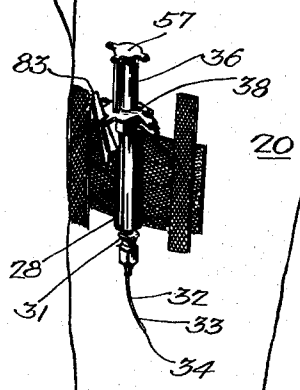
Sept. 26, 1950 N. STEINBERG 2,523,850

MEDICAL SYRINGE AND PROCESS

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Fig. 2.



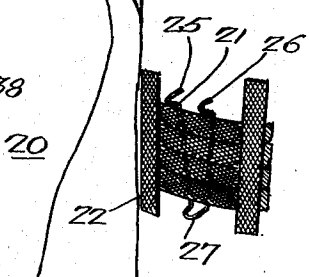


Fig. 1.

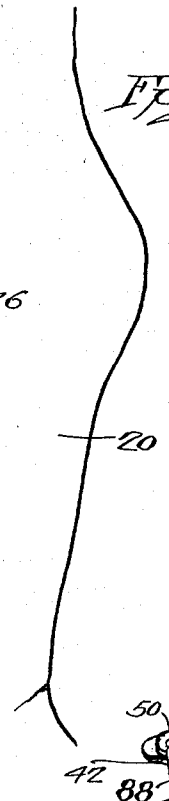


Fig. 4.

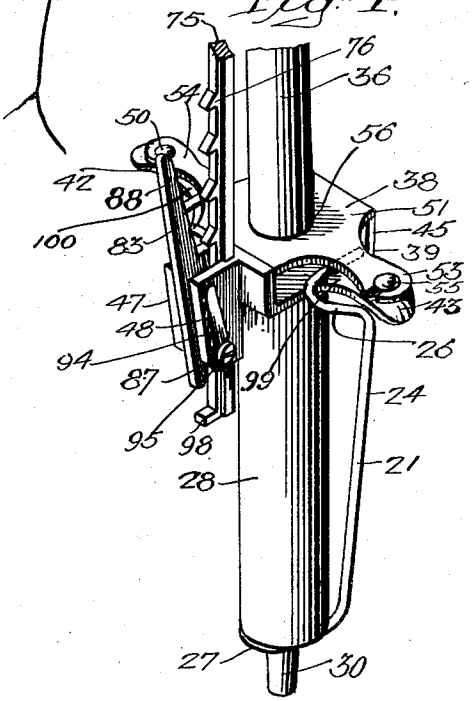
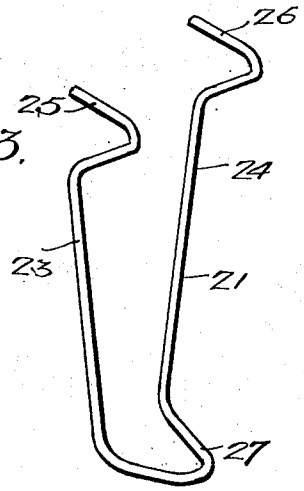


Fig. 3.

