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**Declarations under Rule 4.17**:

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

**Published**:

— *with international search report (Art. 21(3))*

(54) Title: DISPOSABLE INJECTOR FOR INJECTING A LIQUID INTO A PATIENT

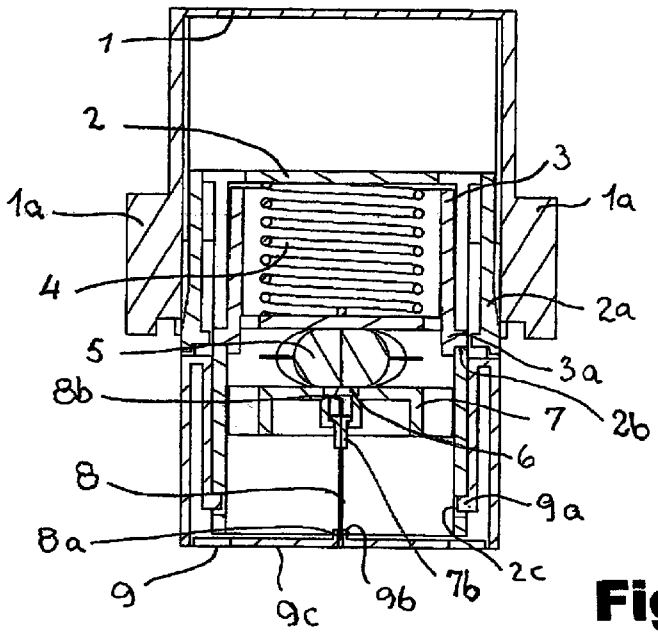


Fig. 1

(57) Abstract: There is provided an injector comprising a cylindrical housing with a distal wall and a proximal wall having a proximal surface (9c) for abutting the surface of an injection site, an injection needle (8) having a sharp distal end (8b) and a sharp proximal end (8a) and arranged axially displaceable in said housing through a passage (9b) in said proximal wall, a compressible container (5) for containing an injection liquid and having a proximal wall portion (6) penetrable by said sharp distal end (8a) of said needle (8), a compression chamber containing said container (5) and adapted to be reduced in volume so as to compress said container (5) to press the injection liquid into the needle (8), and displacement means (4, 10) for respectively ejecting and retracting the needle (8).

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# Disposable injector for injecting a liquid into a patient

The present invention relates to a disposable automatic injector for injecting an injection liquid.

In connection with such injectors, there are many different problems related to safety of use, simplicity of use, price, re-utilisation without sterilisation of the injection needle, size as regards logistical considerations in connection with high volume vaccination programs and so on.

Many different solutions to one or more of these problems have been devised, but there is still a need for an injector that addresses most, if not all, of these problems in a price effective, simple and easy to use way.

According to the invention, most, if not all, of these problems are addressed in a novel and effective manner by the injector according to the invention comprising:

a cylindrical housing with a distal wall and a proximal wall having a proximal surface for abutting the surface of an injection site,

an injection needle having a sharp distal end and a sharp proximal end and arranged axially displaceable in said housing through a passage in said proximal wall

a compressible container for containing an injection liquid and having a proximal wall portion penetrable by said sharp distal end of said needle,

a compression chamber containing said container and adapted to be reduced in volume so as to compress said container to press said injection liquid into said needle, and

displacement means, preferably biasing means, for:

- displacing said compression chamber and said needle in the proximal direction towards said proximal wall such that said needle is extended outside said proximal wall,
- causing said sharp distal end of said needle to penetrate into said container,
- reducing the volume of said compression chamber, and

- displacing said needle, said container and said compression chamber in the distal direction away from said proximal wall such that the sharp proximal end of said needle becomes located within said housing.

Hereby, an easy to use, nearly automatic, non-reusable, safe, cheap and relatively small injector is obtained.

In the following, the invention will be explained more in detail in connection with the currently preferred embodiment thereof shown, solely be way of example, in the accompanying drawings, where:

Figs. 1- 9 are schematic cross-sectional views of a currently preferred embodiment of an injector according to the invention illustrating sequential positions of the various elements of the injector when carrying out an injection,

Figs. 2a-2c are schematic enlarged scale views of details of Figs. 2 and 3, an

Figs. 10-11 are schematic perspective views of some elements of the currently preferred embodiment shown in Figs. 1-9.

Referring now to Figs. 1 and 2, the injector device comprises a cylindrical release housing 1 in which a spring housing 2 is arranged axially displaceable, and a skin contact housing 9 in which a plunger assembly 3 is arranged axially displaceable. Skin contact housing 9 has a proximal wall with a proximal surface 9c intended for being pressed against the skin of a patient during injection of a liquid

A coil spring 4 is arranged in spring housing 2 such that spring 4 exerts a force on plunger 3 in the proximal direction (towards proximal surface 9c).

