

[54] SYRINGE

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[51] Int. Cl. A61m 5/00

[58] Field of Search.....128/220, 218 N, 218 M, 218 P, 128/218 D, 218 PA

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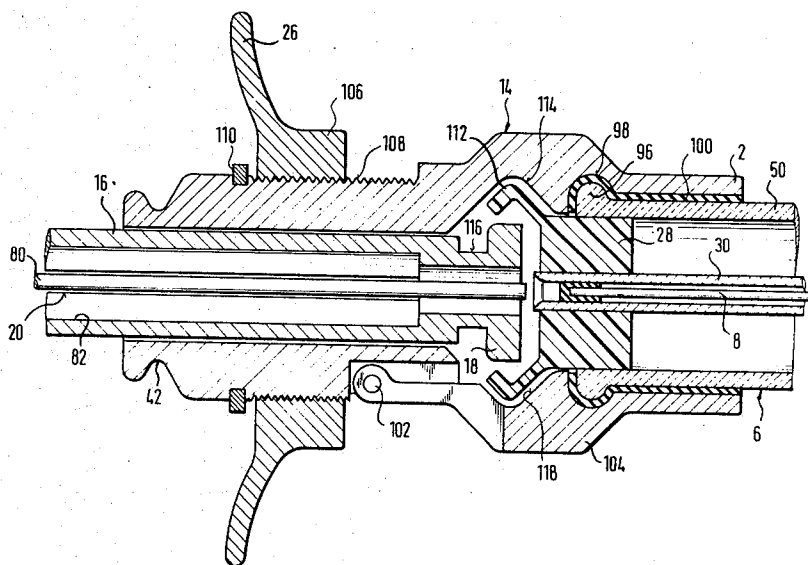
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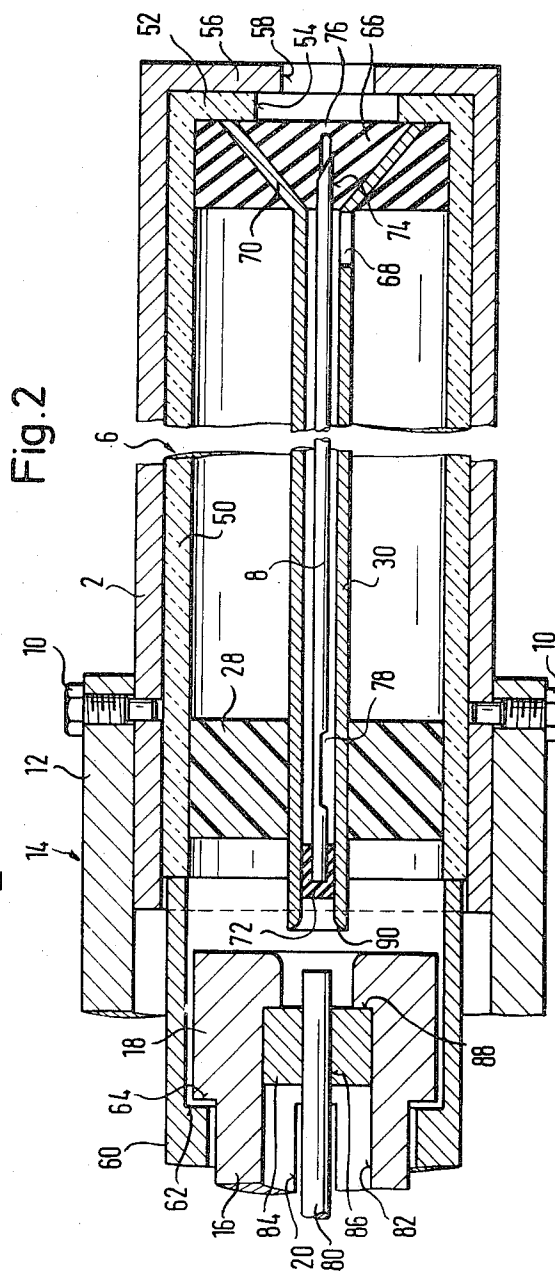
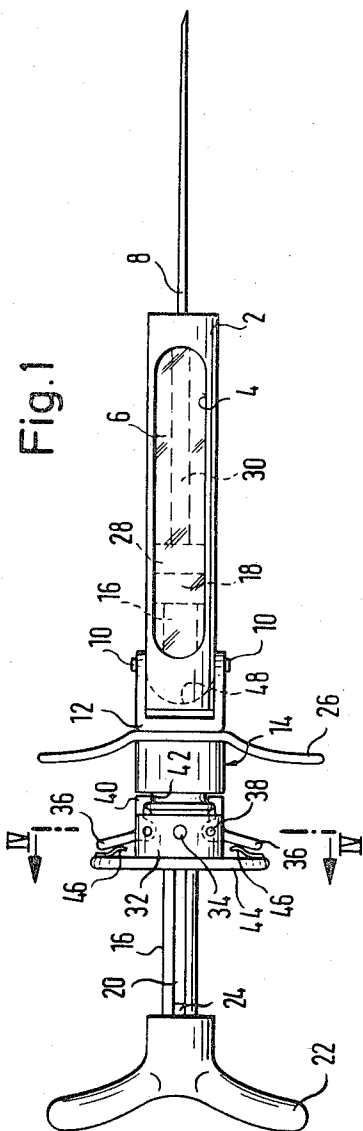
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[57] ABSTRACT

