INJECTION DEVICE
Modified Trigger

FIELD OF THE INVENTION

The present invention relates to an injection device of the type that receives a syringe, extends it, discharges its contents and then retracts it automatically.

BACKGROUND OF THE INVENTION

Previously known injection devices are described in WO95/35126 and EP-A-0516473. Such devices tend to employ a trigger that, when a releasable locking mechanism is engaged, may be operated to cause a drive spring to act upon a syringe.

Generally, in such devices, the trigger is rotatable about a pivot axis so that when it is depressed at a first end, a second end (which normally engages the drive spring) is also rotated away from the drive spring, thereby releasing it, so that the syringe extends under the bias of the drive spring and its contents are discharged. The trigger comprises a protrusion that is engagable with a cut-out on the releasable locking mechanism when the releasable locking mechanism is engaged, thereby allowing the trigger to be activated. When the releasable locking mechanism is not engaged, the protrusion abuts a portion of the releasable locking mechanism and thus prevents rotation of the trigger and release of the drive spring. In this way, accidental activation of the trigger can be prevented.

A problem with an injection device of this type is that the protrusion on the trigger flexes when a force is applied to the trigger and the releasable locking mechanism is not engaged. A strong force applied to the trigger can cause enough flex in the protrusion that the end of the protrusion can engage the cut-out on the releasable locking mechanism, thereby allowing the trigger to be activated even when the releasable locking mechanism has not been engaged. A co-pending UK patent application,

published as GB 2424835 and incorporated herein in its entirety by reference, addresses this problem by providing a protrusion on the releasable locking mechanism and a cut-out on the trigger. In this way, when a force is applied to the trigger when the releasable locking mechanism is not engaged, the trigger and its protrusion both flex in such a way that the protrusion is forced away from the cut-out, thereby decreasing the risk of accidental activation of the trigger.

The injection device described in GB 2424835 requires a particular sequence of operation to fire the device. Specifically, the releasable locking mechanism must be engaged before the trigger can be activated. If the trigger is first held down before the releasable locking mechanism is activated, the trigger is forced against the protrusion so that the releasable locking mechanism cannot be moved into is engaged position (i.e. its position in which activation of trigger is possible). Movement of the releasable locking mechanism is prevented in this way by the presence of a ridge on the trigger over which the protrusion cannot pass when the trigger is held down before the releasable locking mechanism is activated. The sequential mode of operation that this configuration necessitates may pose difficulties for some users of the device.

SUMMARY OF THE INVENTION

The injection device of the present invention is designed to overcome this and other problems.

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

a housing defining a first axis and adapted to receive a syringe having a discharge nozzle, so that the syringe is movable between a retracted position, in which the discharge nozzle is contained within the housing, and an extended position, in which the discharge nozzle extends from the housing through an exit aperture;

a drive that is acted upon and in turn acts upon the syringe;

a trigger movable from a rest position, in which it causes the drive to be retained, to an active position, in which it no longer causes the drive to be retained; and

a releasable locking mechanism movable from a first position, in which the trigger is prevented from moving into its active position, to a second position, in which the trigger can be moved to its active position,

wherein the trigger has an activation surface on which pressure can be applied to move the trigger from its rest position to its active position when the releasable locking mechanism is in its second position;

wherein the trigger and the releasable locking mechanism are arranged such that the trigger moves to its active position when the releasable locking mechanism is moved to its second position whilst pressure is being applied to the activation surface of the trigger.

Thus, the device may be activated by a user pressing and holding down the trigger and subsequently engaging the releasable locking mechanism. Preferably, the releasable locking mechanism forms part of a sliding sleeve which protrudes, in its first position, from the exit aperture and which is moved to its second position by pressing the sliding sleeve against the skin of a user. The above sequence of operation greatly assists users of the device who may find it difficult to hold the injection device against their skin before pressing down on the trigger. This arrangement may additionally allow the device to be operated by a user engaging the releasable locking mechanism and subsequently pressing the trigger.

In one embodiment of the invention, the trigger includes a locking component and the releasable locking mechanism includes a locking element. The locking component and the locking element are in contacting juxtaposition when the trigger is in its rest position and the releasable locking mechanism is in its first position such that the trigger is prevented from moving to its active position when pressure is applied to the activation surface of the trigger.

Preferably, the locking component and the locking element are adapted such that, whilst pressure is being applied to the activation surface of the trigger when the trigger is initially in its rest position and the releasable locking mechanism is initially in its first position, the releasable locking mechanism can be moved to its second position in which

the locking component and the locking element are not in contacting juxtaposition, such that the trigger moves from its rest position to its active position.

