

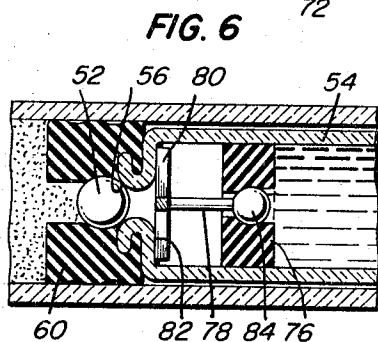
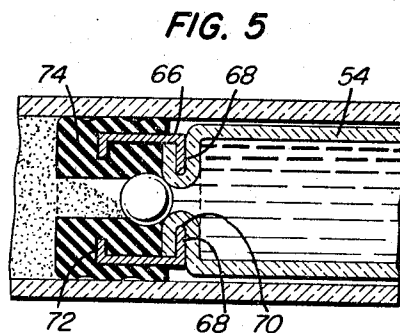
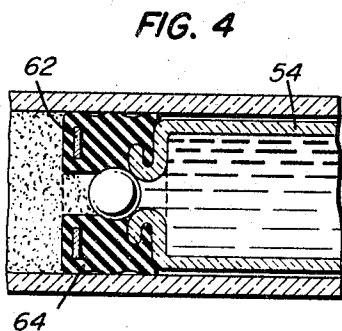
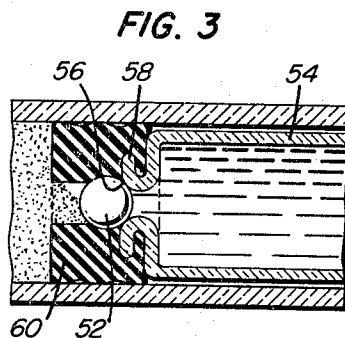
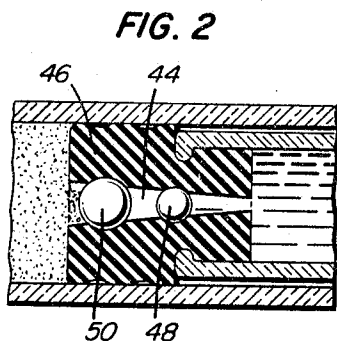
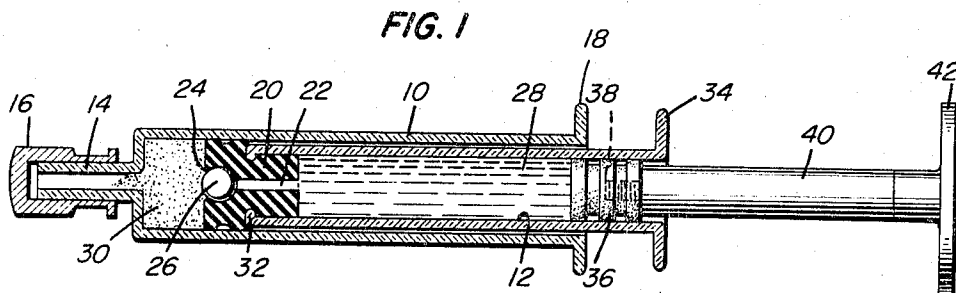
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S. J. SARNOFF ETAL

3,326,215

TWO COMPARTMENT SYRINGE WITH VAPOR SEAL BETWEEN COMPARTMENTS

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3,326,215

TWO COMPARTMENT SYRINGE WITH VAPOR SEAL BETWEEN COMPARTMENTS

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This invention relates to hypodermic syringes. In particular it relates to syringes of the type which stores a solid medicament in a chamber of the syringe and which is to be dissolved in a liquid supply also initially stored within a second chamber in the syringe.

It is an object of this invention to improve such a syringe by facilitating the transfer of liquid from the liquid storage chamber into the solid medicament or powder containing chamber.

It is another object of the invention to provide an efficient vapor barrier between the two chambers to prevent undesired deliquescent action on the part of the powder.

Other objects will become apparent after a consideration of the following specification when taken in conjunction with the accompanying drawing in which

FIG. 1 illustrates a syringe made in conformity with the invention.

FIG. 2 illustrates a modification of the invention employing two balls with a space therebetween.

FIG. 3 shows another modification wherein a ball seats against an end of an inner tube.

FIG. 4 shows still another form of invention wherein in addition to a single ball for obstructing the vapor, there is employed a barrier plate.

FIG. 5 is a view similar to FIG. 4 showing a modified form of barrier plate and

FIG. 6 shows still another form of the invention for securing a dual vapor barrier between the liquid chamber and the powder containing chamber.

Now referring to the drawings in greater detail, at 10 in FIG. 1 is indicated an outer cylindrical barrel, which may be of glass within which is telescoped a second cylindrical barrel 12, which also may be of glass. The outer cylindrical barrel at its forward end is constructed as at 14 to form an orifice which may be sealed off by a removable cap 16 or may be formed to accommodate a hypodermic needle. The other or rear end of the barrel 10 is flared to form an annular flange 18 so that the fingers of an operator may readily straddle the barrel 10 and be engaged beneath the flange.

