Description

The present invention relates to a syringe, and more particularly to a syringe for preventing "needle stick" by the syringe needle after use. Embodiments are disclosed which prevent reuse of the syringe.

In order to minimise the risk of contamination from a used syringe, it is common practice for used syringes to be deposited into heavy duty plastic bins which cannot be pierced by the needles. The bin and contents are then moved to a disposal facility at which they are incinerated. This means of disposal is of limited effect as it does not eliminate "needle stick" risk between needle use and disposal. Current disposal methods are also relatively expensive.

Numerous attempts have been made to design an acceptable syringe in which, after use, the needle is withdrawn into the body of the syringe and retained there in some manner. These designs are all directed to the same end of covering the needle after use to prevent inadvertent "needle stick" injuries with their attendant risk of cross-infection and to prevent reuse of the syringe. In many of these prior art arrangements the withdrawal of the needle into the body is entirely manual and requires the syringe user to remember to make some deliberate relative movement, normally between the plunger and the body, to effect withdrawal of the needle into the body of the syringe. Proposals have been made, as in Australian Patent Specifications 593,513, 594,634 and 35,676/89, to induce automatic withdrawal of the plunger into the body by the use of a helically coiled spring. This necessitates the use of additional and costly parts in the syringe and complicates its assembly.

EP-A-0326983 discloses a syringe comprising a body, a plunger mounted within the body, means for connecting the plunger to a needle holder at the end of the injection stroke of the plunger whereby subsequent retraction of the plunger withdraws the needle into a shielded position within the body, and energy storage means energizable by the insertion stroke to cause such withdrawal of the plunger and needle after the injection stroke.

It is an object of the present invention to at least partially mitigate some of the foregoing disadvantages.

According to the present invention there is provided a syringe comprising a body, a plunger mounted within the body, means for connecting the plunger to a needle holder at the end of an injection stroke of the plunger whereby subsequent retraction of the plunger withdraws the needle into a shielded position within the body, and energy storage means energizable by the insertion stroke to cause such withdrawal of the plunger and needle after the injection stroke, characterised in that:-

the energy storage means comprising a vacuum chamber defined between the plunger and the syringe body, vacuum being created within the chamber by movement of the plunger during the injection stroke, said vacuum serving to withdraw the plunger and needle after injection pressure on said plunger is removed.

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

Fig. 1 is a schematic longitudinal section of a syringe in accordance with the preferred embodiment of the invention, the right half of the section showing the syringe in a condition prior to use and the left half of the section showing the syringe in a condition at the end of its injection stroke, the left half of the section also showing an alternative mounting for the syringe needle;

Figs. 2a-2d show five longitudinal sectional views through a syringe according to another embodiment of the present invention; Fig. 2a shows the syringe in the condition in which it is shipped for use; Fig. 2b shows the syringe in a condition ready to draw up an injectable liquid; Fig. 2c shows the syringe in a condition in which the liquid has been drawn up and the does of the liquid is about to be selected with an accompanying exclusion of air from the syringe; Fig. 2d shows the syringe in a condition immediately after the injection has been given; and Fig. 2e shows the syringe in a condition after the needle has been automatically withdrawn into the syringe body;

Fig. 3 is a longitudinal sectional view through one end of a narrow base syringe according to another embodiment of this invention, and

Fig. 4 is a longitudinal sectional view through a needle holder and adjacent end of the body of a wide base syringe according to another embodiment of the present invention.

BEST METHOD FOR CARRYING OUT THE INVENTION

The syringe shown in Fig. 1 comprises a body 2 and a plunger 4 mounted within the body 2. A needle holder 6 is mounted at the forward or inner end of the body 2 by means of an annular array of releasable locking pawls 8 which normally engage over a shoulder 10 of the holder 6 in order to prevent retraction of the holder 6 into the body 2. A forwardly-projecting part 12 of the needle holder 6 is of conventional form in order to mount a standard needle which is a friction fit on the holder. Alternatively the body 2 can mount a needle with an integral holder 6b as shown in the left half of Fig. 1, the holder 6b co-operating with the releasable pawls 8 in the same manner as the holder 6. The pawls 8 extend rearwardly from a sleeve 13 which centres the needle holder in the body 2.

The plunger 4 carries, towards its forward end, an annular travelling seal 14 in sliding contact with the inner surface of the syringe body 2. The seal 14 is intended to form a high quality hermetic seal and is shaped to define a series of axially spaced annular sealing zones against the body 2. A similar high quality annular seal 16 is fixedly mounted on the body 2 towards its rear or outer end. This fixed seal 16 has on its inner surface a series of annular

sealing zones which seal against the outer surface of the plunger 4. The space 18 defined between the two seals 14, 16 constitutes a vacuum chamber. Upon actuation of the syringe the movement of the seal 14 away from the seal 16 generates a vacuum in the vacuum chamber 18 to cause eventual withdrawal of the holder 6 or 6b together with the needle into the syringe body 2 after use.

The forward end of the plunger 4 includes a radially-extending braking flange 20 which frictionally engages the inner surface of the body 2 in order to prevent non-intentional retraction of the plunger 4 under the influence of the vacuum created in the vacuum chamber 18. The braking flange 20 is a resilient flange defined at an outer edge of a conical wedge 22 formed at the forward end of the plunger. The conical wedge 22 is adapted to co-operate with the retaining pawls 8 for the needle holder in order to release the pawls 8 as will subsequently be described. The forward end of the plunger is also formed with an annular array of flexible pawls 24 arranged inwardly of the conical wedge 22. The pawls 24 are shaped to engage into an undercut groove 26 formed in the head of the needle holder in order to anchor the needle holder to the plunger 4 when the plunger 4 is in its forward position.

