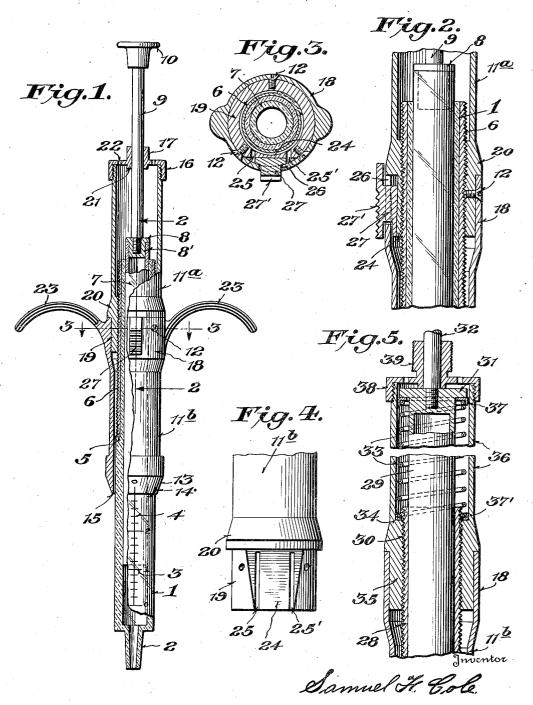
SYRINGE

Filed June 12, 1935



## UNITED STATES PATENT OFFICE

2.129.675

## SYRINGE

Samuel F. Cole, Washington, D. C.

Application June 12, 1935, Serial No. 26,298

15 Claims. (Cl. 128-218)

This invention relates to fluid measuring devices of the character known as syringes, especially of the type adapted for use in the medical, and allied, professions for the handling, measuring, and administration of fluids.

The objects of the invention are: First, to provide a measuring device for fluids adapted for maximum accuracy in the administration of drugs and medicines, and in the transfer and 10 dispensing of fluids; second, to provide a device of the above character with which unusual accuracy may be attained without the inherent disadvantages of fine graduations; third, to provide a device of the above character adapted to ac-15 curately discharge minute quantities of fluid; fourth, to provide a device of the above character wherein a single adjustment for volume suffices for repeated discharges of a predetermined quantity; fifth, to provide a device of the above 20 character wherein a view of the plunger is unnecessary to an accurate adjustment for volume; and sixth, to provide a device of the above character wherein the barrel and plunger may be constructed either of glass or of metal. Other 25 objects will be apparent upon the following disclosure of the invention.

In the accompanying drawing, wherein similar reference numerals indicate corresponding parts throughout the several views, I have disclosed an 30 embodiment of my invention which has proved satisfactory in actual use.

Figure 1 is a front elevation, partly in section, of my invention provided with a glass barrel and plunger.

Figure 2 is an enlarged fragmentary view, in section, on line 2—2 of Figure 1.

Figure 3 is a plan of Figure 1 on line 3—3. Figure 4 is an enlarged detail showing the flexible tongue.

Figure 5 is an enlarged fragmentary view, in section, of a modification provided with a metal barrel and plunger and with a resilient member engaging the plunger.

The principle of this invention comprises the use of a micrometrical member rotatably mounted upon the barrel of a syringe and adapted to limit the stroke of the plunger to control the volume of a fluid admitted into, or ejected from, said barrel, and to simultaneously indicate the quantity of fluid thus admitted or ejected. A syringe constructed in accordance with this principle permits accurate adjustment for volume without the necessity of viewing the plunger and therefore permits the substitution of opaque materials, such as certain plastic compounds and non-

corrosive, or rustless, metals, for glass in the manufacture of the barrel and plunger. The use of non-breakable materials permits the construction of a syringe adapted to withstand thorough cleaning, rapid changes in temperature, sterilization at high temperatures, and comparatively rough handling without danger of breakage. From the following description, it will be obvious that the plunger may be depressed with much greater exactitude by rotating the micrometrical member than by the use of the push-rod of the plunger in the conventional manner.

