

March 9, 1954

F. HARNISCH

2,671,448

AUTOMATIC HYPODERMIC SYRINGE

Filed Feb. 19, 1951

2 Sheets-Sheet 1

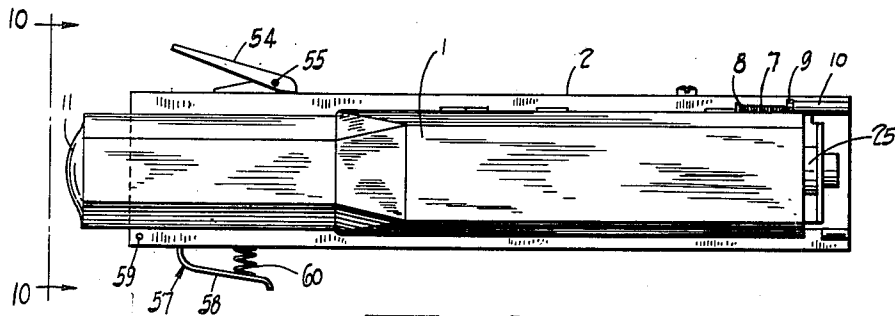


FIG. 1

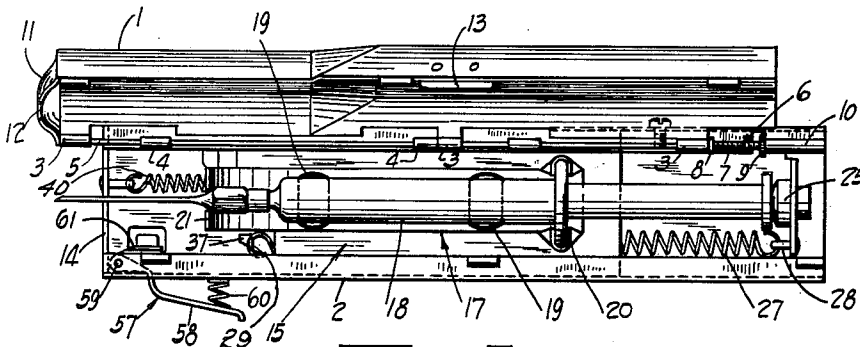


FIG. 2

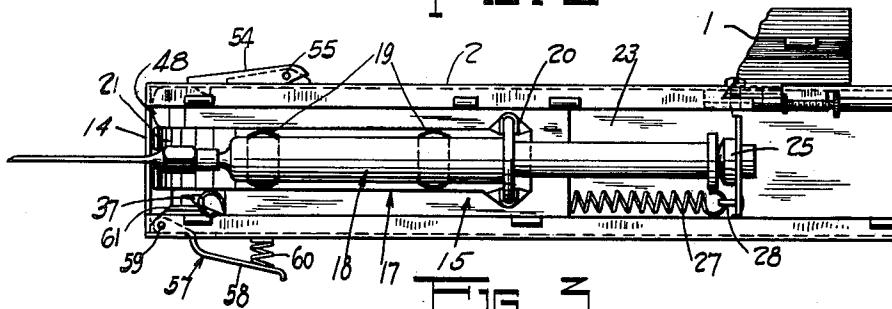


FIG. 3

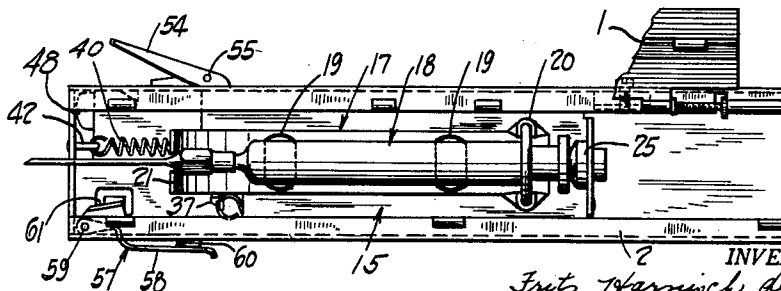


FIG. 4

INVENTOR.
Fritz Harnisch, deceased.
BY L. W. Harnisch,
Administratrix
Robb & Robb,
Attorneys

