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

(11) EP 0 753 352 A2

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
15.01.1997 Bulletin 1997/03

(51) Int Cl.[6]: **B05B 11/00**

(21) Application number: **96201935.2**

(22) Date of filing: **10.07.1996**

(84) Designated Contracting States:
AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE

(30) Priority: **14.07.1995 IT MI950505 U**

(71) Applicants:
- **S.O.R.I. S.r.l.**
  Milano (IT)
- **Torretta, Roberto**
  Milano (IT)

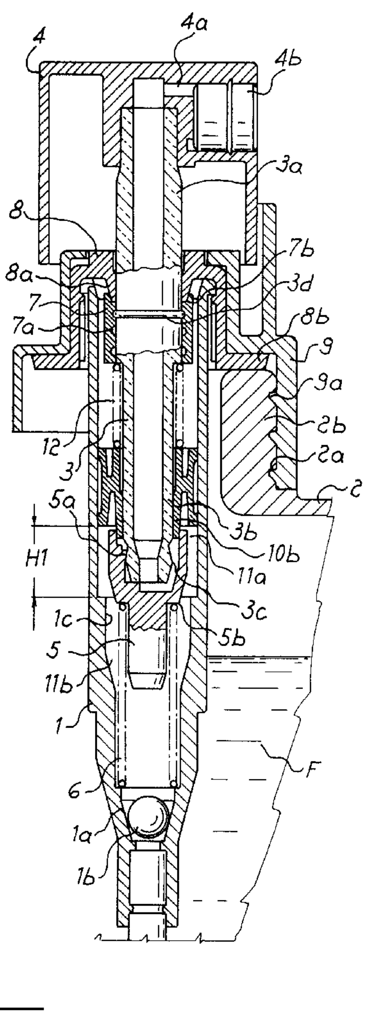
(72) Inventor: **Torretta, Roberto**
Milano (IT)

(74) Representative:
Raimondi, Alfredo, Dott. Ing. Prof. et al
Dott. Ing. Prof. RAIMONDI ALFREDO S.r.l.
Piazzale Cadorna 15
20123 Milano (IT)

(54) **Fluid dispenser comprising quantity control means for pre-compression pump**

(57) Delivery device for fluids (F) contained in a container (2), comprising a hollow body (1) and a hollow stem (3) coaxially movable in a direction with respect to the said hollow body (1) against the thrusting action of first resilient means (6) and second resilient means (12) for delivery of the fluid, in which the bottom end of said second resilient means (12) is in abutment against an annular gasket (10) arranged between the hollow body (1) and stem (3) and axially movable, said stem (3) being provided with a collar (7;107) against which the top end of said second resilient means (12) acts and the axial dimension of which is designed to determine the volume of fluid which can be delivered during each operating cycle of the device, there also being provided an interchangeable base-piece (5) which can be reversibly fitted to the bottom end of the stem (3) and which cooperates with said gasket (10) for sealing off the fluid delivery duct.

Fig. 1



EP 0 753 352 A2

Description

The present invention relates to a fluid delivery and atomizing device which is provided with means for regulation of the quantity of fluid to be delivered during each operating cycle and with interchangeable parts for regulation of the aperture of the fluid delivery duct depending on the density of the fluid itself.

In the art, numerous forms of delivery pumps of the reciprocating type are known, designed to draw off a certain quantity of a fluid from a storage vessel such as, for example, a perfume bottle or the like and convey it under pressure to a micronization and delivery nozzle.

More particularly, so-called pre-compression pumps are known, namely of the type which are provided with an obturator movable against the action of a suitably calibrated spring; said obturator covers a hole through which the fluid flows towards the delivery cap and is lifted from this hole only after being subjected by the user to a pressure corresponding to the force sufficient to overcome the opposing action exerted by the said spring on the obturator itself.

These devices have numerous drawbacks including the fact that the amount of fluid delivered each time pressure is exerted by the user is fixed and depends on the volume of the pump chamber, therefore resulting in the need for individual and specific dimensions and designs for the entire device depending on the quantity of fluid which is to be delivered for each cycle of the pump.

In addition to this, the fluid flow ducts are of considerable length and have a small cross-section and are therefore the cause - in particular when the pump is used for high-density fluids - of pressure drops during flowing of the fluid, resulting in irregular delivery and the need to overdimension the load of the pre-compression spring, with the consequent need for a considerable operating force on the part of the user.

