March 14, 1939. L. A. DUNAJEFF 2,150,738

HYPODERMIC SYRINGE

Filed Oct. 29, 1937

FIG. 1

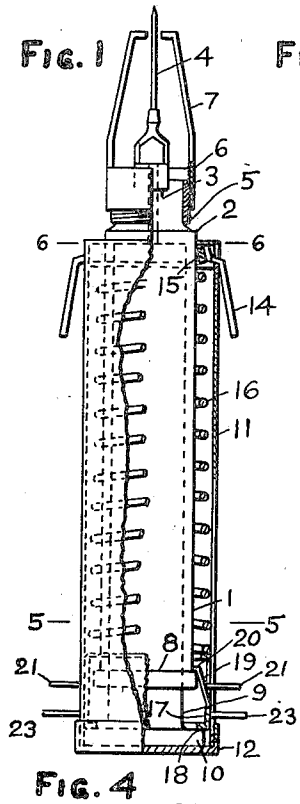


FIG. 2

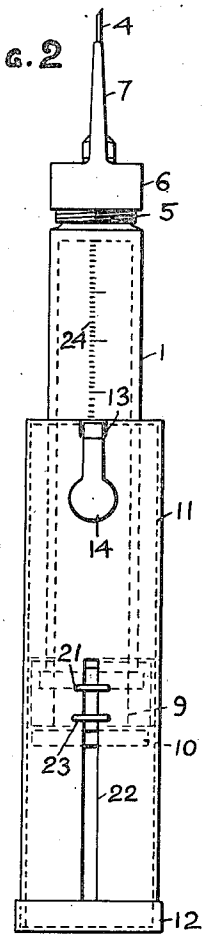


FIG. 3

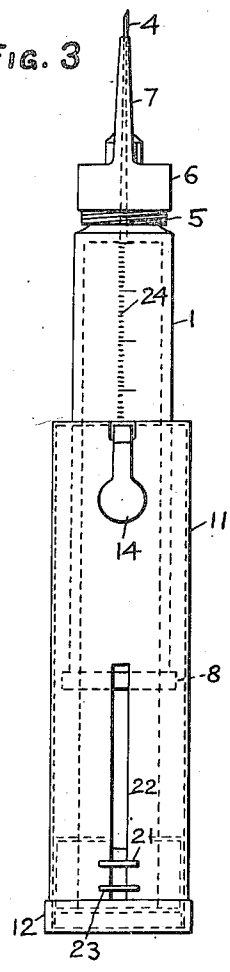


FIG. 4

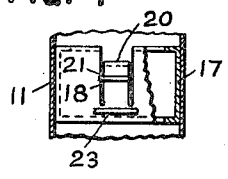


FIG. 5

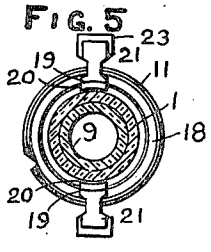


FIG. 6

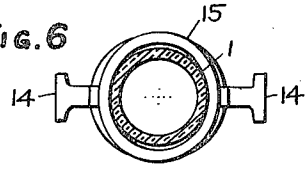
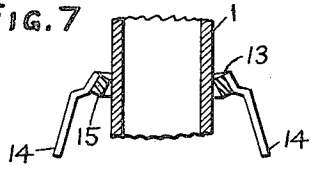


FIG. 7



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HYPODERMIC SYRINGE

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5 Claims. (Cl. 128—215)

My invention relates to hypodermic syringes and has particular reference to syringes used for injecting medicinal liquids into living tissues.

Hypodermic syringes usually employ very fine needles having relatively high resistance to the flow of liquids so that it takes a long time to fill a syringe with a liquid, during which time the plunger must be slowly withdrawn from the cylinder, requiring constant attention of the operator so as to fill the syringe with a desired quantity of the liquid. My invention has for its object therefore to replace the manual labor of filling the syringe by an automatic operation. For this purpose I provide a spring mounted on the outside of the syringe cylinder and having manually operable clamps for setting the spring at a desired point on the cylinder under proper compression and subsequently releasing the other end of the spring for engagement with the plunger so as to cause the latter to be withdrawn from the cylinder by the spring.

The ordinary manual process of injecting liquids into living tissues also has considerable disadvantages in that the hands, while engaged in forcing the plunger into the cylinder, cannot remain perfectly steady with a result that the point of the needles moves in the tissue, causing pain and being liable to break off. Another object of my invention is therefore to provide an automatic means for forcing the plunger into the cylinder after the latter has been filled with the liquid thereby relieving the operator's hands from the work of manipulating the plunger and therefore enabling him to hold the syringe steadily in a desired position.

For this purpose I use the same spring which is provided for withdrawing the plunger from the cylinder. The spring has an outer shell extending from its end nearest the needle, which for convenience may be called front end, to the rear end of the plunger. The front end of the spring is attached to the shell and is provided with a clamp for engaging the cylinder, the rear end engages a sliding sleeve with a clamp which may be set to engage the end of the cylinder or the plunger. In the latter case the spring will force the plunger out of the cylinder as was explained for the syringe filling operation. By clamping the sleeve on the end of the cylinder, however, the spring through the tubular shell will pull the plunger in the cylinder if the clamp on the front end of the spring is released. It is only necessary for the operator to hold the syringe steadily with the clamp released in order to inject the liquid into the tissues. The operation can be stopped at any time by releasing the clamp handle or retarded by partially releasing the clamp handle and using the clamp as a brake.