A flexible container, capsule or bladder 5 for containing an injection liquid is arranged between a pressing surface of plunger 3 and an abutment surface of a needle guide body 7 in which an injection needle 8 having sharpened

opposed proximal and distal ends, 8a and 8b respectively, is received axially displaceable and guided in a passage of the guide body 7 by means of a needle guide 7b fixedly attached to needle 8.

The proximal end 8a of needle 8 is also received axially displaceable in a needle passage 9b of skin contact housing 9. The needle passage 9b protrudes slightly from the skin contact housing proximal wall to form a distally directed protrusion 9b.

A rubber film or disk 6 is adhered to the outer surface of capsule 5 in the region to be penetrated by distal end 8b of needle 8. The distal surface of capsule 5 is adhered to pressing surface of plunger 3 in a region around the centre line of said pressing surface.

Flexible snap arms 9a of skin contact housing 9 engage recesses 2c in spring housing 2 and ensure that said two housings 9 and 2 cannot move relative to one another. Release housing 1 is provided with flexible release arms 1a. Spring housing 2 is provided with blocking arms 2a, and plunger 3 is provided with locking arms 3a. Spring housing 2 is provided with recesses 2b

The blocking arms 2a ensure that the release arms 1a cannot be pressed towards one another and thereby prevent the plunger 3 in being displaced in the proximal direction. Locking arms 3a maintain the spring 4 clamped between spring housing 2 and plunger 3 by resting on recess 2b.

Skin contact surface 9c of skin contact housing is provided with a not shown layer of an antiseptic substance covered by a plastic film to protect the substance during storage.

Referring now to Figs. 2-9, the operation of the injector when carrying out an injection will be described.

The first operation steps are that the injector is held by the release housing 1 by a care giver while the protective plastic film is removed from the antiseptic layer and the antiseptic is applied to the injection site by rubbing the surface 9c against the injection site surface.

Thereafter, the care giver presses the release housing 1 towards the skin housing 9 in the direction of arrow R1 while the skin contact surface 9c is pressed against the injection site surface. When the release housing is pressed as far as possible in the proximal direction, the release arms 1a are freed such that they can be pressed together in the direction of arrows R2 (see Fig. 3 and Figs. 2a-2c).

When the release arms 1a are pressed together they press the blocking arms 2a inwards which in turn press the locking arms 3a out of engagement with the recesses 2b whereby the spring 4 is allowed to displace the plunger 3 in the proximal direction.

From this point on the operation of the injector is automatic, and the care giver only has to hold the injector stable and pressed against the injection site surface.

Since the container 5 is adhered, for instance by adhesive, to the pressing surface of plunger 3 and to the rubber disc 7 as well as the abutment surface of the needle guide 7, all these elements as well as the needle 8 are pressed by the spring 4 in the proximal direction as indicated by arrows R3 in Figs 4-7 with the locking arms 3a gliding along the inner surface of spring housing 2.

In the position shown in Fig. 5 the needle has been inserted in the injection site and protrusion 9b abuts the needle guide 7b whereby the needle 8 cannot be extended further outside the housing 9.

As the needle guide 7 is forced further towards the bottom wall of skin housing 9, the protrusion 9b forces the needle guide 7b and the distal end 8 b of needle 8 through the rubber disc 6 and into the container 5 as shown in Fig. 6.

Further pressure by the spring 4 will now press injection liquid from the container 5 into and through the needle 8 into the injection site until the entire contents of the container has been injected as shown in Fig. 7 just before the container 5 is empty.

When the plunger 3 is as far as it can move in the proximal direction (with the container 5 empty as shown in Fig. 8) the tensioned locking arms 3a will snap into the recesses 2c in the spring housing 2 and push the snap arms 9a of skin housing 9 out of engagement with the recesses 2 c thereby freeing spring housing 2 from skin housing 9 and locking plunger 3 to spring housing 2 by means of locking arms 3a engaged in recesses 2c.

This will also allow spring elements 10 shown in Figs. 10 and 11 to displace spring housing 2 in the distal direction away from skin housing 9 and at the same time displace needle 8, needle guide body 7, container 5, plunger body 3 and spring 4 in the distal direction until proximal needle end 8a is located within skin housing 9 as shown in Fig. 9.

Hereby the needle 8 will automatically be retracted from the injection site and into concealment inside the spring housing and therefore cannot by accident prick the care giver or others with the risk of infecting them.

Furthermore, the injector cannot be re-utilized, thus eliminating the risk of infecting other persons because of non-sterilisation of the needle between multiple injections with the same needle.

The springs 4 and 10 may be replaced by various displacement means, for instance elastically expandable elements such as rubber bands and may be

arranged in many different manners as long as the described functions are achieved.