The technical problem which is posed, therefore, is that of providing a device for delivering and atomizing fluids contained in a storage container, which allows the quantity of fluid delivered to be varied in a simple and economic manner without the need for modifying correspondingly the dimensions of each individual part forming the device.

Within the scope of this problem a further need is to be able to vary in a precise, but at the same time simple and economical manner, the aperture of the duct through which the fluid flows across the chamber for compression thereof, depending on the greater or lesser density of the fluid itself, so that the operating load may be kept small.

These results are obtained by the present invention which relates to a fluid delivery and atomizing device comprising a hollow body and a hollow stem which are coaxially movable with respect to the said hollow body against the thrusting action of first and second resilient elements, in which the bottom end of said second resilient means is in abutment with an annular gasket radially arranged between the hollow body and stem and axially movable relative to the latter, said device being designed such that said stem is provided with a collar on which the top end of said second resilient means act and the axial dimension of which is designed to determine the volume of fluid which can be delivered during each operating cycle of the device, there also being provided an interchangeable base-piece which can be reversibly fitted to the bottom end of the stem and which cooperates with the movable annular gasket in order to seal off the fluid delivery duct at the end of the compression stroke of the stem.

Further details may be obtained from the following description, with reference to the accompanying drawings, in which:

Figure 1 shows a section along an axial plane of the device according to the present invention in the rest position;

Figure 2 shows a section similar to that of Figure 1 with different positioning of the element for regulating the volume of fluid to be delivered;

Figure 3 is an axial section illustrating a variation of embodiment of the means for regulating the quantity of fluid to be delivered;

Figure 4 shows a cross-section along the plane indicated by IV-IV in Figure 3;

Figure 5 shows the device according to Figure 3 during the delivery stroke.

Figure 6 shows the device according to Figure 3 at the end of the return stroke;

Figure 7 shows an axial section through the device according to Figure 3 with different dimensions of the means for regulating the quantity of fluid to be delivered.

As shown in Figure 1, the delivery device according to the invention comprises a hollow substantially cylindrical body 1 on the bottom of which there is formed a seat la housing a floating sphere 1b designed to function as a one-way valve for the passage of a fluid "F" contained in a bottle 2 inside which the said hollow body is inserted and sealingly fastened via suitable means described in detail below.

The hollow body 1 has arranged inside it, coaxially therewith, a stem 3 which in turn is internally hollow and slidable in an axial direction relative to hollow body 1 itself. The top end 3a of the stem 3 projects in an axial direction beyond the hollow body so as to support a delivery cap 4 provided with a radial hole 4a for supplying the fluid to a micronization chamber 4b from where the fluid emerges suitably atomized for the application.

The opposite bottom end 3b of the stem 3 has reversibly fitted to it a base-piece 5 which is provided on its internal surface with shoulders 5a (Figures 1 and 4) designed to engage with a corresponding annular projection 3c of the stem 3. The inclined surface of the said shoulders 5a and of the annular projection 3c allows easy insertion of the base-piece 5 which in this way is stably coupled to the stem 3.

The said base-piece 5, although it is provided with internal openings for passage of the fluid is, however, closed externally, avoiding the need for arranging sealing elements in between with obvious simplification of the design of the parts to be combined.

The external surface of the base-piece 5 has formed on it a support surface 5b with, acting against it, the top end of a spring 6 which reacts against an associated seat of the hollow body 1 so as to keep the base-piece itself, and hence the stem 3, raised with respect to an annular abutment shoulder lc which can be fitted onto the internal surface of the hollow body 1.

The stem 3 has formed in its approximately middle part (Figures 1 and 2) an annular rib 3d designed to engage with corresponding concave seats 7a formed on the internal surface of a sliding piece 7 coaxially mounted on the stem 3.

The upper surface of the sliding piece 7 has formed on it an annular seat 7b designed to enter into contact with an end-of-travel element 8a of a gasket 8 arranged between a stopper 9 with an internal thread 9a designed to be coupled with the threading 2a of the neck 2b of the container so as to sealingly fasten the delivery device to the container itself.

Between the stem 3 and the hollow body 1 there is also arranged an annular gasket 10 provided with a vertical tongue 10b designed to come into contact and form a seal with the top edge 5c of the base-piece 5; in this way the gasket 10, the body 1 and the base-piece 5 define a pressure chamber 11 consisting of an upper part lla of substantially cylindrical shape and a lower part llb of substantially frustoconical shape, through which the fluid F is drawn up for delivery, as will be described below.

