April 1, 1952 F. E. BROWN 2,591,046

HYPODERMIC SYRINGE ASSEMBLY

Filed Oct. 18, 1948

Fig. 1.

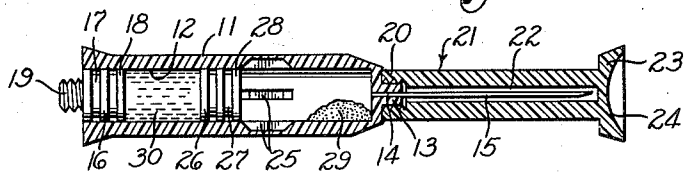


Fig. 2.

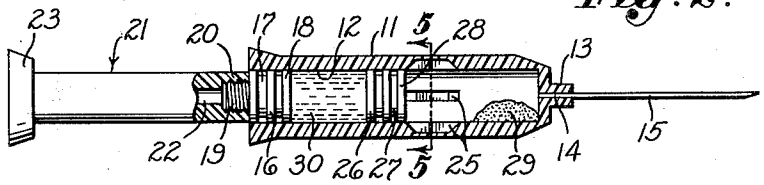


Fig. 3.

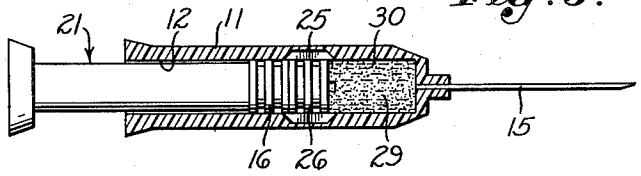


Fig. 5.

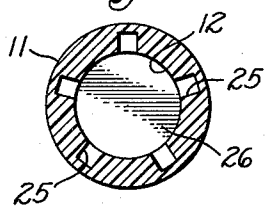


Fig. 4.

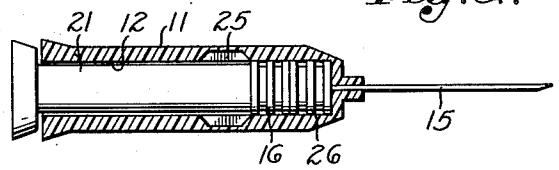
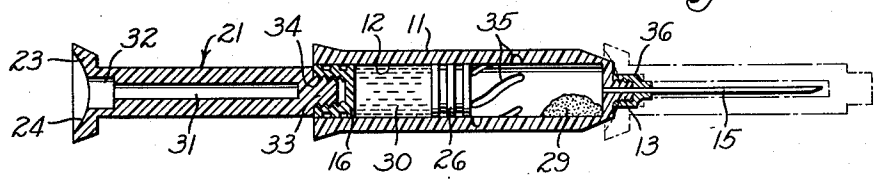


Fig. 6.



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HYPODERMIC SYRINGE ASSEMBLY

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13 Claims. (Cl. 128—218)

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This invention relates to a structurally and functionally improved syringe assembly and in its more specific aspects aims to provide a hypodermic assembly which, if desired, may be thrown away after a single use.

By the present invention, improved units which form a part of a syringe assembly are provided. These units are readily manufactured by quantity production methods and are capable of being easily grouped together to furnish an economical and improved apparatus.

As a result of this novel construction herein taught, it is feasible to provide a segregated grouping of liquid vehicle and medicament in pre-determined and desired quantities; the thus packaged unit being susceptible to storage over long periods of time without deterioration or loss of its contents. Moreover, by the present structure, the vehicle and medicament may be readily intermixed immediately prior to the injection step. Additionally, the parts may be rendered sterile and may be maintained in this condition until ready for use.

