United States Patent

Steiner

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[54] **HYPODERMIC SYRINGES, IN PARTICULAR SELF-INJECTING SYRINGES**

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[51] **Int. Cl.**.....**A61m 5/00,** A61m 5/20
[58] **Field of Search**.....128/218 R, 218 F

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[57] **ABSTRACT**

A hypodermic syringe having a body, an ampoule slidably mounted in said body and containing a liquid to be injected and having a front wall and rear inlet orifice. A needle is slidably carried by said ampoule and has a rear part adapted to pierce said front wall. A closure member for the inlet orifice is slidably mounted in the ampoule, and a plunger tube having an external diameter smaller than the internal diameter of the ampoule is slidably mounted in said body, and the tube is urged toward the closure member by a spring. A threaded nut is adjustably mounted on the tube and has an external diameter larger than the internal diameter of the ampoule to form a stop for the plunger and thereby to permit the injection of a predetermined amount of liquid.

4 Claims, 6 Drawing Figures

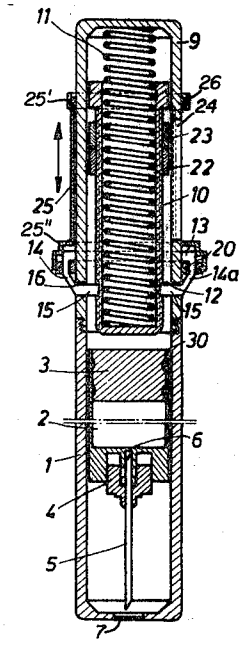


FIG. 1

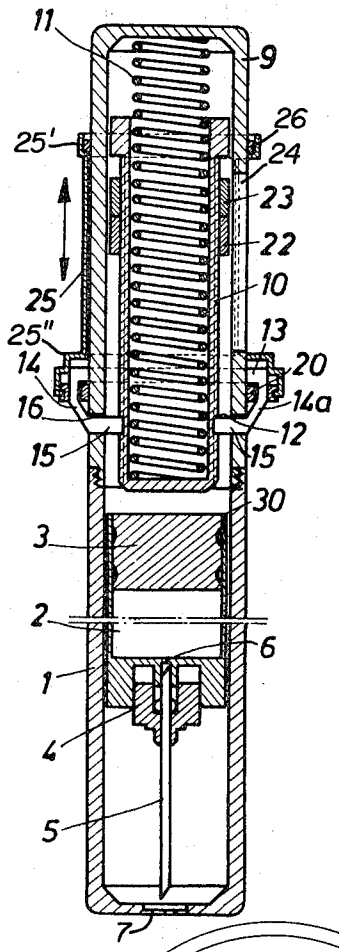


FIG. 2

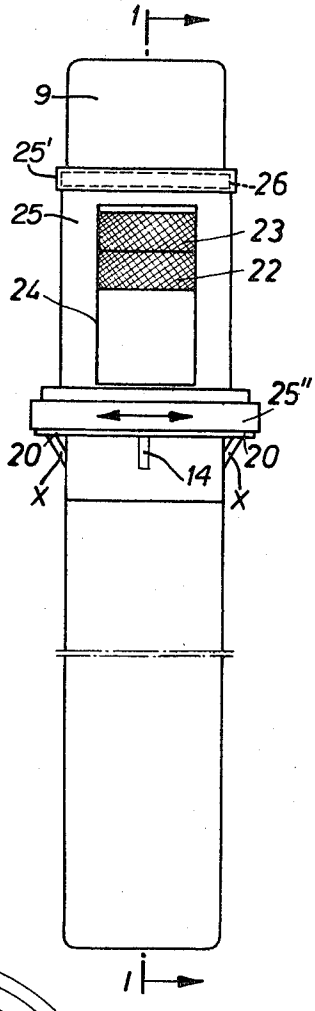


FIG. 5

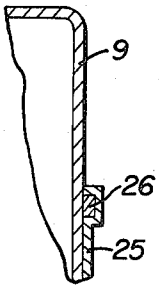
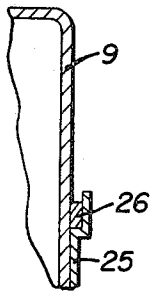