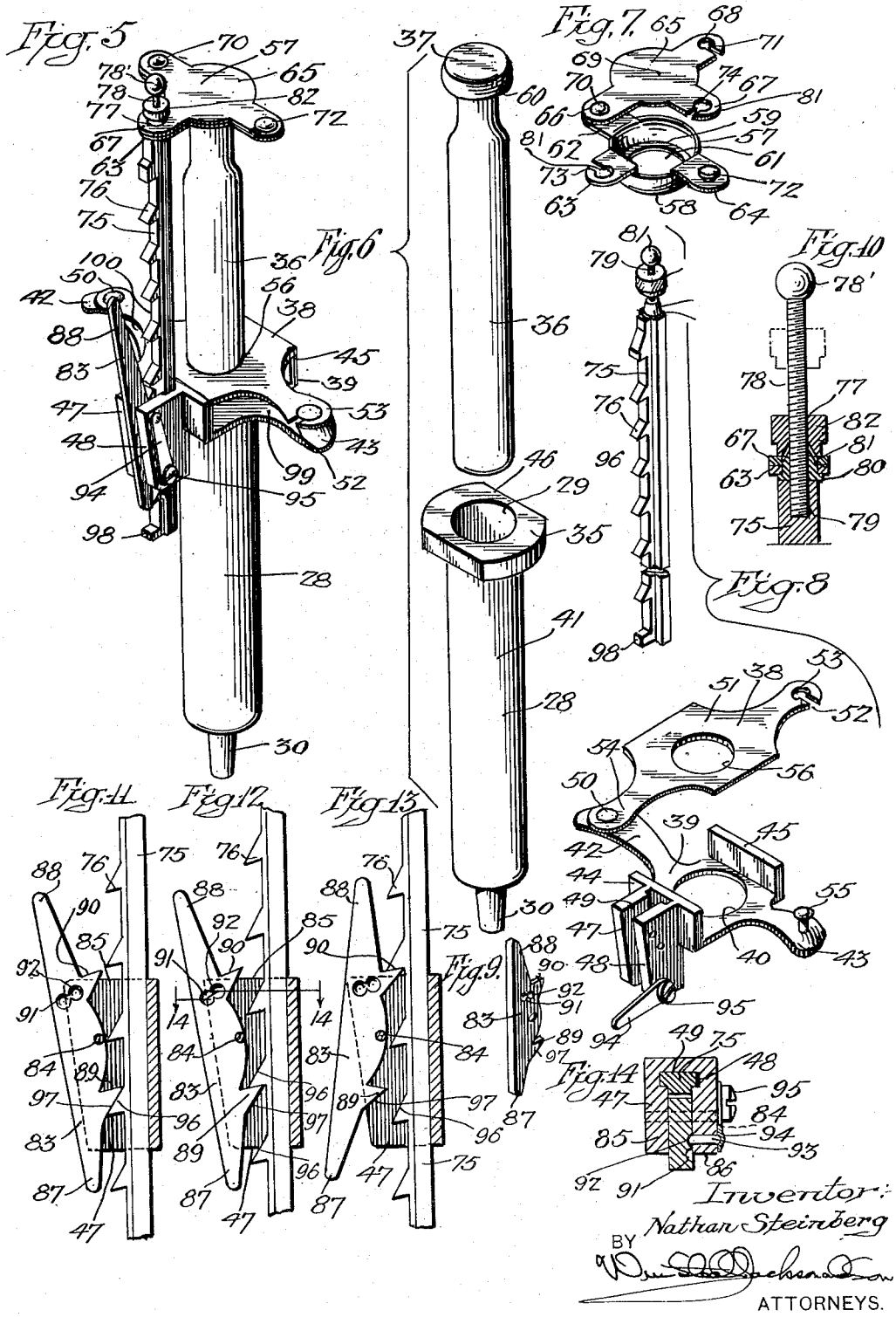


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Patented Sept. 26, 1950

2,523,850

UNITED STATES PATENT OFFICE

2,523,850

MEDICAL SYRINGE AND PROCESS

Nathan Steinberg, Philadelphia, Pa.

Application December 11, 1947, Serial No. 791,009

14 Claims. (Cl. 128—215)

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The present invention relates to medical syringes and processes of medication.

A purpose of my invention is to permit the injection of medicaments into the body of a patient by a layman, who may be the patient himself or a non-medically trained person caring for the patient.

A further purpose is to administer medicaments subcutaneously or intravenously into the body of a patient at frequent intervals without the necessity of hospitalization.

A further purpose is to permit an ambulatory patient to take an extensive course in hypodermic medication.

A further purpose is to permit successive hypodermic injections over a period of time without the necessity of subsequent punctures from a hypodermic needle.

A further purpose is to reduce the danger of breaking off a hypodermic needle in the body of the patient.

A further purpose is to permit the injection of medicaments while the patient is asleep without disturbing the patient.

A further purpose is to mount a hypodermic syringe semipermanently from a carrier attached to the body of a patient and to administer a succession of doses from the syringe through a hypodermic needle applied in the same puncture in the body of the patient.

A further purpose is to provide an escapement lever, which limits a rack in step by step motion of a syringe plunger in a barrel, and desirably to mount the rack on a sandwich clamp bracket from the barrel.

A further purpose is to provide a quick release of the rack from the plunger.

A further purpose is to hold the escapement lever at each end of the stroke by a detent.

A further purpose is to provide a U-shaped or forked carrier which has hooked ends interconnecting with the bracket and which has a yoke bridging the opposite end of the barrel of the syringe.

Further purposes appear in the specification and in the claims.

In the drawings I have chosen to illustrate one only of the embodiments in which my invention may appear, choosing the form shown from the standpoints of simplicity in illustration, satisfactory operation and clear demonstration of the principles involved.

