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2,725,877

HYPODERMIC SYRINGE WITH FEED CONTROL

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Application December 22, 1950, Serial No. 202,202

11 Claims. (Cl. 128—218)

The present invention is directed to hypodermic syringes, more particularly to an improvement therein in which there is a definite control of the feed of liquid through a syringe.

In general, hypodermic syringes as made and used in the past consisted essentially of a chamber in which an ampule of a liquid such as an anesthetic or sedative is held. At one end of the chamber a hypodermic needle was inserted which pierced the ampule to allow flow of the liquid. At the other end there was a plunger operated by a suitable handle for forcing the liquid from the ampule through the needle. Such a device had certain disadvantages, particularly in that the user thereof was apt to press the plunger with considerable force, thus causing a rapid flow of the liquid through the needle and into the patient. This caused a considerable amount of liquid to be injected in a short time, causing irritation and pain and damage to tissues.

The present invention is intended and adapted to overcome the difficulties and disadvantages inherent in prior devices of the type described, it being among the objects of the present invention to provide a syringe wherein a controlled flow or feed of a liquid to be injected is obtained.

It is also among the objects of the present invention to provide a relatively simple arrangement which is positive in its operation and which is capable of giving a slow and even flow of said liquid, with very little exertion or manipulation by the user.

It is further among the objects of the present invention to provide a syringe of the type described, in which pneumatic means are employed to act either as a means of urging the plunger forward or of otherwise controlling the feed of the liquid.

In practicing the present invention, there is provided a hypodermic syringe having at one end thereof a casing which is adapted to hold an ampule, and having at said end an ordinary arrangement of hypodermic needle cooperating therewith. The casing is secured in a suitable housing which carries an operating mechanism at the other end thereof.

Said mechanism includes a barrel which extends in alinement with the casing and has a means of communication therewith. The barrel contains a bar extending into the casing and having a plunger at the casing end thereof adapted to press the cap or cover of the ampule. A handle is attached to the other end of the bar for suitable manual manipulation. Usually a rack is formed on the bar and gearing meshes with the rack, said gearing being mounted in the housing. A pivoted lever on the housing has means for locking or releasing the gearing to prevent or permit motion of the plunger in the various operations of the syringe.

The barrel is provided with a chamber or cylinder which is adapted to be made air-tight. A piston operating in the cylinder, and suitably controlled either by compression of air or by a spring or equivalent element is se-

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cured to the handle so that the plunger operates simultaneously with the piston.

In the accompanying drawing constituting a part hereof and in which like reference characters indicate like parts,

Fig. 1 is a longitudinal cross-sectional view of a hypodermic syringe made in accordance with the present invention, some parts being shown in full for clearness;

Fig. 2 is a transverse cross-sectional view taken through a parallel along line 2—2 of Fig. 1;

Fig. 3 is a transverse cross-sectional view through the housing, taken along line 3—3 of Fig. 1;

Fig. 4 is a longitudinal cross-sectional view of a modified form of the invention; and

Fig. 5 is a fragmentary longitudinal cross-sectional view of the right hand end of the mechanism shown in Fig. 4, illustrating a different position of certain of the elements thereof.

With reference to Figs. 1 to 3, there is provided a housing 1, generally cylindrical in form, having a casing 2 threaded into one end of housing 1, as shown at 3. The opposite end 4 of the casing is threaded and carries a similarly threaded collar 5, into the outer end 6 of which a hypodermic needle 7 is held. The inner end 8 of the needle is adapted to extend into the casing. It pierces soft rubber disk 9 which closes one end of ampule 10, carrying suitable liquid 11. A plug 12 at the other end of the ampule seals the liquid and maintains it sterile, although said plug is adapted to be moved by a suitable plunger.

To the opposite end of housing 1 is secured a barrel 13 having a cylinder or chamber 14 therein. A piston 15 is mounted in cylinder 14 and has attached thereto a push-rod or piston rod 16 extending through cap 17 at the free end of the cylinder. Said piston divides the barrel into an inner portion adjacent to the casing and an outer portion remote therefrom. A spiral spring 18 surrounding piston rod 16 tends to urge piston 15 to the left. The rod is attached to handle 19, whereby the device may be manipulated.

An opening 20 is provided in the end of cylinder 14 adjacent to housing 1 and is closed by valve 21 fixed on lever 22 which is pivoted on pin 23 held between ears 23' on housing 1. A finger piece 24 pressed upwardly by spring 25 extends from the opposite side of pin 23. The lever carries a dog 26 adapted to latch into the teeth of gear 27 mounted on pin 27' in housing 1. This in turn meshes with teeth of a rack 28 formed on a portion of bar 29, the free end of which is also secured to handle 19. Plunger 30 at the end of rack 28 is of such size as to fit within ampule 10 and to press upon plug 12. In the operation of the device handle 19 is retracted while a finger is being pressed against finger piece 24 to raise valve 21 against the action of spring 25, allowing air to flow into cylinder 14. At the same time, dog 26 is released, permitting operation of the gearing during the retraction of the rack. Finger piece 24 is released, closing valve 21 and confining air in cylinder 14. Ampule 10 and needle 7 are placed in the positions shown in Fig. 1 and casing 2 is locked onto housing 1. The operator then gently presses with his finger on finger piece 24, raising valve 21 slightly, thereby permitting the tension of spring 18 to force piston 15 to the left, expelling air from the chamber. This movement causes similar movement of plunger 30, forcing liquid through needle 7. The operator may adjust the speed of feed of liquid by slight changes of finger pressure, thereby regulating the size of opening 20 and the rate of release of air from the cylinder. At any moment he may interrupt the flow of liquid completely by removing pressure from finger piece 24, locking the gearing against any further movement, while still

