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S. F. COLE

2,283,915

SYRINGE

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Fig. 1.

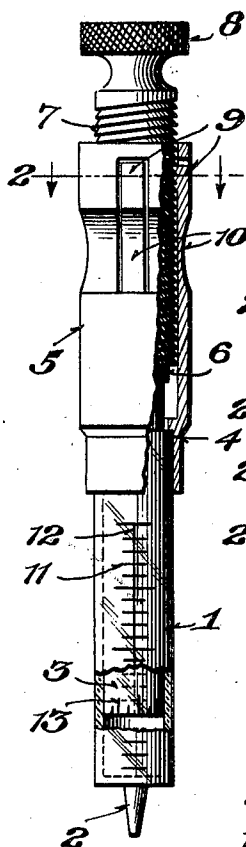


Fig. 4.

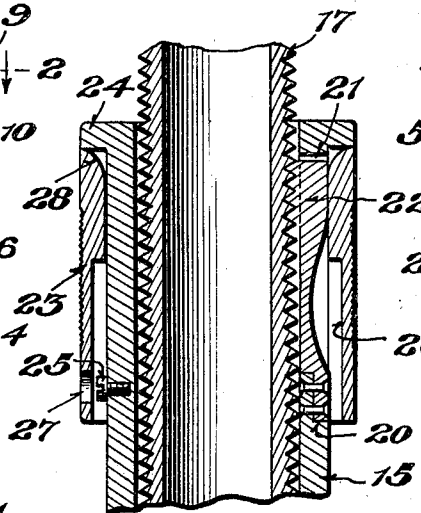


Fig. 5.

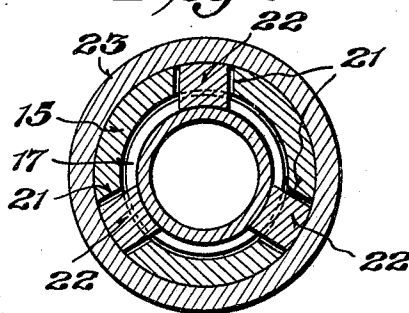


Fig. 2.

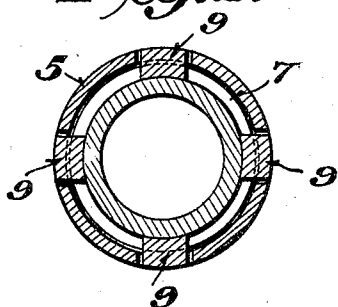
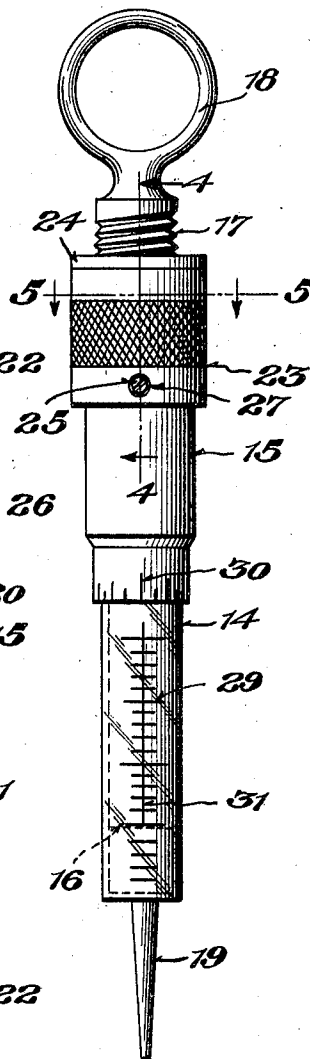


Fig. 3.



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SYRINGE

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16 Claims. (Cl. 128—218)

This invention relates to syringes and comprises a modification of the device disclosed in my prior Patent No. 2,129,675, issued September 13, 1938.

The primary objects of this invention are: to provide a syringe which is adapted for the exact administration of liquids—under pressure, if desired; to provide a syringe pipette which is adapted for the accurate transfer of liquids; to provide a syringe burette which is adapted for the precise measurement of liquids; to provide instruments of the above character in which the piston will have a rotative inward stroke, and both a rotative and a sliding outward stroke; and to provide a device of the above character which is simple in operation and construction. Other objects will be apparent upon the following disclosure of this invention.

