Jan. 13, 1970 J. D. SHAW 3,489,147

COMBINATION MIXING AND INJECTING MEDICAL SYRINGE

Original Filed July 21, 1964 2 Sheets-Sheet 1

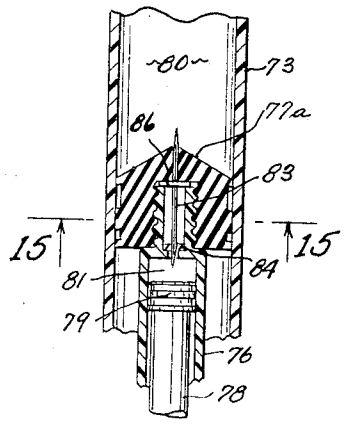

FIG. 2

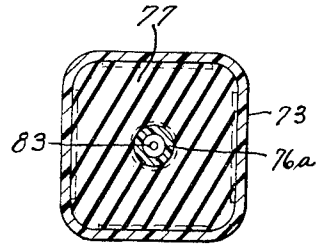

FIG. 3

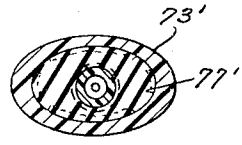

FIG. 4

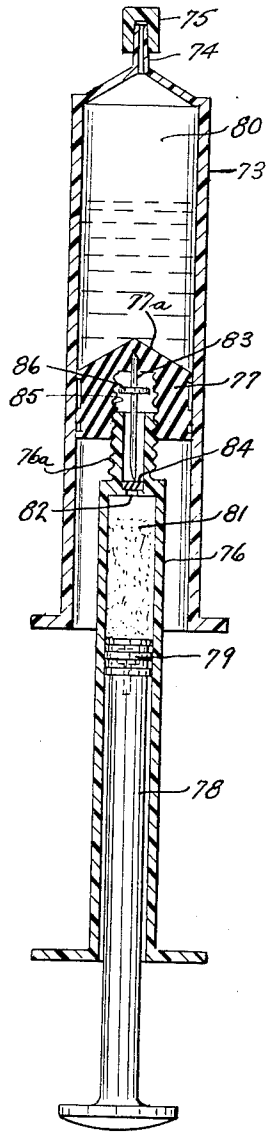

FIG. 1

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Jan. 13, 1970 J. D. SHAW 3,489,147

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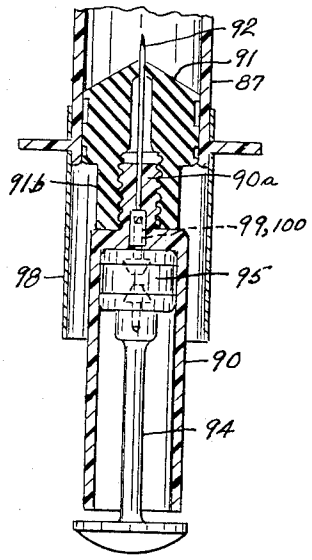
Original Filed July 21, 1964 2 Sheets-Sheet 2

