Jan. 20, 1942. S. R. DUTKY ET AL 2,270,804

MICROINJECTOR

Filed July 18, 1940 2 Sheets-Sheet 1

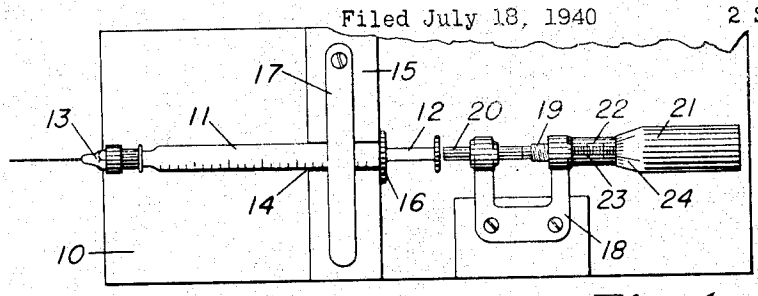

Fig. 1

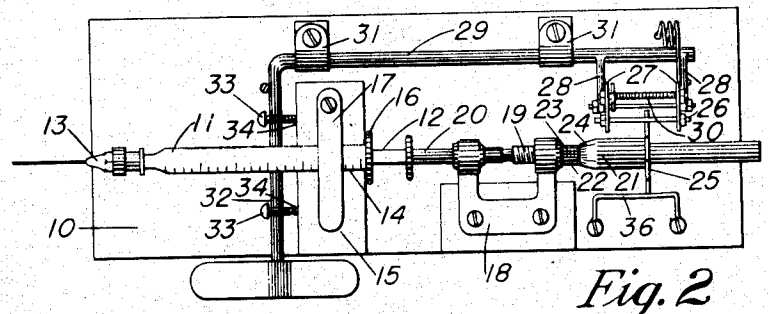

Fig. 2

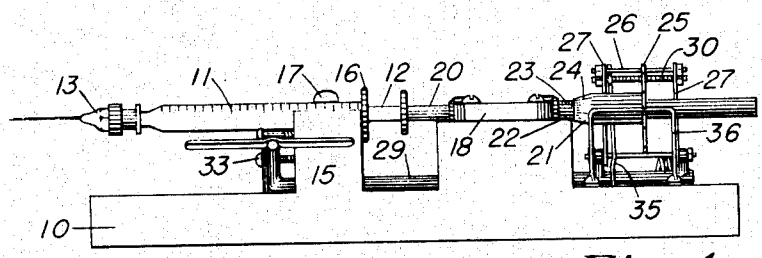

Fig. 4

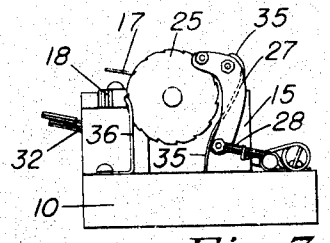

Fig. 3

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MICROINJECTOR

Filed July 18, 1940 2 Sheets-Sheet 2

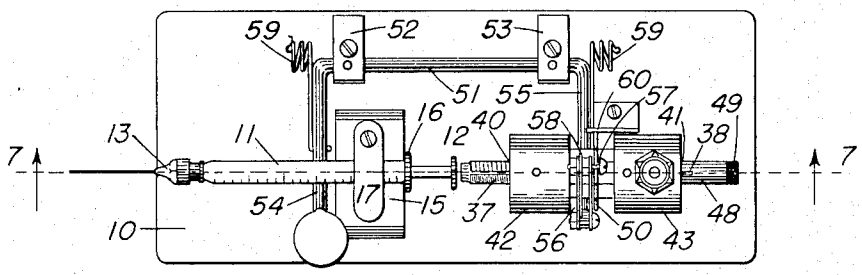

Fig. 5

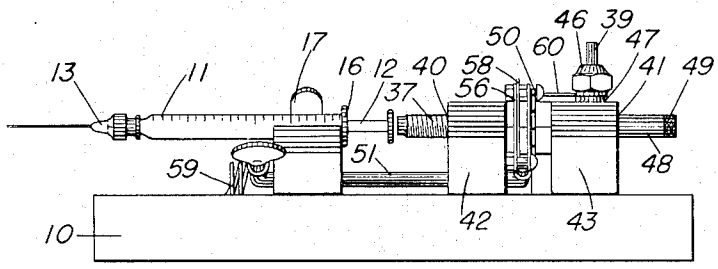

Fig. 6

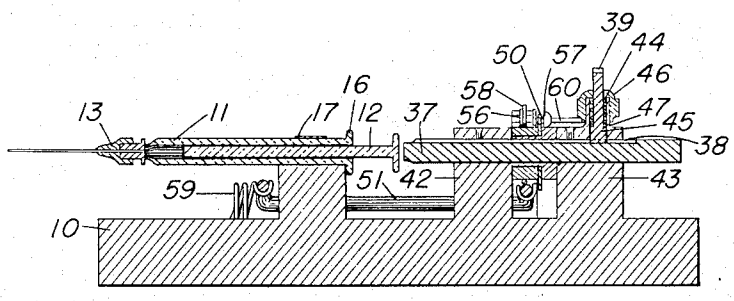

Fig. 7

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Patented Jan. 20, 1942 2,270,804

