

[72] Inventor Masahide Isobe
Hayamamachi, Miura-gun, Japan
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[73] Assignee Tokyo Sokuhan Co. Ltd.
Kawagawa-ken, Japan
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[56]

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Primary Examiner—William E. Kamm

Attorney—McGlew and Toren

[54] JET-TYPE HYPODERMIC INJECTION DEVICE
3 Claims, 1 Drawing Fig.

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ABSTRACT: An exit injector for administering hypodermic injections without the use of a hypodermic needle, is formed of a hydraulic cylinder containing a movable, spring actuated piston positionable between a loaded and a discharged position. A second cylinder containing another piston is arranged in the injector to receive and discharge the fluid to be injected and it is filled when the piston in the hydraulic chamber is moved to its loaded position. When the hydraulic cylinder piston is moved to its discharged position, at the same time the other piston discharges the fluid to be injected from the second cylinder.

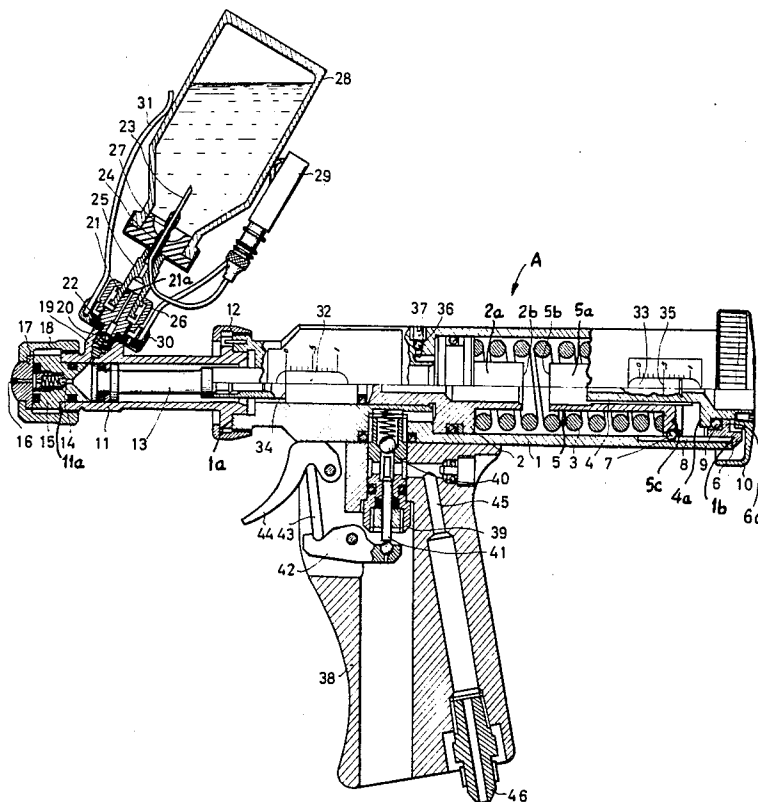
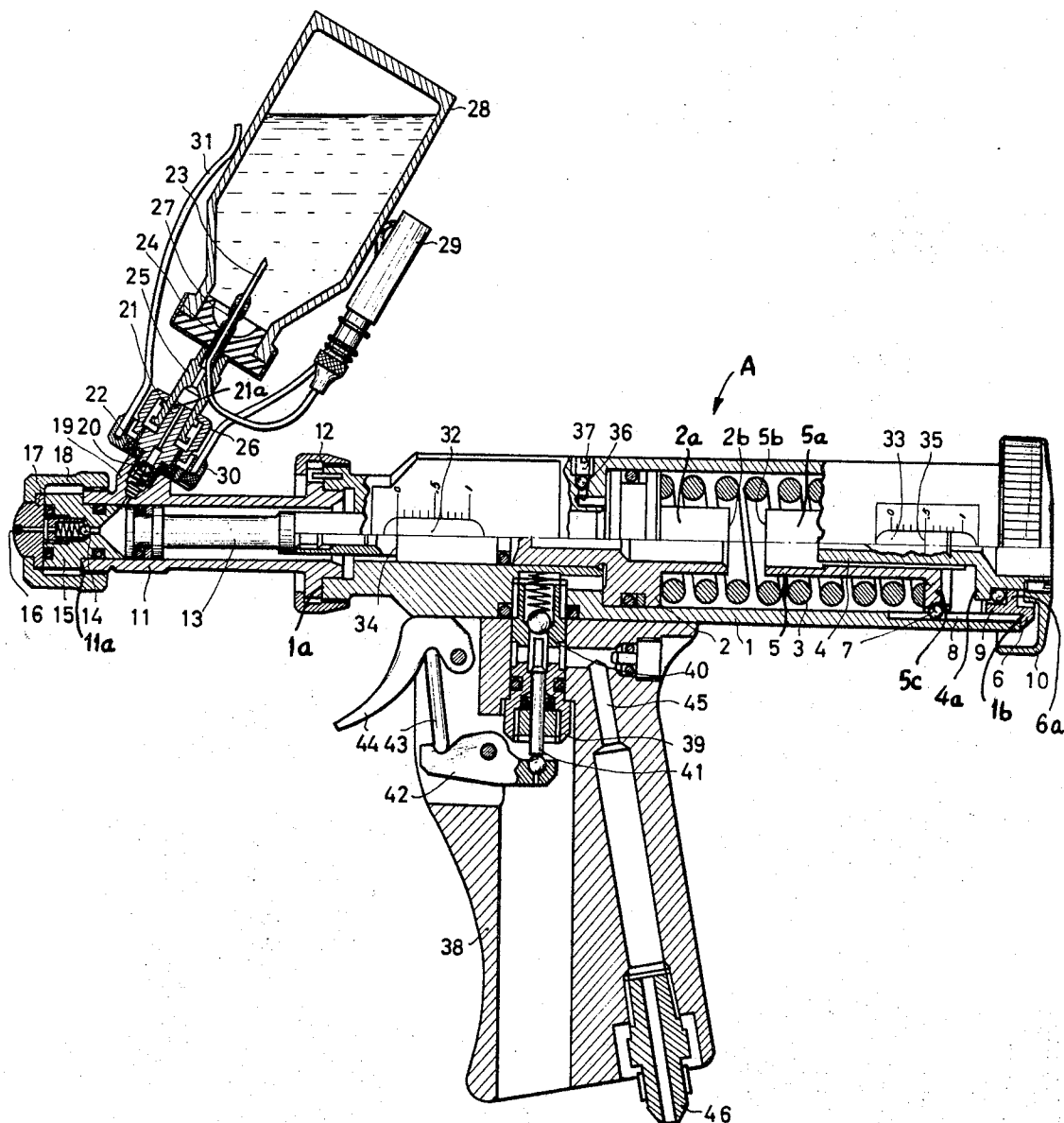


