

April 5, 1966

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3,244,173

SYRINGE

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2 Sheets-Sheet 1

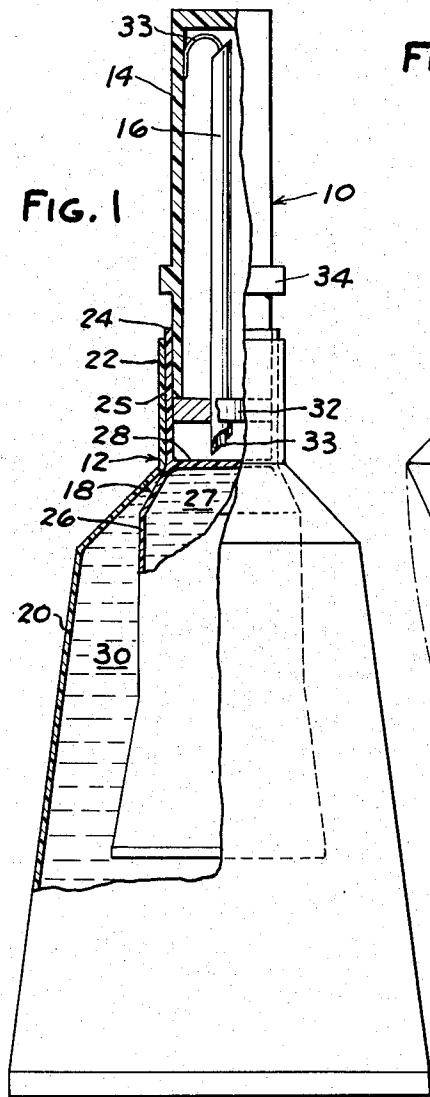


FIG. 1

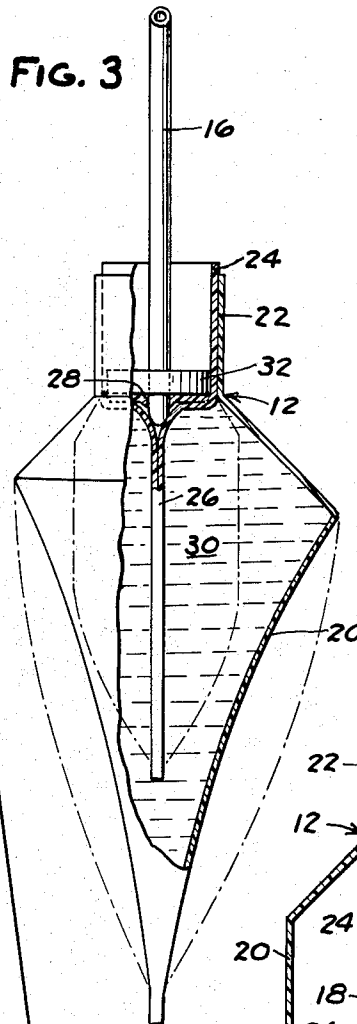


FIG. 3

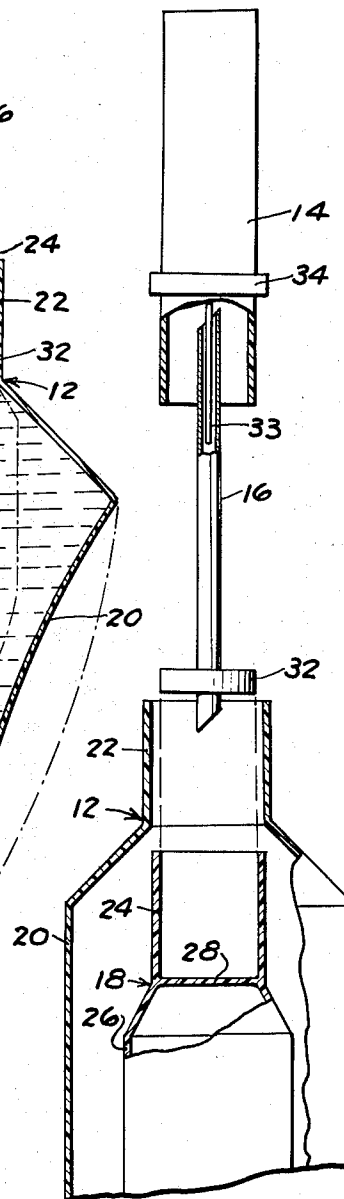


FIG. 2

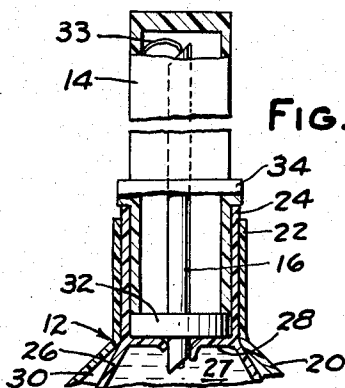


FIG. 4

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2 Sheets-Sheet 2

