A syringe system component

Abstract Title: A combined syringe plunger and needle cap

A dual-purpose syringe component 104 has an elongate body provided with an internal elongate cavity, the elongate cavity having an engagement section adjacent an opening of the elongate cavity at an open end of the elongate body, wherein the elongate body is configured for use as both a syringe plunger and a syringe needle cap, the elongate cavity is adapted for insertion of a syringe needle 108, and the engagement section is configured for engagement with a syringe mount that is provided around the syringe needle, such that withdrawal of an inserted syringe needle from within the elongate cavity is prevented; and a syringe system comprising a syringe barrel and such a dual-purpose syringe component.
A SYRINGE SYSTEM COMPONENT

The present invention relates to syringe systems, and more particularly to syringe plungers.

BACKGROUND

Syringe systems are well known, comprising a syringe barrel, a syringe plunger and a syringe tip, which comprises a needle within a needle mount. Medicament for injection is either directly received into the syringe barrel or a vial of liquid medicament is inserted into the barrel. An end of the syringe plunger is received into the syringe barrel for applying pressure onto the vial or directly onto the fluid, to cause the fluid to dispense out through the syringe needle when the opposite end of the plunger is depressed by the user. Syringe plungers are typically solid or have a cruciform cross-section.

After use, the contaminated needle presents a substantial biohazard to medical staff and waste disposal services. Accordingly, it is necessary to fit the needle tip with a protective cover that covers at least the needle. For this purpose, syringe tips are commonly supplied within a removable needle cap that is retained on the syringe tip by frictional engagement, and which can be replaced onto the syringe tip after use.

Disadvantageously, this requires the provision of a separate needle cap. Further, such needle caps can become separated from the syringe tip, giving rise to an attendant risk of a needle-stick injury during the waste disposal process. Also, such removable needle covers may be deliberately removed for reuse of the syringe tip, which presents a serious biohazard to the subsequent patient.

Alternatively, it is known to provide a syringe tip with a hinged needle cover that flips over the needle after use. Such needle covers may leave part of the needle exposed, and may be easily damaged.

In the case of conventional removeable needle caps, misalignment of the sharp end of the needle with the open end of the needle cap can lead to a needle-injury, in which the user accidentally jabs the needle tip into the hand holding the tubular cap. To avoid this it is necessary to provide a yet further component, in the form of a dedicated holder, which is a wide bung with a central bore, into which the tubular cap is located, prior to insertion of the needle into the tubular cap, with the wide bung providing a protective shield to the user's
hand. Alternatively, a separate holder is required, into which the needle cap is inserted prior to single-handed insertion of the syringe tip into the needle cap.

**SUMMARY OF THE DISCLOSURE**

According to a first aspect, there is provided a dual-purpose syringe component having an elongate body internally provided with an elongate cavity, the elongate cavity having an engagement section adjacent an opening of the elongate cavity at an open end of the elongate body, wherein the elongate body is configured for use as both a syringe plunger and a syringe needle cap, the elongate cavity is adapted to receive an inserted syringe needle, and the engagement section is configured for engagement with a syringe mount that is provided around the syringe needle, such that withdrawal of an inserted syringe needle from within the elongate cavity is prevented.

According to a second aspect, there is provided a syringe system comprising a syringe barrel and a dual-purpose syringe component having an elongate body internally provided with an elongate cavity, the elongate cavity having an engagement section adjacent an opening of the elongate cavity at an open end of the elongate body, wherein the elongate body is configured for use as both a syringe plunger and a syringe needle cap, the elongate cavity is adapted to receive an inserted syringe needle, and the engagement section is configured for engagement with a syringe mount that is provided around the syringe needle, such that withdrawal of an inserted syringe needle from within the elongate cavity is prevented, and wherein the syringe barrel has a chamber configured to receive a medicament and provided with a chamber opening, and the exterior of the elongate body of the syringe component adjacent the opposite end from the opening is adapted to be received into the chamber through the chamber opening.

The engagement section may be provided with a resiliently deformable engagement element for latching engagement with the syringe mount.
The engagement element may have a fixed end and a free end, the fixed end is fixed to a main body of the engagement section, and the free end has an internally projecting portion that projects into the elongate cavity.

The engagement element may extend generally parallel to the direction of elongation of the elongate cavity, such that the free end is closer to the opening than the fixed end.

The engagement element may extend generally circumferentially about the direction of elongation of the elongate cavity.

The free end may have a bevelled face angled away from the fixed end and towards a central axis of the component. In the case that the engagement elements extend generally parallel to the direction of elongation of the elongate cavity, the bevelled face may be angled towards the opening at an acute angle. In the case that the engagement element extends generally circumferentially about the direction of elongation of the cavity, the free end may have a bevelled face angled towards the direction of rotational engagement with a complementary screw thread and towards the interior of the elongate cavity.