maintaining pressure in cylinder 14 for further operation.

In the modification shown in Figs. 4 and 5, there is provided a housing 1', a casing 2', having oval openings 3' on opposite sides of the casing for the purpose of inspecting the liquid in ampule 10. A barrel or chamber 32 is formed on the end of housing 1' opposite to casing 2'. This chamber is adapted to be made air-tight. Piston 33 operating in chamber 32 is secured to a push-rod or piston rod 34 extending through the end of the chamber terminating in handle 35. A bar 36 extends from the inner end of piston rod 34 and terminates in a plunger 37', which is adapted to contact with plug 12' of ampule 10.

Within the cylinder and surrounding piston rod 34 is a sleeve 37 made of a flexible vulcanized rubber or the like and relatively thin so as to be capable of being folded. It is also elastic and is capable of being stretched. One end of said sleeve is secured to piston 33 along a circle 38, and the other end 39 of said sleeve is attached to cap 40 of chamber 32. This provides a space 41 which is completely enclosed and is air-tight. At the end of chamber 32 adjacent to housing 1' are several vent holes 42. On bar 36 is formed a rack 43 which extends through housing 1', which has an opening or passageway 44 to act as a guide for said rack.

Pinion 45, pivoted in housing 1' meshes with teeth 43 of the rack and also meshes with gear 46 mounted in the housing on pivot 46'. Operating lever or finger piece 47, pivoted on either side of gear 46 on pivot 46' is provided with a spring catch 48, one end of which is secured to lever 47 and the other end is adapted to enter between the teeth of gear 46. Crank arm 49 is pivoted at 50 on lever 47 and the end 51 thereof contacts with spring 48. By manipulation of catch 48 by means of arm 49, the device is placed in operative or in inoperative position relative to rack 43. A dog 52 pivoted on housing 1' enters between the teeth of gear 46 and acts as a stop. On yoke 53 is a pin 54 extending through an opening in dog 52 and having a coil spring 55 bearing against the dog to hold it in position relative to the teeth of gear 46.

In operation the device is in the position shown in Fig. 4 with catch 48 in the operative position. Finger piece 47 is depressed causing catch 48 to move gear 46 through the arc of one tooth and resulting in rack 43 and piston 33 advancing to the left to force a single drop of liquid through needle 7'. Spring 56 lifts finger piece up when pressure thereon is released, and the action is repeated. When it is desired to re-set the device, arm 49 is moved downward causing end 51 to lower catch 48 out of contact with gear 46, dog 52 is raised out of contact with said gear by pressing yoke 53, and handle 35 is pulled to the right. A fresh ampoule 10 may then be inserted and the device made ready for further operation.

Although the invention has been described setting forth two specific embodiments thereof, it is intended that they illustrate the scope of the invention and not to limit it. Various changes in the details of construction may be made within the principles set forth above. For example, the barrel may be made integral with the housing. The size, shape and positions of the several elements may be varied at will. Instead of an arrangement of gearing and dogs, equivalent means for controlling the movement of the plunger may be used. These and other changes may be made within the principles set forth and the invention is, therefore, to be broadly construed and to be limited only by the character of the claims appended hereto.

We claim:

1. A hypodermic syringe comprising a hollow housing, a casing secured to one end thereof, a barrel secured to the other end, said casing and barrel being in alinement and in communication with each other, a piston in said barrel, means in said barrel for urging said piston towards said casing, air in an air chamber constituting pneumatic pressure means pressing on said piston to oppose said motion, a push-rod movable in said casing and attached

to said piston, and means acting on said chamber and attached to said housing for releasing said pneumatic pressure.

2. A hypodermic syringe comprising a hollow housing, a casing secured to one end thereof, a barrel secured to the other end, said casing and barrel being in alinement and in communication with each other, a piston in said barrel, a spring in said barrel for urging said piston towards said casing, air in an air chamber constituting pneumatic pressure means pressing on said piston to oppose said motion, a push-rod movable in said casing and attached to said piston, and means acting on said chamber and attached to said housing for releasing said pneumatic pressure.

3. A hypodermic syringe comprising a hollow housing, a casing secured to one end thereof, a barrel secured to the other end, said casing and barrel being in alinement and in communication with each other, a piston in said barrel, a pressure chamber in said barrel, means in said barrel for urging said piston towards said casing, the pressure in said chamber pressing on said piston to oppose said motion, a push-rod movable in said casing and attached to said piston, and means acting on said chamber and attached to said housing for releasing said pressure.

