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Tarter

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[54] **FLUID METERING DEVICE**

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[51] **Int. Cl.** **G01f 11/02**

[58] **Field of Search** 222/21, 309, 434, 435, 438, 222/439, 440, 443; 73/113, 223

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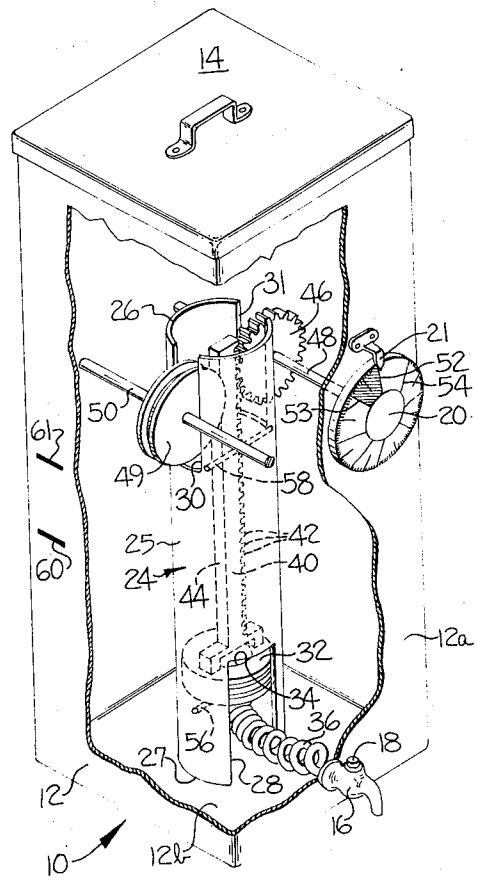
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Assistant Examiner—Thomas E. Kocovsky

[57] **ABSTRACT**

An apparatus for metering and delivering a preselected quantity of a fluid comprising a container for holding a relatively large quantity of the fluid, a vertically extending tube positioned within the container and having an open upper end adapted to lie above the fluid level and an open lower end adapted to lie below the fluid level, and a piston translatably mounted within the tube. The piston has a passageway extending therethrough which is connected via an extensible tube to a delivery spigot attached to the exterior of the container. In use, the piston is initially translated to a position below the open lower end such that the fluid in the container passes into the tube. The piston is then raised to a selected elevation such that the fluid in the tube is retained and lifted causing the excess thereof to spill from the open upper end back into the container. This results in a measured quantity of the fluid carried above the piston, which may then be released through the delivery spigot.