## Claims

1. A disposable automatic injector for injecting an injection liquid and comprising:
   - a cylindrical housing with a distal wall and a proximal wall having a proximal surface for abutting the surface of an injection site,
   - an injection needle having a sharp distal end and a sharp proximal end and arranged axially displaceable in said housing through a passage in said proximal wall
   - a compressible container for containing an injection liquid and having a proximal wall portion penetrable by said sharp distal end of said needle,
   - a compression chamber containing said container and adapted to be reduced in volume so as to compress said container to press said injection liquid into said needle, and
   - displacement means, preferably biasing means, for
     - displacing said compression chamber and said needle in the proximal direction towards said proximal wall such that said needle is extended outside said proximal wall,
     - causing said sharp distal end of said needle to penetrate into said container,
     - reducing the volume of said compression chamber, and
     - displacing said needle, said container and said compression chamber in the distal direction away from said proximal wall such that the sharp proximal end of said needle becomes located within said housing.

2. A disposable injector according to claim 1 and comprising:
   - a housing having an axis extending from a distal end to a proximal end and having a proximal skin contact wall for abutting the injection region, said contact wall being provided with an aperture for receiving an injection needle,

- a plunger body having a pressing surface facing in the proximal direction towards said skin contact wall and arranged for axial displacement to and fro in said housing between a first distal position, a first intermediate position, a second intermediate position and a first proximal position,
- a needle guide body having an abutment surface facing in a distal direction towards said pressing surface and arranged for axial displacement to and fro between a second distal position, a third intermediate position and a second proximal position, said guide body being provided with a passage for receiving and guiding said injection needle,
- said injection needle having a sharp distal end received in said passage and a sharp proximal end received in said aperture and arranged for axial displacement between a third distal position and a third proximal position,
- a container for injection liquid arranged between said pressing surface and said abutment surface and axially displaceable together with said surfaces, said container being compressible by displacing said plunger body towards said needle guide body, and said container being penetrable by said distal end of said needle, and
- injection displacement means, preferably biasing means, adapted to displace said plunger body in said proximal direction such that said plunger body, said container, said guide body and said needle are displaced in the following sequence:
  - said plunger body and said guide body from said first distal position and said second distal position, respectively, to said first and said third intermediate position, respectively, and said needle from said third distal position to said third proximal position, wherein said proximal end of said needle projects distally outside said skin contact wall,
  - said plunger body and said guide body from said first and said third intermediate position, respectively, to said second intermediate position and said second proximal position, respectively, wherein

said distal end of said needle has penetrated into said container, and

- said plunger body from said second intermediate position to said first proximal position, wherein said container has been compressed such that at least a portion of the liquid therein has been pressed out through said proximal end of said needle

- said injector furthermore comprising retraction displacement means, preferably biasing means, adapted to displace said needle, said compressed container, said guide body and said plunger body in the distal direction such that said distal end of said needle is located within said housing and thus no longer projects outside said skin contact wall.

3. A disposable injector according to claim 2, wherein said injection displacement means and said retraction displacement means each comprise a spring element.
4. A disposable injector according to claim 2, wherein said injection displacement means and said retraction displacement means are constituted by a single biasing means, preferably an elastically expandable element such as a rubber band or string.
5. A disposable injector according to any of the preceding claims, wherein said injection liquid container is made of a plastic film.
6. A disposable injector according to any of the preceding claims, wherein the region of the container wall which is to be penetrated by said sharp distal needle end is provided with a sealing film, for instance made of rubber, that is intended to seal against the side surface of said needle, when said needle has penetrated into said container.
7. A disposable injector according to any of the claims 1-6, wherein the outer surface of said skin contact wall intended for abutting the skin around the injection point is provided with an antiseptic means intended for being applied to the injection site.