Said gaskets 10 and collar 7 have axially arranged between them a spring 12 designed to cause the pre-compression of the device since, only when the thrusting action exerted by the user on the delivery cap 4 has compressed the spring 12, does delivery of the fluid externally occur.

As can be understood from a comparison between Figure 1 and Figure 2, the different positioning of the sliding piece 7 with respect to the stem 3 results substantially in a different position of the stem 3 itself with respect to the cylindrical top part lla of the chamber 11, which has a greater/smaller height (H1, H2) and hence a larger/smaller volume depending on the different positions of the sliding piece with respect to the stem. As will become obvious below, this volume of the cylindrical part 11a of the chamber 11 corresponds to the quantity of fluid delivered each time the pump is operated.

In a further constructional embodiment (not shown) said cavities 7a of the sliding piece 7 and said rib 3d of the stem3could also be arranged inclined in accordance with the pitch of a thread/nut screw fastening system which can be operated by means of rotation of the delivery cap 4, in this case resilient relief-type elements being provided in order to prevent undesired rotation of the sliding piece 7, but instead allow axial translation thereof following actuation by the user and the springs 6 and 12.

Figure 3 shows a simplified example of embodiment of the device according to the invention in which the stem 3 has a fixed collar 107 with a top surface having in it an incision so as to form an annular seat 107b designed to come into contact with the said end-of-travel element 8a of the gasket 8.

As can be understood from a comparison between Figure 3 and Figure 7, the height of the said collar 107 determines once again the different height (H1, H2) of the upper part lla of the chamber 11 and hence the quantity of fluid to be delivered.

Operation of the device described for the sake of simplicity with reference to Figures 3, 5 and 6 is as follows:

After ascertaining the density of the fluid and establishing the quantity of fluid to be delivered for each pumping cycle and having consequently calibrated the height of the collar 107 (or, in the embodiment of Figure 1, axially translated the sliding piece 7 into a suitable position), as well as fitting to the stem 3 a base-piece 5 of suitable external diameter, the delivery device is fitted to the bottle 2 by means of the stopper 9.

In the rest condition (Figure 3), the spring 6 keeps the collar 107 in abutment against the lug 8a of the sealing gasket 8, while the spring 12 keeps the lug 10b of the annular gasket 10 in contact with the top edge 5c of the base-piece 5: in these conditions both entry of air "A" into the container and delivery of fluid therefrom is prevented. For the sake of simplicity it is also assumed that the chamber 11 is already full of fluid "F" following the execution of a few cycles under no load. In order to obtain delivery, the cap 4 is pressed, causing the descent of the stem 3 inside the hollow body 1, since the fluid F present inside the chamber 11 cannot be compressed and cannot return into the container 2, being retained by the sphere 1b, and constitutes an obstacle to descent of the gasket 10 which remains immobile until the spring 12 is compressed and the base-piece 5 is consequently separated from the gasket 10 itself.

This separation causes opening of the chamber lla and consequent rising up again of the fluid F through the internal cavity of the stem 3 as far as the delivery cap 4 inside which it is atomized for delivery.

The delivery continues until the base-piece 5 reaches the cylindrical-body portion 1c and the gasket 10 reaches the top edge of said portion 1c, causing closure of the chamber 11a, the contents of which at this point have been completely delivered.

At the same time as delivery, descent of the stem 3 causes separation of the collar 107 from the gasket 8a, placing in communication the inside of the container 2 with the external environment (Fig. 5) and causing the entry of air "A" inside the bottle.

Once the stem 3 has reached the bottom end-of-stroke position, the spring 12 reacts against the collar 7, which at this point is at a standstill, and begins exerting its thrusting action on the annular gasket 10, pushing it downwards so that the lug 10b comes back into contact with the top edge 5c of the base-piece 5, closing again the chamber 11 and consequently interrupting delivery. Releasing the delivery button 4, the spring 6 is allowed to push again upwards the base-piece 5 and hence the gasket 10 and the stem 3 which move simultaneously causing a drop in pressure inside the chamber 11 itself which raises the sphere 1b, opening up the bottom of the body 1 and causing fluid F to be drawn back inside the chamber 11 which in this way is filled again for subsequent delivery.

The fluid F, rising back up from the container to the chamber 11, causes a drop in pressure inside the container which is balanced by the entry of air drawn in from outside.

