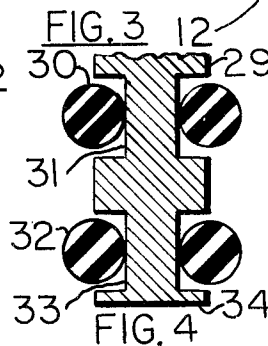
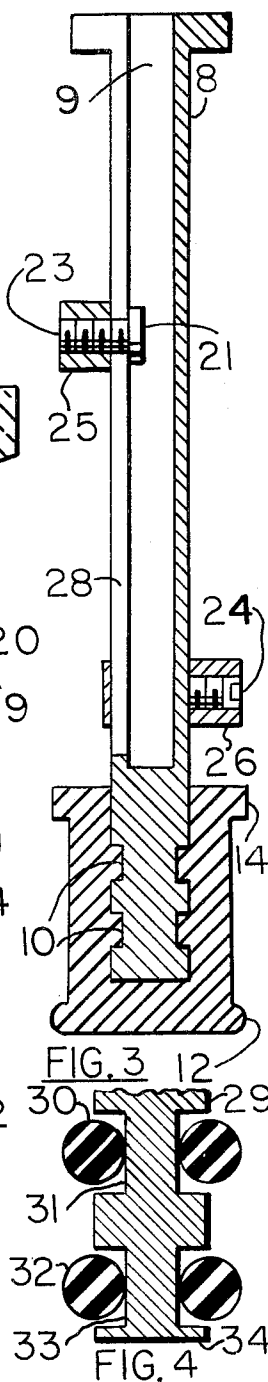
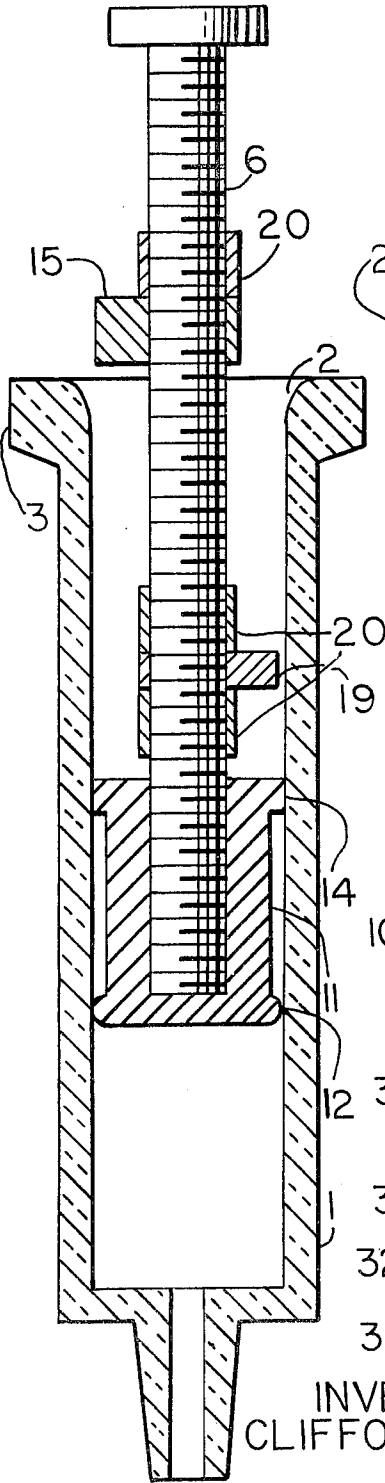
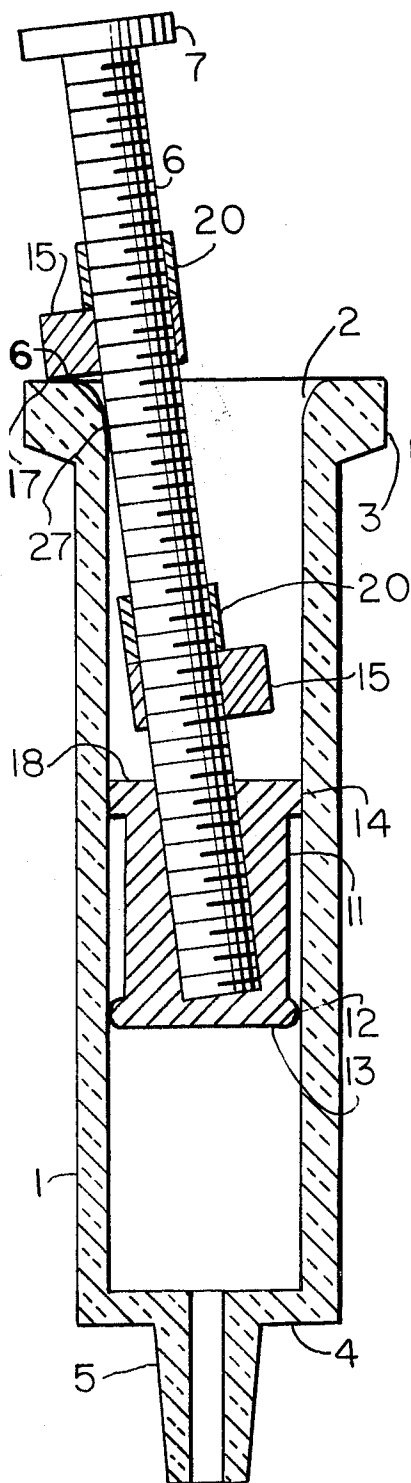


