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H. S. AUSTIN
HYPODERMIC SYRINGE

2,409,656

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Fig. 1

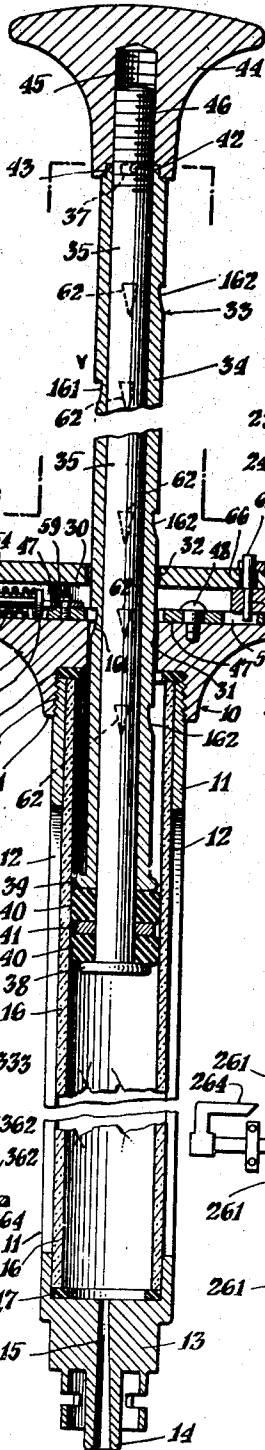


Fig. 2

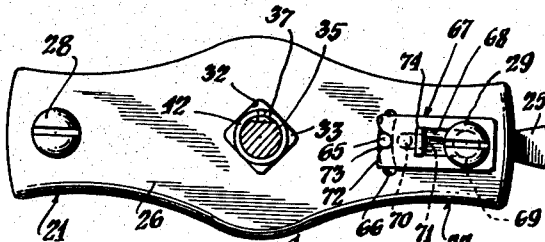


Fig. 3

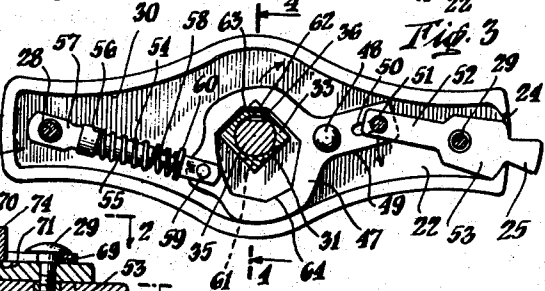


Fig. 4

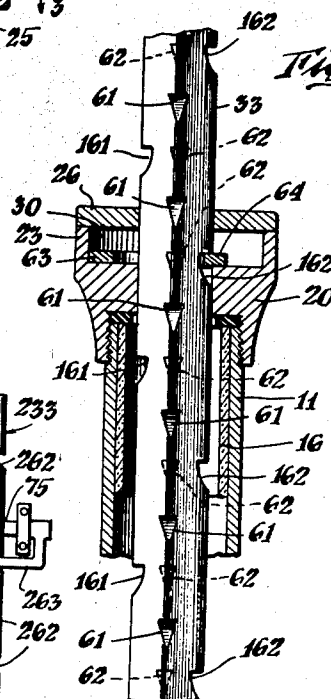


Fig. 5

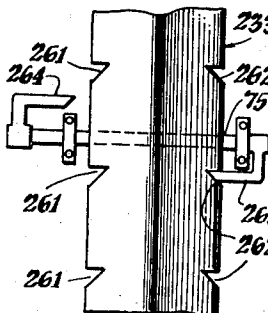
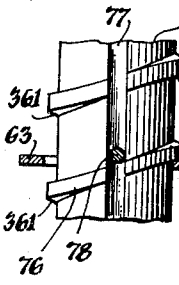


Fig. 6



INVENTOR

BY

Harold S. Austin
Watson, Bristol, Johnson & Leavenworth
ATTORNEYS

UNITED STATES PATENT OFFICE

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HYPODERMIC SYRINGE

Harold S. Austin, Dallas, Tex.

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The present invention relates to hypodermic syringes and, more particularly, to a type thereof which may be selectively operated and controlled to administer predetermined fluid doses.

A general object of the present invention is to provide a hypodermic syringe which is of such simple construction as to be readily and economically manufactured, is capable of being efficiently manipulated in a ready manner as to assure efficient delivery therefrom of successive doses of precise or substantially equal quantities, may be adjusted in a simple manner efficiently to change the quantity of the successive doses, and is capable of operation in the usual manner of certain types of syringes adapted to discharge the entire barrel contents in a single dose.