In addition, the locking component may extend from a first end of the trigger in a direction along the first axis and includes a cut-out therein and the locking element comprises a protrusion along a second axis for communicating with a contact surface of the locking component when the releasable locking mechanism is in its first position and for communicating with the cut-out when the releasable locking mechanism is in its second position, wherein the second axis is at an angle to the first axis.

Advantageously, the locking component may comprise a cammed surface on which the locking element acts when the releasable locking mechanism is in its first position such that, whilst pressure is being applied to the activation surface of the trigger in a direction substantially along the second axis and into the injection device, the locking element can be moved over the cammed surface, as the releasable locking mechanism is moved to its second position, into a position in which the locking component and the locking element are not in contacting juxtaposition.

The cammed surface may be angled in such a way that the application of pressure to the activation surface of the trigger, when the releasable locking mechanism is in its first position, biases the protrusion of the locking element away from the cut-out of the locking component. Preferably, the cammed surface is sloped away from the protrusion in a direction away from the first end of the trigger.

Additionally, the protrusion may comprise a ridge adapted to communicate with an edge of the cut-out when the releasable locking mechanism is in its second position and the trigger is in its active position, thereby preventing movement of the trigger from its active position to its rest position. Thus, the trigger can be maintained in a rotated position following its activation, thereby serving to indicate that the injection device has been used.

Furthermore, the locking component may further include a first portion which extends into the cut-out from the locking component and which is arranged to communicate with

the ridge when the releasable locking mechanism is in its second position and the trigger is in its active position.

Preferably, the releasable locking mechanism comprises biasing means arranged to bias the protrusion against the first portion of the locking component. Advantageously, the protrusion may comprise a sloped surface, which is angled with respect to the second axis. This feature ensures that the protrusion enters the cut-out smoothly when the releasable locking mechanism is moved to its second position.

Preferably, the first axis and the second axis are perpendicular to each other, thereby ensuring that the protrusion and the locking component are optimally arranged to ensure that the protrusion enters the cut-out when the releasable locking mechanism is moved to its second position, but also means that the protrusion and the locking component will flex in such a way as to avoid accidental activation of the trigger when the releasable locking mechanism is in its first position.

Preferably, the releasable locking mechanism comprises a sleeve, which protrudes from the exit aperture when the releasable locking mechanism is in its first position. Even more preferably, the releasable locking mechanism is biased into its first position when it is not activated.

A second aspect of the invention provides a method of operating an injection device comprising a housing and a syringe with a discharge nozzle, the syringe being movable between a retracted position, in which the discharge nozzle is contained within the housing, and an extended position, in which the discharge nozzle extends from the housing through an exit aperture, the injection device further comprising a drive that is acted upon and in turn acts upon the syringe, a trigger which is movable from a rest position, in which it causes the drive to be retained, to an active position, in which it no longer causes the drive to be retained and a releasable locking mechanism moveable from a first position, in which the trigger is prevented from moving into its active position, to a second position, in which the trigger can be moved to its active position, the method comprising:

applying pressure to an activation surface of the trigger with the releasable locking mechanism in its first position preventing the trigger releasing the drive; and then

moving the releasable locking mechanism from its first position to its second position, thereby permitting the trigger to be moved, from its rest position to its active position by the pressure applied to the activation surface, such that the drive is released and the discharge nozzle is thus extended out through the exit aperture.

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;

Figure 2 shows a side view of the injection device of figure 1 with an upper section of its housing not shown;

Figure 3 shows a side view of the injection device of figure 2 with further components not shown;

Figure 4 shows a top plan view of the injection device of figure 3;

Figure 5 shows a perspective view of a trigger and releasable locking mechanism according to an embodiment of the present invention;

Figure 6 shows an alternative perspective view of the trigger and releasable locking mechanism of figure 5; and

Figure 7 shows a side cross-sectional view of the trigger and releasable locking mechanism of figures 5 and 6.

DETAILED DESCRIPTION OF THE DRAWINGS

Figures 1 to 4 show an injection device (110) and its internal components according to one embodiment of the present invention. The injection device (110) has an injection device housing (112) and a longitudinal axis (101).

A syringe (122) is contained in the housing (112). The injection device (110) comprises a trigger (114) and a releasable locking mechanism (116). The trigger (114) has a first end (114a) and a second end (114b). The trigger (114) is rotatable about a pivot (115) from a rest position (as shown in figure 2) to an active position (not shown) by applying downwards pressure in direction R (into the injection device (110)) onto an activation surface (114c). The second end (114b) of the trigger (114) connects with a drive coupling (121) which is acted upon by a drive spring (120). The drive coupling (121) is in communication with the syringe (122).