Figure 1 is a diagrammatic elevation showing the carrier applied to the body of the patient.

Figure 2 is a view corresponding to Figure 1 showing the syringe mounted on the carrier and the hypodermic needle inserted in the body of the patient.

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Figure 3 is a perspective of the carrier alone.

Figure 4 is a fragmentary perspective of the syringe mounted in the carrier.

Figure 5 is a perspective of the syringe alone, without the hypodermic needle.

Figure 6 is an exploded perspective of the plunger and barrel separated from the remaining parts.

Figure 7 is a perspective of the sandwich clasp mount for the end of the plunger.

Figure 8 is an exploded perspective of the sandwich clamp bracket and rack.

Figure 9 is a perspective of the escapement lever.

Figure 10 is an enlarged longitudinal section of the connection between the rack and the mount.

Figures 11 to 13, inclusive, are fragmentary longitudinal sections of the rack and escapement lever in different relative positions.

Figure 14 is a section on the line 14—14 of Figure 12.

Describing in illustration but not in limitation and referring to the drawings:

In recent medical practice extensive use has been made of subcutaneous or intravenous medicaments which must be injected into the body of the patient at frequent intervals. While the invention may in some cases be applicable to the treatment of animals generally, it is anticipated that the invention will find its chief use in the treatment of humans, and accordingly the patient will be considered generally as a human being, although the invention will also be applicable in some cases to the treatment of, or the medical experimentation upon, animals other than humans.

While the medicament employed may be of any character which will be injected hypodermically, it is believed that the widest application of the invention will be in administering antibiotics such as aqueous penicillin, streptomycin and the like. Extensive use is being made of such medicaments employing frequent injections in the treatment of tuberculosis, syphilis and other diseases. Such treatments must frequently be administered to patients who cannot be hospitalized by reason of their prejudice against hospitalization, unavailability of hospital space, insufficient income of the patient to pay for hospitalization or the like, and the requirement of hospitalization has been a limiting factor which has retarded the more extensive use of such treatment.

One of the primary purposes of the present invention is to permit the administration of medicaments, especially antibiotics such as penicillin and streptomycin, to a patient who is not hospitalized, by a person such as the patient himself or his friends or relatives and who is without medical training and could not safely make a puncture with a hypodermic needle.

At the same time I seek to permit the patient, in many cases, to remain ambulatory and to administer the repeated injections while going about his affairs.

It is also intended to overcome the difficulty which is encountered with some patients through objection to the pain of puncturing and through increased objection because of soreness of a local area when repeated punctures must be made in such area.

At the same time it is possible to avoid the difficulty of breaking off the hypodermic needle which occurs whenever very frequent injections are made, and to avoid the danger to the surgeon of exposing his body to X-rays while operating to remove a broken needle under the fluoroscope. I also desire to permit administration of an injection to a sleeping patient without disturbing the patient in some cases.

In accordance with the invention, after the hypodermic syringe is filled with a sufficient quantity of medicament for several doses, the hypodermic needle is inserted into the body of the patient and the syringe is affixed to the patient's body so that repeated doses can be injected through the same puncture of the hypodermic needle.

The mounting of the syringe on the body of the patient is preferably accomplished by a carrier suitably fastened to the body. The dosage is preferably automatically limited by step by step mechanism which permits injection of one dose at a time reliably without special attention by the person administering it.

As seen in Figure 1, a suitable location on the body is selected for the injection, such as the thigh 20, to which a carrier 21 is secured by any suitable means. While a belt, bandage or the like may be employed, it is preferred to use adhesive tape 22 for attachment of the carrier to the body. The adhesive tape is preferably carried across prongs 23 and 24 of the forked carrier which has hooks 25 and 26 at one end for engagement with the syringe at its back portion and a yoke 27 to straddle the forward portion of the syringe barrel. This latter feature is best seen in Figure 2.

It will be evident that the carrier 21 can be put in place before the syringe is applied, and can be left in place when the syringe is removed for any purpose, unless it is desired to move the carrier to relocate the puncture.

The syringe may be of any suitable type, conveniently consisting of a barrel 28 having an interior cylinder 29 connecting to a tubular discharge fitting 30 which receives the hub 31 of a hypodermic needle 32 bent at 33 and inserted into the body of the patient at 34. At the end of the barrel at which the cylinder 29 opens, the barrel is flanged to form a head 35. The cylinder 29 receives a cooperating plunger 36 which at the opposite end carries a head 37. The plunger and cylinder may be of any suitable material, consisting for example of glass, plastic or the like.

