

[54] **SYRINGE FOR INJECTION OF FRESHLY MIXED LIQUID-POWDER**
 [72] Inventor: **Milton J. Cohen**, 7111 Connecticut Ave., Chevy Chase, Md. 20015
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Primary Examiner—Joseph S. Reich
Attorney—McDougall, Hersh, Scott & Ladd

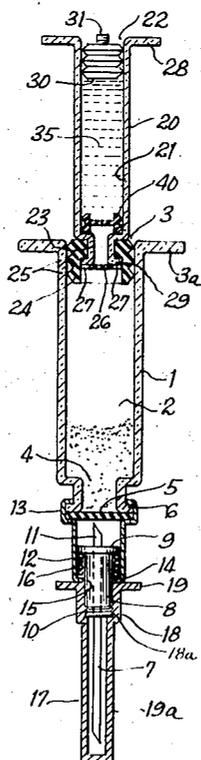
[52] U.S. Cl.128/220, 128/218 M
 [51] Int. Cl.A61m 05/22
 [58] Field of Search...128/218, 215, 218 M, 218 NV, 128/220, 221

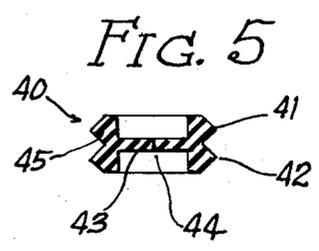
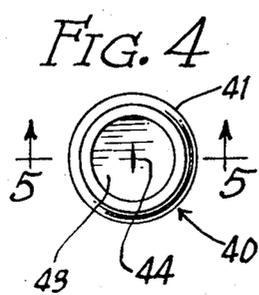
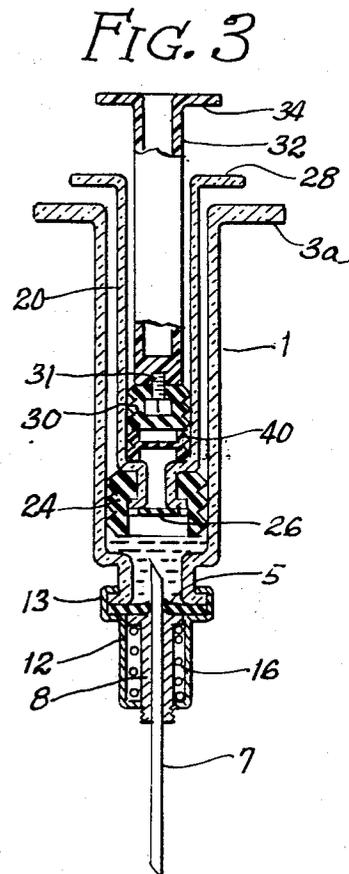
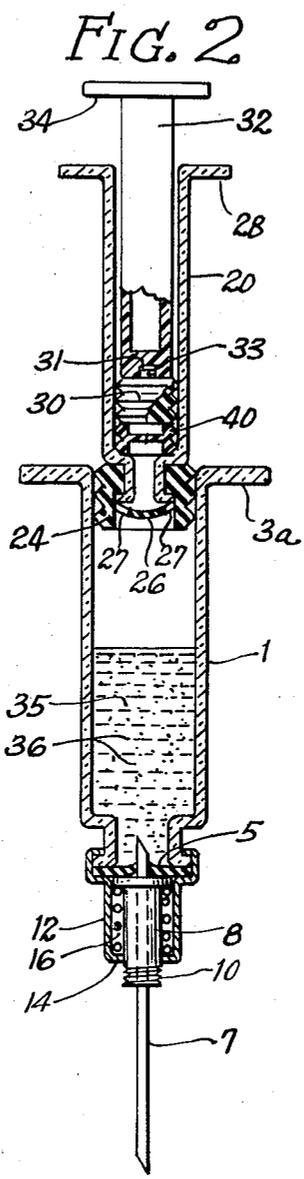
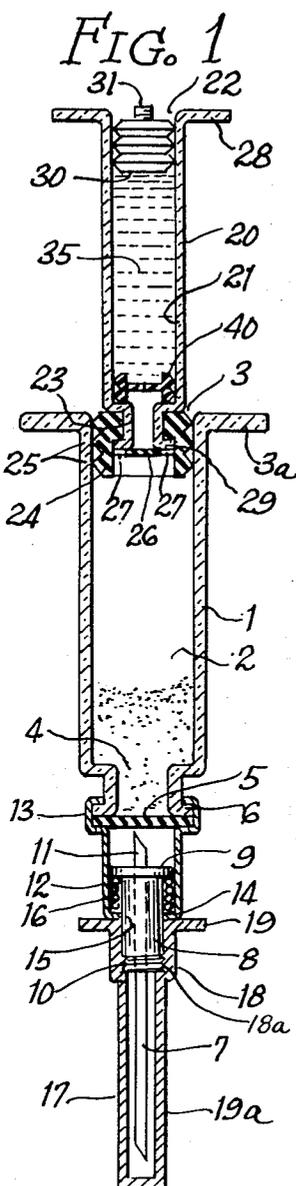
[57] **ABSTRACT**