Referring to the drawing: the numeral I indicates a glass cylindrical chamber, or barrel, the lower end of which terminates in a discharge 15 nozzle 2 which is adapted to accommodate the conventional hypodermic needle or the equivalent. Barrel I is graduated with the longitudinal scale 3 which is intersected by the longitudinal index-line 4. The upper portion of barrel i is 20 circumferentially reduced to form the offset 5 upon which the exteriorly screw-threaded collar 6 is firmly cemented. The glass plunger 7 is ground to a sliding fit in the bore of barrel and is provided with the flanged member 8 firmly 25 attached to its upper end with the depending tubular extension 8' disposed within the plunger. This tubular extension is interiorly screw-threaded to accommodate the screw-threaded lower end of the detachable push-rod 9. The upper end of 30 push-rod 9 is equipped with a suitable thumbrest 10. A cylindrical micrometrical sleeve, composed of the upper tubular member I a and the lower tubular member 11b, is concentric with barrel I and rotatably mounted thereon as hereinafter described. The tubular members 11a and 11b are firmly connected by any suitable means, such as screws 12, and function as a unitary When referring to these members member. jointly, the assembly will be designated as micro- 40 metrical sleeve II. The lower end of the tubular member 11b is formed into the bevel 13 which is calibrated with the peripheral graduations 14 adapted to coact with scale 3 to indicate fractional parts of the individual graduations of said 45 The periphery of bevel 13 will be referred to as knife-edge 15. The scale 3 is read with reference to knife-edge 15 whereas the graduations 14 are read with reference to the indexline 4. Scale 3 and graduations 14 are obviously 50 read in conjunction with one another and are provided with appropriate indicative numerals. The upper end of tubular member ! a is provided with the knurled head, or cap, 16 formed with the upwardly extending axially disposed tubule 55