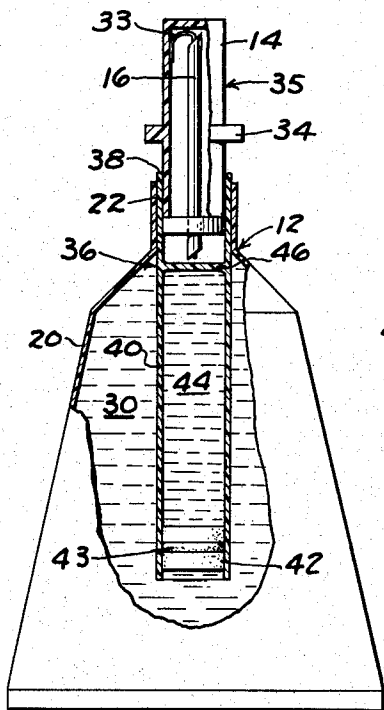


FIG. 5

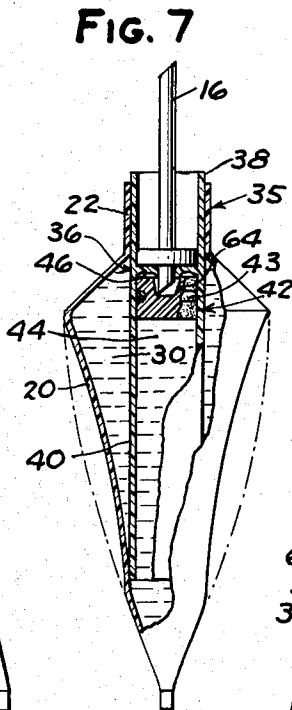


FIG. 7

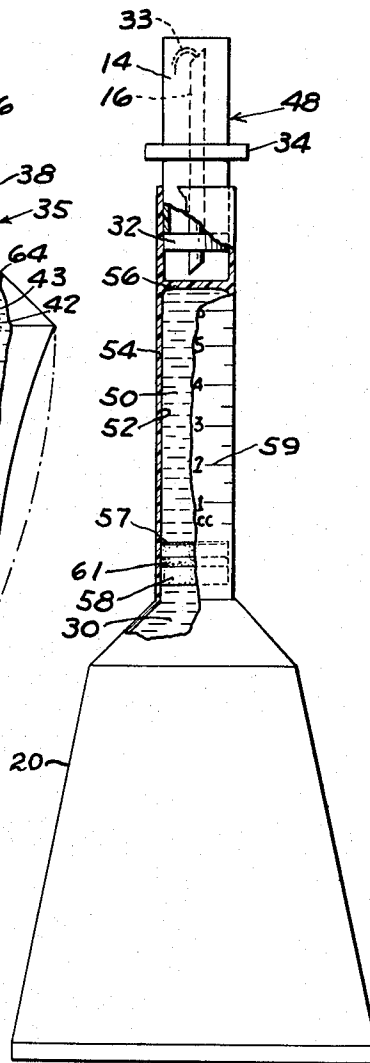


FIG. 6

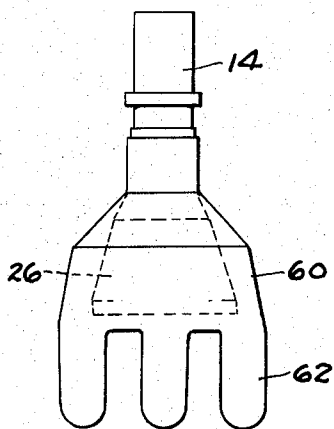


FIG. 8

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This invention relates to a disposable hypodermic syringe for conveniently dispensing small dosages of liquid medicament.