Another object of my invention is to provide an adjustable guide at the end of the needle for limiting the depth of its insertion in the tissues.

My invention is more fully described in the accompanying specification and drawing in which—

Fig. 1 is a view of my syringe partly in section and in its inoperative position with the plunger in the cylinder.

Fig. 2 is an outside view of the syringe with the spring set for operation and the sleeve set for withdrawing the piston from the plunger.

Fig. 3 is an outside view of the syringe with the spring expanded upon completion of the liquid drawing operation.

Fig. 4 is a detail view of the sliding sleeve.

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 1.

Fig. 6 is a sectional view taken on the line 6—6 of Fig. 1.

Fig. 7 is a detail view of a locking and braking device for the upper end of the spring.

My syringe consists of a cylinder 1 with a closed front end 2 having a tapering extension 3 for a needle 4 which fits frictionally on the extension. The extension 3 has a threaded tubular portion 5 on which is threaded a collar 6 with lugs 7 converging on the needle. The ends of the lugs form a guide for limiting the depth of insertion of the needle into living tissues for injection. The length of the needle beyond the guide may be regulated for the desired depth of the insertion by screwing the collar on the portion 5 to a desired depth. The cylinder 1 has a shoulder or rim 8 on the open rear end. A piston or plunger 9 slidably fits in the cylinder and has a shoulder or flange 10 on the rear end. The front closed end has an aperture inside registering with the central aperture in the needle.

It may be noted that the described parts form an ordinary hypodermic syringe. In fact, my device can be used with any suitable syringe provided it has enlarged portions 8 and 10, and if the front end can be provided with the portion 5, although the latter may be omitted if desired. The syringe cylinder may be made of any suitable material such as glass, composition or metal. Needles of different sizes can be used and they can be removed and replaced without removing the guide member formed of the collar 6 with the lugs 7.

A tubular casing 11 is placed over the cylinder

1 and is threaded on the rear end for a cap 12. The front end is closed over the cylinder and has openings 13 for handles 14 extending from a clamping ring 15. The latter is made of tempered steel and is twisted as shown in detail in Figs. 6 and 7 so that it clamps the cylinder but can be released by squeezing the handles 14 between the operator's fingers. A helical compression spring 16 is placed on the cylinder inside the casing 11 and rests against the clamping ring 15. The rear end of the spring rests against the front flanged end of a sleeve 17 sliding in the casing 11. The rear end of the sleeve has a flange 18 resting against the inner side of the flange 10. The spring is made so that it remains under tension when fully extending to the front of the syringe cylinder 1 as shown in Fig. 1. The sleeve 17 has punched out portions 19 bent inwardly and provided with hooks 20 on the ends engaging the inner or front shoulder of the rim 8. The inner diameter of the flanges on the sleeve 17 is slightly larger than the diameter of the rim 8 so that the sleeve 17 can be moved on either side of the rim. The diameter of the flange 10 is, however, larger than the diameter of the rim 8 so that the sleeve 17 bears against the front shoulder of the flange 10 by the flange 18. The sleeve is made of a resilient metal such as tempered steel so that the lugs 19 can be deflected away from the rim 8 by pressing on handles 21 extending from the lugs 19 through longitudinal slots 22 in the casing 11. The sleeve has also handles 23 extending through the slots 22 from the solid portion of the collar. The collar is therefore released from the rim 8 by squeezing the handles 21 and 23 between the operator's fingers.

The operation of my syringe is as follows.

The syringe when not used has the spring 16 fully extended with the plunger in the cylinder and the casing 11 moved fully over the cylinder as shown in Fig. 1. For drawing a liquid into the cylinder, the handles 14 are squeezed together thereby releasing the grip of the clamping ring 15 on the cylinder. The casing is then moved back until its front edge registers with a mark on a scale 24 indicating the volume of the liquid which is desired to introduce into the cylinder. The handles 14 are then released so that the ring 15 clamps the cylinder, retaining the sleeve in this position. The spring is then compressed between the front flange of the sleeve 17 and the clamping ring 15. This position of the sleeve is shown in Fig. 2. The needle 4 is then placed in the liquid, and the handles 21 moved toward the handles 23 thereby releasing the lugs 19 from the rim 8. The rear end of the spring becomes now free and it exerts its full pressure on the flange 10 of the piston, moving the latter out of the cylinder and thereby sucking the liquid into the cylinder through the needle. The syringe can now be left in the liquid and it will continue to draw the liquid until the rear end of the plunger comes to rest against the cap 12 in the casing. This position is shown in Fig. 3. The spring becomes again fully extended. It has a certain initial tension in this position, however, which is necessary in order to continue drawing the liquid until the last moment when the piston or plunger is stopped by the cap 12.