The engagement section may be provided with a female screw thread for rotational engagement with a complementary male screw thread on the syringe mount.

The internally projecting portion may comprise a plurality of teeth.

The teeth may be sawtooth-shaped teeth orientated to facilitate engagement and to prevent disengagement of the syringe mount from within the engagement section.

A circumferential flange may be provided around the open end of the elongate body.

The circumferential flange may be funnel-shaped for guiding a syringe needle point towards the opening.

The exterior of the elongate body of the syringe component adjacent the opposite end from the opening may be adapted to form a snug fit with the chamber opening.

The opposite end of the syringe component from the opening may be a closed end and may be adapted to form an airtight seal with the interior of the chamber.
The syringe system may further comprise a syringe needle.

BRIEF DESCRIPTION OF THE DRAWINGS

5 Embodiments of the invention are further described hereinafter with reference to the accompanying drawings, in which:

- Figure 1 shows a syringe system according to the present invention prior to use for injection;
- Figure 2 shows the syringe system of Figure 1 after the syringe tip has been capped with the syringe plunger;
- Figure 3 shows a syringe body of Figure 1;
- Figure 4 shows the syringe plunger of Figure 1;
- Figure 5 shows the syringe tip of Figure 1;
- Figure 6 shows a cross-sectional view through part of the syringe system of Figure 2;
- Figure 7 shows a cross-sectional view through part of an alternative syringe system; and
- Figure 8 shows a cross-sectional view through part of a further syringe system.

DETAILED DESCRIPTION

20 In the described embodiments, like features have been identified with like numerals, albeit in some cases incremented by integer multiples of 100, i.e. 100, 200 and 300 each indicate a syringe system.

25 Figures 1 and 2 illustrate a syringe system 100 in two different modes of operation, which are respectively: in readiness for the insertion of a vial and use in an injection; and, made safe after an injection has been administered. The syringe system 100 comprises a syringe barrel 102, a syringe plunger 104, and a syringe tip 106 having a needle 108.

30 Figure 1 shows the syringe system 100 with part 104A of the plunger 104 extending within the barrel 102, and with the needle 108 of the syringe tip 106 exposed. Figure 2 shows the syringe system 100 of Figure 1, in which the plunger 104 has been removed from within the syringe barrel 102, and connected over the needle 108 of the syringe tip 106, as a safety cap. Figure 2 also shows a vial 110 for a liquid medicament (e.g. a 1.8 ml or 2.2 ml vial) within the barrel 102 (omitted from Figure 1 for clarity).
Figures 3, 4 and 5 respectively show the syringe barrel 102, the syringe plunger 104 and the syringe tip 106 in greater detail, and Figure 6 shows a cross-sectional view through part of the syringe system of Figure 2.

The syringe barrel 102 has a chamber 112 for receiving the medicament vial 110, and is, for example, made from acrylonitrile butadiene styrene (ABS) or polypropylene (PP). A male screw thread 114 is provided on a hollow projection 116 at one end 118 of the chamber 112 for connection of the syringe tip 106, which has a complementary female screw thread (it will be appreciated that alternative tip connectors may be used, such as a connector of the known Luer taper type, or a frictional engagement type). The male thread 114 is spaced from the end 118 by an unthreaded section 120. The other end 122 of the chamber 112 is provided with an opening 124 configured to guide the plunger 104, e.g. by the provision of a collar 126 within the opening, and has a pair of finger grips 128. The collar 126 may, for example, be formed of thermoplastic polyurethane (TPU) or thermoplastic elastomer (TPE).

The syringe plunger 104 is operable as a dual-purpose syringe component for use as both a plunger and as a syringe cap. The plunger 104 has a hollow stem 130 connected coaxially with a syringe tip engagement section 132, and is, for example, made from acrylonitrile butadiene styrene (ABS) or polypropylene (PP). The stem 130 has a closed end 134, and the opposite end 136 of the plunger 104 has a central opening 138 and a flange 140 provided around the circumference of the engagement section 132, and extending away from the opening. The stem 130 is a hollow elongate cylinder with a central bore 140 that is configured to receive the needle 108 of the syringe tip 106. The engagement section 132 has a larger external diameter than the stem 130. The engagement section 132 is hollow with a throat 142 that is wider than the bore 140. The engagement section 132 is provided with a plurality (e.g. four) resiliently deformable engagement elements 144, each of which is connected to the body of the engagement section 132 at a fixed end 146, and has a free end 148 that projects into the throat 142. The free end 148 of the engagement elements 144 has a bevelled edge 150 facing towards the opening 138 at an acute angle to the central axis 152 of the plunger 104.