With these and additional features in mind, reference is had to the attached sheet of drawings illustrating practical embodiments of the invention and in which:

Fig. 1 is a longitudinal sectional view of the charged or loaded hypodermic syringe assembly in the form in which it is stored and sold;

Fig. 2 is a side elevational view partially sectioned of the hypodermic syringe with the parts arranged in position preparatory to moving the liquid vehicle into contact with the medication;

Fig. 3 is a side elevational view partially sectioned of the syringe illustrated in Figs. 1 and 2 with the parts in the position which they occupy after the medication and the liquid vehicle have been mixed and prior to their injection;

Fig. 4 is a side elevational view partially sectioned of the syringe illustrated in Figs. 1 to 3 with the parts in the position occupied when the medication and the liquid vehicle have been ejected from the syringe;

Fig. 5 is a transverse sectional view taken as indicated by the arrows 5—5 of Fig. 2; and

Fig. 6 is a side elevational view partially sectioned of a modified embodiment of the invention.

Referring to the drawings, which are for illustrative purposes only, the numeral 11 indicates a syringe barrel having therein a bore 12 forming a reservoir, which bore extends through one end of the barrel 11. The other end of the barrel 11 is provided with a reduced portion forming

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a boss 13 through which there is extended a passage 14 coaxial with the bore 12. Mounted by the boss 13 is a hollow needle 15 having the usual sharpened and pointed forward end.

Slidable within the bore 12 of the barrel 11 is a primary piston 16. The piston 16 is preferably formed with a plurality of annular recesses 17 separated by annular ribs 18; the peripheries of the ribs 18 engaging the inner wall of the barrel 11 in sealing relationship.

In the embodiment illustrated in Figs. 1 to 5, inclusive, the primary piston 16 is provided upon its outer end with a threaded projection 19 adapted to be secured within a threaded end 20 of a plunger 21. The plunger 21 has a chamber 22 extending from the open threaded end 20 coaxially with the plunger 21 and terminating within the plunger. At its other end the plunger 21 is provided with an enlarged end 23 having a cavity or recess 24 therein formed to receive the finger of the user.

Formed in the inner wall of the barrel 11 intermediate it sends are a number of recesses or grooves 25, illustrated as five in number, for a purpose which will be later described. These grooves or passages extend axially of the bore 12. They have a length in excess of the lengths of an auxiliary piston to be disposed adjacent to them.

Movable within the bore 12 of the barrel 11 is a floating or auxiliary piston 26. This piston, like the primary piston 16, is preferably provided with a plurality of annular recesses 27 separated by annular ribs 28, the periphery of each of the ribs being in sealing relationship with the inner wall of the barrel 11.

When the syringe is to be charged with the medication and the liquid vehicle therefor, the primary piston 16 and the floating piston 26 are not in position within the barrel 11. The medication, indicated by the numeral 29 in Figs. 1 and 2, is positioned within the bore 12 adjacent the forward end thereof. The auxiliary piston 26 is positioned in the outer end of the bore 12 and moved inwardly to the position in which it is illustrated in Figs. 1 and 2. The liquid vehicle, indicated by the numeral 30, is introduced into the bore 12 behind the auxiliary piston 26. The primary piston 16 is positioned within the outer end of the bore 12, so that the body of liquid vehicle 30 is confined and sealed within the bore 12 between the primary piston 16 and the auxiliary piston 26.

The threaded end 20 of the plunger 21 is positioned upon the boss 13 of the barrel 11; the in-

terior dimensions of such threaded end 20 and the exterior dimensions of such boss 13 being such that the plunger 21 is conveniently secured to the barrel 11 by a pressed fit. This attachment of the plunger 21 to the barrel 11 and the sealing engagement of the pistons 16 and 26 with the inner wall of the barrel 11 seal the needle 15 within the plunger 21, so that it is maintained sterile. The structure also seals the medication 29 in the forward portion of the bore 12 and the liquid vehicle 30 in the rearward portion of the bore 12, so that the medication 29 and liquid vehicle 30 therefor are maintained separate from each other, and their intermixture is prevented.

With the parts arranged as described and as illustrated in Fig. 1, the hypodermic syringe containing a measured amount of the medication 29 and a measured amount of the liquid vehicle 30 may be stored and shipped to a pharmacist, stored by him until sale to the user, and stored by the user until the time of use without any danger of impairing the efficacy or volume of the mixture of the medication 29 and the liquid vehicle 30 at the time when it is to be injected.