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F. HARNISCH

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2 Sheets-Sheet 2

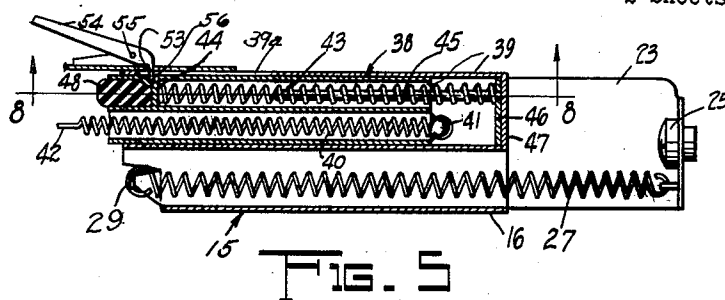


FIG. 5

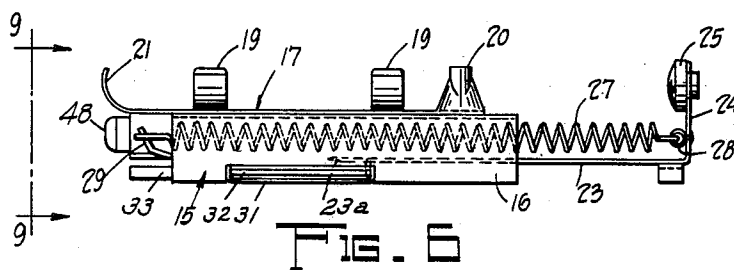


FIG. 6

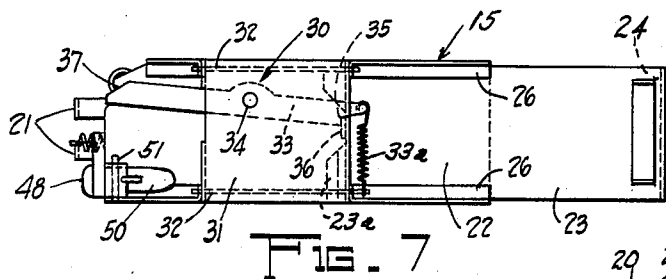


FIG. 7

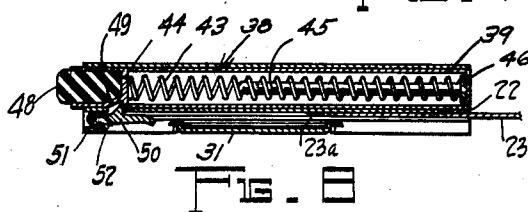


FIG. 8

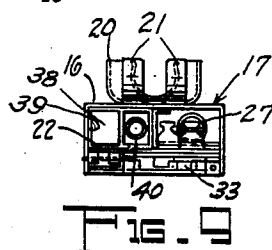


FIG. 9

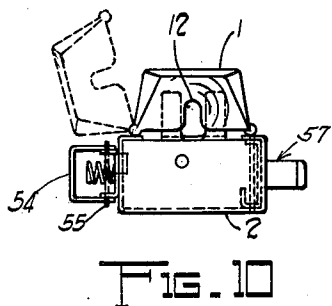


FIG. 10

INVENTOR.
Fritz Harnisch, deceased
BY E. W. Harnisch,
Administratrix
Robb & Robb,
Attorneys

UNITED STATES PATENT OFFICE

2,671,448

AUTOMATIC HYPODERMIC SYRINGE

Fritz Harnisch, deceased, late of New Orleans,
La., by Georgiana W. Harnisch, administratrix,
New Orleans, La.

Application February 19, 1951, Serial No. 211,642

7 Claims. (Cl. 128—218)

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This invention relates to a novel form of automatic hypodermic syringe operating mechanism or device, constructed so as to avail of the usual hypodermic syringe in conjunction with simple, unique, and automatic features included in a unit with which the syringe is adapted to be associated.

This invention is an improvement upon prior application for patent, Serial No. 780,255, filed October 16, 1947, now Patent No. 2,531,267, issued November 21, 1950, the primary improvements over that said application residing in a construction which makes possible completely automatic operation of the device herein described.

One of the primary features of this particular device is that it is suitable for use by persons who are not necessarily skilled in using the ordinary hypodermic syringe, since it includes certain features which carry out the sequence of injection of the needle into the epidermis, a forcing of the medicament through the needle and into the vein or other part of the body, as the case may be, and subsequent withdrawal of the needle when the injection of the medicament has been completed.

The device as a unit is entirely enclosed and maintains the syringe in a set condition preliminary to use and may be very simply operated by manipulation thereof; enabling unskilled ordinary persons to use the same, with very simple initial instructions.