A syringe formed a rearward tubular member adapted to contain a liquid carrier and a forward tubular member adapted to contain a dry medicant to be taken up with the carrier for injection whereby the materials are freshly mixed immediately prior to injection and wherein the dry medicant and liquid carrier are separately maintained in sealed relation within their respective tubular members until admixed immediately prior to injection, a covered hypodermic needle is mounted onto the forward tubular member in position to penetrate the forward end of that tubular member in response to removal of the needle cup.

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7 Claims, 5 Drawing Figures





INVENTOR
 Milton J. Cohen
 By *McDougal, Herch, Scott
 and Ladd* Attys

SYRINGE FOR INJECTION OF FRESHLY MIXED LIQUID-POWDER

This application is similar in several respects with my application Ser. No. 732,622, filed May 28, 1968, which application has matured into U.S. Pat. No. 3,557,787, on Jan. 26, 1971.

This invention relates to a device for injection of solutions or dispersions of a solid medicant in a liquid carrier and more particularly to a hypodermic syringe adapted to contain dry solids separate and apart from the carrier liquids until, immediately prior to administration, the liquid is caused to flow into the compartment containing the solid material for injection of the solution or mixture formed thereof.

To the present, it has been the practice to make use of stock solutions housed within a container of relatively large capacity, and from which increments can be removed, for administration by a suitable syringe. This procedure is deemed to be unsatisfactory by reason of the fact that most solutions of the type described are of insufficient stability to militate against change before the stock solution or mixture has been used up. With a liquid composition of short "shelf life", utility may become dissipated before complete utilization.

The most effective means for maintaining shelf life over extended periods of time is to maintain complete separation between the liquid carrier and the solid medicant until immediately prior to use. Maintenance of solid-liquid separation until use presents other problems with respect to ejecting and administering the solution or dispersion containing the necessary concentration of ingredients and under the most sanitary conditions. The usual practice is to introduce the solids into the liquid for solution or dispersion in a suitable container from which the solution or dispersion can be taken up by a syringe for injection. This procedure requires the use of at least three separate containers and their maintenance under sterile conditions, as well as accurate measurement of the ingredients.

It is an object of this invention to provide a single device in which accurately measured amounts of solid medicant and liquid carrier can be maintained in a completely separated relation; in which the measured amounts of liquid carrier and solid medicant can be brought together immediately prior to injection; and in which the freshly formed mixture can be injected, all while maintaining the ingredients in a sealed and sanitary state, without exposure to the outside atmosphere and in which the entire operation for admixture or solution and administration can be carried out with one hand.

It is another object to provide a disposable syringe adapted to house the liquid and solids in separately sealed compartments and in which the mixture of liquid and solids can be effected entirely within the confines of the syringe to provide a freshly prepared solution or dispersion of the measured amounts of the ingredients and from which the freshly prepared solution or dispersion can be injected in the manner desired for use.

