INJECTION DEVICE

FIELD OF THE INVENTION

The present invention relates to an injection device of the type that receives a syringe and includes a cap over a dispensing aperture of the injection device.

BACKGROUND OF THE INVENTION

Injection devices of a general description are shown in WO 95/35126 and EP-A-0 516 473 and tend to employ a drive spring and some form of release mechanism that releases the syringe from the influence of the drive spring once its contents are supposed to have been discharged, to allow it to be retracted by a return spring.

Often, such injection devices are required to work with sealed hypodermic syringes which typically have a hermetically sealed cover or "boot" that covers the hypodermic needle and maintains the sterility of the syringe contents. Naturally, it is necessary to maintain the sterility of the syringe contents up to the point of administration, which means that for devices that are designed to be disposable, the boot must be removed with the syringe inside the injection device.

In previously known injection devices, the action required to remove the boot from the syringe entails either pulling the boot away from the syringe or twisting the boot and, at the same time, pulling it away from the syringe.

If the injection devices are used by patients having rheumatoid arthritis or elderly or weak patients, it is difficult for the patient to remove the boot from the syringe prior to its use. In addition, the boots are small and fiddly to grip for all users but particularly for users who have poor flexibility in their joints or limited manual dexterity. Since the boot of the syringe may be positioned inside the housing, there may also be limited access to the boot.

Co-pending United Kingdom patent application no. 0412051.5, the contents of which is incorporated herein by reference, describes a cap for an injection device that connects to the boot of the syringe so that removal of the housing closure member from the housing causes removal of the boot from the syringe.

In certain types of syringe, for example a Bünder ReadyJect™ type syringe, the boot must be twisted to break a frangible joint before it can be pulled off. An inexperienced user of the injection device might attempt to pull the cap of the injection device off without first twisting. This could lead to either the boot pulling out of the cap of the injection device and remaining on the syringe or the syringe components separating. In either case, the user will not be able to use the injection device to successfully deliver a drug product.

SUMMARY OF THE INVENTION

The injection devices of the present invention are designed to deal with these problems.

In view of the foregoing and in accordance with the present invention, there is provided an injection device comprising:

a housing adapted to receive a syringe having a discharge nozzle and a boot that covers its discharge nozzle, the housing having a longitudinal axis and including a first guide; and

a housing closure member including a second guide;

wherein the first guide and the second guide are arranged so that rotation of the housing closure member relative to the housing causes the housing closure member first to rotate relative to the housing and then to move away from the housing, wherein the housing closure member further comprising means for connecting to the boot of the syringe so that removal of the housing closure member from the housing causes removal of the boot from the syringe.

Hence, the boot is first twisted to break a frangible joint holding it the syringe before being pulled off. This way, an inexperienced user of the injection device cannot pull the cap of the injection device off without first twisting.

Preferably, one of the first guide and the second guide comprises a slot and the other of the first guide and the second guide comprises a protrusion for communicating with the slot.

The slot can have a first section which runs in a direction perpendicular to a first axis of the housing and a second section which turns away from the first section towards the direction of the first axis.

Preferably, the protrusion is moulded from the same material as the housing closure means.

In one embodiment of the invention, one of the housing and the housing closure member has a second slot and the other of the housing and the housing closure member has a second protrusion for communicating with the second slot.

The injection device may further comprise an external grip feature with which a user can grip the housing closure member.

Advantageously, the means for connecting may comprise a plurality of splines.

Preferably, the plurality of splines is arranged around the internal diameter of a cylinder mounted on the housing closure means.

The splines may be mounted on the cylinder such that the angle formed between each spline and a radius of the cylinder is less than 90 degrees. Upon connecting the boot of the syringe to the housing closure member and rotating the housing closure member, the splines rotate the boot of the syringe relative to the discharge nozzle.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a perspective view of an injection device according to the present invention with the housing closure member removed;

Figure 2 shows a plan view of the injection device of figure 1;

Figure 3 shows a side view of the injection device of figure 1;

Figure 4 shows a plan view of the injection device of figures 1 to 3, with the housing closure member in place;

Figure 5 shows a perspective view of the injection device of figure 4;

Figure 6 shows a perspective view of a housing closure member for use in an injection device according to an embodiment of the present invention;

Figure 7 shows the housing closure member of figure 7 when engaged with a syringe boot of a syringe used with an injection device according to an embodiment of the present invention;

Figure 8 shows a side view of a syringe used in the injection device according to an embodiment of the present invention; and

Figure 9 shows a side view of the syringe of Figure 8 with a syringe boot engaged with the syringe.

DETAILED DESCRIPTION OF THE DRAWINGS

Figures 1 to 5 and 9 show an injection device 110 according to a first embodiment of the present invention. The injection device 110 has an injection device housing 112.

The injection device 110 has a longitudinal axis 101.

The housing 112 contains a hypodermic syringe 114 of conventional type, including a syringe body 116 defining a reservoir and terminating at one end in a hypodermic needle 118. The syringe 114 has a hermetically sealed cover or boot 117 that covers the hypodermic needle 118 and maintains the sterility of the syringe contents. The boot 117 is generally formed of a soft rubber or plastics material. The boot 117 comprises a plurality of flat faces 165 formed on its outer surface about its circumference.

Whilst the syringe illustrated is of hypodermic type, this need not necessarily be so. Transcutaneous or ballistic dermal and subcutaneous syringes may also be used with the injection device of the present invention.