While in his former device, disclosed in the application above referred to, he provided means for controlling the injection of the needle into the epidermis, manually, and withdrawal of the same manually, in the present disclosed device all of the foregoing operations are carried out in proper sequence and by automatic operation of the unit or device shown.

He further provides means for effecting adjustment of the device so as to limit or regulate the depth of penetration of the needle into the epidermis, and by a unique combination of slidable members under the control of simple triggers or releasing devices, effect the entire operation of hypodermic injection, making possible a uniform method of procedure such as is commonly availed of by experts who use hypodermic syringes as general practice.

It is therefore an object of this invention to disclose such automatic means and arrangement of parts for carrying out the same, whereby persons who require the hypodermic injections

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may be able to effect them for themselves, without resorting to skilled assistance therefor.

It is a further object of this invention to provide a useful device having relatively few parts, so arranged and constructed as to carry out the sequence of operation by simple manipulation.

It is a still further object of this invention to provide a novel form of hypodermic syringe carrier, which carrier may be preloaded after the syringe is arranged thereon and by subsequent manipulation the needle of the syringe is carried into the epidermis, and at a predetermined time, depending upon the characteristics of various springs and under the control of the operator, the medicament may be injected, and thereafter the needle of the hypodermic syringe is automatically withdrawn, whereby the complete operation is thus effected.

It is a further object of this invention to provide a novel form of cartridge associated with the carrier, which upon preloading may be released to move the carrier in one direction, and upon suitable manipulation of the releasing member said carrier will be moved in the other direction by the cartridge.

It is a still further object of this invention to provide a completely enclosed unit adapted to support therein the usual hypodermic syringe, including the needle thereof for manipulation in a manner to effect the desired injection of medicament.

An understanding of his invention will be had upon reference to the following detailed description and to the accompanying drawings, and in the drawings:

Figure 1 is a top plan view of the mechanism of his device, showing the cover thereon in closed condition and the control members in their relationship on opposite sides of the device.

Figure 2 is a top plan view of the mechanism with the cover in open position, showing the hypodermic syringe in position on the carrier, the same figure disclosing the device as initially loaded prior to injection.

Figure 3 is a plan view similar to Figure 2 showing the device as having permitted movement of the hypodermic syringe as a whole toward the left, whereby the needle of the same is injected into the epidermis preliminary to expulsion of the medicament therein.

Figure 4 is a view similar to Figure 3 wherein the medicament has been expelled from the hypodermic syringe, and the carrier is moved to the right so as to withdraw the needle from the epidermis.

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Figure 5 is a longitudinal sectional view, somewhat fragmentary, illustrating relationship of various parts and associated springs when the device is in the condition disclosed in Figure 2.

Figure 6 is a sectional view, somewhat fragmentary in nature, disclosing the carrier as having been removed from the syringe, the same being in its preloaded position.

Figure 7 is a bottom view of the part of the device shown in Figure 6, disclosing certain parts of the latching and releasing mechanism.

Figure 8 is a sectional view taken about on the line 8—8 of Figure 5, through the cartridge, disclosing the means for maintaining the cartridge in loaded condition.

Figure 9 is an end view of Figure 6 showing the form of the carrier.

Figure 10 is an end view of Figure 1, looking from the left thereof, disclosing the cover (in full lines) in closed position and in its open position in the dotted lines.

Referring to Figures 1, 2 and 10, it will be noted that the device or unit comprises a housing including a cover 1 and a channel shaped body 2. The cover 1 is hingedly connected along one side of the open portion of the body by hinge members 3 formed with the cover 1 and hinge members 4 formed with the body 2. A hinge pin 5 engages members 3 and 4 in a manner to permit movement of the member 1 from the full line position shown in Figure 10 to the dotted line position shown therein.

Adjacent one end of the body 2 and at one side, an adjusting screw device 6 is provided, comprising a threaded member 7 having a head 8 thereon adapted to abut with one of the hinge members 3 of the cover. A suitable nut 9 is provided for threaded engagement with the member 7, the said member 7 being received in a cylindrical opening formed by rolling up the edge of the body at 10. It will be obvious that manipulation of the nut 9 along the member 7 will permit movement of the cover 1 on the hinge pin 5, within limits, and for purposes to be hereinafter set forth.

The cover 1 is provided at one end with a hemispherical portion 11, as seen in Figures 1 and 2, the said hemispherical portion 11 having an opening 12 therein, through which the needle of the hypodermic syringe can be projected. The hemispherical or dome like portion 11 is intended to be placed against the epidermis during manipulation of the device as will be subsequently disclosed.

