Oct. 15, 1968 R. L. PIERICK 3,405,712

DESICCATIVE SYRINGE

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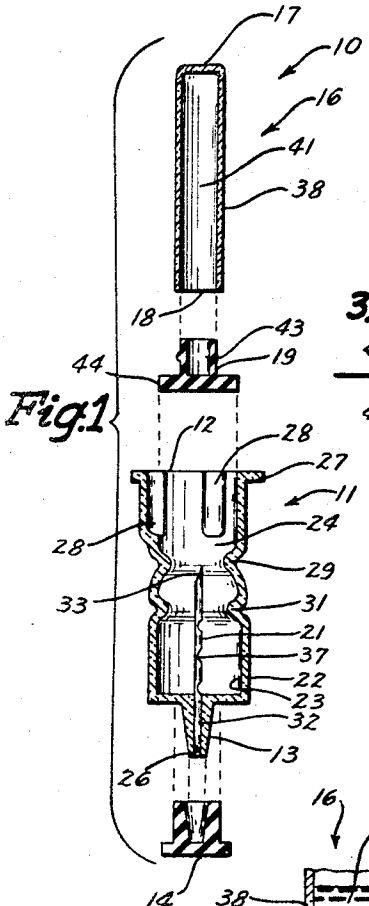



Fig. 1

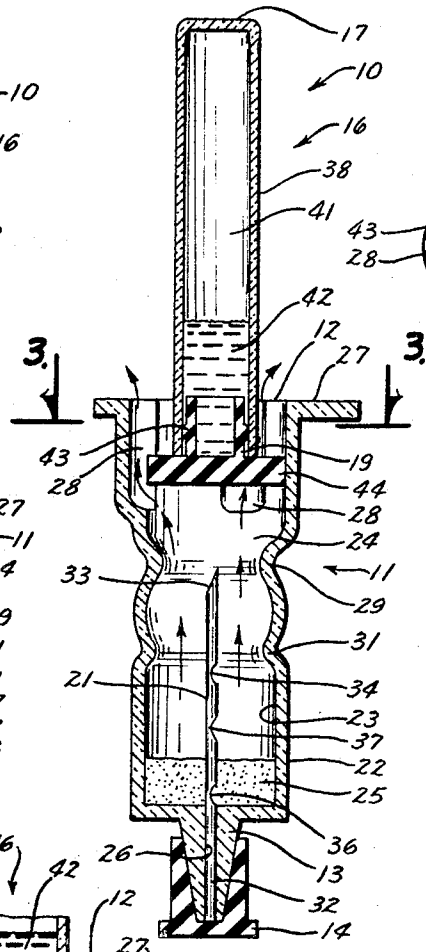



Fig. 2

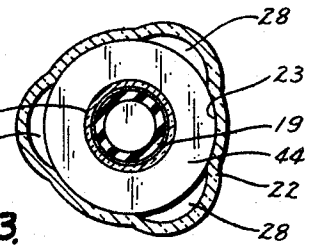



Fig. 3

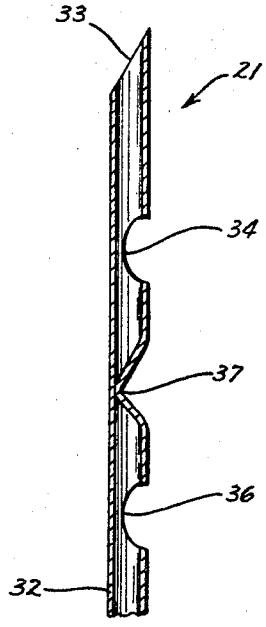



Fig. 4

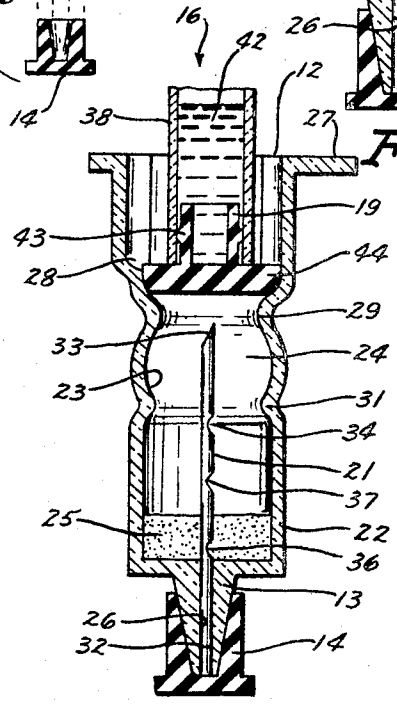



Fig. 5

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DESICCATIVE SYRINGE

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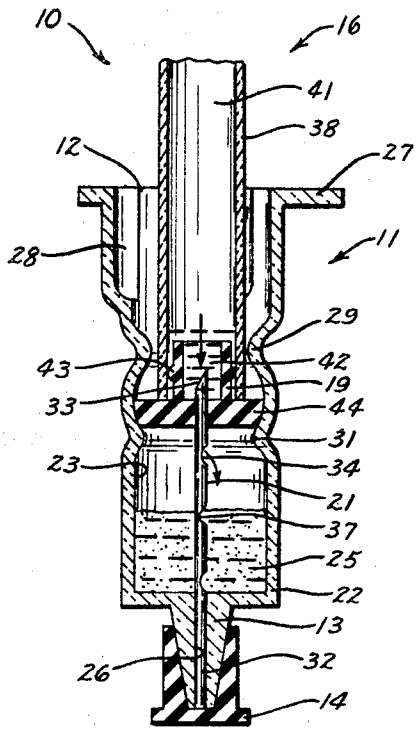



