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Weingarten

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[54] **MULTI-CHAMBER SYRINGE**

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[*] Notice: The portion of the term of this patent subsequent to July 29, 1992, has been disclaimed.

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[21] Appl. No.: **484,104**

Related U.S. Application Data

[63] Continuation of Ser. No. 255,099, May 19, 1972, abandoned.

[52] **U.S. Cl.** ..... **128/218 R;** 128/218 G

[51] **Int. Cl.²** **A61M 5/00**

[58] **Field of Search** ..... 128/218 M, 218 R, 218 D, 128/218 DA, 272, 215, 216, 218 P, 218 F, 218 A, 218 G

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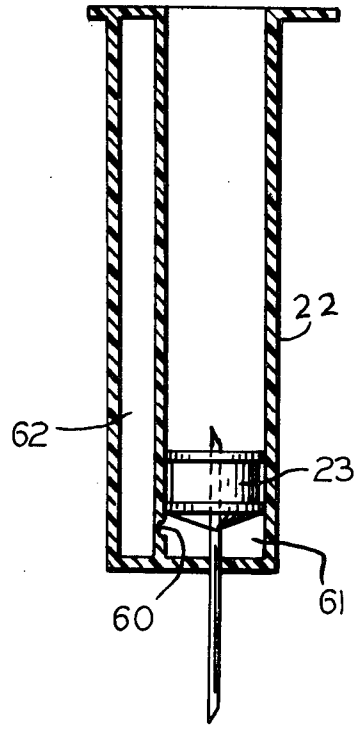
[57] **ABSTRACT**

A syringe has a floating barrier seal located at approximately the middle of the syringe chamber, thereby forming (at least) two different chambers on opposite sides of the barrier to provide separate storage space for (at least) two different medicines. A hypodermic needle projects inwardly into the adjacent one of the chambers, far enough to pierce the floating barrier after the first medicine has been dispensed. The needle passes through the barrier to dispense the second medicine on the other side of the barrier. At this time, the barrier seals the first medicine away from the needle so that it cannot mix with or contaminate the second medicine.

