June 25, 1929. A. E. SMITH 1,718,596

AUTOMATIC SYRINGE

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Fig. 1

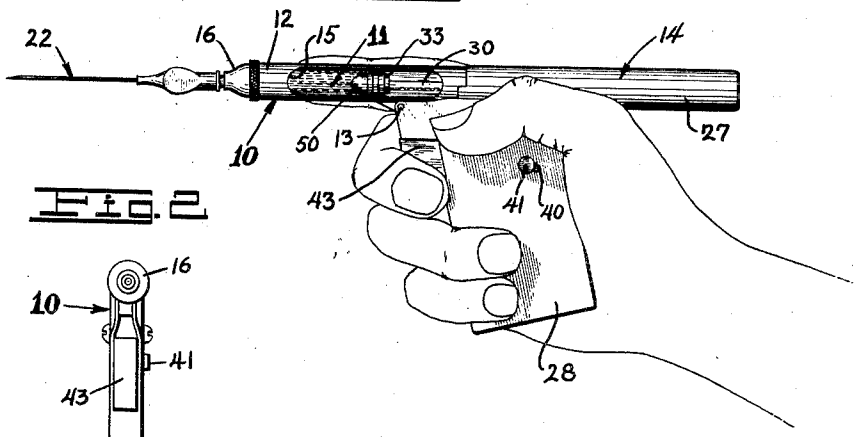

Fig. 2

Fig. 3

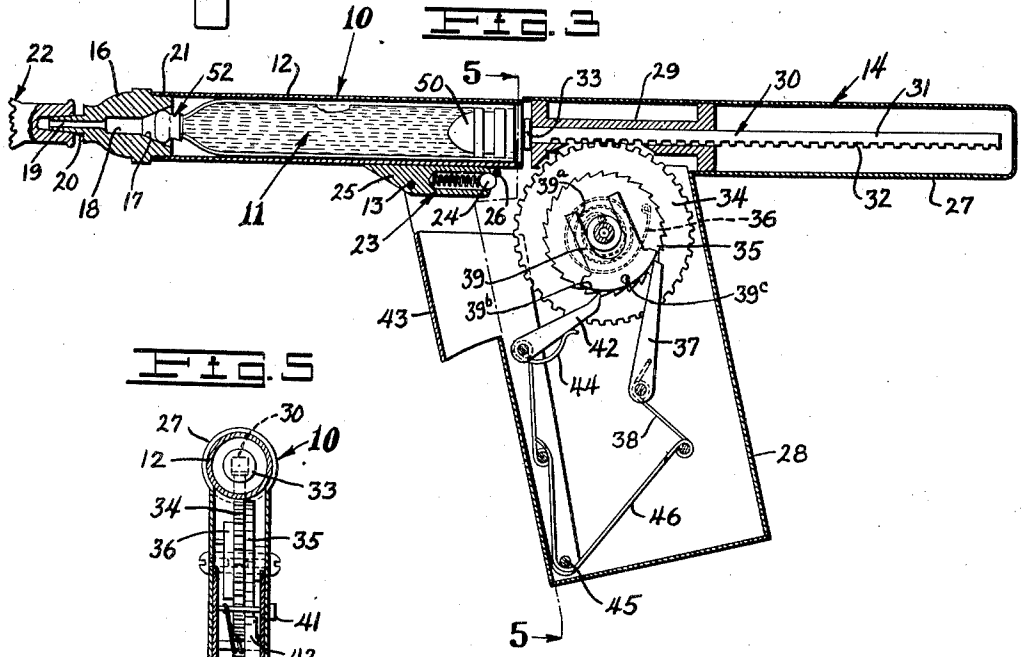

Fig. 5

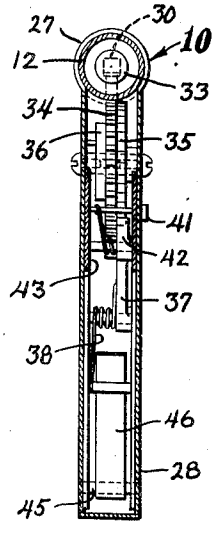