Fig. 6

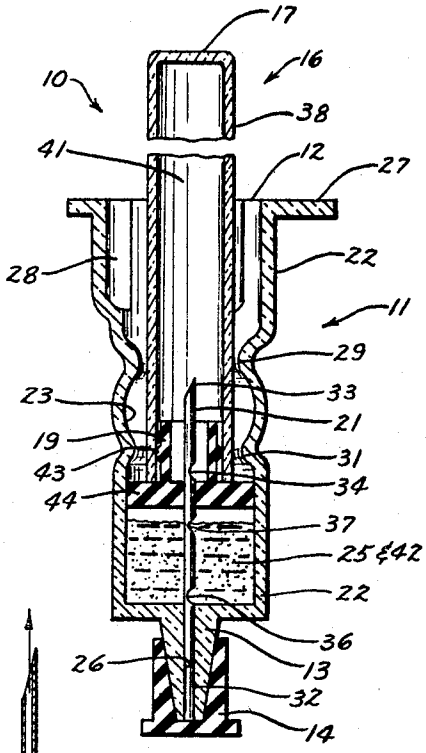



Fig. 7

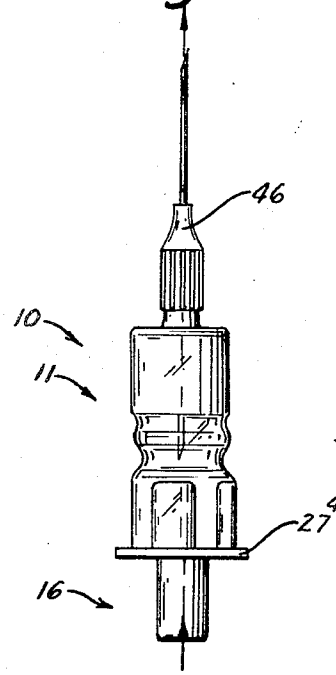



Fig. 9

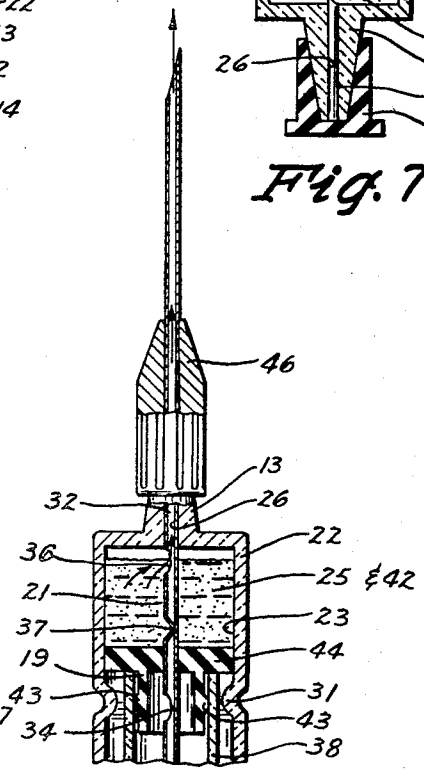



Fig. 8

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3,405,712

# DESICCATIVE SYRINGE

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3 Claims. (Cl. 128—218)

## ABSTRACT OF THE DISCLOSURE

The invention is embodied in a single device usable both as a desiccator for a powdered medicament, and as a transporter of the powdered medicament under vacuum in conjunction with a liquid medicament physically separated therefrom, until at the point of use the device is operable to mix the medicaments prior to ejection therefrom by means of a hypodermic needle affixed thereto. The arrangement includes forming one end of the powdered medicament-holding casing with at least one flute formed on its interior, which flute enables an evacuation of moisture from the powdered medicament held within the interior of the casing, past a portion of a tube inserted into the casing prior to the desiccation process, which tube holds the liquid medicament. At the end of the desiccation process, the tube is forced past the flute and further into the casing such that the relative positions of the tube and the casing effect a sealing relationship between the powdered medicament, now under a vacuum, and the liquid medicament. At the point of use, due to the provision of a cannula tube held within the casing, and which tube has a trio of longitudinally spaced portions formed therein, one of which is at the pointed end of the tube, and the other two of which are not in fluid communication within the tube, coaction between the tube and the casing effects first a mixing of the medicaments together, and secondly an ejection therefrom, said ejection being transmitted by a hypodermic-type needle which has been affixed to the casing.

This invention relates to a syringe, and more particularly to a syringe which is suitable to be placed in a desiccator, wherein the diluent is initially sealed in one element of the syringe and the pharmaceutical, or biological, to be desiccated is initially contained in another separate element of the syringe. The elements of the syringe are manipulatable to accomplish admixture of the diluent and the pharmaceutical, and then are operable as a piston and cylinder means to eject the resulting mixture in the hypodermic administration thereof.