6 Claims, 4 Drawing Figures



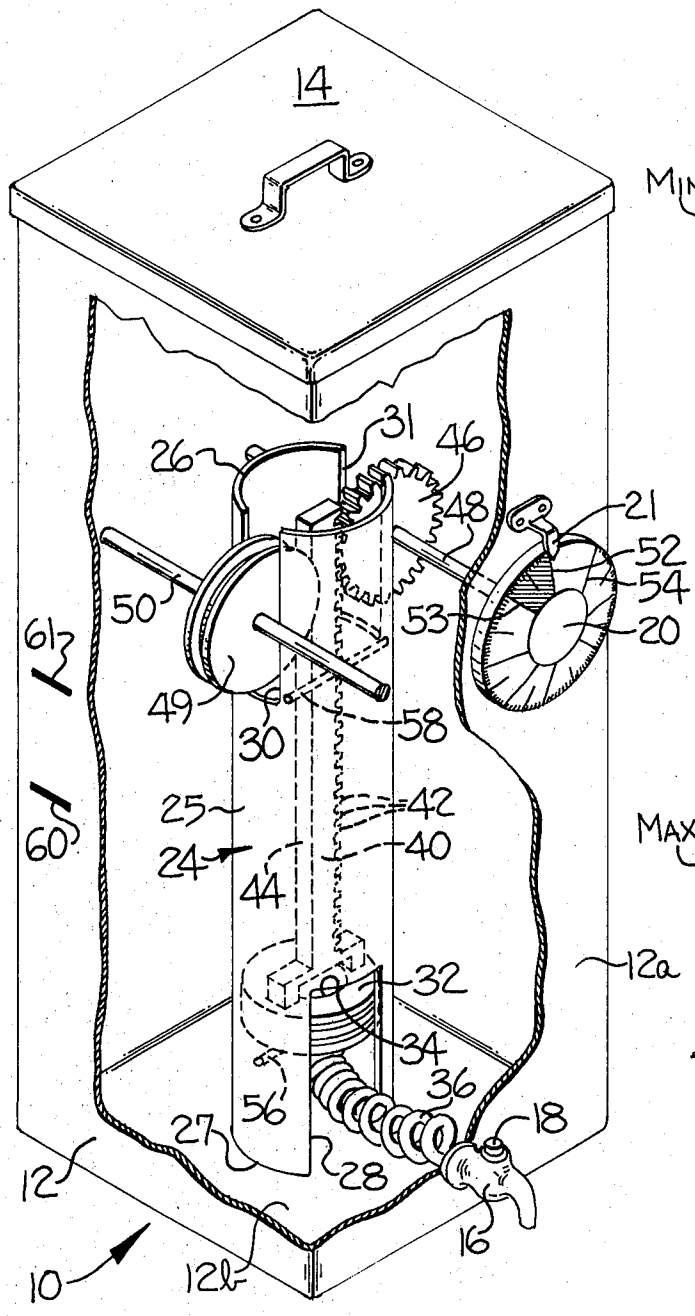


Fig-1

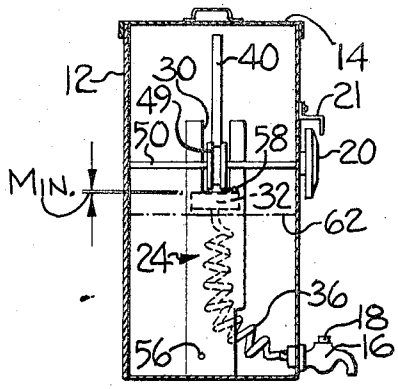


Fig-4

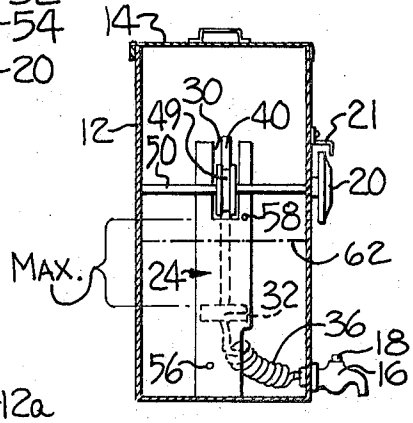


Fig-3

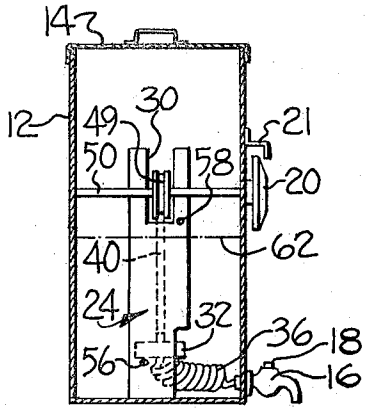


Fig-2

FLUID METERING DEVICE

The present invention relates to an apparatus for metering and delivering a variable and pre-selected quantity of a fluid, and which is adapted for use in a wide variety of applications. More specifically, the apparatus may be used by pharmacists or laboratory technicians in performing repeated measurements of a fluid in the preparation of various compounds and chemical mixtures. In addition, the present invention is adapted for use in kitchens, restaurants, hospitals, automatic vending machines, and many other instances where the frequent measurement of a fluid is required.

Conventionally, fluids are measured by drawing the fluid into a graduated cylinder, and then conducting a series of careful additions or subtractions until the technician is satisfied that the proper amount is present. As will be readily apparent, this is a time consuming and tedious operation, particularly when it must be performed many times and where accuracy is required. In addition, the routine nature of the process often causes the technician to become somewhat careless and errors are easily made.

It is accordingly an object of the present invention to provide an apparatus which is adapted to meter and deliver a pre-selected quantity of a fluid, and which requires a minimum of time and attention from the operator.

It is a further object of the present invention to provide an apparatus of the described type which may be constructed entirely from materials capable of being autoclaved, and which may be easily disassembled for cleaning.

It is another object of the present invention to provide an apparatus of the described type which may be readily designed in various proportions to fit different applications, and which is adapted to achieve a high degree of accuracy in the measurement of the fluid.

It is another object of the present invention to provide an apparatus which is adapted to meter a preselected quantity of a fluid carried within the apparatus by manually rotating an external dial, and then deliver the measured quantity through a delivery spigot by manually opening an external valve.

