Feb. 25, 1964 G. GODA 3,122,280

ADJUSTABLE STROKE LIQUID DISPENSER HAVING YIELDABLE ALIGNING MEANS

Filed Aug. 14, 1961

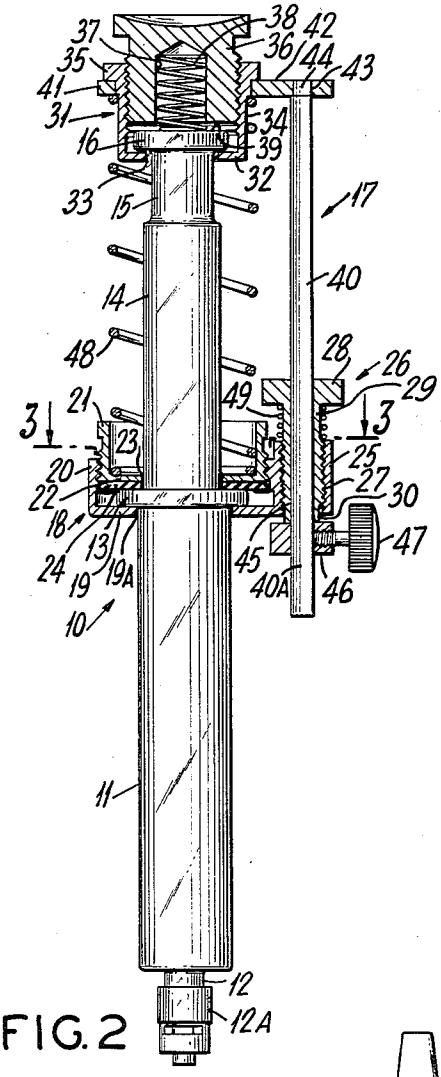

FIG. 2

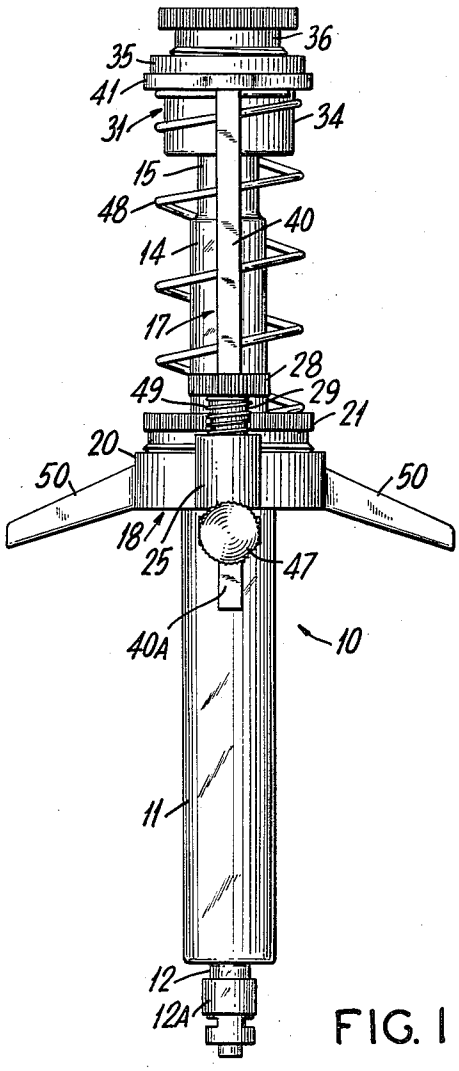

FIG. 1

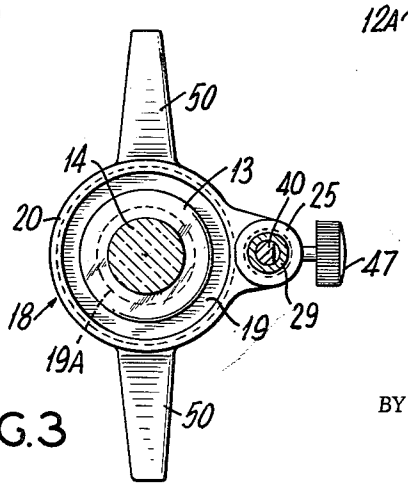

FIG. 3

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United States Patent Office 3,122,280 Patented Feb. 25, 1964

