

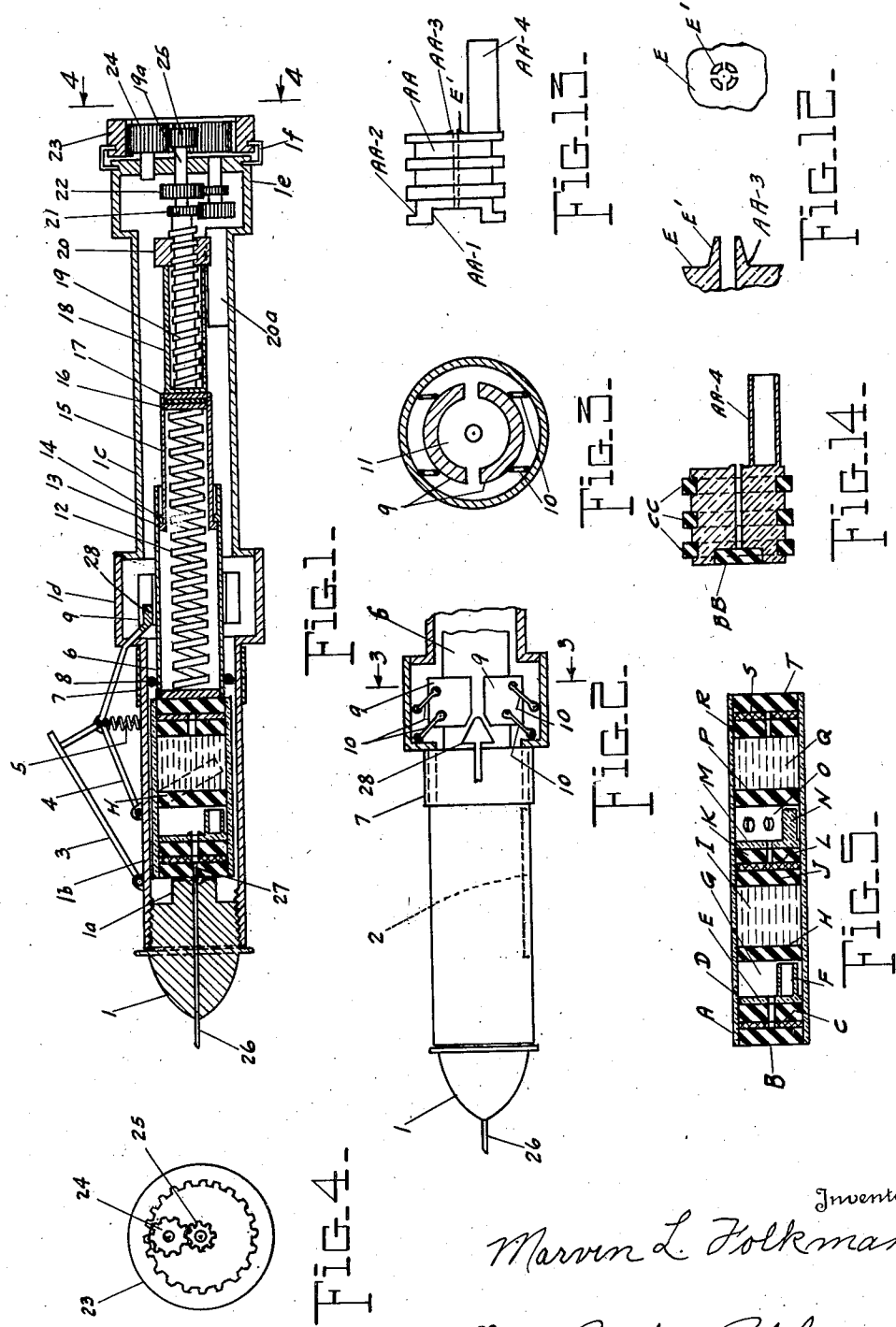
Jan. 25, 1949.