When it is desired to inject a mixture of the medication 29 and the liquid vehicle 30, the plunger 21 is removed from the boss 13 of the barrel 11, and the threaded end 20 of the plunger 21 is threaded upon the projection 19 of the primary piston 16, as illustrated in Fig. 2.

Thereafter, the primary piston 16 is moved toward the auxiliary piston 26 by exerting pressure upon the enlarged end 23 of the plunger 21. This forward motion of the primary piston 16 advances the body of liquid vehicle 30 and the auxiliary piston 26 until the auxiliary piston is in position contacting the inner wall of the barrel 11 between the grooves 25, so that the liquid vehicle 30 may pass through these passages around the auxiliary piston 26 into the forward portion of the bore 12, where it contacts the medication 29. The auxiliary piston 26 remains in such position while the liquid vehicle 30 by-passes it during the proper advancement of the primary piston 16, because the frictional resistance to advancement of the auxiliary piston 26 by virtue of its contact with the inner wall of the barrel 11 between the grooves 25 is greater than the resistance to advancement of the liquid vehicle 30 around the auxiliary piston 26.

When all of the liquid vehicle 30 has by-passed the auxiliary piston 26, the primary piston 16 is in contact with the auxiliary piston 26. At this time the syringe may be vibrated or shaken—if necessary—in order to assure a proper uniform mixture. Thereafter the parts may be advanced so as to expel all air from the needle 15. That needle may now be caused to penetrate the epidermis. Continued pressure upon the enlarged end 23 of the plunger 21 advances both the primary piston 16 and the auxiliary piston 26, thus ejecting the mixture of the medication 29 and the liquid vehicle 30 through the hollow needle 15 and into the body of the patient.

The parts may be designed and proportioned to receive a pre-determined amount of vehicle or diluent. Ordinarily the quantity of the latter may be 1 cc. Thus, the distance between the primary and auxiliary pistons and the size of the bore 12 will be sufficient to accommodate the proper volume of diluent. This body has been indicated by the reference numeral 30. When the parts have been shifted to the position shown in Fig. 3, the area of the bore in advance of the auxiliary piston 26 should be adequate to receive the body of the diluent or vehicle and all of the medicament indicated at 29.

In the modified embodiment of the invention illustrated in Fig. 6, in which corresponding numbers indicate the parts corresponding to the embodiment previously described, the plunger 21 is provided with a chamber 31. This chamber 31 communicates with an enlarged bore 32 in the enlarged end 23 of the plunger 21, and the chamber 31 terminates within the plunger 21. The end of the plunger 21 opposite the enlarged end 23 is provided with a threaded projection 33.

Prior to its use, the plunger 21 is positioned upon the barrel 11 by the insertion of the boss 13 into the enlarged bore 32 with a pressed fit therein, the needle 15 being received and sealed within the chamber 31, as illustrated by the broken lines in Fig. 6. When in use, the plunger 21 is removed from the boss 13, and the threaded projection 33 is threaded within a threaded bore 34 in the outer end of the primary piston 16.

An advantage of providing the threaded projection 33 for connecting the primary piston 16 to the plunger 21 upon the plunger 21, as illustrated in Fig. 6, instead of upon the outer end of the primary piston 16, as illustrated in Figs. 1 and 2, is that in the former case the pressure exerted by the plunger 21 upon the primary piston 16 to advance it in the barrel 11 tends to expand the primary piston 16 to some extent and to increase its sealing engagement with the inner wall of the barrel 11.

Formed in the inner wall of the barrel 11 are grooves 35. These passages 35 differ from those previously discussed and which extend parallel to the axis of the barrel 11 in that the grooves 35 are in the form of spirals. This structure imparts to the liquid vehicle 30 a swirling movement as that vehicle 30 is discharged into the forward portion of the bore 12, increasing the intimacy of the mixture of the medication 29 with the liquid vehicle 30.

