United States Patent [19]

Shinn

[11] **3,785,526**

[45] **Jan. 15, 1974**

[54] **DISPENSING APPARATUS**

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[22] Filed: **Aug. 7, 1972**

[21] Appl. No.: **278,471**

[52] **U.S. Cl.** **222/14,** 222/76, 222/309, 222/389, 222/340

[51] **Int. Cl.** **B67d 5/30**

[58] **Field of Search** 222/259, 76, 52, 222/14, 17, 22, 333-336, 340, 309, 387, 389; 307/118

[56] **References Cited**

UNITED STATES PATENTS

3,341,076	9/1967	Wasilewski et al.	222/334 X
2,420,708	5/1947	Hutshell	222/309
3,122,271	2/1964	Grant	222/17
2,824,585	2/1958	Andres	222/504 X

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[57] **ABSTRACT**

An apparatus for dispensing pre-selected amounts of liquid includes a cylinder having at one end an inlet valve coupled to a reservoir and an outlet valve for delivery of the liquid. A piston is normally retained by a spring adjacent the other end of the cylinder. Delivery is effected by supplying a compressed gas, via a solenoid actuated valve, to the space between the other end of the cylinder and the piston to drive the piston towards the outlet valve end. At the same time, the outlet valve is opened to allow discharge of the liquid. Movement of the piston stops after delivery of the pre-selected amount, the outlet valve closes, and the spring returns the piston to its normal position, the reverse movement of the piston opening the inlet valve and refilling the cylinder from the reservoir.

A manually settable selector switch and a companion servoswitch actuated by movement of the piston cooperate to meter delivery. The manual selector is set to a position corresponding to the amount desired and the compressed air solenoid valve actuated by closing a switch. As the piston moves forward in the cylinder, a wiper on the servoswitch advances until it reaches a contact corresponding to the position set on the manual selector. At that point, the solenoid valve is de-energized, delivery is stopped and the piston is returned to its initial position. Various circuit features are provided to indicate the state of operation of the device, the cumulative amount of liquid dispensed and an empty reservoir.

