,0 mm liegt und/oder der hohle Kolben (6) als eine Kapillarröhre aus Metall ausgebildet ist.

6. Fingerpumpe nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** der Körper des Betätigungsglieds (9) aus Metall, vorzugsweise Aluminium, oder aus einem hochdruckfesten Kunststoff hergestellt ist.

7. Fingerpumpe nach einem der vorhergehenden Ansprüche, außer Anspruch 5, **dadurch gekennzeichnet, dass** der Kolben (6) fest an dem Flüssigkeitsreservoir (1) angebracht ist, während der Zylinder (3) und der Zerstäuber (5) im oder als Teil des Betätigungsglieds (9) angeordnet sind.

8. Fingerpumpe nach einem der vorhergehenden Ansprüche, außer Anspruch 4, **dadurch gekennzeichnet, dass** der Zylinder (3) fest am Flüssigkeitsreservoir (1) und der Kolben (6) fest am Betätigungsglied (9) angebracht ist.

9. Fingerpumpe nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** zum Schutz des Zerstäubers (5) ein Filter (14) zwischen dem Zylinder (3) und dem Zerstäuber (5) vorgesehen ist und/oder zwischen dem Zerstäuber (5) und dem Zylinder (3) ein zweites Einwegeventilmittel (15) vorgesehen ist, das verhindert, dass während des Rückhubs Luft über den Zerstäuber (5) in den Zylinder (3) eintritt.

10. Fingerpumpe nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Flüssigkeitsreservoir (1) eine starre Flasche ist, mit der das Durchgangsmittel (7) fest verbunden ist, wobei vorzugsweise zur Gestattung von Druckausgleich im Flüssigkeitsreservoir (1) das starre Flüssigkeitsre-

servoir (1) mit einem Entlüftungsmittel (16) versehen ist.

11. Fingerpumpe nach einem der Ansprüche 1 bis 9, **dadurch gekennzeichnet, dass** das Flüssigkeitsreservoir (1) ein kollabierbarer Beutel ist, der direkt mit dem Durchgangsmittel (7) verbunden ist.

12. Fingerpumpe nach einem der Ansprüche 1 bis 11, **dadurch gekennzeichnet, dass** ein Befestigungsmittel (19) vorgesehen ist, das das Betätigungsglied (9) am Reservoir (1) in seiner unteren Position festlegt und vor dem Betätigen der Sprühpumpe für einen ersten Rückhub freigebbar ist.

Revendications

1. Pompe de vaporisation actionnée à l'aide d'un doigt, comprenant :

un réservoir pour liquide (1) destiné à contenir une alimentation de liquide (2) ;
un cylindre (3) connecté à une de ses extrémités à un atomiseur (5) et destiné à contenir une portion du liquide du réservoir (1), une partie dudit liquide devant être éjectée à travers l'atomiseur (5) ;
un piston (6) monté de manière étanche à l'intérieur du cylindre (3) et apte à se déplacer à l'intérieur et par rapport audit cylindre (3) dans une course de vaporisation de telle sorte que le volume à l'intérieur du cylindre (3) est réduit et de telle sorte qu'une quantité correspondante du liquide dans le cylindre (3) est éjectée à travers l'atomiseur (5), et dans une course de retour de telle sorte que le volume à l'intérieur du cylindre (3) augmente et de telle sorte qu'une quantité correspondante du liquide est aspirée depuis l'alimentation de liquide (2) jusque dans le cylindre (3) ;
un moyen de passage (7) reliant le cylindre (3) à l'alimentation de liquide (2) dans le réservoir pour liquide (1) ;
un moyen de vanne unidirectionnelle (8) du moyen de passage (7), permettant un écoulement de liquide uniquement depuis l'alimentation de liquide (2) jusque dans le cylindre (3) ; et
un actionneur (9) entraîné à l'aide d'un doigt, apte à se déplacer sous la pression d'un doigt, par rapport au réservoir pour liquide (1) ;