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SYRINGE ASSEMBLY
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SYRINGE ASSEMBLY

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This invention relates to a syringe and more particularly to a syringe which has one or more volume stops to permit repeated filling to the same volume or volumes.

Prior to the present invention there has been a long existing need for an inexpensive and functionally improved syringe to permit the user to quickly and easily expel the same amount of liquid time after time. One very important example of this need concerns insulin hypodermic syringes for diabetics. Diabetics frequently take the same dosage of insulin day after day, but there is always a hazard of the user filling the syringe to an incorrect volume. The need is further accentuated by the large percentage of diabetics who have weak eyesight. Although many diabetics take injections of only one type of insulin, a substantial number of diabetics use a mixture of two types of insulin that are taken in one injection, and this invention also meets this need.

In addition to the need for insulin hypodermic syringes with repeat volume settings, there are other important medical applications requiring syringes of this type. There are also many laboratory and industrial needs for syringes with repeat volume settings that can be easily and quickly used.

It is an object of this invention to provide a simple and inexpensive syringe which can be repeatedly filled to the same volume or volumes with minimum time consumption and with no difficulty.

Another object of this invention is to provide a syringe which has one or more reliable adjustable volume settings that can be easily and quickly set to the desired volume.

It is a further object of this invention to provide a syringe with one or more adjustable repeat volume settings that is absolutely safe to use and easily used by anyone regardless of mechanical aptitude.

With these and other objects in mind, reference is had to the attached sheet of drawings illustrating practical embodiments of the invention and in which:

FIG. 1 is a sectional side view of an assembly wherein the plunger assembly has been pushed to one side by the user so that one of the volume stops on the plunger assembly is in contact with the syringe barrel and thereby measuring the desired volume.

FIG. 2 is a sectional side view of an assembly wherein the plunger assembly has been released by the user and the plunger rod has automatically returned to a centered position with respect to the syringe barrel.

FIG. 3 is a sectional side view of an alternative plunger assembly.

FIG. 4 is a sectional side view of the forward end of an alternative plunger assembly.

Referring primarily to FIG. 1, the numeral 1 indicates the body of a syringe barrel. The rear or entrance end of the barrel bore is preferably flared to a desired extent as indicated at 2. Adjacent this end an outstanding flange portion 3 is preferably provided as an integral part of barrel 1. The forward end of that barrel is defined by a wall 4 continued in a tip 5 of any desired type and by means of which, in the case of a hypodermic syringe, the hub of a detachable needle (not shown) may be secured against movement with respect to the barrel. The body of that barrel may be formed of glass or a suitable plastic such as polypropylene or nylon although other materials may be used.

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A plunger rod 6 is employed in connection with the barrel. This plunger rod is conveniently formed of plastic such as polypropylene or nylon or metal such as brass although other materials may be used. As shown in FIG. 1, it has a rear or head part 7 providing an actuating portion. As in FIGS. 1 and 2, the plunger rod may be formed with a threaded body. As in FIG. 3, the plunger rod 8 is formed of a body which may have a hole 9 and which is provided with one or more tip mounting grooves 10 or other tip mounting means at its forward end. The plunger rod may also be conveniently formed of a circular body or a noncircular body including longitudinally extending grooves or flutings or of a body with a multi-sided cross section. Regardless of the structure employed, the forward end of the plunger rods shown in FIGS. 1, 2 and 3 is a mounting portion upon which a tip or plunger body is mounted. This tip or plunger body is preferably formed of material of relatively easy elastic deformability such as natural or synthetic rubber although other materials may be employed. It may be lubricated in any desired manner such as employing a light film of silicone oil.

At the forward end of tip or plunger body 11 is a sealing lip or annular bearing 12 which engages the surface of the barrel bore. The forward end of the tip or plunger body preferably terminates in a face 13 which should conform to the inner face of end wall 4.

At or reasonably near the rear end of tip or plunger body 11 is a centering lip or annular bearing 14 which preferably engages the surface of the barrel bore. The centering lip or annular bearing 14 in combination with the sealing lip or annular bearing 12 centers the tip or plunger body 11 and the plunger rod 6 in relation to the barrel bore.

Mounted on the plunger rod 6 are one or more volume stops 15. The volume stops are set at the desired positions along the length of the plunger rod 6 in order to obtain the desired volumes. As shown in FIG. 1, the plunger rod 6 is pushed toward the side wall of the barrel by the user during filling of the syringe so that the forward face 16 of the volume stop comes in contact with the face 17 of the barrel and the plunger rod 6 preferably also comes in contact with the barrel at location 27, thus providing an exact and easily repeatable positioning of the plunger rod 6 and tip or plunger body 11 and thereby providing an exact volume measurement. When the user releases the plunger rod 6, the compression of the elastic tip material at location 18, in combination with the previously described centering lip or annular bearing 14 as well as some centering from sealing lip or annular bearing 12, forces the plunger rod 6 to a centered position with respect to the barrel as shown in FIG. 2. This centering is therefore accomplished without the need for the user to touch any part of the syringe. With the plunger rod 6 in the centered position as shown in FIG. 2, the volume stops are adequately centered in the barrel bore, thus permitting the user to expel the contents of the syringe in a conventional manner.

Two volume stops are shown in FIGS. 1, 2 and 3. Only one volume stop or two or more volume stops may be used, depending upon the requirements. When two or more volume stops are used, there must be no interference from any of the other volume stops that would prohibit sufficient side movement to the position illustrated in FIG. 1. Therefore, as illustrated in FIGS. 1, 2 and 3, the volume stops 15, 19, 25 and 26 have a portion that extends considerably more to one side of the plunger rod than to the other side of the plunger rod. When two volume stops are used, this side extending portion of the bottom volume stop is preferably positioned 180 degrees from the side extending portion of the top volume stop as illustrated in FIGS. 1, 2 and 3. When

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three volume stops are used, this side extending portion of each volume stop is preferably positioned 120 degrees from the side extending portion of the other volume stops, and so on for more volume stops.

As shown in FIG. 1, plunger rod 6 is pushed toward the side wall of barrel 1 until it contacts the barrel at location 27 and the forward face 16 of volume stop 15 contacts the face 17 of the barrel. In order to provide a more positive stop between faces 16 and 17, as well as to permit a slightly more accurate volume measurement in case the plunger rod 6 may not quite come in contact with the barrel at location 27, the face 17 of the barrel may be formed in an angle or radius to duplicate the angular position of face 16 as shown in FIG. 1.

Many diabetics, for example, use a mixture of two types of insulin in one injection. Utilizing the FIG. 1 syringe assembly the diabetic would first fill the syringe to the desired amount with the first type of insulin using the top volume stop and then fill to the desired amount with the second type of insulin using the bottom volume stop, after which the syringe would be used in a conventional manner.

One function of the flared portion 2 of the barrel bore is to permit easier assembly of the tip or plunger body 11 into the barrel bore. Another function of this flared portion 2 is to permit unrestricted movement of the volume stop 15 into the barrel bore even in the event of a slight misalignment of the plunger rod 6 with respect to the barrel bore, which might in some cases result from manufacturing inaccuracies.