A removable stop ring 28 is mounted in an inner annular seat formed in the inner surface of the body 2 rearwardly of the fixed seal 16. The stop ring 28 is a split ring which is resiliently biased to an external diameter greater than that of the inner seat. An outer seat 30 for the stop ring 28 is formed in the body 2 rearwardly of the inner seat. The stop ring 28 has, on its internal surface, an annular groove 32 adapted to receive an annular rim 34 formed on the external surface of the plunger 4 towards the rear end of the plunger.

The syringe is supplied with the plunger 4 in its retracted position. In order to use the syringe, the plunger 4 is pushed inwardly to expel most of the air from the fluid-receiving chamber which is defined between the forward end of the plunger 4 and the needle holder 6 or 6b. Insertion of the plunger during this phase is limited by the stop ring 28, the rear edge of which engages a shoulder 36 at the outer end of the plunger 4. In this limit position, the annular groove 32 in the stop ring 28 is axially aligned with, and is engaged by, the projecting annular rim 34 on the plunger body whereby the stop ring 28 is releasably connected to the plunger 4. The stop ring 28 prevents insertion of the plunger 4 to its forwardmost position and hence prevents connection of the pawls 24 at the forward end of the plunger 4 with the groove 26 in the head of the needle holder. The plunger 4 can then be retracted to draw fluid into the fluid chamber of the syringe. It is to be noted that during this mode, the braking flange 20 on the plunger frictionally engages the inner wall of the body 2 in order to prevent retraction of the plunger under the influence of the vacuum generated within the vacuum chamber 18 during the insertion of the plunger. As mentioned above, at the end of the initial insertion stroke, the stop ring 28 was engaged by, and was connected to, the plunger. As the plunger is withdrawn to draw fluid into the chamber, the stop ring 28 is withdrawn with the plunger until the stop ring 28 is clear of the inner seat. When the stop ring moves into alignment with the outer seat 30, the inherent resilience of the stop ring 28 enables the stop ring to expand into the outer seat 30. The increased diameter of the outer seat 30 enables the stop ring 28 to expand to such a diameter that it disengages from the annular rim 34 on the plunger and is retained in the outer seat, as shown in the left half of Fig. 1. A retaining lip 37 at the outer end of the outer seat 30 ensures that the ring 28 is retained within the seat in order to prevent accidental displacement of the ring 28 and possible jamming of the plunger.

When the required quantity of fluid has been drawn into the fluid chamber, the plunger is then depressed in order to expel air from the chamber in the usual manner and then to discharge the fluid into the patient. It is to be noted that as the plunger reaches the end of its injection stroke, the plunger is no longer subject to the influence of the stop ring 28 which is now in its larger diameter outer seat 30 and this enables the plunger to be moved into its fully forwards condition for discharge of substantially the entire contents of the fluid chamber. During the injection stroke, vacuum again builds up in the vacuum chamber 18, the effect of this vacuum being resisted by the braking flange 20 which frictionally engages the inner surface of the syringe body.

As the plunger nears the end of its injection stroke, that is beyond the stop position previously defined by the presence of the stop ring 28 when in its inner seat, the conical wedge 22 contacts the retaining pawls 8 in order to deflect these pawls outwardly beyond the retaining shoulder 10 on the needle holder and into engagement with the inner surface of the syringe body as shown in the left half of fig. 1. At the same time, the pawls 24 at the plunger move into snap-engagement in the undercut groove 26 in the head of the needle holder in order to connect the needle holder with the plunger. The rear ends 8a of the retaining pawls 8 constitute shear knives which, when the pawls 8 are deflected outwardly by the wedge 22, lie against the inner surface of the syringe body in order to contact the braking flange 20 and to deflect the flange 20 inwardly and rearwardly by plastic deformation of the flange, thereby reducing or removing the frictional contact between the braking flange 20 and the syringe body. When manual pressure is removed from the rear end of the plunger and with the braking action of the braking flange 20 removed or reduced consequent on its plastic deformation, the vacuum generated in the vacuum chamber 18 during the injection stroke acts to withdraw the plunger and thus the needle holder and needle which is now attached to the plunger. In the withdrawn position of the plunger, the needle is enclosed fully within the plunger body with no portion of the needle exposed for accidental contact. The needle holder is a relatively loose fit on the pawls 24 so that the axis of the needle holder and needle can incline relative to the syringe body whereby the tip of the needle will lie to one side of the syringe body and will be prevented by

the sleeve 13 from accidental extension from the body. The sleeve 13 may also comprise a central iris structure held open by the needle holder when in its operative position. As soon as the needle holder is withdrawn by the plunger, the iris structure contracts or closes in order to close the central aperture of the sleeve 13 and thereby to prevent any access to the interior of the syringe body.

As no part of the needle is exposed after use of the syringe, the syringe can be disposed of in a conventional plastic bag. The absence of exposure of the needle also assists in preventing the spread of infection by contaminated needles.