17 in which the push-rod 9 is slidably confined. When the diameter of cap 16 is considerable, the tubule 17 may be elongated and knurled as shown in Figure 5 by the numeral 39. This permits a more rapid rotation of sleeve 11. The diameter of the upper end of the tubular member 11b is increased to form the hub 18 which accommodates the interiorly screw-threaded bearing 19 formed upon the lower end of the tubular mem-10 ber 11a. The outside diameter of the tubular member (1a, immediately above the upper end of the threaded bearing 19, is increased to correspond with the diameter of hub 18 and forms an annular stop 20 for hub 18. The threaded 15 bearing 19 is housed within the hub 18 and is attached thereto by the screws 12 as hereinbefore mentioned. The threads on collar 6 engage the interior threads of bearing 19 and thereby adapt the micrometrical sleeve for rotatable 20 movement on barrel 1. The rotation of the micrometrical sleeve on collar 6 effects its longitudinal travel with reference to barrel I resulting in the registration of knife-edge 15 with the graduations of scale 3 and in the alinement of 25 graduations 14 with the index-line 4. The inside diameter of tubular member 11a above the threaded bearing 19, and of the tubular member 11b above the bevel 13, is increased to provide adequate clearance for the collar 6. The under 30 side of cap 16 is formed with the depending annulus 21 concentric therewith and adapted for contact with the upper end of plunger 7. This construction minimizes the possibility of inaccuracy due to the accidental presence of foreign 35 matter between cap 16 and the top of plunger 7 and also reduces the friction between cap 16 and plunger 7 when the micrometrical sleeve 11 is used to depress the plunger. Cap 16 is obviously in fixed relation to knife-edge 15. It is provided 40 with suitable vent-holes 22 to permit the escape of air from sleeve II upon the outward movement of the plunger. It will be clear from the foregoing that cap 16 intercepts plunger 7 upon its outward movement thereby functioning as an 45 adjustable stop for the plunger and also as a means for engaging the plunger when rotating the sleeve to discharge a fluid from the barrel. The length of sleeve II is such that, when knifeedge 15 registers with the bottom graduation of 50 scale 3 on barrel 1, the annulus 21 is in contact with the upper end of plunger 7 and the lower end of the plunger is in its lowest position. While the barrel may be graduated in the conventional manner, with the scale starting from the bottom 55 of the barrel and therefore indicative of the position of the lower end of the plunger within the barrel, the method disclosed in Figure 1 is preferable owing to the fact that it affords a finger-grip upon the lower end of the barrel with-60 out obstructing a clear view of the graduations. From the foregoing description, it will be obvious that the stroke of the plunger, and therefore the capacity of the barrel, is regulated by the position of sleeve !! upon the barrel and 65 that this sleeve functions simultaneously as an adjustable stop for the plunger, as a micrometer for accurately indicating the adjusted capacity of the barrel, or of the volume of a fluid discharged therefrom, and also as a means for de-70 pressing the plunger to effect the discharge of the fluid. The reading of the device is obviously made by noting the position of the knife-edge 15 with reference to the graduations of scale 3 simultaneously with the position of the gradua-75 tions 14 with reference to the index-line 4. The pitch of the threads on collar 6, and in the threaded bearing 19, is preferably such that one complete revolution of sleeve !! produces a longitudinal travel of knife-edge 15 exactly equivalent to the distance between any two adjacent 5 graduations on barrel I. However, the pitch and the form of the thread may be varied to meet any given requirements. The graduations 14 are thus indicative of the distance traveled by knife-edge 15 with one revolution of sleeve 11 and thus of 10 the corresponding fractional parts of the individual graduations of scale 3. Obviously, fine threads are indicated for the measurement of minute quantities and coarse threads for rapidity of operation. By the use of double, or triple, 15threads, the pitch may be increased without necessitating the use of coarse threads requiring correspondingly thick-walled members. Maximum speed of adjustment is attained by developing the screw-thread into a spiral groove. Suit- 20 able finger-grips 23 are shown attached to hub 18 but their location may be varied to suit requirements. In order to prevent the accidental rotation of sleeve II after its adjustment to a prédetermined volume, a locking means is pro- 25 vided whereby the sleeve may be releasably secured in any desired position on barrel 1. An efficient method of securing the sleeve | | against accidental rotation involves slitting the threaded bearing 19 to impart flexibility to a portion there- 30 of and imparting a releasable pressure to said flexible portion to cause a frictional pressure between its threads, and the threads of collar 6, sufficient to retain the sleeve in its adjusted position on the barrel. While this may be accom- 35 plished in several similar ways, the form illustrated in Figures 2, 3 and 4 disclose a satisfactory embodiment of the principle. In these figures, the numeral 24 indicates a flexible tongue formed in the interiorly threaded bearing 19 by  $_{40}$ the parallel slits 25 and 25' which extend longitudinally for a distance slightly less than the length of the bearing. The outer surface of tongue 24 is flattened, said flattening being progressively deeper towards the inner end of the  $_{
m 45}$ tongue thereby forming the outer surface of this member into an inclined plane with its thinnest end adjacent to tubular member IIa. This construction imparts the necessary flexibility to tongue 24. A longitudinally extending slot 26, 50 somewhat less in width and length than tongue 24, is cut through the wall of hub 18 and is centered above tongue 24 when the tubular members IIa and IIb are assembled. Slidably mounted in slot **26** is the outwardly protruding knurled  $_{55}$ thumb-bar 27' which is integral with the wedgeshaped locking member 27. This is clearly shown in Figure 2 while the construction of tongue 24 is shown in Figure 4. The outer side of locking member 27 is given the same curvature as the  $_{60}$ inner surface of hub 18 while its under side is tapered to correspond with the inclined surface of tongue 24. Due to its greater width than slot 26, the locking member 27 may readily be supported under said slot in sliding contact with 65 the inclined surface of tongue 24. These features are clearly shown in Figure 3. A slight movement of the thumb-bar 27' in the direction of the nozzle suffices to impart an inward movement to tongue 24 which forces the threads on its  $_{70}$ under surface into firm frictional contact with the threads of collar 6. This action effectively locks sleeve !! against accidental displacement from its adjusted position. The construction of my invention hereinbefore 75

