Claims

1. Auto-injector (1) for administering a dose of a liquid medicament (M), comprising:
- an elongate case (12) arranged to be held by a user,
- a tubular chassis (2) telescopable in the case (12) and biased against the case (12) so as to protrude from the case (12),
- a syringe (3) with a hollow injection needle (4), a drive spring (8) and a plunger (9) for forwarding load of the drive spring (8) to a stopper (6) of the syringe (3),
- a trigger button (13) distally arranged in or on the case (12),

wherein the trigger button (13) is initially coupled to the case (12) in a manner to protrude distally from the case (12) and interlocked to the chassis (2) in a manner preventing the trigger button (13) from disengaging the case (12) and thus preventing actuation of the trigger button (13) in an initial position, wherein the case (12) is arranged to translate in the proximal direction (P) against the bias relative to the chassis (2) thereby also translating the trigger button (13) releasing the interlock to the chassis (2) so as to allow actuation of the trigger button (13), wherein the trigger button (13) is arranged to lock in a more proximal position on actuation.

2. Auto-injector (1) according to claim 1, characterized in that a carrier subassembly is arranged comprising a tubular carrier (7) slidably arranged relative to the chassis (2) inside the case (12), the carrier (7) adapted to contain the syringe (3) with the hollow injection needle (4), the drive spring (8) and the plunger (9), wherein the syringe (3) is lockable for joint axial translation with the carrier (7), wherein the trigger button (13) exhibits at least one proximal beam (13.1) arranged to be in a ramped engagement with the case (12) in a manner to inwardly deflect the proximal beam (13.1) and decouple it from the case (12) when the trigger button (13) is forced in the proximal direction (P) against the case (12), wherein in the initial position the proximal beam (13.1) inwardly abuts the carrier (7) so as to prevent inward deflection, wherein the carrier is initially coupled to the chassis (2) for joint axial translation by a detent mechanism (18), wherein the detent mechanism (18) is arranged to decouple the chassis (2) from the carrier (7) upon actuation of the trigger button (13) thus allowing the carrier (7) to move relative to the chassis (2), wherein a first window (7.11) in the carrier (7) is arranged so as to allow inward deflection of the proximal beam (13.1) when the case (12) is translated in the

proximal direction (P) from the initial position.

3. Auto-injector (1) according to claim 2, characterized in that the proximal beam (13.1) is arranged to engage in the first window (7.11) on actuation of the trigger button (13) abutting the carrier (7) so as to translate it in the proximal direction (P) relative to the chassis (2), wherein the case (12) is arranged to outwardly abut the proximal beam (13.1) engaged in the first window (7.11) preventing it from disengaging the carrier (7).

4. Auto-injector (1) according to one of the claims 2 or 3, characterized in that a control spring (19) is arranged around the carrier (7), wherein a needle insertion control mechanism (24) is provided for coupling a proximal end of the control spring (19) to either the carrier (7) for advancing it for needle insertion or to the chassis (2) for needle retraction depending on the relative axial position of the carrier (7) and the chassis (2), wherein a plunger release mechanism (27) is arranged for releasing the plunger (9) for injection when the carrier (7) has at least almost reached an injection depth during needle insertion, wherein the detent mechanism (18) when released is arranged to allow the carrier (7) to move relative to the chassis (2) so as to cause the needle insertion control mechanism (24) to switch the proximal end of the control spring (19) to the carrier (7) for needle insertion, wherein a syringe retraction control mechanism (25) is arranged for coupling a distal end of the control spring (19) to either the carrier (7) for needle retraction or to the case (12) otherwise.

5. Auto-injector (1) according to claim 4, characterized in that the needle insertion control mechanism (24) comprises a first collar (20) biased by the control spring in a proximal direction (P), wherein at least one resilient beam (20.1) is proximally arranged on the first collar (20), wherein respective recesses are arranged in the carrier (7) and case (2), wherein a transversal extension of a head of the resilient beam (20.1) is wider than a gap between the carrier (7) and the chassis (2) causing the head of the resilient beam (20.1) to abut a distal face on the recess in the chassis (2) while being prevented from deflecting in an inward direction (I) by the carrier (7) or to abut a distal face on the recess in the carrier (7) while being prevented from deflecting in an outward direction (O) by the chassis (2) thereby forwarding load from the control spring (19) to the carrier

(7) for needle insertion, wherein the resilient beam (20.1) is arranged to be switched between the chassis (2) and the carrier (7) by ramped engagement of the head to the distal faces under load of the control spring (19) depending on the relative longitudinal position between the chassis (2) and the carrier (7).