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Fig. 4

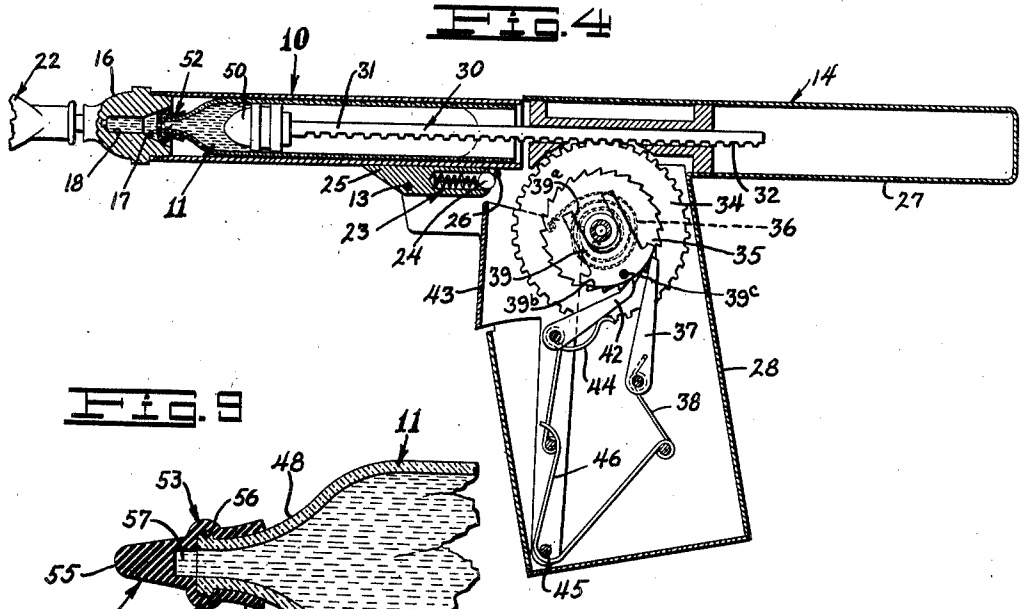


Fig. 5

Fig. 8

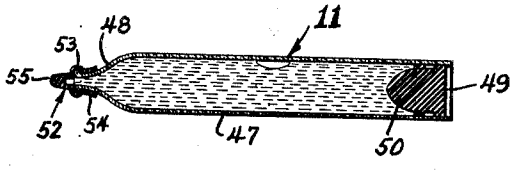


Fig. 6

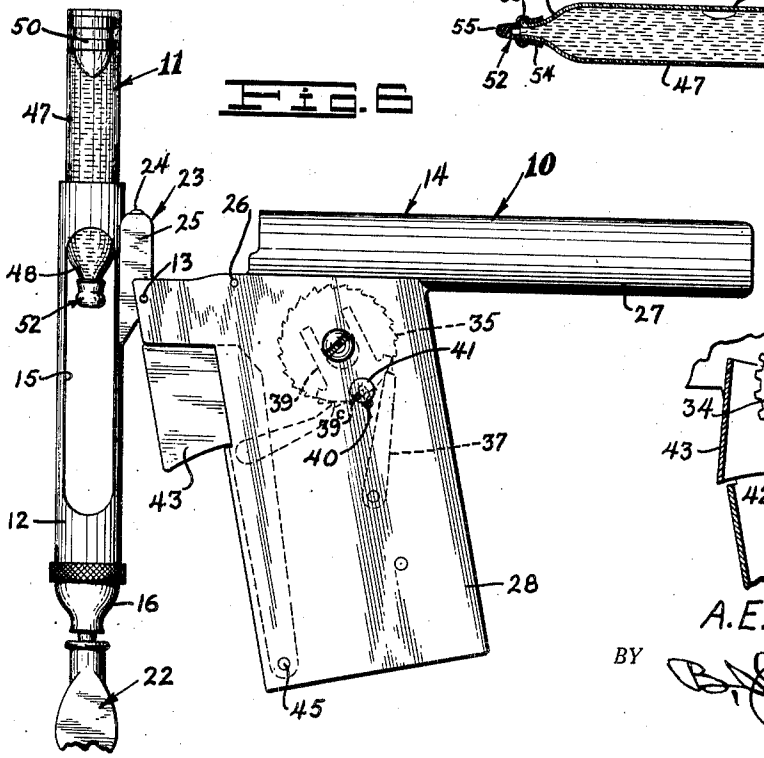
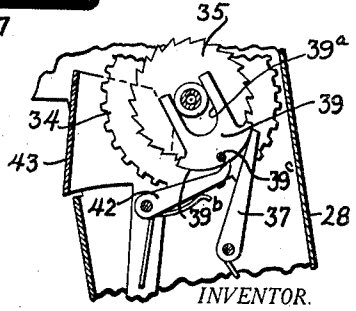