3,122,280

ADJUSTABLE STROKE LIQUID DISPENSER HAVING YIELDABLE ALIGNING MEANS

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Filed Aug. 14, 1961, Ser. No. 131,317
9 Claims. (Cl. 222—309)

This invention relates to liquid dispensers and more particularly concerns pipettes or the like for dispensing a precise, predetermined quantity of liquid repeatedly therefrom.

Liquid dispensers of the pipette type, which comprise a barrel-piston syringe and associated attachments for limiting the travel of the piston in the barrel, have been proposed. The user of such a device presses the piston downwardly in the barrel by applying the thumb to the head of the piston. If the thumb or point of pressure is slightly off center with respect to the axis of the piston, the downstroke of the piston may result in a binding action as between the piston and the barrel, causing poor reciprocatory action in the device.

Also, in the case of the smaller capacity syringes of the order of 1 and 3 cc., the pistons are of very small diameter which renders them susceptible to breakage when the piston is depressed with even a slightly off center application of pressure to the piston head.

Accordingly, an object of this invention is to provide a barrel-piston syringe with means for interconnecting the relatively movable parts of the syringe to positively guide the movement of the piston relative to the barrel irrespective of the point of application of pressure for the downstroke of the piston.

Another object of this invention is to provide positive guide means for the piston of a barrel-piston syringe, such guide means also including presettable means for limiting the travel of the piston in the barrel so as to dispense precise equal quantities of liquid each time the piston is reciprocated.

A further object of this invention is to provide an improved piston guide and stop means for a syringe wherein the stop means may be adjusted to vary the extent of travel of the piston in the barrel, together with vernier adjustment means for making fine precise adjustments of the position of the stop means to thereby finely adjust the quantity of liquid dispensed.

Other objects of this invention will in part be obvious and in part hereinafter pointed out.

In the drawing, FIG. 1 is a side elevational view of a liquid dispensing device embodying the invention;

FIG. 2 is a vertical view thereof with parts in section; and

FIG. 3 is a transverse sectional view taken on the line 3—3 of FIG. 2.

Referring in detail to the drawing, 10 designates a liquid dispenser of the barrel-piston type, embodying the invention. The same comprises a conventional tubular glass syringe barrel 11 having a dispensing tip 12 at the lower end thereof and the usual radial flange 13 at the upper open end thereof. A glass piston 14 is reciprocably mounted in barrel 11 and is ground to have a fine precision sliding fit with the inner barrel surface. Piston 14 has the usual neck portion 15 and terminates at its head in a radial flange 16 which has a diameter somewhat greater than the diameter of the piston proper.

Combination guide and stop means, generally indicated at 17, interconnects barrel 11 and piston 14 to adjustably set the travel of piston 14 in barrel 11, whereby to accurately determine the quantity of liquid drawn up into the barrel 11 on the upstroke of piston 14, which quantity is dispensed on the downstroke of said piston.

Means 17 comprises a barrel attachment including a

cupped member 18 having a bottom wall 19 formed with a central opening 19A for passing the barrel 11; the barrel flange 13 resting on the top surface of wall 19. The cylindrical side wall 20 of member 18 is internally threaded to receive an externally threaded cup shaped member 21 which has a bottom wall 22 formed with a central opening 23 having a diameter which will pass the piston 14.

Flange 13 of barrel 11 is firmly clamped between wall 19 of member 18 and wall 22 of member 21; a gasket 24 being interposed between barrel flange 13 and member 21. The cupped member 18 further includes a laterally related, vertically disposed internally threaded guide collar 25 which is integral with side wall 20 of member 18.

A tubular guide screw 26 is threaded into collar 25, said screw having an intermediate threaded portion 27, a knurled, radial head portion 28 at the upper end thereof, a neck portion 29 between portions 27 and 28, and a lower end portion 30 of slightly reduced diameter.