UNITED STATES PATENT OFFICE

2,270,804

MICROINJECTOR

Samson R. Dutky, Palmyra, and William C. Fest, Masonville, N. J., dedicated to the free use of the People in the territory of the United States

Application July 18, 1940, Serial No. 346,155

3 Claims. (Cl. 128—215)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

This application is made under the act of March 3, 1883, as amended by the act of April 30, 1928, and the invention herein described and claimed, if patented, may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment to us of any royalty thereon.

We hereby dedicate the invention herein described to the free use of the people in the territory of the United States to take effect on the granting of a patent to us.

This invention relates to an instrument designed to deliver accurately predetermined volumes of liquids for the purpose of making hypodermic injections.

In general, the invention comprises a hypodermic syringe of the plunger type and a micrometer screw adapted to actuate the plunger of the syringe, means being provided to determine relative positions of the micrometer screw as a function of the volume of liquid delivered.

In the accompanying drawings, there are illustrated three embodiments of my invention, in which:

Figure 1 is a plan view of the simplest embodiment.

Figure 2 is a plan view of the second embodiment.

Figure 3 is an end view of Figure 2.

Figure 4 is a side elevational view of Figure 2.

Figure 5 is a plan view of the third, and preferred, embodiment of my invention.

Figure 6 is a side elevation of Figure 5.

Figure 7 is a longitudinal section along the line 7—7 of Figure 5.

Referring with more particularity to Figure 1, the embodiment illustrated comprises a suitable base 10, upon which is removably mounted an ordinary hypodermic syringe 11 of the plunger type. The plunger of said syringe is designated by the numeral 12 and the needle and coupling therefor by the numeral 13. The barrel of the syringe 11 is seated in a groove 14 of a block 15 transversely mounted on the base 10, the flange 16 of the syringe abutting the said block 15, substantially as shown. A hinged flap 17 is mounted on the block 15 so as to hold the syringe in place in the groove 14. To the rear of block 15, there is horizontally secured a U-shaped bracket 18, through the rearward arm of which a micrometer screw 19 is threadedly engaged in line with the plunger 12. Between the plunger 12 and the end of the micrometer screw 19 a spacing bar 20 is disposed through the other arm of the bracket 18. The spacing bar is mounted so that it will not rotate under the influence of the micrometer screw 19. The micrometer screw 19 is actuated by a cylinder 21, to which it is secured, said cylinder operating over a barrel 22 fixed to the bracket 18. The barrel 22 is provided with a longitudinal scale 23, and the cylinder 21 is provided with a circular scale 24 so that relative displacements of the micrometer screw may be determined in terms of the volume of liquid deliverable by the syringe. By turning the micrometer screw forward any desired quantity of liquid may be expelled through the syringe. By keeping the spacing bar 20 in a non-rotatable position so that it is only capable of a thrust motion, the plunger 12 is prevented from rotating, and, consequently, any errors which might result from such rotation are prevented.

The embodiment illustrated in Figures 2, 3, and 4 employs substantially the same parts as that illustrated in Figure 1 except that means are added to permit the operator to actuate a lever and thereby cause the device to deliver a predetermined volume of liquid without reference to the scales 23 and 24. In this embodiment a ratchet wheel 25 is secured to the cylinder 21. A pawl 26 is associated with the wheel 25 and is mounted between two arms 27, 27 straddling the wheel 25. The arms 27, 27 are hinged to arms 28, 28 of a shaft 29. Said arms are secured together for coaction by means of a rod 30.

The shaft 29 is rotatably mounted in suitable bearings 31, 31 fixed to the base of the instrument. The shaft 29 extends toward the front of the instrument and is bent to form an arm 32 etxending across the device beneath the syringe 11. The vertical movement of the arm 32 is made adjustable by means of abutment pins 33 which are removably disposed in apertures 34 of the block 15, substantially as shown. The pawl 26 is held against the wheel 25 by means of a spring 35 mounted for tensioning between the base of the instrument and one of the arms 27, or some other suitable part fixedly associated therewith. In order to prevent a return movement of the wheel 25 after the pawl 26 has been actuated downward and released, a yieldable abutment, such as a U-shaped bar 36, is mounted on the base of the instrument in contact with the wheel 25, preferably on the side opposite the pawl 26. By changing the size of the wheel 25 or the number of teeth thereof, or by changing the position of the abutment pins 33, variations in the quantity of liquid ejected on each stroke of the arm 32 may be accomplished.