6. Auto-injector (1) according to one of the claims 4 or 5, characterized in that in the plunger release mechanism (27) the plunger (9) in an initial state is locked to the carrier (7) by a ramped engagement to the carrier (7) and by being prevented from rotating out of this ramped engagement depending on a relative longitudinal position of the carrier (7) in the case (12), wherein the plunger (9) is arranged to be released for rotating out of the ramped engagement upon the needle (4) reaching at least nearly a predefined injection depth on translation of the carrier (7) in the proximal direction (P) for advancing the needle (4) beyond a proximal end of the auto-injector (1).

7. Auto-injector (1) according to claim 6, characterized in that the carrier (7) has a longitudinal aperture (7.9), wherein an outward protrusion (9.1) is arranged on the plunger (9) in a manner to engage a face (7.8) on the carrier (7) in the aperture (7.9), wherein at least one of the outward protrusion (9.1) or the face (7.8) on the carrier (7) is ramped so as to force the plunger (9) to rotate when translated, wherein an inward longitudinal rib (21.5) connected to the case (12) inwardly protrudes into the longitudinal aperture (7.9) in a manner to prevent disengagement of the outward protrusion (9.1) from the face (7.8) on the carrier (7) prior to translation of the carrier (7) for advancing the needle (4) and wherein the outward protrusion (9.1) comes clear of the inward longitudinal rib (21.5) on translation of the carrier (7) for advancing the needle (4) so as to rotate past a proximal end of the inward longitudinal rib (21.5) due to its ramped engagement to the carrier (7) under load of the drive spring (8).

8. Auto-injector (1) according to claim 7, characterized in that the inward longitudinal rib (21.5) is arranged on a second collar (21) arranged in the case (12) and initially locked to the case (12) for joint axial translation, the second collar (21) being part of a syringe retraction control mechanism (25), wherein the syringe retraction control mechanism (25) is arranged to disengage from the case (12) and engage to the carrier (7) when the

case (12) is moved in the distal direction (D) from a position with the needle (4) in the injection depth, wherein a control spring (19) is arranged in the case (12) around the carrier (7), the control spring (19) acting between the second collar (21) and a proximal first collar (20) so as to bias the case (12) or the carrier (7) in the distal direction (D).

9. Auto-injector (1) according to one of the claims 2 to 8, characterized in that the detent mechanism (18) comprises a resilient beam (2.1) on the chassis (2) and a rhomboid ramp member (7.1) on the carrier (7), the resilient beam (2.1) being essentially straight when relaxed and having a first beam head (2.2) arranged to interact in a ramped engagement with a proximal fourth ramp (7.2) or a distal fifth ramp (7.3) on the rhomboid ramp member (7.1) in such a manner that application of a translative force on the carrier (7) relative to the chassis (2) in the proximal direction (P) with the first beam head (2.2) engaged to the fourth ramp (7.2) deflects the resilient beam (2.1) in one transversal direction (O, I) when a predetermined value of the translative force, at least depending on the resilience of the resilient beam (2.1), is overcome so as to allow the first beam head (2.2) to travel along one transversal side of the rhomboid ramp member (7.1) on continued relative translation of the components (2, 7), wherein the resilient beam (2.1) is allowed to relax when the first beam head (2.2) has reached the fifth ramp (7.3) thereby engaging it in a manner that application of a translative force on the carrier (7) in the distal direction (D) deflects the resilient beam (2.1) in the other transversal direction (I, O) when a predetermined value of the translative force, at least depending on the resilience of the resilient beam (2.1), is overcome so as to allow the first beam head (2.2) to travel along the other transversal side of the rhomboid ramp member (7.1) on continued translation of the carrier (7).

10. Auto-injector (1) according to one of the claims 2 to 9, characterized in that the case (12) is arranged to lock the detent mechanism (18) prior to being translated in the proximal direction (P) relative to the chassis (2) when the chassis (2) is being pressed against the injection site, wherein the case (12) when translated into an advanced position in the proximal direction (P) is arranged to unlock the detent mechanism (18) rendering it operable.

