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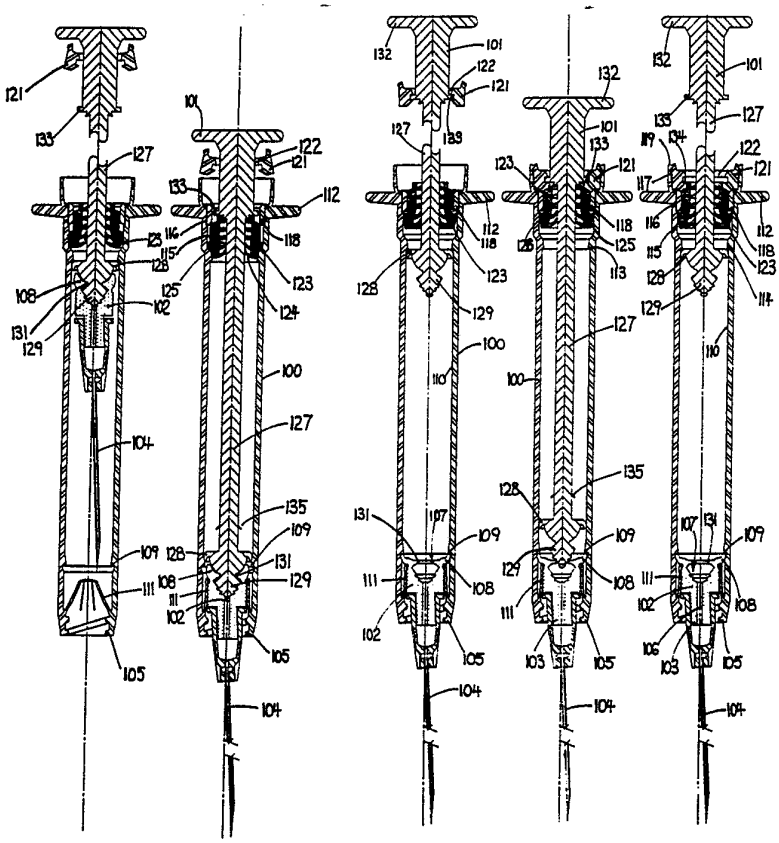
(54) Title: SYRINGE

(57) Abstract

A safety syringe for preventing "needle stick" injury and/or reuse of the syringe. The syringe comprises a body (2), a plunger (4) mounted within the body, connection means (24) for connecting the plunger (4) to a needle holder (6) carrying a needle at the end of an injection stroke of the plunger (4) whereby subsequent retraction of the plunger (4) withdraws the needle holder (6) and the needle into a shielded position within the body (2). The withdrawal of the plunger (4) is effected by 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 (9) during the injection stroke and serving to withdraw the plunger (4), the needle holder (6) and needle after injection pressure is removed. The syringe may be provided with braking means (20) to control the rate of withdrawal of the needle and/or to prevent withdrawal until the injection stroke of the plunger (4) has been completed.



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"SYRINGE"

FIELD OF THE INVENTION

The present invention relates to a syringe, and more particularly to a safety syringe for preventing contamination, fear of contamination and physical injury by "needle stick" by the syringe needle after use and/or for preventing reuse of the syringe.

BACKGROUND ART

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Numerous attempts have been made to design an acceptable syringe in which, after use, the needle is withdrawn into the body of the syringe and retained there in some manner.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. In its first

aspect the present invention is directed to an alternative arrangement for the automatic withdrawal of a syringe needle into the body of the syringe.

In the above proposals for automatic withdrawal of the plunger they have the disadvantage that immediately the positive manual pressure holding the plunger in a depressed condition is removed the spring will immediately commence the return of the plunger to its extended condition and simultaneously commence withdrawal of the needle into the body of the syringe. This could cause tissue tear and inadvertent and unwanted suction of blood into the syringe unless the operator consciously keeps the plunger depressed until the syringe is fully withdrawn from the patient's body. In a second aspect the present invention provides braking means to slow at least the initial rate of withdrawal of the needle into the body of the syringe.

DISCLOSURE OF THE INVENTION

According to a first aspect of 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, the energy storage means comprises 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 is removed.