The syringe shown in Figs. 2a to 2e comprises a body 100 and a plunger 101. A needle holder 102 is mounted at the forward or inner end of the body 100. The needle holder 102 has at its forward end a cylindrical boss 103 inclined slightly to the longitudinal axis of the syringe body 100. A needle 104 is disposed on the boss 103 and is held in place thereon by a conventional U-lock fitting 105. Due to the inclination of the boss 103 the needle 104 is also inclined to the longitudinal axis of the body 100. The needle holder 102 has a bore 106 extending longitudinally through it and communicating at one end with an undercut recess 107, adapted to engage with a suitably shaped protuberance on the plunger as will be hereinafter described, and at the other end with the needle 104. A flange 108 on the needle holder 102 surrounding the undercut recess 107 engages behind an annular rib 109 on the inside wall of the body 100. A plurality of triangular sprags 111 project inwardly from the forward end of the body 100 and engage about the circumference of the needle holder 102. The engagement of the flange 108 of the needle holder 102 with the annular rib 109 of the body 100 and the engagement of the sprags 111 about the circumference of the needle holder 102 serve to securely locate the needle holder at the forward end of the body 100 until it is released therefrom by engagement with the plunger as will be hereinafter described.

The body 100 defines a substantially cylindrical bore 110 extending from the annular rib 109 which retains the needle holder 102 in place at the forward end of the body 100 to a second annular rib 113. Rearwardly of the annular rib 113 the body 100 increases in internal diameter through a frusto-conical zone 114 to a substantially cylindrical zone 115. The cylindrical zone 115 is directly connected to a second cylindrical zone 116 of slightly increased internal diameter which in turn is connected to a tapering zone 117 which tapers outwardly in diameter to the free end 119 of the body 100. Between the zones 116 and 117 the body is formed integrally with an annular collar 118. This collar 118 is moulded extending rearwardly of the junction between the two zones 116 and 117 and is then turned over to lie within zone 116, forming an inwardly directed annular abutment. The free end 110 of the body 100 is moulded integrally with a pair of diametrically opposed stop members 121 joined by a thin flexible ring 122. The stop members 121 and ring 122 are also moulded integrally with, and extended rearwardly of, the body 100 and are then turned over to lie within the zone 117.

A resilient annular braking and sealing member 123 is positioned within the zones 115 and 116 of the body 100. The member 123 includes a pair of inwardly directed annular sealing lips 124 sliding radially inwardly from the member 123 and adapted to sealingly engage about the plunger 101. Rearwardly of the lips are three braking ribs 125, which could in another embodiment of the invention be replaced by rows of bosses which may serve the same purpose. The braking ribs are adapted to apply a braking force to the plunger 101. The radially outer surface of the member 123 carries at its forward end a circumferential rib 126. In the initial configuration of the syringe the member 123 is positioned with the rib 126 abutting against the forward end of the collar 118. The collar 118 then surrounds the member 123 and serves to compress the braking ribs 125 against the plunger 101.

The rearward end of the syringe body 100 is formed with a pair of outwardly extending finger grips 112 disposed in diametric opposition about the body 100.

The plunger 101 includes an elongate shaft 127 and at its forward end a radially extending sealing flange 128 in sealing engagement with the bore 110 of the body 100. At its forward free end the plunger 101 is formed with a protuberance 129 adapted to engage with the recess 107 in the needle holder 102. The protuberance 129 and recess 107 are so dimensioned that on engagement of the protuberance 129 in the recess 107 an inwardly directed flange 131 will be pivoted inwardly and forwardly by contact with the protuberance 129 which will cause the flange 108 on the needle holder to be pivoted rearwardly and inwardly to free the flange 108 from the annular rib 109 on the bore of the body 100.

The rearward end of the plunger 101 is formed with an enlarged head 132 which head 132 includes at its forward end a radially outwardly extending flange 133. The enlarged head 132 on the plunger 101 is preferably formed by heat reforming the rearward end of the plunger after the sealing and braking member 123 has been positioned on the stem 127 of the plunger 101.

In use the syringe is shipped in conditions depicted in Fig. 2a. The plunger 101 is in its fully retracted position and the braking and sealing member 123 is surrounded by the collar 118 such that the braking ribs 125 are urged firmly against the shaft 127 of the plunger 101.

In order to draw an injectable fluid into the syringe the plunger 101 is depressed to the position shown in Fig. 2b. The plunger 101 is depressed until it is stopped by the engagement of the flange 133 on the head 132 of the plunger 101 with a pair of inwardly directed recesses 134 in opposed faces of the stop members 121. This engagement occurs when the protruberance 129 on the forward end of the plunger 101 is closely adjacent but not engaged with the undercut recess 107 in the needle holder 102. Subsequent retraction of the plunger 101 will draw an injectable liquid, into which the needle has been inserted, into the body 100 of the syringe. Such retraction

will also shear the thin connection between the stop members 121 and the body 100 of the syringe. The dose of liquid in the syringe may then be adjusted, and air removed from the syringe, by depression of the plunger 101. The braking force applied to the shaft 127 of the plunger 101 is at this point sufficient to resist movement of the plunger 101 relative to the body 100 under the influence of the vacuum created between the braking and sealing member 123 and the sealing flange 128 as the plunger 101 is depressed into the body 100. Thus movement of the plunger 101 relative to the body 100 will only occur by manual application of force to the plunger 101 by the person using the syringe.