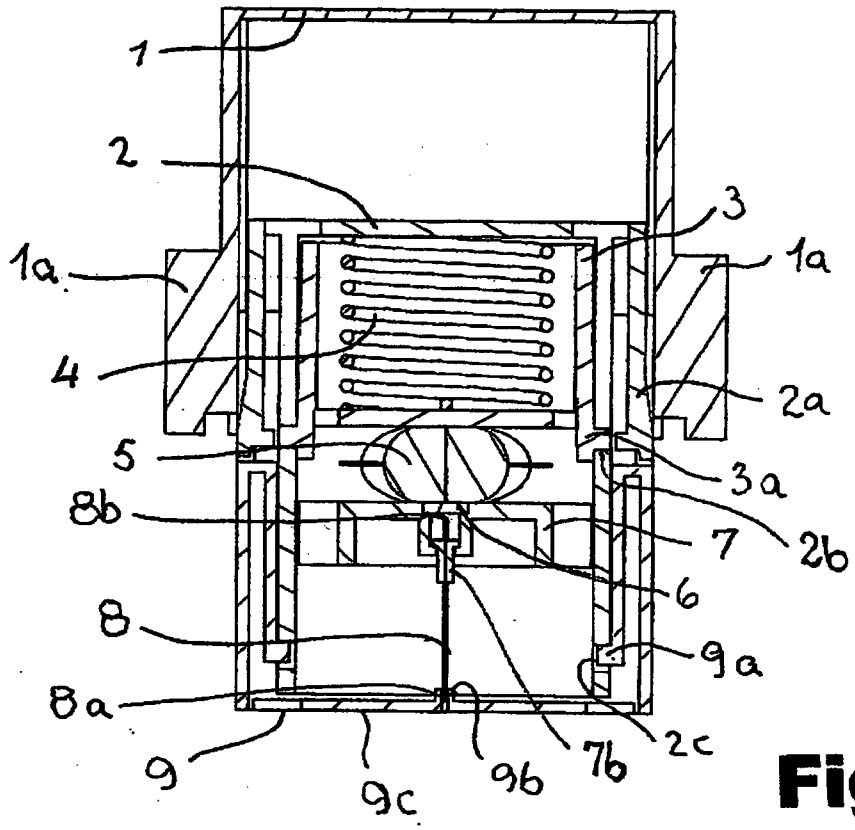


Fig. 1

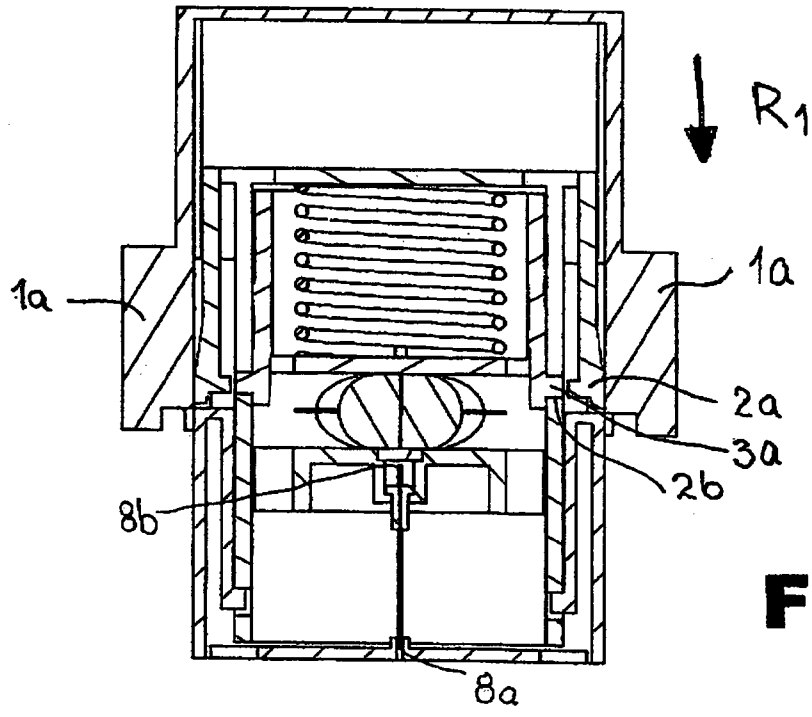


Fig. 2

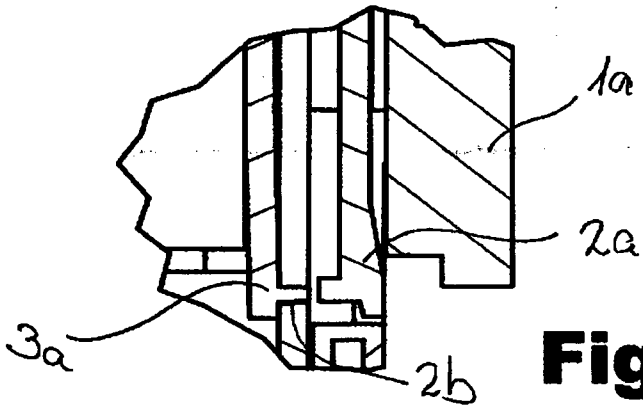


Fig. 2a

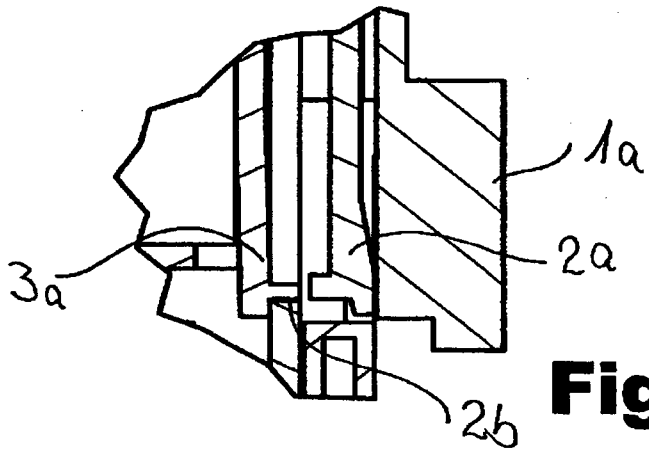


Fig. 2b

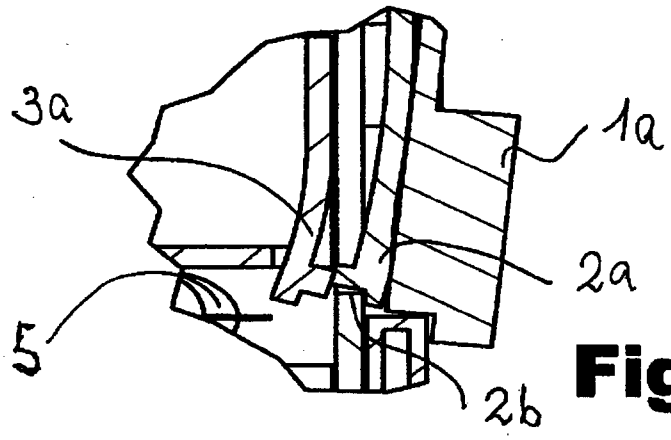


Fig. 2c

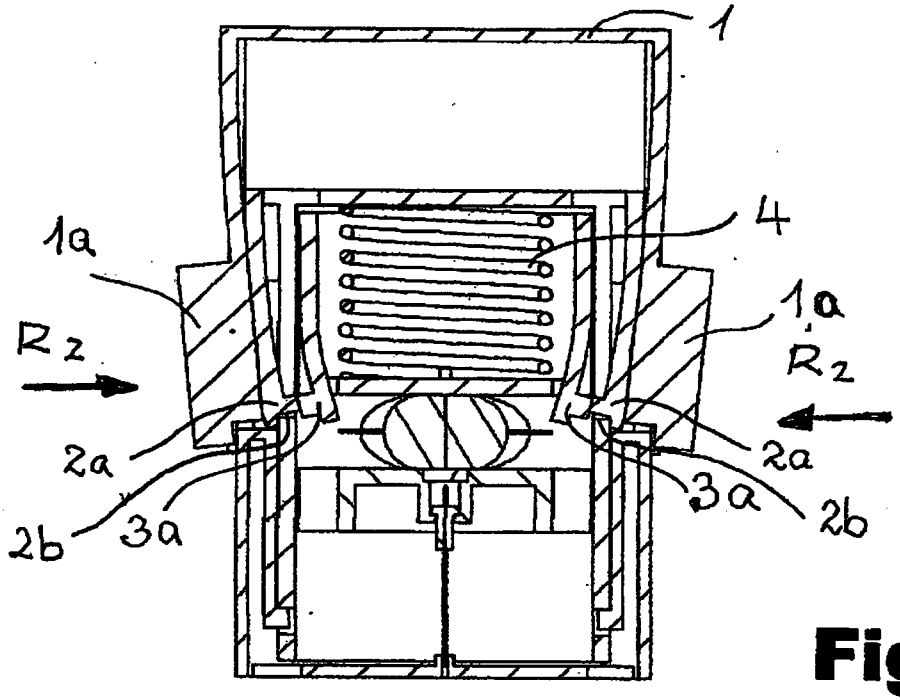


Fig.3

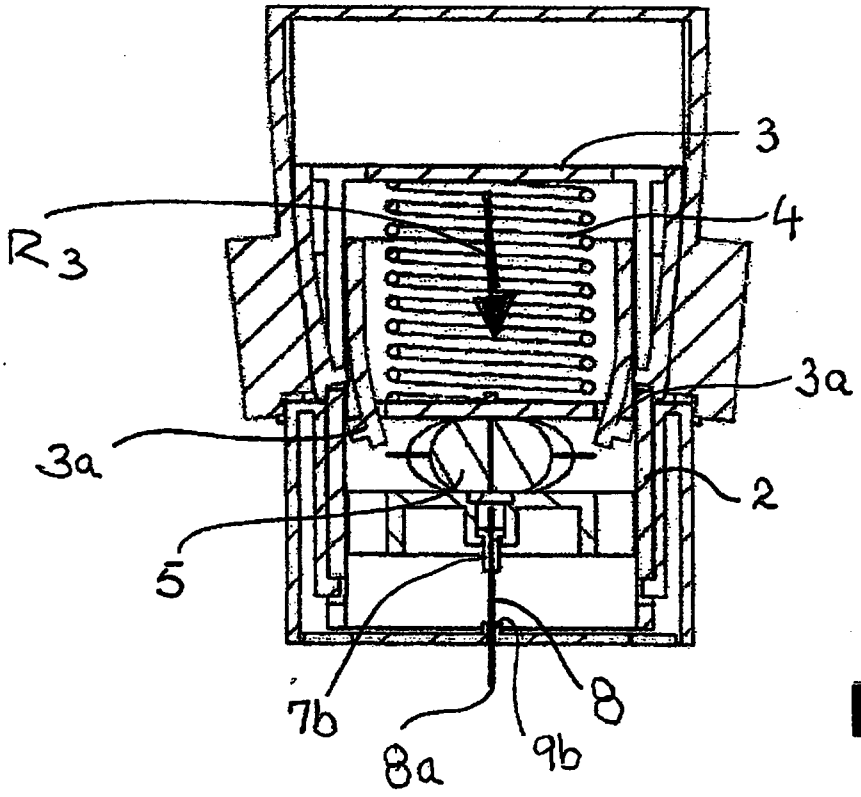


Fig. 4

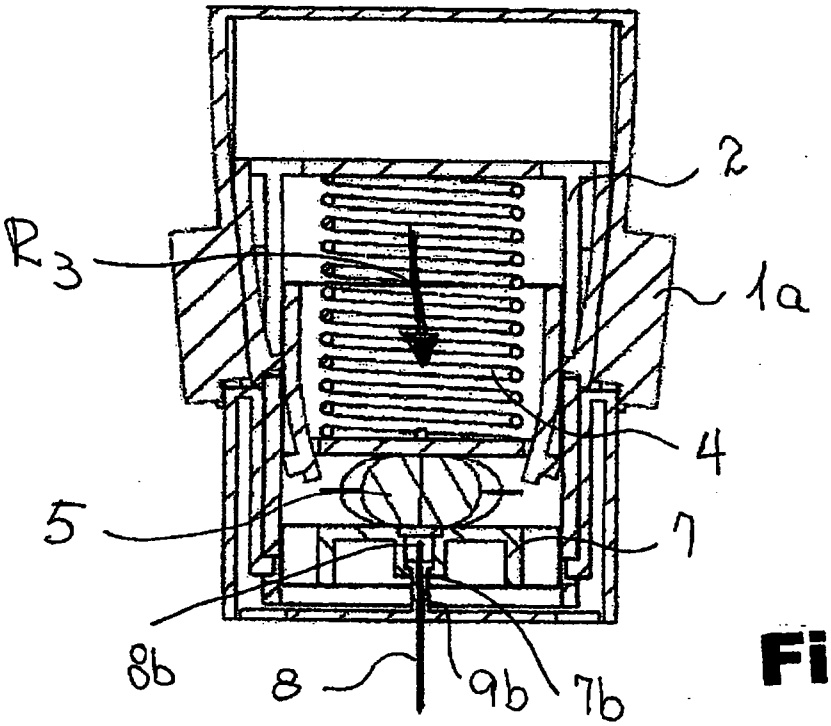


Fig. 5

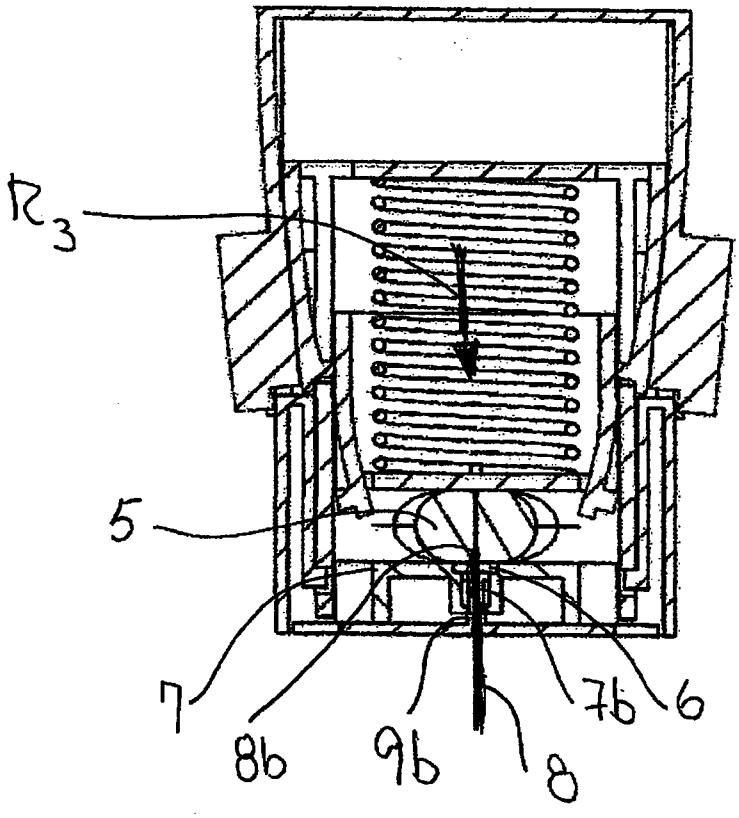


Fig. 6

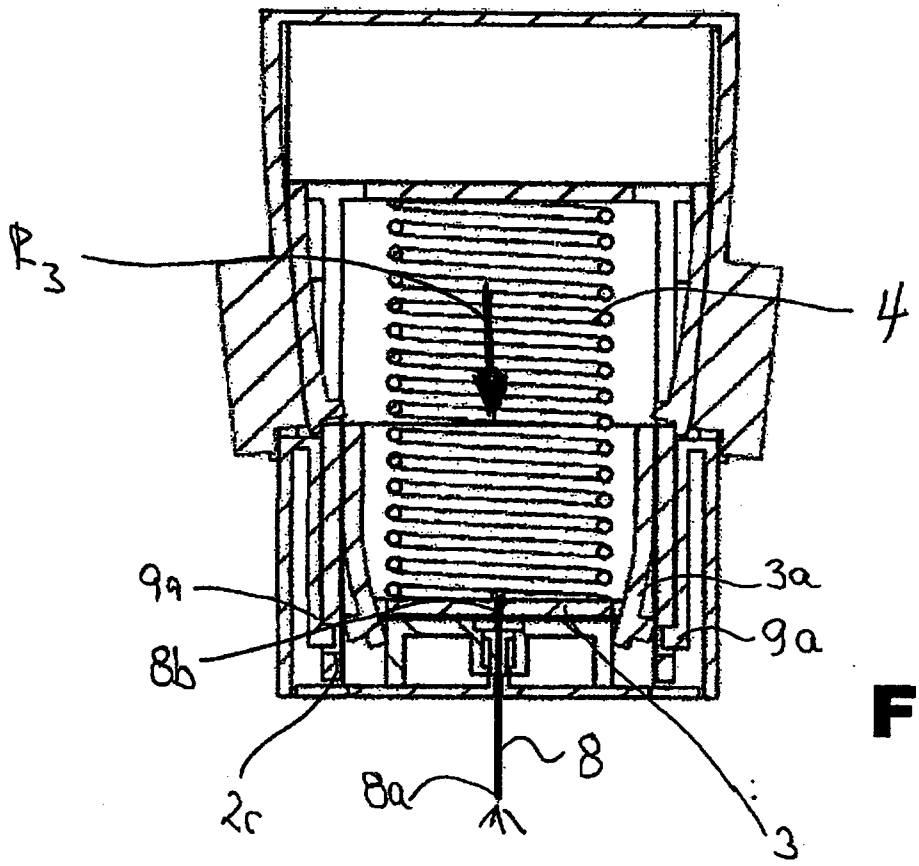


Fig. 7

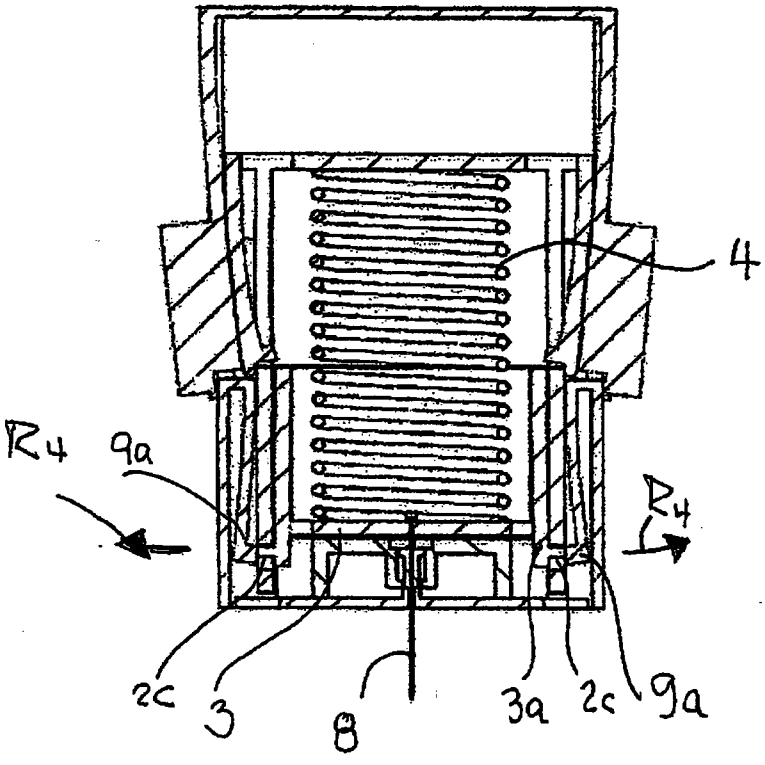


Fig. 8

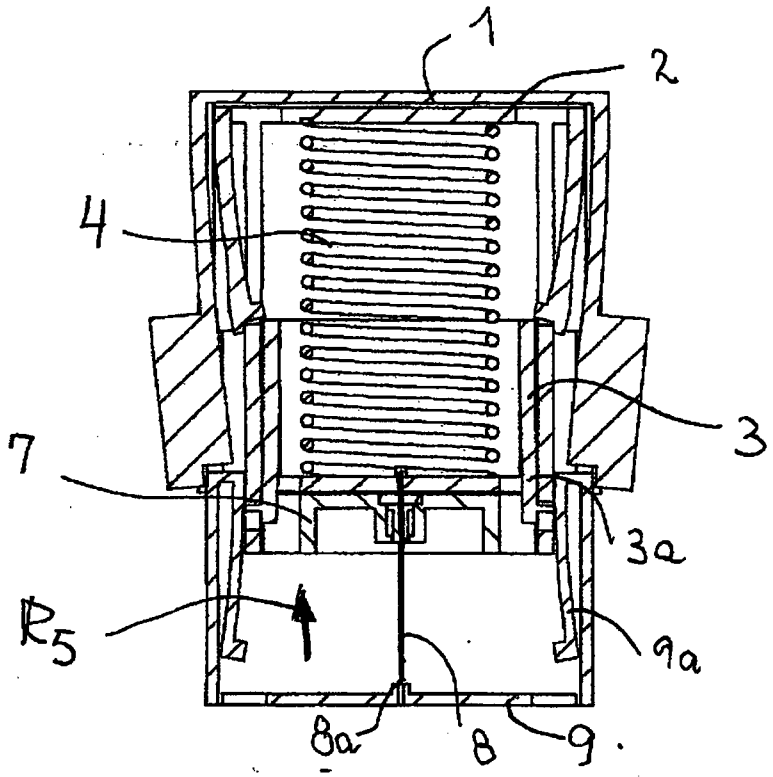


**Fig. 9**

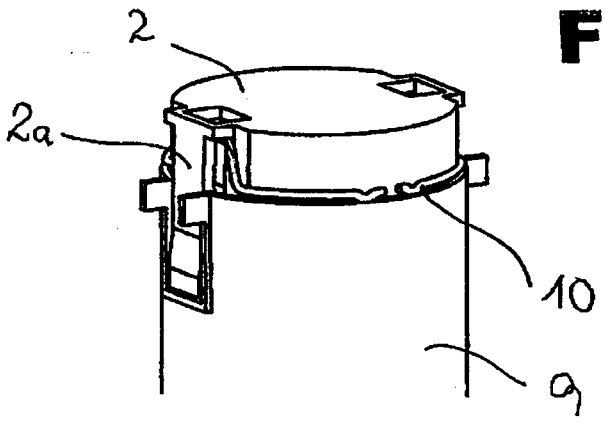