FIG. 1



INVENTOR.
MASAHIDE ISOBE

BY

McGraw & Toren
ATTORNEYS

JET-TYPE HYPODERMIC INJECTION DEVICE

SUMMARY OF THE INVENTION

The present invention is directed to an improvement in hypodermic injection devices and more particularly it is concerned with an exit injector, that is an injection device for hypodermically administering fluid to be injected without the use of an injection needle.

In instances where hypodermic injections are being administered to a large number of persons using an exit injector of the usual type, the person operating the injector is liable to be fatigued because of its size and weight, and further because the means for determining the quantity of fluid to be injected is inconvenient.

Accordingly, a primary object of the present invention is to lessen the size and weight of the injector.

Another object of the invention is to afford means for facilitating the determination of the quantity of fluid to be injected.

A further object of the invention is to incorporate means for regulating the quantity of fluid to be injected as an integral part of the device.

Still, another object of the invention is to position the vessel containing the fluid to be injected in such a location that it limits the interference with the positioning of the device at the site of the injection.

Yet, another object of the invention is to provide a spring actuating arrangement for simply and rapidly instituting the injection operation.

Therefore, the present invention concerns an exit injector formed of a pair of axially aligned cylinders. The first cylinder contains a piston, a spring and a spring support member and is mounted on a pistol grip member. By delivering the pressurized fluid into the first cylinder the piston is located in a loaded position relative to the position of the spring support member. Positioned at the opposite end of the first cylinder from its connection to the second cylinder is a screw member for locating the spring support member within the first cylinder and thereby determining the loaded position of the piston.

In the second cylinder another piston is secured to the piston in the first cylinder and is positionable in the second cylinder relative to the location of the first piston within the first cylinder. When the first piston is in its loaded position the second piston in the second cylinder is also in a loaded position and fluid to be injected is drawn into the second cylinder from a vessel containing the fluid which is mounted on the second cylinder. At its free end the second cylinder has a nozzle opening for discharging the fluid to be injected. The container for the fluid to be injected is positioned at an oblique angle to the axis of the second cylinder sloping backwardly toward the first cylinder to afford the minimum interference with the line of sight of the operator of the injector.

