

SYSTEM AND METHOD FOR NEEDLE HIDING IN INJECTORS

REFERENCE TO RELATED APPLICATIONS

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Reference is hereby made to U.S. Patent Application 14/423,834, filed September 3, 2013, which has published as US20150202367 and entitled "ELECTRONIC AUTO-INJECTION DEVICE", the disclosure of which is incorporated by reference in its entirety.

Reference is hereby additionally made to U.S. Provisional Patent Application
10 62/345,897, filed June 6, 2016 and entitled "Electronic auto-injection device for drugs in cartridges", the disclosure of which is incorporated by reference in its entirety.

Reference is hereby made to a PCT Patent Application PCT/IL2017/050607, filed June 1, 2017, which has published as WO2017212473 and entitled "Multiple use computerized injector", the disclosure of which is incorporated by reference in its entirety.

15 Reference is hereby additionally made to U.S. Provisional Patent Application 62/977,746, filed February 18, 2020 and entitled "Multiple use computerized injector", the disclosure of which is incorporated by reference in its entirety.

Reference is hereby additionally made to U.S. Provisional Patent Application
20 63/052,562, filed July 16, 2020 and entitled "SYSTEM AND METHOD FOR INFORMATION MANAGEMENT IN COMPUTERIZED INJECTORS", the disclosure of which is incorporated by reference in its entirety.

FIELD OF THE INVENTION

25 The present invention generally relates to a needle hiding feature in an injector, and more specifically to a needle hiding feature forming part of an injector, in particular a reusable, computerized injector, adapted for administration of medication to a patient.

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BACKGROUND OF THE INVENTION

Many injectors, in particular reusable injectors and more particularly computerized injectors adapted for administration of medication to a patient are known. It is known that many users have a needle-phobia. Thus, it is advantageous to hide the needle at all times during the manipulation of the injector.

The invention relates more particularly to an injector comprising a housing arranged along a longitudinal axis and configured to receive a medicament cartridge; an injection drive mechanism for driving a piston, the piston forming part of the medicament cartridge, the injection drive mechanism injecting a medicament when the piston is forwardly displaced; and a needle hiding element, which is slidably attached to the housing.

In reusable injectors of this type, the user typically needs to attach a needle at the distal end of the injector before proceeding to the injection and also detach the needle after use. This operation is rendered rather difficult due to the presence of the needle hiding element as the user needs to retract the needle hiding element and maintain it in a retracted position against the action of a biasing spring, while attaching the needle. Similar handling is required to detach the needle.

An object of the invention is to facilitate the operations of attaching and detaching the needle.

SUMMARY OF THE INVENTION

The present invention seeks to provide an injector with a needle hiding element, that is easy to handle for attaching or detaching a needle.

There is thus provided in accordance with an embodiment of the present invention an injector, comprising a housing arranged along a longitudinal axis and configured to receive a medicament cartridge; an injection drive mechanism for driving a piston, the piston forming part of the medicament cartridge, the injection drive mechanism injecting a medicament when the piston is forwardly displaced; and a needle hiding element, which is slidably attached to the housing and positionable in at least one of an extended orientation and a retracted orientation, wherein in the extended orientation the needle hiding element protrudes forwardly from the housing and in the retracted orientation, the needle hiding element is locked relative to the housing.

The user can thus selectively place the needle hiding element, by manually acting thereon, either in a retracted stable position, such that a needle can be easily attached or detached, or in fully extended position, such that the device is ready for use when a needle is attached.

Preferably, in the extended orientation the needle hiding element is slidable relative to the housing and in the retracted orientation the needle hiding element does not protrude forwardly from the housing or protrudes to a lesser extent than in the extended orientation.

Further preferably, the needle hiding element is also positionable in a partially retracted orientation, in which the needle hiding element protrudes forwardly from the housing to a greater extent than in the retracted orientation and is slidably moveable relative to the housing.

Still further preferably, the needle hiding element is biased to be displaced forwardly under the urge of at least one biasing element, which is supported between the housing and the needle hiding element.

According to a preferred embodiment, the needle hiding element includes at least a flexible arm, extending axially and comprising a snap-fit locking feature that can be engaged in a corresponding feature provided on the housing and a radially protruding button that can be handled by a user for deflecting the arm and axially moving the needle hiding element, whereby the user can position the needle hiding element in one of said extended and retracted orientations.

Preferably, the snap-fit locking feature of the flexible arm and the corresponding feature of the housing are designed to provide the locked retracted orientation of the needle hiding element, that can be unlocked by the user by pressing on the button whereby the locking feature of the arm is disengaged from the corresponding feature of the housing.