M. L. FOLKMAN
SYRINGE AND AMPOULE

2,459,875

Filed Sept. 11, 1944

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

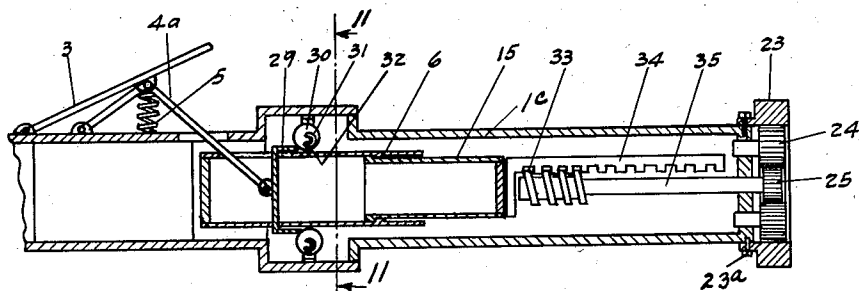


FIG. 6.

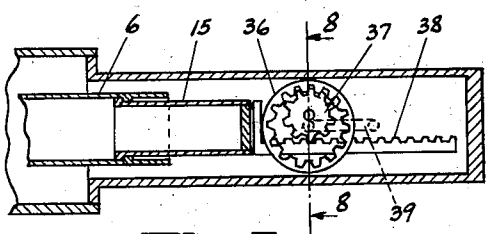


FIG. 7.

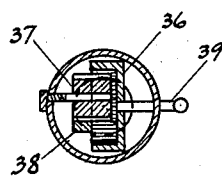


FIG. 8.

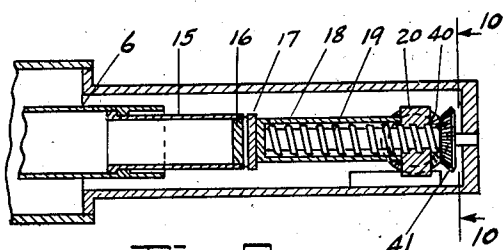


FIG. 9.

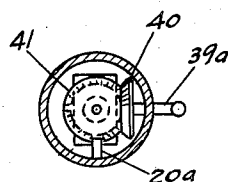


FIG. 10.

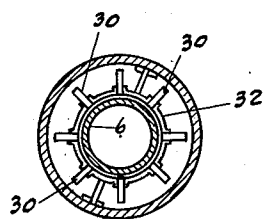


FIG. 11.

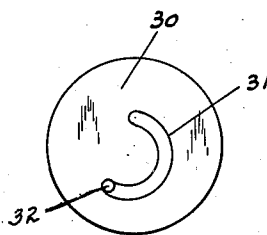


FIG. 15.

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UNITED STATES PATENT OFFICE

2,459,875

SYRINGE AND AMPOULE

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Application September 11, 1944, Serial No. 553,605

3 Claims. (Cl. 128—215)

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This invention pertains to the art of hypodermic or similar syringes and involves novel improvements in this type of surgical instruments.

An especial object of the invention has been to produce a syringe of the class mentioned in which energy storing means, which may be of a mechanical or fluid pressure type, may be availed of for ejecting the medicant in the syringe therefrom through the hypodermic needle or through any other similar applicator means.

A preferred form of the invention is contemplated to utilize an improved type of energy storing spring as the mechanical means for ejecting the medicant from the syringe, and the invention involves, further, different types of operating instrumentalities whereby to compress or otherwise act upon said spring in order to store up the energy required for the ejecting action previously referred to.

Still another object of the invention has been to devise certain novel instrumentalities controlling the application of the force of the energy storing means to the ampoule or cartridge which contains the medicant.

It is notable that the syringe of the type of my invention is utilized in connection with ampoules or cartridges to be emplaced therein preliminary to ejection of medicant therefrom, and one of the objects of the invention is to facilitate the loading and unloading of the ampoules with respect to the syringe casing or body.

Another object of the invention has been to devise a syringe construction in which complete ease of holding and manipulation is obtainable in use and no stretching or special extra manipulation of the hand is required in order to force the medicant from the syringe.

A special feature of the invention resides in the instrumentalities employed in my instrument whereby the ease of control of the operation thereof is greatly enhanced. In other words, my control instrumentalities respond instantly in respect to giving either drop by drop or full stream flow of the medicant from the administering needle by means of simple finger pressure and the medicant is readily further controllable to be held in the syringe until it is required for use. Likewise, a further objective lies in having a construction of cartridge or ampoule in which medicant is maintained dry and free from deterioration by moisture or light until it is ready for use, at which time practically instantaneous and complete dissolving of the medicant may be effected prior to such use.