The inner barrel 12 at its forward end is provided with a rubber plug 20 having a passageway 22 therethrough, the forward end of which is enlarged as at 24 to releasably hold a ball 26 therein. The ball is wedged in the rubber of the plug sufficiently to act as a liquid seal and vapor barrier between a liquid 28 in the inner barrel and a medicament powder 30 soluble in the liquid, the powder being confined in the forward end of the outer barrel by initial positioning of the plug in contact with the powder. The plug is held in any convenient fashion against displacement relative to the inner barrel as by slightly constricting the forward end of the inner barrel and compressing the plug as indicated at 32. The rear end of the barrel 12 is also flanged as indicated at 34 and in the initial position of parts, flange 34 is close to flange 18.

Within the rear end of the inner barrel is a rubber piston 36 threaded as indicated at 38 to removably receive the threaded end of a piston rod 40 having a head 42 adapted to be engaged by the thumb of an operator while his fingers are engaged beneath the flange 18, pressure with his thumb on the head then driving the piston down into the barrel 12.

In so doing, liquid pressure will exist in passageway 22 resulting in driving the ball out of the plug and allowing the liquid to commingle with and dissolve the powder 30. As the liquid is expelled, back pressure on the plug 20 will cause the barrel 12 to be shifted to the rear end of the assemblage until engagement of flange 34 and head 42 takes place whereupon both plunger rod 40 and inner barrel 12 with its plug move forwardly expelling the syringe contents out through the orifice 14 or the needle therein. The cap 16 may be removed at any appropriate time, this cap covering a needle if a needle be employed. Prior to the coupling of the plunger with the piston, the overall length of the syringe is much less than the final extended position of the barrels. So, if instant compactness of parts be desired, the piston rod 40 need not be coupled with the piston until immediately before use of the syringe.

To improve the seal afforded between the ball 26 and the adjacent compressed wall of the plug, and to provide for a space of reduced vapor pressure, two balls may be inserted in the passageway 22. Such a construction is shown in FIG. 2. In this figure, for efficiency in operation, the passageway, here indicated as 44 in the plug 46 is tapered and two balls 48 and 50 are located in the passageway, the larger ball being in the larger diameter portion of the passageway. The compression of the walls of the passageway adjacent the balls form effective seals, the sealing being enhanced by reason of the spacing of the balls. In this space between the balls only a vapor pressure can exist, this pressure being insufficient to cause leakage beyond the ball 50.

In accordance with FIG. 3, the seal is made not only between the ball, here indicated as 52 and the plug, but also with the lower end of the inner barrel, here indicated as 54. For this purpose the barrel is formed on its forward end with an annular seat 50. For the purpose of forming the annular seat, the forward end of the barrel 54 is constricted inwardly toward the longitudinal axis of the barrel and then is reversely shaped. As shown at 58, the reverse shaping also affords a means for securing the plug 60 to the inner barrel.

In FIG. 4 there is shown an additional seal which restricts liquid or vapor flow through the material of the plug past the plug. This seal is provided by providing a metal plate 62 in the form of an annulus embedded in the plug 64, the central aperture in the annulus being of a size to enable the ball to be squeezed past the plate under pressure of the liquid in the barrel 54.

FIG. 5 shows a modification of the last form of invention in that the extra liquid and vapor barrier is a metal cylinder 66 having a flange 68 engaged in the neck 70 of the barrel 54. The forward end of the cylinder is inwardly bent as indicated at 72 the resulting flange performing the function of the annulus 62 of FIGURE 4. This construction of the metal piece not only provides an efficient seal but also enables the plug 74 to be held securely against the end of the barrel.

Still another embodiment of the invention is disclosed in FIG. 6. The forward end of barrel 54, the plug 60, ball 52 and seat 56 are formed as has been disclosed in FIG. 3.

In addition to the seal formed by these parts, there is provided a backing up seal in the form of a longitudinally centrally perforated resilient supplemental piston 76 cooperating with a stud 78 having a number of spider legs 80, as four, radiating from the stud and bearing against the inner forward face 82 of the barrel. The major portion of the stud is of a diameter considerably smaller than the diameter of the passageway through the supplemental piston but is provided at its rear end with a ball head 84 slightly larger than the normal diameter of the passageway in the supplemental piston. In initial position of parts the piston 76 is located so that there is a

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considerable space between the bottom face of the piston and the spider. The thickness of the piston 76 is such that when pressure is applied to the liquid in barrel 54 and the piston 76 is displaced, the ball head will protrude well to the rear of the piston allowing free flow of liquid past the stud, and when the ball 52 is displaced, past the plug 60, into the chamber in outer barrel 10. Thus a triple seal is obtained in this form of the invention, these being provided by reason of the engagement of the stud head 84 in the passageway of piston 76, the seating of the ball 52 against the lower end of the barrel 54 and the sealing of the ball 52 in the pasageway of plug 60. It is obvious that the supplemental piston and associated stud could be utilized in the other forms of invention as well, though these would not provide as many barriers in series as in FIG. 6.