Still further preferably, the needle hiding element includes a pair of opposing flexible arms, each provided with a snap-fit locking feature and a button, whereby the locked retracted orientation of the needle hiding element can be unlocked by the user by simultaneously pressing on the buttons for simultaneous deflection of the arms.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully from the following detailed description, taken in conjunction with the drawings in which:

Fig. 1 is a simplified pictorial illustration of an injector constructed and operative in accordance with an embodiment of the present invention and shown in a closed operative orientation;

Figs. 2A and 2B are simplified respective pictorial and side planar view illustrations of the injector of Fig. 1 shown in an open operative orientation;

Fig. 3 is a simplified exploded view illustration of the injector of Figs. 1 - 2B;

Figs. 4A, 4B, 4C and 4D are simplified respective pictorial, rear planar view, side planar view and front planar view of a top housing portion of the injector of Figs. 1 - 3;

Figs. 5A, 5B and 5C are simplified respective pictorial, rear planar view and side planar view of a bottom housing portion of the injector of Figs. 1 - 3;

Figs. 6A, 6B, 6C, 6D, 6E, 6F and 6G are simplified respective two pictorials views taken from different perspectives, two side planar views, top planar view, bottom planar view and a section view of a needle hiding element of the injector of Figs. 1 – 3, section view being taken along lines G – G in Fig. 6F;

5 Fig. 7 is a simplified pictorial partially cut-out illustration, showing a portion of the needle hiding element of Figs. 6A – 6G as part of the assembled injector of Figs. 1 – 3;

Figs. 8A and 8B are simplified respective pictorial and section view illustrations of the injector of Figs. 1 – 3 operated by a user, in a needle attachment operative orientation, section view being taken along lines B – B in Fig. 8A;

10 Figs. 9A, 9B and 9C are simplified respective pictorial and two section view illustrations of the injector of Figs. 1 – 3 operated by a user, in a needle attached operative orientation, section views being taken along lines B – B and C – C respectively in Fig. 9A;

Figs. 10A, 10B and 10C are simplified respective pictorial and two section view illustrations of the injector of Figs. 1 – 3 operated by a user, in a needle exposure operative orientation, section views being taken along lines B – B and C – C respectively in Fig. 10A;

15 Figs. 11A and 11B are simplified respective pictorial and section view illustrations of the injector of Figs. 1 – 3 operated by a user, in a needle hiding operative orientation, section view being taken along lines B – B in Fig. 11A;

Figs. 12A and 12B are simplified respective pictorial and section view illustrations of the injector of Figs. 1 – 3 operated by a user, in an injection operative orientation, section view being taken along lines B – B in Fig. 12A;

Figs. 13A and 13B are simplified respective pictorial and section view illustrations of the injector of Figs. 1 – 3 operated by a user, in a needle cover attachment operative orientation, section view being taken along lines B – B in Fig. 13A;

25 Figs. 14A and 14B are simplified respective pictorial and section view illustrations of the injector of Figs. 1 – 3 operated by a user, in a needle cover attached operative orientation, section view being taken along lines B – B in Fig. 14A.

30 DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

An injector according to the invention and illustrated on the Figures comprises a housing arranged along a longitudinal axis and configured to receive a medicament cartridge; an injection drive mechanism for driving a piston, forming part of the medicament cartridge, for
35 injecting a medicament. The injector also comprises a needle hiding element, forming part of the injector. The needle hiding element is biased to an extended orientation, in which the needle is covered, and being selectively lockable in a retracted orientation, in which the needle is

exposed. It is noted that the drive mechanism can be either one of manual, mechanical or electrical and the injector preferably includes a computer-controlled motor.

In the present description, the term "orientation" relating to the needle hiding element, for example in the expressions "[retracted or extended] orientation" or "operative orientation", shall
5 be understood as referring to the axial position of the needle hiding element.

Reference is now made to Fig. 1, which is a simplified pictorial illustration of an injector constructed and operative in accordance with an embodiment of the present invention and shown in a closed operative orientation and to Figs. 2A and 2B, which are simplified respective pictorial and side planar view illustrations of the injector of Fig. 1 shown in an open operative
10 orientation. Reference is additionally made to Fig. 3, which is a simplified exploded view illustration of the injector 100 of Figs. 1 - 2B.

An injector for cartridge insertion 100 is seen in Figs. 1 – 3. The injector 100 is shown in a closed operative orientation in Fig. 1 and in an open operative orientation in Figs. 2A and 2B, just prior to insertion of a medicament cartridge 102 thereinto.

15 It is seen in Figs. 1 – 3 that the injector 100 includes a housing comprising a top housing portion 106 and a bottom housing portion 104, fixedly coupled thereto, both arranged along a mutual longitudinal axis 107. A display 108 is preferably disposed within the injector 100 formed in the top housing portion 106.

It is also seen particularly in Figs. 2A - 3 that a cartridge enclosure assembly 130 is
20 mounted through an opening 132 formed in top housing portion 106 and is configured to be pivotably mounted with respect to top housing portion 106.

It is a particular feature of an embodiment of the present invention that a selectively lockable needle hiding element 140 is mounted to the forward (or distal) end of the injector 100 and is at least partially inserted into the enclosure volume formed between the top housing
25 portion 106 and the bottom housing portion 104. It is noted that the needle hiding element 140 is slidably moveable with respect to the housing portions 104 and 106 and is selectively lockable in a rearward (or proximal) position in some of the operative orientations as described in detail hereinbelow.

It is particularly seen in Fig. 3 that a chassis assembly 150 is residing within the
30 enclosure formed between the top housing portion 106 and the bottom housing portion 104. The chassis assembly 150 is configured to support the internal components of the injector 100. A drive assembly 160 is preferably supported on the chassis assembly 150. The drive assembly preferably includes an electrical motor 162, powered by a battery 164 and configured for axially displacing a plunger rod 170 along the longitudinal axis 107.

