

[54] SYRINGE

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[58] Field of Search 222/31, 41, 43, 46, 222/47, 49, 309; 128/218 C

[56]

References Cited

UNITED STATES PATENTS

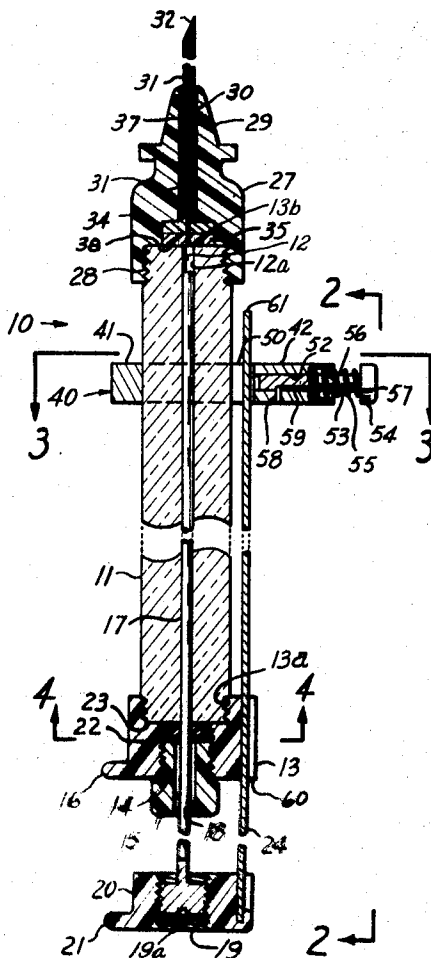
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[57] ABSTRACT

A syringe according to this invention comprises a body having a bore in which a plunger is reciprocally mounted. A thumbpiece is attached to the plunger and calibrator means is mounted to the thumbpiece to reciprocate with the plunger. Means mounted to said body cooperates with the calibrator means to enable determination of the volume of fluid in the bore. Preferably, and according to one feature of the syringe, the plunger is threadably assembled to said thumbpiece to permit adjustment of the relative position of said plunger with respect to said calibrator means. Stop means may be positioned so that repeated deliveries of the same quantity of fluids can be made.