9 Claims, 2 Drawing Figures

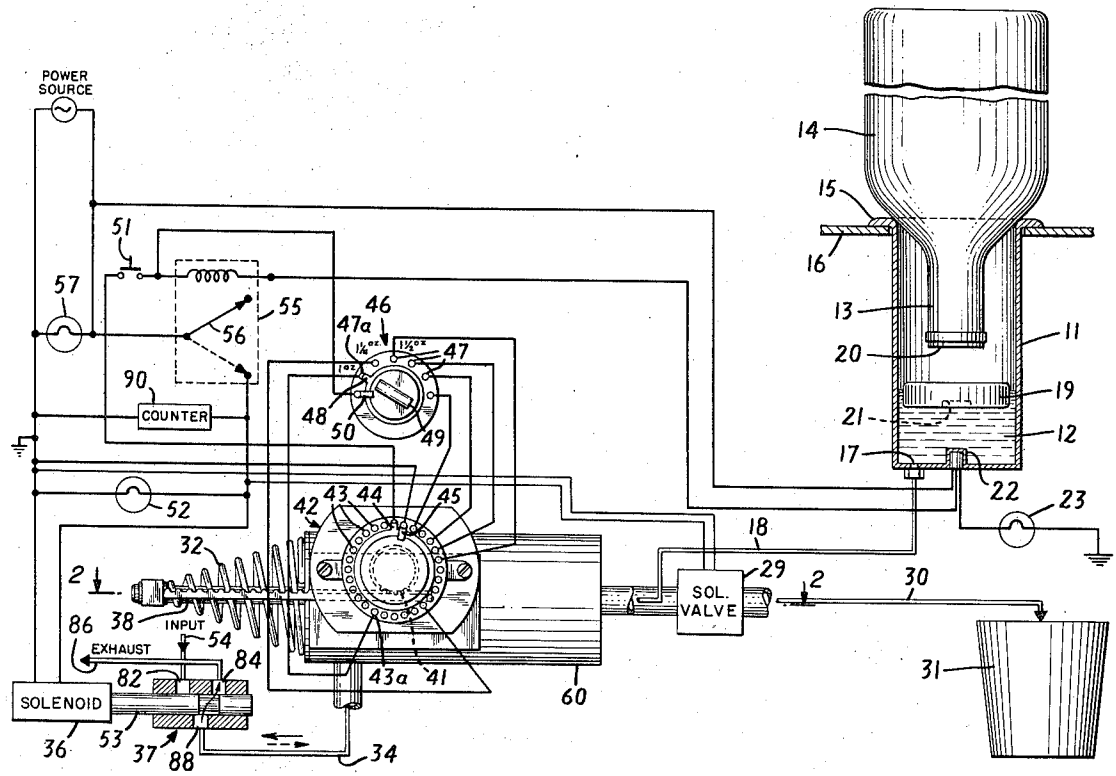


FIG. 1

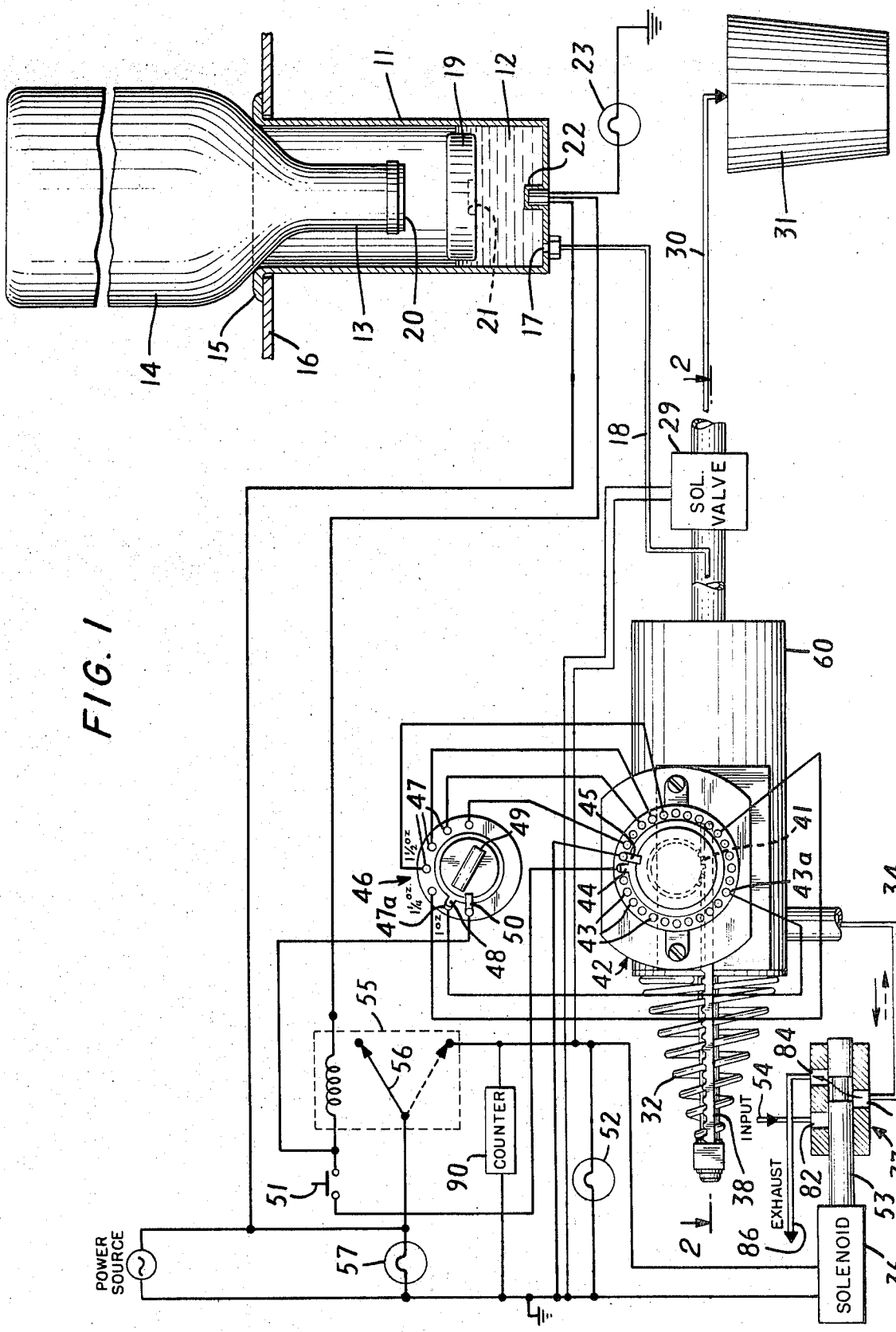
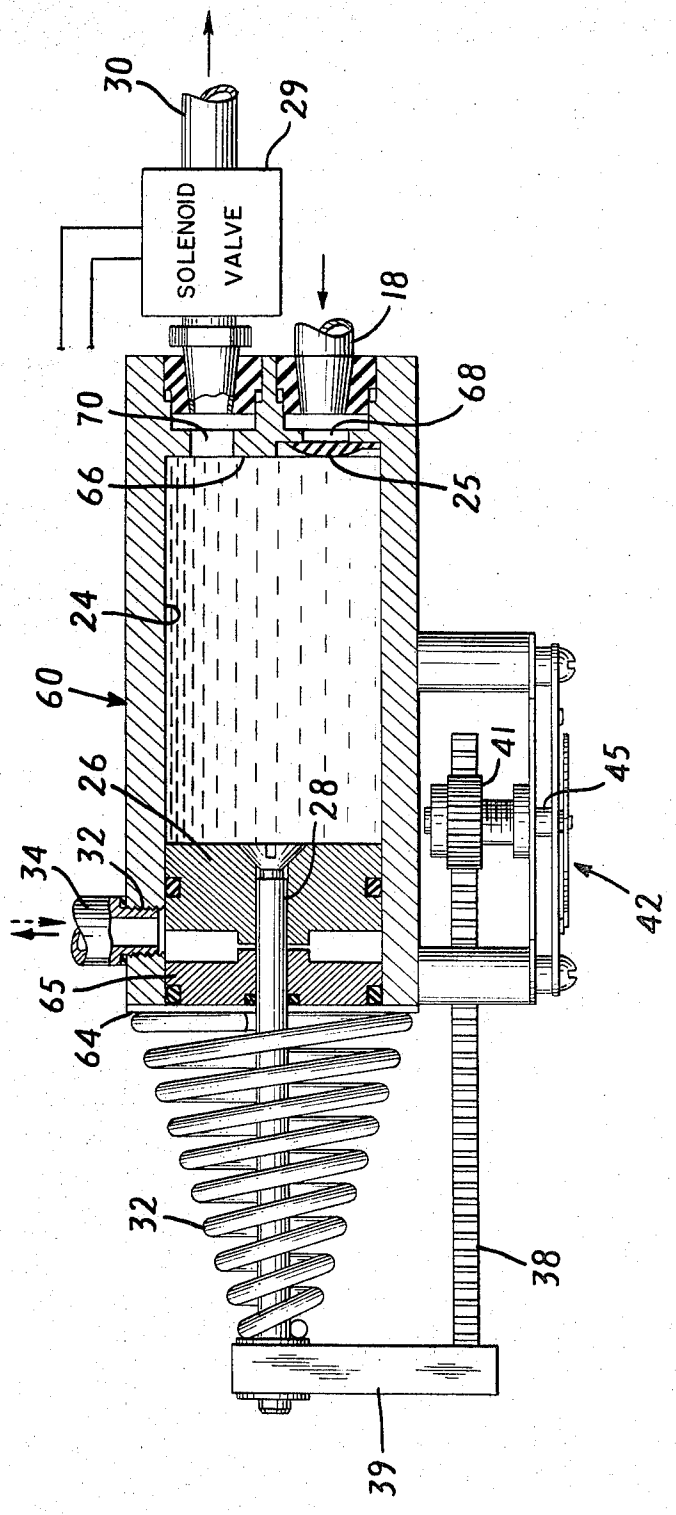

POWER SOURCE
SOLENOID
SOL. VALVE
COUNTER
INPUT
EXHAUST
1½ oz
1¼ oz
1 oz

FIG. 2


30
29
SOLENOID VALVE
18
68
70
66
25
24
60
26
28
41
45
32
34
42
65
64
32
38
39

DISPENSING APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to apparatus for accurately and automatically dispensing pre-selected amounts of liquid. The invention is of particular advantage where the amounts of liquid to be delivered are small, e.g., up to 4 ounces, such as required in the dispensing of alcoholic beverages.

