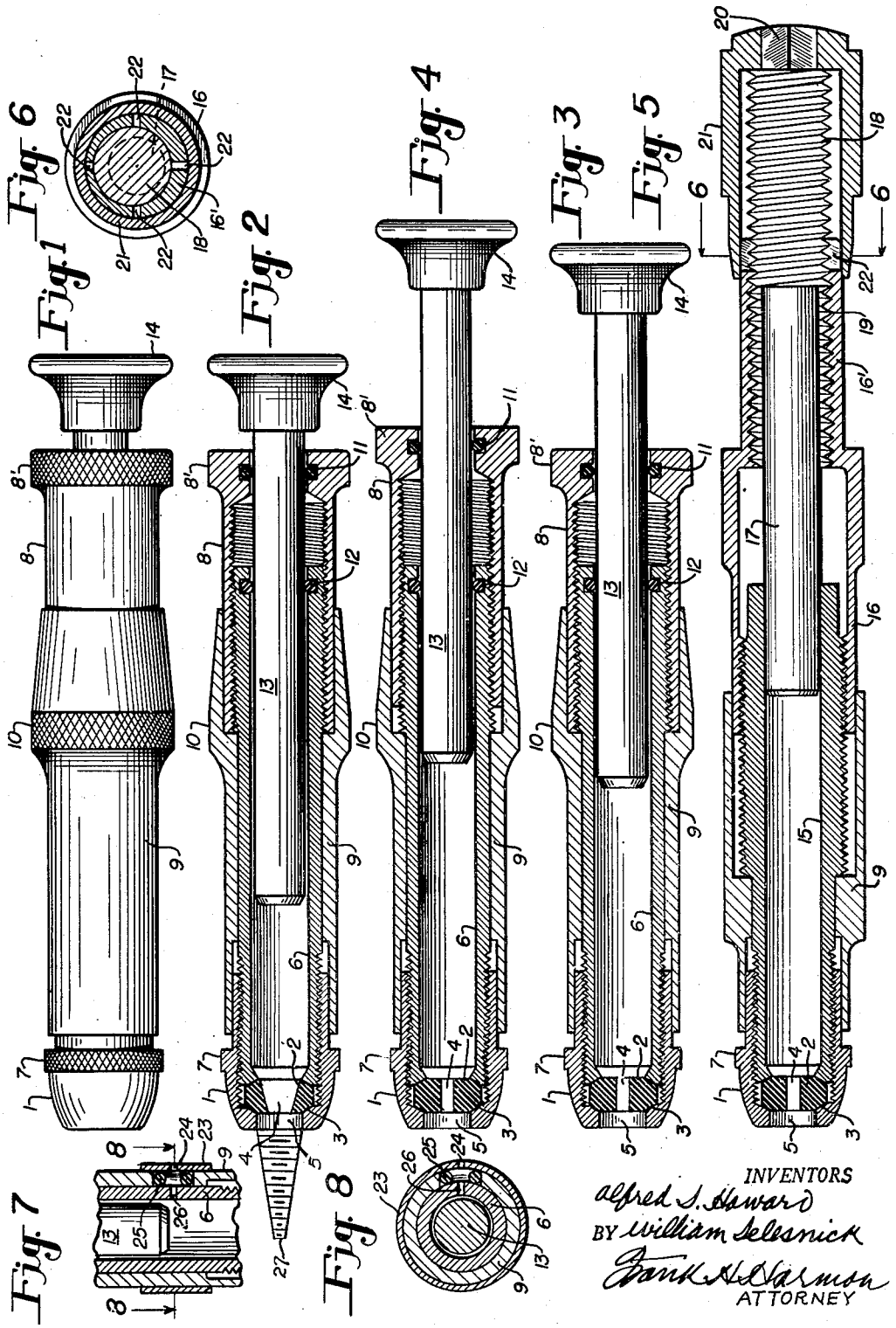
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SYRINGE WITH VERNIER ADJUSTMENT

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SYRINGE WITH VERNIER ADJUSTMENT

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This invention relates in general to fluid measuring devices and more particularly to devices generally known as syringes and of the type adapted for use in the medical, scientific and allied professions for handling, measuring and administration of fluids.