As can be understood from the previous description relating to operation of the device with the fixed collar 107, the working stroke of the stem 3 with respect to the hollow body 1, and hence the volume of fluid which can be delivered during each cycle of the pump, is substantially determined by the height in the axial direction of the said collar 107 which, as illustrated in Figure 7, may be made with a much greater height, thus resulting in a reduction in the compression stroke and hence a reduction in the volume of fluid delivered per cycle. In a similar manner as in the other embodiment shown in Figure 1, the stroke of the stem is determined by the more or less lowered position of the sliding-piece 7.

Consequently, it is obvious how it is possible to vary in a simple and economical manner the volume of fluid delivered per cycle by varying only the heightwise dimension of the said collar.

In particular, while the simplified version of the device according to the invention may prove suitable for those mass production operations where a corresponding variation in the forming mould has an essentially negligible impact on the final unit cost, the realization of the device with a sliding piece which allows a variation in the quantity of fluid which can be delivered, without the need for variations in the moulds, but by means of a simple positional adjustment, will certainly prove convenient owing to the series of small number of parts.

In addition to this, reversible coupling of the base-piece to the stem also allows the aperture of the fluid flow passage through the chamber to be varied, a requirement which is of particular importance when there is an increase in the density of the fluid to be delivered.

With the delivery device according to the invention it is therefore possible to obtain a multiplicity of adaptations to the particular conditions of use of the device itself, while reducing to a minimum the modifications of the various elements which make up the device.

Claims

1. Device for delivering and atomizing fluids (F) contained in a container (2), comprising a hollow body (1) which has coaxially arranged inside it a hollow stem (3) movable against the thrusting action of first resilient elements (6) and second resilient elements (12), in which the bottom end of said second resilient means (12) is in abutment against an annular gasket (10) radially arranged between the hollow body (1) and stem (3) and axially movable with respect to the stem (3), characterized in that said stem (3) is provided with a collar (7;107) against which the top end of said second resilient means (12) acts and the axial dimension of which is designed to determine the volume of fluid which can be delivered during each operating cycle of the device, there also being provided an interchangeable base-piece (5) which can be reversibly fitted to the bottom end of the stem (3) and which cooperates with the gasket (10) for sealing off the fluid delivery duct at the end of the compression stroke of the stem.

2. Device according to Claim 1, characterized in that said collar (7;107) has a top surface provided with an annular seat (7b) designed to come into contact with a corresponding relief (8a) of a sealing gasket (8), which is coaxial with the stem (3), forming an upper end-of-travel stop for axial displacement of the stem itself.

3. Device according to Claim 1, characterized in that said collar (7) consists of a sliding piece provided with internal annular cavities (7a) designed to be coupled with a corresponding annular rib (3d) of the stem (3) for stable positioning of the sliding piece relative to the stem itself.

4. Device according to Claim 1, characterized in that said collar consists of an annular relief (107) fixed to the stem (3) and of suitable axial height depending on the quantity of fluid to be delivered.

5. Device according to Claim 1, characterized in that the internal surface of said base-piece (5) is provided with shoulders (5a) designed to engage with a corresponding annular projection (3c) of the stem (3) for reversible fastening of the two parts.

6. Device according to Claim 1, characterized in that said base-piece is internally closed.

7. Device according to Claim 1, characterized in that said internal cavities (7a) of the sliding piece (7) and said rib (3d) of the stem (3) are arranged inclined in accordance with the pitch of a thread/nut screw fastening system so as to allow variation in the position of the sliding piece itself by means of rotation of the delivery cap (4).

