Nov. 21, 1950 F. HARNISCH 2,531,267

HYPODERMIC SYRINGE OPERATING DEVICE

Filed Oct. 16, 1947 3 Sheets-Sheet 1

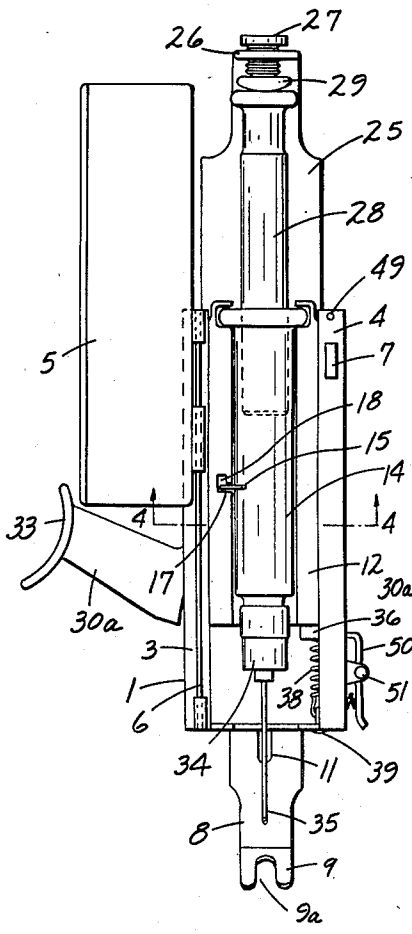

FIG. 1.

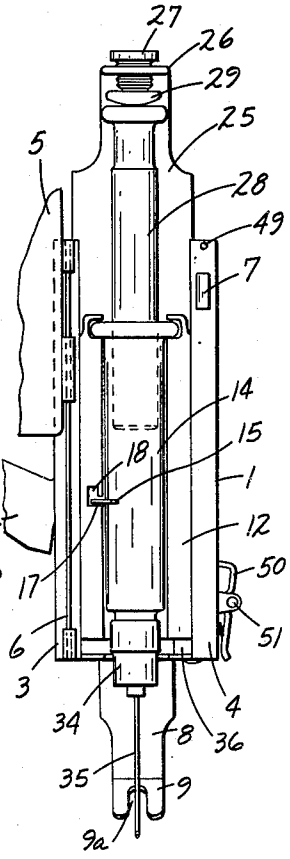

FIG. 2.

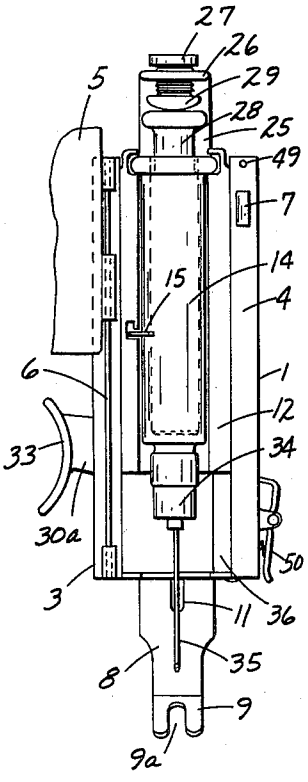

FIG. 3.

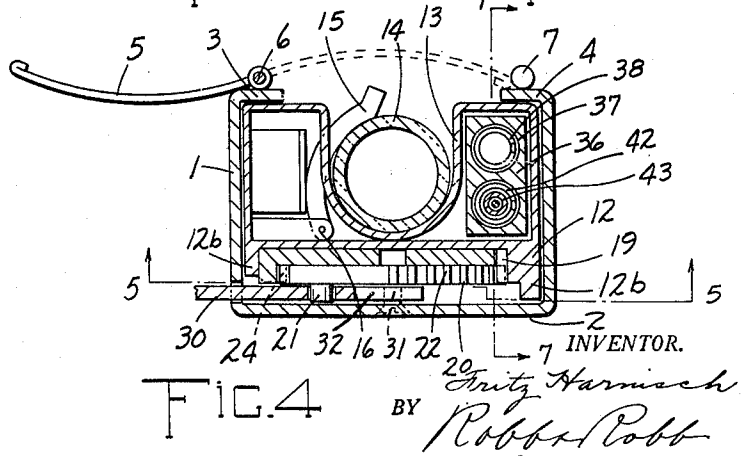

FIG. 4.