2 Claims, 4 Drawing Figures



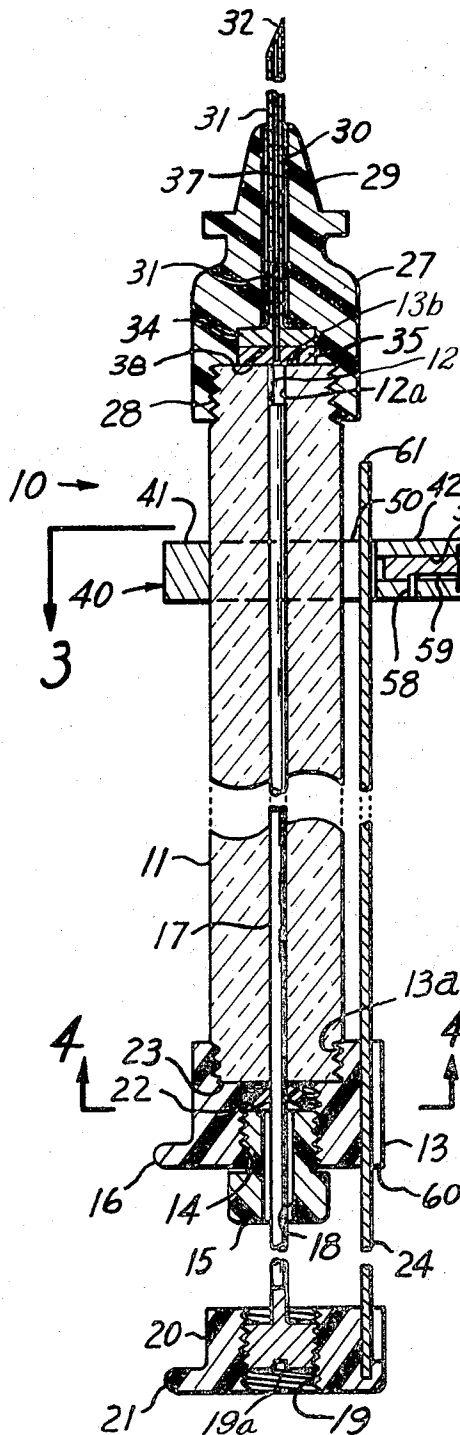


FIG. 1

FIG. 2

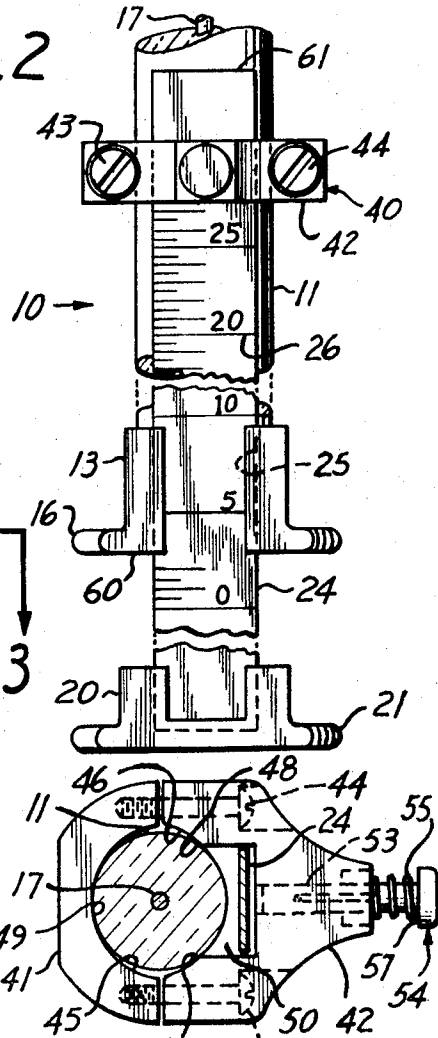


FIG. 3

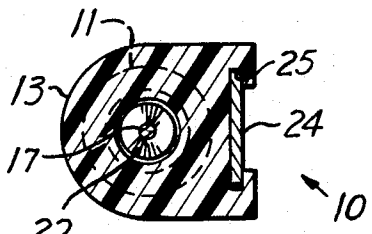


FIG. 4

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SYRINGE

This invention relates to syringes, and particularly to precision syringes for repetitively delivering a predetermined quantity of fluid.

In my prior U.S. Pat. No. 3,223,282, granted Dec. 14, 1965, for "Precision Measuring Syringe" there is described an adjustable syringe capable of dispensing precise volumes of fluid under pressure. The syringe described in my aforesaid U.S. Pat. No. 3,223,282 was adjusted by adjusting the position of the needle of the syringe with respect to calibrations on the barrel and thereafter locking the needle in place by means of a lock nut. One disadvantage of the syringe described in my U.S. Pat. No. 3,223,282 resided in the fact that the needle was occasionally moved out of position during the rotation and movement of the lock nut thereby destroying the calibration of the syringe. To overcome the problem of adjustment of syringes, I developed another syringe which is described in my U.S. Pat. No. 3,366,286, granted Jan. 30, 1968, for "High Precision Syringe". The syringe described in my said U.S. Pat. No. 3,366,286 utilized a counterbore within the syringe body or barrel which was accurately located with respect to the calibrations on the barrel. The syringe was calibrated by simply placing the needle in the counterbore and against the end wall thereof so the location of the needle with respect to the calibrations was fixed in a predetermined position when the needle was locked into place. One problem associated with the syringe described in my U.S. Pat. No. 3,366,286 resided in the fact that the syringe was relatively expensive to manufacture due to the close mechanical tolerances that were necessary during manufacture. Particularly, the location of the end wall of the counterbore respect to the calibrations had to be held to with close tolerances.

It is an object of the present invention to provide a syringe which can be manufactured without requiring the close dimensional tolerances heretofore required in the manufacture of precision syringes.

It is another object of the present invention to provide a precision syringe having a dispensing plunger whose position is adjustable with respect to the calibrations so that the syringe can be calibrated.

Another object of the present invention is to provide a precision syringe having a calibrator means adjustably attached to a plunger so that the syringe may be calibrated independently of the position of the needle.

Another object of the present invention resides in the provision of a stop means for repetitively delivering identical quantities of fluid.

In accordance with the present invention, a syringe body or barrel is provided with a bore disposed axially therethrough. A dispenser plunger is positioned in the bore for reciprocal motion therein. A needle is positioned against the end of the barrel or body so that the plunger forces liquid in the bore through the needle. A calibrator is adjustably mounted to the plunger so that the position of the plunger with respect to the calibrator may be selectively adjusted.

According to one feature of the present invention, the calibrator is adjustably positioned with respect to the plunger rather than the needle, so that the syringe can be accurately calibrated without regard to manufacturing tolerances.

According to another feature of the present invention, stop means is attached to the body or barrel of the syringe for engaging the calibrator to stop the recip-

cal movement of the plunger in the bore in a predetermined position. The position of the lock means may be selectively adjusted along the length of the barrel and is operable to stop the calibrator at selected positions of the plunger.

The above and other features of this invention will be more fully understood from the following detailed description and the accompanying drawings, in which:

FIG. 1 is a side view elevation in cutaway cross-section of a syringe in accordance with the presently preferred embodiment of the present invention;

FIG. 2 is a frontal elevation of a portion of the syringe illustrated in FIG. 1 taken at line 2—2 in FIG. 1;

FIG. 3 is a section view of the syringe taken at line 3—3 in FIG. 1; and

FIG. 4 is a section view of the syringe taken at line 4—4 in FIG. 1.