Fig.1

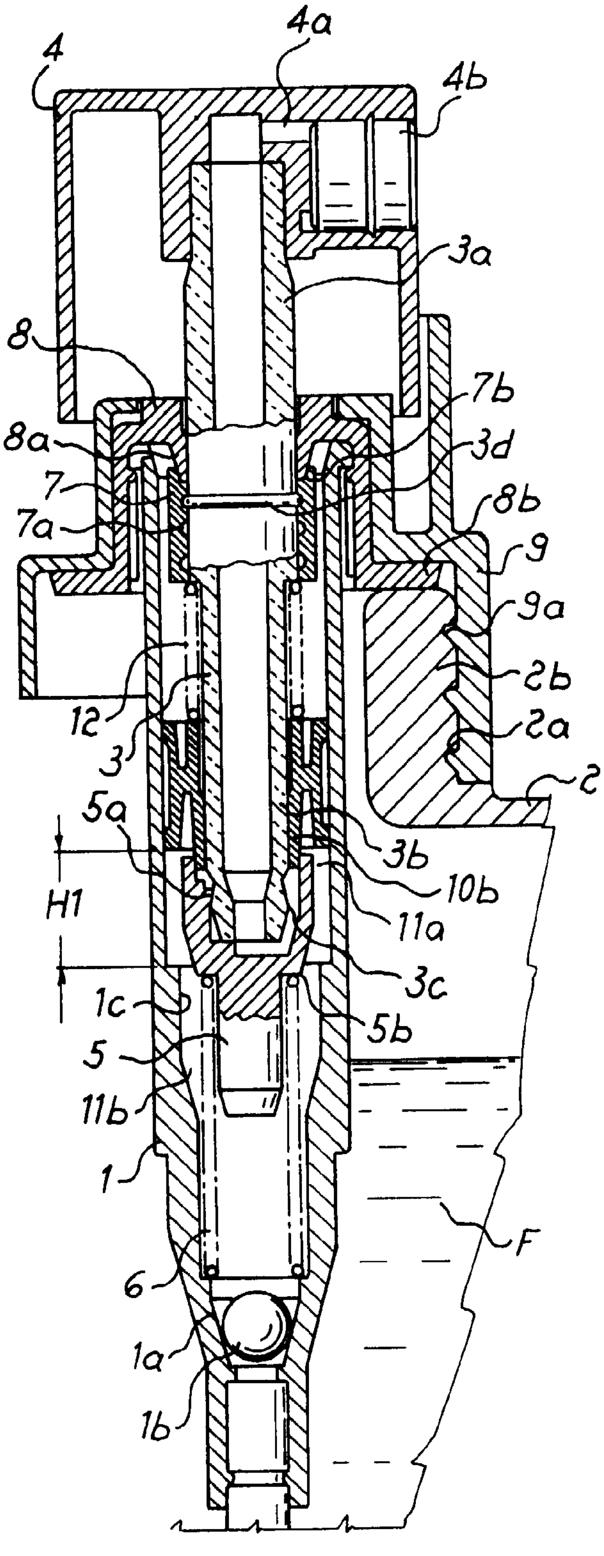

4
4a
4b
3a
8
8a
7
7a
7b
3d
8b
9
9a
2b
2a
2
12
3
5a
3b
10b
H1
11a
3c
1c
5b
5
11b
1
F
6
1a
1b