According to a second aspect of 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, resilient braking means being disposed within the space defined between the body and the plunger, and being disposed on one of them and bearing against the other sufficiently to retard but not stop the withdrawal of the plunger and needle after the injection stroke.

In a preferred embodiment of the second aspect of the invention the resilient braking means is formed integrally with sealing means defining one end of the vacuum chamber of the first aspect of the invention. It is to be understood, however, that the resilient braking means could be applied to a syringe in which the energy storage means is other than a vacuum chamber.

It is preferred that the resilient braking means is moveable longitudinally of that one of the body and the plunger to which it is affixed so as to alter the braking force it applies to the other of those members. This allows the withdrawal of the plunger under the action of the vacuum chamber to be prevented until the completion of injection stroke of the plunger if desired.

In a third aspect the present invention consists in 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, stop means attached to the body or to the plunger to prevent depression of the plunger into the body sufficient to connect the plunger to the needle holder in a first stroke of the plunger into the body, engagement means on the

other one of the body or the plunger to engage the stop means upon completion of the first stroke of the plunger and to render the stop member inoperative upon a first retraction of the plunger to draw an injectable liquid into the syringe following the first stroke such that the plunger may be connected to the needle holder on completion of the following injection stroke.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be further described 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 upper half of the section showing the syringe in a condition prior to use and the lower half of the section showing the syringe in a condition at the end of its injection stroke, the lower half of the section also showing an alternative mounting for the syringe needle;

Fig. 2 shows 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 dose 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

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 lower part 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 lower 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 lower 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 forced 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, 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, the energy storage means comprises 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 is removed.

2. A syringe as claimed in claim 1 in which the vacuum chamber extends between a sealing member carried by the plunger at or adjacent its end within the body and a sealing member carried by the body at or adjacent its end distal to the needle holder and closely surrounding the plunger.

3. 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, resilient braking means being disposed within the space defined between the body and the plunger, and being disposed on one of them and bearing against the other sufficiently to retard but not stop the withdrawal of the plunger and needle after the injection stroke.

4. A syringe as claimed in claim 3 in which the braking means may be moved longitudinally of that one of the body

and the plunger on which it is disposed to alter the braking force it applies to the other of those members.

5. A syringe as claimed in claim 4 in which the braking means comprises a resilient cylindrical member disposed within the body and having engagement members resiliently bearing against the plunger, the cylindrical member being movable longitudinally along the body between zones of different internal diameter to alter the braking force it applies to the plunger.

6. A syringe as claimed in claim 1 or claim 3 in which stop means are provided on the syringe body to prevent complete depression of the plunger into the body until after the syringe has been filled with an injectable liquid.

7. A syringe as claimed in claim 1 in which the stop means comprises an abutment formed on the body of the syringe engageable by engagement means on the plunger when the plunger is first depressed and which abutment means may be sheared from the body by subsequent retraction of the plunger.

8. A syringe as claimed in claim 1 or claim 3 in which the means for connecting the plunger to the needle holder comprises a protruberance at the end of the plunger and a complementary undercut recess in the needle holder.

9. A syringe as claimed in claim 8 in which the needle holder is retained in place in the body by a radially extending flange engaged with complementary engagement means within the body, the connecting means being such that upon the connection of the protruberance with the undercut recess the flange is released from the complementary engagement means.

10. A syringe as claimed in claim 1 or claim 3 in which the syringe body includes adjacent the needle holder a plurality of fingers which upon the withdrawal of the needle into the body move radially inwardly at their free

ends to form an iris substantially occluding the end of the body through which the needle has been withdrawn.

11. A syringe as claimed in claim 1 or claim 3 in which a needle on the needle holder is disposed at an angle to the longitudinal axis of the syringe.

12. 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, stop means attached to the body or to the plunger to prevent depression of the plunger into the body sufficient to connect the plunger to the needle holder in a first stroke of the plunger into the body, engagement means on the other one of the body or the plunger to engage the stop means upon completion of the first stroke of the plunger and to render the stop member inoperative upon a first retraction of the plunger to draw an injectable liquid into the syringe following the first stroke such that the plunger may be connected to the needle holder on completion of the following injection stroke.