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HYPODERMIC SYRINGE OPERATING DEVICE

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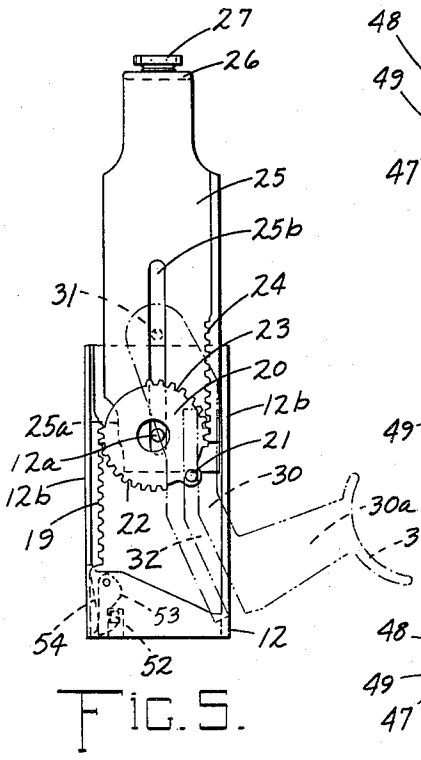

FIG. 5.

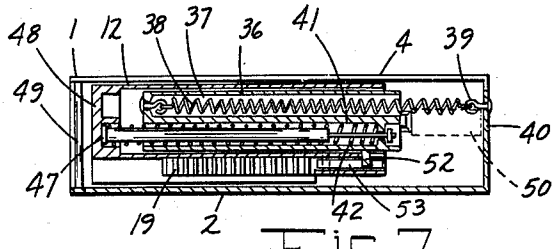

FIG. 7.

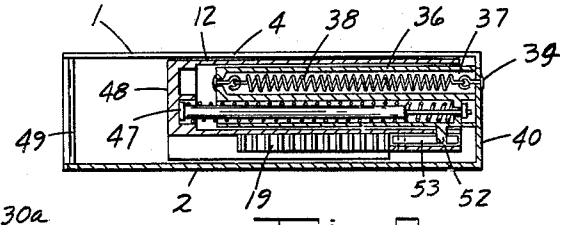

FIG. 8.

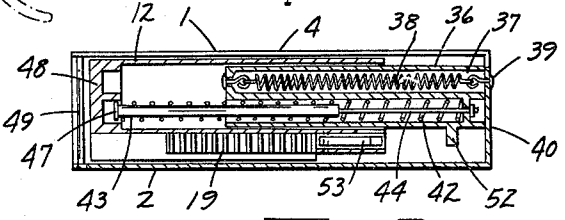

FIG. 9.

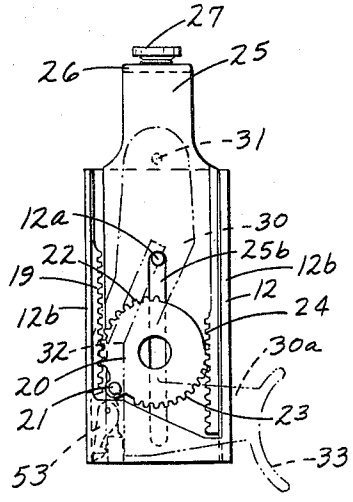

FIG. 6.

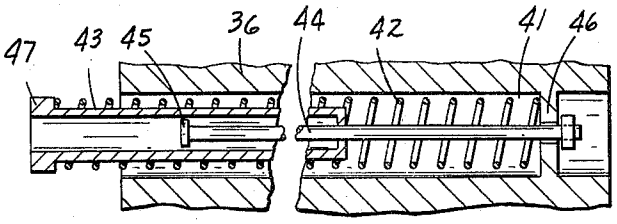

FIG. 10.

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HYPODERMIC SYRINGE OPERATING DEVICE

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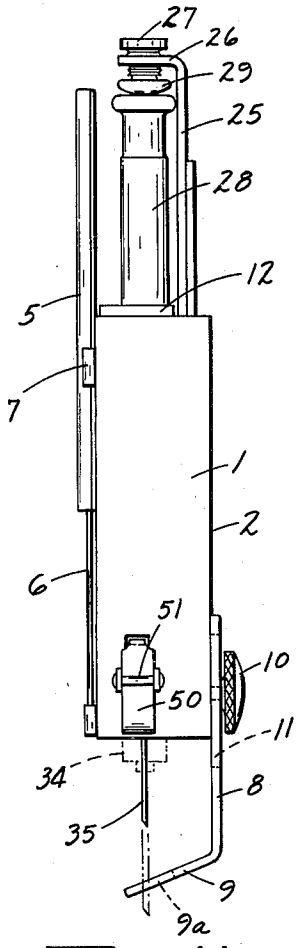

FIG. 11.