In syringes of the class of my invention, one of

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the essential things desirable is to practicalize and reduce the cost of the ampoule as much as possible. Obviously the ampoules are manufactured and sold in large numbers, and it is a further object hereof that my invention shall provide an ampoule or cartridge which may be made in a very simple manner from a manufacturing viewpoint, so as to reduce the expense thereof to a minimum, and yet be very effective in its actual cooperative use in conjunction with the syringe instrument, for the purpose of ejecting the medicant therefrom through the administering needle or other applicator to be employed.

Other objects of my invention will become more apparent as this description proceeds, and I have illustrated different modifications of my invention for preferred constructions thereof, in the accompanying drawings, in which:

Figure 1 is a longitudinal sectional view of a hypodermic syringe embodying the essential features of my invention, and in this figure the ampoule illustrated and placed in the syringe is shown just after the movement thereof by which the end disc of the ampoule is punctured in order to establish communication between the needle and the medicant chamber.

Figure 2 is a fragmentary top view partly in section showing the applicator portion of my syringe and bringing out more clearly the side openings of the said portion through which the ampoule may be introduced into the applicator section previous to the use of the syringe; certain brake devices are also illustrated for holding the energy storing means against action for ejecting the contents of the ampoule through the needle applicator.

Figure 3 is a sectional view taken on the line 3—3 of Figure 2, looking in the direction of the arrows.

Figure 4 is a view looking toward the operating end of the syringe or handle means and illustrating the actuating gearing for initiating the storage of energy in the compression spring.

Figure 5 illustrates a sectional view of a modified form of the ampoule in which fluid pressure may be generated for the purpose of obtaining the necessary energy for ejecting the medicant from the ampoule, and from the syringe.

Figure 6 is a partial longitudinal sectional view showing more particularly the operating section of my syringe and illustrating a modified form of actuating means for the energy storing spring; also modified brake means.

Figure 7 is a view similar to Figure 6, but illus-

trating still another modification of my invention.

Figure 8 is a vertical sectional view taken about on the line 8—8 of Figure 7.

Figure 9 is a view similar to Figures 6 and 7 but showing a modification of the same class of construction.

Figure 10 is a vertical sectional view taken about on the line 10—10 of Figure 9.

Figure 11 is a transverse or vertical sectional view taken about on the line 11—11 of Figure 6.

Figure 12 is a dual fragmentary section and front elevational view showing more clearly the peculiarly formed small projections of the inner side of the left end plunger of the ampoule.

Figure 13 is a detail side elevation of a modified form of the left end plunger of the ampoule, some parts omitted.

Figure 14 is a sectional view of the construction of plunger shown in Figure 13.

Figure 15 is an elevation of the brake mechanism.

With a view to facilitating a later clear understanding of the construction of my syringe, I now set forth the detail structure or formation of my ampoule and its parts. The ampoule or cartridge is generally designated A and comprises a straight glass tube. At one end of this glass tube A is a movable plunger and attached to said plunger is the tube which contains the medicant to be dissolved and then subsequently injected. For simplicity and economy the said plunger, instead of being molded, as has been the practice in the art before, is made up of laminated discs cemented together. While two rubber discs of approximately $\frac{1}{8}$ " thickness can be cemented together for making the said plunger, I prefer, as shown in Figure 1 of the drawings, to utilize an outer imperforate rubber disc B, an inner perforated rubber disc D, and between the two discs I emplace a felt or asbestos disc C also centrally perforated. The felt disc C offers advantages in facilitating movement of the plunger as well as in conjunction with the rubber discs providing for the necessary tightness of the plunger in the tube A. Likewise, the disc C at its peripheral edge may be caused to carry a film of glycerine, which will act as a lubricant.

Obviously, the discs D, C, and B can readily be stamped from sheets of suitable material of the class described, or equivalent material, thus reducing the cost of making up the plunger as now being described. Any good quick-drying water-proof cement such as rubber cement, etc., can be used for cementing the discs B, C, and D together.