Other objects and advantages of this invention will hereinafter appear and for purposes of illustration, but not of limitation, an embodiment of the invention is shown in the accompanying drawings in which

FIG. 1 is a sectional elevational view of a syringe embodying the features of this invention with the elements illustrated in position prior to use;

FIG. 2 is a sectional elevational view of the syringe shown in FIG. 1 with the syringe partially actuated to effect displacement of the liquid carrier from the liquid compartment to the solid compartment for solution or admixture therewith;

FIG. 3 is a sectional elevational view of the syringe shown in FIGS. 1 and 2 with the syringe in fully actuated position to effect displacement of the freshly prepared solution from the solids compartment for injection;

FIG. 4 is a top plan view of the floating piston seal embodied in the liquid chamber; and

FIG. 5 is a sectional view taken along the line 5—5 of FIG. 4.

With reference to the drawings, the syringe embodying the features of this invention comprises an outer casing 1 in the form of an elongate tubular member, formed of glass, plastics or the like, having a bore 2 extending continuously therethrough from an open rearward end 3 to a forward open-ended neck portion 4. The forward open end is adapted to be sealed by means of a sealing disc member 5 dimensioned to be greater than the opening at the forward end and to abut the outwardly extending annular lip 6 on the end of the neck portion. The rearward end of the tubular member is formed with an outwardly extending flange 3^a which serves as a finger grip.

The hypodermic needle 7 is mounted in a needle hub 8, in the form of a cylindrical member, having an outwardly extending flange portion 9 at its rearward end and a threaded portion 10 in the peripheral surface at the forward end.

Means are provided to secure the sealing disc member 5 in sealing relation onto the open end of the casing 1 and to mount the needle hub 8 for axial displacement in the direction toward and away from the casing 1 with the rearward end 11 of the needle 7 in endwise alignment with the sealing disc member 5 and forwardly thereof, when in normal retracted position, and to pierce the disc member 5 and extend into the interior of the casing 1 when in operated position. Such means is illustrated as comprising a cup-shaped cap member 12 having a rearward end portion 13 which is crimped about the outwardly extending lip 6 with the sealing disc 5 thereon to position the disc in sealing relationship across the open end of the casing. The body portion of the cup-shaped member, having a diameter greater than the flanged portion 9, extends forwardly for a distance and then is formed with an inwardly turned portion 14 at its forward end to define an opening 15 corresponding to the cross-sectional dimension of the needle hub 8 to enable relative sliding movement therein. The needle hub 8 and the supported needle 7 are continuously urged towards operated position by means of a compression spring, in the form of a coil spring 16, which surrounds the needle hub, with one end abutting the shelf 14 while the other end abuts the annular flange 9 on the rearward end of the needle hub 8.

The needle hub is held in its normal retracted position with the rearward end 11 of the needle 7 within the cup immediately in advance of the sealing disc 5, as by means of a needle cover 17 having a cupped rearward end portion 18 dimensioned to correspond with the cross-section of the needle hub and flanged portion 19 extending outwardly from the rearward end thereof,

and a tubular portion 19^a dimensioned to receive the end portion of the needle 7 extending forwardly beyond the needle hub in protection thereof. The internal wall of the cup portion 18 is formed with a threaded portion 18^a for threaded engagement with the forward end portion 10 of the needle hub whereby the needle cover is threaded onto the threaded end of the needle hub by an amount to bring the flanged portion 19 into engagement with the cap 12 whereby the needle hub is retained in retracted position with the rearward end of the needle adjacent the front wall of the sealing disc and with the compression spring 16 in stressed relation such that, when the cover is removed, the needle hub is released for axial displacement. Thus the compression coil spring 16 becomes effective to displace the needle hub in the rearward direction automatically to project the end of the needle 7 through the sealing disc 5 and into the interior of the casing 1. The elements are pre-assembled within the cup-shaped member 12 before it is crimped onto the lip 6.

A second tubular member 20 of glass, plastic or the like material is dimensioned to have an outer wall to wall dimension which is less than the inner wall to wall dimension of the tubular member 1 to enable the former to be telescoped through the interior of the outer tubular member 1. The second tubular member is similarly formed with a passage 21 extending from the open rearward end 22 through a neck portion 23 of smaller cross-section at the forward end. The forward neck end portion of the second tubular member is fitted with a rubber stopper 24 including an outer ribbed piston ring portion 25 fitted in gripping relationship about the neck and extending into the first tubular member for a distance to effect sealing engagement with the inner walls of the forward tubular member 1 whereby the second tubular member is capable of the function of a piston movable axially relative the forward tubular member 1 thereby to provide a piston and cylinder arrangement between the two tubular members.