The objects of this invention are to provide a hypodermic syringe that may be simply and economically filled, assembled, sterilized and sealed; that is simple and easy to use, especially when administering small quantity dosages; that accurately dispenses small quantity dosages; and that is expendable after one shot.

In the drawings:

FIG. 1 is a view enlarged about three times the actual size illustrating a disposable syringe having a collapsible inner chamber from which a liquid medicament is dispensed through a needle when hydraulic pressure is applied to the inner chamber by squeezing a deformable portion of the syringe body.

FIG. 2 is a fragmentary view showing the component parts pulled apart as they might appear prior to assembly of the syringe shown in FIG. 1.

FIG. 3 is a side view of the syringe shown in FIG. 1 having the cap removed and having cutaway portions to illustrate the collapse of the inner chamber when the deformable portion of the syringe body is squeezed.

FIG. 4 is an exploded view of the cap and double ended needle arrangement used with the instant invention illustrating how the sealed inner chamber is punctured just prior to the use of the syringe.

FIG. 5 shows another embodiment of the instant invention wherein medicament is dispensed from a rigid tubular inner chamber by an axially movable piston which is subjected to hydraulic pressure in a manner similar to that shown in FIG. 1.

FIG. 6 is yet another modification of the instant invention similar to that modification shown in FIG. 5, wherein the inner chamber is within an elongated neck member of the syringe body.

FIG. 7 is a side view of the syringe shown in FIG. 5 having the cap removed and having cutaway portions to illustrate the position of the piston after the medicament has been dispensed by squeezing the deformable portion of the syringe body.

FIG. 8 is a modification of the syringe body shown in FIGS. 1, 5 and 6 wherein a plurality of fingers are provided in the syringe body so that fractional dosages are dispensed when a single finger is squeezed.

FIG. 1 shows a completely assembled disposable syringe 10 generally comprising a body 12, a cap 14, a hypodermic needle 16 and a medicament receptacle 18. Syringe body 12 has a deformable outer chamber 20 and an integral rigid neck 22. Medicament receptacle 18 has a sack-like, collapsible inner chamber 26 and an integral rigid neck 24 that is fitted snugly within and suitably sealed to neck 22 of syringe body 12 at interface 25. A liquid medicament indicated generally at 27 fills inner chamber 26 and is contained therein by a frangible sterile seal 28, preferably integral with medicament receptacle 18. Inner chamber 26 is spaced from outer chamber 20 of syringe body 12. A liquid 30 fills the spacing between inner chamber 26 and outer chamber 20. For small dosage injections, outer chamber 20 preferably contains a volume of liquid 30 substantially greater than the volume of medicament 27 in inner chamber 26. The lower end of needle 16 as viewed in FIG. 1, passes through and is sealably and fixedly mounted in an annu-

lar needle support 32. Needle support 32 is fitted within neck 24 for axial movement therein. Cap 14 is open at its lower end and closed at its upper end, the lower end portion of cap 14 fitting snugly within neck 24 to provide a protective closure for needle 16. The lower end of cap 14 abuts needle support 32. When cap 14 is forced downward as viewed in FIG. 1, needle support 32 moves downward within neck 24 and bottoms on seal 28, carrying needle 16 downward to fracture and penetrate seal 28 and place the lower end of the needle in contact with medicament as shown in FIG. 4. Air in the spacing between needle support 32 and seal 28 is forced through needle 16 and also past the peripheral edge surface of needle support 32 into cap 14. Cap 14 may be provided with an annular flange 34 to facilitate gripping the cap. Flange 34 may be positioned to provide a stop that engages neck 24 to restrain further downward movement of needle 16 after needle 16 penetrates seal 28 (FIG. 4). To prevent any cutout portion of seal 28 from blocking needle 16 when it penetrates the seal, a fine wire 33 is positioned inside needle 16, terminating in the opening at the lower end of needle 16. The outer end of wire 33 is affixed to cap 14 so that when cap 14 is removed wire 33 is withdrawn from needle 16. In FIG. 1, as well as in the other figures, needle 16 is illustrated as having a diameter approximately twice its actual diameter in relation to the other parts. Needle 16 should extend sufficiently below needle support 32 to assure that any burrs on seal 28 do not interfere with the lower opening in needle 16 after the needle penetrates the seal.