35 It is seen in Fig. 3 that the cartridge enclosure assembly 130 is residing between the housing portions 104 and 106. The cartridge enclosure assembly 130 is adapted to receive the medicament cartridge 102 therewithin and is generally pivotably mounted with respect to the housing portions 104 and 106. The cartridge enclosure assembly 130 is configured to be biased

to an open operative orientation with respect to housing portions 104 and 106. The cartridge enclosure assembly 130 includes a forward generally externally threaded end 172, adapted for engagement of a needle assembly therewith.

It is noted that a piston 174 is disposed within the medicament cartridge 102 and
5 confines a medicament within the medicament cartridge 102. The plunger rod 170 is configured to displace the piston 174 within the medicament cartridge 102 following receipt of a suitable signal from the CPU of the injector 100 to effect ejection of medication therefrom.

It is seen in Fig. 3 that a piston contact element 176 is mounted onto the forward end of
10 plunger rod 170 and is configured to engage the piston 174 in certain operative orientations of the injector 100, as described in detail hereinbelow.

The medicament cartridge 102 has a generally cylindrical barrel 178 with a forward end including a resilient septum 180. A medicament is contained within the cylindrical barrel 178 and is sealed therewithin by piston 174. The cylindrical barrel 102 is arranged along the longitudinal axis 107.

15 It is noted that any type of medicament container may be employed as part of an embodiment of the present invention, such as for example, pre-filled cartridges containing a liquid medication, dual-chamber cartridges containing a powder drug preparation and a solvent or any other suitable medicament cartridge 102.

It is further noted that the particular spatial relationships between the various
20 components of the injector 100 are preferably similar to the spatial relationships as described in PCT patent application PCT/IL2017/050607, which is incorporated by reference herein in its entirety.

It is a particular feature of an embodiment of the present invention that the needle hiding element 140 is biased forwardly under the urge of springs 190, which are supported between
25 the needle hiding element 140 and the housing portions 104 and 106.

Reference is now made to Figs. 4A, 4B, 4C and 4D, which are simplified respective pictorial, rear planar view, side planar view and front planar view of the top housing portion 106 of the injector 100 of Figs. 1 – 3.

The top housing portion 106 is an integrally formed element arranged along longitudinal axis 107 and having display portion 108 and opening 132 for mounting of the cartridge enclosure assembly 130 therethrough. The top housing portion 106 has a forward end 200 and a rearward end 202. An opening 203 is formed at the forward end 200.
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It is seen specifically in Fig. 4B that a flange 204 is disposed adjacent the forward end 200, the flange 204 generally extends transversely to the longitudinal axis 107. A generally
35 cylindrical hollow longitudinal protrusion 206, which serves as a spring enclosure, extends rearwardly from the flange 204 and has a closed rearward end 208, serving as a spring stop.

Reference is now made to Figs. 5A, 5B and 5C, which are simplified respective pictorial, rear planar view and side planar view of the bottom housing portion 104 of the injector 100 of Figs. 1 – 3.

The bottom housing portion 104 is an integrally formed element arranged along longitudinal axis 107 and having a forward end 220 and a rearward end 222. An opening 223 is formed at the forward end 220.

It is seen specifically in Figs. 5A and 5B that a flange 224 is disposed adjacent the forward end 220, the flange 224 generally extends transversely to the longitudinal axis 107. A generally cylindrical hollow longitudinal protrusion 226, which serves as a spring enclosure, extends rearwardly from the flange 224 and has a closed rearward end 228, serving as a spring stop. The flange 224 also includes a cut-out 230 for insertion of a portion of the cartridge enclosure assembly 130 therethrough.

The bottom housing portion 104 defines a generally concave back wall 240 joined with two side walls 242 on two opposite sides thereof.

It is seen in Figs. 5A and 5C that typically two longitudinal cut-outs 250 are formed on the side walls 242 of the bottom housing portion 104, the cut-outs 250 generally disposed adjacent the forward end 220 thereof. Typically, a relatively small snap cut-out 252 is formed adjacent each one of the cut-outs 250 and is slightly rearwardly spaced therefrom.

It is noted that alternatively, a single cut-out, equivalent to cut-out 250 may be formed on the back wall 240 of the bottom housing portion 104 and a relatively small snap cut-out, equivalent to snap cut-out 252 may be formed rearwardly thereof on the back wall 240. Further alternatively, any other number of such cut-outs may be formed at any other location on the bottom housing portion 104.

Reference is now made to Figs. 6A, 6B, 6C, 6D, 6E, 6F and 6G, which are simplified respective two pictorial views taken from different perspectives, two side planar views, top planar view, bottom planar view and a section view of the needle hiding element 140 of the injector 100 of Figs. 1 – 3, section view being taken along lines G – G in Fig. 6F.

The needle hiding element 140 is an integrally formed element arranged along longitudinal axis 107. The needle hiding element 140 has a base wall portion 260 defining a rearwardly facing surface 262 and a forwardly facing surface 264. The base wall portion 260 also has a substantially cylindrical section, axially extending between the rearwardly and forwardly facing surfaces 262, 264, and is designed to at least partially enclose a needle attached to the cartridge 102, in particular to hide and prevent access to the tip of the needle. An opening 266 is formed through the base wall portion 260. The opening 266 has a cylindrical portion 268 extending forwardly from the rearwardly facing surface 262 and a forwardly tapered conical portion 270 extending forwardly of the cylindrical portion 268 and up to the forwardly facing surface 264. A forwardly facing shoulder 272 is formed between the cylindrical portion 268 and the conical portion 270.