A bracket 38 of metal or the like surrounds and is fastened on the head 35 of the barrel. The

bracket is preferably in the form of a sandwich clamp, comprising a base 39 recessed at 40 near the center to pass the outside of cylinder portion 41 of the barrel and having opposite wing projections 42 and 43 projecting from the base. At preferably diametrically opposite positions from the wing projections, shoulders 44 and 45 parallel to one another extend in the direction of the axis of the hole 40 to engage against flats 46 on the head 35 and prevent rotation of the barrel. The shoulder 44 also carries guides 47 and 48 which with the shoulder provide a key slot 49 in the direction of the axis of the hole 40.

The wing 42 carries a pivot 50 which provides pivotal connection to a spring top 51 on the bracket, which spring top is capable of flexing to bring pressure on the head 35 of the barrel and is locked by a recess 52 in a wing 53 opposite to a wing 54 which turns in the pivot 50. The recess 52 makes connection in closed position beneath a locking head 55 on the wing 43 of the base. Thus when the barrel is inserted in the hole 40 of the base and the top 51 is pivoted and locked to engage the top of the head 35 of the barrel, the barrel and bracket are locked together as shown in Figures 4 and 5 both from the standpoint of longitudinal motion and rotation, but they can be readily separated by simply unclamping the connection at 52 and 55 and swinging to the position of Figure 8. A hole 56 is provided in the top 51 to allow the plunger 36 to pass through into the cylinder.

A sandwich clamp mount 57 is provided on the plunger, engaging its head. This mount, as seen in Figure 7, consists of a metallic base 58 having a socket portion 59 engaging a ball portion 60 on the plunger head 37 and provided with a hole 61 for insertion and removal of the plunger. Wings 62, 63 and 64 are provided extending radially from the base, preferably at 90° intervals around the base.

A spring metal top 65 of the mount has corresponding wings 66, 67 and 68 as well as a central gripping portion 69. The wing 66 on the top is pivotally connected at 70 with the wing 62 on the base and the wing 68 on the top has a locking recess 71 for engagement under a locking head 72 on the wing 64 on the base. The wing 63 on the base is slotted at one side at 73 and the corresponding wing 67 on the top is slotted at the corresponding side at 74.

A rack 75 having ratchet teeth 76 facing (having their stop portions facing) in the forward direction with respect to the plunger makes a quick release connection 77 with the mount by engaging in the slots 73 and 74, thus also locking together the base and top of the mount in the closed position shown in Figure 5 to grip the head of the plunger. The quick release connection is conveniently formed by a screw 78 threaded into the rack 75 at 79, and having a circular seat nut 80 threaded thereon, and engaging in circular recesses 81 in the slots 73 and 74 of the wings. A nut 82 holds the wings in place, and a stop 78' prevents inadvertent removal of the nut 82.

The rack extends to a position beyond the bracket in the outermost position of the plunger. The rack passes through the guiding keyway 49 of the bracket for control of the forward motion. An escapement lever 83 is pivoted preferably near its middle at 84 from opposite walls 85 and 86 forming parts of the guides 47 and 48. The escapement lever has tripping handles 87 and 88 at its opposite ends to permit movement

back and forth between its two limiting positions and has on each side of the pivot and equidistant from the pivot an escapement tooth 89, 90 opposed to and cooperating with the rack for escapement purposes. Detent recesses 91 and 92 on the escapement lever are engaged in the two limiting positions alternatively by a detent plunger 93 extending in a hole through the wall 86 and beyond the same for engagement with a leaf spring 94 mounted by a screw 95. The leaf spring 94 can be rocked to the side for purposes of disassembly of the detent, as shown in Figure 8.

The escapement lever teeth 89 and 90 are spaced from one another by a distance which includes an integer plus a fraction of the tooth space of the rack, for example one and three-eighths, one and one-half, one and five-eighths, two and three-eighths, two and one-half, two and five-eighths, three and one-fourth, etc. times the tooth spacing. Thus in a given position in which the handle 87 is depressed, as shown in Figure 11, the rack will advance until the escapement tooth 89 engages the next tooth on the rack, at which point the rack will stop as in Figure 12. The rack and plunger cannot further advance until the escapement is shifted by depressing the handle 88, at which point the escapement tooth 89 releases its engagement with the rack tooth as shown in Figure 12 and the escapement tooth 90 engages in front of another rack tooth permitting the rack to advance one-half a tooth distance. Thus in the form illustrated each step is one-half times tooth distance, and the dose will be a corresponding volume, say one-half cubic centimeter, on the syringe.

