Nov. 25, 1958 E. R. SANDHAGE ET AL 2,861,571

MULTIPLE DOSE DISPOSABLE SYRINGE

Filed Oct. 30, 1956

2 Sheets-Sheet 1

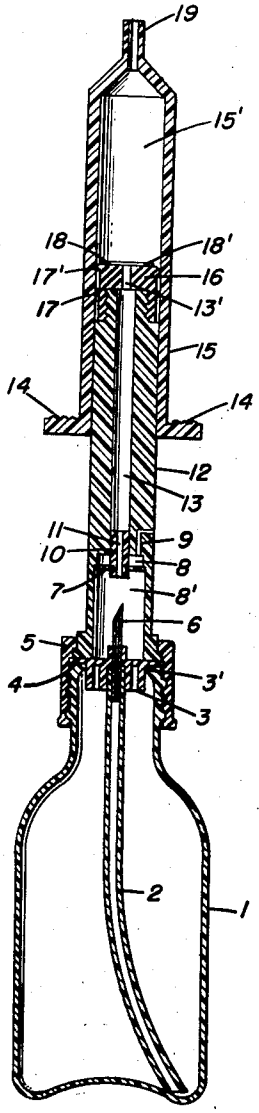


Fig. 1.

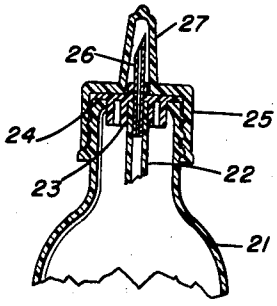


Fig. 2.

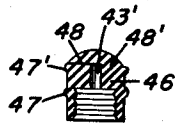


Fig. 4.

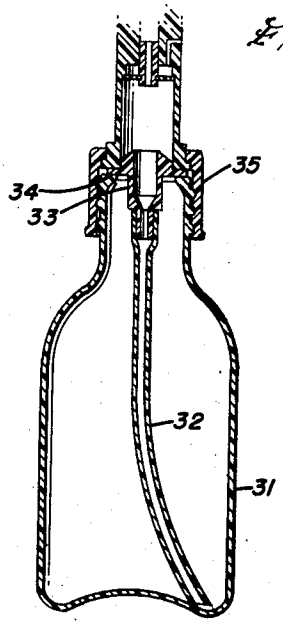


Fig. 3.

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2 Sheets-Sheet 2

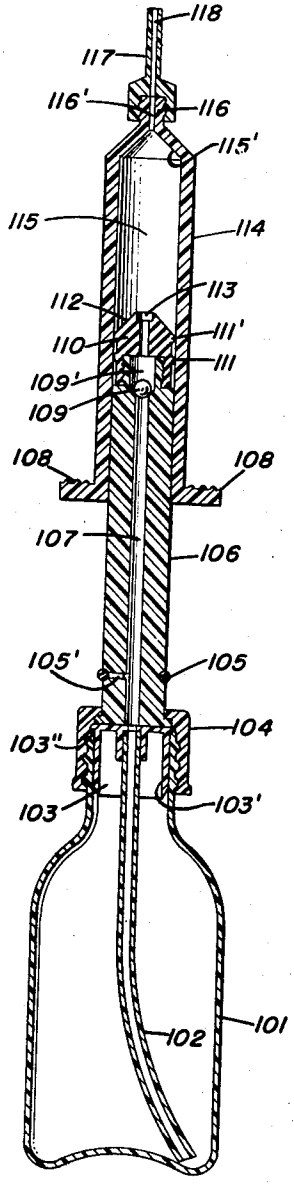


Fig. 5.

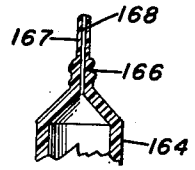


Fig. 6.

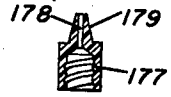


Fig. 7.

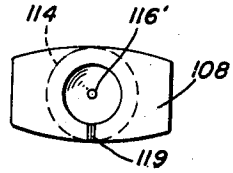


Fig. 9.