Typically, two guiding pins 276 extend rearwardly from the rearwardly facing surface 262 and are disposed generally diagonally with respect to each other.

Typically, two mounting arms 280 mutually facing each other, extend axially and rearwardly from the base wall portion 260 and define an inwardly facing surface 282 and an outwardly facing surface 284. A button 290 is formed on the outwardly facing surface 284 of each of the mounting arms 280 and a snap protrusion 292 is also formed on the outwardly facing surface 284 and is slightly rearwardly spaced from button 290. The buttons 290 preferably define an outer surface with an array of small protrusions or a like to assist with gripping by the user. The axially extending arms 280 are spaced from the axis 107 and provided at opposing locations with respect to the axis. Each one of the opposing arms 280 is flexible and can be resiliently deflected by exerting a radial pressure thereon. Each snap protrusion 292 defines a snap-fit locking feature that can be engaged in a corresponding feature, the snap cut-out 252, provided on the housing. Each button 290 is radially protruding and can be handled by a user for deflecting the arm 280 and for axially moving the needle hiding element 140 with respect to the housing 104, 106, whereby the user can position the needle hiding element 140 in an extended or in a retracted position with respect to the housing.

It is noted that alternatively a single mounting arm or any other number of mounting arms may be formed as part of the needle hiding element 140, all according to an embodiment of the present invention.

Reference is now made to Fig. 7, which is a simplified pictorial partially cut-out illustration, showing a portion of the needle hiding element 140 of Figs. 6A – 6G as part of the assembled injector 100 of Figs. 1 – 3.

The assembled injector 100 is seen in Fig. 7. It is particularly seen that the needle hiding element 140 is partially inserted into the enclosure formed by the upper housing portion 106 and the bottom housing portion 104, through their respective openings 203 and 223.

The guiding pins 276 of the needle hiding element 140 are axially aligned with protrusion 206 of the upper housing portion 106 and protrusion 226 of the bottom housing portion 104. One of the biasing springs 190 is mounted onto one of the guiding pins 276 and is supported against the closed end 208 of protrusion 206 of the upper housing portion 106. The other biasing spring 190 is mounted onto another one of the guiding pins 276 and is supported against the closed end 228 of protrusion 226 of the bottom housing portion 104.

It is noted that alternatively, any other number of biasing springs 190 supported in any other suitable manner may be employed in accordance with an embodiment of the present invention.

It is noted that the forward portion of the injector is cut-out in two different plane to clarify the position of both biasing springs 190, since the springs 190 are disposed diagonally with respect to each other and thus lay in two different planes.

The springs 190 are configured to bias the needle housing element 140 forwardly along longitudinal axis 107, relative to the housing portions 104 and 106.

It is seen in Fig. 7 that the springs 190 are in a non-stressed orientation (i.e. non-stressed or non-compressed state), biasing the needle hiding element 140 fully forwardly.

5 Reference is now made to Figs. 8A and 8B, which are simplified respective pictorial and section view illustrations of the injector 100 of Figs. 1 – 3 operated by a user, in a needle attachment operative orientation, section view being taken along lines B – B in Fig. 8A.

The injector 100 is seen in storage in Figs. 8A and 8B, prior to attachment of a needle assembly 300 to the externally threaded end 172 of the cartridge enclosure assembly 130.

10 It is seen in Figs. 8A and 8B that the needle hiding element 140 is partially inserted into the forward end of the housing portions 104 and 106 of the injector 100 and is biased forwardly along longitudinal axis 107 under the urge of biasing springs 190, as specifically described with reference to Fig. 7.

It is a particular feature of an embodiment of the present invention that the needle hiding
15 element 140 is non-releasably slidably mounted onto the housing portions 104 and 106 and is slidably displaceable with respect thereto. Particularly, buttons 290 and the snap protrusions 292 of the needle hiding element 140 are seated within cut-outs 250 of the bottom housing portion 104 in the storage operative orientation, before the attachment of the needle assembly 300 to the injector 100.

20 It is particularly seen in Fig. 8B that buttons 290 of the needle hiding element 140 are supported against the forward ends of cut-outs 250 of the bottom housing portion 104, and thus the needle hiding element 140 is restrained from forward displacement along longitudinal axis 107 relative to the housing portions 104 and 106 and removal therefrom.

It is seen that in this storage operative orientation, the biasing springs 190 are disposed
25 in their non-stressed operative orientation, thus biasing the needle hiding element 140 to its forward position, in which the needle hiding element 140 extends forwardly from the forward end 200 and 220 of the upper and bottom housing portions respectively, such that the forwardly facing surface 264 of the needle hiding element 140 is forwardly spaced from the forward ends 200 and 220.

30 It is particularly seen that the buttons 290 of the needle hiding element 140 are disposed at the forward end of the cut-outs 250 of the bottom housing portion 104 and the snap protrusions 292 are forwardly spaced from the snap cut-outs 252 in the bottom housing portion 104.

It is also seen in Fig. 8B that the medicament is confined within the medicament
35 cartridge 102 by means of the piston 174 and the piston contact element 176 of the plunger rod 170 engages the piston 174. The drive assembly 160 that drives the plunger rod 170 along the longitudinal axis 107 is preferably similar in all respects to the one described in PCT patent application PCT/IL2017/050607, which is incorporated by reference herein in its entirety.