11. Auto-injector (1) according to one of the claims 4 to 10, characterized in that the syringe retraction control mechanism (25) comprises the second collar (21) bearing against the distal end of the control spring (19) and having a resilient proximal beam (21.1) with a second beam head (21.2) having an inward boss (21.3), wherein the second beam head (21.2) is arranged to be in a ramped engagement with a second case detent (12.2) in the case (12) in a manner ramping the second beam head (21.1) in the inward direction (I) under load of the control spring (19) in the distal direction (D), wherein the inward boss (21.3) is arranged to inwardly abut the carrier (7) for preventing inward deflection of the second beam head (21.1) and keep the second collar (21) locked to the case (12), wherein a third recess (7.7) is arranged in the carrier (7) for allowing the inward boss (21.3) to be inwardly deflected on translation of the case (12) in the distal direction (D) relative to the carrier (7) on removal of the auto-injector (1) from the injection site.

12. Auto-injector (1) according to one of the preceding claims, characterized in that a releasable noise component (28) is provided, capable of, upon release, generating an audible and/or tactile feedback to a user, wherein the noise component (28) is arranged to be released when the plunger (9) reaches a position relative to the syringe (3) in which the stopper (4) is located in proximity of a proximal end of the syringe (3), and wherein the released noise component (28) impacts on a housing component (12, 13) indicating the end of the injection.

13. Auto-injector (1) according to claim 12, characterized in that the housing component of the auto-injector (1) comprises at least part of the chassis (2), the case (12), the trigger button (13), the carrier (7) and/or the plunger (9).

14. Auto-injector (1) according to one of the claims 5 to 13, characterized in that a visual use indicator is provided, comprising at least one indicator window (32) in the case (12), wherein a part of the chassis (2) is arranged to be located behind the indicator window (32) when the case (12) is in its distal position biased by the control spring (19), wherein a tab (20.4) on the first collar (20) is located outwardly from the part of the chassis (2) after the first collar (20) has been translated in the proximal direction (P) during needle

insertion, wherein the tab (20.4) and the part of the chassis (2) exhibit a visually distinctive feature.

CLAIMS

1. Auto-injector (1) for administering a dose of a liquid medicament (M), comprising:

- an elongate case (12) arranged to be held by a user,

- a tubular chassis (2) telescopable in the case (12) and biased against the case (12) so as to protrude proximally from the case (12),

- a syringe (3) with a hollow injection needle (4), a drive spring (8) and a plunger (9) for forwarding load of the drive spring (8) to a stopper (6) of the syringe (3),

- a trigger button (13) distally arranged in or on the case (12),

wherein the trigger button (13) is initially coupled to the case (12) in a manner to protrude distally from the case (12) and interlocked to the chassis (2) in a manner preventing the trigger button (13) from disengaging the case (12) and thus preventing depression of the trigger button (13) in an initial position, wherein the case (12) is arranged to translate in the proximal direction (P) against the bias relative to the chassis (2) thereby also translating the trigger button (13) releasing the interlock to the chassis (2) so as to allow depression of the trigger button (13), wherein a carrier subassembly is arranged comprising a tubular carrier (7) slidably arranged relative to the chassis (2) inside the case (12), the carrier (7) adapted to contain the syringe (3) with the hollow injection needle (4), wherein the syringe (3) is lockable for joint axial translation with the carrier (7), **characterized in that** the carrier (7) is furthermore adapted to contain the drive spring (8) and the plunger (9), wherein the trigger button (13) exhibits at least one proximal beam (13.1) arranged to be in a ramped engagement with the case (12) in a manner to inwardly deflect the proximal beam (13.1) and decouple it from the case (12) when the trigger button (13) is forced in the proximal direction (P) against the case (12), wherein in the initial position the proximal beam (13.1) inwardly abuts the carrier (7) so as to prevent inward deflection, wherein the carrier is initially coupled to the chassis (2) for joint axial translation by a detent mechanism (18), wherein the detent mechanism (18) is arranged to decouple the chassis (2) from the carrier (7) upon depression of the trigger button (13) thus allowing the carrier (7) to move relative to the chassis (2), wherein a first window (7.11) in the carrier (7) is arranged so as to allow inward deflection of the proximal beam (13.1) when the case (12) is translated in the proximal direction (P) from the initial position, wherein the proximal beam (13.1) is arranged to engage in the first window (7.11) on depression of the trigger button (13) abutting the carrier (7) so as to translate it in the proximal direction (P) relative to the chassis (2),

wherein the case (12) is arranged to outwardly abut the proximal beam (13.1) engaged in the first window (7.11) preventing it from disengaging the carrier (7) such that the trigger button (13) locks in a more proximal position when depressed.

