

[54] **HYPODERMIC SYRINGE**
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 [58] Field of Search.128/218 G, 218 F, 218 D, 218 DA, 128/218 R, 216, 215, 220, 223, 224, 230, 218 M, 213, 235, 173 H, 218 A

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[57] **ABSTRACT**

A hypodermic syringe which is provided with a relatively small injection chamber the volume of which is adjustable and from which an injection solution such as insulin or the like may be ejected by a piston through a hypodermic needle, and with a second relatively larger chamber, for example an ampoule, which is adapted to hold a relatively large supply of the injection solution and from which the injection chamber may be filled repeatedly for several injections.

10 Claims, 2 Drawing Figures

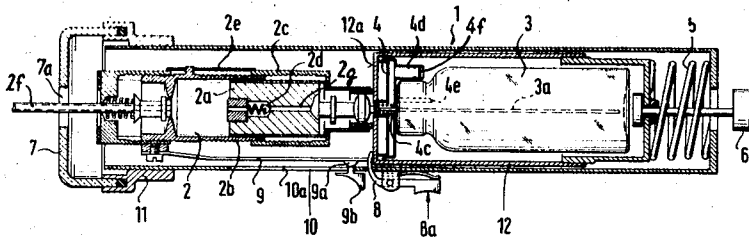


Fig. 1

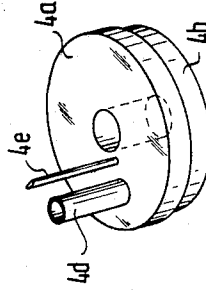
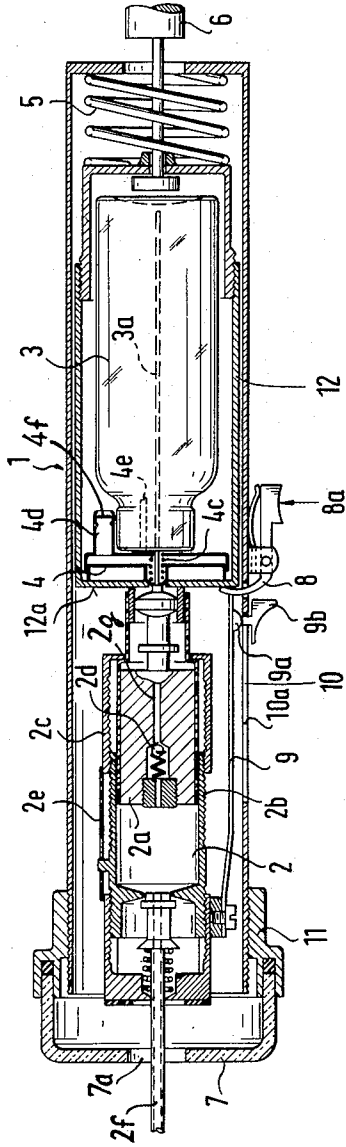


Fig. 2

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HYPODERMIC SYRINGE

BACKGROUND OF THE INVENTION

It is old in the art to provide a hypodermic syringe with a container having a supply of the injection solution from which the injection chamber of the syringe can be filled repeatedly. Syringes of this type typically are provided with an intermediate chamber which communicates at one side with a supply container and at the other side with the injection chamber in such a manner that, when the plunger is retracted, the injection solution is forced out of the intermediate chamber into the injection chamber while a return flow of the solution into the intermediate chamber is prevented by a one-way valve between the two chambers. This type of syringe however has the disadvantage of being complex in construction and is expensive to manufacture.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a hypodermic syringe of the above mentioned type which is relatively simple in construction and inexpensive to manufacture but which is positive and reliable in operation. To this end, the syringe of this invention is provided with an injection chamber which is adapted to serve also as a measuring chamber, the latter being connected with a supply chamber and with a pump which is associated with the supply chamber and operable by a plunger from outside the syringe.

Injection of the injection solution is carried out according to the present invention by releasing a main spring which first pushes the filled injection chamber forwardly to introduce the hypodermic needle and then pushes the injection piston forwardly within this chamber to inject a predetermined amount of the solution. In order for the two operations of piercing the hypodermic needle into the body of a human being or animal and of infusing the prescribed amount of the injection solution, the present invention provides that, before the injection piston can be pushed forwardly within the injection chamber, the injection chamber has to be pushed forwardly for a certain distance.

It is a most important advantage of the hypodermic syringe of this invention that, while it may generally have a similar tubular cylindrical shape, it is provided with a preferably exchangeable container for a larger supply of an injection solution and with a device for measuring the amount of this solution which is required for an injection and that it merely requires the simple manual actuation of a plunger to pass this required amount of the solution from the supply container to the injection chamber.