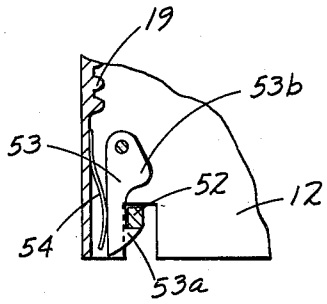

FIG. 12.

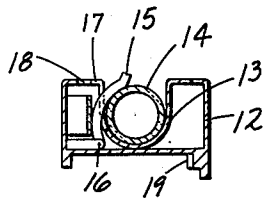

FIG. 13.

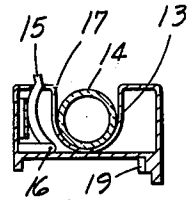

FIG. 14.

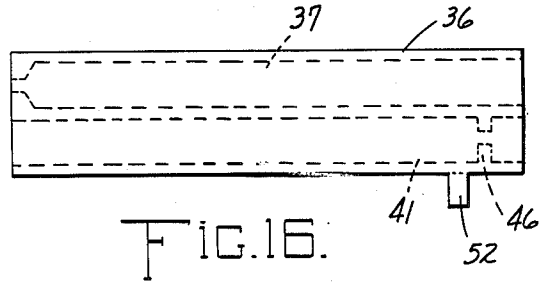

FIG. 16.

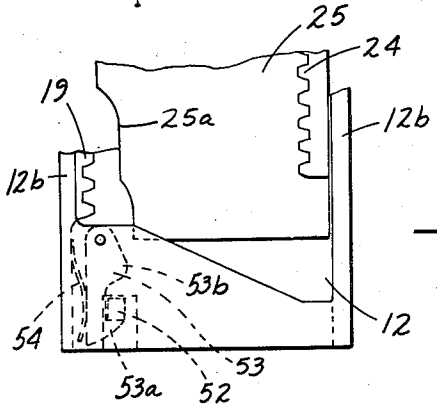

FIG. 15.

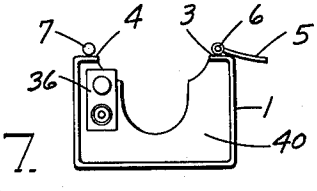

FIG. 17.

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Patented Nov. 21, 1950

2,531,267

UNITED STATES PATENT OFFICE

2,531,267

HYPODERMIC SYRINGE OPERATING DEVICE

Fritz Harnisch, New Orleans, La.

Application October 16, 1947, Serial No. 780,255

6 Claims. (Cl. 128—218)

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My present invention embodies a novel type or construction of mechanical operating device or unit designed to be used in connection with, and for operating, an ordinary hypodermic syringe for facilitating the proper use of the syringe in administering medicament to a patient, intravenously.

In carrying out my invention I contemplate the employment of an operating device of the class referred to in which the hypodermic syringe may be readily inserted when filled, and removed when empty, the said operating device having provisions such that the physician or person using the same may manipulate certain parts whereby to cause instantaneous operation of my device for inserting the hypodermic needle into the flesh, other parts for then effecting a gradual ejection of the medicament from the syringe so as to pass through the needle for administering of the medicament, and upon the completion of the administering of the medicament, cause the provisions of my device to act substantially instantly to withdraw the needle from the flesh of the patient treated.

The purpose of my invention is to eliminate the difficulty which is at present incident to the employment of the ordinary syringe as manually operated by the physician. Usually the needle of the syringe is jabbed into the patient initially, pressure is applied to the piston of the syringe to eject the medicament, and then the syringe is manually pulled out of the flesh of the patient. In my invention the operations of causing the initial penetration of the needle into the flesh of the patient and the final withdrawal of the needle are mechanically performed and effected instantly, this being conducive to a more easy operation for the patient to endure in the use of hypodermic syringes in the manner stated.

The novel features of my invention reside in the special provisions of my construction of operating device by which I am enabled to perform the operations above referred to in respect to the hypodermic syringe which may be mounted in my device.

An understanding of my invention will be had upon reference to the following detail description, and to the accompanying drawings, and in the said drawings:

Figure 1 is a view of a hypodermic syringe mounted in a device according to my invention by the opening of a door on the front of the casing of the device, the door being shown in open position and the parts of the syringe as when they are ready for administering of the medicament for

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injection purposes upon the closing of the door.