The general known practice is to place the diluent in one sealed bottle and the desiccated pharmaceutical in a second bottle for shipment to the place of use. The diluent is then removed from the bottle by a syringe wherein a hypodermic needle attached thereto is forced through the seal and the diluent is drawn into the syringe. The seal of the pharmaceutical bottle is then punctured by the hypodermic needle and the diluent is then ejected therein. The diluent and desiccated pharmaceutical are thoroughly mixed and again the hypodermic needle is forced into the bottle to withdraw the mixture prior to injection into the patient.

It is well known that it is extremely difficult if not impossible to meet the sanitary requirements necessary in the hypodermic administration of a desiccated pharmaceutical when the diluent is added at the time of use and then the mixture must be placed in a syringe for administration thereof.

An object of this invention is to provide a multi-compartment syringe, wherein each compartment contains one component of a charge, which can be placed in a desiccator for desiccation of one of the components, shipped, and then used as a syringe without structural change.



Another object of the invention is the provision of a syringe of a two part, two compartment, telescopically arranged structure, wherein absolutely perfect sanitation is provided, no contamination of one component of a charge with another component being possible.

A further object of this invention is to provide a multi-compartment syringe, wherein the desiccated product occupies one compartment and the diluent occupies another, and both compartments can be shipped together as a unit.

Yet another object of this invention is to provide a syringe carrying two components of a charge in separated compartments, which is constructed for placement in a conventional desiccator chamber, and manipulatable to effect a mixing immediately prior to use of the components.

A still further object of this invention is the provision of a syringe employing only a casing for containing one component of a charge to be ejected by a syringe, and a plunger slidable into the casing, and with the plunger containing another component of a charge, and wherein the casing and the plunger are operable in one position to effect a condition suitable for the desiccation of the first component with the second component in a sealed condition, operable in a second position to effect a transportation condition with both components sealed off, operable in a third position to provide a mixing condition where the components are mixed together within the casing, and operable in a fourth position wherein the casing assumes the function of a cylinder and the plunger assumes the function of a piston to eject the mixed charge from the casing.