The inner end of the plunger, as above described, notably the outer plunger of the ampoule as it is emplaced in the applicator section of my syringe, has cemented to the disc D a thin plastic disc E, and integral with this plastic disc E is disposed at right angles to the plane thereof a hollow tube which carries or contains the medicant. The medicant is thus permanently housed or protected from moisture and light in said tube until it is ready to be dissolved and used. The tube mentioned is designated F and is disposed eccentric to the axis or center of the plunger so that it serves the function of an arm as later described, the purpose of which is to open the water compartment when the entire plunger is pushed back into the glass tube A preliminary to the ejecting operation. The discs or members C, D, and E are centrally perforated, while the rubber disc B is not perforated. The object in this connection is to maintain the contents of

the ampoule air-tight at the end of the same where the plunger means just described is located. As will be later set forth, the rubber disc B will be centrally punctured in order to establish communication between the hollow portion of the syringe needle and the medicant containing chamber of the ampoule.

Located approximately near the middle portion of the tube A is the rubber disc or partition H which seals up the medicant in the chamber F of the tube and separates it from the liquid in the chamber, or compartment I, which liquid is employed to mix with the medicant in the chamber F and thus place the medicant in solution. At the right hand or inner end of the ampoule of the tube A is located a plunger which is very similar in construction to the first described plunger, in that it comprises a unit made up of discs R, S, T. The discs R and T are made of rubber and the disc S of felt.

The foregoing description of the ampoule applies to the construction of this member of my invention as illustrated in Figure 1 of the drawings. However, in Figure 5 I show a somewhat modified ampoule construction in that I desire under some conditions to provide such a construction wherein the pressure force may be generated in the ampoule itself for the expulsion of the medicant therefrom. In Figure 5, therefore, my ampoule is of the same general construction which has been previously set forth in respect to Figure 1, but is elongated in respect to the length of the glass tube container.

According to the construction of Figure 5, the left end plunger means, the partition H, and the right end closing plunger R, S, T, are as previously set forth. However, in this construction I provide a middle special composite plunger the parts of which are designated J, K, L, and M, and which correspond generally with the parts B, C, D, E, as set forth. The middle plunger means J, K, L, M involves the use of a plastic disc or member M in which the offstanding arm designated N is solid and merely constitutes a tilting arm for a partition or disc P that separates water in the compartment Q from the dry gas producing medium which is illustrated in tablet form in the compartment O which is disposed between the member P and the member M. The manner of use of the ampoule just described will be set forth later, though the principle of operation involves the tilting of the disc or partition P so that the water in the chamber Q may act in conjunction with the gas producing medium in the compartment O to generate a gas by which the medicant in the compartment G, in dissolved condition, may be caused to pass from the ampoule to the administering needle.

Describing my syringe as it is illustrated in Figure 1 of the drawings, I generally characterize the body of the syringe as being divided into a left hand applicator section and a right hand operating section, because the means for supplying the medicant from the syringe is primarily located in the applicator section while the right hand section of the syringe body is devoted to containing the operating mechanism for forcing the medicant from the syringe.

At one end of the applicator section of the syringe body is located the nozzle 1 which carries the needle 26—27. The outer end of the needle, namely 26, is used for making the injection in the patient. The inner end of the needle, namely 27, is employed to puncture the cartridge or ampoule plunger B and establish contact be-

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tween the hollow portion of the needle and the dissolved medicant which is formed in the ampoule as later to be set forth.

My syringe is of the side loading type and the cartridge is therefore inserted in the side opening 2 of the syringe and pressed forward or to the left in Figure 1 as far as it will go, this performing two actions—first, the puncturing of the rubber disc B, and second, the forcing of the left end plunger of the ampoule inwardly in the tube A. When the ampoule is emplaced in its chamber of the applicator section of my syringe, the sleeve 7 surrounding the said section will be pulled leftward or toward the needle 26 in order to partially cover the rear portion of the opening 2 and prevent accidental displacement of the ampoule in handling the syringe.