A hypodermic syringe comprising, a body assembly, a space being defined in said body, a preparation container receivable in said space, a tube extending through said preparation container, a hollow needle positioned within said tube, a seal on the end of said tube through which said needle is extrudable, an auxiliary plunger slidable within said body assembly and adapted to be moved into said tube to extrude said needle and an actuating plunger slidable within said body assembly and adapted to act on said container to expel said preparation through said extruded needle.

11 Claims, 6 Drawing Figures





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Fig. 3

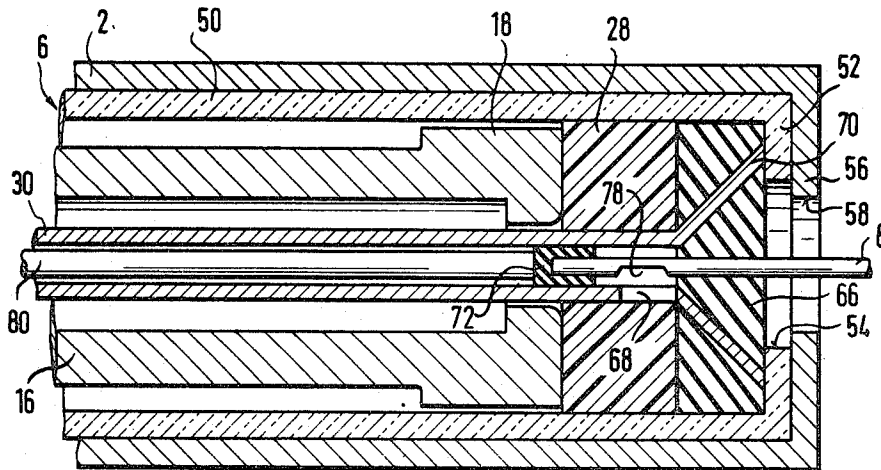
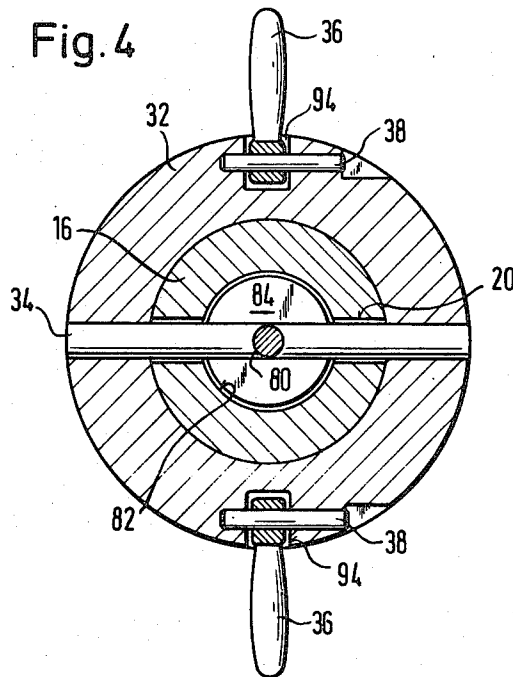