Another object of this invention is the provision of a syringe particularly constructed for use in a desiccator wherein the shelves of the latter are moved relative to each other, the syringe operable to permit desiccation of a pharmaceutical carried therein, and responsive to the operation of the desiccator to seal the desiccated pharmaceutical for future ejection by the syringe itself without other attachments, except for a conventional hypodermic needle.

It is another object of this invention to provide a syringe capable of attaining the above designated objectives, which is economical to manufacture, simple and rugged in construction, and effective in use.

These objects and other features and advantages of this invention will be readily apparent according to the following description when taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is an exploded, sectional view of the elements of the syringe of this invention taken along the longitudinal axis of the syringe;

FIG. 2 is an enlarged, sectional view of the syringe, showing the parts thereof in a desiccation position, with a pair of components to make up an injection charge shown in separated compartments;

FIG. 3 is a sectional view taken along the line 3—3 in FIG. 2;

FIG. 4 is a greatly enlarged, fragmentary sectional view of the tube taken along the longitudinal axis thereof;

FIG. 5 is an enlarged, fragmentary sectional view similar to FIG. 2, wherein the plunger part of the syringe is shown in a transportation position;

FIG. 6 is an enlarged, fragmentary sectional view similar to FIG. 2, and showing the parts in a third position permitting thereby the components to be mixed;

FIG. 7 is an enlarged, fragmentary sectional view similar to FIG. 6, wherein the plunger part of the syringe is shown in a fourth position wherein the components are mixed and sealed in the casing;

FIG. 8 is a greatly enlarged, fragmentary sectional

view, wherein the syringe has been rotated to a position immediately prior to use with a hypodermic needle unit attached to the exposed end of the casing; and

FIG. 9 is a plan view of the syringe with a hypodermic needle attached.

Referring now to the drawings, a preferred embodiment of the syringe of this invention is indicated generally at **10** in FIGS. 1 and 2. The syringe comprises basically a casing **11** having an open top end **12**, and a nozzle-type bottom end **13** normally closed by a cap **14**. A tubular plunger **16** is provided for axial, reciprocable insertion into the casing **11**, having a closed upper end **17** and an open lower end **18** normally sealed by a knob **19**. A tube **21** is mounted in the casing **11** on the longitudinal axis thereof.

More specifically, the casing **11** comprises an elongated cylindrical body **22**, the inner wall surface **23** of which has a substantially constant diameter, forming a substantially cylindrical interior **24**, adapted to contain one component **25** (FIG. 2) of a charge to be ejected by the syringe **10**. A passage **26** is axially formed through the bottom end **13**. An annular end flange **27** is provided at the top end of the casing body **22**. A plurality of arcuately and equally spaced, longitudinally extended flutes **28** are formed in the casing body **22**, as best shown in FIGS. 1 and 3, which are open to the interior **24**.

A first annular flange **29** (FIG. 1), extending into the interior **24**, is formed on the interior wall **23** intermediate the top and bottom ends **12** and **13**, respectively, of the casing **11**. A second annular flange **31** (FIG. 1), extending into the interior **24**, is formed on the interior wall **23** parallel to and spaced a certain distance from the first flange **29** toward the bottom end **13**. The diameters of the flanges **29** and **31** are substantially identical, and are less than the diameter of the body **22**. It will also be noted that the flutes **28** extend from the inner edge of the flange **27** toward but ending intermediate the edge and the closest flange **29**.

The tube **21** (FIG. 1), having an outer end **32** mounted in the opening **26**, is hollow, with the inner pointed end **33** located longitudinally intermediate the first and second flanges **29** and **31**. Two longitudinally spaced cut-outs **34** and **36** (FIG. 4) are formed in the tube **21**, and fluidly communicate thhe interior of the tube **21** with the casing interior **24**. The first cut-out **34** is disposed immediately below the second flange **31**, as best shown in FIG. 2, and the second cut-out **36** is disposed near the bottom end **13**. The interior of the tube **21** is closed by a plug **37** (FIG. 4) or by crimping intermediate the cut-outs **34** and **36**. The outer end **32** extends through the bottom end **13** and fluidity communicates the interior **24** with the atmosphere.