Reference is now made to Figs. 9A, 9B and 9C, which are simplified respective pictorial and two section view illustrations of the injector 100 of Figs. 1 – 3 operated by a user, in a needle attached operative orientation, section views being taken along lines B – B and C – C respectively in Fig. 9A.

5 The injector 100 is seen in needle attached operative orientation in Figs. 9A – 9C, following attachment of the needle assembly 300 to the externally threaded end 172 of the cartridge enclosure assembly 130. It is seen particularly in Fig. 9B that the needle assembly 300 preferably includes a needle 302, attached to a needle hub having an internal threading, that is adapted to be threaded onto the externally threaded end 172 of the cartridge enclosure
10 assembly 130. Preferably, an internal needle cap 304 is mounted onto the needle 302 and an outer needle cap 306 is mounted over the internal needle cap 304 and over the needle hub. The outer needle cap 306 includes a circumferential rear end 308.

It is seen particularly in Fig. 9B that upon attachment of the needle assembly 300 to the injector 100, the needle 302 with the needle hub is threadably attached to the externally
15 threaded end 172 of the cartridge enclosure assembly 130, thereby engaging the circumferential rear end 308 of the outer needle cap 306 with the forwardly facing shoulder 272 of the needle hiding element 140. Engagement of the outer needle cap 306 with the needle hiding element 140 causes rearward slidable displacement of the needle hiding element 140 relative to the housing portions 104 and 106 against the urge of the biasing springs 190.

20 It is seen in Figs. 9A – 9C that the needle hiding element 140 is now disposed within the enclosure formed by the housing portions 104 and 106, such that the forwardly facing surface 264 of the needle hiding element 140 is rearwardly spaced from the forward ends 200 and 220 of housing portions 106 and 104 respectively.

It is a particular feature of an embodiment of the present invention that the needle 302 in
25 this needle attached operative orientation is covered by the internal needle cap 304 and the outer needle cap 306 and the needle hiding element 140 is disposed in a retracted locked orientation, which is the rearwardmost position of the needle hiding element 140. It is specifically seen in Fig. 9B that in this retracted locked orientation of the needle hiding element 140, the snap protrusions 252 are rearwardly displaced relative to the housing portions 104 and
30 106 and are now inserted into snap cut-outs 292 of the bottom housing portion 104 and the buttons 290 are positioned adjacent the rearward ends of the cut-outs 250. The needle hiding element 140 is temporarily locked in its retracted position and is restrained from forward longitudinal displacement along longitudinal axis 107 by means of engagement between snap protrusions 292 with snap cut-outs 252. The locking of the snap protrusions 292 with snap cut-
35 outs 252 is enabled due to temporary inward deflection of the mounting arms 280 of the needle hiding element 140.

It is also seen particularly in Fig. 9C that the biasing springs 190 are now disposed in a compressed operative orientation, but are prevented from displacing the needle hiding element

140 forwardly due to the locking engagement of the snap protrusions 292 with the snap cut-outs 252.

It is particularly seen in Fig. 9B that buttons 290 of the needle hiding element 140 are rearwardly spaced from the forward end of cut-outs 250 of the bottom housing portion 104.

5 It is also seen in Fig. 9B that the medicament is confined within the medicament cartridge 102 by means of the piston 174 and the piston contact element 176 of the plunger rod 170 engages the piston 174. The drive assembly 160 that drives the plunger rod 170 along the longitudinal axis 107 is preferably similar in all respects to the one described in PCT patent application PCT/IL2017/050607, which is incorporated by reference herein in its entirety.

10 It is also seen in Fig. 9B that the needle 302 now penetrates the septum 180 of the medicament cartridge 102 and thus is disposed in fluid communication with the medicament confined within the medicament cartridge 102.

It will be appreciated that, during the operation of attaching the needle, the temporary locking of the needle hiding element 140 in the retracted position, caused by the engagement of the snap protrusions 292 with the corresponding snap cut-outs 252, facilitates the completion of the operation as the user does not need to maintain the needle hiding element against the biasing force of the springs 190. While the operation of attaching the needle that has been described involves a step of pushing the needle hiding element 140 backwards with the outer needle cap 306, the user may alternatively act on the buttons 290 to manually move the needle
15 hiding element 140 to the locked retracted position prior to engaging the needle assembly 300.

Reference is now made to Figs. 10A, 10B and 10C, which are simplified respective pictorial and two section view illustrations of the injector 100 of Figs. 1 – 3 operated by a user, in a needle exposure operative orientation, section views being taken along lines B – B and C – C respectively in Fig. 10A.

25 The injector 100 is seen in needle exposure operative orientation in Figs. 10A – 10C, following removal of the outer needle cap 306 along with the internal needle cap 304 from needle 302.

It is seen particularly in Fig. 9B that the needle 302 with the needle hub remain threadably attached to the externally threaded end 172 of the cartridge enclosure assembly
30 130.

It is seen in Figs. 10A – 10C that the needle hiding element 140 remains disposed within the enclosure formed by the housing portions 104 and 106, such that the forwardly facing surface 264 of the needle hiding element 140 is rearwardly spaced from the forward ends 200 and 220 of housing portions 106 and 104 respectively.