The rubber stopper in the form of a flexible closure 24 has a disc portion 26 which normally spans the forward end of the passage to seal the tubular member. It is further formed with one or more openings 27 in the lateral portions beyond the passage to enable flow of liquid from the second tubular member into the first when the sealing disc 26 is flexed for displacement from sealing engagement with the flanged lip 29 of the second tubular member. Again, the rearward end portion of the second tubular member is formed with an outwardly extending flanged portion 28 for use as a finger grip, as will hereinafter be described. The rearward end of the passage 21 is sealed with a rubber plug 30 mounted for axial displacement through the passage 21 as a piston within the cylinder defined by the second tubular member. Means, such as a threaded stud 31, is provided on the rearward end of the plug type piston for connection of an actuator 32 for displacement of the piston relative the cylinder. As illustrated the actuator 32 is in the form of a third elongate tubular member dimensioned to have a cross-section less than the cross-section of the passage 21 through the second tubular member and formed at one end with an internally threaded female portion 33 for threaded engagement onto the threaded stud 31. The rearward end of the ac-

tuator is formed with an outwardly extending flanged portion 34, for use as a finger grip.

An additional sealing member is provided in the second tubular member to achieve a floating seal between the fluid contained in the second tubular member and the dry particulate material adapted to be contained in the first casing for admixture with the fluid. For this purpose, there is provided a piston seal in the form of a rubber or rubber-like member 40 having a sealing rib 41 or sealing ribs 41 and 42 dimensioned to correspond with the cross-sectional dimension of the bore of the tubular member slidably to engage the inner wall thereof in sealing relation. The sealing ribs represent a continuation of a sealing body portion 43 having a slit 44 which extends through the central portion thereof and which is normally closed but which can be distorted to open position to enable passage of fluid when the piston 30 is displaced forwardly to pressurize the fluid in the tubular member.

In the specific embodiment illustrated, the sealing member is formed of parallel, spaced sealing ribs 41 and 42 connected by a tubular section 45 of smaller dimension with a crosswise extending deformable member 43 midway between the ends of the tubular member with the slit 44 formed in the center thereof.

In the assembled relation, illustrated in FIG. 1, fluid 35 is housed in sealing relationship within the second tubular member with the floating sealing member 40 in the forward end portion thereof while the dry medicant 36 is housed in sealing relationship within the first tubular member 1. The loaded device can be shipped and stored for extended periods of time without deterioration of the ingredients and without exposure of the elements to non-sanitary conditions. The double seal effected by the sealing member 26 and the floating member 40 operates to maintain complete separation between the two chambers whereby the dry medicant material is not exposed to the fluid or moisture of the liquid contained in the second tubular member.

In use, the device is held with the two middle fingers under the flanged member 28 of the second tubular member and the actuator 32 is pressed by the thumb to effect displacement of the plug 30 through the cylindrical passage 21. This operates to place the liquid 35 under pressure which first distorts the member 43 to open the slit 44 in the piston seal to enable the liquid to flow to the resilient closure disc 26 to cause flexure sufficient to distort the disc and establish communication between the chambers 21 and 2 through the openings 27 to enable flow of fluid under pressure from the chamber 21 in the second tubular member into the chamber 2 of the first tubular member for admixture with the dry medicant 36. This intermediate position is illustrated in FIG. 2. The liquid takes the medicant into solution or suspension, with shaking when necessary, to provide a freshly prepared fluid system ready for administration by injection.

Thereafter or before, the needle cover 17 is removed to expose the needle 7 and to free the compression spring 16 which operates automatically to effect rearward displacement of the needle hub and needle whereby the rearward end portion 11 of the needle is projected through the sealing disc 5 into communication with the chamber 2 containing the mixture of fluid and medicant in the freshly dispersed or dissolved state.