A more specific object of the invention is the provision of such a hypodermic syringe which has a manual control or button readily accessible to an operator's digit which may be successively manipulated in a simple manner without requiring employment of both hands to permit step-by-step plunger action efficiently to discharge from the barrel successive doses of precise or equal quantity as may be determined.

Another object of the invention is to provide such a hypodermic syringe with plunger shaft means having a plurality of series of abutment means alternately to cooperate with manually operable stop means so that an engaging means of the latter may be moved into and out of the path of one series of abutment means and another engaging means of the stop means may be operated in a reverse manner with respect to another series of the abutment means by the same manual action to permit the abutment means of the plurality of series thereof alternately to operate as effective stops for plunger travel.

A further object of the invention is to embody the novel structure thereof in a few simple parts which may be easily substituted for standard parts of existing commercial constructions thereby permitting ready economical conversion of the latter to structures assuring attainment of the desired ends in an efficient manner.

A still further object of the invention is to provide such hypodermic syringe constructions with means permitting at will cooperative action of the engaging stop means with respect to pre-determining plunger travel abutment means to assure attainment of a desired step-by-step plunger action in discharge of precise or uniform doses from a single charge of fluid, or manipulation of the stop means to inactive position to permit dis-

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charge from the barrel of the whole charge with a single operation of the plunger.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combination of elements and arrangement of parts, which will be exemplified in the construction hereinafter set forth and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawing, in which:

Fig. 1 is a longitudinal section of an embodiment of the hypodermic syringe of the present invention, with parts broken away;

Figs. 2 and 3 are sectional views taken respectively along lines 2—2 and 3—3 of Fig. 1;

Fig. 4 is a view similar to Fig. 1 of the structure shown therein but taken along a plane normal to the plane of sectioning of Fig. 1 and showing the plunger shaft in elevation, with parts broken away;

Fig. 5 is an elevational view, with parts broken away, of a modified form of plunger shaft and stop means of the present invention; and

Fig. 6 is an elevational view, with parts broken away and in section, of a further modified form of plunger shaft and associated stop means of the invention.

Referring to the drawing like numerals identify similar parts throughout. As shown in Figs. 1 to 4 inclusive, an embodiment of the hypodermic syringe of the present invention comprises a casing structure 10 including a casing barrel 11 preferably windowed at 12, 12 for sight inspection of contents. The barrel portion 11 of the casing structure terminates at the bottom or forward end in a hub 13 provided with a needle-receiving sleeve 14 having the bore thereof aligned with a passage 15 in the hub portion 13 to form a tapered hole, as shown, for wedging reception of the usual needle (not shown) and for communication between the latter and the interior of barrel structure.

A cylindrical barrel 16, preferably of transparent material such as glass, is received or telescoped within the barrel portion 11 of the casing structure with its lower end seated against a resilient gasketing ring 17 mounted adjacent the inner face of the hub 13. The upper end of the barrel portion 11 of the casing structure is preferably externally threaded at 18 and a gasketing

ring 19 of resilient material is seated upon the top ends of the barrel portion 11 and the barrel 16. A hub assembly 20 completes the casing structure 10 and has a socketed flange 21 internally threaded and engaged with the external threads 18 of the barrel portion 11, the ring 19 gasketing the joint between the former and the barrel assembly.

The hub assembly 20 preferably includes a pair of diametrically opposed laterally extending wings 21 and 22 serving as finger grips or supports adapted to rest or be supported by fingers of the operator, such as the index and middle fingers. Preferably the wings 21 and 22 and other portions of the hub assembly 20 are adapted to serve as a housing for certain plunger travel-limiting mechanism, and for this purpose are provided with an upstanding flange 23 cut away at 24 on the end of the wing 22 to provide an access hole for projection from the interior of a manually operable control or button 25. Flange 23 is overlaid with a plate 26 preferably held in the position shown by suitable tying members such as internally threaded and headed anchoring sleeves 27, 27 and headed screws 28 and 29 to provide with the wing and flange structure a closed chamber 30.

The base portion of hub assembly 20 and the cover plate 26 are respectively provided with holes 31 and 32 to receive a plunger shaft means 33 reciprocable therethrough. In the preferred embodiment the holes 31 and 32 are polygonal in shape, preferably square, and the plunger shaft means 33 is preferably of similar or complementary shape to prevent relative rotation and to assure longitudinal movement of the plunger shaft in a selected position without rotation thereof. However, it is believed to be obvious that the shaft means 33 may be made cylindrical or of any other suitable shape, and the holes 31 and 32 formed of such shape to receive such shaft for longitudinal movement, any suitable means being provided to prevent relative rotation therebetween, such as a longitudinal groove or grooves and a suitable projection to be slidably received therein with the groove or grooves being provided in either of the shaft means and hub assembly means and the projection being fixedly mounted on the other.