DESCRIPTION OF THE DRAWING

FIG. 1 is a longitudinal sectional view of a hypodermic syringe assembly embodying the invention, and

FIG. 2 is a perspective view of a pump forming a part of the syringe assembly.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As illustrated in the drawing, the hypodermic syringe of this invention comprises a main cylindrical outer casing or housing 1. Mounted on the forward end of the casing 1 is an injection cylinder 2b having a chamber 2 which contains a solution of insulin for example to be injected into a human being or animal through a hypodermic needle 2f carried by the cylinder 2b and extending forwardly thereof through an opening 7a in a cap 7 on the forward end of the casing 1. An injection piston 2a is axially slidable within the cylinder 2b and advancement of the piston 2a in the cylinder 2b ejects a predetermined amount of the solution in the chamber 2 through the needle 2f. The volume of chamber 2 is variable by means of an adjustable cap nut 2c threaded on the rearward end of the cylinder 2b. Thus, by varying the position of the cap nut 2c on the cylinder 2b it is possible to adjust the volume of the chamber 2 very accurately and thus the amount of injection

solution discharged therefrom. The adjusted setting of the cap nut 2c may be retained in any suitable or conventional way as by a locking spring 2e.

Behind the injection cylinder 2b, the syringe contains a supply container for the injection solution here shown in the form of a glass ampoule 3 which is confined in a cylindrical casing 12. When full, the ampoule 3 holds a supply of the injection solution which is sufficient for several injections. The injection solution is forced from the ampoule 3 into the chamber 2 through the discharge tube 3a of the ampoule and a connecting passage 2g in the piston 2a by a pump 4 interposed between the forward end of the ampoule and the adjacent end of the casing 12.

As shown particularly in FIG. 2, the pump 4 consists of a cup-shaped piston 4b which is mounted for reciprocation in a cup-shaped cylinder 4a and is held normally retracted by a central spring 4c. Air is admitted into the pump 4 through an air inlet duct 4d which is controlled by a check valve 4f and air under pressure is discharged from the pump into the ampoule through a tube 4e which preferably is in the form of a hollow needle. In practice, the needle-like tube 4e is adapted to pierce through the end of the ampoule 3 when the latter is introduced into the casing 12. A manually operable plunger 6 mounted and supported in reciprocation in the rearward ends of the casings 1 and 12 is movable against the ampoule 3 to push the latter against the pump 4 so as to advance the cylinder 4a on the piston 4b against the action of the spring 4c whereby to force air under pressure into the ampoule through the tube 4e. Air pressure in the ampoule 3 in turn forces solution liquid therein to discharge through the tube 3a and passage 2g past the check valve 2d into the injection chamber 2. Repeated operation of the plunger 6 assures that the chamber 2 is completely full of the liquid. Each time the plunger 6 is released, the internal spring 4c of the pump 4 retracts the pump cylinder 4a and the ampoule 3 to draw air into the pump through the inlet 4d to prepare the pump for the next operation of the plunger 6. During this action, the check valve 2d of course prevents any back flow of injection solution from the injection chamber 2.

The volume of the injection chamber 2 may be varied by adjustment of the cap nut 2c along a male screw thread on the cylinder 2b. Each complete turn or a specific part of a turn of the cap nut 2c results in a predetermined adjustment of the volume of the chamber 2 which may be indicated by a suitably graduated scale (not shown) on the nut. In practice, the cap nut 2c is adjustably positioned so that the person using the syringe may be sure that he will inject a desired predetermined amount of solution at each injection.

When the injection chamber 2 is filled, the injection may be carried out by placing the point of the hypodermic needle against the flesh of the person or animal and releasing the locking lever 8 from the bottom 12a of the inner casing 12 by the pressure of a finger upon the outer end 8a of lever 8 in the direction of the arrow. The main compression spring 5 acting upon the other end wall of the inner casing 12 then shifts this casing, the ampoule 3, the injection cylinder 2b and the piston 2a bodily forwardly in the outer casing 1 until the injection casing 2b engages the cap 7. During this action the needle 2f is driven into the flesh preparatory to the injection. Mounted on the outside of the injection cylinder 2b and butting against the casing 12 is a leaf spring 9 which holds the two cylinders 2b and 12 normally in fixed spaced relation. The spring 9 thus prevents forward movement of piston 2a in the cylinder 2b during initial advancement of the inner components of the syringe in the manner described above. However, after sufficient initial forward movement has occurred to insert the needle 2f a desired amount, the slide contact 9a carried by the spring 9 reaches a relatively wide place 10a in the slot 10. When this occurs, the leaf spring 9 snaps outwardly through the slot 10 and thereby releases the rear casing 12 so that it can move forwardly independently of and relative to the injection cylinder 2b. This action preferably occurs shortly before the time the injection cylinder 2b strikes the cap 7. In this connection, it