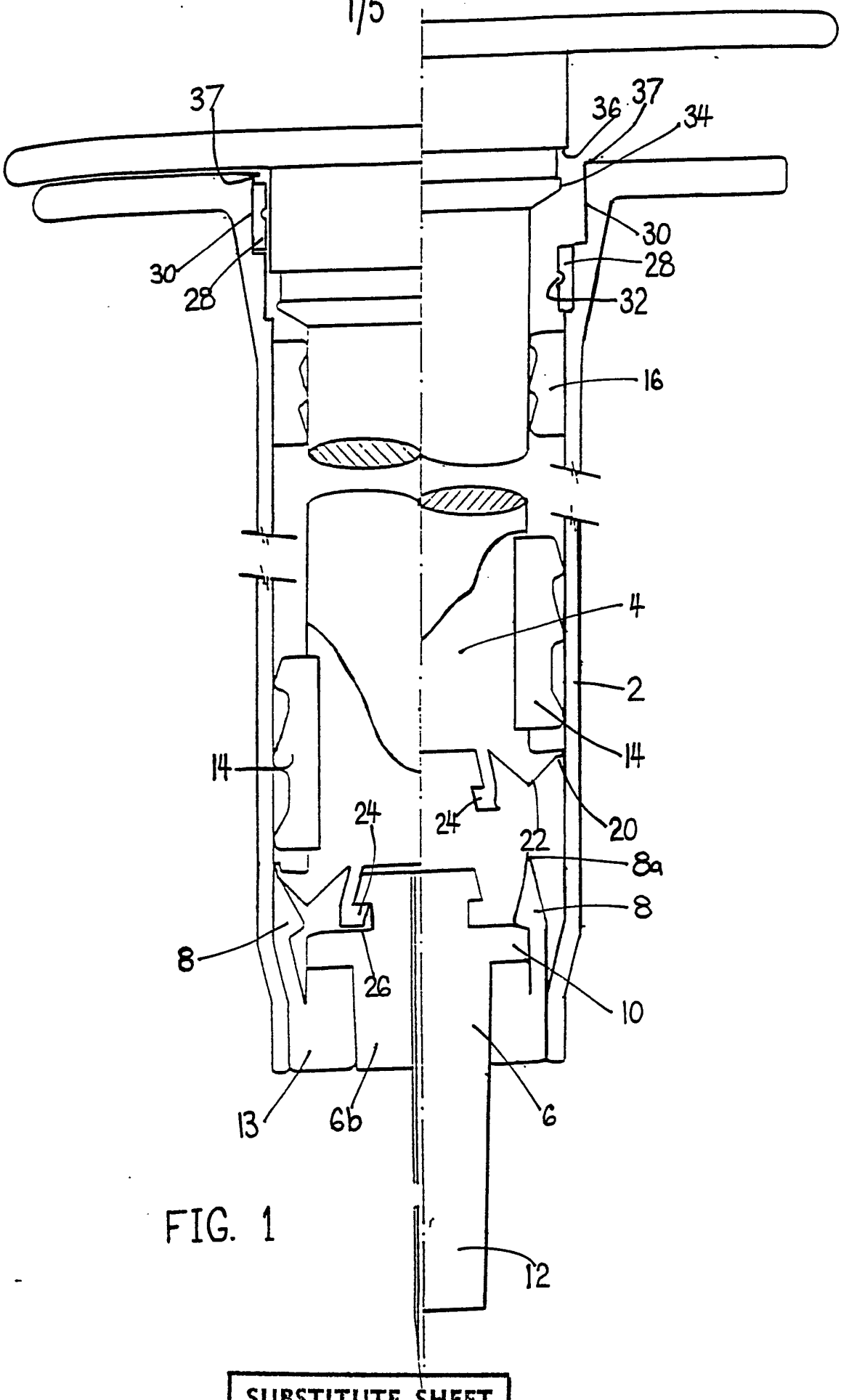