Plunger means are provided which may include as the shaft means 33 a sleeve 34 having a cylindrical bore receiving a rod 35 preferably flattened on one side, such as at 36, to cooperate with a lug 37 fixed in the sleeve bore at the top end thereof, and thus prevent relative rotation between the sleeve and the rod while permitting relative longitudinal movement thereof.

The rod 35 is provided with a head 38 at its lower end and carries between the head and a flange 39 on the lower end of the shaft sleeve 34 a pair of resilient and expandable plunger washers 40, 40 between which is interposed a rigid washer 41. The upper end of the sleeve 34 is machined to provide a circular flange 42 rotatably received in a socket 43 of a plunger-operating knob 44, the latter being adapted to receive depressing force from the thumb of the operator. The knob 44 has aligned with and inward of socket 43 a smaller internally threaded socket 45 engaged with external threads on the upper end 46 of the rod 35. Accordingly, with the rod 35 held against relative rotation with respect to shaft sleeve 34 by lug 37, when the knob 44 is rotated and draws the threaded end 46 of the rod thereinto, compressive pressure will be exerted upon the resilient washers 40, 40 to cause them

to expand so as to assure a fitting of the latter within the barrel 16 for efficient discharge of fluid from the latter during plunger action, and to provide for reverse action to permit ready withdrawal of the plunger means from the barrel.

Such a structure as described above is somewhat similar to hypodermic syringe constructions now being employed, except for certain details which have particular purposes with respect to novel features of the present invention, as will more fully appear hereinafter. However, with such former structures wherein index marks may be provided on the plunger shaft so as to permit the operator successively to discharge from the barrel separate doses which are intended to be equalized as dictated by the index marks, there is no assurance that the operator will efficiently discharge from the barrel the precise amount or quantity of fluid that should be measured forth as a single dose. This is true, even in syringes where such plunger shaft means have threaded thereon a stop collar to be rotated from index mark to index mark and adapted to engage the rear hub assembly as a stop. In accordance with the present invention, such difficulties are avoided by providing readily operable stop mechanism which assures equidistant step-by-step travel of the plunger means.

In accordance with the preferred embodiment of the invention, this plunger stop mechanism preferably is housed in the chamber 30 and may comprise a toggle snap means including a shaped apertured stop plate 47 through which the plunger shaft means extends. The stop plate 47 is pivotally mounted at 48 by a pin or screw and has an operating arm 49 slotted at 50 slidably to receive a pin 51. A lever of the first class is preferably pivotally mounted by means of screw 29 and its cooperating sleeve 27, and has one arm 52 thereof carrying pin 51 and its other arm 53 provided with the manual control or button 25 projecting through the access hole 24. As a result, when the control or button 25 is pivoted back and forth about an axis through screw 29, stop plate 47 is swung back and forth about its fulcrum pin 48, preferably with a snap action brought about by a suitable biasing spring means.

Such biasing spring means may comprise a tension spring fixed at suitable points to the lever arm 52 and stop plate arm 49, or, as is preferred, may comprise a compression spring 54 received upon a guiding sleeve 55 provided with a spring abutment flange 56 and a mounting ear 57 pivoted to the finger grip or wing 21, such as by means of the screw 28 and its sleeve 27. The helical compression spring 54 is also arranged about a pin 58 slidably received in the sleeve 55 and pivotally mounted at 59 upon the stop washer 47. The pin 58 is also provided with a spring abutment flange 60 and the spring 54 is held under compression between that flange and flange 56.

The shaft sleeve 34 is provided with a plurality of series of abutment means to cooperate with stop means provided by the stop plate 47. Such abutment means may be provided by forming a plurality of notches in diametrically opposite edges of the substantially square structure, or in any other desired location as may be dictated by any certain shape and construction of the shaft means and the stop means.