As stated before, as the ampoule is moved to the left or forward, the part 1a of the syringe nozzle engages the plunger B, C, D, E of the ampoule and thus moves the entire plunger inwardly in the glass tube A. This movement of the said plunger causes the medicant tube F to bear against the closure or partition disc H, swinging it around and permitting the solvent in the compartment I to dissolve the medicant in the tube F. The plastic disc E of the plunger B, C, D, E near the middle portion thereof has projections shown in Figure 12 to prevent the possibility of the disc H falling in a position that might cause closing of the middle aperture of said part E. The said projections are designated E' in the drawings.

It is apparent that simultaneously with the dissolving of the medicant in the water from the chamber I by the above action of emplacing and moving the ampoule in the syringe, the needle 27 will have punctured the disc B of the left end plunger and thus contact is established between the compartment G of the ampoule and the needle 26—27.

By reason of the special control instrumentalities used for my syringe and now to be described in reference to the operating section thereof, the medicant will not flow from the needle 26 until placed under pressure by the energy storing or pressure means now to be set forth.

The pressure for forcing the liquid medicant from the ampoule is obtained from the energy storing spring 12. This spring is enclosed in a spring case made in two sections 6 and 15, each one closed at one end and open at the other end, the two ends which are open being telescopically fitted together and slidable so that the sections 11 and 15 are slidable one upon the other. The spring case members are supported as follows. The inner case section is held rigidly to bearing plate 17 and the outer case section is supported by ring 8 which acts as a bushing. Different mechanical devices may be resorted to for compressing the spring 12 in order to store up energy therein to be used at will for the ejecting of the medicant from the ampoule in the applicator section of the syringe.

It will be seen from Figure 1 of the drawings that the body of the syringe is made up of the nozzle 1, the left hand applicator section 1b of hollow form, the right hand operating section 1c of similar hollow form, and the middle bulged portion 1d which provides a brake chamber or chamber for certain mechanism of the syringe. The parts 1b, 1c, and 1d might be integral, but the part 1c is shown in the drawings adapted to be screwed into the part 1d so as to provide for

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separation of the casing element for access to the interior thereof. At the right hand end of the operating section is an enlarged portion 1e which may be termed a handle section and contains certain gearing under some modifications of the invention.

Reverting to the spring compression mechanism of my syringe, it is notable that the outer or larger section 11 of the spring case must be kept rigid so that the spring may be completely compressed without having it push the bearing end of the spring case 6 against the plunger of the ampoule or cartridge; otherwise the contents of the cartridge would be expelled before desired. I have shown modified arrangements for a means for holding the outer spring case section 6 stationary or rigid preliminary to the ejection of the medicant from the ampoule.

In Figure 1 the last referred to means embodies two brake shoes 9, each forming a semi-circle around the outer spring case section 6. Each brake shoe in turn is held lightly against this spring case section 6 by two spring wires 10 which form links or pivotal connections between the brake shoes and the portion 1b of the syringe body or casing. The normal position of the links or suspension means 10 is such that any tendency of the spring case section 6 to move to the left as seen in Figures 1 or 2 is resisted by the automatic dragging or braking action of the shoes 9. In Figure 1, I provide certain gearing and operating devices for placing the spring 12 under tension as it works in connection with the spring case section enclosing same. This means includes an internal gear 23 that provides a revolvable handle and which gear meshes with a spur gear 24. The gear 24 in turn engages gear 25 and there are additional gear reductions at 22 and 21 for carrying the turning force of the above mentioned gears to the screw 19. The gear 21 is secured to the screw 19. The screw 19 is hollow and mounted upon the shaft 19a which carries the gear 22 fixed thereto. Turning of the handle gear 23 will result in several turns of the screw 19. Riding on the screw 19 is a nut 20 which is engaged with a spline or guide member 20a that prevents turning of the nut. When the screw 19 is rotated by means of the handle gear 23, as seen in Figure 1, the nut 20 moves to the left. By means of rods 18 attached to the nut, the bearing plate 17 also attached to the rods moves to the left an equal distance with the nut. The bearing plate 17 is rigidly fastened to the closed end 15 of the smaller spring case or section member 15 and would push the entire spring assembly and case to the left unless the brake means 9 were provided. The friction between the brake shoes 9 and the member 6 of the spring case is greater the more pressure is exerted against the spring case section 6 to the left, and only upon release of the friction of the brake shoes 9 will the spring case section 6 be permitted to move leftward. Thus as the gear 23 is turned, the screw 19 revolves and nut 20 moves forward or to the left moving with it the bearing plate 17 against the inner spring case member 15 which in turn compresses the spring 12 without moving the outer spring case 6.