In many chemical and biological operations a very high degree of precision in measurements of fluid volume is essential. The conventional practice of achieving such measurements is to use transparent graduated pipettes, the volume of fluid in the pipette being controlled by the suction of the mouth of the operator.

Such a practice has many drawbacks. For instance, in attempting to make precise dilutions of blood for use in counting the number of blood cells present, it has been found that, because of the relatively small volume involved, such suction control is not sufficiently sensitive, smooth or reliable. Also, such a practice in the measurement of accurate amounts of irritating volatile liquids, corrosive chemicals, bacteriologically infectious solutions or radio-active chemicals is highly dangerous to the operator.

It is, therefore, one of the primary objects of the invention to provide a mechanical hand controlled suction device capable of high precision in suction, measurement and discharge of fluids.

Another object is to provide such a syringe capable of such high precision measurements without the inherent disadvantages of fine gradations.

Another object is to provide such a syringe that is adapted to removably receive a pipette in air tight relationship, whereby neither the pipette holder nor its adjustable parts need be graduated nor actually receive any fluid in order to effect a controlled suction and measurement of fluid in the pipette or controlled discharge from the latter.

Another object is to provide an improved means of adjustment of the pipette holder for fluid suction and discharge control in the pipette that provides means for both coarse and vernier like adjustment for purposes of facility and precision in operation.

With the foregoing and other objects in view, the invention resides in the combination of parts and in the details of construction hereinafter set forth in the following specification and appended claims, certain embodiments thereof being illustrated in the accompanying drawings, in which:

Figure 1 is a view in elevation of the syringe, or pipette holder, the pipette not being shown;

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Figure 2 is a view in longitudinal section taken through the pipette holder in the same retracted position shown in Figure 1;

Figure 3 is a view similar to Figure 2 with the plunger extended for coarse adjustment and the thimble not as yet actuated for vernier like adjustment;

Figure 4 is a view similar to Figure 3, showing the thimble having been extended for vernier like adjustment for suction;

Figure 5 is a view in longitudinal section of a pipette holder having a fine vernier like screw adjustment for the thimble and plunger and a coarse screw adjustment for the plunger, instead of the direct manual manipulation thereof, as in Figures 1 to 4, inclusive;

Figure 6 is a view in cross-section taken along line 6—6 of Figure 5;

Figure 7 is a fragmentary view in longitudinal section taken through the thimble, grip and barrel in the suction chamber below the plunger showing a modification thereof to include the added feature of an air vent, or suction relief, the same including a small shell about the grip frictionally maintained in position but adjustable to bring about registry of apertures to provide an air vent to the suction chamber and out of registry to prevent such air admission; and

Figure 8 is a view in section taken along line 8—8 of Figure 7.

Referring more particularly to the drawings, the new and novel syringe comprising the invention is illustrated with the pipette shown only in Figure 2 at 27, it being understood that the pipette, itself, may be included also in the remaining figures and of any suitable conventional type and be releasably secured and held by a collet 1 that carries a rubber-like member 2 resting on an internal shoulder 3 and centrally apertured at 4 to receive the pipette 27 extending through the aperture 5 in the collet and through aperture 4.

This collet is internally screw-threaded to engage the corresponding external screw-threads of a hollow barrel 6 and the collet has a knurled portion 7 to facilitate relative longitudinal adjustment of the collet on the barrel 6. In practice, the collet is preferably adjusted downwardly on the barrel and the upper unrestricted end of the pipette 27 forced only a short distance through aperture 4 of washer 2. The collet is then screwed upwardly on the barrel, bringing the lower end of the barrel 6 downwardly against the upper bevelled end of washer 2 to squeeze

the latter radially inwardly to more tightly engage the pipette therein.

Barrel 6 also has its upper portion externally screw-threaded to engage the internal screw threads of a hollow thimble 8 to provide for relative longitudinal adjustment between the barrel and thimble. Thimble 8 is also provided with a knurled portion 8' to facilitate such adjustment. Slidably and rotatably surrounding thimble 8 and collet 1 and press fit on barrel 6, is a hand grip 9 with a knurled portion 10.

