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) which is initially abutted against the case (12) thus preventing actuation,

   wherein the chassis (2) is arranged to translate into the case (12) against the bias, wherein the trigger button (13) is at least initially coupled to the chassis (2) in such a manner that the trigger button (13) emerges from the case (12) when the chassis (2) is being translated towards the case (12) for starting an injection cycle.

2. Auto-injector (1) according to claim 1, characterized in that the trigger button (13) is arranged distally in or on the case (12).

3. Auto-injector (1) according to claim 2, 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) is initially coupled to the chassis (2) through the carrier (7) by the trigger button (13) abutting the carrier (7) and the carrier being coupled to the chassis (2) by a detent mechanism (18), wherein the a detent mechanism (18) is arranged for coupling the chassis (2) to the carrier (7) for joint axial translation relative to the case (12), 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).

4. Auto-injector (1) according to claim 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 the plunger release mechanism (27) comprises at least one resilient arm (15) on the carrier (7) arranged to be in a ramped engagement to the plunger (9) so as to

disengage them under load of the drive spring (8), wherein a peg (14) protrudes from a distal end face of the trigger button (13) in the proximal direction (P) in a manner to support the resilient arm (15) preventing disengagement of the carrier (7) from the plunger (9) and thus release of the drive spring (8) when the carrier (7) is in a distal position, wherein the trigger button (13) is arranged to remain in position relative to the case (12) when the carrier (7) is translated for advancing the needle (4) so as to pull the resilient arm (15) away from the peg (14) thus allowing deflection of the resilient arm (15) due to the ramped engagement under load of the drive spring (8) for disengaging the plunger (9) from the carrier (7) and releasing the drive spring (8) for drug delivery when the carrier (7) has reached a predefined position during needle advancement.

7. Auto-injector (1) according to one of the claims 4 to 6, characterized in that the detent mechanism (18) is arranged to provide a resistive force which has to be overcome to advance the carrier (7) in the proximal direction (P) for needle insertion.

8. Auto-injector (1) according to one of the claims 4 to 7, characterized in that the detent mechanism (18) is arranged to provide a resistive force resisting translation of the carrier (7) in the distal direction (D) relative to the chassis (2) for keeping the carrier (7) in a defined position in a transitional state with both ends of the control spring (19) decoupled from the carrier (7).

9. Auto-injector (1) according to one of the claims 7 or 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 4 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 an 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 a 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 claims 4 to 11, 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 12, 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 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 proximally 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) which is initially abutted against the case (12) thus preventing actuation, wherein the chassis (2) is arranged to translate into the case (12) against the bias, **characterized in that** the trigger button (13) is at least initially coupled to the chassis (2) in such a manner that the trigger button (13) emerges from the case when the chassis (2) is being translated towards the case (12) for starting an injection cycle.

2. Auto-injector (1) according to claim 1, **characterized in that** the trigger button (13) is arranged distally in or on the case (12).

3. Auto-injector (1) according to claim 2, **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) is initially coupled to the chassis (2) through the carrier (7) by the trigger button (13) abutting the carrier (7) and the carrier (7) being coupled to the chassis (2) by a detent mechanism (18), wherein the a detent mechanism (18) is arranged for coupling the chassis (2) to the carrier (7) for joint axial translation relative to the case (12), 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).

4. Auto-injector (1) according to claim 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** the plunger release mechanism (27) comprises at least one resilient arm (15) on the carrier (7) arranged to be in a ramped engagement to the plunger (9) so as to disengage them under load of the drive spring (8), wherein a peg (14) protrudes from a distal end face of the trigger button (13) in the proximal direction (P) in a manner to support the resilient arm (15) preventing disengagement of the carrier (7) from the plunger (9) and thus release of the drive spring (8) when the carrier (7) is in a distal position, wherein the trigger button (13) is arranged to remain in position relative to the case (12) when the carrier (7) is translated for advancing the needle (4) so as to pull the resilient arm (15) away from the peg (14) thus allowing deflection of the resilient arm (15) due to the ramped engagement under load of the drive spring (8) for disengaging the plunger (9) from the carrier (7) and releasing the drive spring (8) for

drug delivery when the carrier (7) has reached a predefined position during needle advancement.

7. Auto-injector (1) according to one of the claims 4 to 6, **characterized in that** the detent mechanism (18) is arranged to provide a resistive force which has to be overcome to advance the carrier (7) in the proximal direction (P) for needle insertion.

8. Auto-injector (1) according to one of the claims 4 to 7, **characterized in that** the detent mechanism (18) is arranged to provide a resistive force resisting translation of the carrier (7) in the distal direction (D) relative to the chassis (2) for keeping the carrier (7) in a defined position in a transitional state with both ends of the control spring (19) decoupled from the carrier (7).

9. Auto-injector (1) according to one of the claims 7 or 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 4 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 an 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 a 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 claims 4 to 11, **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 12, **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 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.