In the accompanying drawing, wherein similar reference characters indicate corresponding parts throughout the several views:

Figure 1 is a front elevation, partly in section, of the modification of my invention which is adapted for use as a syringe or as a burette.

Figure 2 is a horizontal cross-section of Figure 1 on line 2—2.

Figure 3 is a front elevation of the modification of my invention adapted for use as a pipette.

Figure 4 is a fragmentary vertical sectional view of the upper portion of Figure 3.

Figure 5 is a horizontal cross-section of Figure 3 on line 5—5.

The present invention differs from the aforementioned prior invention in that it eliminates the "micrometrical sleeve 11" of the latter invention, and effects measurements of comparable accuracy by means of the threaded engagement of the barrel and plunger of the instrument, and also by adapting the plunger to subdivide the individual graduations of the scale which is inscribed on the barrel. The plunger employed in the modification of my invention shown in Figures 1 and 2 is designed for a rotative inward stroke, and for either a rotative or a sliding outward stroke. The plunger employed in the modification shown in Figures 3, 4 and 5 is designed for either a rotative or a sliding stroke in either direction. Obviously, a sliding stroke of the plunger permits the more rapid charging of the barrel of the device, and, to adapt the threaded plunger for a sliding outward stroke, the hereinafter described release means is employed. Two modifications of this means are illustrated—one for use with buttress threads (Figures 1 and 2), and one for use with V threads

(Figures 3, 4 and 5). Either of these means may be employed with each modification of my invention.

Referring now to Figures 1 and 2, the numeral 1 denotes a cylindrical glass barrel which is open at its upper end and provided with the conventional discharge nipple 2 at its lower end, said nipple being adapted to support a hypodermic needle or the equivalent. The tubular glass plunger 3 is ground to a sliding fit in the bore of barrel 1 and extends above the upper end thereof. The upper end of the barrel is firmly attached within the tubular seat 4 which is formed by the contracted lower end of the tubular barrel-extension 5. The upper end of plunger 3 is firmly attached within the tubular seat 6 which is formed in the lower end of the exteriorly threaded plunger-extension 7. The threads on the plunger-extension are of the buttress type, and are in engagement with the cooperating interior threads of the hereinafter described resilient tongues 9. The upper end of the plunger-extension 7 terminates in the knurled head 8 by means of which the plunger may be operated. The above mentioned "release means" comprises a plurality of longitudinally disposed resilient tongues 9 which are formed in, and integral with, the barrel-extension 5. The required flexibility may be imparted to these tongues by reducing their thickness, as indicated by the numeral 10, for as much of their length as may be necessary. The upper end of tongues 9 are of sufficient thickness to permit of their inward projection beyond the inner surface of the barrel-extension 5 to allow for the threads in the barrel-extension 5, and also to provide adequate clearance between the inner surface of the barrel-extension 5 and the outer surface of the plunger-extension 7. The resiliency of these tongues provides adequate tension to maintain a constant frictional contact between the threaded surfaces, and also sufficient flexibility to permit the lateral movement of the free end of the tongues during the sliding contact of the threaded surfaces incidental to the outward stroke of the plunger.

Barrel 1 is inscribed with any suitable longitudinally disposed scale 11 which is readable with reference to either the periphery of the lower end of the plunger, or to a suitable circumferentially disposed line on the plunger. The barrel is also inscribed with a longitudinal graduation in the form of an index-line 12 which is shown bisecting the graduations of scale 11. Inscribed around the lower end of plunger 3, and viewable through the barrel, are the longitudinally dis-

posed graduations 13 which are registerable with the index-line 12, and adapted to subdivide the individual graduations of scale 11 into fractional parts thereof.

The operation of the above described embodiment of my invention is as follows:

The barrel 1 is charged by a sliding outward stroke of the plunger 3. The plunger is then rotated to expel the trapped air and to bring its lower end into registration with the desired graduation of scale 11 simultaneously with the alinement of the predetermined graduation 13 with the index-line 12. The contents of the barrel may then be discharged by rotating the plunger-extension at the desired rate. Obviously, fractional parts of the quantities indicated by the registration of the plunger with the scale on the barrel are indicated by the alinement of the graduations of the plunger with the index-line.