FIG. 7



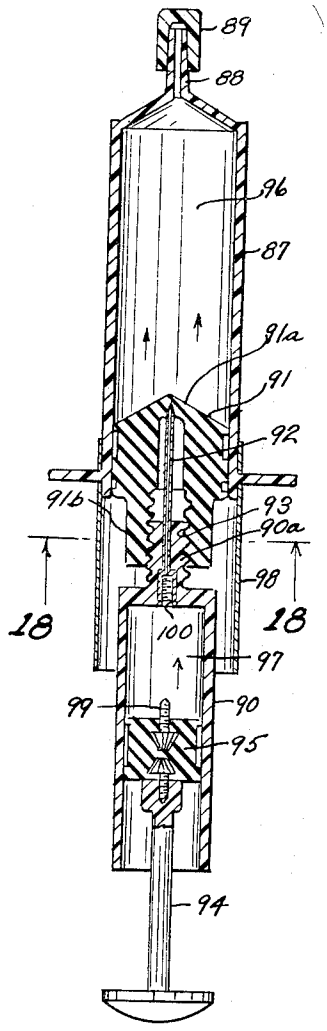


FIG. 5

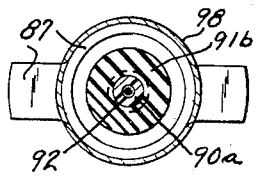


FIG. 6

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COMBINATION MIXING AND INJECTING MEDICAL SYRINGE

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Continuation of application Ser. No. 384,148, July 21, 1964. This application Aug. 22, 1967, Ser. No. 662,340
Int. Cl. A61m 5/00; A61j 1/00; B67d 5/56
U.S. Cl. 128—218 4 Claims

ABSTRACT OF THE DISCLOSURE

A combined mixing and injecting syringe has an outer barrel to contain a first ingredient and provided with an injection outlet, has an inner barrel slidable in a sealed manner longitudinally of the outer barrel for containing a second ingredient, and has a plunger slidable in a sealed manner longitudinally of the barrel. The inner barrel has a discharge opening communicating with the hollow of the outer barrel and normally closed by a gasket. A needle carried by the plunger is in position to pierce this gasket upon relative movement of the plunger in the inner barrel and then adapted to provide communication for the free exit of the second ingredient from the inner barrel to mix with the first ingredient in the outer barrel, after which the mixture may be injected by relative movement of the two barrels.

This is a continuation of application Ser. No. 384,148, filed July 21, 1964, and now abandoned.

This invention relates to a combined mixing and injecting syringe useful among other things in medical practice for the injection of a two-ingredient mixture.

One of the objects of the present invention is the provision of a syringe whereby one ingredient, such as a powder or liquid, may be dissolved in a suitable diluent second ingredient and then injected into a patient by the use of this novel syringe.

Other objects of this invention include the arrangement of the parts for quick assembly and disassembly for loading or cleaning, means for quickly measuring the amounts of the mixed ingredients, and other objects and advantages as will be apparent in the accompanying drawings and description.

In the drawings:

FIG. 1 is a central sectional view through one embodiment of my invention;

FIG. 2 is a sectional view of an intermediate portion of FIG. 1 with the parts in a different actuated position;

FIG. 3 is a cross-sectional view, enlarged, taken along the line **15—15** of FIG. 2;

FIG. 4 is a cross-sectional view showing another non-circular section through the parts similar to FIG. 3 and illustrating how an embodiment of FIGS. 1 and 2 might be constructed;

FIG. 5 is a central sectional view through another embodiment of this invention;

FIG. 6 is a cross-sectional view taken along the line **18—18** of FIG. 5; and

FIG. 7 is a central sectional view of the intermediate portion of FIG. 5 showing an operated position of the parts.

Prior to this invention, to the best of my knowledge and belief, there has been an unmet need for a mixing syringe wherein two or more ingredients could be easily placed in separate chambers of the syringe with no mixing occurring until just before the injection of the combined ingredients into a patient and constructed with easily manipulated parts whereby a breachable passageway communicating with the chambers containing the separate ingredients is adapted to be easily and quickly opened followed by mixing of the ingredients in a mixing chamber and the immediate propulsion of the contents out of the syringe.