FIG. 1

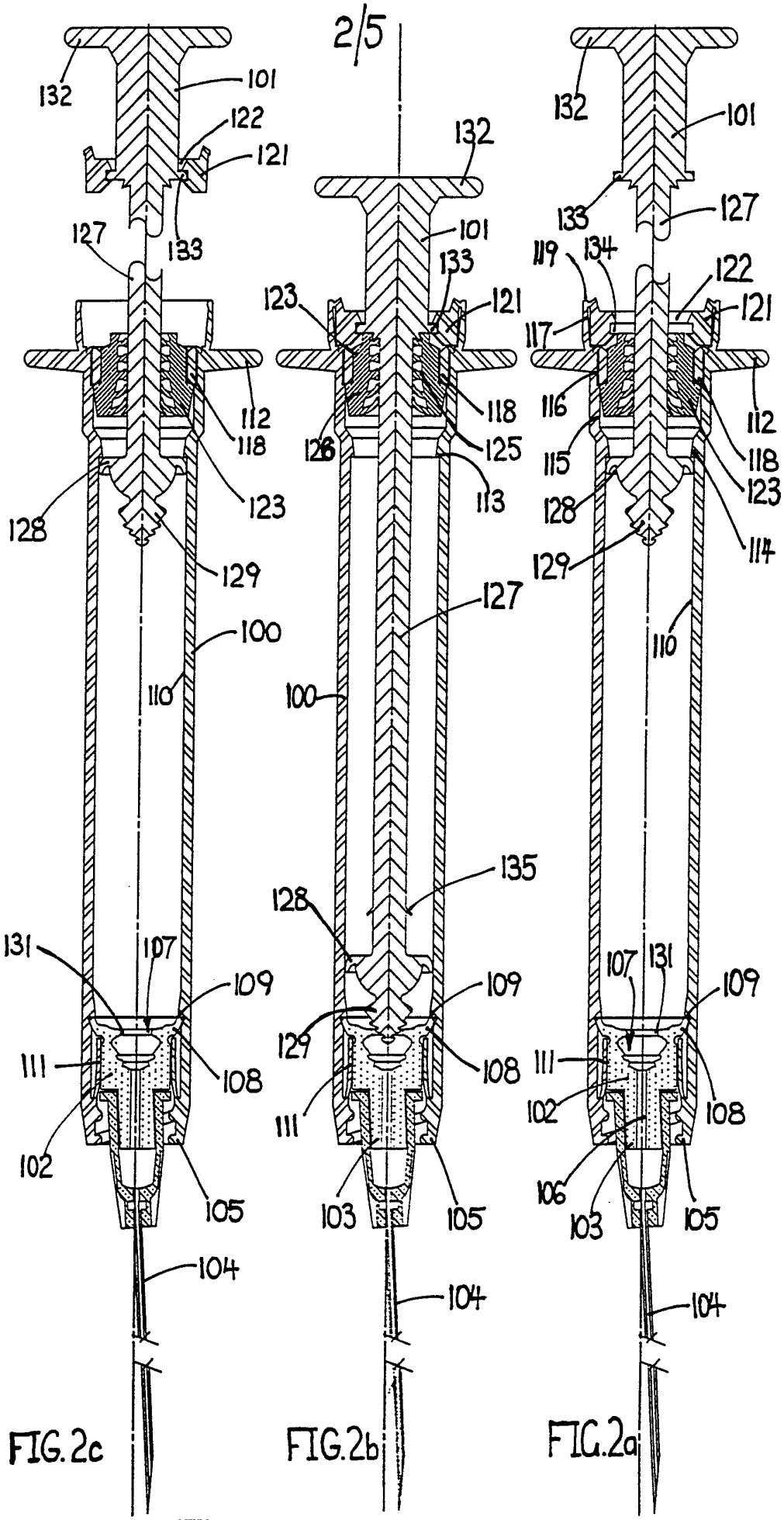