Fig. 7



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UNITED STATES PATENT OFFICE.

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AUTOMATIC SYRINGE.

Application filed August 8, 1927. Serial No. 211,393.

This invention relates to hypodermic syringes.

The general object of my invention is to provide an improved syringe which is adapted to receive an ampule for injection of the drug contained in the ampule.

Another object of the invention is to provide a syringe having novel means for expelling the contents of the syringe.

A further object of the invention is to provide a syringe having novel means for engaging the hand of the operator.

A still further object of my invention is to provide a syringe having novel means for loading.

An additional object of the invention is to provide novel means for readily forming a fluid tight joint between a syringe and an ampule.

A further object of the invention is to provide a syringe with means for gauging the amount of liquid injected.

A further object of the invention is to provide a syringe with novel means allowing its use with ampules which contain various amounts of medicinal preparations.

Other objects and advantages of this invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

Fig. 1 is a side elevation of my improved syringe showing the manner of holding it when making an injection.

Fig. 2 is a front view of the syringe with the hypodermic needle removed.

Fig. 3 is an enlarged central longitudinal section through my improved syringe.

Fig. 4 is a view similar to Fig. 3 showing the position the various parts of the syringe assume when moved to expel the contents of an ampule in the syringe.

Fig. 5 is a vertical cross section of the syringe taken on line 5—5 of Fig. 3.

Fig. 6 is a side elevation of the syringe showing the manner in which the ampule is placed therein.

Fig. 7 is a fragmentary view showing the actuating pawls in a released position.

Fig. 8 is a central longitudinal section through an ampule which may be used in connection with my improved syringe, and

Fig. 9 is an enlarged fragmentary longitudinal section of the discharge end of the ampule shown in Fig. 8.

Referring to the drawings by reference characters I have indicated my improved syringe generally at 10. This syringe is preferably made of metal and is particularly designed for use with an ampule 11 which may be made of glass as shown in detail in Fig. 8. The syringe 10 comprises a barrel 12 pivotally hinged as at 13 to a body portion 14. The barrel 12 is preferably provided with a plurality of spaced viewing apertures or slots 15.

At the discharge end of the barrel 12 I provide a tip 16 which includes a central tapered conical aperture 17. The aperture 17 communicates through an aperture 18 with an aperture 19 which extends out through a reduced conical end portion 20 of the tip. The tip 16 may be secured to the barrel 12 by screw threads as shown at 21 or in any other suitable manner. The tip 16 is adapted to position and support a hypodermic needle indicated generally at 22. The hub of the hypodermic needle 22 may frictionally engage the reduced conical end portion 20 of the tip 16 as shown in the drawings, or it may have screw threaded engagement therewith or other suitable attaching means may be used.

The barrel 12 is preferably retained in operative engagement with the body 14 by a latch 23. As shown in the drawings, this latch 23 comprises a spring pressed ball 24 mounted in a housing 25 arranged on the barrel 12. When the barrel 12 is in a closed position as shown in Figs. 1, 3 and 4, the ball 24 is adapted to abut the under side of a pin 26 in the body 14 and thus prevent the barrel 12 from becoming out of alignment with the body 14. The housing 25 as shown also acts as a bearing through which the pivot pin 13 passes.

The body portion 14 includes a cylindrical portion 27 of approximately the same diameter as the barrel 12 and a gripping portion or handle 28. Arranged in the cylindrical portion 27 and supported in an elongated bearing 29 I provide a plunger rod 30 which includes a shank 31 having a toothed rack 32 provided on its under surface and a head 33 provided at its forward end for engagement with the stopper of an ampule.