The above described embodiment of my invention, when used with a suitable hypodermic needle, is especially adapted for use as a micro-syringe. However, when modified by reducing the diameter and increasing the length of the plunger-head 8 to form an elongated knurled member adapted for relatively rapid rotation between the thumb and forefinger, the device becomes a syringe-burette. The latter embodiment is especially adapted for chemical work, such as micro-analysis. When thus used as a burette, the discharge nipple 2 may be elongated to dispense with the use of detachable needles, and the device should be clamped in a suitable support (not shown) to hold it vertically in a fixed position.

The operation of this syringe-burette is substantially the same as the micro-syringe. A number of modifications of this device will be obvious, such as connecting a reservoir to the barrel by means of a three-way stop-cock communicating with the discharge-nipple.

When used as a syringe-pipette (see Figures 3, 4 and 5), my invention is further modified to permit the rotation of the cylindrical glass barrel 14, and its attached barrel-extension 15, on the tubular glass plunger 16, and its attached plunger-extension 17. These members are similar to the corresponding elements in the first described embodiment, and are joined in the same manner. It will be obvious that the operation of this device differs from conventional practice in that the plunger is held stationary, while the barrel is rotated thereon. The finger ring 18, on the upper end of the plunger-extension 17, provides a means for supporting the device in operating position. The lower end of barrel 14 terminates in the elongated discharge-nozzle 19, which may be replaced by suitable detachable members, if desired.

The plunger-release illustrated in Figure 4 differs somewhat from that shown in Figure 1 owing to the fact that the buttress threads of the latter have been replaced with V threads which engage the corresponding threads on the inwardly projecting upper ends of the flexible tongues 22.

Referring now especially to Figure 4, the barrel-extension 15 is provided with a plurality of longitudinally disposed rectangular grooves 20 in its outer surface. These grooves communicate with prolongations in the form of correspondingly disposed rectangular apertures 21 in the barrel-extension 15, and accommodate the lower ends of the resilient tongues 22 which are attached therein. The free portion of tongues 22 lie with-

in the apertures 21. Unlike tongues 9, the tongues 22 are normally sprung outwardly to automatically provide adequate clearance between their interiorly threaded upper ends and the threads on the plunger-extension 17. This clearance permits the disengagement of the tongues and the plunger-extension, and thereby permits the sliding outward stroke of the plunger 16.

The numeral 23 denotes a knurled collar which is slidably confined on the barrel-extension 15 between an upper stop and a lower stop. The upper stop comprises an outwardly projecting annular rim 24 which is integral with the barrel-extension 15, while the lower stop is formed by the outwardly projecting head of the screw 25, which is confined within the longitudinal groove 26 in the inner surface of collar 23. Screw 25 cooperates with groove 26 to permit the limited sliding movement of collar 23 and to prevent its rotation on the barrel-extension 15. Access to screw 25 is through the annular aperture 27 in the lower end of collar 23. Collar 23 is utilized to depress the outwardly projecting portions of tongues 22 and to thereby force their threaded inner surface into engagement with the threads on the plunger-extension 17. The inner wall of the upper end of collar 23 is flared as indicated by the numeral 28 to facilitate the upward movement of the collar against the projecting tongues.

The barrel 14 is graduated with the scale 29 which is readable with reference to the periphery of plunger 16. Inscribed on the lower end of the barrel-extension 15 are the circumferentially disposed graduations 30 which are readable with reference to the longitudinal index-line 31 inscribed on plunger 16.

This embodiment of my invention may be conveniently operated with one hand by inserting the forefinger through the ring 18 to support the device in operating position, and by rotating the barrel by means of the collar 23 which is held between the thumb and second finger. This device is charged by pushing the collar in the direction of the discharge-nipple to release the plunger which may thereafter be manipulated in the conventional manner. After the barrel is charged, the collar is pushed upwardly to bring the threaded tongues again into engagement with the barrel. Measurement, and discharge of the contents of the barrel, is effected by rotating the barrel to bring the desired graduation of scale 30 into alinement with the index-line 31 for minute quantities, and the desired graduation of scale 29 into registration with the lower end of the plunger for larger quantities.