Referring with more particularity to Figures 5,

6, and 7, which illustrate the third, and preferred, embodiment of my invention, the same general ararngement of parts is employed as in the first two embodiments with respect to the syringe and the micrometer screw, except that the spacing bar is omitted. The micrometer screw 37, in this preferred embodiment, is held in a non-rotatable position by means of a longitudinal groove 38, engaging a guide pin 39. The micrometer screw is slidably disposed through apertures 40 and 41 of a pair of mounts 42 and 43, respectively, longitudinally aligned with respect to the syringe 11, and the guide pin 39 is disposed through one of the mounts 43 and held in place by means of a spring 44 mounted for tensioning between a shouldered portion 45 of said pin and the upper flange 46 of a sleeve fitting 47 secured to said mount 43. The rearward end of the screw 37 terminates in a shaft 48 which projects beyond the mount 43 and is provided with a knurled surface 49 to permit easy manual rotation of the screw when the guide pin 39 is disengaged from the groove 38.

Between the two mounts 42 and 43, the ratchet wheel 50 is disposed about the screw 37, the hub of said wheel being threadedly engaged with said screw and flanged so as to fill up the space between the two mounts at that point. By these means, when the ratchet wheel is rotated, the micrometer screw 37 is translated through the apertures 40 and 41, the guide pin 39 preventing the screw from rotating. A U-shaped bar 51, similar to the shaft 29 illustrated in the second embodiment, is disposed on the base of the instrument, the web thereof being pivoted in longitudinally disposed bearings 52 and 53. One arm 54 of the bar is disposed beneath the syringe on the forward part of the instrument, and the other arm 55 is disposed beneath the ratchet wheel 50. To the arm 55 there is hinged an assembly 56, including a pawl 57 adapted to engage the teeth of the ratchet wheel 50. A spring 58 is disposed between the pawl 57 and the arm 55 and so tensioned that it urges the pawl against the ratchet wheel. Springs 59 are provided between the base of the instrument and the bottom of the arms 54 and 55, respectively so as to urge and normally hold said arms in an elevated position, whereby when the arms 54 and 55 are depressed, they are automatically returned to their normal position. A yieldable abutment 60 is also provided in association with the ratchet wheel, similar to the member 36 in the second embodiment illustrated.

When the arm 54 is depressed, the pawl 57 is actuated downward, thereby causing the ratchet wheel to rotate a given distance, which, in turn, causes the micrometer screw 37 to be propelled forward against the plunger of the syringe. Upon release of the bar 54, the springs 59 return both of the bars 54 and 55 to their normal positions together with the pawl 57, the ratchet wheel being held stationary by means of the abutment 60. The movement of the screw 37 urges the plunger inward and causes the delivery of a given amount of liquid for each stroke of the arm 54. When it is desired to replenish the supply of liquid in the syringe, the syringe is removed, reloaded, and replaced in the instrument. However, upon replacement it is necessary to retract the micrometer screw 37 to make room for the extension of the plunger. To accomplish such a retraction, the guide pin 39 is elevated against the action of the spring 44, thereby permitting the micrometer screw 37 to rotate. The shaft 48 of the micrometer screw is then rotated in the same direction in which the ratchet wheel is normally operated, while the ratchet wheel is held in a fixed position.

Having thus described our invention, we claim:

1. A microinjector comprising a base structure, means for removably securing a plunger actuatable syringe on said base, a micrometer screw for actuating the plunger of said syringe, a ratchet wheel secured to said screw, a pawl for unidirectionally engaging said ratchet wheel, means for actuating said pawl, and means for limiting the movement of said pawl so that each time said pawl is fully actuated said screw is moved a predetermined distance.

2. A microinjector comprising a base structure, means for removably securing a plunger actuatable syringe on said base, a micrometer screw for actuating the plunger of said syringe, a ratchet wheel threadedly engaged with said screw, axial abutments for said wheel, means for holding said screw is a non-rotatable position with respect to said plunger, a pawl for unidirectionally rotating said ratchet wheel, and means for actuating said pawl.

3. A microinjector comprising a base structure, means for removably securing a plunger actuatable syringe on said base, a micrometer screw for actuating the plunger of said syringe, said screw having a longitudinal groove, a ratchet wheel threadedly engaged with said screw, axial abutments for said wheel, a removable pin engaging said groove to prevent rotation of said screw, a pawl for unidirectionally rotating said ratchet wheel, and means for actuating said pawl.

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