July 9, 1957 V. C. HALL 2,798,488

SYRINGE UNIT

Filed Sept. 15, 1954 2 Sheets-Sheet 1

Fig. 1.

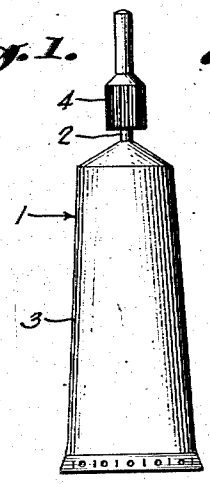


Fig. 2.

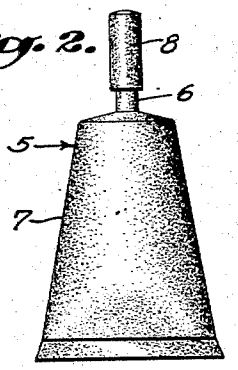
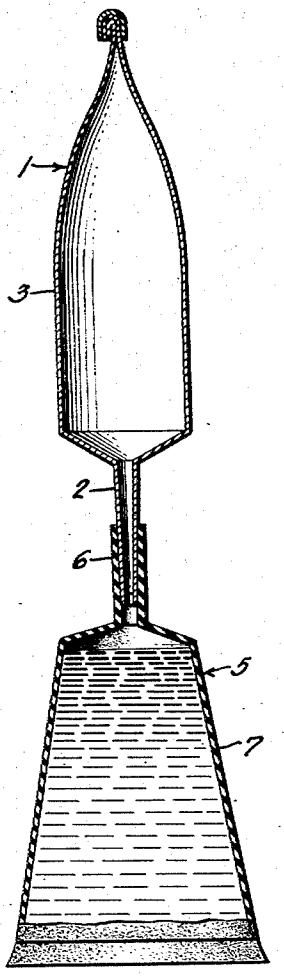


Fig. 5.



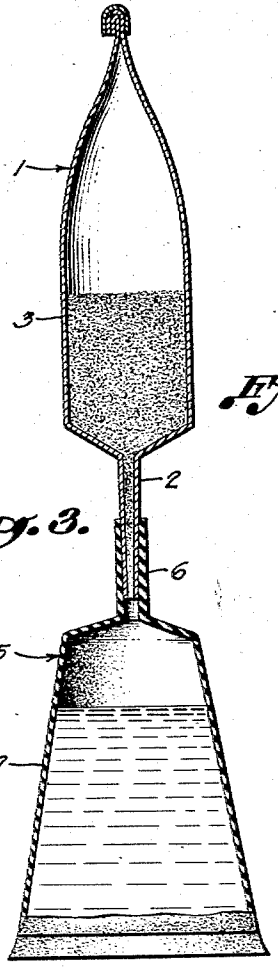


Fig. 3.

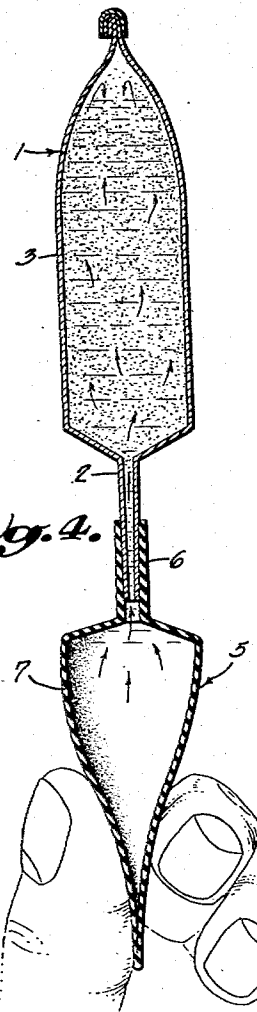


Fig. 4.

INVENTOR

VICTOR C. HALL

BY Raymond Underwood

ATTORNEY

July 9, 1957 V. C. HALL 2,798,488

SYRINGE UNIT

Filed Sept. 15, 1954 2 Sheets-Sheet 2

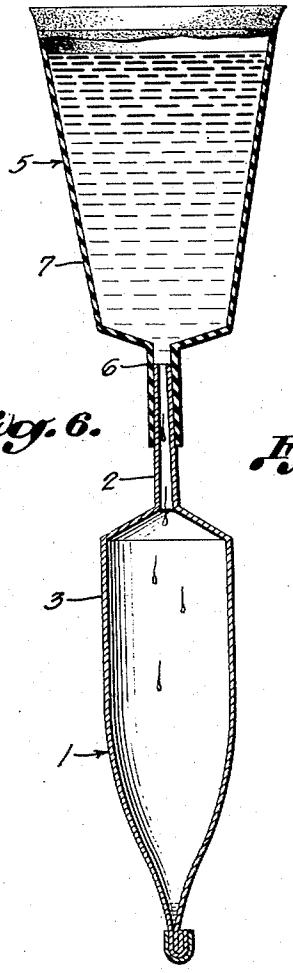


Fig. 6.