Rotation of the trigger (114) about the pivot (115) near direction R (i.e. downwards into the housing (112) at its first end (114a)) causes the second end (114b) of the trigger (114) to disengage from the drive coupling (121) thereby letting the drive spring (120) drive the syringe (122) (via the drive coupling (121)) along the longitudinal axis (101) out of an aperture (118) in the housing (112).

The releasable locking mechanism (116) is in communication with a sliding sleeve (126) which protrudes, when in a first position, from the aperture (118) in the housing (112). The releasable locking mechanism (116) is activated by movement of the sliding sleeve (126) along the longitudinal axis (101) into the housing (112) into a second position.

A first end (126a) of the sliding sleeve (126) can be placed against the body into which a drug is being delivered, thereby deactivating the releasable locking mechanism (116) and allowing the trigger (114) to rotate in direction R from its rest position to its active position.

As can be seen from figures 5 and 6, the trigger (114) is provided at its first end (114a) with a locking component (150) having a cut-out (152). The locking component (150)

extends from the first end (114a) of the trigger (114) in a direction substantially parallel to the longitudinal axis (101).

The releasable locking mechanism (116) includes a locking element (154) that takes the form of a protrusion (154), which projects in a direction along a perpendicular axis (181) that is perpendicular to the longitudinal axis (101). The cut-out (152) is dimensioned to receive the protrusion (154).

When the releasable locking mechanism (116) is in its first position, as shown in figures 2 to 6, an end (154a) of the protrusion (154) abuts an undersurface (156) of the locking component (150), thereby preventing rotation of the trigger (114).

When the releasable locking mechanism (116) is in its second position (not shown) following movement of the sliding sleeve (126) into the housing (112), the cut-out (152) is positioned above the end (154a) of the protrusion (154), allowing it to pass over the protrusion (154) while a downwards force is applied to the trigger (114). Hence, the trigger (114) is no longer prevented from rotating and disengages itself from the drive coupling (121), thereby extending the syringe (122).

The protrusion (154) comprises a ridge (166). The trigger (114) includes a first portion (162) that extends into the cut-out (152) from the locking component (150) of the trigger (114) and that is arranged to communicate with the first portion (162) following rotation of the trigger (114) so that the ridge (160) is locked over the first portion (162), thereby preventing movement of the trigger (114) from its active position back to its rest position.

The releasable locking mechanism (116) includes biasing means, in the form of resilient arms (171), which act against the internal surface of the housing (112) to bias the releasable locking mechanism (116) and sliding sleeve (126) in a direction out of the aperture (118). This way, following activation of the trigger (114), the ridge (160) is locked over the first portion (162) of the trigger (114), thereby holding the trigger (114) in its active position.

As will be seen from Figure 7, the locking component (150) of the trigger (114) comprises a cammed surface (164) on the under-surface (156) of the locking component (150) that is positioned between the cut-out (152) and the end of the locking component (150). The cammed surface (164) is sloped away from the protrusion (154) in the direction away from the first end (114a) of the trigger (114). The cammed surface (164) abuts the protrusion (154) when force is applied to the trigger (114) in a direction R and the releasable locking mechanism (116) is in its first position. This has the effect that when pressure is applied to the trigger (114), when the releasable locking mechanism (116) is in its first position, the locking component (150) and protrusion (154) flex so that the end (154a) of the protrusion is directed away from the cut-out (152). This prevents the trigger (114) (and hence injection device (110)) being accidentally operated by pushing down hard on the trigger (114) when the releasable locking mechanism is in its first position.

The cammed surface (164) is sloped such that the releasable locking mechanism (116) can be moved from its first position to its second position whilst pressure is being applied to the trigger (114), in such a way that the end (154a) of the protrusion (154) moves over the cammed surface (164) to the cut-out (152), thus allowing the trigger (114) to move from its rest position to its active position, thereby activating the injection device (110).

The protrusion (154) has a sloped surface (166) that is angled with respect to the perpendicular axis (181), which allows the first portion (162) of the trigger (114) to pass over the protrusion (154) more effectively when the trigger (114) moves from its rest position to its active position when the releasable locking mechanism (116) is in its second position.