When the operator desires to use the dissolved medicant in the ampoule, he presses lever 3, which in turn presses down the toggle links 4 and thus forces a brake release wedge 23 between the semi-circular brake members 9, moving the latter apart. Slight pressure on the lever 3 will permit only a slow movement of the section 6 of

the spring case to the left, and the end of which bears against plunger R, S, T, of the ampoule or cartridge. Thus a slow discharge from the cartridge will take place in the injection operation, even permitting a drop by drop flow. On the other hand, if a full stream of medicant is desired at higher pressure, more force is exerted on the lever 3, which in turn separates the brake members 9 further and permits a rapid flow by reason of rapid movement of spring case member 6. Release of the member 3 stops the flow entirely because the member 6 cannot move under the action of the energy stored up in the spring 12.

The left hand end or closed portion of the spring case section 6 is of a diameter very slightly smaller than the inner diameter of the glass tube A of the ampoule, and therefore the said end of the member 6 is adapted to enter the tube and to force the right hand plunger R, S, T of the ampoule against the liquid medicant for ejecting the same through the needle 25. After the contents of the ampoule have been discharged, the handle gear 23 is given one complete turn in the opposite direction to its spring energizing direction of movement, and this brings the nut 20 back to its original position. The movement of the nut 20 pulls on the rods 18 and upon the casing section 15 and an end flange 13 on said casing section engages lugs 14 on the inner surface of the section 6 of the spring casing, and thus the section 6 is pulled back as the spring 12 expands and assumes its original condition wherein energy is not stored therein by means of the gear 23. A ring member 1f may be used to hold the portion 1e of the syringe casing in proper cooperation with the ring gear 23 that forms the operating handle, see Figure 1. Normally a spring 5 cooperates with the toggle links 4 to maintain the same and the handle 3 in the unoperated positions thereof as seen in Figure 1. Of course, in the restoring action of the parts last referred to the movement in a rightward direction of the case section 6 is not resisted by the brake shoes 9 owing to the arrangement of the supporting links 10 for the latter.

In the modification of Figure 6 I again use the handle gear 23 and gears 24 and 25 cooperative therewith, but in this instance the gear 25 carries a shaft 35 and the shaft carries a worm 33. The worm 33 engages the teeth of a rack bar 34 and the rack bar is secured to the adjacent closed end of the spring casing member 15. By turning of the worm 33 in a reverse direction the reverse movement may be imparted to the rack 34 necessary to perform the functions previously described in regard to the spring compressing operation and the release of compression. In this construction I use the unique brake means illustrated in Figures 6 and 11 of the drawings. The brake devices consist of discs having arc-shaped slots therein, the arcs of which commence at the center of the discs and approach the peripheral portions, the slots being therefore eccentric. The discs are designated 30 and the slots 31, and a ring surrounding the section 6 passes through the slots 31 and is designated 32. The said ring may be suitably supported in the portion 1b of the syringe casing, and by reason of the method of mounting of the discs 30, it will be seen that movement to the left of casing member 6 is resisted by the braking effect of said discs. Therefore, I use a sleeve 29 operable by the lever 3 and by the proper link member 4a normally held to the left by means of the spring action 5, which sleeve 29 is adapted to engage the peripheral portions of the

discs 30 and thereby to release the braking effect thereof when it is desired to permit movement of the spring section 6 for causing the ejection of the medicant from the ampoule.

In Figure 7 of the drawings I show a further modification of my invention. In the Figure 7 construction I utilize a crank lever 39 on the side of the body of the syringe by which to give a complete revolution to an internal gear 36. The internal gear in turn engages a spur gear 37 which is engaged with a rack 38 and imparts movement to the latter. The rack 38 is of course attached to the closed end of the inner spring case section 15 and the operation is substantially the same as in the Figure 6 construction.