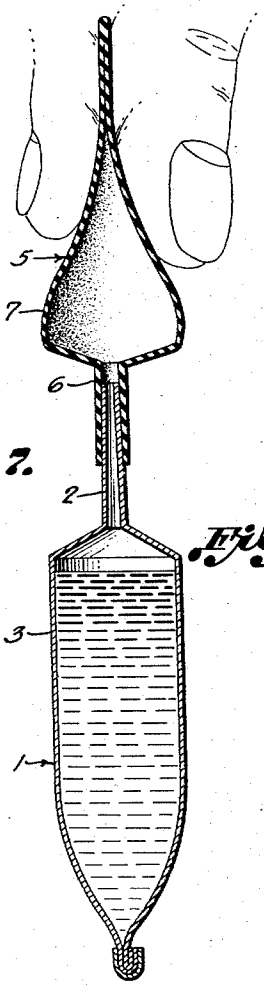


Fig. 7.

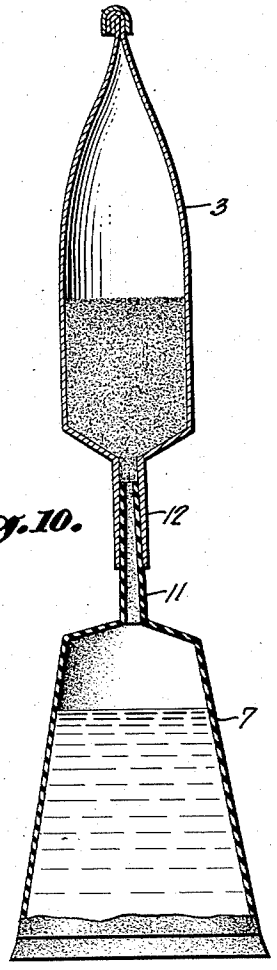


Fig. 10.

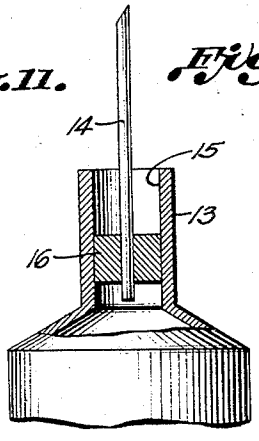


Fig. 11.

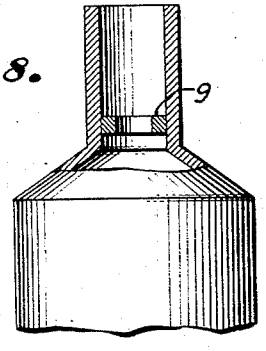


Fig. 8.

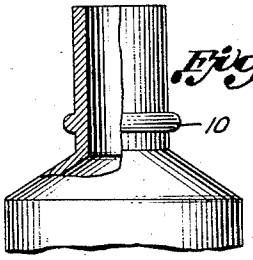


Fig. 9.

INVENTOR
VICTOR C. HALL

BY Raymond Underwood

ATTORNEY

United States Patent Office 2,798,488 Patented July 9, 1957

2,798,488

SYRINGE UNIT

Victor C. Hall, Media, Pa., assignor to Merck & Co., Inc., Rahway, N. J., a corporation of New Jersey

Application September 15, 1954, Serial No. 456,123

4 Claims. (Cl. 128—232)

This invention relates to syringes and more particularly to a syringe unit for internal mixing of the contained ingredients. More specifically it relates to a syringe unit comprising applicator and mixing containers for segregated ingredients of therapeutic or other preparations.

It is often desirable, when packaging therapeutic compositions, to segregate the ingredients to prevent deterioration or other undesirable reactions occurring during storage. At the time of use, these ingredients have to be combined for joint administration. At present there is no convenient or satisfactory device for accomplishing this desired packaging and intermixing.

It is known to employ multiple compartment containers in an attempt to segregate ingredients of a therapeutic composition but there is no particularly desirable nor particularly suitable structure for assuring that there will be no admixing of ingredients during the storage period. For example, it is difficult, if not impossible, to provide a membrane between the ingredients that is both readily rupturable when it is desired to mix the ingredients and at the same time absolutely impervious to the passage of ingredients on one side of the membrane to the other during storage. Displaceable stoppers have this same objection. This is especially true if water or other solvent is segregated from other liquids or solid (dry) medicaments, for example, antibiotics.

It is also known to segregate ingredients of therapeutic compositions by replacing one or more components in one glass receptacle and the remainder in a separate glass receptacle. This device also is not entirely suitable because if it is necessary to draw the liquid ingredients out of one container and then inject it into the other, contamination can readily occur. If, on the other hand the liquid ingredient in one container is to drain into the second container then it is often necessary to have the liquid under gas or air pressure and, again, it is possible, when breaking the seal, to either contaminate the ingredients or allow the gas to escape before the liquid is forced into the second container. Further, in glass devices of this type it is difficult to assure thorough mixing of the ingredients. In addition, when glass or other non-resilient containers are employed it is necessary to administer the ingredients by means of a hypodermic needle.

The present invention provides simple and relatively inexpensive disposable syringes, hereinafter referred to as a syringe unit, in which the ingredients or components of a medicinal or therapeutic solution or suspension are separately maintained under sterile conditions with means for thoroughly admixing them just prior to use and then ejecting the freshly made solution or suspension through the nozzle of one of the syringes.

A particular feature of this invention resides in a syringe unit comprising two receptacles or containers, one of which contains a solvent or a liquid medium and the other of which contains a solid, powdered or crystalline material which is to be dissolved or suspended in the solvent or liquid medium.

A preferred embodiment of the invention involves two separate containers each provided with a hollow body portion and a nozzle, the nozzles being so relatively proportioned that the nozzle of one container can be inserted within the passageway of the other nozzle to form an air-tight and a moisture-tight seal and provide a passageway between the interior of each container. Preferably, one syringe has a collapsible body portion and a relatively rigid nozzle member and will contain the solid, powdered or crystalline component or components of the ultimate solution or suspension, and the second syringe has a resilient body portion and a relatively rigid nozzle member and will contain the solvent or liquid medium.

Further details of the invention will in part be obvious and will in part be more particularly described hereinafter in the accompanying drawings:

Figure I is a side elevation of the collapsible container and

Figure II is a side elevation of the resilient container;

Figure III is a longitudinal sectional view through the two assembled containers of Figures I and II as they appear to form the syringe unit;

Figure IV is similar to Figure III but shows the resilient container compressed to force its contained liquid ingredient into the interior of the collapsible container;

Figure V is similar to Figure III but shows the contained material having been returned to the interior of the resilient container;

Figure VI is a longitudinal sectional view showing the position of the parts when it is desired to return all of the mixture from the resilient container into the interior of the collapsible container preparatory to administration.

Figure VII is similar to Figure VI showing all of the medicament expressed out of the resilient container and into the interior of the collapsible container;

Figure VIII is a longitudinal sectional view through a modified container showing an internal flange on the nozzle providing a shoulder against which the end of the nozzle of the other container seats.

Figure IX is a combined longitudinal sectional view and an elevational view of another modification, wherein a flange is incorporated on the outer surface of the nozzle and against which the end of the nozzle of the other container comes to rest.

Figure X illustrates a further modified type of syringe unit wherein the nozzles are in a reversed relationship as compared with that illustrated in Figure III.

Figure XI illustrates a still further modified type of syringe unit equipped with a hypodermic needle.

By reference to the drawings, it will be observed that the new syringe unit of this invention comprises two syringes, one a collapsible container, 1, and the other a resilient container, 5. The collapsible container, 1, includes a substantially rigid nozzle, 2, having a passageway therethrough and a relatively larger collapsible hollow body portion, 3. The container, 1, is of any of the suitable or usual materials used to make collapsible containers such as tin, tin coated lead, aluminum or plastic. The term collapsible container used in the specification and claims means a container that remains permanently deformed once pressure has been applied to its opposite walls forcing them to move toward each other. In accordance with known practice, this container has sealed within it the solid, powdered or crystalline ingredient or ingredients of the composition to be prepared.

The sealing means for the collapsible container can be a removable cap 4 which engages the outside surface of

to the nozzle by conventional means. Other suitable sealing means can be a plug or stopper which fits within the nozzle passageway.

The resilient container **5** includes a substantially rigid nozzle **6** having a passageway therethrough, and a relatively larger resilient hollow body portion **7**. The container **5** is of any suitable or usual material employed in making containers having a resilient body portion which is self-restoring to its open hollow interior formation after pressure on its walls is released. For example, the resilient material may be rubber, polyethylene or similar plastic.

In accordance with known practice, this container has sealed within it a sufficient quantity of solvent or liquid medium of the composition ultimately to be prepared to completely fill the body portion of the container.

The sealing means of this container can be a removable cap **8** which engages the outside surface of the nozzle by conventional means. Other suitable sealing means such as an internal stopper or plug can be employed.

As an important feature of the invention the outside of the one nozzle closely fits within the passageway of the other nozzle to form an air-tight, liquid-tight seal. This is best obtained if one of the nozzles has a reversibly tapered wall so that the other nozzle will come into frictional engagement with the narrow inner portion of the tapered wall when the insertion is complete, as shown in Figure III. Alternately this can be accomplished if the contacting surfaces are complementarily tapered so that insertion is facilitated and they come to a continuous frictional engagement when the insertion is completed.

Reverting to the collapsible container **1**, the volume of material therein must be smaller than the total available volume of the container **1** to provide adequate space to accommodate all of the solvent or liquid medium contained in the resilient container **5**. The amount of air normally occupying the remaining space in the container **1** after the solid material has been filled into it exerts a pressure upon the solution or suspension formed in the collapsible container **1** when the ingredients are mixed as described below and assists in returning the composition to the resilient container **5** when pressure on the walls of the latter is released during the mixing operation. Because of the thin fill, or small volume of solid material, in the collapsible container **1**, the capacity of the container can expand to a slight degree when the solvent or liquid medium is forced into it from the resilient container.

According to a preferred embodiment of this invention, container **1** holds the solid ingredient or ingredients which is or are to be dissolved or suspended in the solvent or liquid medium in container **5**, and while this may be any suitable or desired medicinal, chemical or other solid material, it is advantageously in the present instance a finely powdered medicinal. The amount of solid material preferably is such that with the solvent or liquid material in container **5** a predetermined dosage having a desired volume and potency will be formed just prior to use, but it may, of course, be sufficient in amount for multiple single doses.

The nozzles advantageously are constructed in such a way that the nozzle having the smaller diameter will not penetrate beyond the point where the nozzle having the larger diameter merges with or joins the body portion of its container. This can be accomplished by accurately proportioning the tapered meeting surfaces. Or the nozzle of smaller cross-section can be of shorter length than the nozzle with the larger passageway. Alternately the nozzle with the larger passageway can be provided with a shoulder **9** on its inner surface displaced outwardly from the jointure between the nozzle and body portions as shown in Figure VIII. Or, the nozzle of smaller cross-section can be provided with a shoulder **10** on its outer surface displaced outwardly from the jointure between the nozzle and body portions of its container as shown in Figure IX.

The nozzle of each container can be of any desired cross-section provided that the inside diameter of one is not greater than the outside diameter of the other so that when the smaller nozzle is inserted into the larger one an air-tight and moisture-tight seal is formed. This is preferably accomplished by tapering the nozzle having the larger bore inwardly so that the inner diameter decreases from the tip of the nozzle toward the jointure of the nozzle to the body portion of the container, Figure II. The length and diameter of each nozzle also can vary depending upon how the syringe will ultimately be used. For example, if the syringe is to be used to instill a medicament into the udder of a cow, the discharge nozzle should have a diameter and length adapted to fit into the teat canal. Figure III illustrates one type of syringe unit wherein the nozzle **2** of the collapsible container is longer than the nozzle **6** of the resilient container and wherein the inside diameter of nozzle **6** is not greater than the outside diameter of nozzle **2**. Another suitable syringe unit is illustrated by Figure X wherein the nozzle **11** of the resilient container is longer than nozzle **12** of the collapsible container and the inside diameter of nozzle **12** is not greater than the outside diameter of nozzle **11**.

In using the syringe unit of the invention, the solid and liquid ingredients are mixed by removing the caps from containers **1** and **5** and then manually inserting the nozzle having the smaller outside diameter into the passageway of the other nozzle to form an air-tight and moisture-tight seal. This provides a communicating passageway between the hollow interiors of the two containers, as shown in Figures III and X.