Engaging the gear teeth 32 of the plunger rod and rotatably mounted within the handle 28 I provide a gear 34 having secured thereto a ratchet 35. A spring 36 anchored to the handle 28 and secured to the gear 34 applies clockwise tension to the gear 34.

The tendency of the spring 36 to rotate

the gear 34 is normally prevented by a pivoted dog 37 which is normally retained in engagement with the ratchet 35 by a wire spring 38. For rotating the gear 34 to move the plunger rod 30 forward within the barrel 12 I provide a pawl 42 pivoted to a trigger 43 and urged into contact with the ratchet 35 by a wire spring 44. The trigger 43 is pivoted at 45 and normally urged to an extended position by a flat spring 46.

When the trigger 43 is retracted to the position shown in Fig. 4, the pawl 42 rotates the gear 34 and causes the plunger rod 30 to move forwardly within the barrel 12 to engage the stopper of an ampule therein.

For releasing the dog 37 and the pawl 42 to allow the spring 36 to rotate the gear 34 to retract the plunger rod 30 I provide a stirrup 39. This stirrup 39 includes a slotted recess 39^a in which the hub of the ratchet 35 is positioned and a surface 39^b which abuts the dog 37 and the pawl 42. For actuating the stirrup 39 to release the dog and pawl I provide a projection 39^c on the stirrup which extends out through a slot 40 in the side of the handle 28 and terminates in an enlarged button 41 (see Fig. 6).

To retract the plunger rod 30 the button 41 on the projection 39^c of the stirrup 39 is moved downwardly thereby disengaging the dog 37 and the pawl 42 from the ratchet 35 and allowing the spring 36 to rotate the gear 34 in a clockwise direction, and as the gear 34 meshes with the gear teeth 32 of the plunger rod shank 31, the plunger rod 30 will be moved rearwardly to a retracted position as shown in Fig. 3.

My improved ampule 11, which is used in connection with my improved syringe 10, is shown in detail in Figs. 8 and 9 as comprising a hollow cylindrical body 47 having a tapered open end portion 48 and a straight open end 49 which is adapted to be closed by a stopper 50. The tapered end portion 48 of the ampule is provided with an outer annular bead 51 over which I may fit a resilient cap 52 which comprises a body portion 53 including a skirt 54 and a reduced tip 55. Within the body portion 53 I provide an annular groove 56 in which the bead 51 of the ampule is positioned.

Communicating with the groove 56 I provide a recess 57 which extends into the tip 55 and which may be of approximately the same size as the adjacent opening in the tapered end of the ampule.

To prepare this ampule for use in the syringe 10 it is only necessary to remove the tip 55 of the cap by cutting it at its juncture with the body portion, thereby exposing the recess 57 which then forms an aperture through which the contents of the ampule may pass. After removing the tip 55 of the ampule cap the ampule is inserted into the syringe barrel 12 as shown in Fig. 6.

To "break" the syringe for loading as shown in Fig. 6, downward pressure is applied to the forward end of the barrel 12 which tends to raise the rear end thereof and forces the ball 24 of the latch 23 to be retracted and pass by the latch pin 26. After the ampule has been inserted the barrel 12 is again placed in an operative position as shown in Figs. 1, 3 and 4.

To eject the contents of the ampule after the ampule has been placed in the syringe barrel 12 and the barrel placed in an operative position, the trigger 43 or operating member is moved to move the pawl 42, ratchet 35, and gear 34. This action will move the plunger rod forward within the barrel 12 as previously described. As the plunger rod 30 moves forward the head 33 thereof will engage the stopper 50 of the ampule and force it toward the tapered end of the ampule. Thus the stopper 50 acts as a piston to force the contents of the ampule out through the tapered end of the ample, through the tip 16 and into the hypodermic needle 22. When the trigger has been retracted it is released and can then be again actuated.

As pressure is applied on the head 33 to move the stopper 50 the portion of the body 53 which is adjacent the bead 51 or some part of the skirt 54 of the ampule cap 52 will be forced into very tight engagement with the surface of the recess 17 in the tip 16. The more pressure applied to move the stopper the tighter the cap 52 will engage the tapered recess 17 of the tip 16, thus creating a fluid tight seal between the discharge end of the ampule and the syringe.