In Figures 9 and 10 I have illustrated another modification in which a turning lever or crank 39a is operable from a side of the syringe body and its shaft portion is connected with a bevel gear 40 inside the casing of the syringe. As the lever 39a is rotated to an arc of 360°, the bevel gear 40 inside drives a companion bevel gear 41 which is at right angles thereto. Connected to the bevel gear 41 is either a screw and nut arrangement as illustrated in Figure 1, or it may be substituted by a worm and rack arrangement as shown in Figure 6. It is quite clear how the drive may be carried from the crank handle 39 to the screw 19 and from the screw 19 to the nut 20 which is the construction actually illustrated in Figures 9 and 10, and is similar to that illustrated in Figure 1.

In Figures 13 and 14 I have illustrated a modified form of plunger such as may be used in substitution for the plunger B, C, D, E previously described, or the plunger J, K, L, M previously described. In this type of construction the body of the plunger is molded plastic as illustrated at A, A. Any one of the plastics which can withstand a sterilizing heat is suitable for the purpose inasmuch as it may be desirable always to sterilize the complete plunger and in fact the complete assembly in the tube of the ampoule. In the modified construction of plunger it is contemplated to employ a rubber disc BB inserted in a cavity AA—1 of the plastic plunger. Rubber rings CC are placed in the grooves AA—2 of the plastic plunger. The grooves hold these rubber rings rigidly and the rubber rings are designed so that they fit snugly in the glass tube A of the ampoule. This gives smooth, yet tight and leak-proof construction. The rubber rings are preferably made from rubber stock which has paraffine incorporated therein so that the rings may have a lubricating quality useful for permitting the movement of the plungers inside the glass tube of the ampoule. At AA—3 is the ridge at the end of the orifice and slots are cut into this ridge to provide the construction which is indicated in Figure 12 where the projections E' are seen as extending from the plastic disc member E. The tubular arm or member AA—4 serves the dual purpose of containing a medicant and actuating the diaphragm or member H. For the middle plunger of an ampoule like shown in Figure 5, the parts AA—4 as illustrated in Figure 14 would be solid and merely constitute a tilting arm for the member P.

The operations of the several forms of my syringe invention as set forth herein has been pointed out as an incident to the explanation of the constructions utilized, and it is believed they will be fully understood with reference to the specific description supplied.

I do not wish to be limited to the precise or

detail forms of construction as I have furnished the same in my drawings, because various departures may be made therefrom within the purview of my claims hereto annexed.

The ampoule of Figure 5 is useful in syringes employing a valve in the applicator section to control passage of the medicant through the needle 26 so the operating means of the operating section would not be employed or be useful under such conditions.

In the Figure 6 construction spring 12 is omitted and screws 23a entering an annular groove in the member 1c permit swiveling rotation of the handle 23 on said member 1c.

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

1. In a syringe, in combination, an applicator section for containing medicant, an operating section, and medicant ejecting means in the operating section including a spring case comprising relatively movable spring enclosing sections, a spring in the case, instrumentalities to compress the spring by relative movement of the case sections including a handle turnable on the operating section and a member operable by the handle to move a case section to put the spring under compression, and manually controllable detent means to normally restrain a section of the case against medicant ejecting action under the action of the spring.

2. In a syringe, in combination, an applicator section adapted to receive an ampoule for containing medicant, an operating section, and medicant ejecting means in the operating section including a spring case comprising relative movable spring enclosing sections, a spring in the case, instrumentalities to compress the spring by relative movement of the case sections, and

manually controllable detent means to normally restrain a section of the case against medicant ejecting action under the action of the spring, in which the instrumentalities mentioned include a handle turnable on the operating section, and worm gear and rack devices operable by the handle to move a case section to put the spring under compression.

3. In a syringe, in combination, an applicator section adapted to receive an ampoule for containing medicant, an operating section, and medicant ejecting means in the operating section including a spring case comprising relative movable spring enclosing sections, a spring in the case, instrumentalities to compress the spring by relative movement of the case sections, and manually controllable detent means to normally restrain a section of the case against medicant ejecting action under the action of the spring, in which the instrumentalities mentioned include a handle turnable on the operating section, and spur gear and rack devices operable by the handle to move a case section to put the spring under compression.

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