Figure 2 is a view similar to Figure 1, showing, however, the device with the parts thereof and the parts of the syringe in the positions assumed thereby when the preliminary substantially instantaneous operation of causing the needle to be inserted in the flesh of the patient has been performed.

Figure 3 is a view similar to Figures 1 and 2 illustrating the device of my invention and the syringe contained therein as when the injection operation has been completed, and the provisions for instantly withdrawing the needle from the flesh of the patient operated to effect such result.

In all of Figures 1, 2, and 3, the door of the main casing is shown open to illustrate the disposition of the interior parts.

Figure 4 is a cross sectional view taken about on the line 4—4 of Figure 1, the door to the main casing of my device being shown open.

Figure 5 is a view looking toward the rear side of the syringe carrier showing the mounting of the ejector slide for the syringe plunger relatively to the carrier and bringing out the arrangement of the lever parts for operating the slide, in dotted lines, since such parts would ordinarily not be shown in the view.

Figure 6 is a view somewhat similar to Figure 5 but showing the operating lever for the ejector slide as when moved to carry the slide toward its final ejecting position for the plunger of the syringe.

Figure 7 is a sectional view taken largely through the casing, the syringe carrier, and the special spring unit parts of my device illustrating the internal arrangement or disposition of the operating features when the device has the parts generally disposed as in Figure 1, at which time the spring unit and the syringe carrier are cocked and ready to be released for instant operation to insert the hypodermic needle into the flesh.

Figure 8 is a view similar to Figure 7 but showing the internal parts as when they have been operated to cause the insertion of the needle into the flesh initially before the injection, in which positions they are shown also in Figure 2.

Figure 9 is a view similar to Figures 7 ant 8 but illustrating the internal parts of the casing as above mentioned when the positions of the parts are as seen in Figure 3, that is, after the syringe has been emptied of its medicament and the hypodermic needle has been substantially instantly withdrawn from the flesh at the end of the injection operation.

Figure 10 is an enlarged view bringing out more clearly the pushing spring means which is employed intermediate the syringe carrier and the spring unit that contains the pushing spring and the pulling spring of the operating mechanism.

Figure 11 is a side view of my device looking from the right as seen in Figure 1, with the parts thereof adjusted substantially as they are shown in Figure 1, with the door of the casing open.

Figure 12 is a detail fragmentary view of the lower end portion of the syringe carrier which supports the dog for interlocking said carrier with the spring unit containing the pushing and pulling spring previously mentioned.

Figures 13 and 14 are horizontal sectional views taken through my device about on a line of the location of the spring catch which holds the barrel or cylinder of the syringe in the casing, Figure 13 showing said spring catch as when engaged with the cylinder of the syringe and Figure 14 showing said catch as when disengaged and held disengaged temporarily for the purpose of removal of the syringe and introducing a fresh syringe or a refilled syringe.

Figure 15 is a rear broken view of the ejector slide and the syringe carrier alone, showing more clearly the cam carried by the ejector slide.

Figure 16 is a view in side elevation of the tubular spring unit which houses the pushing and pulling springs cooperative with the said unit and with the syringe carrier.

Figure 17 is a top end view looking down into the casing and illustrating only the spring unit therein to disclose its arrangement more fully.

Referring to the drawings, it is noted that my operating unit comprises a casing 1 which is largely of U-shaped formation in cross section as seen in Figure 4, the back of the casing being closed as at 2 and the front portion of the casing, which is generally open, being formed with inturned flanges 3 and 4, the flange 3 carrying a pivoted door 5 having limited vertical sliding movement on a pintle rod 6, the free end of said door engageable when closed and held closed with a catch 7 on the flange 4. The door 5 will be open to enable the placing of the hypodermic syringe in filled condition in the casing and the removal of said syringe when emptied. At the back of the casing 1 near its lower end is mounted an adjustable guard member 8 having a lateral arm 9 inclining forwardly therefrom. This guard member is attached to the back 2 of the casing by a headed screw 10, the stem of which passes through a slot 11 formed vertically of the guard member 8, thereby to enable vertical adjustability of the guard member on the casing 1 to bring the arm 9 different distances toward or from the lower end of the casing. The object in providing the arm 9 is to have a means to engage the fleshy portion of the patient to whom the contents of the syringe is to be administered, thereby to control the depth of penetration of the hypodermic needle which is adapted to move through a slot 9a in the arm 9 in the injection operation later to be described.