When it is desired to administer a dosage of medicament, cap 14 is merely pushed downward until needle 16 punctures seal 28 and communicates with the medicament 27 as described hereinabove. Cap 14 is then removed and needle 16 is inserted into the patient's tissue. Outer chamber 20 is then squeezed with the fingers, the squeezing pressure being transmitted by liquid 30 to collapse inner chamber 26 and thereby dispense medicament 27 through needle 16 into the patient. A slight squeeze on outer chamber 20 will displace air from needle 16 prior to insertion in the tissue. In FIG. 3 outer chamber 20 of the syringe shown in FIG. 1 has been squeezed from its normal expanded condition shown in broken lines to its collapsed condition shown in full lines, inner chamber 26 being completely collapsed by the pressure exerted through liquid 30.

The hypodermic syringes shown in FIGS. 5 and 6 are similar to that shown in FIG. 1 (corresponding elements being indicated by like numerals) except that the medicament is dispensed by hydraulic pressure acting on a piston axially displaceable within a rigid tubular medicament receptacle. In the syringe 35 of FIG. 5, the medicament receptacle 36 is a circular cross section tube having a rigid neck 38 and rigid inner chamber 40. The lower end of inner chamber 40 is open, the opening being closed by a tight fitting piston 42 axially slidable within inner chamber 40. Piston 42 may be made of rubber and may be provided with an O-ring seal 43. Medicament 44 is sealed in inner chamber 40 between a frangible sterile seal 46 at the top and the upper face of piston 42 at the bottom. Preferably, outer chamber 20 contains a volume of liquid 30 substantially greater than the volume of medicament in inner chamber 40 for small dosage injections. In the syringe 48 of FIG. 6, an inner chamber 50 corresponding to chambers 26 and 40 in FIGS. 1 and 5 is defined by the inner peripheral surface 52 of an elongated neck 54, between a frangible sterile seal 56 and the upper face 57 of an axially slidable piston 58 which is mounted adjacent the lower end of elongated neck 54. Piston 58 is moved axially within elongated neck 54 by hydraulic pressure from liquid 30 when outer chamber 20 is squeezed. Elongated neck 54 is fitted within neck 24 of syringe body 12 and is sealed to neck 24 at interface 59. A liquid 30 fills the spacing between inner chamber 50 and outer chamber 20. For small dosage injections, outer chamber 20 preferably contains a volume of liquid 30 substantially greater than the volume of medicament 44 in inner chamber 50. The lower end of needle 16 as viewed in FIG. 1, passes through and is sealably and fixedly mounted in an annu-

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gated neck 54 of syringe 48 may have suitable calibrations 59 corresponding to fractional dosages. For small dosage injections outer chamber 20 should contain a volume of liquid 30 substantially greater than the volume of medicament in inner chamber 50. Piston 58 may be made of rubber and provided with an O-ring seal 61 and a suitable marker to register with calibrations 59. The upper faces of pistons 42 (FIGS. 5 and 7) and 58 (FIG. 6) may be provided with a cavity 64 (FIG. 7) to accommodate the lower end of needle 16 so that the pistons can displace substantially all the medicament.