6 Claims, 6 Drawing Figures



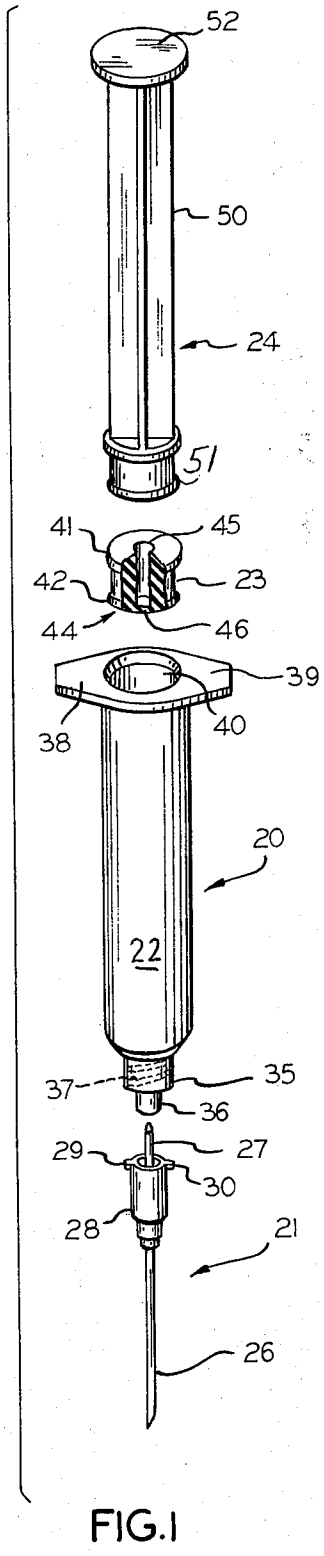


FIG.1

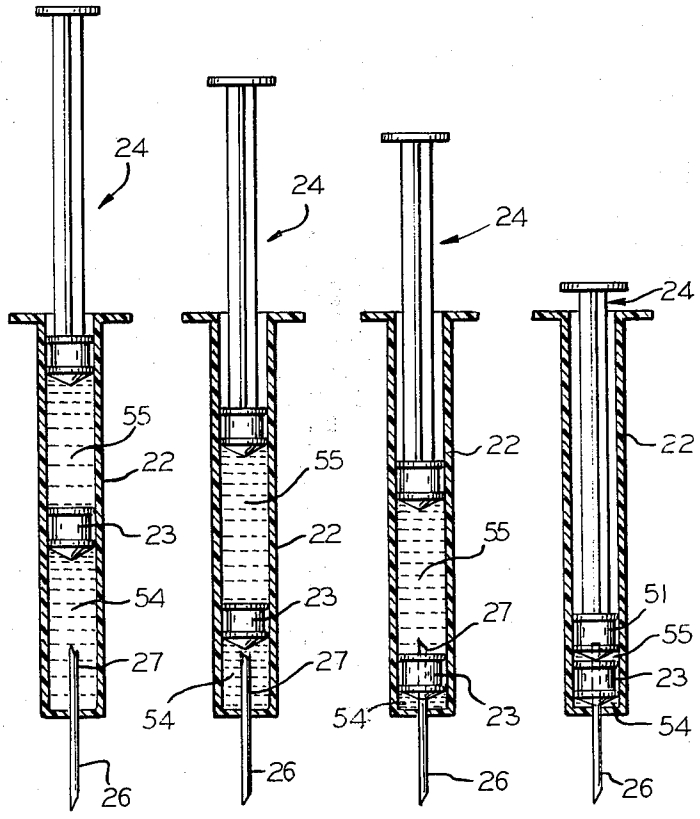


FIG.2 FIG.3 FIG.4 FIG.5

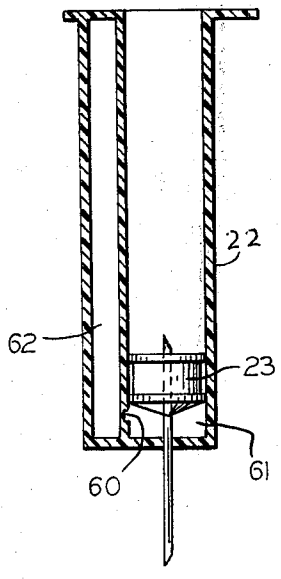


FIG.6

MULTI-CHAMBER SYRINGE

This is a continuation of application Ser. No. 255,099 filed May 19, 1972, and now abandoned.

This invention relates to syringes for giving multimedicine injections and, more particularly, to syringes which do not allow two or more medicines to mix prior to their sequential injection into a patient.

Syringes are used to inject medicine into the body of a human or an animal. Usually, the injected medication is a single fluid or a mixture, in which case the syringe has a single compartment and a single needle. Sometimes, the medication includes two chemicals or drugs which must be mixed immediately prior to the injection. Here, the syringe usually has two compartments separated by a barrier which either ruptures or opens at the time of injection so that the injected medicine is a single chemical mixture as it passes into the patient's body.

When it has been necessary to inject two separate and unmixed chemicals, the customary practice has been to use two separate syringes. This doubles the cost of preparing and administering the mixtures for injection, and it doubles the pain by requiring two punctures of the patient's skin.

A suggested alternative is to provide twin, rigidly interconnected syringes which does nothing for the cost, but supposedly gives a single sensation of pain since the two needles are physically too close together to be perceived as more than a single point of contact. Aside from the double cost, this twin syringe requires greater skill on the part of the doctor or nurse administering the medication.

Accordingly, an object of this invention is to provide a syringe for administering two medications which are completely separate and unmixed at the time of injection. Here an object is to provide a syringe having substantially the same cost as a single medication syringe. In this connection, an object is to provide a disposable, double compartment syringe having such a low cost that it may be filled with two or more medications and prepackaged in a sterile container by a pharmaceutical company.

Another object of the invention is to reduce the skill level required to administer a multi-medication injection. Here, an object is to reduce the patient's pain and psychological suffering in anticipation of and during the injection.

In keeping with an aspect of this invention, these and other objects of the invention are accomplished by a syringe having a floating barrier therein at approximately the middle of the syringe chamber. Two different chambers are thereby formed on opposite sides of the floating barrier to separate the two different medications. A single hypodermic needle projects inwardly into the bottom one of the chambers far enough to pierce the floating barrier after substantially all of the first medication has been dispensed. The needle passes through the barrier to thereafter dispense the second medication on the other side of the barrier. At this time, the barrier seals the first medication away from the needle so that it cannot mix with or contaminate the second medication.

The nature of a preferred embodiment of the invention may be understood best from an inspection of the attached drawings wherein:

FIG. **1** is an exploded view, in perspective, of the inventive syringe;

FIGS. **2–5** are stop motion views schematically showing how two medications are separately dispensed so that neither mixes with or contaminates the other prior to injection; and

FIG. **6** schematically shows a method of evacuating the remainder of a first medication after it is no longer being injected into a patient.