Either the barrel 11 or the primary piston 16 and the auxiliary piston 26, and preferably all of them, are made of a material or materials having a greater resiliency than glass, as, for example, a synthetic resin or natural or synthetic rubber.

It is to be noted that the forward end of the primary piston 16 and the forward end of the auxiliary piston 26 are plane surfaced without any bevel at their peripheries, so that there is no groove defined between the ends of the piston and the inner wall of the barrel 11 within which any medication may accumulate. It will also be noted that in all of the illustrated forms of the device the medication compartment has a capacity such that in addition to the medication it may receive the vehicle 30 embraced within the assembly.

The invention finds particular utility in the injection of a suspension of forms of penicillin such as crystalline sodium penicillin or crystalline potassium penicillin (penicillin G), in a liquid vehicle such as water.

It finds utility also when the liquid vehicle is water and the medication is a tablet or powder of morphine, coramine, epinephrine, or any of its derivatives, ephedrine, or any of its derivatives, any cardiovascular stimulant, or any other medication in solid or liquid form in connection with which it is desired to utilize any of the objects primarily stated herein.

The needle 15 may be permanently mounted

in the passage 14, as illustrated in Fig. 1, and discarded with the syringe after a single use, or it may be attached to a collar 36 which is threaded upon the boss 13 and over which the plunger 21 has a pressed fit when in the position illustrated by the broken lines of Fig. 6, so that the needle 15 may be removed for repeated use.

The invention is capable of utilization also without any needle whatsoever, the passage 14 being made of such small dimensions that a fine jet of the mixture of the medication 29 and the liquid vehicle 30 is ejected under sufficiently high pressure to penetrate the dermis into the tissues.

Likewise the invention may be utilized in connection with a spring actuated plunger 21, the spring being set and released in a manner not shown but well known in the art.

While the embodiments of my invention hereinbefore illustrated and described are fully capable of performing the objects and accomplishing the advantages primarily stated, it will be understood that my invention is not limited to the specific embodiments illustrated and described, but embraces all modifications thereof coming within the scope of the claims which follow.

I claim as my invention:

1. In a hypodermic syringe, the combination of: a barrel having an orifice for the discharge of liquid therefrom; a primary piston movable in and in sealing relationship with said barrel; and an auxiliary piston movable in and in sealing relationship with said barrel between said primary piston and said orifice and dividing said barrel into a chamber for a medication and a separate chamber for the liquid vehicle for the medication, the medication chamber having a capacity such that in addition to the medication which it may contain it may receive all of the liquid vehicle within the separate chamber, said barrel having, in its inner wall, a groove within the medication chamber and short of the end of said barrel, said groove providing a passage through which the vehicle bypasses said auxiliary piston into contact with the medication during travel of said auxiliary piston toward said orifice.

2. In a hypodermic syringe, the combination of: a barrel having an orifice for the discharge of liquid therefrom; a primary piston movable in and in sealing relationship with said barrel; and an auxiliary piston movable in and in sealing relationship with said barrel between said primary piston and said orifice and dividing said barrel into a chamber for a medication and a separate chamber for the liquid vehicle for the medication, said barrel having, in its inner wall, a groove within the medication chamber and short of the end of said barrel, said groove providing a passage through which the vehicle bypasses said auxiliary piston into contact with the medication during travel of said auxiliary piston toward said orifice, said groove being so spaced from said orifice that the portion of said barrel between said orifice and said auxiliary piston in position for bypass may receive all of said liquid and said medication.

3. A unit to form a part of a hypodermic syringe assembly, said unit embracing an imperforate body provided with a bore to receive liquids and to slidably accommodate a stopper, said body being formed with an integral bypass extending throughout only a portion of its length and intermediate the ends of said bore, said by-pass providing a passage for liquid normally confined within the bore and to the rear of a resilient stopper within the same, as the latter is shifted axially of the bore to a position in line with said by-pass.