2. Auto-injector (1) according to claim 1, **characterized in that** a control spring (19) is arranged around the carrier (7), wherein a needle insertion control mechanism (24) is provided for coupling a proximal end of the control spring (19) to either the carrier (7) for advancing it for needle insertion or to the chassis (2) for needle retraction depending on the relative axial position of the carrier (7) and the chassis (2), wherein a plunger release mechanism (27) is arranged for releasing the plunger (9) for injection when the carrier (7) has at least almost reached an injection depth during needle insertion, wherein the detent mechanism (18) when released is arranged to allow the carrier (7) to move relative to the chassis (2) so as to cause the needle insertion control mechanism (24) to switch the proximal end of the control spring (19) to the carrier (7) for needle insertion, wherein a syringe retraction control mechanism (25) is arranged for coupling a distal end of the control spring (19) to either the carrier (7) for needle retraction or to the case (12) otherwise.

3. Auto-injector (1) according to claim 2, **characterized in that** the needle insertion control mechanism (24) comprises a first collar (20) biased by the control spring in a proximal direction (P), wherein at least one resilient beam (20.1) is proximally arranged on the first collar (20), wherein respective recesses are arranged in the carrier (7) and case (2), wherein a transversal extension of a head of the resilient beam (20.1) is wider than a gap between the carrier (7) and the chassis (2) causing the head of the resilient beam (20.1) to abut a distal face on the recess in the chassis (2) while being prevented from deflecting in an inward direction (I) by the carrier (7) or to abut a distal face on the recess in the carrier (7) while being prevented from deflecting in an outward direction (O) by the chassis (2) thereby forwarding load from the control spring (19) to the carrier (7) for needle insertion, wherein the resilient beam (20.1) is arranged to be switched between the chassis (2) and the carrier (7) by ramped engagement of the head to the distal faces under load of the control spring (19) depending on the relative longitudinal position between the chassis (2) and the carrier (7).

4. Auto-injector (1) according to one of the claims 2 or 3, **characterized in that** in the plunger release mechanism (27) the plunger (9) in an initial state is locked to the carrier (7) by a ramped engagement to the carrier (7) and by being prevented from rotating out of this ramped engagement depending on a relative longitudinal position of the carrier (7) in the case (12), wherein the plunger (9) is arranged to be released for rotating out of the ramped engagement upon the needle (4) reaching at least nearly a predefined

injection depth on translation of the carrier (7) in the proximal direction (P) for advancing the needle (4) beyond a proximal end of the auto-injector (1).

5. Auto-injector (1) according to claim 4, **characterized in that** the carrier (7) has a longitudinal aperture (7.9), wherein an outward protrusion (9.1) is arranged on the plunger (9) in a manner to engage a face (7.8) on the carrier (7) in the aperture (7.9), wherein at least one of the outward protrusion (9.1) or the face (7.8) on the carrier (7) is ramped so as to force the plunger (9) to rotate when translated, wherein an inward longitudinal rib (21.5) connected to the case (12) inwardly protrudes into the longitudinal aperture (7.9) in a manner to prevent disengagement of the outward protrusion (9.1) from the face (7.8) on the carrier (7) prior to translation of the carrier (7) for advancing the needle (4) and wherein the outward protrusion (9.1) comes clear of the inward longitudinal rib (21.5) on translation of the carrier (7) for advancing the needle (4) so as to rotate past a proximal end of the inward longitudinal rib (21.5) due to its ramped engagement to the carrier (7) under load of the drive spring (8).