Fig. 4



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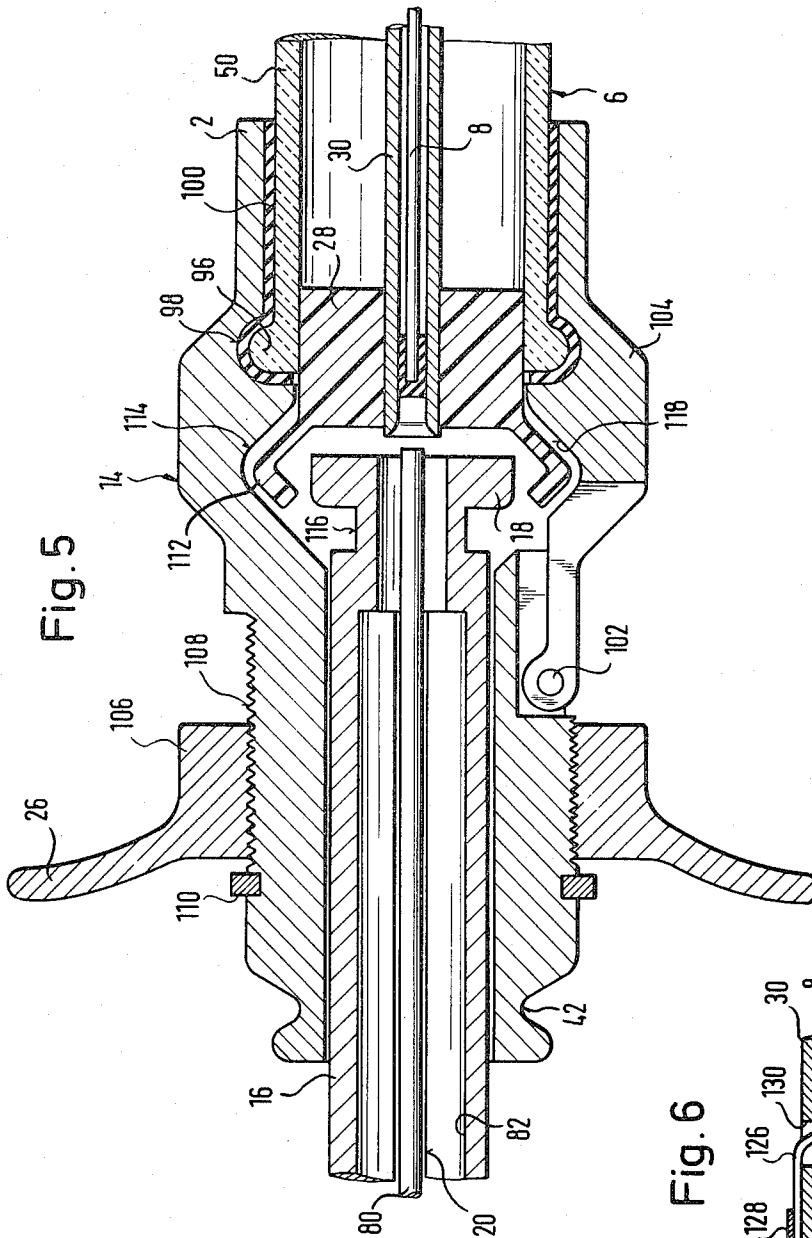
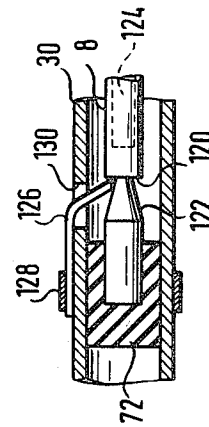


Fig. 6



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SYRINGE

The present invention relates to syringes, more especially hypodermic syringes for medicinal purposes, having associated preparation containers, which may be formed as interchangeable preparation cartridges.

In known hypodermic syringes it is difficult to manipulate the hollow needle and yet keep it sterile. When syringes are to be sterilized with the hollow needles fitted thereto, it is easy for the needles to become bent and be damaged. Handling and storage of such syringes is cumbersome. In many cases therefore it has become the custom to use hypodermic needles once only. Such single purpose hollow needles are packed sterile and supplied in a threaded holder which may be screwed on to a thread provided on the syringe. The connection with the preparation container of the syringe is effected in a conventional manner in that the rear end of the needle punctures an elastic front seal of the preparation container. Usually, in connection with single purpose needles, preparation containers in the form of interchangeable preparation cartridges are used which after use are discarded together with the needle. It is, however, necessary to remove the needle from its wrapping, screw it on to the syringe and after use to unscrew it again from the syringe. This is still relatively cumbersome and there is still the danger that the sterility of the needle may be lost as it is screwed to the syringe.