In the preferred embodiment as shown, the escapement tooth spacing is one and one-half times the rack tooth spacing, and thereby rack and plunger advance one-half rack tooth spacing distance for each shift of the escapement lever.

The reverse faces of the rack teeth and the escapement teeth have cooperating cam faces 96 and 97 which automatically shift the escapement lever back and forth to permit withdrawal of the rack and plunger without pressing the escapement lever by hand. This permits quick withdrawal of the plunger for the purpose of refilling.

At the outward limit of motion of the rack the rack may be prevented from complete withdrawal by means of a stop 98 at the end of the rack.

In operation the glass parts of the syringe may be conveniently removed from the metal parts as shown in Figures 6 to 8, inclusive, and the various parts, particularly the glass parts, sterilized. The syringe will then be reassembled using sterile technique as well known. The various parts and syringe are sterilized as a single unit in actual practice.

The area of the body where the puncture is to be made should be suitably cleaned, and then the carrier fastened at the proper location by any suitable attachment to the body such as a bandage, belt or adhesive tape. The syringe is then filled with a suitable subcutaneous or intravenous medicament, for example an antibiotic such as penicillin or streptomycin in a suitable quantity. For example the complete daily dosage of the antibiotic may be placed in the syringe at one time, containing for instance two hundred thousand to one million units of penicillin. Convenient sizes for the syringe may be 5 cc., 6 cc. and 12 cc. The syringe is then inserted in the forward end of the carrier by passing the hypodermic needle through the yoke of the carrier, after which the needle is forced into the body of the patient. The needle, as well known, is fastened on the forward end of the barrel of the syringe and is conveniently bent at an angle, preferably somewhat less than a right angle so that it will extend transversely into the body of the patient.

The bracket of the syringe is provided at each side with sockets or recesses 99 and 100 between the base and top wings of the bracket and on either side of the syringe barrel. The rear of the syringe is then brought down against the body and the carrier is forced up so that the hook ends 25 and 26 at the rearward end of the carrier are received in the sockets of the bracket, hooked over the wings 42 and 43.

The syringe is now in its outermost operating position, and the user can apply the first dose by pressing forward on the rear of the plunger. If the barrel advances, a dose corresponding for example to ½ cc. will be administered. If the syringe does not advance the user shifts the escapement lever to its opposite position and again presses on the rear of the plunger to advance the syringe one half tooth distance which corresponds to one dose.

The equipment is then allowed to remain in its position until time for the next dose, when the patient again tries the forward pressure on the plunger, and if the plunger moves forward he can administer a dose indicating that the escapement lever has been inadvertently rocked during the period between doses. If, however, the plunger does not move forward the escapement lever is then shifted and the plunger carried forward to apply the dose.

This procedure is continued until the syringe has been exhausted or the time arrives for the refilling of the syringe, at which time the syringe may be replaced or refilled in any suitable manner.

To remove the syringe from the carrier, the hooked ends of the carrier are removed from the sockets of the syringe, the hypodermic needle removed from the body and the forward end of the syringe withdrawn from the yoke. The carrier can be left in place to receive the replacement syringe (or the same syringe refilled) which is to apply the next series of doses. In some cases, special techniques may be used to refill the syringe without removing the needle from the puncture.

To disassemble the syringe once it has been taken away from the patient, the quick release at 77 between the rack and the mount is loosened and the top of the mount is turned to the position of Figure 7, releasing the mount from the head on the end of the plunger. The whole mount is turned to disengage the mount completely from the rack. The plunger is then withdrawn, after which the mount can be slid off the plunger. The screw 78 can then, if desired, be removed from the end of the rack, first loosening the seat nut 80, and the rack can then, if desired, be taken out of the guideways of the bracket. The bracket is separated from the head of the barrel by turning the spring top of the bracket away from the shoulder 44 (which acts as a stop, over the shoulder 45 which acts as a detent) to the position of Figure 8 and sliding the barrel out of the bracket. The reverse procedure can be followed in reassembly.

If the glass or plastic barrel or plunger break, it can readily be replaced when the parts are disassembled.