Referring to the drawings, there is illustrated a syringe 10 in accordance with the presently preferred embodiment of the present invention. Syringe 10 includes a body or barrel 11 preferably constructed of thick-walled transparent plastic or glass. Barrel 11 includes an axially-extending bore 12 extending therethrough, the bore being defined by a cylindrical side wall 12a. A "second" housing 13 is threaded at 13a to one end 23 of barrel 11 and includes internal threaded portion 14 to which nut 15 is in threaded engagement. Annular lip 16 protrudes from housing 13 about a portion of its circumference to enable a user to grasp lip 16 between his fingers. Dispensing plunger 17 is slidably mounted in bore 12 for reciprocable movement herein and extends through internal aperture 18 of nut 15. Plunger 17 is sized so as to make close fluid sealing contact with the sidewall 12a of bore 12 and is threadedly assembled to internal threaded portion 19 of thumbpiece 20. The end of the plunger includes torque-tool engagement means 19a, for example a screw driver slot.

Thumbpiece 20 preferably includes an annular lip 21 about a portion of its circumference by which the thumbpiece may be grasped. It is threadedly engaged to the dispensing plunger at threaded portion 19. Washer 22 is assembled between end 23 of barrel 11 and nut 15 to provide a fluid seal between plunger 17 and the barrel. By way of example, housing 14, nut 15, and thumbpiece 20 may be constructed of suitable hard plastic, and washer 22 may be constructed of suitable neoprene or suitable rubber. The dispensing plunger passes through second housing 13.

Calibrator strip 24 is rigidly attached to thumbpiece 20 by press fitting therein, and extends through an aperture 25 in second housing 13. It is the function of this aperture to provide a passage through the housing 13 which will embrace the calibrator strip and prevent its sideward movement relative to its axis and thereby key the thumbpiece against rotation. The calibrator strip is free to move axially in this aperture. It is a convenience in reading the calibrator strip to provide the aperture as a slot having an open wall, but such construction is not a limitation on the invention. Calibrator strip 24 includes suitable calibration indicia 26 for indicating volumetric measurements, as will be more fully understood hereinafter. Calibrator strip 24 may be constructed of any suitable rigid material such as hard plastic or metal such as stainless steel.

"First" housing 27 is threaded at thread 28 to the other end 13b of barrel 11. This housing includes an

axial bore 30 through which needle 31 extends. Needle 31 includes a tip or sharpened point 32 and an annular flange 34 which bears against a teflon washer 35. Washer 35 is considered to be part of the needle in this embodiment. Axial passage 37 passes through needle 31 and its flange, and is coaxial with bore 12. It is also in fluid communication with bore 12 so that fluid in bore 12 of barrel 11 may be dispensed through the needle. Preferably, bore 37 is smaller than bore 12 so that end 38 of needle 31 (or, more precisely, of washer 35) provides a forward stop position for plunger 17. It is evident that whether the wall against which plunger 17 "bottoms out" is on a washer, or on the structure integral with the pointed part of the needle, is immaterial. Needle 31 is assembled to the syringe so that washer 35 is sandwiched between lip 34 of the needle and the end of barrel 11 so that washer 35 provides a fluid seal between the needle and the barrel, and the needle abuts end 13b of the body (barrel). The plunger is long enough that it can abut the end 38 of the needle.

Stop means 40 comprises a first housing 41 and a second housing 42 fastened together by means of threaded fasteners 43 and 44. Housing 41 includes a substantially semi-circular recess portion 45 having a diameter slightly larger than the largest diameter of barrel 11. Likewise, housing 42 includes a similar semi-circular recessed portion 46 having a diameter slightly larger than the largest diameter of barrel 11. It can be appreciated that the assembled stop means 40 comprising housing 41 and 42 will grip against the circumference of barrel 11 at portions 47, 48 and 49 of the stop means housing. An additional recess 50 accommodates passage of calibration strip 24. The stop means may be positioned anywhere along the barrel.

Housing 42 includes an extended portion having an internal bore 52 adapted to receive shank 53 of a reciprocable plunger 54. Plunger 54 is preferably spring-loaded by compression spring 55 which is seated in counterbore 56 to react against head 57 of plunger 54. Key 58 is carried by housing 42 to engage slot 59 on shank 53 to prevent removal of plunger 54 from bore 52 due to the force of spring 55.