Syringes have also been known in which the complete syringe is intended to be used only once. In these syringes, which are made of a light plastics material, the needle is already firmly connected to the front end of the charged preparation container and is enclosed by a hood safeguarding the sterility, which hood is removed shortly before use. The hood or another packing part may be used as an actuating plunger and serve to push a plug sealing the rear end of the preparation container forward to force the preparation out of the needle. Such single purpose syringes, however, have the disadvantage that, when they are stored, the needle and its protecting hood occupies considerable space.

The object of the invention is to form a syringe and an associated preparation container so that difficulties with regard to the needle are overcome and such that the syringe can be changed for use without endangering the sterility thereof.

To solve the problem posed, the syringe of the present invention comprises an actuating plunger for pushing a plug forward in a preparation container, an auxiliary plunger adapted to be forwardly displaced parallel to but independently of the actuating plunger for sliding out a hollow needle held ready in the preparation container through the front seal of the preparation container, and an optionally releasable arresting device to retain the hollow needle in the advanced position.

In the syringe in accordance with the invention any handling of the needle is avoided; instead in preparation of the syringe, the only parts handled are those which need not be sterile. Moreover, the advancing of the auxiliary plunger is a simple operation requiring no manual dexterity.

In a further development of the invention an arresting device may engage the hollow needle or a part connected therewith.

In an alternative embodiment of the invention, the arresting device engages the hollow needle or a part connected therewith and locks the auxiliary plunger in the advanced position. This feature, which may also be used together with the initially described locating device on the hollow needle, has the advantage that the preparation container and the parts appertaining thereto can have greater tolerances and can be of simpler structure.

A further advantageous feature of the invention is that the arresting device is adapted to be engaged such that no special handles are required to retain the needle in the advanced position. The arresting device is preferably optionally releasable.

In a further development of the invention, the auxiliary plunger may be slidably mounted in the actuating plunger and actuated through a slot formed in the actuating plunger. Thus, the auxiliary plunger, preferably at its rear end, is secured to a

block mounted on the actuating plunger. This construction is particularly simple and easy to manipulate. In accordance with the invention the arresting device may be provided with catch elements adapted to be engaged with one another. These catch elements can be provided on the block and on a component supported against the preparation container. More especially, it is preferable for at least one stop member, displaceable by hand in the direction of release, to be mounted on the block and pre-tensioned in the stop direction. This causes the arresting device to be automatically engaged after the block has been completely advanced and the auxiliary plunger mounted thereon. Thus, the advanced needle is retained in its position of use.

A syringe in accordance with the invention in which the preparation container is formed as an interchangeable preparation cartridge, can in a further development of the invention be characterized by a hingeable seal adapted to be locked in a closed position to receive the preparation cartridge. The seal can have a hingeable half and have profiling provided therein which engages the preparation cartridge.

The syringe can be adapted to be filled by preparations by profiling the front end of the actuating plunger, such that this profiling engages with corresponding profiling on the plug in the preparation cartridge, when this plug is advanced.

To solve the problem posed, the invention uses a further preparation container, in the form of an interchangeable preparation cartridge which is provided with a seal closing the front end thereof. The cartridge being connected to a hollow needle and having a plug sealing the rear end thereof, the plug being displaceable therein. In accordance with the invention this preparation cartridge for use in the syringe of the invention, is characterized by the feature that, when the preparation cartridge is not yet in use, the hollow needle is located in the interior of the preparation cartridge so as to be forwardly displaced. This is an important feature of the present invention as it means that a separate packaging and separate space requirement for the needle can be dispensed with and that the preparation of the syringe does not necessitate in any way any handling of the sterile needle.

In a further development of the invention it is expedient for the hollow needle to be guided in the interior of the preparation cartridge, a stationary tube is provided which passes with a seal through the plug, the latter being displaceable on the tube, and the rear end of the hollow needle is mounted in a closure plug tightly sealing the rear of the tube and mounted with a seal slidably in the tube. This construction provides particularly reliable guidance and sealing for the needle. It is thus expedient to provide openings at the front end of the tube adjacent the front seal and in the hollow needle near to the closure plug. These openings connect the interior of the tube with the interior of the preparation cartridge or the interior of the hollow needle with the interior of the tube.

The tube is conveniently anchored in the front seal of the preparation cartridge. It is expedient to laterally support the tube in the radial direction in the wall of the preparation cartridge.