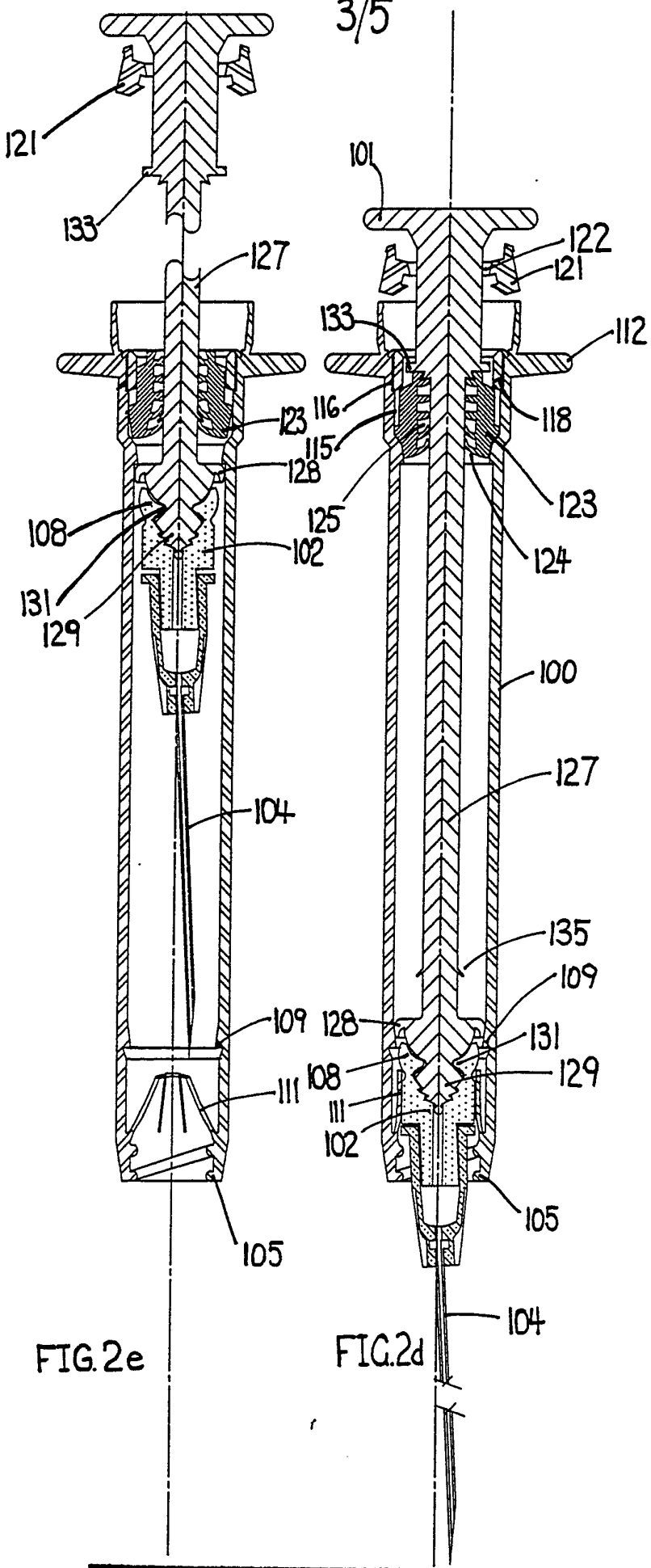