DESCRIPTION OF THE PRIOR ART

Various forms of devices for dispensing measured amounts of liquid have been developed in the past, employing both mechanical and electrical features. One such apparatus, as exemplified in U.S. Pat. No. 1,984,296, includes a pair of axially disposed piston-cylinder units with both pistons controlled by a single piston rod. One of said cylinders has a pair of oppositely directed one-way valves at its free end, one of said valves arranged to admit liquid from a reservoir and the other to deliver liquid to a user upon forward movement of the piston. The other cylinder is provided with fluid ports on both sides of its two-way piston, whereby selective application of pressurized fluid to one or the other side of the piston will move it in the desired direction, at the same time moving the piston in the other cylinder to withdraw liquid from the reservoir or dispense it.

To establish the amount of liquid to be dispensed, mechanical or electrical means are provided in association with an adjustable stop arranged to engage a rearward extension of the piston rod. The position of the stop is adjusted manually and manual actuation of the valve means for controlling the delivery of pressurized fluid to the second or power cylinder is required.

Although the dual piston cylinder arrangement provides a workable pumping means for delivering metered amounts of liquid, the dual cylinder construction is cumbersome and the electromechanical control system associated with such apparatus is bulky, unduly complicated and therefore subject to unreliable and inaccurate operation. Moreover, the necessity for a number of manual steps to initiate the dispensing operation makes use of such systems relatively slow and subject to further error.

Although somewhat more sophisticated electrical selecting and actuating arrangements for dispensing systems have been proposed; see, for example, U.S. Pats. No. 2,080,535 and 3,122,271, no simple control arrangement for a piston-cylinder metering system which is accurate, reliable in operation and capable of rapid repeated delivery of small amounts of liquid has heretofore been developed.

SUMMARY OF THE INVENTION

In accordance with the present invention, a single piston-cylinder arrangement is provided with the piston normally maintained, by a coil spring mounted between the end of a piston rod extending through the end of the cylinder casing and the casing, in a rest position slightly spaced from one end of the cylinder. Inlet and outlet valves for the liquid to be dispensed are mounted in the opposite end wall of the cylinder, the inlet valve being connected by a conduit to a liquid reservoir and the outlet valve being connected to a delivery conduit. In the rest position of the piston, the cylinder is filled with the liquid to be dispensed.

A source of compressed fluid, e.g., air, CO_2, is coupled via a solenoid operated valve through the cylinder wall and into the space between the one end of the cylinder and the piston when in its rest position. Energization of the solenoid valve supplies pressurized fluid between the piston and the cylinder end, forcing the piston towards the valves against the biasing force of the spring. The outlet valve is opened simultaneously with energization of the solenoid and liquid in the cylinder is discharged through the delivery conduit by forward movement of the piston.

At a preselected point in the forward travel of the piston, corresponding to a desired amount of dispensed liquid, the solenoid valve is de-energized, stopping the supply of pressurized fluid and thereby the piston movement. At the same time, the outlet valve is closed. The spring now acts to withdraw the piston back to its rest position, exhausting the compressed fluid behind it. During the return stroke, the inlet valve opens, allowing the suction action of the piston to refill the cylinder from the liquid reservoir.