In the embodiment shown in Figs. 1 to 4 inclusive, and as more clearly indicated in Fig. 4, a series of notches 61-61 are provided in the edge on one side of the shaft sleeve 34, and are

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preferably spaced an equal distance apart. The diametrically opposed edge of the shaft sleeve 34 is provided with a similar series of notches 62—62, preferably also spaced an equal distance apart and staggered with respect to the notches 61—61 in a manner as to be arranged substantially intermediate of the latter. The relative arrangement of these two series of notches is such as to assure discharge from the barrel 16 of a certain predetermined quantity of fluid when the plunger means is moved a distance equal to the distance between a transverse plane through a notch in one series, such as one of the notches 61, and a transverse plane through the nearest notch in the other series, such as the next following notch 62. For example, this hypodermic syringe construction may be incorporated in a two cubic centimeters (2 cc.) syringe with the plunger travel from a notch 61 to a notch 62, or vice versa, assuring discharge of one-eighth of a cubic centimeter ($\frac{1}{8}$ cc.) of liquid, suitable as a dose of a certain medicinal preparation for employment in the injection of sheep and goats to prevent anthrax.

To assure precise stoppage of the plunger means as dictated by and to cooperate with the notches 61—61 and 62—62, the apertured stop plate 47 includes a pair of engaging means, such as a portion 63, adapted to be engaged in one of the notches 62—62 when the stop plate is pivoted to the position shown in Fig. 3, and a portion 64 adapted to be engaged in one of the notches 61—61 when the stop plate is snapped over or swung to its other position, which is just the reverse of that shown in Fig. 3.

In operation of the structure shown in Figs. 1 to 4 inclusive, with the plunger structure completely retracted so that the flange 39 of the shaft sleeve 34 is seated against the back end of the barrel structure, or the ring 19, and with the barrel 16 filled with a charge of fluid, a first dose may be discharged from the syringe through a needle fitted in the passage 15 in the following manner. The manual control or button 25 may be swung over to a position opposite to that indicated in Fig. 3, so that the engaging means 64 of the stop plate 47 is biased by spring structure 54 to the path of an abutment provided in the formation of the first notch 61. Then, with the index and middle fingers seated beneath and supporting the wings 22 and 21, the plunger means may be depressed by the application of force against the knob 44, such as by means of the thumb. The plunger means will move down into the barrel 16 until the engaging means 64 is permitted to click into the notch 61, which stops travel of the plunger means. As a result, a precise or predetermined amount of fluid will be discharged from the barrel 16 through the needle.

For the next dose, the manual control or button 25 will then be swung back to the position indicated in Fig. 3 so that the engaging means 63 of the stop plate 47 will be biased by the spring structure 54 toward the path of the abutment provided in the formation of the next following notch 62. The plunger means may then again be depressed until the engaging means 63 clicks into that notch 62 and, as a result, a precise or predetermined amount will again be discharged from the barrel through the needle. By proper placement and staggering of the notches of the pair of series 61—61 and 62—62 it is thus possible to predetermine successive doses of substantially equal quantity which may be successively discharged from the barrel as the plunger means is

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depressed step-by-step as permitted by swinging the manual control or button 25 back and forth. In this manner exact care on the part of the operator is made unnecessary in the successive discharge of precise or substantially equal doses.

At times it may be desired to eliminate the step-by-step successive discharge of a plurality of doses from the filled barrel 16. This may be readily accomplished by locking in any suitable manner the stop plate 47 in a position which holds both of the engaging means 63 and 64 thereof out of the paths of the two series of abutments provided in the formation of the two series of notches 62—62 and 61—61. A simple means for accomplishing this end is shown in Figs. 1 and 2 and may comprise an extension 65 of the pin 51 which projects up through an arcuate slot 66 in the top plate 26. A slidable latch plate 67 is placed upon the top plate 26 with a slot 68 in the former receiving a collar 69 on the shank of the bolt 29. A projection 70 on the under side of the slidable latch plate 67 is seated within a groove 71 and guides the slide plate for longitudinal movement. The latch plate 67 is provided in its nose 72 with a notch 73 adapted to receive the pin 65 when the latter is in an intermediate position. In the formation of the slot 68 a portion of the stock of the plate 67 may be bent upwardly to provide a latch handle 74 for sliding operation of the latch plate. It will thus be seen that when the manual control or button 25 is moved to an intermediate position with the engaging means 63 and 64 out of the paths of the abutments provided by the notches 62—62 and 61—61, the click-stop mechanism may be locked in this position by moving the latch plate 67 forward until the notch 73 thereof receives the pin 65. Thereafter the plunger means may be reciprocated at will in the barrel. Such operation of the hypodermic syringe of the present invention may be advantageous in connection with the larger size syringes, particularly when their employment is desired for hog cholera work.