By providing the apertures 15 in the barrel 12 of the syringe, sight openings are formed through which the contents of the ampule will be visible and so that the movement of the stopper 50 and the extent to which the contents of the ampule have been discharged may be readily observed by the operator.

If desired the discharge mechanism of the syringe may be so arranged as to expel a certain predetermined equal amount of the ampule contents on each full depression of the trigger 43. For example, the ampule may contain eight cubic centimeters of fluid and each operation of the trigger may be made to eject two cubic centimeters although the size of the ampule and the amount discharged at each operation may be varied.

As shown in Fig. 1, I prefer to hold the syringe, when making an injection, by grasping the handle 28 in the palm of the hand. I then place the first finger alongside of the barrel 12 and operate the trigger 43 with the second finger. When the syringe it thus held the exertion required to move the trigger does not move the syringe when it is actuated to expel the contents of the ampule.

Also when the syringe is so held the thumb is in a position whereby a slight movement thereof will move the button 41 to release the dog 37 and pawl 42 to thereby retract the plunger rod 30.

From the foregoing description it will be apparent that I have provided an improved syringe which is reliable, accurate, and quickly operated and one which can be economically manufactured.

Having thus described my invention, what I claim is:

1. In an automatic syringe, a body, a barrel mounted on said body to permit movement to expose a part of the barrel to allow the introduction of an ampule, means for making fluid tight contact between the forward end of the ampule and the barrel, a plunger movable in said body, an operating member, and means connecting the operating member and the plunger to cause said plunger to move along said body.

2. A syringe including a barrel and a body portion, a plunger rod movable into said barrel, gear teeth on said plunger rod, a gear in said body meshing with the gear teeth of said plunger rod, a ratchet connected with said gear, means to rotate said ratchet to cause said gear to rotate to thereby move said plunger rod, holding means to prevent movement of said ratchet in one direction, means to release said holding means, and means to pivot said barrel on said body to allow access to the rear end of said barrel.

3. A syringe including a barrel and a body portion, means to retain said barrel in opertive alignment with said body, means permitting movement of said barrel out of alignment with said body, a plunger rod in said body, gear teeth on said plunger rod, a gear in said body meshing with the gear teeth of said plunger rod, a ratchet connected with said gear and means to actuate said ratchet to cause said gear to rotate to thereby move said plunger rod.

4. A syringe including a barrel and a body portion, said barrel being hinged to said body and releasable means to retain said barrel in operative engagement with said body, a plunger rod in said body, gear teeth on said plunger rod, a gear in said body in mesh with the gear teeth of said plunger rod, means to rotate said gear to advance said plunger rod, resilient means normally urging said gear to rotate to retract said plunger rod, holding means normally acting to prevent rotation of said gear in a direction to retract said plunger rod, and means to release said holding means to thereby allow said plunger rod to be retracted.

5. In an ampule holding syringe, a body portion and a barrel, said barrel being hinged to said body, releasable latch means to retain said barrel in operative alignment with said body portion, a bearing supported in said body, a plunger rod positioned in said bearing and movable into said barrel, an enlarged head on said plunger rod adapted to engage the stopper of an ampule positioned in said barrel, a rack on said plunger rod, a gear in said body in mesh with the teeth of the plunger rod, a ratchet connected to said gear, resilient means normally urging said gear to rotate to retract said plunger rod, a pivoted dog, resilient means normally urging said dog into engagement with said ratchet to prevent movement of said gear in one direction, a trigger pivotally mounted on said body, resilient means to normally urge said trigger to an extended position, a pawl pivotally mounted on said trigger, resilient means to urge said pawl into engagement with said ratchet whereby when said trigger is actuated said ratchet will be moved to move said gear to advance said plunger rod, means to simultaneously move said dog and said pawl out of engagement with said ratchet, a tip detachably secured on said barrel and having means thereon for receiving a hypodermic needle and means in said tip adapted to engage the discharge end of an ampule positioned in said barrel.

In testimony whereof, I hereunto affix my signature.

ARTHUR E. SMITH.