4. A hypodermic syringe comprising a hollow housing, a casing secured to one end thereof, a barrel secured to the other end, said casing and barrel being in alinement and in communication with each other, a piston in said barrel, a pressure chamber in said barrel, means in said barrel for urging said piston towards said casing, the pressure in said chamber pressing on said piston to oppose said motion, a push-rod movable in said casing and attached to said piston, and means acting on said chamber and attached to said housing for releasing said pressure including a valved opening in said barrel.

5. A hypodermic syringe comprising a hollow housing, a casing secured to one end thereof, a barrel secured to the other end, said casing and barrel being in alinement and in communication with each other, a piston in said barrel, means in said barrel for urging said piston towards said casing, air in an air chamber constituting pneumatic pressure means pressing on said piston to oppose said motion, a push-rod movable in said casing and attached to said piston, and means acting on said chamber for releasing said pneumatic pressure including a manually operable valve on said chamber, a set of gears in said housing, one of said gears being attached to said push-rod, a dog adapted to enter the teeth of one of said gears and spring-mounted on said housing, said dog serving to lock said gears against movement, and a lever to which said valve and dog are attached.

6. A hypodermic syringe comprising a hollow housing, a casing secured to one end thereof, a barrel secured to the other end, said casing and barrel being in alinement and in communication with each other, a piston in said barrel, pneumatic pressure means in said barrel for urging said piston towards said casing, a push-rod movable in said casing and attached to said piston, and means for releasing said pneumatic pressure including a rack attached to said push-rod, a pinion meshing with said rack and a lever mounted in said housing, a spring catch on said lever and meshing with said pinion and a dog pivoted on said housing and a spring biased against said dog and pressing said dog between the teeth of one of said gears adapted to lock said gears against reverse movement.

7. A hypodermic syringe comprising a hollow housing, a casing secured to one end thereof, a barrel secured to the other end, said casing and barrel being in alinement and in communication with each other, a piston in said barrel, pneumatic pressure means in said barrel for urging said piston towards said casing, a push-rod movable in said casing and attached to said piston, and means for releasing said pneumatic pressure including a rack, a pinion meshing with said rack and a lever mounted in said housing, a spring catch on said lever and meshing

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with said pinion and a dog pivoted on said housing and a spring biased against said dog and pressing said dog between the teeth of one of said gears adapted to lock said gears against reverse movement, said rack being mounted on said push-rod.

8. A hypodermic syringe comprising a hollow housing, a casing secured to one end thereof, a barrel secured to the other end, said casing and barrel being in alinement and in communication with each other, a piston in said barrel, an air-tight chamber in said barrel, means in said barrel for urging said piston towards said casing, air in said chamber constituting pneumatic means pressing on said piston to oppose said motion, a push-rod movable in said casing and attached to said piston, an opening in said chamber, a valve adapted to close said opening, and means for lifting said valve from said opening for releasing said air from said chamber.

9. A hypodermic syringe comprising a hollow housing, a casing secured to one end thereof, a barrel secured to the other end, said casing and barrel being in alinement and in communication with each other, a piston in said barrel, an air-tight chamber in said barrel, means in said barrel for urging said piston towards said casing, pneumatic means pressing on said piston to oppose said motion, a push-rod movable in said casing and attached to said piston, an opening in said chamber, a valve adapted to close said opening, and means for lifting said valve from said opening for releasing said air from said chamber including a gear in cooperative relation with said push-rod and a dog for locking the same.

10. A hypodermic syringe comprising a hollow housing, a casing secured to one end thereof, a barrel secured to the other end, said casing and barrel being in alinement and in communication with each other, a piston in

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said barrel, an air-tight chamber in said barrel, means in said barrel for urging said piston towards said casing, pneumatic means pressing on said piston to oppose said motion, a push-rod movable in said casing and attached to said piston, an opening in said chamber, a valve adapted to close said opening, and means for lifting said valve from said opening for releasing said air from said chamber including a rack and gear arrangement in cooperative relation with said push-rod and a dog for locking the same.

11. A hypodermic syringe comprising a hollow housing, a casing secured to one end thereof, a barrel secured to the other end, said casing and barrel being in alinement and in communication with each other, a piston in said barrel, said piston constituting means for dividing said barrel into an inner and an outer portion, said outer portion having a pressure means for biasing said piston toward said inner portion, at least one opening in said inner portion to allow escape of air therefrom when said piston moves in the direction of said inner portion, a push-rod movable in said casing and attached to said piston, a hand-operable means on said housing for opposing and controlling said movement of said piston.

References Cited in the file of this patent

UNITED STATES PATENTS

2,017,276	Ericson et al.	Oct. 15, 1935
2,295,849	Kayden	Sept. 15, 1942
2,309,502	Douglas	Jan. 26, 1943

FOREIGN PATENTS

673,293	France	Oct. 7, 1929
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