To facilitate ejection of the needle, the front end of the hollow needle is mounted in a recess of the closure, sealed by an easily punctured thin wall.

In order, in a simple manner, to enable preparations to be induced into the preparation container, the plug sealing the rear end of the preparation cartridge is provided with claw-like projections which, when the plug is advanced by engaging in the wall of the preparation cartridge, are retained in an inwardly folded position. In this manner the claw-like projections co-operate with the correspondingly profiled actuating plunger of the syringe and lock. The preparation cartridge is preferable provided with a locking profile, which may comprise a groove extending in a peripheral direction.

The invention will be described further, purely by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a schematic side view substantially in natural size, of a syringe in accordance with the invention having an interchangeable preparation cartridge; the needle being shown in its advanced operational position;

FIG. 2 is an enlarged schematic sectional view of the front end of the syringe shown in FIG. 1, the needle and the actuating plunger, however, being shown in their retracted position;

FIG. 3 is also an enlarged schematic sectional view through the front end of the syringe, the needle and the actuating plunger being advanced to their momentary end positions;

FIG. 4 is a section taken on the line IV—IV of FIG. 1;

FIG. 5 is a schematic sectional view of the center portion of an alternative embodiment of a syringe in accordance with the invention;

FIG. 6 is a schematic fragmentary section of a modified embodiment, in which the arresting device engages the hollow needle.

The syringe shown in FIG. 1, substantially in natural size, operates in known manner. The preparation container is an interchangeable preparation cartridge. For syringes having fixedly mounted preparation containers, more especially single purpose syringes, the following statements apply.

A cylinder 2 supports the preparation cartridge 6. Elongated viewing openings 4 are provided so that the level of the preparation in the cartridge 6 can be observed. In the position of use shown, a hollow needle 8 connected to the front end of the preparation cartridge 6 projects from a front opening provided in the cylinder 2. At its rear open end the cylinder 2 by means of pins 10 is pivotally mounted about a transverse axis in a bifurcated part 12 of a seal 14. An actuating plunger 16 moves within the seal 14. The thickened front end 18 of the plunger 16 can be inserted into the cartridge 6. In the embodiment shown in FIG. 1, a longitudinal slot 20 extends through the actuating plunger 16 throughout its whole length. The rear end of the actuating plunger is anchored in a grip 22, and at this point the slot 20 is filled with a key 24. The seal 14 is provided with a handle 26.

FIG. 1 shows the position of use of the syringe, in which the cylinder 2 is coaxial with the actuating plunger 16, and the actuating plunger 16 is partially advanced (in FIG. 1 the forward direction is to the right). It is shown that the front end 18 of the actuating plunger has pushed forward a plug 28 which was originally located in the rear end of the preparation cartridge 6, so that a corresponding part of the preparation in the cartridge 6 has been emptied through the hollow needle 8. (In FIG. 1 the backward direction is to the left). FIG. 1 also shows a tube 30 extending through the preparation cartridge 6. The actuating plunger 16 has a longitudinal bore (not shown in FIG. 1), which receives the tube 30 as the plunger 16 moves forward. As explained in more detail hereinafter, the hollow needle is protected by the tube 30 while the preparation cartridge 6 is out of use. An auxiliary plunger, not shown in FIG. 1, mounted in the longitudinal bore of the actuating plunger 16 is used to slide the hollow needle 8 out of the tube 30 and into the operational position shown in FIG. 1. At its rear end the auxiliary plunger is anchored on a block 32. The block 32 is slidably mounted on the actuating plunger 16 and is engaged therewith by means of a rib 34 which passes from the block 32 and through the slot 20 of the plunger 16. When the block 32 has been completely displaced into the right hand end position shown in FIG. 1, it engages the seal 14 so that the auxiliary plunger and hence also the hollow needle 8 are locked in their position of use. The locking device contains interengaging catch elements. In the embodiment shown in FIG. 1 two stop levers 36 are mounted in the block 32 and are rotatable about pins 38. The front ends 40 of the levers 36 are hook-shaped, and these ends engage a groove 42 formed in the seal 14.

The rear ends of the stop levers 36 project from the block 32 and are resiliently supported against a gripping plate 44. Leaf springs 46 connected the plate 44 to the block 32 and serve to pre-tension the stop levers 36 in the stop position shown in FIG. 1. In the stop position, the block 32 is con-

nected to the seal 14. It is readily seen from FIG. 1 that the locking between block 32 and the seal 14 is released when, during retraction of the block 32 with the fingers, the stop levers 36 are urged against the grip plate 44.