When an injection is to be given the needle is inserted into the patient in a conventional manner. This insertion is facilitated by the inclination of the needle 104 relative to the body 100 of the syringe as the body 100 is disposed at a more convenient angle to the skin of the patient, at least in the case of intravenous injections, than would be the case if the needle 104 was in axial alignment with the body 100 of the syringe. The plunger 101 is then depressed to inject the liquid into the patient. At the end of the plunger stroke the protruberance 129 will engage with the undercut recess 107 of the needle holder 102, as the earlier removal of the stop members 121 now allows the plunger 101 to be fully depressed. The engagement of the protruberance 129 with the undercut recess 107 causes the flange 108 on the needle holder 102 to be drawn radially inwardly free of the circumferential groove 109 in the body 100. As the protruberance 129 is entering the undercut recess 107 so the flange 133 on the head of the plunger 101 engages the rearward end of the braking and sealing member 123 pushing it into zone 115 of the syringe body 100 free of collar 118. The braking and sealing member 123 can expand radially within the zone 115 so that the braking pressure on the shaft 127 of the plunger 101 is reduced. When the syringe is withdrawn from the patient the vacuum created between the braking and sealing member 123 and the sealing flange 108 will be sufficient to slowly draw the plunger 101 back into the body 100 of the syringe. The plunger 101 will also draw the needle holder 102, now freed from engagement with the body 100, and the needle 104 into the body. As the needle holder 102 is drawn into the body the free ends of the triangular sprags 111 will spring radially inwardly to form an iris precluding egress of the needle 104 outwardly from the now open forward end of the syringe body 100.

The vacuum pressure created in the syringe body 100 will be sufficient to draw the needle 104 fully into the body 100 behind the iris formed by the triangular sprags 111, and to engage radially outwardly directed fingers 135 on the shaft 127 of the plunger 101 behind at least the forwardmost one of sealing lips 124. Any subsequent use of the syringe is prevented firstly by the fact that the needle 104 is trapped within the body 101 by the sprags 111 and the inclination of the needle 104 and secondly by the fact that any depression of the plunger 101 will cause fingers 135 to drag the braking and sealing member 123 into the frustoconical zone 114 of the body where the braking ribs 125 of the braking and sealing member 123 will be caused to tightly bind against the shaft 127 of the plunger 101.

The arrangement of Fig. 3 shows the application of the present invention to a narrow bore syringe which would typically be used for giving an injection of about 1ml of liquid to a patient. In this case the construction and operation of the syringe is as has been described with reference to Figs. 2a to 2e except that the vacuum pressure is created between the braking and sealing member 123 and an additional sealing flange 136 mounted on the shaft 127 of the plunger 101 intermediate its ends. A step 137 on the shaft 127 causes the sealing flange 136 to move downwardly of the bore 110 as the plunger is depressed creating a vacuum between the sealing lips 124 and the flange 136. This vacuum will draw the flange 136 rearwardly when the injection has been completed and the flange 136 will carry the plunger 101 and the needle 104 rearwardly with it.

The arrangement of Fig. 4 shows the needle holder 102 positioned in a wide bore syringe. In this case the arrangement is as described with reference to Figs. 2a to 2e except that the sprags 111 do not need to be moulded so as to spring inwardly to form an iris upon withdrawal of the needle holder into the body 100 as the inturned flanges 137 and 138 are sufficient to prevent the needle 104 from being re-extended from the syringe once it has been drawn into the body 100.

The embodiments of the invention are given for the purpose of example only and are not intended to limit the broad scope of the present invention as defined by the claims. The needle holder 102 could if desired be held in place in the body 100 of the syringe by a friction fit without the need for the rib 109. Similarly the braking ribs 125 could be replaced by other configuration of means adapted to apply a braking effect between the plunger 101 and the syringe body 100.

Claims

1. A syringe comprising a body (2), a plunger (4) mounted within the body, means (24) for connecting the plunger to a needle holder (6) at the end of an injection stroke of the plunger whereby subsequent retraction of the plunger (4) withdraws the needle into a shielded position within the body, and energy storage means energizable by the insertion stroke to cause such withdrawal of the plunger and needle after the injection stroke, characterised in that:-

   the energy storage means comprising a vacuum chamber (18) defined between the plunger (4) and the syringe body (2), vacuum being created within the chamber (18) by movement of the plunger during the injection stroke, said vacuum serving to withdraw the plunger and needle after injection pressure on said plunger (4) is removed.

will also shear the thin connection between the stop members 121 and the body 100 of the syringe. The dose of liquid in the syringe may then be adjusted, and air removed from the syringe, by depression of the plunger 101. The braking force applied to the shaft 127 of the plunger 101 is at this point sufficient to resist movement of the plunger 101 relative to the body 100 under the influence of the vacuum created between the braking and sealing member 123 and the sealing flange 128 as the plunger 101 is depressed into the body 100. Thus movement of the plunger 101 relative to the body 100 will only occur by manual application of force to the plunger 101 by the person using the syringe.

When an injection is to be given the needle is inserted into the patient in a conventional manner. This insertion is facilitated by the inclination of the needle 104 relative to the body 100 of the syringe as the body 100 is disposed at a more convenient angle to the skin of the patient, at least in the case of intravenous injections, than would be the case if the needle 104 was in axial alignment with the body 100 of the syringe. The plunger 101 is then depressed to inject the liquid into the patient. At the end of the plunger stroke the protruberance 129 will engage with the undercut recess 107 of the needle holder 102, as the earlier removal of the stop members 121 now allows the plunger 101 to be fully depressed. The engagement of the protruberance 129 with the undercut recess 107 causes the flange 108 on the needle holder 102 to be drawn radially inwardly free of the circumferential groove 109 in the body 100. As the protruberance 129 is entering the undercut recess 107 so the flange 133 on the head of the plunger 101 engages the rearward end of the braking and sealing member 123 pushing it into zone 115 of the syringe body 100 free of collar 118. The braking and sealing member 123 can expand radially within the zone 115 so that the braking pressure on the shaft 127 of the plunger 101 is reduced. When the syringe is withdrawn from the patient the vacuum created between the braking and sealing member 123 and the sealing flange 108 will be sufficient to slowly draw the plunger 101 back into the body 100 of the syringe. The plunger 101 will also draw the needle holder 102, now freed from engagement with the body 100, and the needle 104 into the body. As the needle holder 102 is drawn into the body the free ends of the triangular sprags 111 will spring radially inwardly to form an iris precluding egress of the needle 104 outwardly from the now open forward end of the syringe body 100.

