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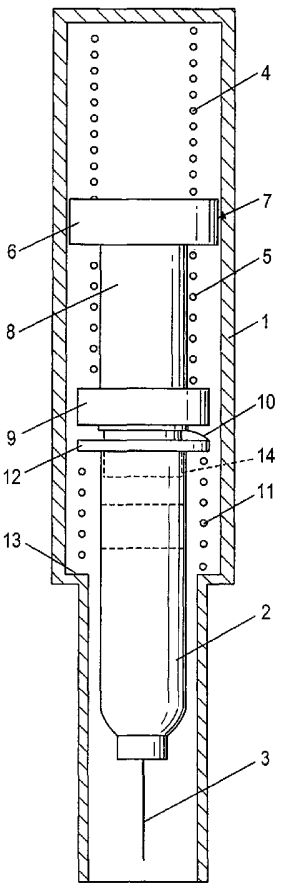
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: MULTI-SPRING SUPPORT FOR NEEDLE SYRINGES



(57) Abstract: When a trigger of an injection device is released, a main spring (4) expands, driving a member (7) forwards. This compresses a weak spring (11), but a spring (5) is stiff enough to remain expanded. A syringe (2) is thus thrust forwards via a collar (9), so that a needle (3) projects from a barrel (1). The spring (4) continues to expand after the syringe has reached its forward position, with the spring (11) fully compressed, so that the stem (8) of the member (7) acts on a piston (14) within the syringe (2), to expel the dose while the spring (5) is caused to be compressed. The spring (5) ensures that the syringe is retained in its forward position during this phase.

WO 03/074111 A1

MULTI-SPRING SUPPORT FOR NEEDLE SYRINGES

This invention relates to injection devices. It is concerned with those devices for medical use where a syringe is loaded into a firing mechanism which first thrusts the syringe forwards to project the needle, and then acts on the piston within the syringe to express the dose.

It is well known to use a single drive spring which, when released, acts on a plunger directly connected to the piston of the syringe. The incompressiblity of the dose and the fineness of the needle bore means that the syringe is thrust forwards by the force on its piston. But once the needle is projected the syringe is arrested while the drive spring continues to act to expel the dose through the needle. There is sometimes a return spring which acts between the syringe and the housing and which is compressed as the syringe moves forwards.

Certain syringes have large needles which require substantial force to make then penetrate. Also there have been developed low friction bungs or pistons for syringes, making it easier to expel a dose. With a combination of a large needle and a low friction piston, and with the single drive spring technique described above, there will be a tendency for the piston to start moving forwards within the syringe before the needle has fully penetrated. The dose will therefore start to be delivered whilst the tip of the needle is still moving into the flesh, and not all of the intended dose will be ejected at the correct depth.

It is therefore desirable for this "pre-drip" to be eliminated as far as possible, which is what the proposal described below seeks to do.

According to the present invention there is provided an injection device

having a housing with a spring drive releasable sequentially firstly to urge a syringe within the housing forwards to project its needle from the forward end of the housing and then to press a piston within the syringe forwards to eject a dose through the needle, wherein the spring drive includes a first spring that acts between the housing and a plunger aligned to co-operate with the piston, and a second spring that acts between the plunger and the syringe, the second spring being weaker than the first spring but being sufficiently stiff to be in an expanded state when the syringe reaches its forward position with its needle penetrating the flesh of a patient, whereupon the first spring, as it fully expands, will then compress the second spring to urge the plunger forwards and thereby move the piston and expel the dose within the syringe, the second spring meanwhile serving to retain the syringe seated at its forward position.

Thus the piston is not acted upon until the needle has penetrated.

It is unlikely that the second spring will act directly on the syringe. Instead, the plunger may have a collar slidable lengthwise within limits, and the second spring will bear on the rear side of this collar, while the forward side of the collar co-operates with the syringe.

To keep the syringe in place initially there may be a third, light spring urging the syringe rearwardly so that its needle is retracted within the housing prior to use. Conveniently this spring encircles the syringe and acts between a rear flange of the syringe and an internal shoulder of the housing. Although it becomes compressed during the injection process it will not be powerful enough to affect the action of the first and second springs, nor will it cause the syringe to retract after use.

For a better understanding of the invention, one embodiment will now be described, by way of example, with reference to the accompanying drawing, in which the single figure is a diagrammatic axial section of an injection device.

The device has a barrel 1 which can house a syringe 2 at its forward end. The syringe is movable axially of the barrel between a position in which its needle 3 is retracted and a position in which that needle projects a set distance.

The forward drive for the syringe, which first moves the syringe body and then urges its piston forwards to expel the dose, consists of two springs 4 and 5 in tandem. The rear spring 4 is the more powerful and acts between the rear end of the barrel and the head 6 of a mushroom shaped member 7 whose stem 8 extends forwardly and can enter the rear end of the syringe 2. The second spring 5, through which the stem 8 extends, acts between the head 6 and a collar 9 slideable along the stem but limited in the forward direction by a circlip 10. A further light spring 11 acts in the rearward direction on the rear flange 12 of the syringe, the spring 11 encircling the syringe body and reacting against an inward shoulder 13 of the barrel 1. The release trigger for the drive spring 4 is not shown for simplicity.

Initially, the syringe is retracted, and the main spring 4 is held compressed. Although shown slightly apart, the collar 9 and syringe flange 12 will be closed together, and there is a balance between the springs 5 and 11 that holds the syringe in place.