The invention has been applied experimentally to administer antibiotics subcutaneously or intravenously to more than seventy patients who in each case continued the administration of the doses themselves or by aid of non-medically trained friends. Only two of these patients refused further treatment by the same method after the first twenty-four hours. Two of the patients were blind and applied the successive doses entirely by feel. Several of the patients were unable to understand the English language and were instructed in the application of the doses by sign language. A substantial number of the patients were of low intelligence, but they were able to carry on the simple operations required. A number of the patients remained ambulatory, one did housework for hire, one attended the movies for pleasure and most of the patients got in and out of bed frequently during the treatment without difficulty through breakage of syringes or hypodermic needles, or interruption of treatment.

Several of the patients who were unable to stand the pain of frequent punctures with the hypodermic needle were enabled to undergo the treatment because the punctures were limited to one each day or each twelve hour period. The experiments have indicated that the invention is of considerable benefit in combating the inroads of tuberculosis and syphilis particularly among persons of low income and persons having highly developed prejudices against hospitalization.

In view of my invention and disclosure variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of my invention without copying the process and structure shown, and I, therefore, claim all such insofar as they fall within the reasonable spirit and scope of my claims.

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

1. In a syringe for use on the body of a patient, a barrel, a plunger cooperating with the barrel, a bracket secured to the barrel adjacent the end at which the plunger enters and including a socket and a carrier engaging in the socket and also engaging the opposite end of the barrel to support the syringe from the body and extending longitudinally of the barrel in spaced relation in position to support the barrel against the body.

2. In a syringe for use on the body of the patient, a barrel, a plunger extending into the barrel and cooperating therewith, a bracket mounted at the end of the barrel at which the plunger enters and a forked carrier having a yoke portion which extends over the forward end of the barrel and an interconnecting portion which engages the bracket at the rearward end of the barrel, the carrier being adapted to be mounted on the body of the patient.

3. In a syringe, a barrel, a plunger entering the barrel and cooperating therewith, a bracket, a quick removable mounting for the bracket on the barrel, a rack, a quick removable mounting for the rack on the plunger and step by step mechanism interconnecting the bracket and the rack to permit advance of the rack limited to a predetermined distance at each step.

4. In a syringe for use on the body of a patient, a barrel, a plunger cooperating with and entering the barrel, a bracket mounted on the barrel at the end at which the plunger enters, a carrier

extending longitudinally of the barrel and having sides spaced laterally for mounting on the body of the patient interconnecting with the bracket to hold the barrel, and step by step mechanism limiting the advance of the plunger to a single step at a time corresponding to a particular dosage.

5. In a syringe, a barrel, a plunger cooperating with the barrel and entering the same at one end of the barrel, a bracket mounted on the barrel, a rack mounted on the plunger at the end opposite to that which enters the barrel and extending generally parallel to the barrel and an escapement lever pivoted on the bracket and having a plurality of oppositely disposed teeth one of which is successively in the path of the rack to limit the advance of the rack to not in excess of a half tooth distance at each step of the rack.

6. In a syringe for use on the body of a patient, a barrel, a plunger cooperating with and entering the barrel, a bracket surrounding and engaging the end of the barrel at which the plunger enters and having sockets on either side thereof, a rack removably attached to the rear end of the plunger and extending parallel to the barrel, a carrier having prongs which engage in the sockets and adapted to hold the barrel against the body of the patient and an escapement lever pivoted on the bracket extending in cooperative relation with and in the direction of the rack and having a pair of spaced teeth one of which is always in engagement with the rack and at different positions with respect to the approaching teeth of the rack so as to limit the advance of the rack one-half tooth distance in either position of the escapement lever.

7. In a syringe for application of doses to a patient, a barrel having a head at an open end thereof and a hypodermic needle connection at the opposite end, a sandwich clamp bracket surrounding and engaging the head and having an opening in line with the interior of the barrel, a plunger extending through the opening of the sandwich clamp bracket and into the barrel, the plunger having a head at the end remote from the barrel, a sandwich clamp mount surrounding the end of the head on the plunger, and step by step mechanism interconnecting the sandwich clamp bracket and the sandwich clamp mount to limit the advance of the plunger at a given step to a single dose.