The cover member 1 is additionally provided with a frictional latch member 13 adapted to engage the edge of the channel-like body 2 at the side opposite the hinge portions 4 thereof, so as to maintain the cover in its closed position, as seen in Figures 1 and 10.

The channel shaped body 2 is closed at one end as at 14, and is provided with a carrier generally designated 15 for reciprocation therein.

Referring now to Figures 5 to 9 inclusive particularly, it will be noted that this carrier 15 includes a substantially U-shaped body member 16 supported in an inverted position within the channel shaped body 2. The upper cross piece of the body of the carrier 15 is provided with a cradle generally designated 17, adapted to support a conventional hypodermic syringe generally designated 18, thereon. This hypodermic syringe cradle 17 includes a pair of semi-circular spring members 19 to receive the body of the hypodermic syringe, a flange receiving member

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20, to receive the flange of the said syringe, and a pair of fingers 21, between which the needle of the syringe is received. The foregoing provisions thus enable the hypodermic syringe to be removably seated on the carrier.

Near the lower edges of the depending sides of the inverted U-shaped carrier 16 (see Figure 9) a cross plate 22 is fixed to the sides and extends from side to side and end to end of the said carrier member 16. This cross plate 22 divides the interior of the carrier 15 into upper and lower sections, as will be seen in Figure 9. In the lower section and beneath the cross plate 22, a plunger actuating slide 23 is supported. This is an L-shaped member including an upstanding portion 24 at one end thereof provided with a resilient bumper 25 for coaction with the plunger of the hypodermic syringe as will be later set forth. A cam portion 23a is formed on the other end of the slide 23. Suitable guide means 26 for the slide 23 are provided so as to maintain the same in position for reciprocation during operation of the mechanism, and shown particularly in Figure 7. A spring 27 fastened at 28 to the upstanding portion 24 of the slide 23, extends through the carrier body 16 in the upper portion thereof, from the cross plate 22, and is fastened at 29 to the said cross plate, said spring 27 being so constructed as to be placed under tension when expanded, for purposes to be made clear as this description proceeds. In order to maintain the slide 23 in the position shown in Figure 6, wherein the spring 27 is under tension, a suitable latch unit generally designated 30 is provided. This latch unit 30 comprises a plate 31 fastened by pins 32 to opposite sides of the guide means for the slide on the opposite sides of the carrier body 16. The latch unit 30 further includes an arm 33 pivotally connected at 34 to the plate 31. One end of the arm 33 is provided with a notch 35 adapted to engage a down-turned ear or detent 36 formed near one end of the slide 23. The other end of the arm 33 includes a cam portion 37 for coaction with a releasing detent as will be later set forth. A suitable spring 33a, connected to the arm 33 and one of the pins 32, tends to maintain the notch 35 engaged with ear 36.

In the upper section of the carrier 15 a cartridge generally designated 38 is provided (see Figure 5), the said cartridge including means for reciprocation of the entire carrier 15 in both directions in the housing 2. The cartridge 38 includes a body 39 comprising a tubular member rectangular in cross section, divided into two passages extending longitudinally thereof, as seen in Figure 9.

The division of the body 39 of the cartridge provides therefor two substantially rectangular passages. A tension spring 40 is fastened at one end to a portion of the cartridge as at 41, and extends through one of the passages, in turn being fastened at 42 (see Figures 2 and 4) to the end wall 14 of the body 2. A compression spring 43 is seated in the other passage of the cartridge body 39 against a closure 44 for the passage. A spring guide 45 in the form of a rod having a foot 46 thereon, is provided, the rod 45 being entered in the coils of the spring 43. The foot 46 engages an end 47 of the carrier 15, this end being a closure for that section of the carrier in which the cartridge 38 reciprocates. The foregoing arrangement provides means for moving the cartridge 38 relatively outwardly, or towards the left in Figure 5, upon expansion of

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the spring 43 from the compressed position shown in said figure. A suitable resilient bumper 48 is fixed in the end of the passage and adapted to abut end wall 14 of the housing 2 during operation of the device as later explained.