FIG. 6



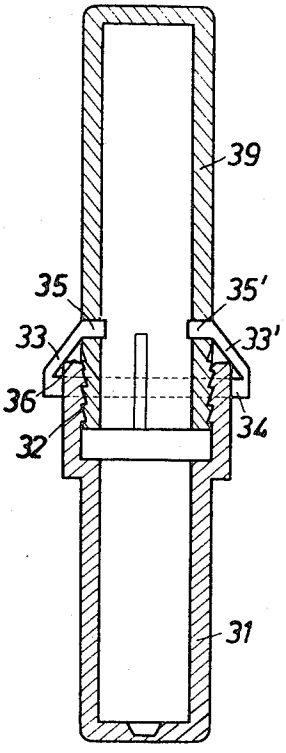
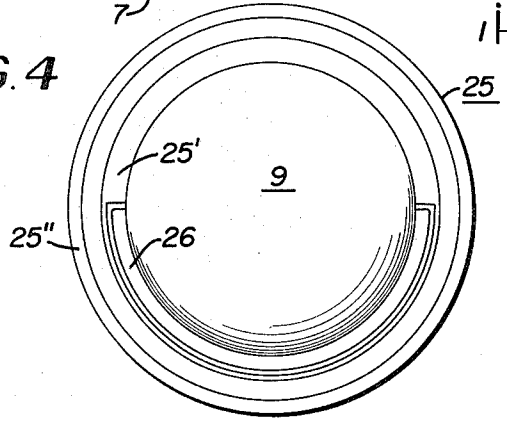


FIG. 3

FIG. 4



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HYPODERMIC SYRINGES, IN PARTICULAR SELF-INJECTING SYRINGES

In some forms of medical treatment, the patient is required to carry out successive intra-muscular injections on himself over a relatively short period of time while the quantities of liquid to be injected may be different.

Self-injecting syringes of known types comprise an ampoule containing a predetermined quantity of liquid and fitted with a stopper which also serves as a piston for emptying the ampoule when subjected to the action of a thrust member which is in turn actuated by a releasing means.

With this type of syringe, almost the entire quantity of liquid contained in the ampoule is injected each time the thrust member is released.

The object of this invention is to permit the adjustment of the injected dose of liquid and accordingly to associate with the thrust member which can be a pusher, a spring or a pusher actuated by a spring, an abutment member which is coupled for translational motion to said thrust member and the longitudinal position of which can be adjusted with respect to said thrust member. Said abutment member is mounted in such a manner as to limit the quantity of liquid injected, for example by being abuttingly applied against the inlet orifice of the ampoule when the syringe is fitted with an ampoule, thus limiting the penetration of said thrust member into said ampoule.

In a particular form of construction, the abutment member is a tube having an external diameter which is smaller than the internal diameter of the ampoule and adapted to surround the thrust member so as to be actuated therewith after said thrust member has been released, said abutment member being fitted with an abutment or stop ring which is positionally adjustable on said tube.

Said stop ring can be formed by a nut which is screwed onto a threaded portion of the tube and locked by means of a counter-nut, said nut having an external diameter which is larger than the internal diameter of the ampoule.

The dose which is injected will evidently depend on the position of the abutment member with respect to the thrust member since said position governs the depth of penetration of the stopper into the ampoule.

The abutment member in accordance with the invention can be provided either on a self-injecting syringe or on a manual syringe since in the latter case, it may also prove advantageous to limit beforehand and in an adjustable manner the depth of penetration of the thrust member at which the liquid to be injected is discharged.

Provision can advantageously be made for at least one window in the casing in order that the position of the abutment member may thus be adjusted from the exterior without entailing disassembly, said window being preferably closed off during storage or transportation by means of a movable shutter which can be rigidly fixed to the releasing member.

In a preferred embodiment, the releasing means comprise an external collar fitted with flexible arms, each arm being adapted to carry at the free extremity thereof a locking lug which normally engages through a window formed in the tube within a holding groove

formed in the plunger and which is intended to disengage from said groove under the action of operating means in order to release the plunger.

The external collar can be stationary and the operating means can consist of an unlocking ring slidably mounted on the tube beneath each lug-arm, said arm being provided with a sloping shoulder with which said unlocking ring can cooperate in such a manner as to produce action on said arm in the radial direction and to move the corresponding lug away from the holding groove of the plunger.