Referring again to Fig. 4 as well as Fig. 1, it will be seen that on a pair of opposite edges of the shaft sleeves 34, other than those in which the two series of notches 61—61 and 62—62 are formed, two additional series of abutment means may be provided by the formation of two additional series of notches 161—161 and 162—162. These may be located so that the distance between transverse planes through the notches 161 and 162 is twice the distance between transverse planes through the notches 61 and 62. Accordingly, these more widely spaced notches may be employed in a manner similar to the use of notches 61—61 and 62—62 for increasing the size of the successive doses to about twice the quantity of the doses assured by the notches 61—61 and 62—62. To use these alternate, more widely spaced abutment means with the same stop mechanism, it is merely necessary to remove the knob 44, dismount the barrel structure 11 and 16 from the casing hub 20, and then withdraw the plunger assembly from the latter, preferably when the stop mechanism is locked in the intermediate position as indicated in Fig. 2. The plunger assembly is then turned through an angle of about 90° so that the path of the notches 161—161 and 162—162 will be located in the paths formerly occupied by the notches 61—61 and 62—62. The plunger assembly is then reinserted through the base hub structure 20 and the other parts then replaced so that they will be arranged in the relative positions indicated in Fig. 4.

This rearranged structure will permit ready employment of the same hypodermic syringe for additional uses and, for example, may assure the discharge of successive doses of one-quarter of a cubic centimeter ($\frac{1}{4}$ cc.) of certain medicinal liquid for anthrax treatment of cattle, horses and mules, while the other opposed series of notches 61—61 and 62—62 may serve to assure the obtainment of successive charges of one-eighth of a cubic centimeter ($\frac{1}{8}$ cc.) of such liquid for like treatment of sheep and goats. It is to be understood that similar provision for doses of other volumes may be made in syringes of other sizes by proper arrangement of the notches, such as in twenty-five cubic centimeters (25 cc.) syringes the notches may assure obtainment of one cubic centimeter (1 cc.) doses when the shaft sleeve 34 is in one position and five cubic centimeters (5 cc.) doses when the shaft sleeve is turned to the other position. Further, it is to be understood that, although the shaft sleeve 34 is shown to be substantially square in cross-section in the preferred embodiment, it may be of any suitable polygonal shape in cross-section, such as hexagonal, etc., with the plurality of opposed edges provided with cooperating notches spaced apart different distances longitudinally.

It will also be understood that although for reasons of simplicity the opposed cooperating pair of series of stop abutment means, or notches providing them, are staggered as proposed in Figs. 1 and 4, with the opposed engaging means located in a common transverse plane, similar results may be attained by forming the abutment means or notches in the opposed series in common transverse planes and staggering the opposed engaging means. Such a structure is shown by way of example in Fig. 5. As therein proposed plunger shaft means 233 may have opposed edges provided with two series of notches 261—261 and 262—262, with those in one series located substantially in the same transverse planes in which the notches of the other series are located. Engaging means 264 are provided for notches 261—261 and engaging means 263 are provided for notches 262—262. These engaging means are staggered as is shown so that the plunger means may be advanced step-by-step substantially equal distances when the engaging means 263 and 264 are alternately moved back and forth. Obviously these engaging means may be of any suitable structure and mounted and operated in any suitable manner to attain the desired ends, such as by being linked together by an element 75 mounted for suitable reciprocal action, or fixed upon a stop plate similar to plate 47 for operation by a manually operable mechanism similar to that shown in Figs. 1 to 3 inclusive. Further it will be understood that, although it is preferred to arrange the cooperating pairs of notches in substantially diametrically opposed paths, the desired results may be obtained by arranging them or suitable abutment means in longitudinal paths which are not diametrically opposed, provided the stop engaging means and operating mechanism therefor are suitably altered to accommodate such variation.

Additionally, it will be apparent that the cooperating pairs of series of abutment means may be provided in other ways, such as by forming the plunger shaft means in the shape of a cylindrical structure as indicated at 333 in Fig. 6, and providing the external surface of such shaft means with a spiraled thread 76, or the like, which forms a pair of series of abutment means 361—361 and

362—362 on opposite sides, with one series adapted to cooperate with engaging means 63 and the other series adapted to cooperate with engaging means 64 in alternate fashion after the manner described above. In such a structure some suitable means should be provided to prevent relative rotation between the plunger shaft means 333 and its supporting casing structure. This may, if desired, be accomplished by forming a longitudinal groove 77 in the shaft sleeve and providing a fixed projection, such as a pin 78, on the casing structure to ride in the groove 77.