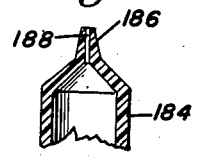


Fig. 8.

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MULTIPLE DOSE DISPOSABLE SYRINGE

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Application October 30, 1956, Serial No. 619,324

8 Claims. (Cl. 128—218)

This invention relates to a multiple dose disposable syringe. More particularly, this invention relates to a multiple dose disposable syringe made of a plastic material. It relates further to a convenient, economical method of administration of injectable materials with a minimum of contamination, due to the unique manner by which the syringe is refilled.

In the pharmaceutical field particularly in the veterinary sciences, it is frequently necessary to administer parenterally preparations to a large number of animals. Such parenteral administration may involve introduction of the desired preparation subcutaneously, intramuscularly, intravenously, or through a natural opening in the animal body. The conventional hypodermic syringe made of glass and metal can be utilized for this purpose. However, if the animal be infected, it is necessary to utilize either a series of syringes and needles or cannulae, or to sterilize the hypodemic device after each administration. Under field conditions, where large numbers of animals are involved, neither of these alternatives is a practical one. For this reason, it has been proposed to utilize syringes made of plastic materials or other inexpensive materials which can be used for one administration and then disposed of. To a limited extent, these proposals have overcome some of the difficulties encountered with the conventional hypodermic devices. However, the very characteristics which make them advantageous over the conventional glass and metal devices produce new disadvantages.

The disposable syringes proposed by the prior art are of the single dosage type; in other words, they contain enough medicament for a single administration to a subject for a particular illness. Since there are many diverse conditions encountered from one animal to another and from one illness to another, obviously these disposable devices of the prior art do not generally answer all the problems which are involved in this field. For example, a disposable syringe containing sufficient medicament for one of the smaller animals does not contain sufficient medicament for one of the larger animals. On the other hand, the severity of the illness may require a larger dosage of a particular medicament and again this type of disposable syringe is found to be lacking.

The multiple dose disposable syringes of this invention alleviate the various disadvantages associated with the syringes proposed in the past, whether disposable or not. The disposable syringes of the present invention can be used under conditions requiring large or small doses of medicament, and thus can be universally used with large or small numbers of large and small animals and for severe and less severe illnesses.

Essentially the multiple dose disposable syringes of the present invention consist of a plastic squeeze bottle containing the material to be injected, to which is attached a plastic syringe. The bottle is squeezed in order to fill the syringe to any desired dose level and the dose is then expelled into the subject being treated by operating the

syringe in the conventional manner. If an additional dose is necessary, the syringe can be refilled by simply again applying hand pressure to the squeeze bottle.

With the above mentioned objects and others in mind, the present invention consists primarily in the structure hereinafter described, the preferred embodiments of which are illustrated in the accompanying drawings wherein:

Figure 1 is a sectional elevation of one embodiment of this invention showing a squeeze bottle in combination with syringe structure.

Figure 2 is a sectional elevation of a portion of the squeeze bottle combination of Figure 1 in combination with a protective cap for the needle of the combination of Figure 1.

Figure 3 is a partial sectional elevation of a somewhat different embodiment of the combination of Figure 1, omitting the needle thereof.

Figure 4 illustrates in section a different embodiment of the resilient valve and sealing member of Figure 1.

Figure 5 is a sectional elevation of another embodiment of this invention.

Figure 6 is a sectional elevation of a portion of one of the embodiments of this invention.

Figure 7 is a sectional elevation of another portion of one of the embodiments of this invention.

Figure 8 is a sectional elevation of a portion of one of the embodiments of this invention.

Figure 9 is an end elevation of the cylindrical member of Figure 5.