The vacuum pressure created in the syringe body 100 will be sufficient to draw the needle 104 fully into the body 100 behind the iris formed by the triangular sprags 111, and to engage radially outwardly directed fingers 135 on the shaft 127 of the plunger 101 behind at least the forwardmost one of sealing lips 124. Any subsequent use of the syringe is prevented firstly by the fact that the needle 104 is trapped within the body 101 by the sprags 111 and the inclination of the needle 104 and secondly by the fact that any depression of the plunger 101 will cause fingers 135 to drag the braking and sealing member 123 into the frustoconical zone 114 of the body where the braking ribs 125 of the braking and sealing member 123 will be caused to tightly bind against the shaft 127 of the plunger 101.

The arrangement of Fig. 3 shows the application of the present invention to a narrow bore syringe which would typically be used for giving an injection of about 1ml of liquid to a patient. In this case the construction and operation of the syringe is as has been described with reference to Figs. 2a to 2e except that the vacuum pressure is created between the braking and sealing member 123 and an additional sealing flange 136 mounted on the shaft 127 of the plunger 101 intermediate its ends. A step 137 on the shaft 127 causes the sealing flange 136 to move downwardly of the bore 110 as the plunger is depressed creating a vacuum between the sealing lips 124 and the flange 136. This vacuum will draw the flange 136 rearwardly when the injection has been completed and the flange 136 will carry the plunger 101 and the needle 104 rearwardly with it.

The arrangement of Fig. 4 shows the needle holder 102 positioned in a wide bore syringe. In this case the arrangement is as described with reference to Figs. 2a to 2e except that the sprags 111 do not need to be moulded so as to spring inwardly to form an iris upon withdrawal of the needle holder into the body 100 as the inturned flanges 137 and 138 are sufficient to prevent the needle 104 from being re-extended from the syringe once it has been drawn into the body 100.

The embodiments of the invention are given for the purpose of example only and are not intended to limit the broad scope of the present invention as defined by the claims. The needle holder 102 could if desired be held in place in the body 100 of the syringe by a friction fit without the need for the rib 109. Similarly the braking ribs 125 could be replaced by other configuration of means adapted to apply a braking effect between the plunger 101 and the syringe body 100.

Claims

1. A syringe comprising a body (2), a plunger (4) mounted within the body, means (24) for connecting the plunger to a needle holder (6) at the end of an injection stroke of the plunger whereby subsequent retraction of the plunger (4) withdraws the needle into a shielded position within the body, and energy storage means energizable by the insertion stroke to cause such withdrawal of the plunger and needle after the injection stroke, characterised in that:-

   the energy storage means comprising a vacuum chamber (18) defined between the plunger (4) and the syringe body (2), vacuum being created within the chamber (18) by movement of the plunger during the injection stroke, said vacuum serving to withdraw the plunger and needle after injection pressure on said plunger (4) is removed.

* C L M S *

2. A syringe as claimed in claim 1 in which the vacuum chamber is defined between a first sealing member (14) carried by the plunger (4) at or adjacent its end within the body (2) and a second sealing member (16) carried by the body (2) at or adjacent its end distal to the needle holder (6) and closely surrounding the plunger, whereby said movement of the plunger (4) during the injection stroke causes said first and second sealing members (14,16) to move relatively apart.

3. A syringe as claimed in claim 2, wherein

said body (2) has a forward end, a rearward end, and a bore extending from the forward end to the rearward end;

said needle holder (6) is slidably disposed within said bore proximate said forward end;

said plunger (4) has an end mounted slidably within said bore of said body, said plunger extending out of said rearward end of said body;

said connecting means (24) connects said plunger (4) to said needle holder (6) on completion of an injection stroke of said plunger by injection pressure on said plunger;

said first sealing member (14) on said plunger (4) extends radially into sliding sealing engagement with said body (2), and

said second sealing member (16) on said body (2) is disposed between said first sealing member and said rearward end of said body (2) and extends radially with sliding sealing engagement against said plunger (4).

4. A syringe as claimed in claim 3 and further comprising:

stop means (24) on said body (2) adjacent said rearward end of said body for arresting movement of said plunger (4) during a preparatory forward stroke of said plunger (4) for preventing said connecting means (24) from connecting said plunger (4) to said needle holder (6) on completion of said preparatory stroke; and

stop engagement means (34) on said plunger adapted to engage said stop means on said preparatory forward stroke and render said stop means inoperative by a subsequent rearward stroke of said plunger so that said stop means does not impede said plunger during the injection stroke.

5. A syringe as claimed in claim 4 wherein;

said bore forms an inner seat on said body;

said stop means comprises an abutment (28) removably disposed on said inner seat; and

said stop engagement (34) means engages said abutment during the preparatory forward stroke so that said abutment is sheared from said body by a rearward stroke of said plunger.

6. A syringe as claimed in claim 3 and further comprising:

resilient braking means (20) for retarding retraction of said plunger disposed within a space between said bore and said plunger, said braking means being disposed on one of said body (2) and plunger (4) and in slidable engagement with the other of said body (2) and plunger (4) for providing a braking force sufficient to retard but not stop retraction of said plunger.