A pair of viewing slots are provided in the barrel of the first cylinder for determining the amount of fluid which the injector is regulated to deliver.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWING

The drawing contains a side elevational view of an injector according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

In the drawing an exit injector A is illustrated having an axially extending hydraulic cylinder 1 with a first end 1a and a second end 1b. Located within the cylinder 1 at its first end 1a

is a piston 2 movably positionable between a loaded position and a discharged position. At the rear of the piston 2 facing toward the second end 1b of the cylinder is a helically coiled spring 3. The end of the spring adjacent the second end of the hydraulic cylinder, abuts against a spring support member 5. Fitted within the spring support member is a screw member 4 for regulating the position of the spring support member in the cylinder, which in turn, establishes the quantity of fluid to be injected by the exit injector A. The piston 2 has an axially extending section 2a extending axially within the helically coiled spring 3 and the section 2a has an end surface 2b facing toward the second end of the cylinder 1. Opposite the section 2a and also located within the spring is an axially extending section 5a of the spring support member 5 which faces toward the piston and has a surface 5b arranged to contact the surface 2b of the piston when it is disposed in its loaded position.

At the second end 1b of the cylinder 1 a cap 6 is threaded into the cylinder for properly positioning the screw member 4. To prevent any relative circumferential movement between the spring support member 5 and the inner surface of the hydraulic cylinder 1, a ball 7 is partially positioned within a hole indented in the peripheral surface of flange 5c on the spring support member and extends into a semi-circular groove 8 formed in the inner surface of the cylinder and extending along a line parallel to the axis of the cylinder. Further, to afford smooth movement of the screw member 4 within the cylinder, balls 9 are provided between a shoulder 4a on the outer end of the screw member 4 and an oppositely arranged shoulder 6a on the cap 6. A knob 10 is fitted to the outer end of the screw member 4 at the second end 1b of the cylinder for regulating the position of the spring support member 5 within the cylinder.

At the first end 1a of the hydraulic cylinder 1 a nut 12 secures a second or injection fluid cylinder to the first or hydraulic cylinder. The second cylinder 11 is in axial alignment with the first cylinder 1 and contains a piston 13 positionable through the second cylinder and secured to the forward end of the piston 2 in the first cylinder. At the outlet end 11a of the second cylinder 11 a non-return outlet ball valve 14 is housed within a valve body 15. The valve body is aligned with a nozzle 16 secured within a nozzle holder 17 and the nozzle holder and the valve body are secured to the second cylinder 11 by means of a cap 18. The front end of the cap 18 is provided with a series of notches or grooves for preventing any slippage of the injector when it is positioned against the skin of a patient.

On the upper surface of the cylinder 11, closely spaced from its front end 11a, is a projection 19 having a passageway therethrough for admitting fluid to be injected into the cylinder. An inlet adaptor 21 is positioned within the projection 19 and is secured in place by an intermediate washer 22 which also has an outer peripheral thread. The outer end of the adaptor 21 spaced from the projection 19 has a tapered nose portion 21a to which a second adaptor 25 is secured by means of a nut 26. Extending through the second adaptor 25 is an inlet tube 24 for delivering injection fluid into the cylinder 11 and a vent tube 23 is positioned concentrically within the tube 24. Both the inlet tube 24 and the vent tube 23 extend into a bottle 28 holding the injection fluid. Holes 27 are provided in the sides of the inlet tube 24 for admitting the injection fluid into the tube for passage therefrom into the cylinder 11. The vent tube 23 extends exteriorly of the bottle 28 and is connected at its outer end to an air filter 29 which contains sterilized absorbent cotton for preventing dirt from entering the bottle 28 when air is being admitted into it.

Secured to the outer peripheral thread of the washer 22 is a holder member 30 from which extend a plurality of resilient gripping wires 31 for holding the bottle 28 firmly in position. The various elements arranged for admitting injector fluid from the bottle 28 into the cylinder 11 are arranged along an axis disposed obliquely to the axis of the cylinder and sloping backwardly from the forward end of the cylinder toward the hydraulic cylinder 1. The bottle 28 is arranged in this fashion

to limit any interference in the field of vision of the person operating the injector at the injection end of the device.

Along the side face of the hydraulic cylinder 1 are a pair of viewing slots 32, 33 each located at one end of the cylinder for determining the quantity of injector fluid to be supplied by the device. In the viewing slot 32 a stepped shoulder 34 on the forward end of the piston 2 acts as an indicator for exhibiting the quantity of fluid received into the cylinder 11. Similarly, in the slot 33 a forward surface 35 of the flange 5c of the spring support member 5 forms the indicator for displaying the amount of fluid that is to be discharged from the injector. Each of the slots is graduated into ten equal parts from 0.1cc to 1.0cc.