The syringe plunger 104 is adapted to cooperate with the syringe barrel 102. The stem 130 is dimensioned to fit within the opening 124 of the syringe barrel 102. The stem 130 has a cylindrical exterior with a diameter approximately the same size as the interior diameter of the collar 126 in the opening 124, such that they form a snug fit. The stem has approximately the same axial length (or at least 80%) as the chamber 112, such that the plunger 104 can be depressed into the barrel 102 so that the closed end 134 of the plunger
can reach the end 118 of the chamber 112, or at least close to the end of the chamber (i.e. allowing for a minimum possible separation between a moveable dispensing piston in the vial 110 and the chamber end 118).

The syringe tip 106 has hollow syringe needle 108 and a needle mount 154. The needle 108 has a sharp first point 156 for insertion into the patient. The mount 154 has a lip 158 and a rim 160 facing away from the first point 156 of the needle 108. At the opposite end from the first point 156, the needle 108 has a short length extending beyond the mount 154, and having a second point 162 for insertion into the vial 110.

Prior to performing an injection, a medicament vial 110 is inserted into the chamber 112 of the syringe barrel 102, and the end 134 of the stem 130 of the syringe plunger 104 is also inserted into the barrel to contact the vial, and press the vial against the second point 162 of the needle, piercing the sealing layer (e.g. latex diaphragm or metal foil) 164 of the vial 110, such that the contained medicament can flow into the needle bore. The flange 140 and finger grips 128 are shaped to accommodate digits (typically the user’s thumb and two adjacent fingers, respectively), and the plunger 104 is depressed further into the chamber 112 to move the vial’s internal dispensing piston (at the opposite end of the vial from the sealing layer 164), such that the medicament is dispensed through the needle bore.

After the injection has been performed, the plunger 104 is withdrawn from within the barrel 102 for use to cap the needle 108. The first point 156 of the needle is inserted into the opening 138 of the plunger 104. The flange 140 is funnel-shaped for guiding the sharp first point 156 of a needle 108 into the opening 138 and stem bore 140 of the plunger 104. As the mount 154 is inserted into the throat 142, the bevelled edge 150 presses against the mount 154 and lip 158, causing the resiliently deformable engagement elements 144 to be bent outwards.

Once the mount 154 is fully inserted within the throat 142, the engagement elements 144 spring back inwards, such that the free ends 148 catch behind the mount 154, against the rim 160. This ensnares the mount 154 within the throat 142, and thereby safely secures the capped needle 108 within the bore 140 of the plunger stem 130, for disposal. The engagement elements 144 permanently latch the syringe tip 106 to the plunger 104, such that the tip and plunger cannot be separated. Accordingly, reuse of the needle 108 is prevented. Also, this arrangement prevents the needle from becoming exposed and presenting a risk of a needle-stick injury during further handling and the disposal process. Conveniently the entire syringe system may be disposed of as a single assembly (i.e. as
shown in Figure 2). Alternatively, the plunger 104 and captured needle tip 106 may be detached from the barrel 102, allowing the barrel to be reused when the needle tip and plunger is disposed of.

The materials of the syringe plunger 104 and the syringe barrel 102 are suitable for shredding.

Although a syringe system 100 has been described that is adapted for use with a medicament vial 110 received within the chamber 112, it will also be appreciated that the present invention is also applicable to a syringe system that is adapted for use without a separate medicament vial. In such a syringe system, the closed end 134 is adapted to form an airtight fit (i.e. a sliding sealing arrangement) with wall of the chamber 112 of the syringe barrel 102.

Figure 7 illustrates part of a further syringe system 200 in which like features have been identified with like numerals incremented by 100 with respect to Figures 1 to 6. The syringe plunger 204 and syringe tip 206 of Figure 7 differ from those of Figures 1 to 6 in relation to the mechanism by which the tip is latched into the plunger. The needle mount 254 is provided with a plurality of circumferential ridges 270, and the resiliently deformable engagement elements 244 are provided a plurality of teeth 272. The teeth 272 are adapted to accept axial insertion of the mount 254 into the throat 242 but to prevent axial withdrawal of the mount from within the throat. The teeth 272 and/or the circumferential ridges 270 are sawtooth shaped.