It is also believed to be apparent that while it may be preferred to house the stop operating mechanism in the finger grips or support wings, such as 21 and 22 of the structure shown in Figs. 1 to 4 inclusive, it is possible to practice the invention by housing a similar mechanism in other portions of the casing structure, such as a hub unit to be substituted for the hub structure 20 and to provide separate finger grips or support wings. Also, instead of employing a compression spring, such as 54 and its mount, to cause the stop means to snap back and forth, other types of spring structure such as an elliptical spring may be employed, or it is possible to use a helical tension spring instead of a compression spring as previously suggested. It will also occur to those skilled in the art that types of stop means mechanism other than those shown and suggested above may be employed to accomplish a similar result, such as by biasing a cam with a spring located in a stationary position and providing a stop plate with suitable indentations to engage the cam so that the plate may be snapped from one position to another in alternate engagement of the abutment means in the pair of series thereof.

It will thus be seen that the objects set forth above and made apparent in the above description are efficiently attained by the present invention, and since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a hypodermic syringe, the combination comprising, reciprocable plunger shaft means having a plurality of cooperating series of abutment means arranged longitudinally thereof with each series located in a different path, a plurality of movable engaging stop means, means to guide each of said stop means in its motion into and out of the path of travel of one of said series of abutment means, means connecting said plurality of stop means together whereby when one thereof is moved into the path of the series of abutment means associated therewith each of the others will be moved out of the path of the series of abutment means associated with the latter so that said abutment means and stop means associated therewith are adapted alternately to stop longitudinal movement of said shaft means as predetermined by the abutment means when

successively moved to engagement with their engaging stop means and to free said shaft means for further longitudinal movement, and means to move one of said engaging stop means out of the path of travel of its cooperating series of abutment means with simultaneous movement of another of said engaging stop means into the path of travel of its cooperating series of abutment means by virtue of the interconnection between said plurality of stop means, so that said shaft means may be moved longitudinally step-by-step with abutment means of one series alternating with others of said abutment means in effective determination of the successive steps of travel of said shaft means.

2. In a hypodermic syringe, the combination comprising, reciprocable plunger shaft means having a pair of cooperating series of abutment means arranged longitudinally on opposite sides thereof, transversely movable stop means having a pair of interconnected engaging means positioned on opposite sides of said shaft means with one engaging means associated with one of said series of abutment means and the other engaging means associated with the remaining series of abutment means, means to guide said stop means to direct motion of each of said engaging means laterally into and out of the path of travel of its associated series of abutment means said pairs of cooperating engaging means and series of abutment means thereby being adapted alternately to stop longitudinal advancing motion of said shaft means as predetermined by the abutment means when successively moved to engagement with their engaging stop means and to free said shaft means for further longitudinal movement, and means to impart guided transverse motion to said movable means so that the latter will carry with it one of said engaging means out of the path of longitudinal travel of its cooperating series of abutment means with simultaneous movement of the remaining movable means-carried engaging means into the path of longitudinal travel of its cooperating series of abutment means so that said shaft means may be advanced longitudinally step-by-step with abutment means of one series alternating with abutment means of the other series in effective determination of the successive steps of travel of said shaft means.

3. In a hypodermic syringe, the combination comprising, reciprocable plunger shaft means having a plurality of cooperating series of abutment means arranged longitudinally thereof with each series located in a different path with the abutment means of one series being staggered with respect to those in another series, transversely movable stop means having a plurality of interconnected engaging means with each engaging means associated with only one of said series of abutment means, means to guide said stop means to direct motion of each of said engaging means laterally into and out of the path of travel of its associated series of abutment means said cooperatively-associated engaging means and series of abutment means thereby being adapted alternately to stop longitudinal advancing motion of said shaft means as predetermined by the abutment means when successively moved to engagement with their engaging stop means and to free said shaft means for further longitudinal movement, and means to impart guided transverse motion to said movable means so that the latter will carry with it one of said engaging means out of the path of longitudinal

travel of its cooperating series of abutment means with simultaneous movement of one other of said engaging means into the path of longitudinal travel of its cooperating series of abutment means so that said shaft means may be advanced longitudinally step-by-step with abutment means of one series alternating with others of said abutment means in effective determination of the successive steps of travel of said shaft means.