When a new preparation cartridge 6 is to be inserted, the stop levers 36 and the block 32 with the auxiliary plunger mounted thereon (not shown in FIG. 1) and also the actuating plunger 16 are slid completely to the rear (to the left in FIG. 1). After all the parts protruding from the seal 14 into the cylinder 2 have been withdrawn, the cylinder 2 can be pivoted about the pins 10 through about 90°, so that the rear open end of the cylinder 2 becomes accessible for the removal or insertion of a preparation cartridge 6. In FIG. 1 the definition 48, located on the other side of the plane of the drawing of the bifurcated part 12 of the closure 14, is indicated in broken lines. This definition 48 serves as a stop for the cylinder 2, both in the ready for use position shown and in the position swung about through 90°. A detailed description of the swiveling operation is dispensed with, since it is used in the same manner in known syringes.

FIG. 2 shows on an enlarged scale a longitudinal section through the cylinder 2 after a fresh preparation cartridge 6 has been inserted and the cylinder 2 has been swiveled back into the position of FIG. 1, with the cylinder 2 coaxial to seal 14 and the actuating plunger 16. In the example shown the cylindrical side wall 50 of the cartridge 6 merges at the front in an annular end wall 52 which has a central opening 54 for the passage of the needle 8. The end wall 52 in the operating position shown is supported against the annular end wall 56 of the cylinder 2, in which a central opening 58 is provided for the passage of the needle 8. At its rear end the cartridge 6 is engaged by a sleeve 60 which is resiliently pre-stressed forwardly (to the right in FIG. 2) and urged forwards. The sleeve 60 has an inner projection 62 which may engage with a step 64 of the actuating plunger 16, so that by drawing the actuating plunger 16 back the sleeve 60 can be drawn to the rear against its pre-tension force until it no longer enters the cylinder 2 and hence the cylinder 2 can be swiveled about the pins 10. These details are also found in known syringes.

The cartridge 6 is sealed at its front end by a seal 66 of elastomeric material which is supported against the end wall 52, and at its rear end by the plug 28 already mentioned. The tube 30, also mentioned above, passes through the plug 28. The plug 28 is displaceable with the seal along the tube 30. The front end of the tube 30 has an opening 68 directly adjacent the front seal 66. In the embodiment shown the tube 30 in the seal 66 continues in shanks 70 extending diagonally outwards. This causes the tube 30 to be supported on the end wall 52, so that a stress occurring in the longitudinal direction of the tube 30 is not absorbed by the seal 66, but by the end wall 52. This is expedient in that it gives more freedom in the choice of material.

Before use of the cartridge 6, the hollow needle 8 is located in the manner shown in FIG. 2 within the tube 30. At its rear end the needle 8 is supported and sealed by a closure plug 72 and at its front end by the seal 66. The seal 66 has a central recess 74 which is closed at the end by a thin wall 76. At its rear end, near the plug 28, the needle 8 has an opening 78. Directly before use of the syringe the needle 8 is slid out of the cartridge 6 through the thin wall 76. This is achieved by the auxiliary plunger 80 which is slidably mounted in the actuating plunger 16. The actuating plunger 16 has an axial bore 82 in which a spacer 84 is slidably mounted. The auxiliary plunger 80 is located within a bore 86 of the spacer 84. The spacer 84 cannot fall from the bore 82 as projections 88 are provided at the front end of the actuating plunger 16. The tube 30 has at its rear end a funnel-shaped inside surface 90 which facilitated the insertion of the auxiliary plunger 80 into the tube 30. The spacer 84 may be moved forwardly together with the plungers 16 and 80 (to the right in the Figs.), until it makes contact with the rear end of the tube 30. In this end position the spacer 84 does not prevent the progressive movement of the plungers 16 and 80, since it is mounted so as to be axially movable between these plungers.

When the auxiliary plunger 80 is forced forwardly (to the right in the Figs.), it passes through the funnel-shaped inside surface 90 in the tube 30 and presses the closure plug 72, together with the needle 8, to the right. With this the front end of the needle 8 punctures the thin wall 76. The resilient seal 66 encloses the needle with a sealing effect.