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 defining a first axis and adapted to receive a syringe having a discharge nozzle, so that the syringe is movable between a retracted position, in which the discharge nozzle is contained within the housing, and an extended position, in which the discharge nozzle extends from the housing through an exit aperture;

a drive that is acted upon and in turn acts upon the syringe;

a trigger movable from a rest position, in which it causes the drive to be retained, to an active position, in which it no longer causes the drive to be retained; and

a releasable locking mechanism movable from a first position, in which the trigger is prevented from moving into its active position, to a second position, in which the trigger can be moved to its active position,

wherein the trigger has an activation surface on which pressure can be applied to move the trigger from its rest position to its active position when the releasable locking mechanism is in its second position, and

wherein the trigger and the releasable locking mechanism are arranged such that the releasable locking mechanism can be moved to its second position whilst pressure is being applied to the activation surface of the trigger.

2. The injection device of claim 1, wherein the trigger includes a locking component and the releasable locking mechanism includes a locking element and wherein the locking component and the locking element are in contacting juxtaposition when the trigger is in its rest position and the releasable locking mechanism is in its first position, such that the trigger is prevented from moving to its active position when pressure is applied to the activation surface of the trigger.

3. The injection device of claim 2, wherein the locking component and the locking element are adapted such that, whilst pressure is being applied to the activation surface of the trigger when the trigger is initially in its rest position and the releasable locking mechanism is initially in its first position, the releasable locking mechanism can be moved to its second position in which the locking component and the locking element

are not in contacting juxtaposition, such that the trigger moves from its rest position to its active position.

4. The injection device of claim 2 or claim 3, wherein the locking component extends from a first end of the trigger in a direction along the first axis and includes a cut-out therein and the locking element comprises a protrusion along a second axis for communicating with a contact surface of the locking component when the releasable locking mechanism is in its first position and for communicating with the cut-out when the releasable locking mechanism is in its second position, wherein the second axis is at an angle to the first axis.

5. The injection device of claim 4, wherein the locking component comprises a cammed surface on which the locking element acts when the releasable locking mechanism is in its first position, such that, whilst pressure is being applied to the activation surface of the trigger in a direction substantially along the second axis into the injection device, the locking element can be moved over the cammed surface, as the releasable locking mechanism is moved to its second position, into a position in which the locking component and the locking element are not in contacting juxtaposition.

6. The injection device of claim 5, wherein the cammed surface is angled in such a way that application of pressure to the activation surface of the trigger, when the releasable locking mechanism is in its first position, biases the protrusion of the locking element away from the cut-out of the locking component.

7. The injection device of any of claims 4 to 6, wherein the protrusion comprises a ridge adapted to communicate with an edge of the cut-out when the releasable locking mechanism is in its second position and the trigger is in its active position, thereby preventing movement of the trigger from its active position to its rest position.

8. The injection device of claim 7, wherein the locking component further includes a first portion which extends into the cut-out from the locking component and which is arranged to communicate with the ridge when the releasable locking mechanism is in its second position and the trigger is in its active position.

9. The injection device of claim 8, wherein the releasable locking mechanism comprises biasing means arranged to bias the protrusion against the first portion of the locking component.

10. The injection device of any of claims 4 to 9, wherein the protrusion comprises a sloped surface, which is angled with respect to the second axis.

11. The injection device of any of claims 4 to 10, wherein the first axis and the second axis are perpendicular to each other.

12. The injection device of any preceding claim, wherein the trigger is pivotally mounted on the housing.

13. The injection device of any preceding claim, wherein the releasable locking mechanism comprises a sleeve, which protrudes from the exit aperture when the releasable locking mechanism is in its first position.

14. The injection device of any preceding claim, wherein the releasable locking mechanism is biased into its first position when it is not activated.

15. A method of operating an injection device comprising a housing and a syringe with a discharge nozzle, the syringe being movable between a retracted position, in which the discharge nozzle is contained within the housing, and an extended position, in which the discharge nozzle extends from the housing through an exit aperture, the injection device further comprising a drive that is acted upon and in turn acts upon the syringe, a trigger which is movable from a rest position, in which it causes the drive to be retained, to an active position, in which it no longer causes the drive to be retained and a releasable locking mechanism moveable from a first position, in which the trigger is prevented

from moving into its active position, to a second position, in which the trigger can be moved to its active position, the method comprising:

applying pressure to an activation surface of the trigger with the releasable locking mechanism in its first position preventing the trigger releasing the drive; and then

moving the releasable locking mechanism from its first position to its second position, thereby permitting the trigger to be moved, from its rest position to its active position by the pressure applied to the activation surface, such that the drive is released and the discharge nozzle is thus extended out through the exit aperture..