6. Auto-injector (1) according to claim 5, **characterized in that** the inward longitudinal rib (21.5) is arranged on a second collar (21) arranged in the case (12) and initially locked to the case (12) for joint axial translation, the second collar (21) being part of a syringe retraction control mechanism (25), wherein the syringe retraction control mechanism (25) is arranged to disengage from the case (12) and engage to the carrier (7) when the case (12) is moved in the distal direction (D) from a position with the needle (4) in the injection depth, wherein a control spring (19) is arranged in the case (12) around the carrier (7), the control spring (19) acting between the second collar (21) and a proximal first collar (20) so as to bias the case (12) or the carrier (7) in the distal direction (D).

7. Auto-injector (1) according to one of the claims 1 to 6, **characterized in that** the detent mechanism (18) comprises a resilient beam (2.1) on the chassis (2) and a rhomboid ramp member (7.1) on the carrier (7), the resilient beam (2.1) being essentially straight when relaxed and having a first beam head (2.2) arranged to interact in a ramped engagement with a proximal fourth ramp (7.2) or a distal fifth ramp (7.3) on the rhomboid ramp member (7.1) in such a manner that application of a translative force on the carrier (7) relative to the chassis (2) in the proximal direction (P) with the first beam head (2.2) engaged to the fourth ramp (7.2) deflects the resilient beam (2.1) in one transversal direction (O, I) when a predetermined value of the translative force, at least depending on the resilience of the resilient beam (2.1), is overcome so as to allow the first beam head (2.2) to travel along one transversal side of the rhomboid ramp member (7.1) on continued relative translation of the components (2, 7), wherein the resilient beam (2.1) is allowed to relax when the first beam head (2.2) has reached the fifth ramp

(7.3) thereby engaging it in a manner that application of a translative force on the carrier (7) in the distal direction (D) deflects the resilient beam (2.1) in the other transversal direction (I, O) when a predetermined value of the translative force, at least depending on the resilience of the resilient beam (2.1), is overcome so as to allow the first beam head (2.2) to travel along the other transversal side of the rhomboid ramp member (7.1) on continued translation of the carrier (7).

8. Auto-injector (1) according to one of the claims 1 to 7, **characterized in that** the case (12) is arranged to lock the detent mechanism (18) prior to being translated in the proximal direction (P) relative to the chassis (2) when the chassis (2) is being pressed against the injection site, wherein the case (12) when translated into an advanced position in the proximal direction (P) is arranged to unlock the detent mechanism (18) rendering it operable.

9. Auto-injector (1) according to one of the claims 2 to 8, **characterized in that** the syringe retraction control mechanism (25) comprises the second collar (21) bearing against the distal end of the control spring (19) and having a resilient proximal beam (21.1) with a second beam head (21.2) having an inward boss (21.3), wherein the second beam head (21.2) is arranged to be in a ramped engagement with a second case detent (12.2) in the case (12) in a manner ramping the second beam head (21.1) in the inward direction (I) under load of the control spring (19) in the distal direction (D), wherein the inward boss (21.3) is arranged to inwardly abut the carrier (7) for preventing inward deflection of the second beam head (21.1) and keep the second collar (21) locked to the case (12), wherein a third recess (7.7) is arranged in the carrier (7) for allowing the inward boss (21.3) to be inwardly deflected on translation of the case (12) in the distal direction (D) relative to the carrier (7) on removal of the auto-injector (1) from the injection site.

10. Auto-injector (1) according to one of the preceding claims, **characterized in that** a releasable noise component (28) is provided, capable of, upon release, generating an audible and/or tactile feedback to a user, wherein the noise component (28) is arranged to be released when the plunger (9) reaches a position relative to the syringe (3) in which the stopper (4) is located in proximity of a proximal end of the syringe (3), and wherein the released noise component (28) impacts on a housing component (12, 13) indicating the end of the injection.

11. Auto-injector (1) according to claim 10, **characterized in that** the housing component of the auto-injector (1) comprises at least part of the chassis (2), the case (12), the trigger button (13), the carrier (7) and/or the plunger (9).

12. Auto-injector (1) according to one of the claims 3 to 11, **characterized in that** a visual use indicator is provided, comprising at least one indicator window (32) in the case (12), wherein a part of the chassis (2) is arranged to be located behind the indicator window (32) when the case (12) is in its distal position biased by the control spring (19), wherein a tab (20.4) on the first collar (20) is located outwardly from the part of the chassis (2) after the first collar (20) has been translated in the proximal direction (P) during needle insertion, wherein the tab (20.4) and the part of the chassis (2) exhibit a visually distinctive feature.