FIG. 3 shows the position of the needle 8 at the end of the forward feed path of the auxiliary plunger 80. The opening 78 at the rear end of the needle then lies substantially opposite the opening 68 at the front end of the tube 30. In this position the auxiliary plunger 80 is arrested by the engagement of the block 28 on the seal 14 (see FIG. 1). After this the hollow and slotted actuating plunger 16 may be advanced. Thus, the plunger 16 moves with radial clearance over the tube 30 and urges the plug 28 forwards. This causes the preparation to be forced out of the cartridge, flowing through the openings 68 and 78. In FIG. 3 the possible end position of the actuating plunger 16 is shown; the plug 28 is thus supported against the seal 66, and the preparation cartridge 6 is practically completely empty.

FIG. 4, by way of a schematic radial section, shows the block 32 with the actuating plunger 16 guided therein, in the axial bore 82 of which the auxiliary plunger 80 and the spacer 84 are mounted. The auxiliary plunger 80 is fastened to rib 34 passing through the block 32. Furthermore FIG. 4 also shows the stop levers, the grooves 94 serving to receive them and the bearing pins 38.

FIG. 5 shows an alternatively possible embodiment in which the cylinder 2 only encloses a part of the preparation cartridge 6, so that the front end of the cartridge 6 is exposed. In this embodiment a part of the cylinder 2 merges integrally in the seal 14. At its rear end (left in the Figs.), the cartridge 6 has an external annular bead 96 which fits into a corresponding annular groove 98 in the seal 14. This annular groove and the inside surface of the cylinder 2 adjacent thereto are lined with an elastomeric coating 100 and form a profiling engaging the preparation cartridge 6 with a retaining effect.

The insertion of the cartridge 6 is made possible in the embodiment of FIG. 5 as the cylinder 2 has a part 104 adapted to be folded over. In the folded over position shown the part 104 can be arrested. As example of a possible arresting device FIG. 5 shows an arresting ring 106 which is adapted to be screwed axially onto a thread 108. It is, of course, also possible to use other arresting devices. The handle 26 appertaining to the seal 14 is herein provided in the arresting ring 106. The arresting ring 106 is secured to the left by a spring ring 110.

FIG. 5 shows a further, independently usable feature which makes it possible to use the syringe not only for ejecting but also inducing preparations. For this purpose the plug 28 sealing the rear end of the cartridge 6 is provided with profiling in the form of claw-shaped extensions 112, which normally extend diagonally outward, as shown in the Figs. The seal 14 has a corresponding annular recess 114 to receive the claw-like extensions 112. The claw-shaped extensions 112 in the inoperative position (FIG. 5) project outward to such an extent that the front end 18 of the actuating plunger 16 can be slid forward unobstructed to the rear end wall of the plug 28. Behind the front end portion 18 in the actuating plunger 16 a profiling in the form of an annular groove 116 is provided, which is large enough to receive the claw-like extensions 112. When the actuating plunger is slid forward (to the right in the Figs.), it presses the plug 28 forward. Thus, the claw-shaped extensions 112 are pressed inward, so that they are supported and locked in the annular grooves 116 of the plunger 16, by the inclined inside surfaces 118 of the recesses 114 and by the engagement of the cartridge 6 with the wall 50.

The claw-shaped extensions 112 remain in this locked position whenever the plug 28 is located in the interior of the preparation cartridge 6. When the actuating plunger 16 is withdrawn, the plug 28 is retracted and hence a new charge can be induced into the preparation cartridge 6. As soon as the plug 28 has resumed the position shown in FIG. 5, the claw-like extensions 112 on account of their resilience again move out of the annular groove 116 and hence out of the path of the actuating plunger 16.

In syringes having a fixed and not an interchangeable preparation chamber there are simplifications in the design due to the omission of the structural details necessary for insertion and removal of the cartridges.

FIG. 6 shows schematically a possible embodiment of an arresting device which engages the needle 8. The hollow needle 8 is movably arranged in the tube 30 and at its rear end is secured by the closure plug 72. The needle 8 has a stop groove in its rear end section, the groove being defined by a steep shoulder 120 and by a conical surface 122. The hollow space 124 of the needle 8, indicated in broken lines, preferably ends in front of the stop groove, as shown. At the front end section of the tube 30 a resilient stop pawl 126 is secured by means of a ring 128. The front end of the stop pawl projects diagonally through an opening 130 into the interior of the tube 30. During the forward feed of the needle 8 the front end of the stop pawl 126 slides along the needle 8 until finally engaging in the stop groove 120, 122. After this a withdrawal movement of the needle is no longer possible. The conical surface 122 permits a certain tolerance in the path of the needle or of the auxiliary plunger (not shown in FIG. 6). When the needle is advanced a short distance beyond the engaging point, the stop pawl 126 slides further along the conical surface and then the needle can be moved back again until the stop pawl 126 engages with the steep shoulder 120. Often, however, a simple, tolerance-free engagement will also be satisfactory; in this case, for example, a stop groove steeply defined in both directions can be used.