In the casing 1 are mounted three important members of my operating unit. First, there is provided the syringe carrier 12 which has a fabricated metal body of generally rectangular form and hollow structure, the formation being such as to provide a syringe receiving seat 13 on the front or outer portion of the carrier, which seat is rounded to conform with the circular cross section of the hypodermic syringe of the usual type employed today. For holding the syringe,

the cylinder of which is designated 14, in the seat 13 of the carrier 12, I employ a latch member 15 pivoted on the carrier at 16 at its inner end and of curved formation so as to partially engage around toward the front of the syringe cylinder 14 for holding the said syringe from displacement from the carrier. This member 15 is seen in Figure 13 in its holding position and in Figure 14 in its disengaged position in respect to the cylinder 14. Disengagement of the latch 15 may be maintained by shifting it pivotally in a direction away from the cylinder 14 in a slot 17 formed in a side of the seat 13, and by shifting the outer end of the latch vertically in a vertical slot 18 in the carrier 12 the latch member is locked in released position enabling the barrel or cylinder 14 of the hypodermic syringe and connected parts to be removed from the carrier 12 as when it is empty and it is necessary to replace it with a syringe in filled condition. The syringe carrier 12 will be understood to be vertically slidable in the casing and certain vertical sliding movement of said carrier is adapted to be compelled by reason of the provision of a rack 19 at one side of the back or inner portion of the carrier, which rack is engageable by an interrupted tooth pinion 20 which is mounted in the space between the back of the carrier and the back 2 of the casing 1, see Figure 4. The pinion 20 is a floating pinion, so to speak, being equipped with a pin 21 for rotating the same while certain of its teeth 22 engage the rack 19, and other of its teeth 23 engage teeth of a rack 24 on a syringe plunger actuating slide 25 which is mounted to move slidably in the space between the back of the spring carrier and the said pinion 20, as well as in the space in back of the spring carrier and back 2 of the casing 1, see Figures 4 and 5. The plunger actuating slide 25 is equipped at its upper end with a laterally extending arm or flat projection 26 in which is mounted an adjustable screw 27 adapted to be alined with the upper end or head of the plunger 28 of the syringe barrel 14 previously mentioned, said inner end of the screw 27 carrying a rubber cushion 29 forming a contact piece between it and the upper end of the syringe plunger 28.

As seen in Figures 4 and 5, mounted between the back 2 of the casing 1 and the pinion 20 is a pressure lever 30 which is pivotally connected at its upper end by a removable screw or like pivot member 31 to the upper end portion of the casing 1 at the back 2 of the latter. The pressure lever 30 may be said to be a swinging lever, swinging about the pivot 31 and shiftable sidewise in the casing 1 at the back thereof, the lever having a generally extending vertical slot 32 which receives the pin 21 on the pinion 20, so that by swinging the lever 30 in one direction as by pressure on its lateral pressure arm 30a, the pinion 20 will be turned in one direction whilst opposite turning of the pinion will involve an opposite direction movement of the lever 30. The outer pressure arm of the lever 30 is formed with a finger seat 33 to receive the finger of the hand which grasps the casing 1 in the operation of injection administration, using my invention.

As readily to be seen from the foregoing, the pressure inwardly toward the casing of the pressure arm 30a of lever 30, see Figure 5, will rock the lever 30, turn the pinion 20 in one direction, clockwise as illustrated in said figure, and compel a downward sliding movement of the plunger actuating slide 25 for causing a plunger engaged thereby to move slidably in the cylinder of the

syringe unit comprising said plunger for the purpose of injecting the fluid contained in said syringe.

The syringe unit which is illustrated in the drawings is the usual type of unit including the parts 14 and 28 above described, and the needle head 34 located at the lower end of the cylinder 14 for receiving the hollow penetrating needle 35 by which the fluid injection is accomplished after the needle penetrates the flesh of the patient.

Referring to Figure 4, it will be seen that within the casing 1 there is a third unit, which I characterize as a movable spring housing 36, the details of construction of which are best seen in Figures 7 to 9 inclusive in conjunction with Figure 4. The spring housing 36 contains certain spring parts the functions of which are to place the syringe carrier 12 under tension preliminary to an injection, and impel the carrier in a direction to cause penetration of the flesh by the needle 35 by a quick or almost instantaneous movement when the carrier is released for the above purpose. Secondarily, the spring unit or housing now described further contains spring means conecting it and the syringe carrier for substantially instantaneously withdrawing the needle from the flesh of the patient after the lever 30 has been operated slowly to gradually move the slide 25 downwardly for slowly ejecting the ejection fluid from the syringe cylinder 14 by the usual action of the plunger or piston 28 thereof.