Means 17 further includes a guide attachment mounted on the upper head end of piston 14. Such attachment includes a cup shaped member 31 with a bottom wall 32 formed with a central opening 33 which will pass the piston proper but seats piston flange 16 on wall 32. The cylindrical side wall 34 of member 31 is internally threaded, the side wall terminating at its upper end in a radial flange 35.

The piston flange 16 is resiliently held against wall 32 by a screw 36 threaded into member 31. Screw 36 is formed with an axial recess 37 to receive a spring 38 therein. The lower end of spring 38 bears against the top surface 39 of piston flange 16, the bottom edge of the screw being short thereof. The bias of spring 38 is regulated by turning screw 36 in one direction or the other. Thus, while the piston 14 may be firmly held in attachment member 31, the connection therebetween is of a complaint or floating type.

Members 18 and 31 are interconnected by a guide pin 40 which extends in parallel relation to the longitudinal axes of barrel 11 and piston 14. The pin 40 is connected to member 31 by a retainer ring 41 which is force fitted on said member 31 and abuts the underside of flange 35 thereof. Ring 41 includes a laterally offset portion 42 which is formed with an opening 43, in which is force fitted the upper reduced end portion 44 of guide pin 41.

The lower end portion 40A of pin 40 passes through the axial bore 45 of screw 26 with a slide fit therein, and a stop ring 46 is adjustably mounted on pin portion 40A by a set screw 47. As the stop ring 46 abuts the lower end of screw portion 30, the extent of the outward movement of piston 14 relative to barrel 11 is limited; piston 14 being biased outwardly of the barrel by the usual coil spring 48 extending about the upper portion of piston 14, abutting ring 41 at its upper end and wall 22 of member 21 at its lower end.

It will be apparent that stop ring 46 may be fixed in selected positions along pin 40 to give a reasonably precise setting of the same on said guide pin. However, the setting may be made even more precise by rotating screw 26 in one direction or the other to shift the position of abutment portion 30 of said screw over extremely small longitudinal increments. A coil spring 49 about neck portion 29 of screw 26, which abuts the collar 25 at its lower end, keeps screw 26 from turning in collar 25 as an incident to vibration of the device; thus preserving a vernier setting of screw 26.

Member 18 includes the usual finger holding grips 50 which project radially and diametrally from wall 20 thereof. A conventional Luer lock 12A may be mounted on barrel tip 12 for suitable connection.

As guide pin 40 has a smooth sliding fit in bore 45 of screw 26 and is fixedly attached to member 31 by way

of ring 41; the movement of piston 14 in barrel 11 is positively guided, irrespective of the precise point of application of pressure to the head of screw 36 for depressing the piston 14. However, the piston flange 16 is in floating relation to member 31 rather than in a rigid, fixed relation thereto; thereby allowing piston 14 to accommodate itself to barrel 11 during the reciprocatory movements of the piston 14 incident to the filling and discharge of device 10.

When device 10 is used repeatedly at successive intervals to dispense a substantial number of equal quantities of liquid, the pressure applied each time piston 14 is depressed may vary and thereby possibly affect the extent of travel of the piston, with a possibility of insufficient depression of the piston, in some cases. However, with the floating relation of piston 14 relative to member 31, the user may regularly exert pressures somewhat in excess of that necessary to fully depress the piston, and thus insure full depressed travel of the piston at all times.

Furthermore, spring 38 is effective to absorb any shock if the bottom of piston 14 makes sudden contact with the lower end of barrel 11 upon depressed movement of said piston, thus avoiding possible breakage of the syringe parts.

As various changes might be made in the embodiment of the invention herein disclosed, without departing from the spirit thereof, it is understood that all matter herein shown or described shall be deemed illustrative and not limiting except as set forth in the appended claims.