Referring specifically to Figure 1, **1** designates a plastic resilient compressible squeeze bottle, preferably made of polyethylene, of conventional structure containing a plastic feed tube **2** which is so curved, or so positioned, as to reach into the very bottom of plastic squeeze bottle **1** at its outer periphery. At the other end of tube **2** is inserted a conventional needle **6**, which needle may be used for insertion through a conventional stopper of a medicament solution-containing bottle. Plastic tube **2** is received by closure member **3** which has a through passage which communicates with that of feed tube **2** and with reservoir **8'**. Tube **2**, closure member **3**, and needle **6** may be assembled by a press-fit. On the other hand, tube **2** may be adhesively secured to closure **3**, and similarly needle **6** may be adhesively secured to both closure member **3** and tube **2**. Closure member **3** possesses a substantially cylindrical outer surface **3'** which sealingly engages a corresponding inner cylindrical surface at the mouth of bottle **1**. It also contains an outer transverse surface which lies flush in sealing relationship with a similar transverse surface at the mouth of bottle **1**; this is designated by numeral **4**. This juncture of closure member **3** and bottle **1** may be sealed merely by tightening cap **5** which exerts downward pressure on plunger **12**, which downward pressure is transmitted transversely to surface **3'** and directly downward to surface **4**. On the other hand, either or both surfaces **3'** and **4** may be adhesively secured to the corresponding cylindrical or transverse surface at the mouth of bottle **1**. The relief valve designated by numbers **7**, **8** and **9** comprises a flexible rubber or plastic disc **7** which separates air chamber **8** and reservoir **8'**. Disc **7** is embedded in a circumferential groove in the outer cylindrical surface of tubular member **10**. Air chamber **8** is connected to the atmosphere by channel **9**. Tubular member **10** contains a longitudinal passage **11** which connects main passage **13** of plunger **12** with reservoir **8'** formed at the very bottom of plunger **12**.

Cylinder **15** is a hollow member which receives plunger **12** and contains conventional finger engaging lugs **14** at its lower end and a cylindrical or tapered projection **19** of relatively small diameter at its upper end. Projection **19**

is adapted to receive the conventional metal or plastic hypodermic needle or cannula, depending upon its use. Most plastic needles, of course, cannot be used to penetrate the skin, the underlying tissue, or the muscular tissue; they are used, on the other hand, for insertion into natural openings. Projection **19** may have any of the conventional means used for securing needles thereto, e. g., screw threads, bayonet joints, a taper suitable for a friction fit, etc.

Plunger **12** contains sealing and valve structure at its upper end, comprising a hollow resilient valve and sealing member **16** made of rubber, plastic or some other resilient material. It has a passage **13'**, an extension of passage **13**, and integrally formed resilient circumferential sealing rings **17** and **17'**. Resilient valve and sealing member **16** is secured by conventional means, herein illustrated as screw threads, to the upper end of plunger **12**. It contains a flexible flapper check valve **18** which may be made of rubber, plastic or some other flexible material, and which is adhesively secured at **18'** to the upper transverse surface of resilient member **16**.

Referring specifically to Figure 2, there is depicted structure substantially identical to that of Figure 1. However, Figure 2 illustrates the manner in which squeeze bottle **1**, with needle **6**, may be safely and efficiently transported. In this embodiment, the reference numerals are the same as in Figure 1 excepting the fact that a number 2 has been inserted before each of the corresponding numbers from Figure 1. There is additionally shown a protective cap, **27** depicting the conical projection on the main portion of the cap **25** which protects and seals needle **26** in its association with squeeze bottle **21**.

Referring specifically to Figure 3, there is illustrated a somewhat different embodiment of the invention as compared to that illustrated by Figure 1, differing from Figure 1 in that it contains no needle in closure member **33**. The other members **31**, **32** and **35** are substantially identical to those illustrated in Figure 1. Closure member **33**, like closure member **3** of Figure 1, may be sealed at **34** by a press-fit or by the used of an adhesive.

Referring specifically to Figure 4, there is illustrated a different embodiment of resilient valve and sealing member **16** and flexible flapper valve **18**. In this embodiment, like that of Figure 1, valve and sealing member **46** is resilient and hollow, having a passage **43'** and integrally formed resilient circumferential sealing rings **47** and **47'**. Passage **43'** is sealed when not in use by flexible flapper valve **48** which is integrally attached and hinged to member **46** at **48'**.