dans lequel, le déplacement de l'actionneur (9) induit le mouvement du piston (6) par rapport au cylindre (3) ;
dans lequel le diamètre externe du piston (6) et le diamètre interne correspondant du cylindre (3) se situent entre environ 0,5 mm et environ 4,0 mm ;
dans lequel le(s) diamètre(s) du ou des orifices de l'atomiseur (5) se situe(nt) entre 15 μm et 150 μm ;
dans lequel la pression de travail au sein du cylindre (3) au cours de la course de vaporisation se situe entre 10 bars et 400 bars ;
caractérisée en ce que
l'actionneur (9) est à même de se déplacer sous la pression d'un doigt par rapport au réservoir pour liquide (1) dans la course de vaporisation et est à même de se déplacer via une force de rappel par rapport au réservoir pour liquide (1) dans la direction opposée, dans la course de retour.

2. Pompe actionnée par un doigt selon la revendication 1, **caractérisée en ce que** la course du piston se situe entre 2 et 30 mm, de préférence entre environ 15 mm et environ 20 mm.

3. Pompe actionnée par un doigt selon la revendication 1 ou 2, **caractérisée en ce que** la dose de liquide par course d'atomisation se situe entre 5 μl et 300 μl, de préférence entre environ 10 μl et environ 100 μl, de manière de loin préférée entre environ 20 μl et environ 50 μl.

4. Pompe actionnée par un doigt selon l'une quelconque des revendications 1 à 3, **caractérisée en ce que** le piston (6) est fixé à demeure au réservoir pour liquide (1) et est réalisé sous la forme d'un piston creux formant de manière simultanée le moyen de passage (7) relié, à une de ses extrémités, de manière directe ou via un tube d'égouttage (11) à l'alimentation de liquide (2) et, à son autre extrémité, au cylindre (3),
dans laquelle de préférence le diamètre interne du piston creux (6) se situe entre environ 0,2 mm et environ 3,0 mm, de préférence entre environ 0,5 mm et environ 1,0 mm et/ou le piston creux (6) est réalisé sous la forme d'un tube capillaire métallique.

5. Pompe actionnée par un doigt selon l'une quelconque des revendications 1 à 3, **caractérisée en ce que** le piston (6) est fixé à demeure à l'actionneur (9) et est réalisé sous la forme d'un piston creux formant de manière simultanée le moyen de connexion (13) reliant le cylindre (3) à l'atomiseur (5), le diamètre interne du piston creux (6) se situant de préférence entre environ 0,2 mm et environ 3,0 mm, de préférence entre environ 0,5 mm et environ 1,0 mm et/ou le piston creux (6) est réalisé sous la forme d'un tube capillaire métallique.

6. Pompe actionnée par un doigt selon l'une quelconque des revendications 1 à 5, **caractérisée en ce que** le corps de l'actionneur (9) est réalisé en métal, de préférence en aluminium ou en une matière plastique résistant à des pressions élevées.

7. Pompe actionnée par un doigt selon l'une quelconque des revendications précédentes, à l'exception de la revendication 5, **caractérisée en ce que** le piston (7) est fixé à demeure au réservoir pour liquide (1) , et le cylindre (3) et l'atomiseur (5) sont arrangés à l'intérieur de l'actionneur (9) ou de telle sorte qu'ils font partie de ce dernier.

8. Pompe actionnée par un doigt selon l'une quelconque des revendications précédentes, à l'exception de la revendication 4, **caractérisée en ce que** le cylindre (3) est fixé à demeure au réservoir pour liquide (1), et le piston (6) est fixé à demeure à l'actionneur (9).

9. Pompe actionnée par un doigt selon l'une quelconque des revendications précédentes, **caractérisée en ce qu'**on prévoit un filtre (14) entre le cylindre (3) et l'atomiseur (5) pour protéger l'atomiseur (5), et/ou **en ce qu'**on prévoit un deuxième moyen de vanne unidirectionnelle (15) entre l'atomiseur (5) et le cylindre (3) pour empêcher l'entrée d'air via l'atomiseur (5) dans le cylindre (3) au cours de la course de retour.