Having thus disclosed my invention, I claim as new and desire to protect by Letters Patent:

1. In combination with a liquid dispensing device having a cylindrical barrel open at one end thereof and a piston reciprocably mounted in the other end thereof, means for guiding the travel of the piston relative to said barrel upon depressing the head of said piston, said means comprising a first member fixedly mounted on said barrel, a second member yieldably mounted on said piston, a guide member extending between said members with one end thereof fixedly secured to one of said members for concurrent movement therewith and means on the other of said members for slidably engaging the other end of said guide member to direct the movement thereof in a confined longitudinal path without lateral deviation therefrom, a stop member slidably mounted on said guide member with means for fixing said stop member in selected positions along said guide member for abutment with said other member upon movement of said piston outwardly of said barrel, spring means disposed to bias said piston outwardly of said barrel, and resilient means between opposed portions of said second member and said piston whereby said piston may accommodate itself to said barrel during the guided movement thereof relative to said barrel.

2. A device as in claim 1 and further including movable means on said first member engageable with said guide member for imparting finely adjusted longitudinal movements of said guide member relative to said first member in response to movement of said movable means.

3. A device as in claim 2 wherein said first member includes a threaded collar and said movable means comprises a tubular screw threaded into said collar with the lower end thereof abutting said stop member, said guide member passing through the bore of said tubular screw.

4. A device as in claim 3 wherein said second member comprises a cup shaped member for seating the upper end of said piston therein, and said resilient means comprises a nut threaded into said cup shaped member and a spring between said nut and the upper end of said piston, said nut being turnable to adjust the bias of said spring relative to the upper end of said piston.

5. A liquid dispenser comprising a barrel having a dispensing tip at one end thereof and open at the other end thereof, a piston reciprocably mounted in the open end of said barrel, means for guiding the movement of the piston relative to the barrel upon reciprocation thereof, said guiding means comprising an elongated guide member extending parallel to the longitudinal axes of said barrel and piston, means rigidly secured to said barrel and including means for slidably passing the lower end portion of said guide member in a confined longitudinal path parallel to the said axes of the barrel and piston, means interconnecting the upper end of said guide member with the upper end of said piston comprising an engaging member fixedly secured to said guide member, said engaging member including means for yieldably receiving an upper end portion of said piston, spring means biasing the upper end portion of the piston relative to said engaging member, and means for resiliently biasing said piston outwardly of said barrel.

6. A liquid dispenser comprising a barrel having a dispensing tip at one end thereof and being open at the other end thereof, a piston reciprocably mounted in the open end of the barrel, means for resiliently biasing the piston outwardly of the barrel, means for guiding the movement of the piston relative to the barrel, said guiding means comprising an elongated guide member disposed parallel to the longitudinal axes of the barrel and piston, a tubular member rigidly secured to said barrel, one end portion of said guide member slidably passing through said tubular member in a laterally confined predetermined longitudinal path, means for connecting the other end of said guide member to the head of said piston, said connecting means comprising a member for yieldably engaging the head of the piston for permitting relative movement therebetween, means for limiting the relative movement between said connecting means and said piston, and abutment means on the one end portion of said guide member engageable with said tubular member for limiting the outward movement of said piston relative to said barrel upon reciprocatory movement of said piston.

7. A liquid dispenser as in claim 6 wherein said connecting means comprises an internally threaded cupped member having a central opening for mounting the head of the piston therein, a screw member in said cupped member and spring means between said screw member and the head of said piston.

8. A liquid dispenser as in claim 6 wherein said tubular member is internally threaded and a tubular screw is threaded into said tubular member, said abutment means engaging one end of said tubular screw.

9. A liquid dispenser comprising a barrel having a dispensing tip at one end and being open at the other end, a piston reciprocably mounted in the open end of said barrel, means for resiliently biasing said piston outwardly of said barrel, guide means fixed on said barrel, depressible movable means slidably engaging said guide means for guided movement of said movable means in a determined longitudinal path and for depressing said piston within said barrel, said movable means comprising a portion in opposed relation to the head of said piston, yieldable means between the head of said piston and the opposed portion of said movable means for permitting limited continued depressed movement of said movable means after said piston has been depressed to a position bringing its lower end into abutment with the lower end of said barrel, and adjustable stop means on said movable means for engagement with said guide means for limiting the outward movement of said piston relative to said barrel.

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