35 In this needle exposure operative orientation, the needle 302 is exposed and the needle hiding element 140 is disposed in a retracted locked orientation, which is the rearwardmost position of the needle hiding element 140. It is specifically seen in Fig. 10B that in this retracted locked orientation of the needle hiding element 140, the snap protrusions 252 remain inserted

into snap cut-outs 292 of the bottom housing portion 104 and the buttons 290 are positioned adjacent the rearward ends of the cut-outs 250. The needle hiding element 140 is temporarily locked in its retracted position and is restrained from forward longitudinal displacement along longitudinal axis 107 by means of engagement between snap protrusions 292 with snap cut-outs 252.

It is also seen particularly in Fig. 10C that the biasing springs 190 remain disposed in a compressed operative orientation, but are prevented from displacing the needle hiding element 140 forwardly due to the locking engagement of the snap protrusions 292 with the snap cut-outs 252.

It is particularly seen in Fig. 10B that buttons 290 of the needle hiding element 140 remain rearwardly spaced from the forward ends of cut-outs 250 of the bottom housing portion 104.

It is also seen in Fig. 10B that the medicament is confined within the medicament cartridge 102 by means of the piston 174 and the piston contact element 176 of the plunger rod 170 engages the piston 174. The needle 302 penetrates the septum 180 of the medicament cartridge 102 and thus is disposed in fluid communication with the medicament confined within the medicament cartridge 102.

Reference is now made to Figs. 11A and 11B, which are simplified respective pictorial and section view illustrations of the injector 100 of Figs. 1 – 3 operated by a user, in a needle hiding operative orientation, section view being taken along lines B – B in Fig. 11A.

The injector 100 is seen in needle hiding operative orientation in Figs. 11A & 11B, following pressing the buttons 290 of the needle hiding element 140 by the user, and thus unlocking the needle hiding element 140 from the housing portions 104 and 106 and causing forward longitudinal displacement of the needle hiding element 140 relative to the housing portions 104 and 106 under the biasing force of springs 190. The snap protrusions 292 of the flexible arms 280 and the corresponding features of the housing 104, 106, namely the snap cut-outs 252, are thus designed to provide the locked retracted orientation of the needle hiding element 140. That locked position can be unlocked by the user by simultaneously pressing on the buttons 290, whereby the snap protrusions 292 are disengaged from the corresponding snap cut-outs 252.

It is seen in Figs. 11A & 11B that upon inwardly pressing the buttons 290 by the user, the needle hiding element 140 is unlocked from the housing portions 104 and 106 by temporarily inwardly deflecting mounting arms 280 of the needle hiding element 140, causing snap protrusions 252 of the needle hiding element 140 to be released from snap cut-outs 252 of the bottom housing portion 104, thus in turn causing forward axial slidable displacement of the needle hiding element 140 relative to the housing portions 104 and 106 under the urge of biasing springs 190.

It is particularly seen in Figs. 11A & 11B that the buttons 290 of the needle hiding element 140 are supported against the forward ends of the cut-outs 250 of the bottom housing portion 104, and thus the needle hiding element 140 is restrained from further forward displacement along longitudinal axis 107 relative to the housing portions 104 and 106 and removal therefrom.

It is seen that in this needle hiding operative orientation that the biasing springs 190 are disposed in their non-stressed operative orientation, thus biasing the needle hiding element 140 to an extended position, which is the forwardmost position of the needle hiding element 140, in which the needle hiding element 140 extends forwardly from the forward end 200 and 220 of the upper and bottom housing portions respectively, such that the forwardly facing surface 264 of the needle hiding element 140 is forwardly spaced from the forward ends 200 and 220 and the needle 302 is hidden within the opening 266 of the needle hiding element 140 and thus hidden from view of the user.

It is particularly seen that the buttons 290 of the needle hiding element 140 are disposed at the forward end of the cut-outs 250 of the bottom housing portion 104 and the snap protrusions 292 are forwardly spaced from the snap cut-outs 252 in the bottom housing portion 104 in this needle hiding operative orientation.

It is also seen in Fig. 11B that the medicament is confined within the medicament cartridge 102 by means of the piston 174 and the piston contact element 176 of the plunger rod 170 engages the piston 174. The drive assembly 160 that drives the plunger rod 170 along the longitudinal axis 107 is preferably similar in all respects to the one described in PCT patent application PCT/IL2017/050607, which is incorporated by reference herein in its entirety.

It is also seen in Fig. 11B that the needle 302 penetrates the septum 180 of the medicament cartridge 102 and thus remains disposed in fluid communication with the medicament confined within the medicament cartridge 102.

Reference is now made to Figs. 12A and 12B, which are simplified respective pictorial and section view illustrations of the injector 100 of Figs. 1 – 3 operated by a user, in an injection operative orientation, section view being taken along lines B – B in Fig. 12A.

The injector 100 is seen in injection operative orientation in Figs. 12A & 12B, following pressing of the injector 100 against an injection site on the skin of the user. Upon pressing the injector 100 against the injection site, the forwardly facing surface 264 of the needle hiding element 140 engages the skin and as the user proceeds pushing the injector 100 axially forwardly against the skin, the needle hiding element 140 is slidably rearwardly displaced against the urge of the biasing springs 190.