10. Pompe actionnée par un doigt selon l'une quelconque des revendications précédentes, **caractérisée en ce que** le réservoir pour liquide (1) est une bouteille rigide à laquelle le moyen de passage (7) est fixé à demeure, le réservoir rigide pour liquide (1) étant muni de préférence d'un moyen d'évent d'aération (16) pour obtenir une égalisation de pression dans le réservoir pour liquide (1).

11. Pompe actionnée par un doigt selon l'une quelconque des revendications 1 à 9, **caractérisée en ce que** le réservoir pour liquide (1) est un sac démontable relié directement au moyen de passage (7).

12. Pompe actionnée par un doigt selon l'une quelconque des revendications 1 à 11, **caractérisée en ce qu'**on prévoit un moyen de fixation (19) pour fixer l'actionneur (9) sur le réservoir (1) dans sa position inférieure et qui peut être libéré pour une première course de retour avant l'amorçage de la pompe de vaporisation.

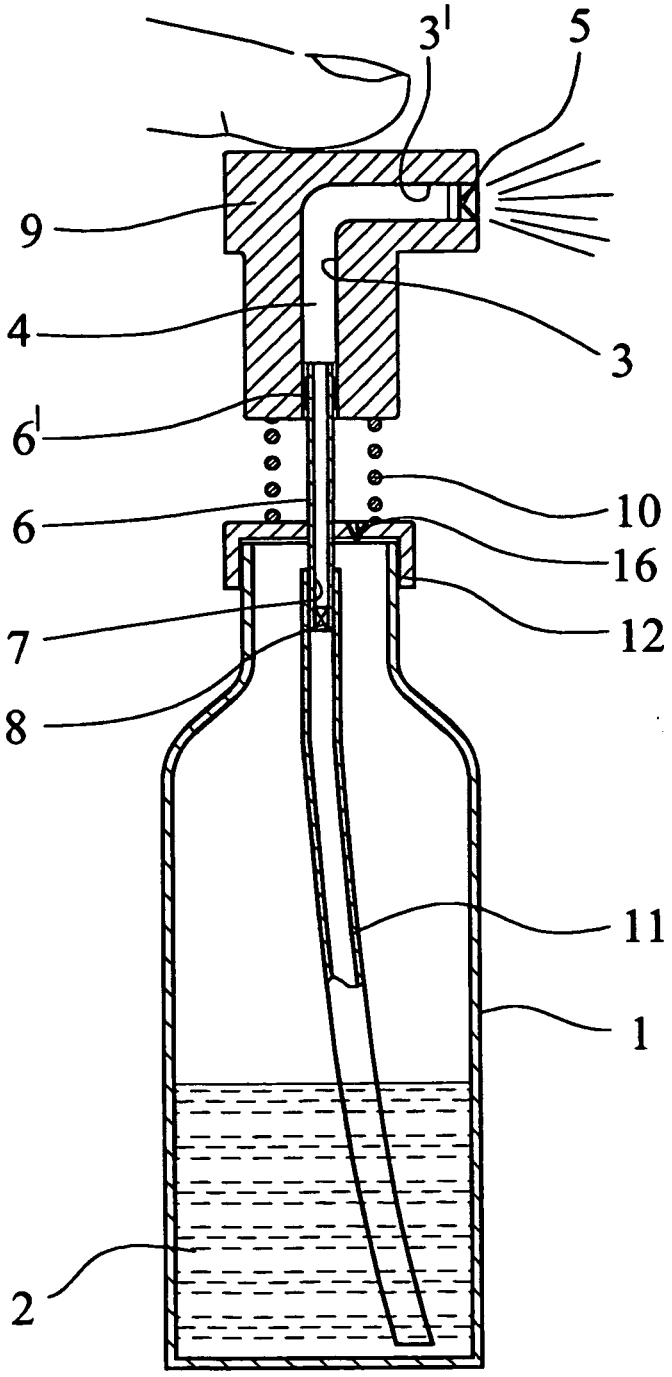

Fig. 1