More particularly as to the plunger **16** (FIG. 1) it comprises also a cylindrical body **38**, the outer diameter of which is substantially constant and which is less than the inner diameter of the casing wall **22** and the inner diameter of the flanges **29** and **31**. The cavity **41** formed within the body **38** is adapted to contain a second component of the charge **42** to be ejected by the syringe **10**. In certain instances the upper end **17** should be flat to facilitate the manipulation of the plunger **16**.

The knob **19** (FIG. 1), of a deformable material, has an annular flange **43** formed thereon which has an outer diameter substantially equal to the inner diameter of the body **38**, thus providing an effective seal when the knob **19** is inserted into the body **38**. A flange **44** is integrally formed on the knob **19**, as best shown in FIG. 1, having an outer diameter substantially equal to the inner diameter of the casing wall **22**. This provides that the plunger **16** slides tightly into the casing **11**, with the flange **44** effecting a seal with the interior surface **23** at any time it engages the wall **22**, except as seen hereinafter.

In operation, the second component **42** of the charge, generally a diluent such as distilled water, is placed in the plunger **16** and the knob **19** is inserted therein, thus sealing the diluent in the plunger **16**. The first component **25** of the charge, a pharmaceutical, is placed in the casing **11** with the cap **14** closing the bottom end thereof, and the plunger is inserted, with the flange **44** of the knob **19** disposed intermediate the longitudinal axis of the flutes **28**, as best shown in FIG. 2.

In the condition of FIG. 2, the syringe **10** is then placed in a desiccator in a vertical position with the cap **14** at the bottom, and the pharmaceutical is desiccated. The moisture extracted from the pharmaceutical will be drawn off and out of the casing interior **24** through the flutes **28**, as shown by the arrows in FIG. 2.

Upon completion of the desiccation cycle, the plunger **16** is pressed down by the desiccator shelf or other structure until the flange **44** seats against the first flange **29**, as best shown in FIG. 5. The syringe **10** (FIG. 5) is thereby automatically, in response to operation of the sandwich, shelf-type desiccator, placed in its transportation position. The two components **25** and **42** are separated, one in the casing **11** and the other in the plunger **16**, by the sealed nature of the flanges **43** and **44**. The frictional engagement of the flange **44** with the casing wall **22** is sufficiently tight such that ordinary transportation jarring of the syringe **10** in the FIG. 5 condition would not cause relative movement of the casing **11** and the plunger **16**. Further, the shipping container itself could be molded to fit the parts of the syringe in their FIG. 5 position to aid in preventing the relative movement.

At the point of use, the syringe **10** is grasped in the normal manner with the fingers below the flange **27** of the casing **11**, and with the thumb against the upper end **17** of the plunger. The plunger **16** is moved into the casing **11**, effecting actually a relative movement of both parts, It may be necessary to supply a slight twisting motion of the plunger **16** to enable the flange **44** of the knob **19** to pass the first flange **29** of the casing **11**.

Axial movement of the plunger **16** relative to the casing **11** is continued until the flange **44** seats against the second flange **31** of the casing **11**, as best shown in FIG. 5, whereby the pointed end **33** of the tube **21** pierces the center of the knob **19** and the flange **44** is disposed intermediate the tube's pointed end **33** and the first cut-out **34**. The diluent **42** is then immediately sucked into the casing interior **24** by the vacuum in the interior **24** created by the desiccation process, whereupon it mixes with the pharmaceutical **25**. This flow is indicated by the arrows in FIG. 6, wherein the diluent flows from the cavity **41** outwardly through the tube **21** from the pointed end **33** and out through the first cut-out **34** into the casing interior **24**. At the same time that the diluent flows into the casing interior **24**, the air in the plunger cavity **41** is also sucked into the casing interior **24** so as to equalize the air pressure within the two cavities.