In an alternative form of the foregoing embodiment which has the advantage of simplicity, the unlocking ring is dispensed with and the function of this latter is performed by the lower portion of the outer body of the syringe ; to this end, said body is made up of two upper and lower sections which are coupled by means of an asymmetrical screw-thread having a saw-tooth thread form over a few sectors of small amplitude such as 30° for example. Said sections are capable of sliding one over the other only in the direction in which they are drawn together and the lug-arms are disposed so as to move apart as the two sections of the body are drawn together.

Two examples of construction of a syringe in accordance with the invention are shown in the accompanying drawings which are given without any implied limitation, and in which :

FIG. 1 is a longitudinal sectional view of one form of construction the section being taken on line 1—1 of FIG. 2 ;

FIG. 2 is a view in elevation of the syringe of FIG. 1 ;

FIG. 3 is a longitudinal sectional view of the outer body and of the locking elements of a second form of construction ;

FIG. 4 is an enlarged top plan view of a syringe as seen in FIG. 1;

FIG. 5 is a fragmentary cross-sectional view illustrating the position in which the control to the shutter is in its locked position; and

FIG. 6 is a fragmentary cross-sectional view illustrating the position in which the control to the shutter is in its unlocked position.

In the example which is illustrated in FIGS. 1 and 2, the reference numeral 1 designates the syringe body which contains the ampoule 2, said ampoule being closed at the rear end by its piston 3 and adapted to carry at the front end the sliding needle-holder 4 together with the hypodermic needle 5 which, at the time of release, will perforate the thinned portion 7 of the base of the body 1, then the capsule 6.

The mechanism which automatically causes the operation of the self-injecting hypodermic syringe is removably mounted on the body 1. This mechanism is contained in a casing tube 9 and comprises a hollow plunger 10 which is capable of sliding axially and is subjected to the action of a helical spring 11 which works in compression.

The plunger 10 is provided with a holding groove 12 with which releasing means are adapted to cooperate. Said means consist of a collar 13 which is rigidly fixed to at least two flexible arms 14, each arm being adapted to carry at the free extremity thereof a locking lug 15 which is adapted to penetrate into the casing tube 9 through a window 16 formed in this latter so as to en-

gage in the groove 12 of the plunger 10, thereby locking said plunger in the inoperative position. A sliding ring 20 which performs the function of releasing member has a larger diameter than the collar 13 and is provided with radial slots for the insertion of the arms 14 which form internal sloping shoulders 14*a*.

An adjusting nut 22 and a lock-nut 23 are mounted on the plunger tube 10 which is provided with a micrometer screw-thread. A scale which is graduated in tenths of a cubic centimeter, for example, may be cut on a flat portion formed on the outer surface. The external diameter of the plunger tube 10 is smaller than the internal diameter of the ampoule 2. The nut 22 and the lock-nut 23 have a diameter which is larger than said internal diameter of the ampoule.

The casing tube 9 which constitutes the top portion of the syringe body is pierced by a window 24 of substantial width so as to permit the adjustment of the two nuts 22, 23 from the exterior without any need for disassembly. A movable shutter 25 is carried by the ring 20 in such a manner as to be capable of rotating about the body 9 and of covering or uncovering the window 24. In the position of closure of the window 24, the shutter 25 is retained by a flange 26 which is formed over approximately one-half of the periphery of the body 9 and which prevents axial sliding of said shutter. The operation of the syringe is as follows :

The shutter 25 is rotated so as to uncover the window 24 and free this latter at the same time from the retaining flange 26. The upper flange 25' of the shutter is provided with an arcuate slot which permits the shutter to slip downwardly away from retaining flange 26 which is rigidly mounted on body 9, the slot in flange 25' being shown in FIGS. 4 and 6 above flange 26. When the shutter which is of a generally cylindrical shape, has been rotated to the position to close window 24, a portion of the top of flange 25' extends inwardly over flange 26, thus locking the shutter in its upper position as viewed in FIGS. 1, 2 and 5 and preventing the shutter from moving downwardly. As seen in FIG. 1, the ring 20 has a groove in its external surface for receiving a lower inwardly directed portion of a lower flange 25'' of a shutter 25 adapted to be rotated on the casing tube 9. The shutter has a size that is greater than that of the window 24 so that such rotation will either cover or uncover the same. However, only when the shutter is in the position in which the window is open can flange 25' be disengaged from flange 26, i.e. in the position illustrated in FIGS. 4 and 6, to permit the shutter, including its flanges 25' and 25'' to move downwardly, forcing ring 20 against arms 14 to release plunger 10.