Fig.2

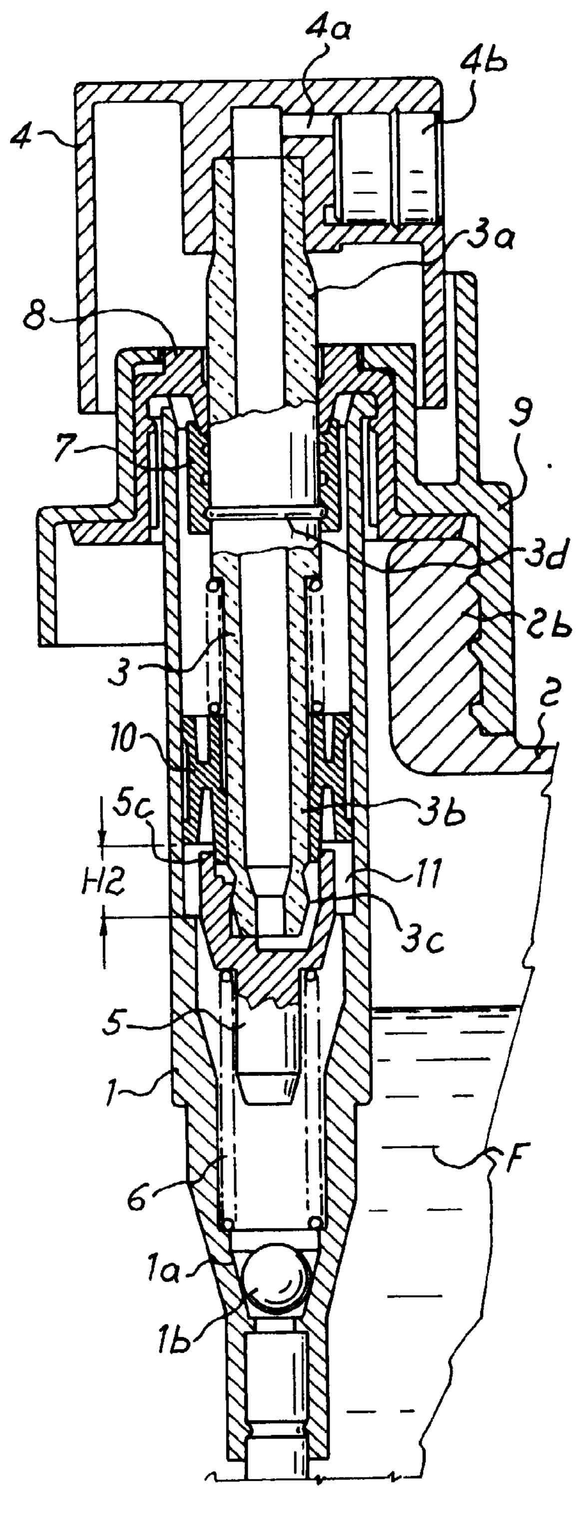

4a
4b
4
3a
8
9
7
9
3d
2b
3
2
10
5c
3b
H2
11
3c
5
1
F
6
1a
1b

Fig. 3

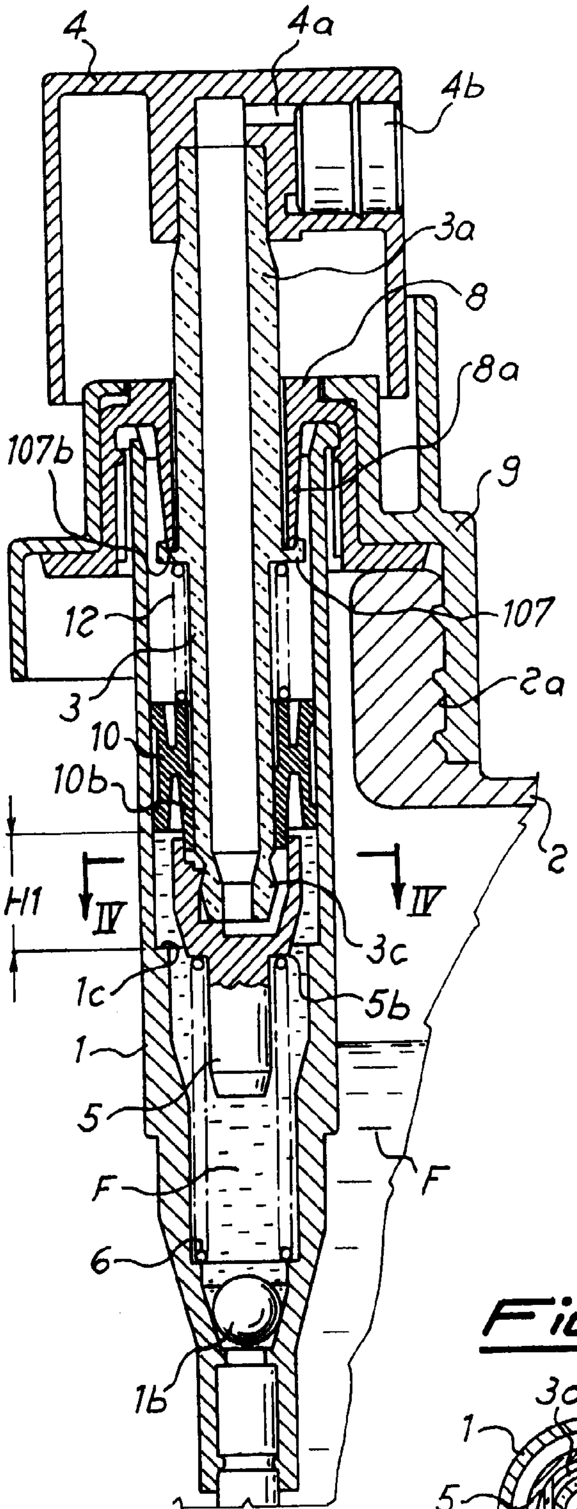


Fig. 5