Administration is made without change of devices and without exposure of the freshly prepared solution or suspension by inserting the needle into the vessel or tissue. For this purpose, the first tubular member may be grasped with one hand with the middle fingers beneath the flanged portion 3^a. The needle is inserted and the thumb is pressed down onto the actuator which, at the end of its travel in the second tubular member, causes displacement of the second tubular member for movement as a piston through the cylindrical passage 2 of the first tubular member thereby forcibly to displace the freshly prepared fluid system from the interior of the first tubular member through the needle and into the tissue.

It will be understood that changes may be made in the details of construction, arrangement and operation without departing from the spirit of the invention, especially as defined in the following claims.

I claim:

1. In a syringe assembly including forward and rearward hollow tubular members wherein the rear member is adapted to be telescoped within the forward member, means at the rearward end portions of each of said members adapted to serve as finger grips, and means sealing the forward ends thereof, the forward a medicament and a carrier in the form of a liquid respectively, whereby actuation of said piston plug will force liquid axially through said rear tubular member causing the slit in said sealing ring to open thereby permitting the liquid to travel through said neck, bend the flexible disc such that the peripheral apertures are spaced forwardly from the forward face of the neck flange thereby permitting said liquid carrier to enter

said forward tubular member and mix with the medicament therein, and whereby subsequent movement of the rear tubular member will cause ejection of the mixed medicament through said hollow needle.

2. A syringe assembly as claimed in claim 1 in which the flexible closure on the forward end of the rear tubular member comprises ring members of rubber-like material in sealing engagement with the outer wall of the inner tubular member and extending into sealing engagement with the inner wall of the outer tubular member.

3. A syringe assembly as claimed in claim 1 in which the flexible closure and aperture disc member are of unitary construction.

4. A syringe assembly as claimed in claim 1 in which the sealing ring within the inner tubular member is formed of rubber-like material having circular ribs dimensioned to extend into sealing engagement with the inner walls of the inner tubular member.

5. A syringe assembly as claimed in claim 1 which includes flanged members extending radially outwardly from the rearward end portions of the forward and rearward tubular members for use as finger grips.

6. A syringe assembly as claimed in claim 1 in which the sealing ring comprises a disc member having a central body portion and rim portions of greater thickness than the central body portion.

7. A syringe assembly as claimed in claim 1 in which the sealing ring comprises a pair of axially spaced rim portions, a tubular portion joining said rim portions and said disc spanning the tubular portion.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,682,174 Dated August 8, 1972

Inventor(s) Milton J. Cohen

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:
column 5, line 25, before "a" insert --- end of the forward member having means therein for mounting a hollow hypodermic needle forwardly of the seal at the forward end thereof, and near whereby said needle may be made to penetrate said seal and communicate with the interior of said forward tubular member, and the rear end portion of the rear tubular member having a piston plug adapted to be reciprocated within the same and having means on the rear end portion thereof for the attachment of an actuator thereto, the improvement wherein the sealing means at the forward end of the rearward tube serves as a closure for the rearward end of the forward tube and wherein said sealing means includes a neck portion at the forward end of the rearward tubular member having a transverse dimension which is less than the remainder thereof, said neck portion having a radially directed flange at the forward end thereof having a transverse internal dimension that is smaller than the transverse dimension of said rear tubular member and having a central opening at the forward end thereof, a flexible closure member having a portion connected to the exterior of said neck portion, extending radially outwardly in resilient sealing engagement with the internal wall of the forward tubular member having a hollow tubular portion extending forwardly of the neck flange and an apertured flexible disc member fixed transversely of and within the hollow interior of said flexible closure and having apertures adjacent to the peripheral portions thereof, said disc member being placed in abutting relation with the forward face of said flange so that said apertures are sealed thereby, and a sealing ring within said rear tubular member positioned in the forward end portion thereof adjacent the rear end portion of said neck, said sealing ring having a peripheral wall in sealing engagement with the internal wall of said rear tubular member and a transverse disc having a slit therein thereby sealing the forward end of said rear tubular member, said forward and rear tubular members being adapted to contain ---

Signed and sealed this 30th day of January 1973.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents