Nov. 19, 1968 L. S. SANTOMIERI 3,411,503

COLLAPSIBLE MIXING SYRINGE WITH EXTRUSION CASING

Filed June 27, 1966

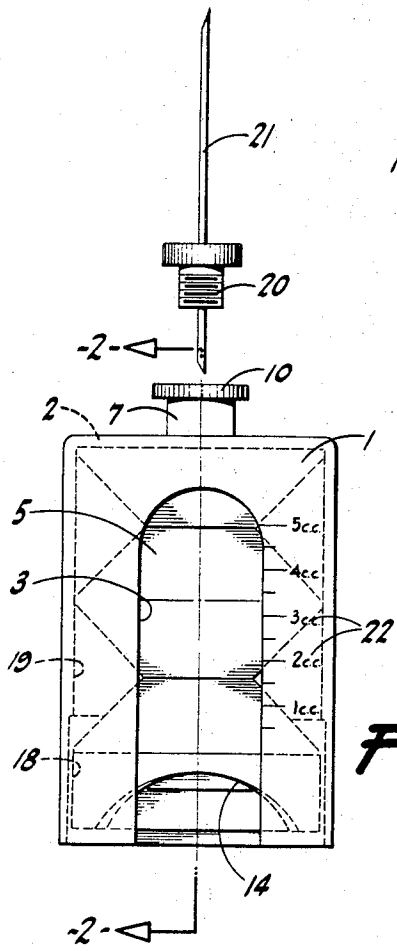


FIG-1

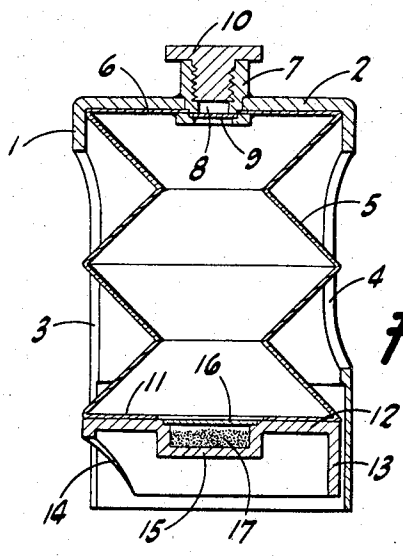


FIG-2

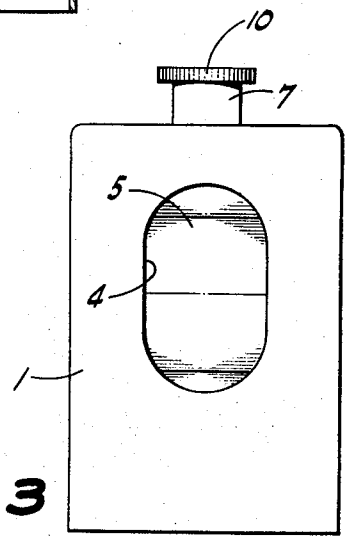


FIG-3

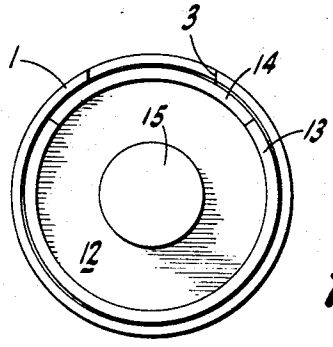


FIG-4

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COLLAPSIBLE MIXING SYRINGE WITH EXTRUSION CASING

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ABSTRACT OF THE DISCLOSURE

A syringe, for medical use, comprising a bellows-type collapsible body containing a diluent and disposed in a case on which a hypodermic needle may be mounted in communication with said body, and a plunger in the case finger-movable in a direction to collapse the body; the plunger including means containing a soluble medicament initially separate from the diluent but which means releases the medicament into the body for mixture with the diluent upon such movement of the plunger prior to mounting of the hypodermic needle on said body.

This invention relates in general to an improved syringe unit adapted for medical use in connection with an initially separate hypodermic needle.