Fig. 10

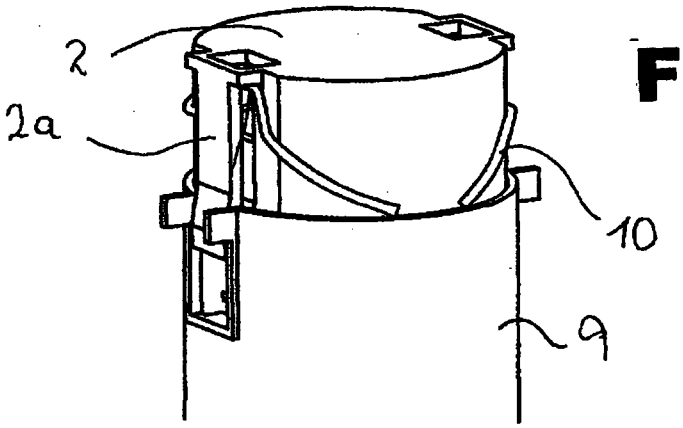


Fig. 11

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK2012/050052

**A. CLASSIFICATION OF SUBJECT MATTER**
**IPC: A61M 5/20 (2006.01)**
**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)**

**IPC: A61M; ICO: K61M**

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

**IPC: A61M 5/20: DK, NO, SE, FI.**

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

**EPODOC, WPI, TXTE.**

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X<br>Y<br>A | US 3605744 A (DWYER) 20.09.1971. Column 6, lines 17-26 and 44-64 and column 8, lines58-61 as well as figures 1-2. | 1, 5-6<br>7<br>2-3 |