will be observed that the cap 7 is adjustable on the outer casing 1 to vary the amount of forward movement of the injection cylinder 2b and the depth of penetration of the hypodermic needle 2f. Manifestly, continued thrust of the spring 5 after release of the leaf spring 9 from the rear casing 12 and engagement of the front casing 2b with the cap 7 shoots the piston 4b forwardly in the chamber 2 to forcibly eject the contents of the chamber through the needle 2f.

When the injection has been completed, the rear casing 12 is pulled back by means of the plunger 6 until the locking lever 8 snaps into place against the front end 12a of the casing to hold the latter fully retracted and the leaf spring 9 is pressed back against the front wall 12a of the casing 12 by pressure on the key 9b to hold the two casings 2b and 12 again in fixed spaced apart relation. The plunger 6 can then be manipulated back and forth in the manner hereinabove described to pump another charge of injection liquid from the ampoule 3 into the injection chamber 2.

The front cap 7 of the syringe, according to the invention, preferably is made of transparent plastic and may be removably secured to the outer syringe casing 1, for example, by being clamped or screwed on the cap nut 11.

Although my invention has been illustrated and described with reference to the preferred embodiment thereof, I wish to have it understood that it is in no way limited to the details of such embodiment but is capable of numerous modifications within the scope of the appended claims.

I claim:

- 1. A hypodermic syringe comprising
 - a housing,
 - a slidable injection cylinder disposed in said housing and provided with
 - an injection chamber adapted to hold a relatively small, predetermined amount of an injection solution,
 - a hypodermic needle carried by said cylinder and extending outwardly through said housing,
 - a piston mounted for reciprocation in said injection chamber,
 - a container adapted to hold a relatively large supply of an injection solution mounted for independent reciprocatory movement in said housing adjacent to said cylinder,
 - valve controlled conduit means interconnecting said container and said injection chamber,
 - pump means in said housing having an air inlet communicating with the exterior of said container and an outlet communicating with said container operable by reciprocatory movement of said container to force the injection solution from the container into said injection chamber,
 - manually operable means for reciprocating said container to operate said pump, and
 - spring actuated manually controlled means operable to slide

said cylinder in said housing to insert said hypodermic needle in use and then to advance said piston in said injection chamber to eject said injection solution from said injection chamber through said hypodermic needle.

2. A hypodermic syringe as defined in claim 1 including means for varying the volume of said injection chamber and therefore the amount of injection solution ejected by said piston.

3. A hypodermic syringe as defined in claim 1 including adjusting means for varying the travel of said injection cylinder in said housing and consequently the insertion amount of said hypodermic needle.

4. A hypodermic syringe as defined in claim 2 wherein said volume varying means comprises a cap nut adjustably screwed on said injection cylinder, and means for maintaining said cap nut in a selected adjusted position.

5. A hypodermic syringe as defined in claim 1 wherein said pump means comprises two pump members telescopically slidable on each other, one of said members having said air inlet and said air outlet in the form of a hollow needle adapted to penetrate into said container.

6. A hypodermic syringe as defined in claim 5 including spring means for holding said pump members normally apart.

7. A hypodermic syringe as defined in claim 1 wherein said piston is operable by reciprocation of said container, and wherein said spring actuated means includes a main spring confined between said container and said housing adapted when released to effect a forward propulsion first of said injection cylinder, said container, and said piston simultaneously and subsequently forward movement of said piston in said injection cylinder to effect ejection of said solution from said injection chamber, means for loading said main spring and for holding it in loaded condition and means for releasing said main spring.

8. A hypodermic syringe as defined in claim 7 further including delaying means for insuring that said movement of said piston on said injection chamber will not occur until said injection cylinder has been moved a predetermined distance in said housing.

9. A hypodermic syringe as defined in claim 8 wherein said delaying means comprise a leaf spring secured to said injection cylinder guided in said housing and adapted to pivot away from the longitudinal direction of said cylinder through a slot in said housing and adapted initially to prevent relative movement between said container and said injection cylinder and then to permit such relative movement.

10. A hypodermic syringe as defined in claim 1, further including a cap nut adjustably mounted on said housing, and a transparent cap removably connected to said cap nut engageable by said injection cylinder to control the forward travel thereof in said housing.

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