For injecting the liquid through the needle into living tissues, the syringe is first prepared by squeezing together the handles 21 and 23 and moving the collar or sleeve 17 forward until the hooks 20 pass beyond the rim 8 when the handles are released. The hooks 20 engage the rim 8 thereby retaining the spring under compression.

The syringe in this charged and cocked position can be handled and even carried to the place of operation, the spring remaining locked in the compressed condition between the clamping ring 15 and the flange 20 of the sleeve 17. The needle may be then inserted into tissues for hypodermic injection, the guide lugs 7 limiting the depth of insertion. The syringe is then held steadily in the operator's hand while the handles 14 are squeezed together, releasing the clamping ring. The spring will then be released for expansion and will move the front end of the casing 11 toward the front end of the cylinder, forcing the plunger into the cylinder by the pressure from the cap 12. This operation will continue automatically until the plunger moves to the end of its stroke or until the clamping ring is tightened by releasing the handles 14. The speed of injection can be controlled by varying the pressure on the handles 14 and using the clamping ring 15 as a brake.

It may be noted that the hand and the fingers do not move the piston during the injection so that the syringe can remain perfectly steady, the slight variations in the pressure on the handles 14 being too slight to cause any change in the steadiness of the operator's hand.

My device can be used as an attachment for an ordinary syringe and can be easily removed for cleaning and sterilizing the syringe as well as the attachment.

I claim as my invention:

1. For a hypodermic syringe having a cylinder, a plunger and a needle on the front end of the cylinder, an attachment comprising a helical spring on the cylinder, means to releasably engage the front end of the spring to the cylinder at a desired point, means to releasably engage the rear end of the spring to the rear end of the cylinder thereby rendering the spring inoperative, and means to release the rear end of the spring, the rear end of the spring when released being adapted to engage the rear end of the plunger for withdrawing the latter from the cylinder.

2. For a hypodermic syringe having a cylinder, a plunger and a needle on the front end of the cylinder, an attachment comprising a helical spring on the cylinder, a tubular casing enclosing the spring, a clamp in the front end of the casing adapted to be manually operated for engaging the front end of the spring with the casing to the cylinder at a desired point, means to engage the rear end of the spring to the rear end of the cylinder for rendering the spring inoperative, handles extending from the rear end engaging means, the casing having slots for the handles, the handles being adapted to be manually operated for releasing the rear end of the spring, means to transmit the spring pressure to the rear end of the plunger, and means on the casing to stop the movement of the plunger at the end of the travel determined by the setting of the front clamping means.

3. For a hypodermic syringe having a cylinder, a piston and a needle, an attachment comprising a helical spring on the cylinder, an enclosing member on the outside of the spring, a ring at the front end of the spring retained by the end portion of the enclosing member, the ring being twisted and made of a resilient material so as to press by the twisted sides against the sides of

the cylinder thereby locking the front end of the spring in a selected position on the cylinder, handles extending from the twisted sides of the ring and adapted to be manually moved for untwisting the ring thereby releasing its pressure on the cylinder, a sleeve movably supported in the enclosing member and abutting the rear end of the spring, and a flange on the sleeve engaging the rear end of the plunger thereby transmitting the spring pressure to the plunger for its withdrawal from the cylinder.

4. A hypodermic syringe comprising a cylinder, a plunger in the cylinder, the cylinder being adapted to support a needle on its front end, the cylinder having a shoulder on the rear end, the plunger having a flange on the rear end, a tubular enclosure slidably fitted over the cylinder and spaced therefrom, the front end of the enclosure being slidably closed over the cylinder, the rear end of the enclosure being closed over the rear end of the plunger, a compression helical spring supported in the space between the cylinder and the enclosure, a clamping member at the front end of the enclosure adapted to retain the front end of the spring in engagement with the cylinder, means to manually release the clamping means, a sleeve slidably fitted in the enclosure between the rear end of the spring and the plunger flange, and means on the sleeve for clamping it to the shoulder on the rear end of the cylinder, the spring being adapted through the enclosure to move the plunger into the cylinder when the front clamp is released.

5. A hypodermic syringe comprising a cylinder, a plunger in the cylinder, the cylinder being adapted to support a needle on its front end, a helical spring slidably fitted on the cylinder, a tubular member fitted over the spring, the front end of the spring engaging the front end of the tubular member, the rear end of the tubular member abutting the rear end of the plunger, a sleeve slidably fitted in the rear portion of the tubular member, the front end of the sleeve abutting the rear end of the spring, a clamp at the front end of the tubular member adapted to hold the front end of the spring against the cylinder, a flange on the rear end of the plunger, the sleeve abutting the plunger flange, means to manually release the clamp for compressing the spring by moving its front end with the tubular member to a desired point on the cylinder, the spring when compressed being adapted to move the plunger through the sleeve out of the cylinder until the rear end of the plunger returns to a contacting position with the rear end of the tubular member, and a manually releasable means on the sleeve for engaging the rear end of the cylinder thereby compressing the spring after the plunger has been moved out of the cylinder, the spring being then adapted to move the plunger into the cylinder upon release of the front clamp.

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