3 2,129,675

described may be modified by the substitution of a non-breakable barrel and plunger for the glass members described and also by the inclusion of a resilient member to automatically extend the plunger. There are numerous obvious advantages inherent in each of these modifications.

Figure 5 illustrates these modifications. In this figure, the numeral 28 indicates a metal barrel corresponding to barrel I but without the offset 10 5 and collar 6. Reciprocally mounted in barrel 28 is the metal plunger 29 which is preferably constructed of tubing but which may be of any suitable construction to effect the purposes of the invention. The upper portion of barrel 28 15 is exteriorly screw-threaded to correspond to the threaded collar 6 described in connection with These threads are indicated by the Figure 1. numeral 30. An annular flanged member 31 is securely attached to the upper end of plunger 29 20 and is interiorly screw-threaded to accommodate the screw-threaded lower end of the detachable push-rod 32. Member 31 differs from the corresponding member 8 of the embodiment illustrated in Figure 1 in that the flange extends radi-25 ally beyond the side-wall of plunger 29 to form an annular seat for the upper end of the coil spring 33. This spring is mounted concentric with plunger 29 and bears, at its lower end, on the annular seat 34 formed by the inwardly projecting threaded bearing 35. Suitable washers 37 and 37' are attached to the upper and lower end respectively of spring 33. The diameter and length of the upper tubular member 36 is increased over the diameter and length of upper 35 tubular member 11a, of Figure 1, to accommodate the spring 33. Plunger 29 and push-rod 32 are also increased in length to correspond to the increase in the length of tubular member 36. The head, or cap, 38 is interiorly screw-threaded to engage the upper end of tubular member 36 and is provided with the knurled tubule 39 which facilitates the rotation of the member. The glass barrel and plunger shown in Figures 1 and 2 are interchangeable with the metal barrel and plung-45 er shown in Figure 5 and thereby adapt both modifications of the syringe for use with each type of barrel and plunger.

The operation of this invention is as follows: The adjustment for volume is made by rotating the micrometrical sleeve to bring the knifeedge into correct registration with the desired graduation on the barrel. If the desired volume includes a fractional part of the quantity indicated by any single graduation, the sleeve is further rotated to bring the desired peripheral graduation on the sleeve into alinement with the index-line on the barrel. After the sleeve has been adjusted, it is locked in its adjusted position by the forward movement of the locking 60 member. Thereafter, the barrel is filled by means of the plunger, and the attached push-rod, in the conventional manner except no further attention is required to volume until a change therein is desired. The plunger is merely pulled outwardly until it contacts with the cap upon the sleeve. If, however, it be desired to discharge a small quantity of the fluid contained within the barrel, or if it be desired to discharge the contents of the barrel slowly, the push-rod is not  $_{70}$  used after the barrel is charged but, instead thereof the sleeve is rotated towards the nozzle until the desired quantity of fluid has been displaced. This method provides absolute control of the quantity and rate of discharge. The modifica-75 tion of the device shown in Figure 1 is readily

dismantled for cleaning and sterilizing by holding the sleeve and unscrewing the barrel, and then holding the plunger and unscrewing the push-rod. The modification shown in Figure 5 is disassembled with equal facility by holding the 5 sleeve and unscrewing the barrel, and then unscrewing the cap from the sleeve followed by unscrewing the push-rod from the plunger.

The foregoing disclosures have clearly defined a measuring device for fluids which is adapted to 10 afford an accurate indication and effect the precise discharge of minute, or large, quantities of fluid without the difficulty, and possible inaccuracy, inherent in the use of fine graduations and incidental to the conventional methods.