Fitted in an inner annular groove in the head of thimble 8 is a frictional gripping sealing ring 11 and also fitted in an inner annular groove in the upper portion of barrel 6 is a sealing ring 12 of less frictional gripping qualities to receive in air tight relationship a cylindrical plunger 13 having an enlarged manually operable head 14.

Figures 1 to 4, inclusive, represent one form that the invention may take. Assuming the pipette to be gripped by the washer 2 in the collet, Figure 2 being a longitudinal sectional illustration of Figure 1, shows the syringe to be in normal retracted position. Both sealing rings 11 and 12 are capable of air and fluid tight sealing. Sealing ring 11, however, is designed to have a much greater capacity for gripping the plunger 13 than has the sealing ring 12. This being true, the preferred operational practice is to first manually extend the plunger so that its enlarged head is slightly above the upper extremity of the thimble and the gripping sealing ring 11 holds the plunger in this adjusted position. This affords the operator the opportunity of manual operation of the plunger for fluid discharge, which opportunity would not be present if the plunger head were resting on the upper end of the thimble.

The normal operational procedure in sucking in a desired volume of fluid into the pipette is to immerse the restricted end thereof into the fluid. While grasping the grip 9 in one hand, the fingers of the same hand may be employed to manipulate the plunger head to withdraw the plunger to an extended position such as that shown in Figure 3, during which operation a volume of fluid just short of that desired has been introduced into the pipette. In order to obtain precision the remaining suction action is hand operated under vernier like adjustment. This is accomplished by releasing the plunger head and, while still holding the grip in the same hand, employing the fingers of the same hand to rotate the thimble in the appropriate direction to extend the thimble upwardly to a position as shown in Figure 4. Due to the gripping action of sealing ring 11 on the plunger, the thimble carries the plunger upwardly to a position slightly higher than that shown in Figure 3. This vernier like suction adjustment is usually carried on while noting a mark or gradation on the pipette and discontinued when the liquid level in the pipette registers with such mark. Thus there is no necessity of drawing any fluid into any part of the apparatus shown in the drawings, nor is there any necessity of providing any part thereof with calibrations. The lead on the engaging screw threads of barrel 6 and thimble 8 is a matter of choice to effect any desired fineness of adjustment so as to predetermine the rate of resulting suction of the fluid into the pipette.

Figures 5 and 6 illustrate another of the forms that the invention may take. Here the same adjustable collet construction for holding the pipette may be employed. Fundamentally it is constructed to be capable of the same fine adjustment for suction as that described in connection with Figure 4. The main difference is the additional provision of an alternately useable high pitch coarse screw adjustment for manually actuating the suction plunger instead of the free direct pulling manipulation thereof described in connection with Figure 3. In detail, collet 1 is externally screw threaded onto a hollow barrel 15 which, in turn, is internally screwed into a hollow thimble 16. A cylindrical suction plunger 17 is slidable in barrel 15 and has its upper portion enlarged and provided with coarse high pitch screw threads 18 to mesh with corresponding internal threads 19 of the upper reduced portion 16' of the hollow thimble 16. The top of plunger 17 may terminate in a hexagonal head 20 to receive a correspondingly shaped aperture in a cap 21 that slidably and rotatably fits about the upper end of thimble 16' and is free from threads 18. Four slots 22 may be provided in the thimble in order to properly control the friction between threads 18 of the plunger and threads 19 of the thimble.

The normal operational procedure here is fundamentally the same as that employed in the embodiment shown in Figures 1 to 4, inclusive. The device may be held in one hand while the fingers of the same hand are employed to rotate the cap 21 in the appropriate direction for first creating a friction between threads 18 and 19 greater than the friction between the plunger and gripping sealing ring 11. Continued turning of the cap in this direction results in drawing the plunger upwardly into an extended position to suck fluid into the pipette in a volume just short of that desired, similarly to that phase of the operation discussed in connection with Figure 3. The cap 21 provides a hand screw control which in some instances may be preferred over direct hand manipulation or direct pull on the plunger of Figure 3.