With the devices of the present invention, it is possible to store fluid and powder in the syringe for a very long time without danger of leakage of the fluid from the liquid containing chamber into the powder containing chamber and without any considerable amount of vapor being transferred from one chamber to the other. These devices are particularly useful where the liquid is of a volatile nature.

Furthermore, because of the mode of initial assembly of parts in initial telescoped condition and the detachable character of the piston rod 40, much less storage room is required than with known prior art devices.

What is claimed is:

1. A hypodermic syringe comprising an outer barrel, said barrel having an orifice at one end thereof, displaceable closure means for occluding said orifice, a medicament in said outer barrel at said orifice end thereof, an inner barrel telescoped into said outer cylinder barrel, a resilient stopper immovably located within the end of said inner barrel which is adjacent the orifice, a passageway through said stopper, a ball slightly larger in diameter than the normal diameter of the passage lodged in said passage, a piston in said inner barrel at the other end of said inner barrel, a solute for said medicament in said inner barrel between the piston and the stopper, a vapor impermeable disc embedded in the stopper in a plane perpendicular to the passageway and located between the ball and face of the stopper adjacent the orifice in the outer cylinder, said disc having formed therewith an annular cylinder, extending rearwardly through the material of the stopper, said cylinder having an inwardly directed flange at its rear end held in a neck portion at the forward end of the inner barrel, and means to drive the piston toward the stopper to first expel the ball from the passage, next force the solute through the passage while the inner barrel is automatically driven to greater extension from said outer barrel, thereby enabling a dissolving of the medicament to occur and preparing the syringe for expulsion of the dissolved medicament from the syringe.
2. A hypodermic syringe comprising an outer barrel, said barrel having an orifice at one end thereof, displaceable closure means for occluding said orifice, a medicament in said outer barrel at said orifice end thereof, an inner barrel telescoped into said outer barrel, a resilient stopper immovably located within the end of said inner barrel which is adjacent the orifice, a passageway through said stopper, a ball slightly larger in diameter than the normal diameter of the passage lodged in said passage,

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- a piston in said inner barrel at the other end of said inner barrel,
- a solute for said medicament in said inner barrel between the piston and the stopper,
- a stud with enlarged head supported at the forward end of the inner barrel,
- a supplemental piston located in the inner barrel and having a passageway within which the head of the stud lies and seals the passageway,
- the thickness of the supplemental piston being such as to allow the head to be projected rearwardly of the supplemental piston in the most forward position of said supplemental piston in the inner barrel,
- said stud being of a diameter less than the diameter of the passageway in the supplemental piston,
- and means to drive the piston toward the stopper to first expel the ball from the passage, next force the solute through the passage while the inner barrel is automatically driven to greater extension from said outer barrel, thereby enabling a dissolving of the medicament to occur and preparing the syringe for expulsion of the dissolved medicament from the syringe.
3. The structure of claim 2 in which the forward end of the inner barrel is formed with a seat and the ball is seated against said seat.
4. A hypodermic syringe comprising an outer barrel, said barrel having an orifice at one end thereof, displaceable closure means for occluding said orifice, a medicament in said outer barrel at said orifice end thereof, an inner barrel telescoped into said outer barrel, a resilient stopper immovably located within the end of said inner barrel which is adjacent the orifice, a passageway through said stopper, a ball slightly larger in diameter than the normal diameter of the passage lodged in said passage, a piston in said inner barrel at the other end of said inner barrel, a solute for said medicament in said inner barrel between the piston and the stopper, a vapor impermeable disc embedded in the stopper in a plane perpendicular to the passageway and located between the ball and face of the stopper adjacent the orifice in the outer barrel, and means to drive the piston toward the stopper to first expel the ball from the passage, and next force the solute through the passage while the inner barrel is automatically driven to greater extension from said outer barrel, thereby enabling a dissolving of the medicament to occur and preparing the syringe for expulsion of the dissolved medicament from the syringe.
5. A hypodermic syringe comprising an outer barrel, said barrel having an orifice at one end thereof, displaceable closure means for occluding said orifice, a medicament in said outer barrel at said orifice end thereof, an inner barrel telescoped into said outer cylinder barrel, a resilient stopper immovably located within the end of said inner barrel which is adjacent the orifice, a passageway through said stopper, two spaced apart balls slightly larger in diameter than the normal diameter of the passage lodged in said passage, a piston in said inner barrel at the other end of said inner barrel, a solute for said medicament in said inner barrel between the piston and the stopper, and means to drive the piston toward the stopper to first expel the balls from the passage, next force the

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solute through the passage while the inner barrel is automatically driven to greater extension from said outer barrel, thereby enabling a dissolving of the medicament to occur and preparing the syringe for expulsion of the dissolved medicament from the syringe.

6. A structure as defined in claim 5 wherein the passageway is tapered with the larger end opening toward the orifice of the outer barrel, and the two spaced balls are of different diameter, with the larger diametered ball nearest the larger end of the tapered passageway.

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