In further embodiments (not illustrated), the needle mount and the throat are respectively provided with mutually co-operable male and female screw threads, by which the mount may be screwed into engagement within the throat. One or more resiliently deformable engagement elements are provided to latch onto corresponding features of the mount to prevent rotational disengagement (i.e. unscrewing) of the mount from within the throat. The engagement section is connected to the body of the engagement section at a fixed end, and has a free end. Figure 8 illustrates a cross-sectional view through part of a further syringe system 300 of a further embodiment, perpendicular to the needle 308, in which like features have been identified with like numerals incremented by 700 with respect to Figures 1 to 6. The free end 348 projects into the throat 342 for engagement with the needle mount 354, and optionally has a bevelled edge 350 to facilitate engagement with a rotational disengagement prevention feature 358 of the mount, to permit screwing together of the mount 354 and the engagement section 332, and to prevent unscrewing of the mount from
the engagement section, and thereby to prevent disengagement of the tip and the plunger. Alternatively, the engagement element may extend along the elongate cavity.

In an alternative embodiment (not illustrated), the engagement elements are provided with a plurality of circumferentially arranged teeth for engagement with corresponding rotational disengagement prevention features of the mount, and one or both of which may comprise a plurality of sawtooth teeth, aligned to permit the mount to be screwed into the throat, but to prevent contrary relative rotation.

The figures provided herein are schematic and not to scale.

Throughout the description and claims of this specification, the words “comprise” and “contain” and variations of them mean “including but not limited to”, and they are not intended to (and do not) exclude other moieties, additives, components, integers or steps. Throughout the description and claims of this specification, the singular encompasses the plural unless the context otherwise requires. In particular, where the indefinite article is used, the specification is to be understood as contemplating plurality as well as singularity, unless the context requires otherwise.

Features, integers, characteristics, compounds, chemical moieties or groups described in conjunction with a particular aspect, embodiment or example of the invention are to be understood to be applicable to any other aspect, embodiment or example described herein unless incompatible therewith. All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive. The invention is not restricted to the details of any foregoing embodiments. The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel combination, of the steps of any method or process so disclosed.

The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.
CLAIMS

1. A dual-purpose syringe component having
   an elongate body internally provided with an elongate cavity, the elongate cavity
   having an engagement section adjacent an opening of the elongate cavity at an open end of
   the elongate body, wherein
   the elongate body is configured for use as both a syringe plunger and a syringe
   needle cap,
   the elongate cavity is adapted to receive an inserted syringe needle, and
   the engagement section is configured for engagement with a syringe mount that is
   provided around the syringe needle, such that withdrawal of an inserted syringe needle from
   within the elongate cavity is prevented.

2. A component according to claim 1, wherein the engagement section is provided with
   a resiliently deformable engagement element for latching engagement with the syringe
   mount.

3. A component according to claim 2, wherein the engagement element has a fixed end
   and a free end, the fixed end is fixed to a main body of the engagement section, and the free
   end has an internally projecting portion that projects into the elongate cavity.

4. A component according to claim 3, wherein the engagement element extends
   generally parallel to the direction of elongation of the elongate cavity, such that the free end
   is closer to the opening than the fixed end.

5. A component according to claim 3, wherein and the engagement element extends
   generally circumferentially about the direction of elongation of the elongate cavity.

6. A component according to claims 4 or 5, wherein the free end has a bevelled face
   angled away from the fixed end and towards a central axis of the component.

7. A component according to any preceding claim, wherein the engagement section is
   provided with a female screw thread for rotational engagement with a complementary male
   screw thread on the syringe mount.

8. A component according to claims any one of claims 3 to 7, wherein the internally
   projecting portion comprises a plurality of teeth.
9. A component according to claim 8, wherein the teeth are sawtooth-shaped teeth orientated to facilitate engagement and to prevent disengagement of the syringe mount from within the engagement section.

10. A component according to any preceding claim, wherein a circumferential flange is provided around the open end of the elongate body.

11. A component according to claim 10, wherein the circumferential flange is funnel-shaped for guiding a syringe needle point towards the opening.

12. A syringe system comprising a syringe barrel and a dual-purpose syringe component according to any preceding claim, wherein the syringe barrel has a chamber configured to receive a medicament and provided with a chamber opening, and the exterior of the elongate body of the syringe component adjacent the opposite end from the opening is adapted to be received into the chamber through the chamber opening.

13. A syringe system according to claim 12, wherein the exterior of the elongate body of the syringe component adjacent the opposite end from the opening is adapted to form a snug fit with the chamber opening.

14. A syringe system according to claim 13, wherein the opposite end of the syringe component from the opening is a closed end and is adapted to form an airtight seal with the interior of the chamber.

15. A syringe system according to claim 12, 13 or 14, wherein the syringe system further comprises a syringe needle.

16. A dual-purpose syringe component substantially as hereinbefore described with reference to the accompanying description and any one of the Figures.

17. A syringe system substantially as hereinbefore described with reference to the accompanying description and any one of the Figures.
Application No: GB120124.1
Examiner: Alex Robinson
Claims searched: 1 to 15
Date of search: 22 March 2012

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

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The following online and other databases have been used in the preparation of this search report

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### International Classification:

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