Under certain conditions the syringe carrier 12 and the spring carrying unit 36 move together, and under other conditions these two units are adapted to have relative or separate movement, as will later be pointed out. The spring unit 36 comprises a body portion mounted in the syringe carrier between the front portion of one side of the latter and the back of the carrier. Said unit is made up of a tubular portion 37 in which is received the needle inserting spring 38, one end of which spring is attached to the upper closed end of the tubular portion 37 aforesaid whilst the other end of the spring 38 is connected to a pin 39 secured to the lower end 40 of the casing 1. The spring 38 is a tension coil spring which, when expanded by movement of the unit 36 upwardly in the casing to a position such as shown in Figure 7, will tend to propel the unit 36 downwardly with the syringe carrier when the latter is locked to said unit 37. The spring unit 37 includes also a tubular spring receiving portion 41 in which is mounted a spring 42 that encircles an extensible pushing member made up of an open top sleeve 43 and a connecting rod 44 passing upwardly through the closed bottom on the lower end of said sleeve 43. The rod 44 has a head 45 on its upper end to abut, for movement limiting purposes, with the bottom of the sleeve 43. The lower end of the rod 44 passes through a partition member 46 near the bottom of the tubular portion 41 of the unit 36. The effective action of the spring 42 is an expanding action tending to force an enlarged head 47 at the top of the sleeve 43 in an upward direction against a top closing portion 48 on the hollow side of the syringe carrier in which the spring unit 36 is disposed. A small removable cross bolt 49 connecting the back plate 2 with a flange 4 at the front of the main casing 1 limits upward movement of the syringe carrier in the casing and prevents unauthorized displacement of this carrier and the unit 36 from the casing.

As seen in the drawings, near the lower end of the casing 1 there is provided a spring actuated catch 50 which is pivoted at 51 to the casing, and the upper end of which passes through an opening in the right side of the casing as seen in Figures 1, 2, and 3, so as to be able to engage beneath the lower end of the spring unit 37 for holding said spring unit in an upraised position as seen in Figure 7, along with the syringe carrier which at such time is interengaged with the spring unit by means now to be described. At the rear of the spring unit 36 as seen in Figures 7 to 9 inclusive, said unit has a rearwardly extending lug 52. Near the lower end of the syringe carrier 12, at a point adjacent to where it slides in relation to the spring unit 36, said spring carrier, as seen in Figure 12, is provided with a pivoted dog 53 which is capable of engaging the lug 52 on the spring unit 36 by means of a catch 53a adapted to underlie the lug 52. A spring 54 between a side of the spring carrier and the dog 53 normally tends to push the dog to cause its catch 53a to engage the lug 52. At its outer side portion the dog 53 has a nose 53b with which a cam 25a formed on one edge of the slide 25 is adapted to engage so that when the slide 25 reaches its lower limit of movement, by which it causes the ejection of the fluid in the cylinder 14 of the syringe, the cam 25a will strike the dog 53 at the nose 53b and rock said dog to disengage its catch 53a from the lug on the spring unit 36.

For guiding the slide 25 vertically in its movement at the rear side of the spring carrier, I provide a slot 25b centrally and vertically or longitudinally of the slide 25 in which slot is received a guide pin 12a projecting rearwardly from the back of the syringe carrier 12. As seen in Figure 4, the syringe carrier 12 has longitudinal flanges 12b at opposite sides thereof and projecting rearwardly from its back plate, one of the flanges 12b carrying the rack previously mentioned. The flanges 12b really provide guides between which the ejector slide 25 operates slidably relatively to the carrier 12. The foregoing sets forth the detail construction of my syringe operating unit or device, and I will now describe in regular order the method of using or operating the same.