Referring specifically to Figure 5, there is illustrated an embodiment of this invention somewhat different from those illustrated by the preceding figures. Fundamentally, the major part of the embodiment shown in Figure 5 is substantially similar to that of Figure 1. Squeeze bottle **101** and feed tube **102** are the same as comparable structural members **1** and **2** of Figure 1. Closure member **103** compares with closure member **3** of Figure 1; however, both the cylindrical wall of closure member **103** and that of the mouth of squeeze bottle **101** are of somewhat greater length and thus afford more efficient sealing. Like the embodiment shown in Figure 1, closure member **103** may be frictionally engaged at **103'** and **103''** with the mouth of squeeze bottle **101**. Furthermore, it may alternatively be adhesively secured at either or both of these two points also.

Syringe plunger **106** embodies the principal departures made in the structure of Figure 5 from that shown in Figure 1. Syringe plunger **106** contains main passage **107** from its bottom end to its top end, communicating at its bottom end through closure **103** with tube **102** and ultimately through a novel valve and sealing structure at its top end with chamber **115** of cylindrical member **114**. A short distance from the bottom end of plunger

106 is relief passage **105** communicating with main passage **107**. Relief passage **105** is shown as being at right angles to main passage **107**; this is, however, a matter of choice. Between the outermost radial portion of relief passage **105** and the outer cylindrical surface of plunger **106**, there is provided a groove substantially semi-circular in cross-section containing an O ring. This O ring **105'** serves as a relief valve in a manner described below. At its upper end, plunger member **106** contains another valve structure which consists of a valve chamber **109'** and a ball check valve **109** which normally seals passage **107** at its juncture with chamber **109'**. There is secured to the topmost portion of plunger **106** a resilient valve and sealing member **110**, having sealing rings **111** and **111'** integrally formed on its cylindrical outer surface. Its upper portion is in the shape of a truncated cone **112**, and it contains a passage **113** which communicates with chamber **109'** and chamber **115**. O ring **105'** and valve and sealing member **110** may be composed of resilient rubber, synthetic or natural; alternatively either or both of them may be made of a resilient synthetic resin. As illustrated, member **110** is connected by screw threads to the upper end of plunger **106**. Alternatively, it may, however, be connected by other equivalent securing means such as a friction-fit, or it may be adhesively secured to plunger **106**. Preferably, check valve **109** is made of stainless steel and should have a diameter greater than the inner diameter of said main passage and smaller than the inner diameter of said enlarged passage. However, it may be made of steel which is chromium plated or some other equivalent non-corrosive composition, such as a plastic composition.

Cylindrical member **114** has conventional finger engaging lugs **108** at its lower end. At its upper end, chamber **115** terminates in a conical surface **115'**, above which there is integrally formed a needle or cannula engaging projection **116**, having screw threads to which is attached cannula **117**. Cannula **117** is relatively long, narrow and cylindrical over the major portion of its length and it contains a through passage **118** which communicates by way of passage **116'** with chamber **115**.

Referring specifically to Figure 6, there is depicted structure similar to that of the preceding figures. Cylindrical member **164** compares with **114** in Figure 5 and **15** of Figure 1. The alternative structure shown in this figure may be used with any of the embodiments shown in the preceding figures. Cylindrical member **164** contains at its upper end an integral projection **166** which has integrally attached thereto cannula **167** which contains a through passage **168**. Projection **166** also contains screw threads which can be used for securing a protective cap over cannula **167**.

Referring specifically to Figure 7, there is illustrated structure which may also be used with any of the embodiments of Figures 1–5. The structure herein illustrated shows an adapter **177** which may be attached, for example, through the use of screw threads or other equivalent means, to projection **116** of Figure 5. Adapter **177** possesses a conical projection **179** which contains through passage **178**. A needle or cannula, metallic or otherwise, may be attached by force-fit to conical projection **179**.