The foregoing disclosures are not to be construed as limitations upon the inventive thought which forms the basis of this application, but merely illustrative of the principles involved. Numerous adaptions and modifications of the 20 structures disclosed are possible without departing from the spirit of my invention and I claim all such adaptions and modifications which fall within the scope of the appended claims.

Having thus described my invention, I claim: 25 1. A device of the character described comprising in combination a cylindrical container provided with discharge means, a plunger reciprocally mounted in said container, an adjustable plunger-stop, and a calibrated indicating mem- 30 ber in threaded engagement with the container and adapted to automatically regulate the stop.

2. A device of the character described comprising in combination a graduated syringe, a graduated indicating member adapted for registration with the graduations on the syringe, and means actuated by the indicating member to operate the syringe and to automatically regulate its capacity.

3. A device of the character described compris- 40 ing in combination a graduated syringe barrel, a plunger reciprocally mounted therein, a micrometrical member rotatably mounted upon the syringe barrel and adapted for registration with the graduations thereon, and an adjustable stop for the plunger responsive to the micrometrical member.

4. A device of the character described comprising in combination a graduated syringe barrel, a plunger reciprocally mounted therein, a micrometer sleeve rotatably mounted upon the syringe 50 barrel, graduations on the micrometer sleeve in cooperative relation with the graduations on the syringe barrel, means in fixed relation to the micrometer sleeve, and responsive to the rotation 55 thereof, to regulate the capacity of the syringe to coincide with the indicated volume.

5. A device of the character described comprising in combination a graduated syringe barrel provided with discharge means, a plunger reciprocally mounted in the barrel, an offset in said plunger, a graduated tubular member rotatably mounted upon the syringe barrel and adapted to engage said offset to limit the stroke of the plunger, and means to prevent the accidental rotation 65 of the tubular member.

6. A device of the character described comprising in combination a graduated syringe barrel provided with a discharge member, a stepped plunger slidably mounted in said barrel, a thread- 70 ed collar mounted upon the barrel, an interiorly threaded tubular member in engagement with the threaded collar, means connected to the tubular member to regulate the plunger, and means to lock the tubular member to the barrel.

75

7. A device of the character described comprising in combination a syringe barrel provided with a discharge member, a plunger reciprocally mounted in the barrel, a push-rod connected to the plunger, exterior threads upon the barrel, an interiorly threaded tubular member in engagement with the threads on the barrel, graduations on the barrel and the tubular member, means controlled by the tubular member to regulate the stroke of the plunger to vary the capacity of the barrel, means to prevent the accidental rotation of the tubular member, and finger-grips on the tubular member.

8. A device of the character described comprising in combination a graduated syringe barrel, a plunger reciprocally mounted in the syringe barrel, a push-rod connected to the plunger, threads upon the syringe barrel, a micrometer sleeve concentric with the syringe barrel, an interiorly 20 threaded collar integral with the micrometer sleeve and adapted to engage the threads of the syringe barrel, graduations on the micrometer sleeve in cooperative relation with the graduations of the syringe barrel, an index line associated with the graduations on the syringe barrel, a plunger-stop actuated by the micrometer sleeve, and means for releasably connecting the micrometer sleeve to the syringe barrel.

9. A device of the character described compris-30 ing in combination a syringe barrel provided with a discharge member, a plunger reciprocally mounted in the syringe barrel, a flange integral with the upper end of the plunger, a detachable push-rod for the plunger, exterior threads upon 35 the syringe barrel, an interiorly threaded tubular member in engagement with the threads on the syringe barrel, graduations on the syringe barrel and on the tubular member, an index line associated with the graduations on the syringe barrel, 40 means responsive to the rotation of the tubular member adapted to vary the capacity of the syringe barrel in accordance with the indicated capacity of said barrel, a resilient member adapted to extend the plunger mounted concentrically 45 therewith, and a lock for the tubular member.