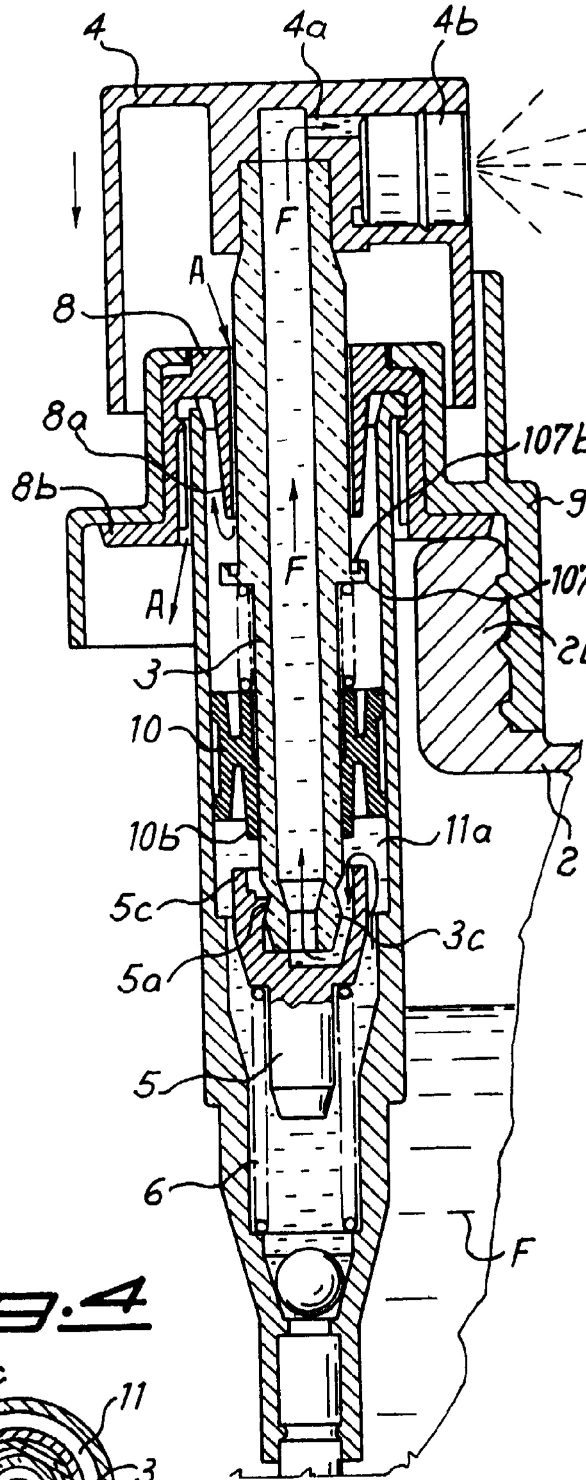


Fig. 4

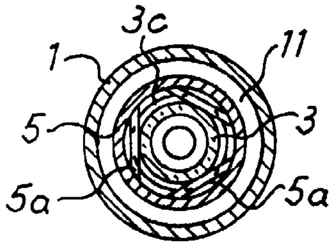


Fig. 6

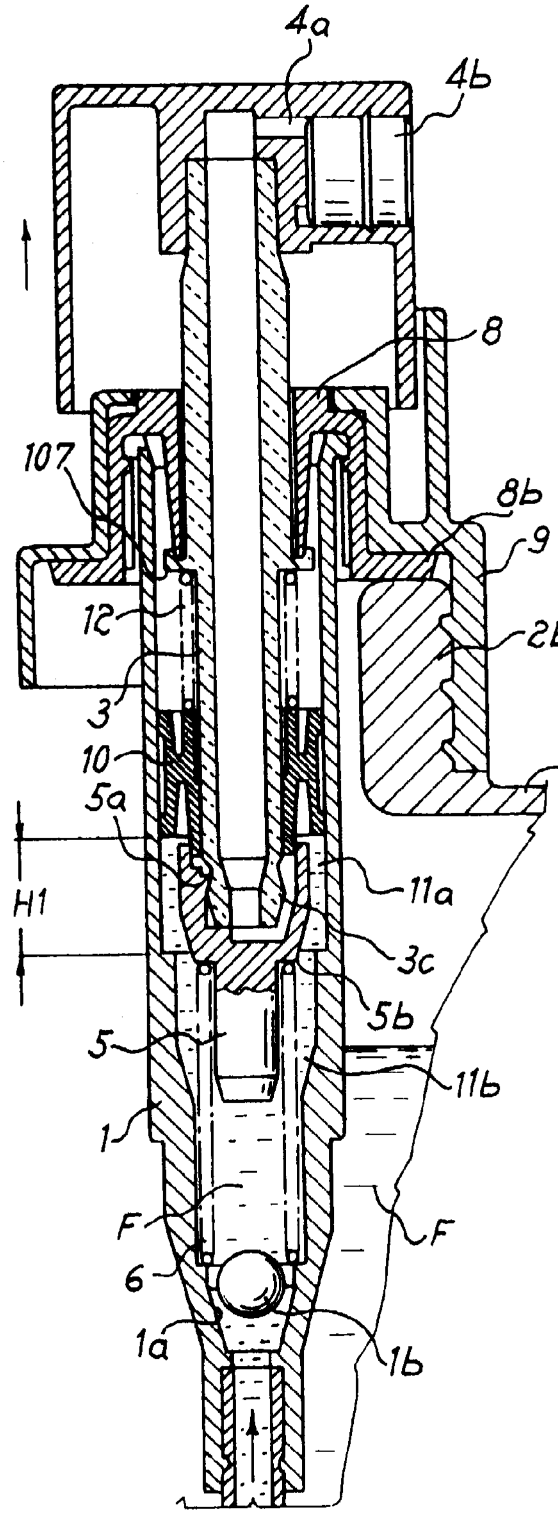