In FIGS. 1 and 2, is shown one embodiment of this invention. Here the outer barrel **73** has a discharge outlet **74** which may be closed if desired by a cap **75**. An inner barrel **76** is reciprocatable in the outer barrel and is sealed thereagainst by a gasket **77**. A plunger **78** is reciprocatable in the inner barrel and is sealed thereagainst by a gasket **79**. Here the breachable means for initially sealing off the contents of the ingredients in chamber **80** and the ingredients in chamber **81** comprises a portion of the gasket **77** which is impervious at **77***a* where the contents of chamber **81** passing through a discharge opening **82** might reach the chamber **80** if it were not for the gasket portion **77***a*. For breaching this closure there is provided a hollow needle **83** which engages, or preferably is embedded in, the material of the gasket portion **77***a* as shown in FIG. 1. The opposite end of the needle is in position to communicate with the chamber **81** in the inner barrel but is temporarily sealed from such communication by means of a penetratable seal **84**. Means is provided for relative movement of the inner barrel against the lower end of needle **83** as seen in FIG. 13 and for causing this needle to perforate the gasket portion **77***a*. The means here shown comprises a hollow neck **76***a* on the inner barrel **76** and provided with a male outer thread which coacts with a female inner thread **85** formed in a recess in gasket **77**. A projection **86** rigid with the needle **83** is provided for a purpose which will presently appear. In use of this device, with the inner barrel removed from the outer barrel, a measured amount of the first ingredient is placed in the chamber **80**. Also, a measured amount of the second ingredient is placed in the chamber **81** and the plunger **78** pushed into proper position. The parts are then assembled as shown in FIG. 1. In this form of the invention, the outer barrel **73** and the coacting gasket **77** are non-circular in form as shown in FIG. 3. The corners are preferably rounded as shown so that a better seal may be had. Alternatively, some other form of non-circular barrel **73'** might be adopted as in FIG. 4 with a gasket **77'** of complementary shape, the forms here being elliptical. By rotating the inner barrel **76** about its longitudinal axis while holding the outer barrel **73** stationary, the threaded connection at **76***a*, **85** is operated to move the parts from the full line position of FIG. 1 about half way to the position shown in FIG. 2, thus causing a first penetration of the needle through the seal **84**. Further operation of the threaded connection to the position shown in FIG. 2 will cause the end of the neck **76***a* to engage against the projection **86** on the needle, thus forcing the needle **83** through the gasket portion **77***a* and establishing communication between chambers **80** and **81**. Movement of plunger **78** into barrel **76** will now discharge the contents of chamber **81** into the mixing chamber **80** to mix with the first ingredient there. The mixture may then be propelled through the discharge outlet **74** by movement of the inner barrel **76** and gasket **77**.

FIG. 5 shows another embodiment of this invention which has great similarity to FIG. 1 except that the seal **84** is not required. Here outer barrel **87** has a discharge outlet **88** which can be closed if desired by a cap **89**. An inner barrel **90** is reciprocatable in the barrel **87** and is sealed thereagainst by a gasket **91**. This gasket has a gasket portion **91***a* which is impervious at the point where the second ingredient might mix with the first ingredient in the same manner as the gasket portion **77***a* described in FIG. 1. A hollow needle **92** is partially embedded in the gasket portion **91***a* at its pointed end, and has its

other end rigidly secured in a projecting neck **90***a* of the inner barrel **90**. A threaded connection is provided at **93** between the neck **90***a* and the gasket **91** for the purpose explained in connection with FIGS. 1 and 2. A plunger **94** is reciprocatable in inner barrel **90** and sealed thereagainst by a gasket **95**. I have thus provided a first ingredient chamber **96** and a second ingredient chamber **97** which may be loaded in any of the manners previously explained and the parts placed in the position of FIG. 5. In this embodiment, the barrel **87** and the gasket **91** are circular in section so it is necessary to hold them manually if one is to actuate the threaded connection at **93**. For this purpose the gasket **90** has a downwardly extending projection **91***b* which extends beyond the open end of the outer barrel **87** so as to be grasped by the fingers of the operator or otherwise. For sterility reasons it may be desirable to attach a sleeve **98** of flexible plastic or the like to the outside of barrel **87** covering the parts as shown in FIG. 5 so that the fingers may grip through the sleeve **98** against the projection **91***b* so as to maintain the parts clean and sterile. With the parts so held, the threaded connection **93** is operated to cause relative movement of the neck **90***a* of the inner barrel relative to the gasket **91**, thus forcing the needle **92** to penetrate the gasket portion **91***a* and provide communication between chambers **96** and **97**. Then, operation of the plunger **94** will force the contents of chamber **97** through the hollow needle **92** into chamber **96** where they may be mixed and injected into the patient as previously described.