The cartridge 38 is provided with a notch 49 formed in the lower side thereof for coaction with a detent 50 (see Figure 8), the said detent being pivoted at 51 to the cross plate 22 previously mentioned, the said detent 50 being below the said cross plate. The detent 50 is adapted to be held in the position shown in Figure 8 by means of a suitable spring 52. In view of the foregoing it will be apparent that the spring 43 will be conditioned by loading the same, when the cartridge 38 is moved to the right, to the position shown in Figures 5 and 8, and the cartridge will therefore be in position to move the carrier 15 as a whole to the right. This will be effected by abutment of the resilient bumper 48 with the end wall 14 of the housing 2 in a manner to be hereinafter set forth.

As seen in Figure 5, the cartridge 38 is additionally provided with a notch 53 located on the side thereof for engagement by a carrier holding latch 54. The latch 54 is pivotally supported on the housing 2 at 55 and includes a notch engaging portion 56. A suitable elongated opening 39a in the cartridge body 39 is provided whereby the portion 56 projects therethrough to engage the notch 53 in a manner and for purposes to be further explained.

A carrier releasing mechanism 57 (see Figure 3), includes a releasing trigger 58 suitably supported at 59 on the housing 2, a spring 60 being availed of to maintain the trigger in non-operating condition as shown in said figure. Pressing inwardly on the trigger 58 against the spring 60 will cause a cam section 61 thereof to engage the cam portion 37 of the arm 33 (see Figures 3, 4, and 7), whereby the arm is pivoted in counterclockwise direction and thus the notch 35 in the said arm is disengaged from the detent 36 of the slide 23. The slide 23 will thereupon move to the left from the position of Figures 3 and 7 to the Figure 4 position, to effect expulsion of the medicament in the syringe 18.

It will be apparent that as the slide 23 reaches its extreme leftward position the cam portion 23a thereof will engage the detent 50 and thus release the cartridge 38 whereby the carrier 15 as a whole will thereafter be moved to the right by expansion of the spring 43 in the said cartridge.

A description of the operation of the mechanism hereinbefore described will now be set forth, said operation including a detailed explanation of the initial setting movements required to place the mechanism in condition for operation, and the subsequent releasing cycle which follows to effect the introduction of the medicament at the point desired.

With the carrier 15 shown in the position of Figure 4, the slide 23 is moved toward the right to a position where the notch 35 of the arm 33, in the latch mechanism 30 is engaged by the detent 36 on the said slide. This will maintain the slide in the position shown in Figure 6. Thereafter by pushing on the upstanding portion 24 toward the left, the notch 49 on the lower side of the cartridge 38 is engaged by the detent 50 in the carrier 15. When the cartridge is in relatively locked relationship with the carrier 15, subsequent movement of the carrier as a whole toward the right, by pushing on the bumper 25

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for example, will cause the engagement of the notch 53 on the side of the cartridge, with the carrier holding latch 54. When the above cycle of operation has been undertaken the position of the parts will be that shown in Figure 2, the slide 23 and bumper thereon being in substantially the extreme right position in the housing 2 of the mechanism. It should also be noted that the spring 27 is expanded placing the same under tension, the same being true of the spring 40 in the cartridge 38. The spring 43 within the cartridge will have been placed under compression by reason of the relative movement of the cartridge in the carrier towards the right, as above set forth.

With the various parts in the position shown in Figure 2, the syringe 18 is placed on the cradle 17 with the plunger of the syringe in its extended position so as to abut the cushion or bumper 25. It will be noted that the needle of the syringe will be completely enclosed within the device when the cover 1 thereof is closed so as to assume the position shown in Figure 1. This is the normal preliminary position with all the parts completely enclosed within the device, ready for use in its injecting operation.

The point of injection having been selected previously, the hemispherical portion 11 of the housing 1 is placed in position on the epidermis and the following releasing cycle will be carried forth:

The carrier holding latch 54 is pressed so as to assume the position shown in Figure 3, whereby the locking portion 56 thereof becomes disengaged from the notch 53 of the cartridge 38 and thus the spring 49 is permitted to contract. This moves the entire carrier 15 toward the left and the needle of the hypodermic syringe penetrates the epidermis through the opening 12 in the cover 1. Thereafter the releasing trigger 57 is pressed, so as to compress spring 60. This compression moves the arm 33 of the latch unit 30 and effects disengagement of the notch 35 on the arm from the detent 36 in the slide 23. This will permit the slide to move toward the left, the rubber bumper or resilient cushion 25 on the slide contacting the plunger of the syringe and forcing the contents thereof through the needle into the patient. When the slide 23 has moved to its extreme left position in its relation to the carrier 15, cam portion 23a thereof will engage the detent 50 and move the same in a clockwise direction around the pivot 51 so as to become disengaged from the notch 49 of the cartridge 38. It will be understood that at this point the contents of the hypodermic syringe 18 have been ejected therefrom through the needle and the operation of releasing of the detent 50 will permit the spring 43 within the cartridge 38 to expand. The contact of the cushion 48 on the end of the cartridge will force the carrier as a whole to the right, carrying with it the syringe 18 and the needle thereon. This action above described may be properly called the withdrawal action. The parts of the device just described will thereupon have assumed the position shown in Figure 4, the operation just described having been substantially automatic under the control of the carrier holding latch 54 and the releasing trigger 58.