When using the syringes shown in FIGS. 5 and 6 the injection process is initiated by puncturing sterile seal 46 (FIG. 5), 56 (FIG. 6) in a manner similar to that previously described in conjunction with FIGS. 1 and 4. After the cap 14 has been removed and needle 16 inserted in the tissue, squeezing outer chamber 20 with the fingers exerts hydraulic pressure through liquid 30 on the lower face of piston 42 (FIG. 5), 58 (FIG. 6) to move the piston upward within the rigid tubular inner chambers 40 (FIG. 5), 50 (FIG. 6) and dispense the medicament through needle 16 into the patient's tissue. FIG. 7 is a side view of syringe 35 of FIG. 5 after deformable outer chamber 20 has been squeezed from its normal expanded condition shown in broken lines to its partially collapsed condition shown in full lines. Piston 42 has moved upward to dispense the medicament through needle 16. Syringe 48 of FIG. 6 operates in substantially the same manner except that piston 58 is moved upward in neck 54.

In FIG. 8 outer chamber 20 of the syringe 10 shown in FIG. 1 has been modified to dispense a fractional portion of the dosage in inner chamber 26. Deformable outer chamber 60 has a plurality of deformable fingers 62 each of which, when collapsed, displaces a fractional portion of medicament 27 from inner chamber 26. For example, when three fingers are provided, each finger is dimensioned to hold a volume of liquid 30 such that a complete collapse of one finger will displace one-third of the dosage contained in inner chamber 26. While the three-fingered embodiment of FIG. 8 is illustrated with sack-like collapsible inner chamber 26 shown in FIG. 1, the embodiment can obviously be used with the syringes shown in FIGS. 5 and 6.

The syringe may be fabricated from any suitable material, such as one of the polyethylenes, so long as the necks 22 of the syringe bodies 12 (FIGS. 1, 5 and 6) and tubular medicament receptacle 36 (FIG. 5) are rigid; the deformable outer chambers 20 (FIGS. 1, 5 and 6), 60 (FIG. 7) are sufficiently flaccid to be squeezed easily but stiff enough so as not to bulge; and the sack-like inner chamber 26 (FIG. 1) is sufficiently flaccid to be collapsed by the fluid pressure when outer chamber 20 is squeezed. The syringes shown in FIGS. 1, 2 and 7 are simply constructed, basically three molded pieces—the body, the medicament receptacle and the cap. In FIG. 6 the medicament receptacle does not require a second separate piece. Each of the syringes disclosed may be manufactured inexpensively and they are therefore disposable after one shot.

A hypodermic syringe as hereinabove disclosed may be completely filled, assembled, sterilized, and sealed at one place to provide a safe, one-shot, expendable syringe. Most dangers of embolisms during injection are eliminated controlled filling. Any suitable liquid 30 such as water, preferably sterile, may be used to transmit hydraulic pressure. Each of the embodiments is especially adapted for dispensing small dosages, fractional cubic centimeters or less than one milliliter volume, without impairing the ease, safety and accuracy of administering the dosage. Outer chamber 20 (FIGS. 1, 5 and 6), 60 (FIG. 8) are made large enough to be grasped and squeezed easily with the fingers. Outer chambers 20, 60 have a volume substantially greater than the volume of the respective inner chambers, and correspondingly, a volume of liquid 30 substantially greater than the volume of medicament, so that the required dosage may be com-

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pletely dispensed by only partially collapsing the outer chambers. By way of example, for an inner chamber having a volume of 1 to 2 milliliters down to about 0.1 milliliter, the outer chamber may be about 5 milliliters.

I claim:

1. A disposable hypodermic syringe for use in administering fractional cubic centimeter dosages comprising a hollow body, said body having a neck and a deformable outer chamber, said outer chamber being connected to said neck adjacent one end thereof, the other end of said neck being open, said neck having a passageway therethrough, a variable volume medicament receptacle interior of said body and spaced from said deformable chamber, said receptacle having an opening therein communicating with said open end of said neck through said passageway, a frangible seal closing said receptacle opening, medicament within said receptacle, liquid filling said spacing between said receptacle and said deformable chamber, and a double ended hypodermic needle axially movable within said neck, one end of said needle being adapted to penetrate said seal to communicate with said medicament, said receptacle comprising a tube extending within said deformable chamber, said tube being sealed at its outer peripheral surface to the inner peripheral surface of said passageway, said tube being open at an end remote from said frangible seal, a piston positioned adjacent said remote open end and axially displaceable within said tube toward said frangible seal.