7. A syringe as claimed in claim 6, wherein:

said braking means further comprises braking modifying means (8a) on said body and cooperating means (20) on said braking means; said braking modifying means (8a) being adapted to bear against said cooperating means (20) so that relative movement therebetween during the injection stroke reduces said braking force after the injection stroke.

8. A syringe as claimed in claim 7, wherein:

said bore comprises zones having different internal diameters (110, 116, 117);

abutment means (133) are provided on said plunger engageable with said braking means during the injection stroke; and

said resilient braking means (123) comprises a resilient crylindrical member (123) slidable on said body and having rib means (125) resiliently bearing against said plunger (101) for exerting a braking force, said resilient cylindrical member being longitudinally movable within said zones of different internal diameter by said abutment means for reducing the braking force on said plunger.

9. A syringe as claimed in any one of claims 3 to 8 and further comprising:

a plurality of pivotable fingers (111) within said bore proximate said forward end of said body, said fingers being resiliently urged radially inwardly for forming an iris substantially occluding said forward end of said body when said needle holder is drawn into said bore.

10. A syringe as claimed in any one of claims 3 to 9, wherein said bore has a longitudinal axis and further comprising:

means (103) on said needle holder inclined relative to said longitudinal axis for inclining a needle thereon at an angle to said longitudinal axis.

11. A syringe as claimed in any one of claims 3 to 10, wherein said connecting means comprises:

a protuberance (129) at said end of said plunger (101) within said bore (110); and

a complementary undercut recess (107) in said needle holder engageable with said protuberance.

12. A syringe as claimed in claim 11 and further comprising:

a radially extending retaining flange (108) on said needle holder;

complementary needle holder engagement means (109) within said bore releasably engaging said retaining flange, and co-acting means (131) on said plunger and needle holder for releasing said retaining flange from said complementary engagement means upon connection of said protuberance with said undercut recess.

Patentansprüche

1. Spritze, umfassend einen Körper (2), einen innerhalb des Körpers angebrachten Kolben (4), Mittel (24) zum Verbinden des Kolbens mit einem Nadelhalter (6) am Ende eines Injektionshubs des Kolbens, wobei ein nachfolgendes Zurückziehen des Kolbens (4) die Nadel in eine geschützte Stellung innerhalb des Körpers zurückzieht, sowie Energiespeicherungsmittel, welche durch den Einstechhub erregbar sind, um ein derartiges Zurückziehen des Kolbens und der Nadel nach dem Injektionshub zu bewirken, dadurch gekennzeichnet,
daß die Energiespeicherungsmittel eine zwischen dem Kolben (4) und dem Spritzenkörper (2) festgelegte Unterdruckkammer (18) umfassen, wobei Unterdruck innerhalb der Kammer (18) durch eine Bewegung des Kolbens während des Injektionshubs erzeugt wird und wobei der Unterdruck dazu dient, den Kolben und die Nadel zurückzuziehen, nachdem der Injektionsdruck auf den Kolben gelöst ist.

2. Spritze nach Anspruch 1, bei welcher die Unterdruckkammer zwischen einem ersten Dichtungselement (14), welches von dem Kolben (4) an oder in der Nähe seines Endes innerhalb des Körpers (2) gehalten ist, und einem zweiten Dichtungselement (16), welches von dem Körper (2) an oder in der Nähe seines Endes, fern von dem Nadelhalter (6) und den Kolben eng umschließend, gehalten ist, festgelegt ist, wobei die Bewegung des Kolbens (4) während des Injektionshubs bewirkt, daß sich das erste und zweite Dichtungselement (14, 16) relativ auseinanderbewegen.

3. Spritze nach Anspruch 2, bei welcher der Körper (2) ein vorderes Ende, ein hinteres Ende sowie eine sich von dem vorderen Ende zu dem hinteren Ende erstreckende Bohrung aufweist; wobei der Nadelhalter (6) innerhalb der Bohrung, nahe dem vorderen Ende verschiebbar angeordnet ist; wobei der Kolben (4) ein innerhalb der Bohrung des Körpers verschiebbar angebrachtes Ende aufweist, wobei der Kolben aus dem hinteren Ende des Körpers herausragt; wobei nach Vollendung eines Injektionshubs des Kolbens das Verbindungsmittel (24) den Kolben (4) mit dem Nadelhalter (6) durch einen Injektionsdruck auf den Kolben verbindet; wobei sich das erste Dichtungselement (14) an dem Kolben (4) radial in einen Gleit-Dichteingriff mit dem Körper (2) erstreckt und wobei das zweite Dichtungselement (16) an dem Körper (2) zwischen dem ersten Dichtungselement und dem hinteren Ende des Körpers (2) angeordnet ist und sich radial mit Gleit-Dichteingriff gegen den Kolben (4) erstreckt.

4. Spritze nach Anspruch 3 und ferner umfassend: Stoppmittel (24) an dem Körper (2) benachbart dem hinteren Ende des Körpers zum Hemmen einer Bewegung des Kolbens (4) während eines Vorbereitungsvorwärtshubs des Kolbens (4) um zu verhindern, daß das Verbindungsmittel (24) den Kolben (4) mit dem Nadelhalter (6) nach Vollendung des Vorbereitungshubs verbindet; und ein Stoppeingriffsmittel (34) an dem Kolben, welches angepaßt ist, um die Stoppmittel bei dem Vorbereitungsvorwärtshub zu ergreifen und die Stoppmittel durch einen nachfolgenden Rückwärtshub des Kolbens außer Betrieb zu setzen, derart, daß das Stoppmittel den Kolben während des Injektionshubs nicht behindert.