As shown in FIG. 1, the plunger rod 6 has an external thread which engages internal threads in volume stops 15 and in lock rings 20 as well as in tip or plunger body 11. The lock rings 20 are tightened against the volume stops to lock the volume stops in place. The volume stops 15 may be formed with a circular threaded inside surface and a circular outside surface although other shapes and means of attachment and adjustment may be used. When using two or more volume stops 15, it is preferable to have a side extending portion, as shown in FIG. 1, in order to permit full side movement of the plunger rod 6, which may be provided by eccentrically forming the outside surface and the inside threaded hole. In the case of the syringe assembly with only one volume stop, the volume stop 15 and the lock ring 20 may be identical parts, both having an outside diameter slightly less than the barrel bore and both having the outside diameter and thread concentric. The volume stops and lock rings are conveniently formed of plastic such as nylon or polypropylene or metal such as brass or stainless steel although other materials may be used.

As shown in FIG. 2, an alternative volume stop 19 is locked in place with two threaded lock rings 20. With this combination, it is not necessary to thread volume stop 19, which will result in more economical manufacture in some cases. With this design the use of a square threaded plunger rod 6 having interrupted threads, with a square hole in volume stop 19, would provide a positive and convenient means of positioning four volume stops at 90 degrees in relation to each other. Similarly, a 3, 5 or 6 sided plunger rod 6 could be used with a volume stop 19 having a 3, 5 or 6 sided hole.

Two alternative volume stop designs are shown in FIG. 3. The lower volume stop 26 is attached to an annular or multi-sided plunger rod 8 by utilizing a set screw 24 or other convenient means. The volume stop 26 may be formed with a cylindrical outside diameter that is eccentric to a cylindrical inside diameter which is slightly larger than the diameter of the body 8, although other shapes may be used. For some applications this combination has the advantages of requiring less space and also providing a very positive locking means.

In FIG. 3 the upper volume stop 25 is locked in place

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by a screw 23 or other fastener that has its head 21 inside the hole 9 and which passes through the slot 28 or a hole through the side of plunger rod 8. The volume stop 25 may be formed with a round threaded hole that is concentric to a round outside surface, although other shapes may be used. This design has the advantages of small space requirements, low cost for some applications, a positive means of spacing two volume stops, for example, at 180 degrees from each other, and the absence of any projection on one side of the plunger rod.

FIG. 4 shows the forward end of an alternative plunger rod 29 which has a forward groove 33 for supporting a sealing member 32 and a rear groove 31 for supporting a centering member 30. The sealing member 32 has the same function as the sealing lip or annular bearing 12 and the centering member 30 has the same function as the centering lip or annular bearing 14. The sealing member 32 and the centering member 30 contact the bore of the barrel in the same manner as do sealing lip or annular bearing 12 and centering lip or annular bearing 14. The sealing member 32 and the centering member 30 may be circular or non-circular and they may have a circular, rectangular or other cross section. The sealing member and centering member may be formed of natural or synthetic rubber although other materials may be used. Any of the plunger body and volume stop designs shown in FIGS. 1, 2 and 3 may be used with the plunger rod forward end design shown in FIG. 4. The FIG. 4 plunger rod forward end design is advantageous in that standard commercially available O-rings or other sealing parts may be used, the costs are less for some applications, and higher pressures may be used. When high pressures are used the depth of the groove 33 should be greater in relation to the cross section of the sealing member than that shown in FIG. 4. In order to minimize any waste of the fluid in the syringe, the forward face 34 should be as near groove 33 as is practical.

Thus, among others, the several objects of the invention as specifically aforementioned are achieved. Obviously, numerous changes in construction and rearrangement of the parts may be resorted to without departing from the spirit of the invention as defined by the claims.

I claim:

1. A syringe comprising a barrel having a bore, a plunger body having axially spaced bearings slidable in said bore, a plunger rod for propelling said plunger body on said bearings, a volume stop longitudinally movably mounted on said plunger rod, means for locking said volume stop in selected volume determining positions, said plunger body having an elastic mounting for the forward portion of said rod in said bearings, whereby said rod may be inclined in said bore to engage said stop with the rear end of said barrel at the end of a volume determining stroke, and automatically returned to centered position for said stop to enter said bore for a dispensing stroke.

2. A syringe as claimed in claim 1, in which said plunger rod is a screw, and said volume stop is a nut threaded thereon.

3. A syringe as claimed in claim 1, in which said barrel has a flanged rear end, and said volume stop extends laterally from said plunger rod to engage said flanged rear end in said inclined position.

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