When the trigger is released and the device is fired, the main spring 4 expands, driving the member 7 forwards. The spring 5 is stiff enough and the spring 11 weak enough for the spring 5 to remain expanded, and to thrust the

syringe 2 forwards via the collar 9, so that the needle 3 projects from the barrel 1. The spring 4 continues to expand after the syringe has reached its forward position, with the spring 11 fully compressed, so that the stem 8 of the member 7 acts on a bung 14, acting as a piston within the syringe 2, to expel the dose while the spring 5 is caused to be compressed. The spring 5 ensures that the syringe is retained in its forward position during this phase.

When the spring 4 is fully expanded, the injection is complete and the device is withdrawn from the patient with the needle 3 still projecting.

CLAIMS

1. An injection device having a housing with a spring drive releasable sequentially firstly to urge a syringe within the housing forwards to project its needle from the forward end of the housing and then to press a piston within the syringe forwards to eject a dose through the needle, wherein the spring drive includes a first spring that acts between the housing and a plunger aligned to co-operate with the piston, and a second spring that acts between the plunger and the syringe, the second spring being weaker than the first spring but being sufficiently stiff to be in an expanded state when the syringe reaches its forward position with its needle penetrating the flesh of a patient, whereupon the first spring, as it fully expands, will then compress the second spring to urge the plunger forwards and thereby move the piston and expel the dose within the syringe, the second spring meanwhile serving to retain the syringe seated at its forward position.

2. An injection device according to claim 1, wherein the plunger has a collar slidable lengthwise within limits, and the second spring bears on the rear side of this collar, while the forward side of the collar co-operates with the syringe.

3. An injection device according to claim 1 or claim 2, including a third, light spring urging the syringe rearwardly so that its needle is retracted within the housing prior to use.

4. An injection device according to claim 3, wherein the third spring encircles the syringe and acts between a rear flange of the syringe and an internal shoulder of the housing.

5. An injection device substantially as herein described, with reference to the accompanying drawings.

6. Any novel combination of features of an injection device as described herein, and/or as illustrated in the accompanying drawings.

1/1

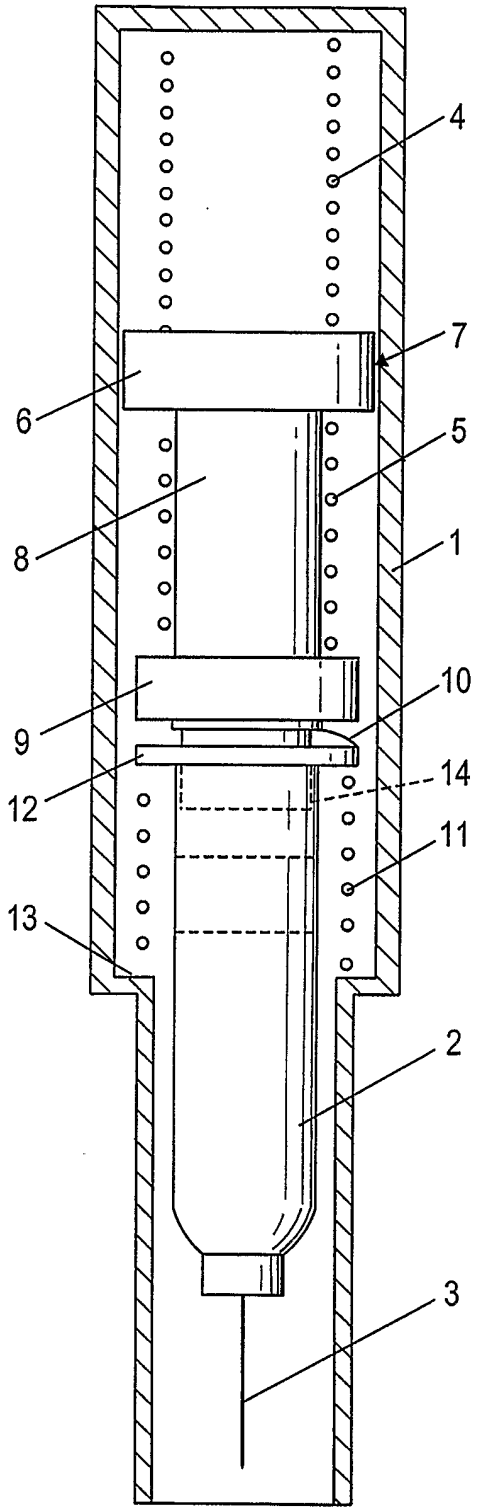


Fig.1

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 03/00902

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61M5/20

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 7 A61M

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 practical, 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	US 3 403 679 A (WATSON CYRIL DANIEL ET AL) 1 October 1968 (1968-10-01) the whole document	1-4
A	US 5 599 309 A (MARSHALL JEREMY ET AL) 4 February 1997 (1997-02-04) column 3, line 36 - line 38; figures 1,2	1-4
A	GB 906 574 A (FED MINISTER OF DEFENCE) 26 September 1962 (1962-09-26) the whole document	1
A	EP 0 516 473 A (OWEN MUMFORD LTD) 2 December 1992 (1992-12-02) figures	1

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

☒ Patent family members are listed in 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 document 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
21 May 2003	03/06/2003

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, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Ehrsam, F

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB 03/00902

Box I Observations where certain claims were found unsearchable (Continuation of item 1 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. [X] Claims Nos.: 5,6
because they relate to subject matter not required to be searched by this Authority, namely:

As the claims 5 and 6 refer to the drawings, no meaningful search could be realized

2. [ ] Claims Nos.:
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:

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 II Observations where unity of invention is lacking (Continuation of item 2 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 an additional fee, this Authority did not invite payment of any additional fee.

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 restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest.

[ ] No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 03/00902

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