4. A unit to form a part of a hypodermic assembly, said unit embracing a body provided with a bore to receive liquids, the face of said bore presenting throughout only a portion of its length relatively raised and recessed portions, said portions providing a by-pass for liquid normally confined within the bore and to the rear of a resilient stopper, as the latter is shifted axially of the bore to a position in line with said portions.

5. A unit to form a part of a hypodermic assembly, said unit embracing a body provided with a bore to receive liquids, the face of said bore presenting throughout only a portion of its length relatively raised and recessed portions, extending in a direction substantially parallel to the axis of the bore, said portions providing a by-pass for liquid normally confined within the bore and to the rear of a resilient stopper, as the latter is shifted axially of the bore to a position in line with said portions.

6. A unit to form a part of a hypodermic syringe assembly, said unit embracing an imperforate body formed with a bore to receive liquid and to slidably accommodate a stopper, the face of said bore presenting throughout only a portion of its length a groove extending in a direction substantially parallel to the axis of the bore and at a point intermediate the ends of said body, said groove providing a by-pass for liquid normally confined within the bore and to the rear of a resilient stopper within the same, as the latter is shifted axially of the bore to a position in line with said groove.

7. A unit to form a part of a hypodermic syringe assembly, said unit embracing in combination a body formed with a bore, relatively raised and recessed portions within said bore and between the ends of the same, a movable piston disposed within said bore at a point short of said portions and the width of said piston being less than the length of said portions.

8. A unit to form a part of a hypodermic syringe assembly, said unit embracing in combination an imperforate body formed with a bore to slidably accommodate a stopper, said body being integrally formed with a groove in the face of said bore and extending substantially parallel to the axis of the latter at a point between the bore ends, a movable piston disposed within said bore at a point short of said groove and the width of said piston being less than the length of said groove whereby with said piston disposed in line with said by-pass liquid may flow through the latter from a point to one side of said piston into the bore to the other side of the same.

9. A unit to form a part of a hypodermic syringe assembly, said unit embracing in combination a body formed with a bore and a bypass between the ends of and extending substantially parallel to said bore, a primary piston within said bore adjacent one end of said body, an auxiliary piston also within said bore and at a point between said by-pass and primary piston and defining with the latter a space to receive liquid and the width of said auxiliary piston being less than the length of said by-pass.

10. A unit to form a part of a hypodermic syringe assembly, said unit embracing in combination a body formed with a bore and a by-

pass between the ends of and extending substantially parallel to said bore, a primary piston within said bore adjacent one end of said body, an auxiliary piston also within said bore and at a point between said by-pass and primary piston and defining with the latter a space to receive liquid, the width of said auxiliary piston being less than the length of said by-pass and said body—beyond said auxiliary piston—providing a bore capacity in excess of the body of liquid initially disposed between said pistons.

11. A unit to form a part of a hypodermic syringe assembly, said unit embracing in combination a body formed with a bore, the face of said bore presenting throughout only a portion of its length relatively raised and recessed portions extending in a direction substantially parallel to the axis of said bore, said portions providing a by-pass, a primary piston within said bore adjacent one end of said body, an auxiliary piston also within said bore and at a point between said by-pass and primary piston and defining with the latter a space to receive liquid and the width of said auxiliary piston being less than the length of said by-pass.

12. A unit to form a part of a hypodermic syringe assembly, said unit embracing in combination a body formed with a bore and a groove within said bore between the ends of the same and extending substantially parallel to the bore axis, a primary piston within said bore adjacent one end of said body, an auxiliary piston also within said bore and at a point between said groove and primary piston and defining with the latter a space to receive liquids and the width

of said auxiliary piston being less than the length of said groove.

13. A unit to form a part of a hypodermic syringe assembly, said unit embracing an imperforate, open-ended body having a single bore extending throughout its length, said body being moreover formed with an axially extending by-pass portion intermediate its ends, a stopper slidably mounted for projection throughout the length of said bore and initially positioned at a point short of said by-pass, the width of said stopper being less than the length of said by-pass and said stopper being shiftable to a position in line with said by-pass to have the ends of the latter extend beyond the opposite faces of said piston.

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