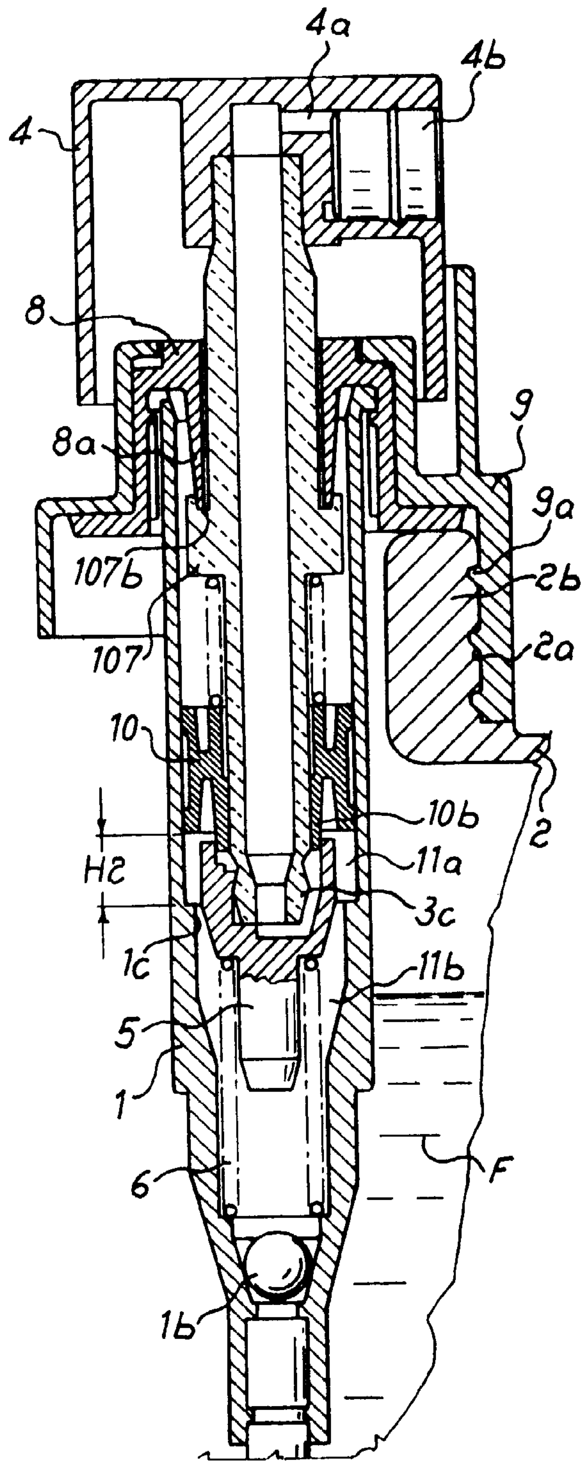

4a
4b
8
107
8b
9
12
2b
3
10
2
5a
H1
11a
3c
5b
5
11b
1
F
F
6
1a
1b

Fig. 7


4a
4b
4
8
9
8a
9a
107b
2b
107
2a
10
2
10b
H2
11a
3c
1c
11b
5
1
F
6
1b