4. In a hypodermic syringe, the combination comprising, reciprocable plunger shaft means having a pair of cooperating series of abutment means arranged longitudinally thereof with each series located in a different path with the abutment means of one series being staggered with respect to those in the other series, movable stop means having a pair of engaging means arranged substantially in a common transverse plane with each adapted to be moved laterally substantially along the common plane into and out of the path of travel of one of said series of abutment means alternately to stop longitudinal movement of said shaft means as predetermined by the abutment means when successively moved to engagement with their engaging stop means and to free said shaft means for further longitudinal movement, and means to move one of said engaging means out of the path of travel of its cooperating series of abutment means with movement of the other of said engaging means into the path of travel of its cooperating series of abutment means so that said shaft means may be moved longitudinally step-by-step with abutment means of one series alternating with abutment means of the other series in effective determination of the successive steps of travel of said shaft means.

5. In a hypodermic syringe, the combination comprising, reciprocable plunger shaft means having a pair of cooperating series of abutment means arranged longitudinally on opposite sides thereof with the abutment means of one series being staggered with respect to those in the other series, movable stop means having a pair of engaging means positioned on opposite sides of said shaft means and arranged substantially in a common transverse plane with each adapted to be moved laterally substantially along the common plane into and out of the path of travel of one of said series of abutment means alternately to stop longitudinal movement of said shaft means as predetermined by the abutment means when successively moved to engagement with their engaging stop means and to free said shaft means for further longitudinal movement, and means to move one of said engaging means out of the path of travel of its cooperating series of abutment means with movement of the other of said engaging means into the path of travel of its cooperating series of abutment means so that said shaft means may be moved longitudinally step-by-step with abutment means of one series alternating with abutment means of the other series in effective determination of the successive steps of travel of said shaft means.

6. In a hypodermic syringe, the combination comprising, a frame, reciprocable plunger shaft means slidably carried by said frame, cooperating interfitted means on said frame and shaft means to prevent rotation of said shaft means relative to said frame during reciprocative sliding movement of said shaft means, a pair of longitudinally extending series of abutment means arranged on opposite sides of said shaft means with those in one series being staggered with respect to those in the other series, a pair of

engaging stops movably mounted on opposite sides of said shaft means, means connecting said stops together for simultaneous similar directional motion, and manual means to operate said connecting means with motion of the latter moving one of said stops into the path of travel of one series of said abutment means and at the same time moving the other of said stops out of the path of travel of the other series of said abutment means to permit a step-by-step longitudinal motion of said shaft means.

7. In a hypodermic syringe, the combination comprising, a frame, reciprocable plunger shaft means slidably carried by said frame, cooperating interfitted means on said frame and shaft means to prevent rotation of said shaft means relative to said frame during reciprocative sliding movement of said shaft means, a pair of longitudinally extending series of notches in opposite sides of said shaft means with those in one series being staggered with respect to those in the other series, a pair of engaging stops movably mounted on opposite sides of said shaft means, means connecting said stops together for simultaneous similar directional motion, and manual means to operate said connecting means with motion of the latter moving one of said stops into the path of travel of one series of said notches and at the same time moving the other of said stops out of the path of travel of the other series of said notches to permit a step-by-step longitudinal motion of said shaft means.

8. In a hypodermic syringe, the combination comprising, casing structure having a barrel and a hole of polygonal shape substantially aligned therewith, plunger means cooperating with said barrel and including a shaft shaped in cross-section similar to the hole and received for longitudinal movement therein, said shaft having each of a pair of its edges provided with a series of equally-spaced abutment means, stop means mounted on said casing structure for reciprocal transverse movement and having a pair of engaging means with one located adjacent the path of travel of one of the series of abutment means and the other located adjacent the path of travel of the other series of abutment means, and manual means to move one of said engaging means into the path of one of the series of abutment means and at the same time move the other engaging means out of the path of the other series of abutment means so that abutment means of the two series thereof alternately serve as stop determining means for said shaft, said engaging means being arranged with respect to the two series of abutment means and the latter being so arranged with respect to each other as to permit said plunger means successively to force from said barrel substantially equal amounts of fluid.

9. In a hypodermic syringe, the combination comprising, casing structure having a barrel and a hole of polygonal shape substantially aligned therewith, plunger means cooperating with said barrel and including a shaft shaped in cross-section similar to the hole and received for longitudinal movement therein, said shaft having each of a pair of its edges provided with a series of equally-spaced notches with those in one series being staggered with respect to and arranged substantially intermediate of those in the other series so that a predetermined amount of fluid may be discharged from said barrel by said plunger means as said shaft is moved longitudinally a distance substantially equal to that between a transverse plane through one notch in

one series and another transverse plane through the nearest following notch of the other series, stop means mounted on said casing structure for reciprocal movement in a substantially transverse plane and having a pair of engaging means with one located adjacent the path of travel of one of the series of notches and the other located adjacent the path of travel of the other series of notches, and manual means to move one of said engaging means into the path of one of the series of notches and at the same time move the other engaging means out of the path of the other series of notches so that notches of the two series thereof alternately serve as stop determining means for said shaft.