Referring specifically to Figure 8, there is illustrated still another embodiment of this invention which may be used alternatively with the structure of any of Figures 1–5. Cylindrical member **184** contains at its upper end an integral conical projection **186** to which may be attached by force-fit a needle or cannula, and which also contains through passage **188**.

Referring specifically to Figure 9, there is illustrated an end elevation of cylindrical member **114** of Figure 5, **116'** denoting the passage through the cannula engaging projection **116** and **108** designating the finger engaging lugs thereof. A relief groove **119**, here shown as having a V shape, is provided in the bottom surface of cylindri-

cal member 114 between the bore of cylindrical member 114 and the outer edge of this bottom surface. The shape of relief groove 119 is, of course, a matter of choice.

Operation of any of the embodiments shown in Figures 1, 3, 4 or 6 through 8 proceeds in the following manner: Having reference to Figure 1 for illustrative purposes, squeeze bottle 1 contains the medicament which is to be used. By sliding the hollow cylindrical member 15 to the desired level with respect to plunger 12, a hollow chamber 15' of the desired volume is formed. It is filled by applying hand pressure to the cylindrical wall of bottle 1 which forces the material contained therein through feed tube 2 into reservoir 8' and from thence into passages 11, 13 and 13'. Upon reaching the valve structure 16 and 18, the pressure of the material in passage 13' forces the flexible flapper check valve 18 upward allowing the material under pressure to enter hollow chamber 15' filling the same to the desired level. When hand pressure is released on bottle 1, resilient disc 18 returns to a sealing position due to the difference in pressure between hollow chamber 15' and passage 13'. Any residual material in passages 13', 13 and 11 then flows downwardly into reservoir 8', and then in the most part empties back into bottle 1.

The function of the relief valve structure designated by numbers 7, 8 and 9 is to facilitate the return of squeeze bottle 1 to a normal or non-compressed state. Thus as the pressure is released on squeeze bottle 1, air is pulled in from the atmosphere through channel 9 into air chamber 8 where it impinges upon flexible disc 7. The difference in pressure between air chamber 8 and reservoir 8' causes flexible disc 7 to flex downwardly until the difference in pressure is eliminated; whereupon flexible disc 7, by virtue of its elasticity, will resume its normal sealing position against the sides of reservoir 8' and the valve seat of air chamber 8.

The embodiment shown in Figure 5, with or without the modifications of Figures 3, 4 and 6–8, functions in a manner similar to that of the embodiment of Figure 1. In this embodiment, the material from bottle 101 passes under pressure up main passage 107 to ball check valve 109, O ring 105' preventing it from escaping through relief passage 105. In response to the pressure of the material in main passage 107, check valve 109 is unseated, allowing the material to pass into valve chamber 109' and from thence through passage 113 into chamber 115, filling it to the desired level. When pressure is released on squeeze bottle 101, check valve 109 will once again seat itself preventing suction of material from chamber 115 back into passage 107 and bottle 101. Relief passage 105 and O ring relief valve 105' perform a function similar to structure 7, 8 and 9 of Figure 1. When plunger 106 is forced into chamber 115, expelling the contents thereof, the bottom inner edge of cylindrical member 114 adjacent lugs 108 engages O ring relief valve 105' partially unseating it and allowing air to pass through relief passage 105, main passage 107 and tube 102 into bottle 101.

The alternative structure shown in Figure 9 may be used in place of that shown in Figure 5. It is possible, if the bottom surface of cylindrical member 114 is a true plane surface, that air would enter between such a surface and O ring 105' with some difficulty. The provision of the relief groove 119 will obviate any such difficulties, for when the bottom inner edge of cylindrical member 114 engages O ring relief valve 105', groove 119 will provide a passage between this bottom inner edge and said O ring allowing air to pass therethrough into bottle 101.