5. Spritze nach Anspruch 4, bei welcher die Bohrung einen inneren Sitz an dem Körper bildet; wobei das Stoppmittel einen entfernbar angeordneten Anschlag (28) an dem inneren Sitz umfaßt; und wobei das Stoppeingriffsmittel (34) während des Vorbereitungsvorwärtshubs mit dem Anschlag derart in Eingriff ist, daß der Anschlag durch einen Rückwärtshub des Kolbens von dem Körper geschert ist.

6. Spritze nach Anspruch 3 und ferner umfassend: ein elastisches Bremsmittel (20) zum Verzögern des Rückziehens des innerhalb eines Raumes zwischen der Bohrung und dem Kolben angeordneten Kolbens, wobei das Bremsmittel an einem Element des Körpers (2) und des Kolbens (4) angeordnet ist und mit dem anderen Element des Körpers (2) und des Kolbens (4) in verschiebbarem Eingriff ist, um eine Bremskraft zu erzeugen, welche ausreichend ist, das Zurückziehen des Kolbens zu verzögern, jedoch nicht zu stoppen.

7. Spritze nach Anspruch 6, bei welcher das Bremsmittel ferner Bremsmodifizierungsmittel (8a) an dem Körper sowie zusammenwirkende Mittel (20) an dem Bremsmittel umfaßt; wobei das Bremsmodifizierungsmittel (8a) angepaßt ist, gegen die zusammenwirkenden Mittel (20) zu drücken, derart, daß eine Relativbewegung zwischen diesen während des Injektionshubs die Bremskraft nach dem Injektionshub reduziert.

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8. Spritze nach Anspruch 7, bei welcher die Bohrung Zonen mit unterschiedlichen Innendurchmessern (110, 116, 117) umfaßt; wobei Anschlagmittel (133) an dem Kolben vorgesehen sind, welche mit den Bremsmitteln während des Injektionshubs zu ergreifen sind; und wobei das elastische Bremsmittel (123) ein an dem Körper verschiebbares elastisches zylindrisches Element (123) umfaßt und Rippenelemente (125) aufweist, welche elastisch gegen den Kolben (101) drücken, um eine Bremskraft auszuüben, wobei das elastische zylindrische Element von dem Anschlagmittel in den Zonen unterschiedlicher Innendurchmesser in Längsrichtung bewegbar ist, um die Bremskraft an dem Kolben zu reduzieren.

9. Spritze nach einem der Ansprüche 3 bis 8 und ferner umfassend: eine Mehrzahl von drehbaren Fingern (111) innerhalb der Bohrung nahe dem vorderen Ende des Körpers, wobei die Finger elastisch radial einwärts gespannt sind, um eine im wesentlichen das vordere Ende des Körpers verschließende Iris zu bilden, wenn der Nadelhalter in die Bohrung gezogen ist.

10. Spritze nach einem der Ansprüche 3 bis 9, bei welcher die Bohrung eine Längsachse aufweist und ferner umfassend: Mittel (103) an dem Nadelhalter, welche relativ zu der Längsachse geneigt sind, um eine Nadel daran in einem Winkel zu der Längsachse zu neigen.

11. Spritze nach einem der Ansprüche 3 bis 10, bei welcher das Verbindungsmittel umfaßt: einen Vorsprung (129) an dem Ende des Kolbens (101) innerhalb der Bohrung (110); und eine komplementäre unterschnittene Ausnehmung (107) in dem Nadelhalter, welche von dem Vorsprung ergreifbar ist.

12. Spritze nach Anspruch 11 und ferner umfassend: einen sich radial erstreckenden Halteflansch (108) an dem Nadelhalter; ein komplementäres Nadelhaltereingriffsmittel (109) innerhalb der Bohrung, welches den Halteflansch lösbar ergreift, sowie zusammenwirkende Mittel (131) an dem Kolben und dem Nadelhalter zum Freigeben des Halteflansch aus dem komplementären Eingriffsmittel nach einer Verbindung des Vorsprungs mit der unterschnittenen Ausnehmung.

Revendications

1. Seringue comprenant un corps (2), un plongeur (4) monté dans le corps, des moyens (24) pour connecter le plongeur à un support d'aiguille (6) à l'extrémité d'une course d'injection du plongeur, un retrait ultérieur du plongeur (4) retirant l'aiguille dans une position protégée à l'intérieur du corps, et des moyens de stockage d'énergie amorçables par la course d'insertion pour provoquer un tel retrait du plongeur et de l'aiguille après la course d'injection, caractérisée en ce que :

les moyens de stockage d'énergie comprennent une chambre à vide (18) définie entre le plongeur (4) et le corps de seringue (2), un vide étant créé à l'intérieur de la chambre (18) par un mouvement du plongeur pendant la course d'injection, ledit vide servant à retirer le plongeur et l'aiguille après que la pression d'injection sur ledit plongeur (4) soit retirée.

2. Seringue selon la revendication 1, dans laquelle la chambre à vide est définie entre un premier élément d'étanchéité (14) porté par le plongeur (4) vers ou près de son extrémité à l'intérieur du corps (2) et un deuxième élément d'étanchéité (16) porté par le corps (2) vers ou près de son extrémité distale du support d'aiguille (6) et entourant étroitement le plongeur, ledit mouvement du plongeur (4) pendant la course d'injection conduisant lesdits premier et deuxième éléments d'étanchéité (14, 16) à s'écarter l'un de l'autre.