A syringe in accordance with the present invention may be assembled by fitting housings 13 and 27 to their respective ends of the barrel. Plunger 17 is threadably assembled to thumbpiece 20 and nut 15 and washer 22 are assembled over the shank of plunger 17. Calibration strip 24 is attached to thumbpiece 20. The shank of plunger 17 is assembled into bore 12 of barrel 11 and calibration strip 24 is inserted into slot 25 in housing 13. Nut 15 is engaged to housing 13 to bear against washer 22 so that the washer makes a fluid seal between plunger 17 and end 23 of barrel 11.

The syringe is calibrated by depressing thumbpiece 20 so that the end of plunger 17 contacts end 38 of needle 31 (or, more precisely, of washer 35). With the plunger contacting end 38, the plunger is rotated, by means of a suitable screw-driver, to axially move or draw the thumbpiece and calibrator strip 24 until the zero indicia on strip 24 is in registration with edge 60 of housing 13. The calibrator strip carries indicia representative of the volume of the bore ahead of the plunger. For example, indicia 26 may represent the volume of bore 12 in advance of the plunger in microliters.

In use of the syringe, the point of the needle is immersed in a reservoir of fluid to be dispensed, and the thumbpiece 20 is withdrawn drawing up plunger 17 to

draw fluid into bore 12. The thumbpiece is withdrawn to such position that the indicia on calibrator strip 24 in registration with edge 60 of housing 13 corresponds to the desired volume of fluid to be dispensed.

When repetitive dispensing is to be done, stop means 40 may be utilized. Thumbpiece 20 is moved to a position wherein the calibration on calibrator strip 24 is in the desired registration with edge 60 of housing 13. Plunger 54 of stop means 40 is depressed and the stop means is moved axially until shank 54 engages end 61 of calibrator strip 24. Stop means 40 is then locked in position by tightening fasteners 43 and 44. Thereafter, plunger 54 is released and thumbpiece 20 is depressed until plunger 17 engages end 38 (and the "zero" indicia on calibrator strip 24 registers with edge 60). The needle is immersed in a reservoir of the fluid and thumbpiece 20 is withdrawn until surface 61 of calibrator strip 24 is beyond stop means 41 (thereby overfilling the syringe). Plunger 54 is then depressed and thumbpiece 20 is depressed until end 61 of calibrator strip 24 stops against shank 53 of the plunger. Bore 12 of the syringe now contains the desired quantity of fluid. Plunger 54 is released, and when the dispensing plunger is pressed until its end in the bore abuts end 38 of the needle, the predetermined amount will be ejected. It will be understood that this operation may be repeated for multiple injections of similar quantities of fluid.

The present invention thus provides a syringe which is capable of being accurately calibrated. The needle may be easily replaced. The syringe may be manufactured without the maintenance of the extremely close tolerances heretofore required in precision syringe manufacture. The syringe may be calibrated after manufacture and assembly by adjustment of the relative position of plunger 17 and calibrator strip 24. Although the syringe is described as having a transparent body 11, it is to be understood that the body may be opaque since the use of the syringe is not dependent on an ability to view the fluid, as was the case in prior syringes. This feature is particularly advantageous when handling photo-sensitive fluids.

The repetitive feature is quite advantageous, especially in the field of gas chromatography, wherein, once the size of the sample is determined, the repetitive delivery of an equal amount is critical. This invention provides a simple means for delivering an accurate sample.

This invention is not to be limited by the embodiment shown in the drawings and described in the description, which is given by way of example and not of limitation.

What is claimed is:

1. A syringe comprising: a body having an internal cylindrical sidewall defining a first bore extending axially through the body, the body having a pair of ends; a first housing mounted to the body at one of said ends; a needle in said first housing having an end which abuts the respective one of the ends of the body and having a passage therethrough of lesser diameter than the bore in the body, said passage and bore being coaxial; a plunger slidably fitted in said bore and in fluid-sealing fitting relationship with the sidewall of the said bore, and being adapted to bear against the said end of the needle in one axial position of the plunger; a second housing mounted to the other end of the body, the plunger passing through said second housing; an aperture through said second housing; a thumbpiece threadedly attached to said plunger, whereby the axial

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position of the thumbpiece can be adjusted relative to the plunger; a calibrator strip rigidly attached to the thumbpiece and passing through the aperture in the second housing, whereby to be axially movable with the plunger and to key the thumbpiece against rotation relative to the body, whereby the relative axial position of the calibrator strip and of the plunger can be adjusted by rotating the plunger; and stop means adjustably mounted to said body so as to be adjustably positionable axially along the same, said stop means including a reciprocable plunger adapted in one position to be

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abutted by the end of the calibrator strip to establish a unique axial position of the plunger, and to be movable out of the path of the calibrator strip to permit the calibrator strip to pass beyond the said last-named reciprocable plunger.

2. A syringe according to claim 1 in which the first-named plunger carries torque-tool engagement means whereby to be engageable by a torque-tool to turn the first-named plunger to adjust its axial position relative to the calibrator strip.

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