The piston stroke, and thus the amount of liquid delivered during a single operation is determined by electrical circuit means including a first multiple fixed contact rotary switch having a movable contact manually settable to any fixed contact position. A second such switch is mounted on the cylinder assembly with its movable contact rotated by a pinion gear meshing with a longitudinal rack gear mechanically connected for movement with the piston rod. Electrical power is coupled through a push-button operated latching relay to the solenoid valves and to the switches. When the push-button is pressed, power is supplied to energize the solenoid valve and deliver pressurized fluid to move the piston forward. The latching relay maintains the power to the solenoid after the push-button is released. As the piston moves, the movable contact on the associated switch is rotated past the fixed contacts in succession, until it reaches the contact corresponding to that to which the manually operated wiper on the companion switch is set. The circuit to the solenoid valve is then opened, ending the supply of pressurized gas to the piston and almost instantaneously stopping its forward movement.

The coil spring, which was put under compression during forward movement of the piston, now returns the piston to its rest position. Upon de-energization, the solenoid valve couples the pressurized fluid behind the piston to the atmosphere or other low pressure exhaust chamber, thereby removing any impediment to return of the piston. During this return movement, the rotary contact on the cylinder mounted switch is returned to its starting position.

Indicator lights are provided for signalling the operative condition of the dispensing mechanism and the empty state of the reservoir. Counter means keep a running total of the amount of liquid dispensed. Although not so limited in application, the invention is particularly suited for metered delivery of small preselected amounts, e.g., up to 4 ounces, of liquid, such as would be required in the dispensing of alcoholic beverages.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of the inven-

tion will become more apparent from the following detailed description thereof, taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a drawing partially in section and partially broken away showing the apparatus of the present invention, including the mechanical and hydraulic elements and the associated electrical circuitry; and

FIG. 2 is a view taken along line 2—2 of FIG. 1 in a direction of the arrows showing in greater detail the piston-cylinder arrangement and the rack and pinion gears forming part of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The liquid dispensing apparatus of the present invention as shown in FIG. 1 comprises a reservoir 11 for the liquid 12 to be dispensed. In the preferred embodiment illustrated, which is particularly adapted to dispense alcoholic beverages, the reservoir is generally cylindrical, having an open upper end which is adapted to receive the neck 13 of an inverted liquor bottle 14. Flange 15, at the bottom of the reservoir, allows it to be mounted in a hole provided in a convenient planar surface 16. Outlet 17, at the bottom of the reservoir, connects with exit duct 18.

A float 19 is provided in reservoir 11. When the bottle 14 has an ample supply of liquid, the reservoir 11 will fill with liquid 12 until the level reaches the open neck 20 of the bottle 14. If the bottle 14 contains insufficient liquor to raise the float 19, the level of liquid 12 in the reservoir will continue to fall upon operation of the apparatus until float 19 and a magnet 21 contained therein rest in close proximity to reed switch 22. The magnet then actuates the switch to light indicator lamp 23 and warn the operator of the low liquid level, at the same time, disabling latching relay 55 to prevent further operation until additional liquid is supplied to reservoir 14, as will be described in greater detail below.

The delivery mechanism of the dispensing system is shown in cross-section in FIG. 2 and comprises a generally cylindrical chamber 24 within an outer housing indicated generally by the numeral 60. The lefthand end of the chamber 32 is closed off by end plate 64 and sealing ring 65, both of which are provided with central apertures through which the piston rod 28 passes. Suitable O-rings, or other packing means, provide a fluid-tight seal.

The righthand end of chamber 24 is closed off by an end wall 66 having an inlet aperture 68 and an outlet aperture 70. A flap 25, formed of a suitable rubber or plastic material, acts as a one-way valve for the aperture 68. The flap preferably is formed of a single piece of material cemented or otherwise secured to the end wall 66 adjacent one edge so that it hingedly deflects away from the plate when subjected to fluid pressure in the direction of the arrow and thereby permits fluid passage through the apertures, or is firmly pressed against the end plate when subjected to fluid pressure in the opposite direction, thereby to seal the aperture and prevent fluid flow. Communicating with the inlet valve 25 is a suitable fitting adapted to receive inlet conduit 18 (see FIG. 1).

Associated with the outlet opening 70 is a valve, preferably of the solenoid actuated type as shown. The valve couples the chamber 24 to the outlet conduit 30. As will be explained hereinafter, the valve 29 is opened at the appropriate time to permit delivery of liquid from the chamber to the receptacle 31 (FIG. 1).