In particular, the invention is directed to, and it is a major object to provide, a novel syringe unit wherein—from the time of manufacture to the time of use—a dry but soluble medicament and a diluent are maintained in sterile, enclosed and separated relation; the medicament being released into the diluent by a simple manipulation of the syringe unit. The resultant solution is thus prepared in a quick and ready manner for use and without any possible exposure to contamination. Such syringe unit is especially adapted for use with those medicaments which are required to be or are preferably placed in solution only shortly before use.

Another important object of the invention is to provide a syringe unit, as above, which includes a collapsible body containing the diluent and a cup on the body containing the dry but soluble medicament; there being a rupturable membrane between the cup and body and the cup opening into communication with the body upon rupture of said membrane caused by forceful, manual collapse of the body.

An additional important object of the invention is to provide a syringe unit which includes a collapsible body of substantially cylindrical, bellows-type form, and a protective substantially cylindrical, open-bottom case in which the bellows-type body is enclosed; the body having a plunger at the bottom, and the case having inside diameters such that the plunger is desirably radially free when in its initial and lowermost position but closely slidably guided in the case when pushed upwardly during use of the syringe unit.

A further object of the invention is to provide a syringe unit which is designed for ease and economy of manufacture.

A still further object of the invention is to provide a practical, reliable, and durable syringe unit and one which is exceedingly effective for the purpose for which it is designed.

These objects are accomplished by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings:

FIG. 1 is a front elevation of the syringe unit, with the double-ended needle shown in position for attachment to said unit.

FIG. 2 is a sectional elevation of the syringe unit; the view being taken on line 2—2 of FIG. 1.

FIG. 3 is a rear elevation of the syringe unit.

FIG. 4 is a bottom plan of the same.

Referring now more particularly to the drawings and to the characters of reference marked thereon, the syringe unit comprises a vertically elongated, cylindrical case **1** having a top **2**; such case being full open at the bottom as shown.

At the front, the case **1** is formed with a longitudinal notch **3** open at its lower end to the bottom of the case; such notch **3** terminating adjacent but short of the top **2** of said case **1**. At the back of the case **1** is provided with a somewhat elongated slot **4**. The notch **3** and slot **4** are for the purpose of permitting finger access into case **1** as will hereinafter appear.

A vertically elongated, collapsible body **5** of cylindrical, bellows-type form is disposed within the confines of case **1**; the body **5** including a top **6** permanently sealed to the underside of the top **2** of case **1**.

An internally threaded neck **7** is mounted centrally on and opens through the top **2**; the throat **8** of the neck being closed at its inner end by a puncturable membrane **9**. For transport or shelf storage, the syringe unit is provided with a removable screw plug **10** threaded into the neck **7** from its outer end.

The bellows-type body **5**, before use of the syringe unit, is fully expanded and is then of a length somewhat less than the case **1**; the bottom **11** of said body **5** being permanently sealed to the topside of a circular plunger **12** having a depending annular skirt **13**. The plunger **12** and skirt **13** form, in effect, a piston-like member on the lower end of the bellows-type body **5** and which member is disposed wholly within the case.

At the front, the skirt **13** has a downwardly opening, substantially semi-circular finger notch **14** therein which is symmetrical to and registers in the main with the vertically elongated notch **3** in case **1**.

The circular plunger **12** is formed with a central, depending cup **15** closed at the top by a rupturable membrane **16** which—until ruptured—prevents communication and provides a seal between said cup **15** and the interior of the bellows-type body **5**.

As the cup **15** depends from the plunger **12**, such cup serves as a central push button adapted for engagement from below by a finger projected laterally into the syringe unit through the notches **3** and **14**.

The cup **15** contains a quantity of a dry but soluble medicament **17** which does not quite fill the cup and so that, as shown, a small void remains below the rupturable membrane **16**. The bellows-type body **5** is filled with a sterile diluent which remains separate from the medicament **17** as long as membrane **16** is unruptured.