3. Seringue selon la revendication 1, dans laquelle

ledit corps (2) comporte une extrémité avant, une extrémité arrière, et un perçage s'étendant de l'extrémité avant à l'extrémité arrière ;

ledit support d'aiguille (6) est placé en glissement à l'intérieur dudit perçage à proximité de ladite extrémité avant ;

ledit plongeur (4) a une extrémité montée en glissement à l'intérieur dudit perçage dudit corps, ledit plongeur s'étendant hors de ladite extrémité arrière dudit corps ;

lesdits moyens de connexion (24) connectent ledit plongeur (4) audit support d'aiguille (6) à la fin d'une course d'injection dudit plongeur par une pression d'injection sur ledit plongeur ;

ledit premier élément d'étanchéité (14) sur ledit plongeur (4) s'étend radialement par engagement d'étanchéité coulissant avec ledit corps (2) ;

ledit deuxième élément d'étanchéité (16) sur ledit corps (2) est placé entre ledit premier élément d'étanchéité et ladite extrémité arrière dudit corps (2) et s'étend radialement avec engagement d'étanchéité coulissant contre ledit plongeur (4).

4. Seringue selon la revendication 3, comprenant de plus :

des moyens d'arrêt (24) sur ledit corps (2) adjacents à ladite extrémité arrière dudit corps destinés à arrêter le mouvement dudit plongeur (4) pendant une course préparatoire vers l'avant dudit plongeur (4) pour éviter que lesdits moyens de connexion (24) connectent ledit plongeur (4) audit support d'aiguille (6) à la fin de ladite course préparatoire ; et

des moyens de prise d'arrêt (34) sur ledit

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plongeur, adaptés pour se mettre en prise avec lesdits moyens d'arrêt lors de ladite course préparatoire vers l'avant et pour rendre lesdits moyens d'arrêt inopérants lors d'une course ultérieure vers l'arrière dudit plongeur, de sorte que lesdits moyens d'arrêt ne gênent pas ledit plongeur pendant la course d'injection.

5. Seringue selon la revendication 4, dans laquelle :

ledit perçage forme un siège interieur sur ledit corps ;

lesdits moyens d'arrêt comprennent une butée (28) placée de manière amovible sur ledit siège intérieur ; et

lesdits moyens de prise d'arrêt (34) se mettent en prise avec ladite butée pendant la course préparatoire vers l'avant, de sorte que ladite butée est arrachée dudit corps par une course vers l'arrière dudit plongeur.

6. Seringue selon la revendication 3, comprenant de plus :

des moyens de freinage élastiques (20) pour retarder le retrait dudit plongeur, placés dans un espace entre ledit perçage et ledit plongeur, lesdits moyens de freinage étant placés sur l'un dudit corps (2) et dudit plongeur (4) et se trouvant en prise coulissante avec l'autre dudit corps (2) et dudit plongeur (4) pour appliquer une force de freinage suffisante pour retarder mais non arrêter le retrait dudit plongeur.

7. Seringue selon la revendication 6, dans laquelle :

lesdits moyens de freinage comprennent de plus des moyens de modification de freinage (8a) sur ledit corps et des moyens de coopération (20) sur lesdits moyens de freinage; lesdits moyens de modification de freinage (8a) étant adaptés pour porter contre lesdits moyens de coopération (20) de sorte qu'un mouvement relatif entre eux pendant la course d'injection réduit ladite force de freinage après la course d'injection.

8. Seringue selon la revendication 7, dans laquelle :

ledit perçage comprend des zones ayant des diamètres intérieurs différents (110, 116, 117) ;

des moyens de butée (133) sont prévus sur ledit plongeur, pouvant se mettre en prise avec lesdits moyens de freinage pendant la course d'injection ; et

lesdits moyens de freinage élastiques (123) comprennent un élément cylindrique élastique (123) coulissant sur ledit corps et ayant des membrures (125) portant élastiquement contre ledit plongeur (101) pour exercer une force de freinage, ledit élément cylindrique élastique étant mobile dans le sens longitudinal à l'intérieur desdites zones de diamètres intérieurs différents par lesdits moyens de butée pour réduire la force de freinage sur ledit plongeur.

9. Seringue selon l'une quelconque des revendications 3 à 8, comprenant de plus :

une pluralité de doigts pivotants (111) à l'intérieur dudit perçage à proximité de ladite extrémité avant dudit corps, lesdits doigts étant pressés élastiquement radialement vers l'intérieur pour former un iris fermant substantiellement ladite extrémité avant dudit corps lorsque ledit support d'aiguille est retiré dans ledit perçage.

10. Seringue selon l'une quelconque des revendications 3 à 9, dans laquelle ledit perçage a un axe longitudinal, comprenant de plus :

des moyens (103) sur ledit support d'aiguille, inclinés par rapport audit axe longitudinal pour incliner une aiguille par-dessus selon un angle par rapport audit axe longitudinal.

11. Seringue selon l'une quelconque des revendications 3 à 10, dans laquelle lesdits moyens de connexion comprennent :

une protubérance (129) à ladite extrémité dudit plongeur (101) à l'intérieur dudit perçage (110) ;

un renfoncement complémentaire (107) en contre-dépouille dans ledit support d'aiguille pouvant se mettre en prise avec ladite protubérance.

12. Seringue selon la revendication 11, comprenant de plus :

sur le support d'aiguille, une bride de retenue (108) s'étendant radialement, des moyens complémentaires (109) de prise sur le support d'aiguille avec le perçage engageant de manière amovible la bride de retenue et des moyens de coopération (131) sur ledit plongeur et ledit support d'aiguille pour relâcher ladite bride de retenue desdits moyens de prise complémentaires après connexion de ladite protubérance avec ledit renfoncement en contre-dépouille.