These and other objects and advantages of the present invention are achieved in the embodiment illustrated herein by the provision of a container which is adapted to hold a relatively large quantity of the fluid. Means for separating a pre-selected quantity of the fluid held in the container from the remaining portion of the same is positioned within the container and includes a vertically extending tube having open upper and lower ends, and a piston translatably mounted within the tube. A manually operable dial is carried externally of the container and is adapted to raise and lower the piston within the tube upon the dial being rotated by the operator. The piston has a passageway extending therethrough which is connected to a coiled extensible delivery tube leading to an external valve and delivery spigot. In use, the container is initially filled with the fluid until it reaches a level intermediate the upper and lower ends of the tube. The dial is then rotated to a position wherein the piston is below the lower tube opening such that the fluid enters the tube and rises to a level corresponding to that of the fluid in the container. The dial is then rotated to lift the piston to a desired level thereby causing the excess fluid to spill

over the open upper end of the tube and return to the fluid in the container. The external valve may then be opened to permit the measured quantity of fluid carried above the piston to be delivered through the spigot.

Some of the objects and advantages of the invention having been stated, others will appear as the description proceeds, when taken in connection with the accompanying drawings, in which:

FIG. **1** is a perspective view, partially broken away, of an apparatus embodying the features of the present invention;

FIG. **2** is a sectional side view in reduced scale of the apparatus shown in FIG. **1**, and showing the piston in the lowermost or refill position;

FIG. **3** is a view similar to FIG. **2** but showing the piston in its raised and maximum volume position;

FIG. **4** is a view similar to FIGS. **2** and **3** but showing the piston is its raised and minimum volume position.

Referring more specifically to the drawings, an apparatus embodying the features of the present invention is generally indicated in FIG. **1** at **10**, and includes a container **12** which is adapted to hold a relatively large quantity of fluid. A removable lid **14** covers the open upper end of the container, preferably in a non-airtight manner. As will be apparent, the lid is designed to be removed whenever fluid is to be added or emptied. The container **12** and lid **14** may be constructed from a wide variety of materials, such as plastic, glass, or metal, and the particular material employed should be selected so as to be non-reactive with the fluid to be dispensed. Also, it is desirable in many instances to employ a transparent material so that the level of the fluid within the container may be readily observed by the operator.

In the illustrated embodiment, the container **12** includes a four cornered peripheral side wall **12***a* and a bottom wall **12***b*. A delivery orifice in the form of a spigot **16** extends through the wall **12***a* adjacent the bottom wall. The spigot **16** includes a manually operable button valve **18** for the purposes to be described. The container **12** also carries an externally mounted calibrated dial **20**, and an associated pointer **21**.

Within the container, there is disposed a vertically extending tube **24**, which as shown, comprises a peripheral wall in the form of a hollow cylinder defining a central enclosure **25**, an upper end **26**, and the lower end **27**. The lower end **27** is cut away or slotted at **28** to define a lower opening in the tube, and the upper end **26** is cut away or slotted at **30** and **31** to define an upper opening.

A piston **32** is mounted for translation within the tube **24**, the piston being generally cylindrical to sealingly engage the tube peripheral wall. In addition, a vertical passageway **34** extends through the piston and communicates with a coiled extensible tube **36**. The tube **36** is in turn connected at its opposite end to the delivery spigot **16**.

A vertically extending rack **40** is connected to the upper side of the piston **32**, the rack having gear teeth **42** along one side edge and a smooth opposite side edge **44**. A pinion **46** is rotatably mounted about a fixed axis defined by the shaft **48**, and is disposed in operative engagement with the teeth **42** of the rack **40**. As illustrated, the pinion **46** extends through the slot **31** to engage the teeth of the rack. Also, a following wheel **49** is mounted for rotation about a fixed axis defined by

the shaft **50**, and is disposed to engage the smooth side edge **44** of the rack to thereby insure mating engagement of the teeth of the rack and pinion.

The calibrated dial **20** is fixedly connected to the shaft **48** so as to be coaxially and rotatably connected to the pinion **46**. Thus, by rotating the dial **20**, the pinion **46** is similarly rotated and the piston **32** is either raised or lowered. As illustrated, the dial **20** carries indicia on its front face which is correlated to the elevation of the piston and thus the quantity of fluid retained within the central enclosure **25** above the piston. As examples of typical calibrations, the dial **20** may include a line **52** indicating the refill position of the apparatus, a line **53** indicating the maximum volume position, a line **54** indicating the minimum volume position, and a number of additional calibrations indicating intermediate settings between the lines **53** and **54**.

To insure that the piston is not lowered below its lowermost or refill position, the tube **24** may mount a transverse stop member or bar **56** which extends across the interior of the tube in the manner seen in FIG. **1**. Thus, as the piston is lowered, the bar **56** will prevent movement beyond the position shown in FIG. **1**. Similarly, a bar **58** may be carried by the tube adjacent the upper end to prevent movement of the piston upwardly beyond the minimum volume position.