By screwing the nut 22 onto the plunger tube 10 and then locking said nut by means of the counter-nut 23, the number of cubic centimeters to be injected then may be regulated by reading from the graduated scale which may be cut on said plunger tube 10. The ring 20 is caused to slide forward together with the shutter 25 by applying the syringe against the patients body, thereby outwardly displacing the arms 14 and releasing the lugs 15 from the groove 12 of the plunger tube 10. Said tube is then projected forward under the action of the spring 11 and forcibly strikes the stopper-piston 3. The assembly consisting of ampoule 2 and needle 5 is projected forward ; the needle 5 pierces the thin-wall portion 7 ; the needle guide 4 is applied against the base of the body 1 around portion 7 and the rear portion of the needle pierces ampoule 2, i.e. the upper end of the needle, as viewed in the drawing, is forced through the thin end wall 6 of the ampoule 2.

The stopper-piston 3 penetrates progressively into the ampoule 2 and the liquid is discharged through the needle duct. If the complete apparatus is applied against any part of the patient's body, intra-muscular injection thus takes place automatically.

However, the stopper-piston 3 will penetrate into the ampoule 2 only up to the moment when the nut 22 finally comes into abutment against the rear edge 30 of the ampoule 2.

In order to use the syringe again, the casing tube 9 is unscrewed and the mechanism is re-set by pushing the plunger tube 10 back until the lugs 15 engage within the groove 12 of said tube. The ampule is then changed, the casing tube 9 is screwed onto the tube 1 and an adjustment of the nuts 22 and 23 may be made if desired. It will be noted that the shutter 25 ensures safety locking since the sliding ring 20 can be pushed forward only if the shutter 25 has been freed from the flange 26 by uncovering the adjusting window 24.

In the example of FIG. 3, the outer body of the syringe is made up of two sections 31 and 39 which are coupled by means of a screw thread 32 having an asymmetrical saw-tooth thread form. The section 31 has only two or three toothed sectors of approximately 30° each and the bottom portion of the section 39 has the shape of a split skirt. The two arms 33, 33' of a locking ring 34 are directed upwards (as seen in FIG. 3) and the lugs 35, 35' are adapted to pass through windows formed in the section 39 of the syringe body.

It is apparent that in this form of construction, the syringe is released simply by application of the section 31 against the section 39. The top edge 36 of the section 31 causes the outward displacement of the locking arms 33, 33'.

In the case in which it is found undesirable to release the syringe by applying this latter against the patient's body, the releasing operation can nevertheless take place by causing the section 39 to rotate with respect to the section 31.

What is claimed is:

1. A hypodermic syringe comprising a body, an ampoule slidably mounted in said body and housing the liquid to be injected and having a front wall and rear inlet orifice, a needle slidably carried by said ampoule and having a rear part adapted to pierce said front wall, a closure member for said inlet orifice slidably mounted in said ampoule, a plunger tube having an external diameter smaller than the internal diameter of the ampoule and slidably mounted in said body, elastic means located inside said tube and urging said tube towards said closure member, said tube having a threaded portion, and a nut adjustably mounted on said threaded portion and having an external diameter larger than the internal diameter of the ampoule.

2. A syringe according to claim 1, wherein a holding groove is provided in the surface of said tube, an external collar is provided with flexible arms, each having at the free end thereof a locking lug which normally seats in said holding groove in the plunger, and a means operatively engages said locking lugs for releasing said plunger.

3. A syringe according to claim 2, wherein the external collar is fixedly mounted on said plunger and said releasing means consists of an unlocking ring slidably mounted on the tube beneath each flexible arm, each arm being provided with a sloping shoulder with which said unlocking ring cooperates in such a manner as to produce action on said arm in a radial direction and to move the corresponding lug away from the holding groove of the plunger.

4. A syringe according to claim 2, wherein said body is made up of two sections consisting of an upper and a lower section which are coupled by means of a screw-thread having an asymmetrical, saw-tooth thread form over a few sectors of small amplitude and capable of sliding one over the other and the lug-arms are disposed so as to move apart as the two sections of the body are moved toward one another.

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