8. In a syringe, a barrel having a head at an open end thereof and a hypodermic needle connection at the opposite end, a sandwich clamp bracket surrounding and engaging the head and having an opening in line with the interior of the barrel, a plunger extending through the opening of the sandwich clamp bracket and into the barrel, the plunger having a head at the end remote from the barrel, a sandwich clamp mount surrounding the head on the plunger, a rack secured at one end to the mount and extending toward and beyond the bracket, a guide on the bracket engaging the rack and an escapement lever pivoted on the bracket and limiting the rack to a predetermined tooth advance at any position of the escapement lever.

9. In a syringe, a barrel having a head at an open end thereof and a hypodermic needle connection at the opposite end, a sandwich clamp bracket surrounding and engaging the head and having an opening in line with the interior of the barrel, a plunger having a head at the rear end and extending through the opening of the sand-

wich clamp bracket and into the barrel, a sandwich clamp mount surrounding the head end of the plunger, a rack extending from the mount to and beyond the bracket, a removable connection between the rack and the mount, a guide on the bracket for the rack and an escapement lever pivoted intermediate its ends on the bracket and having a pair of teeth cooperating with the teeth on the rack and located one on each side of the pivot, only one tooth of the escapement lever being in the path of the rack at a given position of the escapement lever.

10. In a syringe, a barrel having a head at an open end thereof and a hypodermic needle connection at the opposite end, a sandwich clamp bracket surrounding and engaging the head and having an opening in line with the interior of the barrel, a plunger having a head at the rear end and forwardly extending through the opening of the sandwich clamp bracket and into the barrel, a sandwich clamp mount surrounding the head end of the plunger, a rack supported at one end and extending from the mount to and beyond the bracket, a removable connection between the rack and the support, a guide on the bracket for the rack and an escapement lever pivoted intermediate its ends on the bracket and having a pair of teeth cooperating with the teeth on the rack and located one on each side of the pivot, the pivot being located so that only one tooth is in the path of the rack at a given position of the escapement lever, and a detent on the bracket which engages the lever in its two opposite positions and retards the lever in its initial motion in the opposite direction.

11. In a syringe for application of doses to a patient, a barrel having a head at an open end thereof provided with a flattened portion at one side of the head and having a hypodermic needle connection at the opposite end, a sandwich clamp bracket surrounding the head having an opening in line with the interior of the barrel and having a gripping wall which engages the flattened portion and prevents turning of the barrel with respect to the clamp, a plunger having a head at the rear end and forwardly extending through the opening of the sandwich clamp bracket and into the barrel, a sandwich clamp mount surrounding the head end of the plunger, a rack supported at one end and extending from the mount to and beyond the bracket, a guide on the bracket for the rack and escapement means on the bracket for releasing the rack step by step to permit administering successive doses.

12. In a syringe, a barrel having a hypodermic connection at one end, a plunger cooperating with and extending into the barrel, a bracket mounted on the barrel, a mount secured upon the plunger and step by step release means interposed between the bracket and the mount including a rack having uniformly spaced teeth and an escapement lever having a pair of spaced escapement teeth alternatively in engagement with the rack, spaced by a distance which is an integer plus a fraction times the rack tooth spacing and further including a pivot for the escapement lever positioned equidistant between the escapement teeth.

13. In a syringe, a barrel having a head at one end and a hypodermic needle connection at the opposite end, a sandwich clamp bracket surrounding and engaging the head and having an opening in line with the interior of the barrel, a plunger extending through the opening of the sandwich clamp bracket and into the barrel, the plunger having a head remote from the barrel, a sandwich clamp mount surrounding the head on the plunger, a rack secured at one end to the mount and extending toward and beyond the bracket, a guide on the bracket engaging the rack and an escapement lever pivoted on the bracket and having escapement teeth on opposite sides and equidistant from the pivot, the spacing of the escapement teeth being an integer plus a fraction times the rack tooth spacing.

14. In a syringe, a barrel having a hypodermic needle connection at one end, a bracket supported on the barrel, a plunger extending into the barrel, a mount secured on the rear end of the plunger, a rack secured at one end to the mount and extending toward and beyond the bracket, the rack having ratchet teeth which provide stop engagement on the forward side and have cam reverse faces, a guide on the bracket engaging the rack and an escapement lever pivoted intermediate its ends and having escapement teeth equidistant from the pivot alternatively cooperating with the rack, having stop faces opposed to the forward faces of the rack teeth and having reverse cam faces opposed to the cam faces on the rack teeth, whereby on reverse motion of the rack the escapement lever will swing back and forth under the action of the cams and release the rack without hand application to the escapement lever itself.

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