The inventive syringe **20** comprises a needle assembly **21,** a cylinder **22,** a floating barrier seal **23,** and a plunger assembly **24.** The needle is separated into first and second parts **26, 27,** respectively. The first part **26** is sharpened and adapted to pierce the skin of a person or animal receiving the medication. The second part **27** of the needle projects into the cylinder **22** for a distance which is adequate to puncture the barrier **23** when it reaches the bottom of the cylinder. A preferably plastic collar **28** is firmly attached to the needle **21** at the junction point between the two parts **26, 27.** The collar **28** includes two oppositely disposed ears **29, 30** which cooperate with internal threads in the syringe to attach the needle thereto.

The cylinder **22** is an elongated hollow tube of uniform cross-section, terminated at the bottom in an internally threaded coupler **35.** Concentrically positioned inside coupler **35** is a tube **36** having an axial opening therein to receive the needle **27** with a sufficiently tight seal to preclude leaking. The threads **37** inside the coupler **35** engage and receive the ears **29, 30** on the collar **28.** Thus, as the assembly **28** is rotated, the two parts **28, 35** come together with a tight seal.

The upper end of the cylinder **22** has opposing tabs **38, 39** which are held by the index and middle fingers of the person administering the injection. The upper end **40** of the cylinder **22** is beveled to provide a conical entrance for guiding and directing the barrier **23** and plunger **24** members upon entrance into the cylinder. The entire unit is preferably made from low cost, thin-walled, transparent plastic material so that the person administering the injection can watch the operation to be sure that the medications are properly fed into the patient.

According to the invention, a floating barrier member **23** is provided for forming two separate chambers in the tube. Preferably, this barrier is a soft rubber plug which has two longitudinally displaced piston rings **41, 42** for making a good seal against the interior wall of the cylinder **22.** The bottom **44** of the plug is somewhat conical to help guide it on its entrance into the cylinder **22.** An axial bore **45** almost completely pierces the plug forming the floating barrier member **23.** However, the bottom of the bore **45** does not quite extend through the bottom of the plug. Therefore, the bottom of the bore **45** is covered by a thin membrane **46** to prevent any fluid from passing through the barrier.

The plunger assembly **24** comprises a ram rod **50** having a soft rubber plug **51** attached to the bottom and a thumb pad **52** attached to the other end. The plugs **23** and **51** are almost identical, both slide inside the cylinder **22.**

The method of its use is illustrated by the stop motion views of FIGS. **2–5.** Preferably, a pharmaceutical manufacturer loads the inventive syringe in his laboratory or factory by depositing a first medicine **54** in the bottom of the cylinder **22.** Then, the barrier **23** is placed in the tube and brought down into contact with the top of the medicine surface, to eliminate all entrapped air. One way of doing this is to invert the syringe, allow the entrapped air to escape through the tube **36,** and then

to seal the tube.

After the first medicine **54** is loaded into the first compartment, a second medicine **55** is loaded into the second compartment. Then, the plunger assembly **24** is brought down into contact with the upper surface of the second medicine, and all entrapped air is withdrawn. One way to withdraw the entrapped air is to slip a small tube of hypodermic needle stock between the soft rubber plug **51** and the inside surface of the cylinder **22** and to vacuum pump the air from the upper chamber. The inventive syringe (FIG. **2**) is now preloaded with two completely separated medications **54, 55,** held securely apart, one from the other.

As the injection is given (FIG. **3**), only the first medicine passes out of the chamber **22** and through the needle **26,** into the patient. As the first medicine is exhausted, the floating barrier **23** engages and is pierced by the upper end **27** of the needle **21.** It is easy to so pierce the floating barrier since only the thin membrane **46** is present at this point. Thereafter, the needle end **27** is in the bore **45** which provides an unimpeded passage for the medicine in the upper chamber. The rubber-like material of the floating barrier surrounds and seals the outside of the needle **27** and prevents any more of the first medicine **54** from passing through the needle.

At this time (FIG. **4**), the second medicine **55** passes through the needle **27** and into the patient receiving the injection. The second medicine is not mixed with or contaminated by the first medicine at any time before or during the injection.

At the bottom of the stroke (FIG. **5**), the plug **51** reaches the top of the barrier **23** or the needle **27,** where it terminates the flow of the medicine through the needle. The medicine is now exhausted, and the spent syringe is discarded.