In the above description, it has been indicated that various parts, exclusive of the needle 6, may be made up of polyethylene. However, it should be quite apparent to one skilled in the art that other equivalent plastic or elastomeric materials can be utilized in place of polyethylene, e. g. methyl styrene, methyl methacrylate, synthetic rubber, natural rubber, etc. Alternatively various parts of the device of this invention, other than the squeeze bottle, can be made of ceramic materials, e. g. glass. On the other hand, any of the parts that require no flexibility could be made of other materials such as metals. It is preferred, however, for purposes of economy and ease and safety of packaging and transporting, to make all parts of plastic materials. Moreover, various combinations and subcombinations have been illustrated in the drawings and described above. Obviously other equivalent structures and procedures may be resorted to without departing from the inventive concept. For example, each of the structural features illustrated and described can be utilized with any or all of other analogous structural features illustrated and described herein. These drawings and descriptions are illustrative only, the scope of the invention being determined by the scope of the appended claims.

We claim:

1. A multiple dose disposable syringe comprising a tubular syringe barrel having a dispensing outlet at one end, a plunger member fitted within said syringe barrel and adapted to slide longitudinally therein in close contact with the side walls thereof thereby to force liquid from the syringe barrel through said dispensing outlet, said plunger having a longitudinal passage from one of its ends to the other permitting passage of liquid therethrough, check valve means in association with said plunger passage at the end closest to said dispensing outlet adapted to prevent flow of liquid through said passage from the syringe barrel, air relief valve means near the other end of said plunger adapted to permit air to flow into said longitudinal liquid passage when pressure within said passage is less than that outside said passage, a resilient compressible container adapted to hold a quantity of liquid, said container being attached to said plunger at the end thereof opposite the dispensing outlet of the syringe barrel whereby upon pressure being applied to said resilient container it is deformed and liquid contained therein is forced therefrom through said plunger passage and check valve into the said syringe barrel.

2. The multiple dose disposable syringe of claim 1 in which the tubular syringe barrel is fitted with lugs whereby the syringe barrel may be more securely held by the operator of the device.

3. The multiple dose disposable syringe of claim 1 in which the liquid check valve associated with the plunger comprises a ball member disposed in an enlarged section of the longitudinal liquid passage, said ball member having a diameter greater than the inner diameter of said main passage and smaller than the inner diameter of said enlarged chamber.

4. The multiple dose disposable syringe of claim 1 wherein the liquid check valve comprises a resilient disc at the syringe barrel end of the plunger, said resilient disc being normally in a sealing position closing the outlet end of said longitudinal passage and being adapted to be deflected away from said outlet passage on the application of pressure from within said passage.

5. The multiple dose disposable syringe of claim 1 in which the air relief valve means comprises a flexible disc within the liquid passage, an air inlet passage permitting entrance of air from outside said plunger member into said liquid passage, said resilient disc being so disposed as to normally prevent passage of air or liquid through said inlet passage and being adapted to deflect upon pressure of air from without said plunger member permitting air to enter into said liquid passage.

6. The multiple dose disposable syringe of claim 1 in which the air relief valve comprises an air relief passage communicating from said liquid passage through the plunger member, a groove around the outside of said plunger member at the outlet of said air passage and a flexible O ring positioned in said groove sealing off said air passage, said O ring being normally positioned on

the plunger member near the container end of said member and adapted to engage with the syringe barrel whereby upon discharge of the liquid contents of said syringe barrel the O ring is deflected away from said air passage and air is permitted to enter into said liquid passage.

7. The multiple dose disposable syringe of claim 1 in which the plunger member is adapted to said flexible container by a screw cap device engaging screw threads at the opening of said container.

8. The multiple dose disposable syringe of claim 1 in which a liquid passage member extends from the liquid passage of said plunger into the lowermost portion of said flexible container.

References Cited in the file of this patent

UNITED STATES PATENTS

1,367,008	Bessesen	Feb. 1, 1921
1,681,744	Bitkin	Aug. 21, 1928
2,290,348	Moule	July 21, 1942
2,695,612	Fields	Nov. 30, 1954