| Y | US 4031889 A (PIKE) 28.06.1977. Antiseptic applicator (21) figures 1, 2, 8, and 9. | 7 |
| Y | US 3977401 A (PIKE) 31.08.1976. Antiseptic applicator (24) the figures 1-3. | 7 |
| A | WO 2007129324 (YIGAL) A2 15.11.2007. Paragraph 68-71. Figures 16-18 | |
| A | US 2871856 A (STEINER) 03.02.1959. Whole document. | |
| A | GB906574 A (FED MINISTER OF DEFENCE) 26.09.1962. Whole document. | |

. ☐ 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

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 02/04/2012 | 13/04/2012 |
| Name and mailing address of the ISA<br>Nordic Patent Institute<br>Helgeshøj Allè 81<br>DK - 2630 Taastrup, Denmark.<br>Facsimile No. + 45 43 50 80 08. | Authorized officer<br><br>Jørgen Olsen<br><br>Telephone No. + 45 43 50 81 24. |

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/DK2012/050052

**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: 4
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

The subject matter of claim 4 is merely speculative and there is no explanation in the description that could make it possible for the reader to understand how a single biasing mean could constitute the injection displacement means as well as the retraction displacement means.

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is only those claims for which fees were paid, specifically claims Nos.:

**Remark on Protest**

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

**INTERNATIONAL SEARCH REPORT**
Information on patent family members

International application No.
PCT/DK2012/050052

| Patent document cited in search report/Publication date | Patent family member(s)/Publication date |
|---|---|
| US3605744 A 19710920 | NONE |
| US4031889 A 19770628 | US3977402 A 19760831<br>US3977401 A 19760831 |
| US3977401 A 19760831 | US4031889 A 19770628<br>US3977402 A 19760831 |
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