In view of the foregoing it will be apparent that he has provided a device which is substantially completely automatic as to its needle injection operation, the ejection of the medicament from within the hypodermic syringe, and the

subsequent withdrawal of the needle from the patient in a unique and novel manner under the control of suitable instrumentalities provided therefor.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent of the United States is:

1. Mechanism of the class described, in combination, a housing, a carrier in the housing, a hypodermic syringe on the carrier including a needle and a plunger, a syringe plunger operating slide mounted in said carrier for moving the plunger, releasable means for moving the carrier in one direction, automatic means operable after movement of the carrier in said one direction has been completed to eject the contents of the hypodermic syringe, said automatic means including means for moving the carrier in the opposite direction, actuated incident to completion of ejection of contents of the syringe, the means for moving the carrier in one direction and the means for moving the same in the opposite direction, comprising a cartridge slidably mounted in the carrier, a detent on the carrier for engagement with said cartridge, a spring conditioned for actuation by relative movement of the cartridge with respect to the carrier, in one direction, a spring conditioned for actuation by movement of the cartridge with respect to the carrier in another direction, and means on the housing for releasing said carrier for movement by one of said springs in said one direction.

2. Mechanism as claimed in claim 1, wherein the carrier includes means for releasing the other spring to operate to move the carrier in the said other direction.

3. Mechanism of the class described, in combination, a housing, a carrier in the housing, a hypodermic syringe on the carrier including a needle, releasable means for moving the carrier in one direction, automatic means operable after movement of the carrier in said one direction has been completed to eject the contents of the hypodermic syringe, said automatic means including means for moving the carrier in the opposite direction, actuated incident to completion of ejection of contents of the syringe, the syringe having a plunger, the means operable on movement of the carrier in said one direction to eject the contents of the syringe comprising a slide provided with a portion in engagement with said plunger, a latch unit in the said carrier, a spring for causing relative movement of the carrier and the slide, and a releasing trigger on the housing cooperable with said latch unit to release said slide and permit movement of the same by the said spring.

4. Mechanism of the class described, in combination, a housing, a carrier in the housing, a hypodermic syringe on the carrier including a needle and a plunger, releasable means for moving the carrier in one direction, automatic means operable after movement of the carrier in said

one direction has been completed to eject the contents of the hypodermic syringe and including a slide having a part engaging said plunger to eject the contents of the syringe, said automatic means also including means for moving the carrier in the opposite direction, actuated incident to completion of ejection of contents of the syringe, the housing comprising a channel shaped body member and a cover hinged thereto, the carrier includes a substantially U-shaped body member and a cross plate therein, the said slide mounted for reciprocal movement in the carrier below said plate, a tension spring fastened to said slide and to said cross plate and extending through said body member, a latch unit adapted to restrain said slide and means on the body member to release said unit when the carrier moves to a position adjacent one end of the body member aforesaid.

5. Mechanism of the class described, in combination, a housing, a carrier in said housing, a hypodermic syringe on the carrier including a plunger, an operating member on said carrier for engagement with the plunger of said syringe for moving said plunger, and a cartridge in said carrier, said cartridge including means for releasable engagement with the carrier and with the housing aforesaid, automatically operable means between said cartridge and said carrier for effecting relative movement thereof, other automatically operable means between said cartridge and said housing for effecting movement of said carrier with respect to said housing, and means for releasing both of said movement effecting means.

6. Mechanism as claimed in claim 5, wherein the means for effecting relative movement between said cartridge and said carrier includes a compression spring, and a detent on the carrier is provided for releasing said spring.

7. Mechanism as claimed in claim 5, wherein the means for effecting movement of said carrier with respect to said housing, comprises a tension spring connected to said carrier and said cartridge, and the means for releasing said spring comprises a trigger on the housing.

GEORGIANA W. HARNISCH,
Administratrix of the estate of Fritz Harnisch, deceased.

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