It is a particular feature of an embodiment of the present invention that in this injection operative orientation, the needle hiding element 140 is rearwardly displaced until the forwardly facing surface 264 thereof is generally aligned with the forward ends 200 and 220 of the housing portions 106 and 104 respectively. In this injection operative orientation, the needle

hiding element 140 is disposed in a partially retracted orientation, in which the needle hiding element 140 is positioned in an intermediate position, which is disposed forwardly of its retracted position and rearwardly of its extended position.

It is a further particular feature of an embodiment of the present invention that the needle
5 hiding element 140 is not locked in this partially retracted orientation and thus enabled to be slidably biased forwardly relative to the housing portions 104 and 106 upon removal of pressure that is applied thereon by the user.

It is seen in Figs. 12A & 12B that the buttons 290 of the needle hiding element 140 in its partially retracted orientation are slightly spaced from the forward ends of the cut-outs 250 of
10 the bottom housing portion 104, but they are rearwardly spaced to a lesser extent in comparison to Fig. 10B. The snap protrusions 292 are disposed within cut-outs 250 and are forwardly spaced from snap cut-outs 252 of the bottom housing portion 104, thus the needle hiding element 140 is not locked with respect to the housing portions 104 and 106.

It is seen in this injection operative orientation that the biasing springs 190 are disposed
15 in their partially-compressed operative orientation. The needle 302 in this injection operative orientation extends forwardly from the needle hiding element 140 and the housing portions 104 and 106, thus penetrates the skin of the user.

It is also seen in Fig. 12B that the medicament is ejected from the medicament cartridge 102 via needle 302 by means of the drive assembly 160, which advances the plunger rod 170
20 axially forwardly and effects displacement of the piston 174 relative to the medicament cartridge 102. The drive assembly 160 that drives the plunger rod 170 along the longitudinal axis 107 is preferably similar in all respects to the one described in PCT patent application PCT/IL2017/050607, which is incorporated by reference herein in its entirety.

Reference is now made to Figs. 13A and 13B, which are simplified respective pictorial
25 and section view illustrations of the injector 100 of Figs. 1 – 3 operated by a user, in a needle cover attachment operative orientation, section view being taken along lines B – B in Fig. 13A.

The injector 100 is seen just prior to attachment of the outer needle cap 306 to the needle 302 in Figs. 13A & 13B, following release of the injector 100 from the skin of the user.

Upon release of the injector 100 from the skin, the needle hiding element 140 is biased to be
30 displaced forwardly relative to the housing portions 104 and 106 to its extended orientation under the urge of biasing springs 190.

It is particularly seen in Figs. 13A & 13B that upon release of the injector 100 from the skin, the needle hiding element 140 is disposed in the same orientation as described with reference to Figs. 11A & 11B. Specifically, the buttons 290 of the needle hiding element 140 are
35 supported against the forward ends of the cut-outs 250 of the bottom housing portion 104, and thus the needle hiding element 140 is restrained from further forward displacement along longitudinal axis 107 relative to the housing portions 104 and 106 and removal therefrom.

It is seen that in this operative orientation the biasing springs 190 are disposed in their non-stressed operative orientation, thus biasing the needle hiding element 140 to an extended position, which is the forwardmost position of the needle hiding element 140, in which the needle hiding element 140 extends forwardly from the forward end 200 and 220 of the upper and bottom housing portions respectively, such that the forwardly facing surface 264 of the needle hiding element 140 is forwardly spaced from the forward ends 200 and 220 and the needle 302 is hidden within the opening 266 of the needle hiding element 140 and thus hidden from view of the user.

It is particularly seen that the buttons 290 of the needle hiding element 140 are disposed at the forward end of the cut-outs 250 of the bottom housing portion 104 and the snap protrusions 292 are forwardly spaced from the snap cut-outs 252 in the bottom housing portion 104 in this operative orientation.

It is also seen in Fig. 13B that the medicament cartridge 102 is empty. Alternatively, a certain dosage of the medicament could have been injected rather than the full amount of medicament contained in the medicament cartridge 102.

Reference is now made to Figs. 14A and 14B, which are simplified respective pictorial and section view illustrations of the injector 100 of Figs. 1 – 3 operated by a user, in a needle cover attached operative orientation, section view being taken along lines B – B in Fig. 14A.

The injector 100 is seen in needle cover attached operative orientation in Figs. 14A & 14B, following attachment of the outer needle cap 306 to the needle 302. This operative orientation is essentially similar to the operative orientation illustrated and described with reference to Figs. 9A - 9C, besides that a portion or all of the medicament is ejected from the medicament cartridge 102 in this operative orientation.

Preferably, the outer needle cap 306 is now mounted over the needle 302 and the needle hub.

It is seen particularly in Figs. 14A & 14B that upon attachment of the outer needle cap 306 to the injector 100, the circumferential rear end 308 of the outer needle cap 306 engages the forwardly facing shoulder 272 of the needle hiding element 140. Engagement of the outer needle cap 306 with the needle hiding element 140 causes rearward slidable displacement of the needle hiding element 140 relative to the housing portions 104 and 106 against the urge of the biasing springs 190.

It is seen in Figs. 14A & 14B that the needle hiding element 140 is now disposed within the enclosure formed by the housing portions 104 and 106, such that the forwardly facing surface 264 of the needle hiding element 140 is rearwardly spaced from the forward ends 200 and 220 of housing portions 106 and 104 respectively.