When the containers **1** and **5** have been so brought into communicable relation with one another, the ingredients are mixed by compressing the resilient body portion of the solvent container thus forcing the solvent into the hollow interior of the collapsible container. This results in bathing, by syringe action, the entire chamber with the solvent or liquid material thus dissolving or suspending the solid ingredients contained therein in the liquid, for example as shown in Figure IV. Upon releasing the pressure applied to the body portion of the resilient container **5**, the solution drains back or is drawn back into it, Figure V. This operation may be repeated a sufficient number of times to insure thorough mixing or dissolution of all ingredients.

If it is desired to administer the medicament by means of the collapsible container, the solution or suspension is returned to the collapsible container by positioning it below the resilient container and then compressing the walls of the resilient container **5** so as to transfer the medicament to the collapsible container **1** as shown in Figure VII. The medicament can then be administered by withdrawing the resilient container and inserting the nozzle of the collapsible container in the body orifice or in close proximity to the area to be treated and compressing its walls to extrude the preparation contained therein.

If it is desired to employ the resilient container for administration of the medicament, the containers are disengaged following the thorough mixing of the ingredients and the solution or suspension flushed into the body cavity or over the area to be treated by compressing its walls in the same manner employed initially to mix the ingredients of the composition. The medicament can be left in the cavity by withdrawing the nozzle before releasing the pressure on the container, or the medicament can be drained out of the cavity by releasing the pressure on the container before the nozzle is withdrawn.

The nozzle of either container can be an applicator of many different forms and of many different materials. For example, the nozzle of the resilient container optionally can carry a hypodermic needle as shown in Figure XI if it is desired to use this container as an aspirator or as a hypodermic syringe to administer the therapeutic or other preparation after mixing of the ingredients.

As shown by Figure XI, the hollow nozzle **13** carries therein a cannula **14** and the cannula can be held in

place in any conventional manner. Thus it can be supported in the bore **15** by means of a support body **16**. The support body **16** is frictionally mounted in the bore **15** or it can be an integral part of the nozzle wall. The cannula **14** can be straight or it can be curved at its portion within the support body **16** to more firmly hold it in place.

The cannula **14** may be carried by either the collapsible container or the resilient container. In either event, the nozzle of that container coacts with the nozzle of the other container to form an air-tight and moisture-tight seal in the same manner that has already been described.

While the syringe unit of this invention has been particularly described as comprising a collapsible container and a resilient container, it is to be understood that it is not essential that a collapsible container always be used in combination with the resilient container. Another resilient container can be substituted for the collapsible container or a substantially rigid container may be used in combination with the resilient container. It is only necessary that at least one of the containers of the syringe unit be resilient.

Also, while the syringe unit has been described as being particularly suitable for the mixing and administration of therapeutic compositions the unit is adaptable for use in mixing and administering other compositions, such as insecticides, where it is desired to keep the ingredients of the ultimate composition segregated until just prior to use. The ingredients to be segregated need not necessarily be of the dry and liquid varieties, as it may be desirable to keep two incompatible liquids, semi-liquids or semi-solids or any combination of ingredients in separate containers for mixture just prior to use, and the syringe unit of this invention can be employed for preparing compositions wherein segregated ingredients of these types are admixed.

What is claimed is:

1. A syringe unit comprising a collapsible container

having a substantially rigid nozzle portion and a resilient container having a substantially rigid nozzle portion, the outside of one nozzle and the inside of the other nozzle having smooth cooperating bearing surfaces which frictionally engage upon direct axial movement of the nozzles toward each other to form an air-tight and moisture-tight seal and provide a communicating passageway between the hollow interiors of the containers, one of them being squeezable to eject the contents when separated from the other container.

2. A syringe unit as claimed in claim 1 wherein the inside diameter of the nozzle of the resilient container is not greater than the outside diameter of the nozzle of the collapsible container.

3. A syringe unit as claimed in claim 1 wherein the nozzle of the one container has an outside tapered formation which fits with a sealing engagement into the inside tapered passageway of the other nozzle.

4. A syringe unit comprising a metal collapsible container having a substantially rigid nozzle portion and a plastic resilient container having a substantially rigid nozzle portion, the outside of one nozzle and the inside of the other nozzle having smooth cooperating bearing surfaces which frictionally engage upon direct axial movement of the nozzles toward each other to form an air-tight and moisture-tight seal and provide a communicating passageway between the hollow interiors of the containers.

References Cited in the file of this patent

UNITED STATES PATENTS

2,654,948 Rubin ---------- Oct. 13, 1953

FOREIGN PATENTS

443,274 Great Britain ---------- Feb. 25, 1936