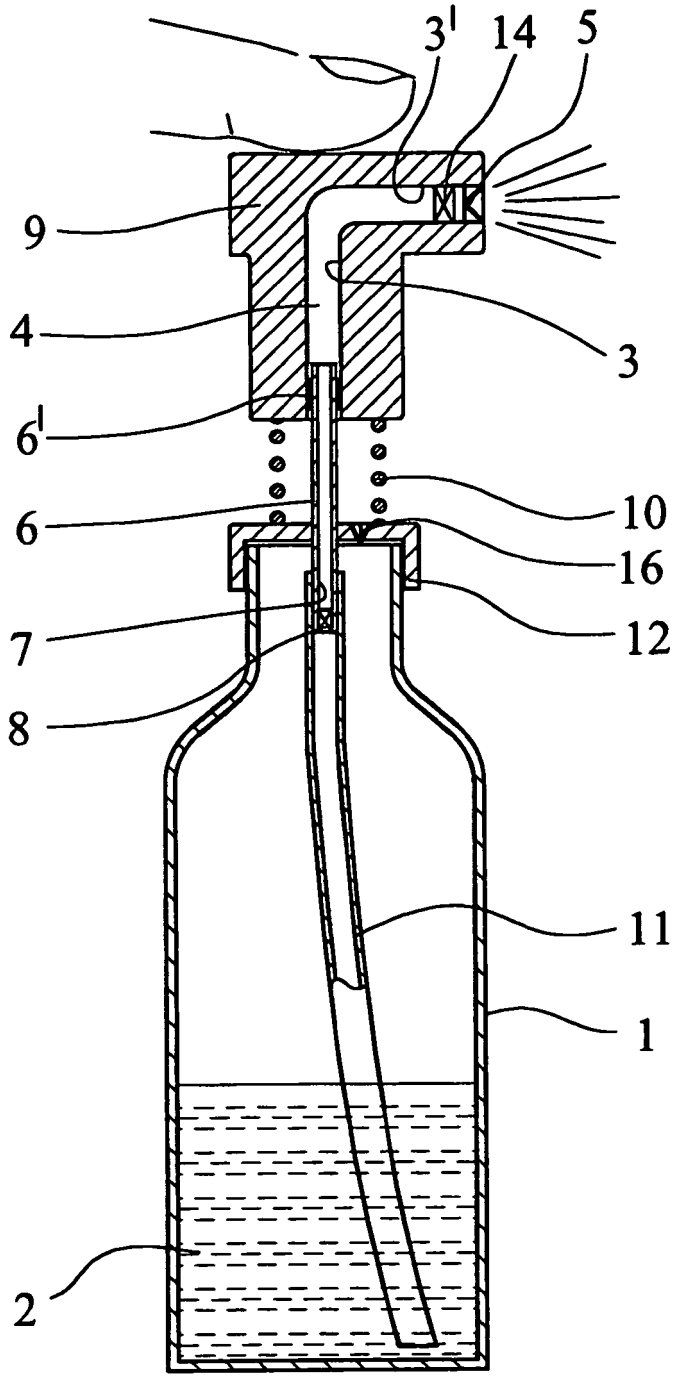

Fig. 2

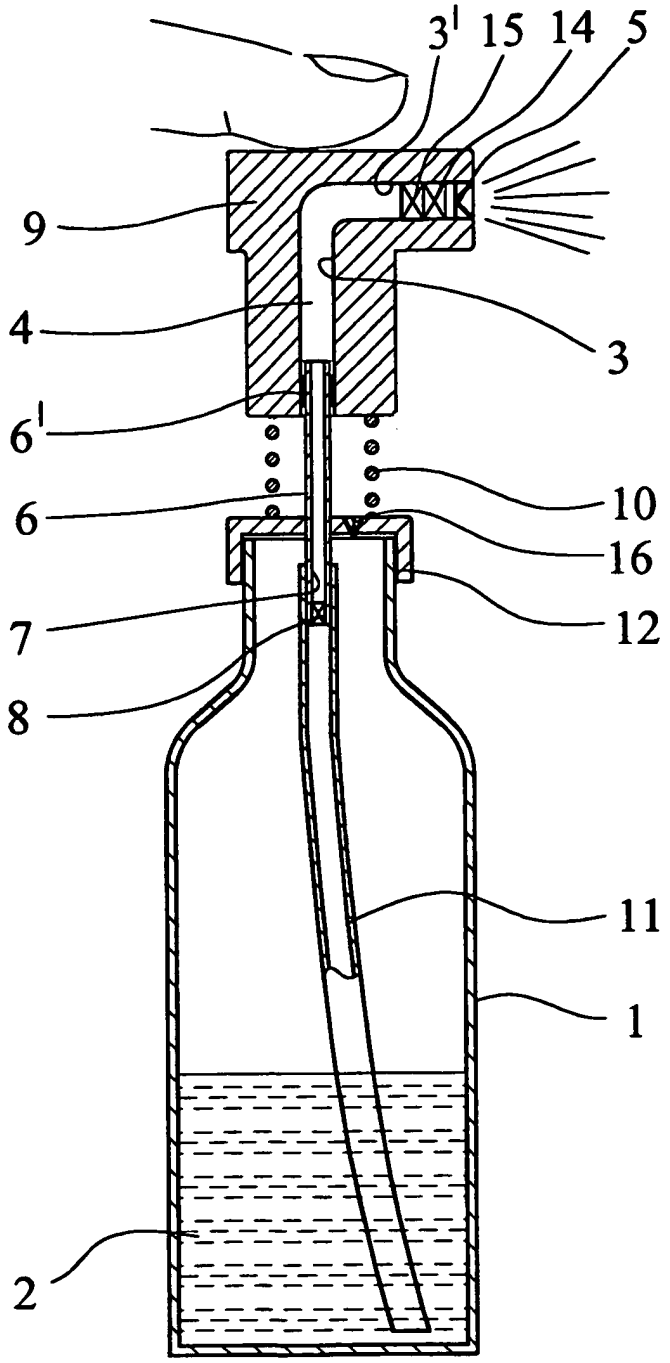

Fig. 3

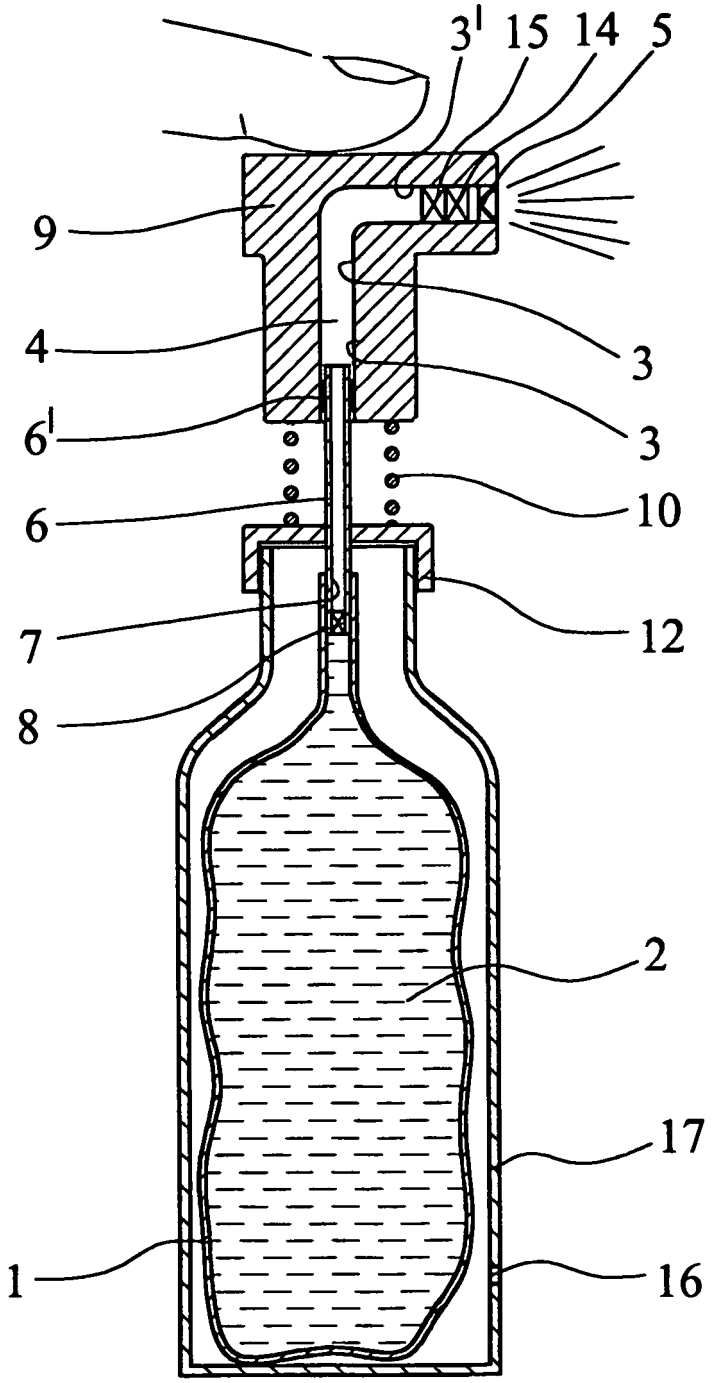

Fig. 4

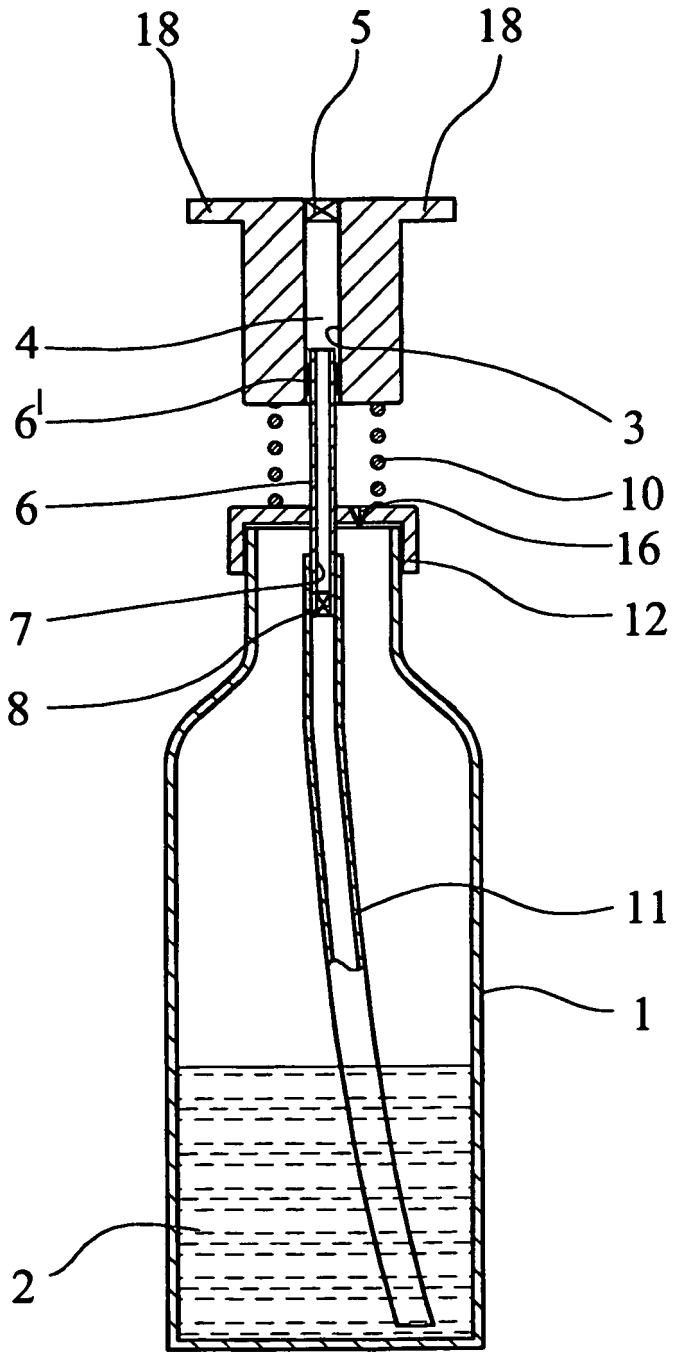

Fig. 5

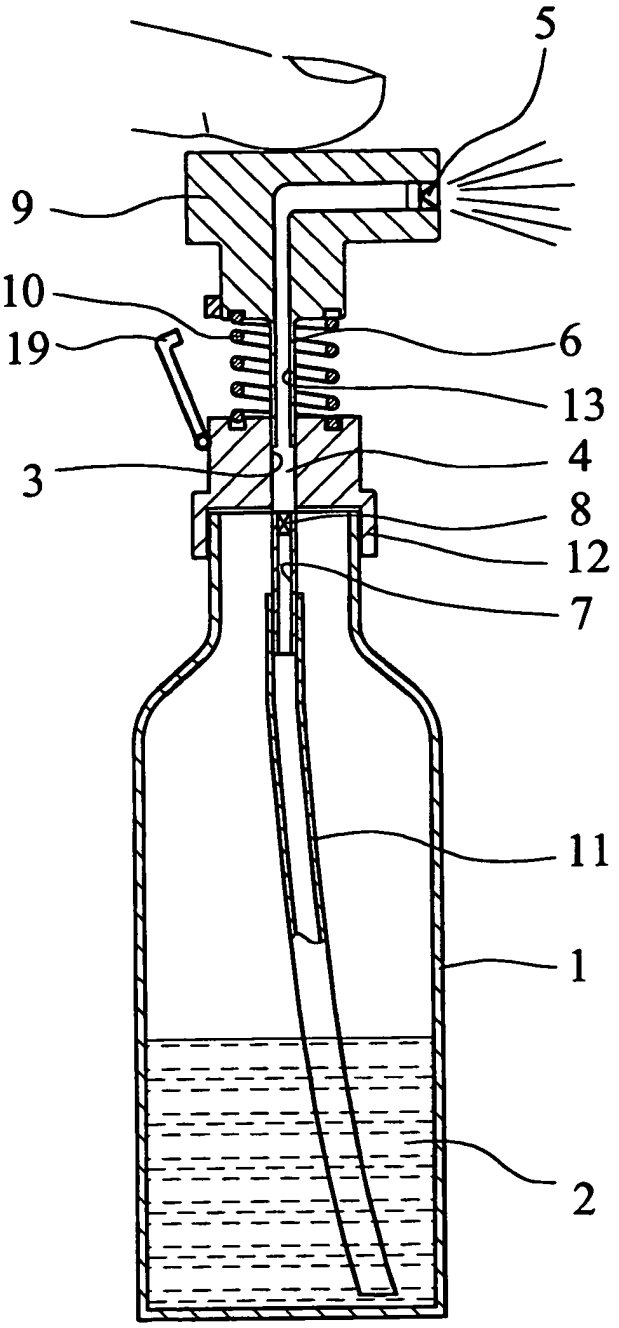

Fig. 6