An air vent is provided from the upper surface of the hydraulic cylinder 1 by means of a ball 36 and a threaded member 37.

A pistol-like grip member 38 is secured to the underside of the cylinder 1 close to its first end 1a by means of a holder member 39 which provides a passageway from the grip 38 into the cylinder 1. Located within the holder member 39 is a non-return ball valve 40 which closes the passageway into the hydraulic cylinder 1. The valve 40 is opened and closed by a trigger mechanism comprised of a push pin 41, a lever 42, a rod 43 and a trigger 44. Extending through the grip member 38 is a conduit 45 for inlet and outlet of pressurized fluid to the passageway controlled by the valve 40. At the lower end of the conduit 45 a connector member 46 is located for securing a hydraulic hose (not shown in the drawing) to the conduit 45.

The injector device A illustrated in the drawing operates as follows: pressurized fluid is supplied to the cylinder through the conduit 45 and the valve 40, the inflowing fluid depressing the spring which holds the ball valve in its closed position. Within the cylinder 1 the pressurized fluid forces the piston toward the rear or second end of the cylinder and compresses the spring 3 which is concentrically disposed about the section 2a of the piston and section 5a of the spring support member. The spring contracts until the surface 2b of the piston comes in contact with the surface 5b of the spring support member. Simultaneously the piston 13 within the second cylinder 11 is withdrawn from the discharge end 11a of the cylinder drawing injection fluid into the cylinder from the bottle 28. The amount of injection fluid removed by suction from the bottle is determined by the distance the piston moves rearwardly toward the spring support member 5. As the injector fluid is drawn into the cylinder 11, the non-return outlet ball valve 14 closes and the non-return inlet ball valve 20 in the projection 19 opens automatically by suction force and the fluid is drawn through the holes 27 in the inlet tube 24 then through the adaptor 25, the other adaptor 21 and the ball valve 20 before it finally enters the cylinder. As the injection fluid is removed from the bottle, air passes through the filter 29 into the vent tube 23 and finally into the bottle 28 to prevent the establishment of a vacuum in the bottle which would interfere with the suction of injection fluid into the cylinder 11.

When the supply of pressurized fluid to the cylinder 1 is discontinued the ball valve 40 is closed under the action of its spring and the pressurized fluid is sealed within the cylinder continuing to compress the spring and hold the piston in its loaded position. At this point the pressurized fluid within the conduit 45 is automatically connected with the tank of a water pump (not shown) which acts as a valve device so that when trigger 44 is pulled or depressed the non-return valve 40 opens under the upward action of the push pin 41 and the pressurized fluid within the cylinder escapes to the tank of the water pump through the conduit 45.

When the pressurized fluid is released from the cylinder 1, the spring 3 which has been compressed quickly expands and moves the piston 2 toward the first end 1a of the cylinder 1. Similarly the piston 13 which is secured to the piston 2 rides forwardly through the cylinder 11 toward the discharge end 11a causing the valve 14 to open and the injection fluid to be forced under high pressure through the nozzle 16. During the forward movement of the piston 13 the valve 20 in the projection 19 is closed to prevent any backflow of the injection fluid into the bottle 28.

The valve device connected between the cylinder 1 and the water tank (not shown) may be such that the valve will automatically open when the piston of the water pump reaches the end of its travel and will connect the fluid within the cylinder with the fluid in the tank, thereby the device will operate advantageously and surely. Regulation of the quantity of injection fluid withdrawn from the bottle 28 each time the piston 2 is moved into its loaded position is achieved by positioning the screw member 4 by means of the knob 10. The position of the screw member determines the position of the spring support member within the cylinder. As the spring support member 5 extends further into the cylinder the quantity of injection fluid is reduced. The forward face of the flange 5c will indicate as line 35 in the viewing slot 33 the amount of injection fluid to be admitted to the cylinder 11 when the pistons are moved into the loaded position. The viewing slot 33 exhibits the position of the spring support member 5 which indicates the amount of liquid to be injected irrespective of whether or not the piston is in its loaded position.