In Figure 5, the subsequent vernier like adjustment is virtually identical with that described in connection with Figure 4. In detail the grip 9 is still held in the same hand, the fingers of which are released from the cap and gripped about thimble 16 to rotate the same in the appropriate direction to draw the thimble upwardly due to the meshing of its fine threads with those of barrel 15. Thus, sensitivity, precision and smooth fluid flow into the pipette is accomplished by a slow sensitivity controlled movement provided for by the meshing of the fine pitch engaging screw threads of barrel 15 and thimble 16.

It follows that the same advantages obtained by the invention in hand controlled smooth sensitive fluid suction flow into the pipette for measurement purposes equally apply in the obtaining of the same smooth sensitive hand controlled fluid discharge from the pipette by the reversal of the adjustment of the movable parts of the device.

From the foregoing it will be seen that there has been provided a new and novel syringe providing for ready installation and removal of a pipette; that no fluid need be drawn into the device nor need it be calibrated; that it provides alternately useable hand adjustment devices for varying degrees of sensitivity and consequent hand controlled fluid suction or discharge by the mere use of one hand.

A further refinement of the device useable in any form of the invention including the modifications shown in Figures 1 to 4, inclusive, and Figures 5 and 6, is shown in Figures 7 and 8. In the use of pipettes of the volumetric type in connection with the syringe of the present invention it has been found that in some instances it may be desired to provide an auxiliary hand controlled air vent for introducing air into the suction chamber in the barrel below the plunger to permit drainage of the fluid from the pipette at normal pressure. In order to accomplish this, an aperture **26** may be provided in barrel **6** at a point below the maximum retracted position of the plunger. Surrounding the grip is a thin band **23** with an aperture **24**. Suitable recesses are formed in the grip to receive an O ring **25** which bears against the exterior surface of the barrel and the interior surface of the band to frictionally maintain the band in any adjusted position. The O ring **25**, moreover, provides an effective air tight seal for aperture **26** in barrel **6** from the exterior as long as it remains out of registry with aperture **24** in the band **23**. Relative adjustment of the band, barrel and grip may thus bring about introduction of air from the exterior into the suction chamber when desired or positively preclude such air admission thereinto during normal operation.

We claim:

1. In a portable hand controlled fluid suction and discharge device, a hollow barrel and a plunger slidably mounted therein to provide a suction chamber in said barrel below said plunger, a collet adapted to releasably receive a pipette and longitudinally adjustably mounted on the lower end of said barrel, a hollow thimble adjustably mounted externally about the upper end of said barrel by relatively fine low pitch meshing screw threads, sealing rings carried internally by said barrel and thimble to be engaged by said plunger, the latter of which sealing rings has a relatively greater frictional grip on said plunger, said plunger being slidably moved in said barrel by manually rotating said thimble relative to said barrel, said plunger being directly manually adjustable longitudinally in said barrel by the same hand independently of relative rotation of said barrel and thimble.

2. In a portable hand controlled fluid suction and discharge device, a hollow barrel and a plunger slidably mounted therein to provide a suction chamber in said barrel below said plunger, a thimble screw-threadedly adjustably

mounted on said barrel, sealing rings carried internally by said barrel and thimble to be engaged by said plunger, the latter of which rings exerts a relatively greater gripping action on said plunger whereby said plunger is adapted to be longitudinally moved in said barrel and thus operated for fluid suction and discharge by a single hand operation both by relative rotation of said thimble and barrel and by direct hand manipulation of said plunger manually with the same hand independently of relative rotation of said thimble and barrel.

3. In a hand controlled fluid suction and discharge device, a hollow barrel and a plunger slidably mounted therein to provide a suction chamber in said barrel below said plunger, a thimble adjustably mounted externally on said barrel by relatively fine low pitch meshing threads, means for normally holding said plunger against longitudinal movement in said thimble, said plunger being manually movable longitudinally for relatively course degree of fluid suction and discharge, said thimble, upon manual rotation on said barrel, being adapted, through said means, to move said plunger longitudinally for relatively finer degree of fluid suction and discharge, hand controlled air vent means for introducing air from the exterior into said suction chamber and comprising a manually rotatable band mounted on said barrel and held thereon by frictional means, said band and barrel having registerable apertures therein leading to said suction chamber.

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