It will be assumed that the parts of my operating device are in the condition of Figures 1 and 7, in which the various parts of the device and the associated loaded hypodermic syringe are ready to be used for an injection. The physician or user will close the door 5, which is shown open in Figure 1, place the arm 9 of the guard 8 in contact with the flesh of the patient and preferably with the physician's hand grasping the device around the casing 1, the tail of the catch 50 will be pressed with the thumb. Now in the condition of the parts in Figures 1 and 7, the spring unit 36 has been raised so that the catch 50 engages the lower end of said unit to hold the same so raised with the spring 38, which is virtually a self contained power device, expanded and exerting a pull downwardly on the unit 36. At this time the syringe carrier 12, having had its dog 53 interengaged with the lug 52 of the carrier 36, in order that by upward pulling on the carrier the unit 36 could be raised to cocked position, so to speak, as seen in Figure 7, it is obvious that the spring carrier is in upraised condition also see Figure 7. The release of the catch 50 from the spring carrier 36 causes the spring 38 to pull downwardly on the unit 36 with a quick movement of the same, and since the carrier 12 is interlocked with the unit 36 by the

catch 53, the syringe carrier is caused to move simultaneously with the unit 36, thereby to bodily carry the syringe and needle 35 thereof to the positions illustrated in Figure 2. The needle 35 is here in a position penetrating the flesh of the patient, this penetration being accomplished by the quick down pull movement of the spring 38 acting on the unit 36 and the carrier 12.

The injection fluid is now ready to be expelled or ejected from the cylinder 14 of the syringe so the person using my device, by the pressure of the second finger of his hand preferably, will gradually force the pressure lever arm 30*a* toward the casing 1, rocking the lever 30 so as to turn the pinion 20 and cause a gradual movement downwardly of the ejector slide 25 incident to the gradual pressure on the part 33 of the lever 30. The slow movement of the lever 30 and corresponding movement of the slide 25 propels the plunger 28 into the cylinder 14, and the medicament in the cylinder 14 is injected into the patient through the needle 35. Figure 2 shows the injecting operation being performed with the needle 35 inserted in the flesh of the patient. When the ejector slide 25 under the compulsion of the movement of the lever 30 has reached the limit of its ejecting movement incident to the operation of the plunger 28 and the cylinder 14 is practically empty of medicament, the lower end cam 25*a* on the slide 25 will strike the nose 53*b* of the dog 53 and rock the catch 53*a* of the dog from under the lug 52 of the spring unit 36 permitting the spring 42 of the spring unit to act automatically upon the expansible connector parts 43 and 44 in a manner to cause the upper head 47 of the sleeve 43 to act upon the adjacent upper end portion of the syringe carrier and push the syringe carrier in an upward direction as seen in Figure 9 and in Figure 3, with a quick movement withdrawing the needle from the flesh of the person, at which time the parts are substantially in the positions of Figures 3 and 9. In other words, the spring 42 is an automatic self contained power device to instantly retract the needle 35 when the intravenous fluid injection operation has been completed.

The syringe is now empty of medicament, and to condition the operating device for a second or fresh operation as above described, the user will, by his hand, move the cylinder catch 15 laterally away from the syringe cylinder 4 and then shift the catch into the notch or slot 18 of the syringe carrier. The empty syringe, such as seen in Figure 3, will now be removed, the door 5 having previously been opened before manipulation of the catch 15.

For conditioning the device for the next use thereof with the same syringe freshly filled, or a new syringe already filled, it is necessary for the operator to cause the slide 25 to be moved upwardly in the casing 1 so its cam 25*a* is not engaged with the dog 53. Thereupon, the syringe carrier is forced downwardly from its position as seen in Figure 9 until the said dog 53 engages beneath the lug 52 of the spring unit 36. Then, by manual force, which may be exerted by pulling upwardly on the slide 25, the syringe carrier 12 is raised in the casing 1 and simultaneously raises the spring unit 36 until the catch 50 engages beneath the lower end of the spring unit 36 and locks it in its upward adjustment, at the same time locking the syringe carrier 12 in its upward position as seen in Figure 7. The operating device of my invention is now cocked, so to speak, ready to operate another syringe placed

therein when the door 5 is open and such syringe engaged at its barrel or cylinder 14 by the catch 15. When the fresh syringe is thus placed in position, the parts will be related as they are shown in Figure 1 and Figure 7, ready for the next injection, which will involve the tripping of the catch member 50 for the instant penetrating action of the needle 35 in the manner previously described, the pressing of the lever arm 30*a*, as previously described, causing the ejecting movement of the slide 25 which finally trips the dog 53 for the pulling out action of the needle when the administration of the medicament is completed.

It is notable that the action of the spring 38 on the spring unit 36 is a downward pulling action, which action works in the same manner on the syringe carrier after the latter is locked to the spring unit 36 and the two upraised to the position of Figure 7. The action of the spring 42 however is an upward pushing action tending in a measure to separate or move the syringe carrier upwards in relation to the syring unit 36 which remains in its down position during the needle 35 withdrawing action.