However, concerning view slot 32 the stepped shoulder 34 at the leading edge of the piston 2 is used as the indicator of the quantity of fluid to be injected. The viewing slot 32 only indicates the quantity of fluid to be injected when the piston is moved into its loaded position. In the drawing it will be noted that the end surface 2b of the piston and the end surface 5b of the support member are spaced apart, whereby the piston is in its discharged position and its stepped shoulder 34 does not indicate the quantity of injection fluid to be used. However, when the two surfaces 2b, 5b are brought into contact by compressing the spring, the stepped shoulder 34 rides rearwardly and indicates, in the viewing slot 32, the amount of injection fluid to be used. Accordingly, the two viewing slots may be employed to afford a check of one against the other.

Although the quantity of injection fluid is regulated by turning the screw member 4 and properly positioning the spring support member 5 within the cylinder, the piston 2 is always moved by the pressurized fluid until the surface 2b of the piston contacts the surface 5b of the spring support member so that the amount of compression of the spring 3 becomes constant and thus the exit force of the injection fluid is constant at the moment the trigger 44 is released, independent of the quantity of the injection fluid.

In the drawing the injector device is shown with a bottle 28 adapted for administering a large number of injections, however, by withdrawing the nut 26 and removing the adaptor 25 from the inlet adaptor 21 an ordinary injection needle can be inserted into the tapered nose portion 21a of the inlet adaptor and an ordinary ampoule of injection fluid can be positioned on the device so that it may serve for administering individual inoculation injections.

In exit injectors used up until the present time the screw member for regulating the amount of injection fluid drawn into the injection device was positioned on the outside of the hydraulic cylinder at the opposite end thereof from the injection nozzle and as a result the length and weight of the body of the device, as well as the diameter of the screw were large and the turning of the screw member required considerable force which was quite inconvenient in administering a number of injections. However, in the present invention, by incorporating the screw member for regulating the quantity of injection fluid within the rear end of the hydraulic cylinder, the length and weight of the device is kept to a minimum as well as is the diameter of the screw member and accordingly, the adjustment of the screw is considerably easier to manipulate than had been experienced in the past.

Further, in the injectors previously used, a viewing slot was provided only at the forward end of the hydraulic cylinder so that it was only possible to determine the quantity of injection fluid when the piston was positioned in its loaded position, however, in the present arrangement with a viewing slot at each end of the hydraulic cylinder it is possible to determine the quantity of injection fluid to be used by checking the location of the flange of the spring support member in the viewing slot and the piston does not have to be disposed in its loaded position.

Accordingly, due to the present invention, an injector device of smaller size, lighter weight and more easily manipulatable is available as compared to injectors which had been previously employed.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

I claim:

1. An exit injector for administering hypodermic injections without the use of a hypodermic needle comprising a first cylinder, said first cylinder having a first end and a second end, a first piston located within said first cylinder and movably positionable therein between a loaded position and a discharged position, a spring disposed within said first cylinder and arranged in contact with said piston at least in its loaded position for moving said piston from its loaded to its discharged position, said spring having a coiled configuration affording an axially extending open space, a spring support member movably positionable within said first cylinder and arranged in contact with the opposite end of said spring from said first piston, said spring support member arranged to act as a stop for said first piston in its loaded position, said spring support member located adjacent the second end of said first cylinder and comprising an axially extending section disposed within the open space in said spring and having a stop surface facing toward the first end of said first cylinder and a radially extending flange section located at the end of said spring support member closest to said second end of said first cylinder, a second cylinder secured to and extending axially from one end of said first cylinder, said second cylinder having a first end connected to the first end of said first cylinder and a second

end spaced therefrom, a second piston disposed within said second cylinder and secured to said first piston and movable therewith within second cylinder between a loaded position and a discharged position, said second cylinder in combination with said second piston forming a variable volume chamber for receiving fluid to be injected, said second cylinder having an opening located at the second end thereof for discharging fluid to be injected, and a screw member positioned within and at the second end of said first cylinder and arranged to position said spring support member within said first cylinder whereby the position of said spring support member determines the extent of movement of said first piston and said second piston secured thereto and in turn determines the quantity of fluid to be injected to be received into said second cylinder.

2. An exit injector as set forth in claim 1 wherein said first piston has an axially extending section directed toward the second end of said first cylinder and located within the open space in said spring and having a contact surface located at the end of said section facing toward the second end of said first cylinder, whereby when said first piston is positioned in its loaded position the contact surface thereof is in contacting relationship with the stop surface of said spring support member.

3. An exit injector as set forth in claim 1 wherein the inner surface of said first cylinder at the second end thereof has a groove extending in parallel relationship with the axis of said cylinder, a ball member disposed within said groove and extending inwardly therefrom, a hole indented in the periphery of said flange of said spring support member for receiving said ball for preventing relative circumferential dislocation of said spring support member relative to said first cylinder.

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