It is a particular feature of an embodiment of the present invention that the needle 302 in this needle attached operative orientation is covered by the outer needle cap 306 and the needle hiding element 140 is disposed in a retracted locked orientation, which is the

rearwardmost position of the needle hiding element 140. It is specifically seen that in this retracted locked orientation of the needle hiding element 140, the snap protrusions 252 are rearwardly displaced relative to the housing portions 104 and 106 and are now inserted into snap cut-outs 292 of the bottom housing portion 104 and the buttons 290 are positioned adjacent the rearward ends of the cut-outs 250. The needle hiding element 140 is temporarily locked in its retracted position and is restrained from forward longitudinal displacement along longitudinal axis 107 by means of engagement between snap protrusions 292 with snap cut-outs 252. The locking of the snap protrusions 292 with snap cut-outs 252 is enabled due to temporary inward deflection of the mounting arms 280 of the needle hiding element 140.

It is also noted that the biasing springs 190 are now disposed in their compressed operative orientation, but are prevented from displacing the needle hiding element 140 forwardly due to the locking engagement of the snap protrusions 292 with the snap cut-outs 252.

It is particularly seen that buttons 290 of the needle hiding element 140 are rearwardly spaced from the forward end of cut-outs 250 of the bottom housing portion 104.

It is appreciated that if medicament still remains within the medicament container 102 and the user wishes to perform injection of an additional dose of medication while hiding the needle 302 during needle penetration into the skin and needle retraction from the skin, the user has to press buttons 290 of the needle hiding element 140 inwardly towards the longitudinal axis 107 in order to unlock the needle hiding element 140 from the housing portions 104 and 106.

It is a particular feature of an embodiment of the present invention that the injector 100 includes a needle hiding element 140 that is displaceable relative to the housing portions 104 and 106 of the injector 100 and positionable in an extended orientation exposing the needle, a retracted orientation, in which the needle hiding element 140 is locked relative to the housing portions 104 and 106 and in a partially retracted orientation during injection of the medicament from the medicament cartridge 102.

It is appreciated that alternatively, instead of the illustrated two mounting arms 280 of the needle hiding element 140, any other number or configuration of such mounting arms of the needle hiding element 140 which enables locking/unlocking of the needle hiding element 140 from the housing portions 104 and 106 in certain operative orientations is considered to be within the scope of embodiments of the present invention. For example, a single mounting arm 280 which engages a cut-out formed on the back wall 240 of the bottom housing portion 104, rather than on the side walls 242 thereof may be employed as part of the present invention.

It is noted that alternative medicament cartridge insertion methods into the injector 100 are considered to be within the scope of the present invention, such as for example providing an opening at the forward end of the housing of the injector 100 and rotatably inserting the medicament cartridge 102 therethrough. Other methods of medicament cartridge insertion into the injector 100 are also considered to be within the scope of the present invention.

It will be appreciated by persons skilled in the art that the present invention is not limited by what has been particularly shown and described hereinabove. Rather the present invention includes both combinations and subcombinations of various features described herein and improvements and variations which would occur to persons skilled in the art upon reading the
5 foregoing description and which are not in the prior art.

CLAIMS

1. An injector comprising:
a housing arranged along a longitudinal axis and configured to receive a medicament
5 cartridge;
an injection drive mechanism for driving a piston, said piston forming part of said medicament cartridge, said injection drive mechanism injecting a medicament when said piston is forwardly displaced; and
a needle hiding element, which is slidably attached to said housing and positionable in at
10 least one of an extended orientation and a retracted orientation, wherein in said extended orientation said needle hiding element protrudes forwardly from said housing and in said retracted orientation, said needle hiding element is locked relative to said housing.
2. Injector according to claim 1 and wherein in said extended orientation said needle hiding
15 element is slidable relative to said housing and in said retracted orientation the needle hiding element does not protrude forwardly from said housing or protrudes to a lesser extent than in said extended orientation.
3. Injector according to claim 1 or 2 and wherein said needle hiding element is also
20 positionable in a partially retracted orientation, in which said needle hiding element protrudes forwardly from said housing to a greater extent than in said retracted orientation and is slidably moveable relative to said housing.
4. Injector according to any one of claims 1 to 3 and wherein said needle hiding element is
25 biased to be displaced forwardly under the urge of at least one biasing element, which is supported between said housing and said needle hiding element.
5. Injector according to any one of claims 1 to 4, wherein the needle hiding element
30 includes at least a flexible arm, extending axially and comprising a snap-fit locking feature that can be engaged in a corresponding feature provided on the housing and a radially protruding button that can be handled by a user for deflecting the arm and axially moving the needle hiding element, whereby the user can position the needle hiding element in one of said extended and retracted orientations.
- 35 6. Injector according to claim 5, wherein the snap-fit locking feature of the flexible arm and the corresponding feature of the housing are designed to provide the locked retracted orientation of the needle hiding element, that can be unlocked by the user by pressing on the

button whereby the locking feature of the arm is disengaged from the corresponding feature of the housing.

7. Injector according to claim 6, wherein the needle hiding element includes a pair of
5 opposing flexible arms, each provided with a snap-fit locking feature and a button, whereby the
locked retracted orientation of the needle hiding element can be unlocked by the user by
simultaneously pressing on the buttons for simultaneous deflection of the arms.