It is apparent that the same principle may be extended to an administration of a larger number of medicines by increasing the number of floating barriers and, therefore, the number of separate compartments inside the cylinder **22.** The membrane member **46** is thin enough and the rubber plug **23** is soft enough so that the needle top **27** may penetrate the bore **45** far enough to admit the second medicine **55** to the needle. However, sometimes the first medicine **54** entrapped under the floating barrier **23** should be evacuated to relieve pressure and to allow the barrier **23** to settle further into the cylinder **22.** This is especially true if there are two or more floating barriers. The first barrier must settle to allow the second barrier to be pierced by the needle **27.**

To provide relief from the back pressure of the first medication, the cylinder **22** is weakened at a point **60** in the entrapped area **61.** An adjacent chamber **62** is positioned to communicate with the entrapped area **61** when the weakened point **60** ruptures. As the first medicine **54** is ejected from the cylinder **22,** the pressure does not exceed the rupture strength of the weakened area **60.** However, when the medication **54** flow is blocked by the needle end **27** passing through the floating barrier, the fluid pressure builds in the entrapped area **61.** Weakened area **60** ruptures under the augmented pressure, and the entrapped medication flows from area **61** into a closed and, perhaps, evacuated chamber **62.** As the fluid flows from area **61,** the barrier **23** settles further into cylinder **22** in order to enable the needle end **27** to properly perform its penetration function. There cannot be a reverse flow since the punctured membrane **46** of the floating barrier **23** seals itself around the outside periphery of the needle. Moreover, any pressure differential is such that the flow will be from the cylinder **22** into the chamber **62.**

It should be understood that modifications may be made without departing from the scope of the invention. Therefore, the appended claims should be construed to cover all equivalent structures.

I claim:

1. A multi-chamber syringe comprising a cylinder having at least one floating barrier means therein forming at least two separate chambers, with each of said chambers containing a liquid, a plunger received in said cylinder, hollow needle means attached to one end of said cylinger and having an unbroken cylindrical shell initially communicating with the chamber intermediate the barrier means and said one end of the cylinder, said shell projecting into said cylinder far enough to puncture and seal said barrier around the periphery of said unbroken cylindrical needle shell to prevent the liquids in the two chambers from mixing when said barrier nears the en of its travel as said syringe is emptied responsive to movement of said plunger, and means associated with said cylinder between said one end and said barrier means for relieving back pressure on said barrier after said needle punctures said barrier whereby said barrier may continue to settle after having been punctured and whereby said continued settling occurs without introduction of the contents of one of said chambers into the other of said chambers.

2. The syringe of claim **1** wherein said floating barrier means comprises a soft plug having at least one integrally formed circumferential piston ring and an axial bore closed by a membrane.

3. The syringe of claim **2** wherein said means for relieving back pressure comprises an unbroken but weakened wall area near the bottom of the stroke between said cylinder and said barrier means, whereby said weakened wall area ruptures under augmented pressure to so receive said back pressure and evacuate the liquid under the floating barrier.

4. The structure of claim **1** and a third closed chamber positioned adjacent said means for relieving said back pressure after said barrier means is punctured, said means for relieving back pressure comprising a weakened rupture area in the wall between said chamber near the end of said barrel travel and said third closed chamber.

5. A syringe comprising a cylinder, a plunger received in one end of the cylinder, a floating barrier received in the cylinder intermediate the plunger and the other end of the cylinder, and a closed chamber adjacent said cylinder with a wall common to said cylinder, a needle extending into said cylinder to pierce said barrier at a predetermined point in the stroke of said plunger, and a weakened rupture area in said common wall between the end of said needle inside said cylinder and the point where said needle is attached to said syringe.

6. A multi-chamber syringe, comprising:

a hollow cylinder for retaining a liquid;

floating barrier means received in the cylinder defining a first chamber intermediate the barrier means and one end of the cylinder and a second chamber intermediate the barrier means and the other end of the cylinder, with both of said chambers containing a portion of said liquid;

a plunger received in the one cylinder end for pumping liquid out of the cylinder;

hollow needle means attached to the other cylinder end and projecting a sufficient distance into said cylinder to puncture and seal said barrier means without mixing liquid between the first and second chambers responsive to movement of the plunger into the cylinder; and

means for diverting and emptying liquid from the second chamber after a portion of the liquid is ejected from the second chamber through the needle means.

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