When the syringe unit is in its manufactured or initial condition, with the cup **15** holding the medicament **17** and the bellows-type body **5** filled with a sterile diluent, said body is fully expanded and the skirted plunger **12** occupies a position in the lower portion of the cylindrical case **1**. Such lower portion of the case has a bore **18** whose inside diameter is greater than the outside diameter of said skirted plunger **12**; the bore **18** extending to a point above said plunger. Consequently, the bellows-type body **5** can freely expand (due to temperature or atmospheric variation) and without the skirted plunger binding in the case. This is an important feature as it prevents accidental rupturing of membrane **16** by undue pressure increase in the body **5**.

Above the lower portion of the case, the bore **19** thereof is reduced in diameter to an extent sufficient to receive the skirted plunger **12** in close but relatively slidable, guided relation.

The above described syringe unit is used in the following manner:

With the syringe unit in hand, one finger is extended through the notches **3** and **14** and into engagement with the bottom of cup **15**; the latter then being forcefully pressed upward. This rapidly increases the pressure in the bellows-type body **5** whereupon the membrane **16** ruptures, the diluent gains access to cup **15** and the medicament **17** therein, and by then shaking the syringe unit the medicament passes into solution in the diluent and is ready for hypodermic injection.

Such injection of the solution is accomplished by removing the screw plug **10** and replacing it with the screw plug **20** of a double-ended hypodermic needle **21** of standard type. As the screw plug **20** is threaded into neck **7**, the inner end portion of needle **21** punctures the membrane **9** and passes into the upper part of the bellows-type body **5**. Thereafter, with the outer end portion of needle **21** medically inserted, the skirted plunger **12** is pressed into the guiding bore **19** of the case and slowly advanced by finger pressure against the bottom of cup **15**; the finger —as before—extending through notches **3** and **14**. As the plunger is so advanced, the bellows-type body **5** is shortened and the solution therein is fed through the needle **21** in a measured quantity indicated by a scale **22** marked exteriorly on case **1** adjacent the vertically elongated notch **3**, and on which scale the plunger reads.

Under certain conditions, it is necessary to partially expand or lengthen the bellows-type body **5** after the skirted plunger **12** has been advanced. This is done by placing fingers through both the front notch **3** and rear slot **4**, and then engaging and applying a light force to the bellows-type body **5** in a direction to expand or lengthen it.

The pre-filled syringe unit of the present invention is quick to use (important in an emergency), wholly avoids the necessity of filling the syringe at the time of use, and assures of a sterile solution for injection.

From the foregoing description, it will be readily seen that there has been produced such a syringe unit as substantially fulfills the objects of the invention, as set forth herein.

While this specification sets forth in detail the present and preferred construction of the syringe unit, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

Having thus described the invention, the following is claimed as new and useful and upon which Letters Patent is desired:

1. A syringe unit comprising a cylindrical case having a top, a cylindrical bellows-type body disposed in the case, the upper end of the bellows-type body being secured in sealed relation to the top of the case, means on the top of the case adapted to receive and support a hypodermic needle in communication with the interior of the bellows-type body, a plunger on the lower end of the bellows-type body, the case being formed to provide finger access to said plunger, a cup formed in the plunger and facing into the bellows-type body, and a pressure rupturable membrane closing the cup against communication with the interior of said body; the cup containing a soluble medicament, and the bellows-type body being filled with a diluent.

2. A syringe unit, as in claim **1**, in which the cup depends from the plunger to provide a push button, the plunger being skirted, there being a finger notch in the skirt, and an elongated finger notch in the case; such notches being in register.

3. A syringe unit, as in claim **1**, in which the lower portion of the bore of the case is of greater inside diameter than the diameter of the plunger, the plunger initially being disposed in said lower portion of the bore of the case, and the upper portion of the bore of the case being of a diameter to receive the plunger in close but relatively slidable, guided relation.

4. A syringe unit, as in claim **1**, in which the case is formed with an elongated finger notch, the plunger being visible and accessible through such finger notch, and scale markings lengthwise on the case adjacent the finger notch.

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