10. In a hypodermic syringe, the combination comprising, casing structure having a barrel and a hole of polygonal shape substantially aligned therewith, plunger means cooperating with said barrel and including a shaft shaped in cross-section similar to the hole and received for longitudinal movement therein, said shaft having each of a pair of its edges provided with a series of equally spaced abutment means, stop means mounted on said casing structure for reciprocal transverse movement and having a pair of engaging means with one located adjacent the path of travel of one of the series of abutment means and the other located adjacent the path of travel of the other series of abutment means, manual means to move one of said engaging means into the path of one of the series of abutment means and at the same time move the other engaging means out of the path of the other series of abutment means so that abutment means of the two series thereof alternately serve as stop determining means for said shaft, said engaging means being arranged with respect to the two series of abutment means and the latter being so arranged with respect to each other as to permit said plunger means successively to force from said barrel substantially equal amounts of fluid, and spring means biasing said stop means so that said engaging means may be snapped back and forth by said manual means alternately to and from abutment-engaging positions.

11. In a hypodermic syringe, the combination comprising, casing structure having a barrel and a hole of polygonal shape substantially aligned therewith, plunger means cooperating with said barrel and including a shaft shaped in cross-section similar to the hole and received for longitudinal movement therein, said shaft having each of a pair of its edges provided with a series of equally-spaced notches with those in one series being staggered with respect to and arranged substantially intermediate of those in the other series so that a predetermined amount of fluid may be discharged from said barrel by said plunger means as said shaft is moved longitudinally a distance substantially equal to that between a transverse plane through one notch in one series and another transverse plane through the nearest following notch of the other series, stop means mounted on said casing structure for reciprocal movement in a substantially transverse plane and having a pair of engaging means with one located adjacent the path of travel of one of the series of notches and the other located adjacent the path of travel of the other series of notches, manual means to move one of said engaging means into the path of one of the series of notches and at the same time move the other engaging means out of the path of the other series of notches so that notches of the two series

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thereof alternately serve as stop determining means for said shaft, and spring means biasing said stop means so that said engaging means may be snapped back and forth by said manual means alternately to and from notch-engaging positions.

12. In a hypodermic syringe, the combination comprising, casing structure having a barrel and a hole of polygonal shape substantially aligned therewith, plunger means cooperating with said barrel and including a shaft shaped in cross-section similar to the hole and received for longitudinal movement therein, said shaft having each of a pair of its edges provided with a series of spaced abutment means, stop means mounted on said casing structure for reciprocal transverse movement and having a pair of engaging means with one located adjacent the path of travel of one of the series of abutment means and the other located adjacent the path of travel of the other series of abutment means, manual means to move one of said engaging means into the path of one of the series of abutment means and at the same time move the other engaging means out of the path of the other series of abutment means so that abutment means of the two series thereof alternately serve as stop determining means for said shaft, spring means biasing said stop means so that said engaging means may be snapped back and forth by said manual means alternately to and from abutment-engaging positions, and means to lock at will said stop means in a position with its engaging means out of abutment-engaging positions.

13. In a hypodermic syringe, the combination comprising, casing structure having a barrel and a hole of polygonal shape substantially aligned

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therewith, plunger means cooperating with said barrel and including a shaft shaped in cross-section similar to the hole and received for longitudinal movement therein, said shaft having each of a pair of its edges provided with a series of equally-spaced notches with those in one series being staggered with respect to and arranged substantially intermediate of those in the other series so that a predetermined amount of fluid may be discharged from said barrel by said plunger means as said shaft is moved longitudinally a distance substantially equal to that between a transverse plane through one notch in one series and another transverse plane through the nearest following notch of the other series, stop means mounted on said casing structure for reciprocal movement in a substantially transverse plane and having a pair of engaging means with one located adjacent the path of travel of one of the series of notches and the other located adjacent the path of travel of the other series of notches, manual means to move one of said engaging means into the path of one of the series of notches and at the same time move the other engaging means out of the path of the other series of notches so that notches of the two series thereof alternately serve as stop determining means for said shaft, spring means biasing said stop means so that said engaging means may be snapped back and forth by said manual means alternately to and from notch-engaging positions, and means to lock at will said stop means in a position with its engaging means out of notch-engaging positions.

HAROLD S. AUSTIN.