10. A device of the character described comprising in combination a calibrated cylindrical member terminating in a nozzle adapted to accommodate accessory discharge members, a  $_{50}$  plunger reciprocally mounted in the cylindrical member, a rotatable micrometrical member concentric with the cylindrical member, a longitudinal index-line intersecting the calibration on the cylindrical member, graduations upon the pe- $_{55}$  riphery of the micrometrical member adapted for registration with the index-line, the said calibrations on the cylindrical member being in cooperative relation with the periphery of the micrometrical member and with the peripheral gradu-60 ations on the micrometrical member for indicating a predetermined volume of fluid, and means in cooperative relation with the micrometrical member and the cylindrical member to lock the micrometrical member in its adjusted position.

11. A device of the character described comprising in combination a syringe barrel the oppositely disposed ends of which are provided with exterior threads and a discharge nozzle respectively, a stepped plunger reciprocally confined within the barrel, an interiorly threaded micrometer sleeve in engagement with the exterior threads, graduations on the barrel, a longitudinal index-line intersecting the said graduations, peripheral graduations on the micrometer sleeve, the periphery of the micrometer sleeve being

adapted for registration with the graduations on the barrel coincidently with the alinement of the peripheral graduations with the index-line, a stop attached to the micrometer sleeve in fixed relation to the periphery thereof and adapted 5 to regulate the movement of the plunger to control the capacity of the barrel and to discharge the contents therefrom, and means in cooperative relation with the barrel and the micrometer sleeve to lock same against accidental movement. 10

12. A device of the character described comprising in combination a syringe barrel provided with a discharge nozzle, a plunger reciprocally mounted in the barrel, graduations on the barrel, a micrometrical sleeve concentric with the 15 barrel, screw-threads upon the barrel and within the micrometrical sleeve adapted for mutual engagement, graduations upon the periphery of the micrometrical sleeve in cooperative relation with the graduations on the barrel, a plunger- 20 stop in fixed relation to the micrometer sleeve, a flexible locking member integral with the micrometrical sleeve and in contact with the threads on the barrel, and means to actuate the flexible locking member to secure the micrometrical 25 sleeve against accidental movement.

13. A device of the character described comprising in combination a graduated syringe barrel provided with a discharge nozzle, a longitudinal index-line intersecting the graduations on 30 the barrel, exterior threads on the upper end of the barrel, a plunger reciprocally mounted in the barrel, a tubular micrometer sleeve concentic with the barrel and in cooperative relation with the graduations thereon, said micrometer 35 sleeve consisting of an upper and a lower member, graduations on the lower end of the lower member in cooperative relation with the longitudinal index-line, interior threads in the lower end of the upper member adapted to engage 40 the threads on the barrel, a flexible tongue integral with the threaded lower end of the upper member, a longitudinal slot through the upper end of the lower member positioned above the flexible member, a wedge slidably con- 45 fined in the slot and adapted to depress the tongue to releasably secure the sleeve in locked engagement with the barrel.

14. A device of the character described comprising in combination a graduated syringe, a graduated member in telescopic engagement therewith and rotatably adjustable for registration with the graduations thereon, and means responsive to the graduated member to regulate the capacity of the syringe, said means being optionally effective for discharging the contents of the syringe.

15. A device of the character described comprising in combination telescopically engaged members, the outer of said members being ad- 60 justable relative to the inner member, the inner member having a piston slidably mounted therein and a discharge means, a scale for the inner member provided with an index line and readable relative to the periphery of the outer 65 member, the said periphery having circumferentially disposed graduations adapted for alinement with the index line to supplement the indications of the scale, means responsive to the outer member to regulate the piston to control 70 the volume of liquid admitted into or discharged from the inner member in accordance with the indications of the scale and the peripheral graduations.

75