The injection device is further provided with a cap 130. As is best seen from figures 1 to 3 and 6, the cap is retained on the housing 112 by a slot 113 on the housing 112, and a corresponding indentation 131 on the inside of the cap 130.

In a first section 190a, the slot 113 is formed around the housing 112 tangential about the longitudinal axis 101 of the housing 112. In a second section 190b, the slot 113 is formed with two opposing camming surfaces 150a and 150b which are curved in such a way that the slot is directed away from the its tangential direction about the longitudinal axis to a direction along the longitudinal axis 101 of the housing 112.

As can be seen from Figures 6 and 7, the interior of the cap 130 is provided with a plurality of splines 160. These splines 160 are arranged around an internal diameter of a cylinder 161 mounted inside the cap 130. The splines 160 are mounted on the cylinder such that the angle formed between each spline and a radius R of the cylinder 161 is less than 90 degrees. The splines 160 are dimensioned so that they flex resiliently in a direction along the radius R of the cylinder.

The exterior of the cap 130 is provided with a pair of grip formations 170. These grip formations 170 provide an element through which a user can grip the cap 130.

As can be seen from figure 6, the interior of the cap 130 may be provided with a support surface 180 which supports the end of the boot 117.

During manufacture of the injection device 110, the syringe 114 and boot 117 are inserted into the housing 112 as a single piece. The cap 130 is placed onto the housing such that the boot 117 is forced into the space in the cylinder 161 between the splines 160 which flex to allow insertion of the cap 130 onto the boot 117. As a result of the flexing of the splines 160, the cap 130 grips the boot 117 firmly because each spline is forced against one of the flat surfaces 165 of the boot 117. Consequently a very firm grip is produced on the boot 117.

When the injection device 110 is to be used, the user holds the housing 112 with one hand, and grips the cap 130 with the other hand using the grip formations 170. The user then rotates the cap 130. In rotating the cap 130, the projection 131 of the cap 130 moves in the slot 113 of the housing 112, thereby rotating the boot 117 relative to the syringe 116. This rotational movement breaks the frangible connection between the boot 117 and the syringe 114 before any axial movement of the boot 117 relative to the syringe 116 takes place. This is because the slot is formed, in its first section 190a, circumferentially on the housing 112 solely in a direction which is tangential to the longitudinal axis 101 of the housing 112. After the frangible connection has broken, the boot 117 is free to move axially. On further rotation, the projection 131 reaches the camming surfaces 150a and 150b of the slot 113 in its second section 190b, thereby allowing the cap 130 and attached boot 117 to move in a direction along the longitudinal axis 101 of the housing 112, thereby removing the boot 117 from the syringe.

The boot 117 is held stationary within the cap 130 by the splines 160 being forced against and gripping the flat surfaces 165 of the boot 117.

The support surface 180 helps to prevent the boot 117 from being pulled away from the syringe 114 at an angle, by maintaining the axial alignment of the boot 117 within the cap 130.

The present invention provides a simple and effective way of solving the problems of the prior art devices.

In particular, when used with the type of syringe in which the boot must be twisted to break a frangible joint before it can be pulled off, the present invention prevents pulling the cap of the injection device off without first twisting. This way, the boot is not pulled out of the cap of the injection device, does not remain on the syringe and does not cause the syringe components to separate.

It will of course be understood that the present invention has been described above purely by way of example and modifications of detail can be made within the scope of the invention.

CLAIMS

1. An injection device comprising:

a housing adapted to receive a syringe having a discharge nozzle and a boot that covers its discharge nozzle, the housing having a longitudinal axis and including a first guide; and

a housing closure member including a second guide;

wherein the first guide and the second guide are arranged so that rotation of the housing closure member relative to the housing causes the housing closure member first to rotate relative to the housing and then to move away from the housing, wherein the housing closure member further comprising means for connecting to the boot of the syringe so that removal of the housing closure member from the housing causes removal of the boot from the syringe.

2. The injection device according to claim 1, wherein one of the first guide and the second guide comprises a slot and the other of the first guide and the second guide comprises a protrusion for communicating with the slot.

3. An injection device according to claim 2, wherein the slot has a first section which runs in a direction perpendicular to the first axis, and a second section which turns away from the first section towards the direction of the first axis.

4. An injection device according to claim 1 or claim 2, wherein the protrusion is moulded from the same material as the housing closure means.

5. An injection device according to any one of claims 2 to 4, wherein one of the housing and the housing closure member has a second slot and the other of the housing and the housing closure member has a second protrusion for communicating with the second slot.

6. An injection device according to any preceding claim further comprising an external grip feature with which a user can grip the housing closure member.

7. An injection device according to any preceding claim wherein the means for connecting comprises a plurality of splines.

8. An injection device according to claim 7, wherein the plurality of splines are arranged around the internal diameter of a cylinder mounted on the housing closure means.

9. An injection device according to claim 8, wherein the splines are mounted on the cylinder such that the angle formed between each spline and a radius of the cylinder is less than 90 degrees.

10. An injection device according to any of claims 7 to 9, wherein, upon connecting the boot of the syringe to the housing closure member and rotating the housing closure member, the splines rotate the boot of the syringe relative to the discharge nozzle.

11. An injection device according to any preceding claim, wherein the means for connecting is moulded from the same material as the housing closure means.