Continued axial movement of the plunger **16** relative to the casing **11**, with possibly a slight twisting, if necessary, brings the parts to another relative position best illustrated in FIG. 7. The flange **44** has passed the second flange **31** of the casing and is positioned intermediate the first cut-out **34** and the second cut-out **36** of the tube **21**. The resulting mixture is then shaken to make certain that all of the pharmaceutical **25** is dissolved. It should be noted that one using the syringe may easily see these various elements. The air entrapped with the casing **24** will flow out through the first cut-out **34** and into the plunger cavity **41** until the flange **44** passes downwardly past the cut-out **34**, thus easing the axial movement of the plunger **16** into the casing **11**. With the flange **44** disposed between the mixture and the cut-out **34**, and due to the crimp **37**, the two components **25** and **42** are now prevented from leaking or being forced from the casing interior **24** to the plunger cavity **41** via the tube **21**.

The syringe **10** is then turned upside down, or turned to a position 180° from that of FIGS. 1–7, whereby the charge rests against the knob **19** (FIG. 8) by gravity. In this position of the syringe **10**, the cap **14** can be removed and a hypodermic needle unit **46** substituted therefor.

The syringe **10** is now ready for use. The plunger **16** is then inserted further into the casing **11** to effect an egress of the charge contained therein through the needle unit **46**.

Although a preferred embodiment of this invention has been described and disclosed hereinbefore, it is to be remembered that various modifications and alternate constructions can be made thereto without departing from the true spirit and scope of the invention as defined in the appended claims.

I claim:

**1.** A desiccative syringe comprising in combination:

a casing open at one end and having a cylindrical interior with a constant inner diameter except for having a pair of longitudinally spaced annular flanges formed therein the inner diameters of which are less than said interior diameter, said casing having a plurality of arcuately spaced flutes formed on the interior surface thereof and extending from the edge of said end toward the closest of said flanges;

a tube mounted axially in said casing at an end opposite said one end to communicate said casing interior with the atmosphere, said tube having an inner pointed open end located intermediate said flange closest to said opposite end and having a pair of longitudinally spaced ports formed threin intermediate said open end and said casing opposite end, each port communicating the interior of the tube with said casing interior, and said tube interior closed intermediate said ports;

a hollow plunger closed at one end, open at the other end, and having an outer diameter less than the inner diameter of said casing interior; and

a resilient knob closing said other plunger end and having an annular flange of substantially the same outer diameter as said casing interior inner diameter, said knob insertable into said casing open end in a sealing manner and adapted to be pierced by said tube pointed end, receiving said tube in a sealing manner;

said flange having a thickness less than the axial distance from said tube pointed open end to the port closest thereto, less than the axial distance betwen said ports, less than the axial distance between said tube pointed open end and the flange closest thereto, and less than the axial length of said flutes.

**2.** A desiccative syringe comprising in combination:

a tubular casing closed at one end and open at the other end and having a substantially constant inner diameter, said casing having at least one flute formed on the interior surface thereof, said flute extended from said open end inwardly thereof;

a cannula tube mounted axially in said casing at said closed end and communicating said casing interior with the atmosphere, said tube having a pointed open end, and having a pair of longitudinally spaced ports formed therein between said open end and said casing closed end within said casing interior, said tube interior closed intermediate said ports;

cap means detachably secured to said casing closed end for closing off said tube from the atmosphere; and

a hollow plunger having one end the circumference of which is slightly smaller than said casing inner diameter, said one end frictionally inserted into said casing open end, said plunger one end having a portion thereof of a material pierceable by said tube pointed open end, and the thickness of said portion being less than the axial distance from said tube pointed open end to the port closest thereto, less than the axial distance between said ports, and less than the axial distance of said flute;

said plunger adapted to have a liquid medicament therein, and said casing adapted to have a powdered medicament therein under a vacuum when said tube one end portion is inserted into said casing between said flute and said casing closed end.

**3.** A desiccative syringe as defined in claim **2**, and further wherein said cap means includes a cap engageable with a substantially flat surface for supporting the remainder of the desiccative syringe in an upright position for desiccation purposes.




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