Obviously, the value of graduations 13 and 30 are determined by the pitch of the threads on plunger-extensions 7 and 17 in relation to the spacing of the graduations of scales 11 and 29 respectively. While the drawing shows relatively fine threads, the pitch of the threads may vary to accommodate the devices to their specific purpose.

Various modifications of my invention may be made, also embodiments in numerous types and classes of syringe devices, and all such modifications, variants and adaptations are to be construed as within the scope of my invention if consistent with the following claims.

Having thus described my invention, I claim:

1. In a device of the character described, the combination of a tubulated container for liquids, a liquid ejecting means adjustably mounted within the container, indicia on the container readable with reference to the periphery of the ejecting

means to indicate primary measurements, indicia on the ejecting means, and secondary indicia on the container adapted to cooperate with the indicia on the ejecting means to supplement the primary measurements.

2. In a device of the character described, the combination of telescopically engaged cylindrical members, multiple scales on one of said members, and an index-line on the other member the graduations of one of said scales being registerable with the periphery of the cooperant member to indicate primary measurements, and the index-line being registerable with the graduations of the other of said scales to subdivide the graduations of the first named scale.

3. In a device of the character described, the combination of a cylindrical barrel provided with a threaded portion, a discharge orifice in said barrel, a plunger provided with a threaded portion in engagement with the threaded portion of the barrel, a longitudinal scale inscribed on the barrel and readable with reference to the periphery of the plunger for coarse measurements, and supplemental indicia inscribed on the plunger and on the barrel, the supplemental indicia on the plunger being registerable with the supplemental indicia on the barrel to indicate fractional parts thereof, the said threaded portion of the barrel providing an adjustable bearing concentric with the longitudinal axis of the barrel.

4. In a device of the character described, the combination of a cylindrical barrel provided with a threaded portion, a discharge orifice in said barrel, a plunger provided with a threaded portion in engagement with the threaded portion of the barrel, means for releasing the engagement between the threaded portions of the barrel and the plunger, independent primary and secondary indicia inscribed on the barrel, and secondary indicia inscribed on the plunger, the primary indicia on the barrel being registerable with the periphery of the plunger, and the secondary indicia on the plunger being registerable with the secondary indicia on the barrel to indicate fractional parts of the primary indicia.

5. In a device of the character described, the combination of a graduated cylindrical barrel, an index-line inscribed on the barrel, a discharge nipple in the lower end of the barrel, a plunger adjustably confined within the barrel and inscribed with a circumferential scale, a plunger supporting means attached to the barrel, and a plunger rotating means releasably coupled to the supporting means, the circumferential scale being registerable with the index-line to indicate fractional parts of the graduations on the barrel.

6. In a device of the character described, the combination of a cylindrical barrel, a discharge orifice in the barrel, a plunger adjustably mounted within the barrel, a cylindrical extension attached to the barrel, a plunger supporting means comprising a plurality of threaded resilient tongues integral with the cylindrical extension, a threaded extension member integral with the plunger and in releasable engagement with the supporting means, a longitudinally disposed scale inscribed on the barrel, said longitudinal scale being readable with reference to the periphery of the plunger, a longitudinally disposed index-line inscribed on the barrel, and a circumferential scale inscribed on the plunger, said plunger being rotatably adjustable to register the graduations of the circumferential scale, with the index-line to supplement the longitudinal scale.

7. In a device of the character described, the combination of a cylindrical barrel, a discharge orifice in the barrel, a plunger adjustably mounted within the barrel, a cylindrical extension attached to the barrel, a threaded extension member attached to the plunger, resilient supporting means for the plunger extension concentric with the cylindrical extension, a primary scale and an index-line inscribed on the barrel, and a secondary scale inscribed on the plunger, the graduations of the secondary scale being disposed parallel to the longitudinal axis of the plunger and registerable with the index-line to denote fractional parts of the graduations of the primary scale.