The container **12** may also include indicia **60** and **61** for indicating the desired minimum and maximum fluid levels in the container. As will be apparent, the fluid level in the container must be maintained above the level of the tube lower opening at **28** and below the level of the upper opening at **30** and **31**. In most applications, the minimum fluid level should lie well above the lower opening to insure that at least some fluid will spill from the upper opening when the piston is raised to its desired position. In the illustrated embodiment, it is assumed that the container is constructed from a transparent material, and thus the indicia **60** and **61** may take the form of lines imprinted on the exterior surface of the side wall **12***a*.

In operation, the container **12** is initially filled with the fluid to a level indicated at **62** in FIGS. **2–4** which lies between the indicia **60** and **61**. The dial **20** is then rotated in a counterclockwise direction until the pointer **21** overlies indicia **52** and the piston contacts the bar **56**. This represents the refill position shown in FIGS. **1** and **2**. At this position, the fluid in the container is free to pass through the slot **28** and into the tube enclosure **25** to reach a level corresponding to that of the fluid in the container. The dial **20** is then rotated in a clockwise direction until the desired setting is reached. It will be understood that during this rotation the excess water will spill from the upper opening defined by the slots **30** and **31** back into the container. Upon reaching the desired setting, the valve button **18** of the delivery spigot **16** is manually depressed which releases the fluid carried above the piston within the enclosure **25**. This quantity of water will of course include the water contained within the tube **36**, and this quantity should be taken into account in initially calibrating the dial **20**.

As a further aspect of the present invention, the described apparatus may be employed to deliver a continuous stream of fluid from the delivery spigot **16** by merely rotating the dial **20** to its refill position as shown in FIG. **1** and depressing the button valve **18**. In this configuration, the fluid in the container is free to enter the tube **24** through the slot **28** and pass directly through the delivery passageway **34** of the piston **32** to the spigot.

As will be apparent to those skilled in the art, the described apparatus may be designed in various proportions to meet specific requirements. Typically, the tube **24** may be designed to hold about 200 cubic centimeters of fluid at the maximum volume setting (FIG. **3**) and about 10 cubic centimeters of fluid at the minimum volume setting (FIG. **4**). In addition, all of the components of the apparatus may be constructed from suitable glass or plastic materials such that the entire apparatus may be autoclaved as a unit. Further, the design of the apparatus is such that the interior components of the container may be mounted so as to be easily removable for cleaning.

In the drawings and specification, there has been set forth a preferred embodiment of the invention, and although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation.

That which is claimed is:

1. An apparatus for metering and delivering a variable and pre-selected quantity of a fluid comprising

a container adapted to hold a relatively large quantity of said fluid and including a delivery orifice,

a vertically extending tube disposed within said container, said tube including a peripheral wall defining a central enclosure and upper and lower ends, means defining a lower opening in said tube adjacent said lower end, and means defining an upper opening in said tube adjacent said upper end, said lower opening being adapted to lie below the level of the fluid in said container and said upper opening being adapted to lie above the level of the fluid in said container,

a piston translatably mounted within said tube, said piston being configured to sealingly engage said tube peripheral wall and including a passageway extending vertically therethrough,

means for selectively translating said piston between a lower position beneath said lower opening wherein the fluid in said container is free to pass through said lower opening and into said central enclosure to reach a level corresponding to that of the fluid in said container, and a variable raised position above said lower opening wherein the fluid above said piston is retained in said enclosure and the upper level of the fluid in said enclosure corresponds to said upper opening such that the quantity of fluid in said enclosure is dependent upon the elevation of said piston at said raised position, and

valve means operatively connected between said piston passageway and said delivery orifice for selectively releasing the fluid carried above said piston and delivering the same through said orifice.

2. The apparatus as defined in claim **1** wherein said means for selectively translating said piston includes a vertically extending rack connected to said piston, a pinion rotatably mounted about a fixed axis for operative engagement with said rack, and means carried externally of said container for rotating said pinion to thereby raise or lower said piston.

3. The apparatus as defined in claim **2** wherein said means for rotating said pinion includes a rotatable dial coaxially connected to said pinion, and a pointer carried by said container in association with said dial, said

dial having indicia thereon correlated to the elevation of said piston and thus the quantity of fluid retained in said enclosure.

4. The apparatus as defined in claim **3** wherein said means for selectively translating said piston further includes stop members carried within said tube for limiting the lower position and maximum raised position of said piston.

5. The apparatus as defined in claim **3** wherein said valve means includes an extensible tube connected between said piston passageway and delivery orifice, and a manually operable valve carried externally of the container.

6. The apparatus as defined in claim **5** wherein said container includes indicia means for indicating desired minimum and maximum fluid levels in said container.

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