2. A disposable hypodermic syringe for use in administering fractional cubic centimeter dosages comprising a hollow body, said body having a neck and a deformable outer chamber, said outer chamber being connected to said neck adjacent one end thereof, the other end of said neck being open, said neck having a passageway therethrough, a variable volume medicament receptacle interior of said body and spaced from said deformable chamber, said receptacle having an opening therein communicating with said open end of said neck through said passageway, a frangible seal closing said receptacle opening, medicament within said receptacle, liquid filling said spacing between said receptacle and said deformable chamber, and a double ended hypodermic needle axially movable within said neck, one end of said needle being adapted to penetrate said seal to communicate with said medicament, said receptacle being within said passageway, an axially displaceable piston positioned within said passageway remote from said open end of said neck, said frangible seal being positioned between said open end and said piston, said receptacle being defined by said passageway, said frangible seal and said piston.

3. A hypodermic syringe comprising a hollow body, said body having a neck and a deformable chamber, said deformable chamber being connected to said neck adjacent one end thereof, the other end of said neck being open, a variable volume medicament receptacle interior of said body and spaced from said deformable chamber, said receptacle having an opening therein adapted to communicate with said open end of said neck, a frangible seal closing said receptacle opening, medicament within said receptacle, and a liquid within said space between said receptacle and said deformable chamber, said deformable chamber having a plurality of deformable hollow fingers, each of said fingers having a predetermined volume corresponding to a fractional dosage of said medicament.

4. A hypodermic syringe comprising a hollow body having a neck and an enlarged portion, said enlarged portion being formed of a deformable material defining a chamber capable of being squeezed between one's fingers to collapse it and thereby reduce its volume, means within said body defining a medicament receptacle spaced from and surrounded by said enlarged portion, said medicament receptacle having a movable wall for reducing the volume of said receptacle when said wall is moved, said receptacle having a peripheral portion thereof sealed to said body adjacent said neck, a quantity of liquid sealed

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in and substantially filling the space between said receptacle and said enlarged portion, medicament sealed in said receptacle, the volume of the liquid being substantially greater than the volume of the medicament, and a hypodermic needle mounted on said syringe, one end of said needle being adapted to communicate with the medicament in said receptacle whereby when said chamber is squeezed between one's fingers said chambers collapses and reduces in volume to apply hydraulic pressure through said liquid to said movable wall and thereby move said wall to reduce the volume of said receptacle and dispense medicament through said needle.

5. The syringe set forth in claim 4 wherein said receptacle is defined by a collapsible sack, said sack having an integral tubular extension thereon, said extension being nested in the neck of said body with the outer periphery of said extension sealably engaging the inner periphery of the neck.

6. The syringe set forth in claim 4 wherein said receptacle is defined by a tube nested in the neck of said body with the outer peripheral surface of said tube sealably engaging the inner peripheral surface of said neck, said tube extending within said enlarged portion of said body, and a piston axially displaceable within said tube.

7. The syringe set forth in claim 4 wherein said enlarged portion has a plurality of deformable hollow fingers, each of said fingers having a predetermined volume corresponding to a fractional dosage of said medicament.

8. A hypodermic syringe comprising a rigid tubular neck having an enlarged portion at one end thereof, the other end of said neck being open, said enlarged portion being formed of a deformable material defining a chamber capable of being squeezed between one's fingers to collapse it and thereby reduce its volume, means forming a

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medicament receptacle in said neck, said receptacle forming means comprising a piston supported in said neck for slidable movement therein to decrease the volume of said receptacle when said piston is moved in a direction toward said open end of said neck, a quantity of liquid sealed in and substantially filling said chamber, medicament sealed in said receptacle, the volume of said liquid being substantially greater than the volume of said medicament, and a hypodermic needle mounted on said syringe, one end of said needle being adapted to communicate with the medicament in said receptacle whereby when said chamber is squeezed between one's fingers said chamber collapses and reduces in volume to apply hydraulic pressure through said liquid to said piston and thereby move said piston axially in said neck to reduce the volume of said receptacle and dispense medicament through said needle.

9. The syringe set forth in claim 8 wherein an elongated hollow cap is sealably nested with said neck to provide a protective cover for said needle.

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