8. In a device of the character described, the combination of a cylindrical barrel inscribed with a scale and an index-line, a discharge orifice in the barrel, a plunger inscribed with micrometer graduations and adjustably mounted within the barrel, a cylindrical extension attached to the barrel, a plurality of threaded resilient tongues comprising a supporting means concentric with the cylindrical extension, an extension member integral with the plunger and provided with a micrometer screw adapted for releasable engagement with the supporting means, said plunger being rotatably adjustable to register the micrometer graduations with the index-line to subdivide the graduations of the scale.

9. In a device of the character described, the combination of a cylindrical barrel, a discharge orifice in the barrel, a plunger adjustably mounted within the barrel, a cylindrical extension attached to the barrel, a plurality of outwardly sprung resilient tongues in cooperative relation with the cylindrical extension, threads on the tongues, a threaded extension member attached to the plunger and in releasable engagement with the resilient tongues, a collar slidably mounted on the cylindrical extension and adapted to depress the resilient tongues to cause their engagement with the threaded plunger extension, primary means for indicating the position of the plunger within the barrel, and secondary means for supplementing the primary means.

10. In a device of the character described, the combination of a cylindrical barrel, a discharge orifice in the barrel, a plunger adjustably mounted within the barrel, a cylindrical extension attached to the barrel, a plurality of threaded resilient tongues in cooperative relation with the cylindrical extension, a threaded extension member attached to the plunger and in releasable engagement with the resilient tongues, a scale on the barrel, an index-line associated with the scale, and graduations on the plunger registerable with the index-line to indicate fractional parts of the graduations of the scale.

11. In a device of the character described, the combination of a cylindrical barrel, a discharge nozzle communicating with the barrel, a plunger adjustably mounted within the barrel, a cylindrical extension attached to the barrel, a plurality of threaded resilient tongues in cooperative relation with the cylindrical extension, a threaded extension member attached to the plunger and in releasable engagement with the resilient tongues, means to operate the resilient tongues, a scale on the barrel, a scale on the cylindrical extension, and an index-line on the plunger registerable with the scale on the cylindrical extension to subdivide the graduations of the scale on the barrel.

12. In a device of the character described, the

combination of a cylindrical barrel, a discharge nozzle communicating with the barrel, a plunger adjustably mounted within the barrel, a cylindrical extension attached to the barrel, a plurality of threaded resilient tongues in cooperative engagement with the cylindrical extension, a threaded extension member attached to the plunger in releasable engagement with the resilient tongues and terminating in a supporting member, means to control the resilient tongues, a scale on the barrel, a scale on the cylindrical extension, and an indicating means on the plunger registerable with the scale on the cylindrical extension to subdivide the graduations of the scale on the barrel.

13. In a device of the character described, the combination of a syringe barrel, a plunger mounted within the barrel, threaded means on the barrel and plunger adapted to adjust the relative longitudinal and the relative axial positions of the barrel and the plunger, and independent means to simultaneously measure the resultant longitudinal and axial movement of the barrel and plunger in units of volume, the said independent means comprising primary and secondary indicia on the barrel and secondary indicia on the plunger, the primary indicia being registerable with the periphery of the plunger to measure the longitudinal movement, and the secondary indicia being mutually registerable to measure the axial movement.

14. In a device of the character described, the combination of a cylindrical container provided with a plunger, a discharge orifice in said container, indicia inscribed on the container readable with reference to the periphery of the plunger to effect coarse measurements, and indicia inscribed on the container and on the plunger adapted to cooperate to effect fine measurements.

15. In a device of the character described, the combination of an inner and an outer tubular member, supporting means for adjustably coupling said members, a discharge orifice in the outer member, the inner member forming a plunger, indicia inscribed on the outer member registerable with the periphery of the inner member for indicating relatively coarse measurements, and supplemental indicia inscribed on the outer and inner members adapted for alinement to indicate fractional parts of the coarse measurements.

16. In a device of the character described, the combination of a graduated cylindrical container, a discharge orifice in the container, a longitudinal index line inscribed on the container, a plunger adjustably confined within the container and inscribed with a circumferential scale, the circumferential scale being registerable with the index line to subdivide the graduations on the container, and supporting means for releasably coupling the container and the plunger.

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