The rubber or cushion member 29 is adjustable by the screw 27 in order to allow the fluid to surely empty the cylinder 14 of the syringe before the dog 53 is tripped to release the syringe carrier to effect the instant upward needle withdrawing movement of the latter.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In an operating device for intravenous injection syringes, in combination, a casing, a syringe carrier movable in the casing, and mechanism coacting with the carrier to cause quick movement of the carrier to first cause needle inserting action of the syringe mounted thereon, and later effect reverse quick needle withdrawing movement of said syringe, the mechanism including a spring unit comprising a spring for causing syringe needle inserting movement of the carrier, means on the carrier to move the said unit to condition said spring for said inserting movement of the carrier, means to lock the carrier from movement when the spring is so conditioned, and means to release the carrier for said movement, said unit including a second spring between it and the carrier adapted to be conditioned by movement of the carrier to cause needle withdrawal movement of the latter, other means to lock the carrier to the unit when the second spring is so conditioned, and a device to unlock the carrier and unit for enabling the spring to effect such needle withdrawal movement.

2. In an operating device for intravenous injection syringes, in combination, a casing, a syringe carrier movable in the casing, and mechanism coacting with the carrier to cause quick movement of the carrier to first cause needle inserting action of the syringe mounted thereon, and later effect reverse quick needle withdrawing movement of said syringe, the mechanism including a spring unit comprising a spring for causing syringe needle inserting movement of the carrier, means on the carrier to move the said unit to condition said spring for said inserting movement of the carrier, means to lock the carrier from movement when the spring is so conditioned, and means to release the carrier for said movement, said unit including a second spring between it and the carrier adapted to be

conditioned by movement of the carrier to cause needle withdrawal movement of the latter, other means to lock the carrier to the unit when the second spring is so conditioned, and a device to unlock the carrier and unit for enabling the spring to effect such needle withdrawal movement, the first spring being put under tension when conditioned as stated, and the second spring being compressed when conditioned as stated.

3. In an operating device for intravenous injection syringes, in combination, a casing, a syringe carrier movable in the casing, and mechanism coacting with the carrier to cause quick movement of the carrier to first cause needle inserting action of the syringe mounted thereon, and later effect reverse quick needle withdrawing movement of said syringe, the mechanism including a spring unit comprising a spring for causing syringe needle inserting movement of the carrier, means on the carrier to move the said unit to condition said spring for said inserting movement of the carrier, means to lock the carrier from movement when the spring is so conditioned, and means to release the carrier for said movement, said unit including a second spring between it and the carrier adapted to be conditioned by movement of the carrier to cause needle withdrawal movement of the latter, other means to lock the carrier to the unit when the second spring is so conditioned, and a device to unlock the carrier and unit for enabling the spring to effect such needle withdrawal movement, said part comprising a cam formed thereon to engage and release the lock means between the carrier and spring unit for initiating said needle withdrawal movement.

4. In an operating device for intravenous injection syringes, in combination, a casing, a syringe carrier in the casing, a syringe ejecting plunger operating device on the casing including a manual presser member, means comprising an automatic power device to actuate the carrier to withdraw the needle of a syringe thereon, means to lock the said power device temporarily inoperative to function, and a part on said operating device to release the lock means when the operating device has substantially completed its plunger operating action to thereby enable the power device to automatically effect needle withdrawing movement of the carrier.

5. In an operating device for intravenous injection syringes, in combination, a casing, a syringe carrier in the casing, means on the casing to move the plunger of the syringe for slowly injecting the fluid contents of said syringe, a power device for imparting quick needle inserting movement of the carrier while supporting a hypodermic syringe, a second power device for imparting quick needle withdrawing movement of the carrier, manually operable means normally locking said first power device against action, and automatically operable means for locking the second power device against action operable by fluid injecting movement of the carrier to release the second power device for needle withdrawal actuation of the carrier.

6. In an operating device for intravenous injection syringes, in combination, a casing, a syringe carrier movable in the casing, and mechanism coacting with the carrier including a first power device comprising a spring operable by movement of the carrier to condition same to effect syringe needle inserting movement of the syringe needle, and a second automatic power device releasable by said carrier, said second power device comprising an automatic acting spring having stored power to suddenly effect needle withdrawal movement, and a lock member operable by the carrier to cause automatic action of the second power device.

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