FIG. 2c FIG. 2b FIG. 2a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124
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135
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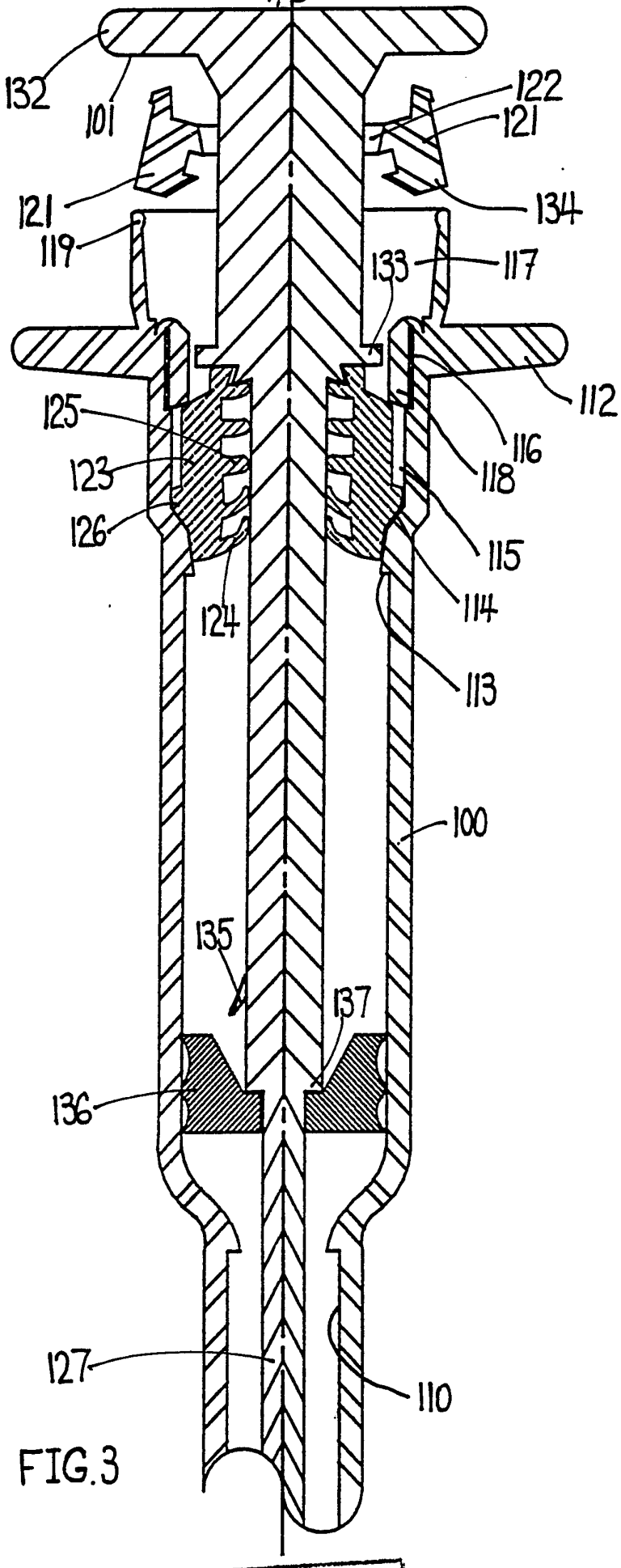
131
108
129
111
102
105
104

FIG. 2e FIG. 2d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127
110

FIG.3

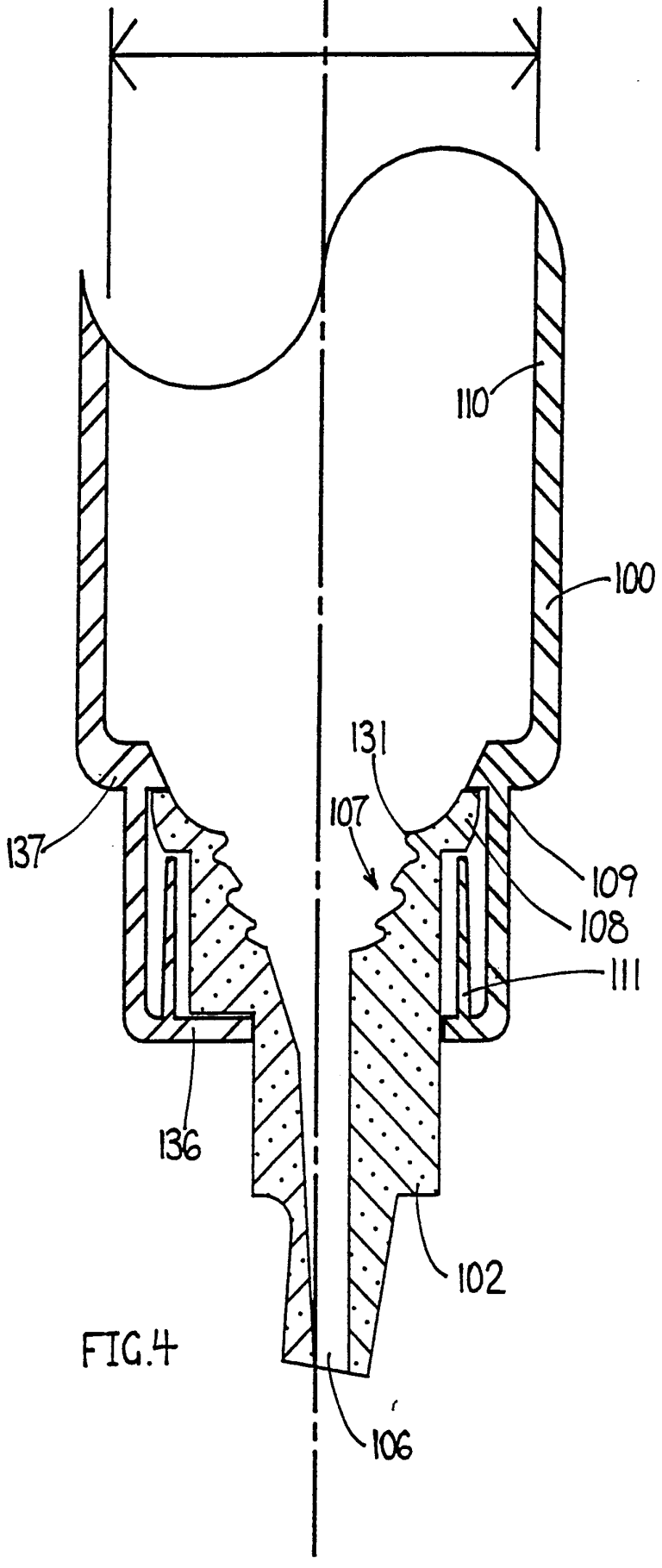

FIG.4

INTERNATIONAL SEARCH REPORT

International Application No. PCT/AU 90/00426

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) 6

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.[5] A61M 5/50, 5/315

II. FIELDS SEARCHED

Minimum Documentation Searched 7

Classification System	Classification Symbols
IPC	A61M 5/22, 5/32, 5/315, 5/50

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched 8

AU : IPC as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT 9

Category*	Citation of Document, [11] with indication, where appropriate, of the relevant passages 12	Relevant to Claim No 13
Y	GB,A, 789027 (HERTIG) 15 January 1958 (15.01.58) See page 1 lines 72-90	(3,8,9,10,11)
Y	GB,A, 874876 (ESCHMANN) 10 August 1961 (10.08.61) See page 2 lines 64-90	(3,8,9,10,11)
Y	EP,A, 326983 (VABIN INTERNATIONAL S.R.L.) 9 August 1989 (09.08.89) See page 3 lines 24-58 and page 4 lines 1-5	(3,8,9,10,11)
P,Y	EP,A, 347742 (VENTURINI) 27 December 1989 (27.12.89) See pages 3-7	(3,8,9,10,11)
P,Y	AU,B, 33933/89 (593513) (WAKELIN) 8 February 1990 (08.02.90) See page 5 lines 17-27 and page 6 lines 1-8	(3,8,9,10,11)

(continued)

* Special categories of cited documents: 10

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
15 November 1990 (15.11.90)	17 December 1990
International Searching Authority	Signature of Authorized Officer
Australian Patent Office	A HENDRICKSON

Form PCT/ISA/210 (second sheet) (January 1985)

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

A	US,A, 3669111 (DUBNER) 13 June 1972 (13.06.72) See entire document	(1-12)
A	US,A, 4246898 (TRAVELENT et al) 27 January 1981 (27.01.81) See claim 1	(1-12)
P,A	WO,A, 90/07350 (MULLER) 12 July 1990 (12.07.90) See pages 3-5	(1-12)

V. [ ] OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE 1

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.[ ] Claim numbers ..., because they relate to subject matter not required to be searched by this Authority, namely:

2.[ ] Claim numbers , because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3.[ ] Claim numbers ..., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4 (a):

VI. [X] OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING 2

This International Searching Authority found multiple inventions in this international application as follows:

Claims 1-2 are directed to a syringe utilizing vacuum to withdraw the plunger and needle. Claims 3-11 are directed to a syringe with resilient braking means between the body and the plunger to retard the withdrawal of the plunger and needle. Claim 12 is directed to a defeatable stop means on the body or plunger to prevent plunger and needle holder connection during injection stroke.

1.[ ] As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2.[ ] As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3.[ ] No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. [X] As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

[ ] The additional search fees were accompanied by applicant's protest.

[ ] No protest accompanied the payment of additional search fees.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL APPLICATION NO. PCT/AU 90/00426

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Members		
EP 326983	BR 8900503	CN 1038218	JP 2005972
	US 4955869	ZA 8900787	
EP 347742			
AU 33933/89			
US 3669111			
US 4246898	AR 221772	AU 60471/80	CA 1147627
	DK 3155/80	EP 22987	JP 56020465
	MX 148110	NO 802064	NZ 194395
	ZA 8004417		
WO 9007350	AU 48211/90	CN 1043876	NO 890027