If the above operation is to be carried out as one-time operation and then the syringe is discarded, then further improvements described herein are unnecessary. In other words, the parts heretofore described will permit the plunger **94** and barrel **90** to drive the gasket **91** into the barrel **87** sufficiently to inject the mixed ingredients from chambers **96** and **97**. However, if it is desired to reciprocate the gasket **91** in the barrel **87**, then a male threaded portion **99** is provided in the center of the gasket **95** extending axially in position to coact with the female thread **100** found in the socket end of the needle **92**. Then, just before the parts reach the position of FIG. 7, the threaded connection at **99**, **100** may be completed by holding the gasket projection **91***b* against rotation about its axis as previously described. This completes a rigid connection between the parts **94**, **90** and **91** so that the gasket **91** may be reciprocated in the barrel **87** if desired.

Note that in every case I have provided a mixing syringe having a mixing chamber closed except for an inlet and an outlet and a second measured ingredient chamber having a closed but breachable passageway communicating with the mixing chamber inlet. Means is provided for opening the breachable passageway and for propelling the contents of the ingredient chamber into the mixing chamber with the ingredient already placed there after which the mixing chamber may be shaken to thoroughly mix the contents. Means is provided then for propelling the contents of the mixing chamber through the outlet to inject a patient. This provides a quick and easy manner of mixing two ingredients in place in a syringe just before injecting a pateint and is an improvement over methods previously known.

What is claimed is:

1. A combined mixing and injecting syringe comprising an outer first-ingredient-retaining barrel open at one end and having a discharge outlet at the other end, an inner second-ingredient-retaining barrel open at one end and having a discharge opening at its other end, breachable means initially closing said discharge opening, said other end having means for sealing engagement with the interior surface of said outer barrel and being movable axially in said outer barrel, a plunger adapted to sealingly engage the interior surface of said inner barrel and movable axially endwise of said inner barrel, whereby a first ingredient of a mixture may be placed in said outer barrel and held there by said inner barrel, and a second ingredient of said mixture may be placed in said inner barrel and held there by said plunger, after which said breachable means may be opened and said second ingredient may be propelled, by manipulation of said plunger, through said discharge opening into said first ingredient in said outer barrel, said two ingredients may be mixed there, and then said mixture may be propelled by said inner barrel through said discharge outlet, and wherein said means for sealingly engaging between said inner barrel and said outer barrel comprises a gasket impervious at the inner end of said inner barrel to provide said breachable means there, a hollow needle has one end substantially in engagement with said gasket and has its other end in position to communicate with said inner barrel, means is provided for relative movement of said inner barrel against said other end of said needle and for causing said needle to perforate said gasket, after which said ingredients may be mixed and said mixture may be propelled out of said discharge outlet.

2. A syringe as defined in claim **1** wherein said last named means comprises a hollow neck on said inner barrel having a threaded connection with said gasket, a needle-penetratable seal closing said neck on the upstream side of said needle, said outer barrel and said gasket being non-circular in section whereby turning of said inner barrel about its longitudinal axis will operate said threaded connection to advance said neck into said gasket causing said needle to perforate said seal, and there being inter-engageable parts on said neck and needle adapted to drive said needle through said gasket by operation of said threaded connection.

3. A syringe as defined in claim **1** wherein said last named means comprises a neck on said inner barrel having a threaded connection with said gasket, said needle rigidly carried by said neck with said other end of said hollow needle in communication with said inner barrel, said gasket having a portion extending outside said open end of said outer barrel for grasping by an operator in order to operate said threaded connection, the proportioning of the parts permitting such operation to drive said needle through said gasket.

4. A syringe as defined in claim **3**, including a rigid connection between said plunger and said neck engageable by said plunger upon propelling said second ingredient out of said inner barrel and enabling reciprocation of said plunger and said gasket as a unit.

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U.S. Cl. X.R.

128—272; 222—137