It is obvious that the arresting device shown in FIG. 6 or the like may also be so constructed that it does not engage the needle directly but a part connected thereto, for example, the closure plug 72.

I claim:

1. A hypodermic syringe comprising, in combination, a body assembly, an elongated preparation container having a fixed sealed end and a movable sealed end mounted on said body assembly, a tube in communication with and extending through said preparation container disposed substantially within the length thereof and fixed with respect thereto, a hollow needle slidably positioned with said tube sealingly extrudible through said fixed sealed end, an auxiliary plunger slidably mounted upon said body assembly and adapted to be received within said tube to extrude said needle through said fixed sealed end, and an actuating plunger slidably mounted upon said body assembly and adapted to engage said container movable sealed end to expel the contents of said preparation container through said extruded needle.
2. A hypodermic syringe as recited in claim 1, further comprising locking means engaging said auxiliary plunger to lock said hollow needle in the extruded position.
3. A hypodermic syringe as recited in claim 2, wherein a hollow block is slidably mounted on said actuating plunger and one end of said auxiliary plunger is secured to said block.
4. A hypodermic syringe as recited in claim 3, wherein a stop member is mounted on said block and is adapted to be manually actuated in the direction of release.
5. A hypodermic syringe as recited in claim 1, wherein said preparation container is an interchangeable preparation cartridge, and a hingeable seal is affixed to said body assembly to receive said cartridge.
6. A hypodermic syringe comprising a body member, a preparation container supported within said body member, a preparation contained within said preparation container, a tube extending through said preparation container, a hollow needle positioned within said tube, a thin seal mounted across the front end of said tube, a first sealing plug mounted in the rear end of said tube, an opening in said needle near the rear end thereof, a hole in said tube near the front end thereof, a second sealing plug mounted in the rear end of said preparation container, a first longitudinal bore extending through said second sealing plug, said tube extending through said first longitudinal bore, a piston rod, a handle attached to the rear end of said piston rod, an elongated slot extending longitudinally along said piston rod, a piston attached to the front end of said

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piston rod, said piston adapted to slide into said preparation container into engagement with said second sealing plug, a block mounted around said piston rod, a rib extending through said block and in sliding engagement in said elongated slot, a second longitudinal bore through said piston, an auxiliary piston within said second longitudinal bore, the rear end of said auxiliary piston being attached to said block, said auxiliary piston being adapted to enter said tube and engage said first sealing plug, locking means attached to said block, such that when said block is slid forward said auxiliary piston moves forward into said tube and engages said first sealing plug, such that when said first sealing plug is moved forward and moves said needle forwardly, said needle breaks the thin seal and moves to its advanced position and is locked in this advanced position by said locking means, said hole in said tube and said opening in said needle being aligned in this advanced position said handle is then depressed such that said piston rod moves forward, moving said piston into engagement with said second sealing plug, said second sealing plug thus forces the preparation through the aligned hole in the tube and opening in the needle and the preparation is ejected through said needle.

7. A preparation cartridge comprising a body member, a

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tube extending through said body member, a hollow needle positioned within said tube, and a first sealing plug mounted in the rear end of said body member.

8. A preparation cartridge as recited in claim 7, further comprising a second sealing plug mounted in the rear end of said tube, a longitudinal bore extending through said first sealing plug, said tube extending through said longitudinal bore.

9. A preparation cartridge as recited in claim 8, further comprising a hole in said tube near the front end thereof and an opening in said needle near the rear end thereof, such that a connecting path is provided between the interior of the hollow needle and the interior of the body member.

10. A preparation cartridge as recited in claim 9, further comprising a thin seal mounted across the front end of said tube, a front opening in the body member adjacent the front end of the needle and a front seal sealing said front opening, said tube being supported by said front seal.

11. A preparation cartridge as recited in claim 10, further comprising laterally projecting claw-shaped extensions affixed to said first sealing plug adapted to be retained in a folded position by engagement with the body member.

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