An opening 32 is provided through the housing 60 to receive duct 34 which serves both to couple pressurized fluid to the chamber during the delivery stroke and as an exhaust line during the return stroke, as will be described in greater detail hereinafter.

A piston 26 is arranged to be moved longitudinally within chamber 24 and is suitably sealed about its circumference so as to make fluid-tight engagement with the interior wall of the chamber. As will be appreciated, the precise form of the piston is not critical as long as it is of relatively short axial length relative to the respective chamber. For purposes of effecting the necessary seals with the chamber walls, O-rings are shown, but any suitable sealing means may be used.

A piston rod 28, secured to the piston by any suitable means, such as a screw, extends through end members 64 and 65 exteriorly of the housing and is provided with a laterally extending arm 39 fixedly secured thereto near its end. A coil compression spring 32, which may be of conical shape, is constrained between the arm 39 and the end plate 64.

As indicated above, the liquid to be dispensed is admitted to and delivered from the chamber 24 through the valves 25, 29 respectively. Movement of piston 26 toward end plate 66 will discharge liquid in the cylinder through the outlet valve 29 which is open at this time, and into the outlet conduit 30, at the same time tightly sealing inlet valve 25. Conversely, retraction of the piston establishes a vacuum, or low pressure condition, which draws liquid from the reservoir 11, through inlet conduit 18 and valve 25 into chamber 24. The valve 29 is closed during the return stroke of the piston.

Forward movement of the piston 26 is effected by supplying pressurized fluid through conduit 34 to the back side of piston 26. With the valve 29 open, the applied pressure will move the piston toward the valve end of the cylinder, discharging liquid through conduit 30. Spring 32 is compressed during the discharge stroke and, upon relief of pressure on the piston, will return the piston to its rest position shown in FIG. 2, refilling the chamber from the reservoir.

Delivery of pressurized fluid through conduit 34 is controlled by a solenoid operated valve 37 (FIG. 1). A source of pressurized fluid, such as an air compressor or hydraulic fluid, is coupled at 54 to the inlet port 82 of the valve body. An exhaust port 84 is connected to exhaust line 86 and conduit 34 is coupled to port 88. Operation of the valve is effected by moving the valve spool 53 between two positions corresponding to energized and non-energized conditions of the solenoid 36. Thus, in the energized condition of the solenoid, the sleeve is so positioned as to couple pressurized fluid from input 54 to conduit 34. When the solenoid is deenergized (as shown in FIG. 1), the input duct 54 is shut and the conduit 34 is connected to exhaust line 86, thereby permitting spring 32 to retract the piston. The valve described is a standard commerically available type and other forms of solenoid valves capable of performing the required functions may be employed.

Metering of the amount of liquid to be dispensed is accomplished by accurately predetermining the extent of movement of piston 26 from its extreme left-hand or rest position, towards the delivery end of the chamber. A servoswitch assembly 42 is mounted exteriorly of the housing 60, such as by screws, adjacent the chamber

24. The switch assembly includes a fixed plate having a plurality of angularly disposed contacts 43, and a rotatable member having a single contact arm 44 disposed so as to successively connect with each of the contacts 43 as it is rotated. Contact 45 provides the common or reference contact for the switch.

A longitudinally extending rack gear 38 is supported in cantilever fashion by means of arm 39 secured to the piston rod 28 exteriorly of the housing 60. The rack 38 is disposed substantially parallel to the piston rod and will move back and forth therewith. Meshing with the rack gear, is a pinion gear 41 rotatably mounted on the servoswitch assembly. The gear 41 is coupled by means of shaft 45 to the rotatable member of the switch assembly so that the latter rotates together with the pinion gear. It will be seen then, that movement of the piston rod-piston assembly effect a corresponding change of position of the movable contact 44, by means of the intervening rack and pinion assembly.

Associated with the servoswitch assembly 42 is a manual selector switch indicated generally at 46. The latter includes a fixed plate having a plurality of contacts 47 which may be equal to or lesser in number than the contacts 43, and a rotatable contact 48 whose position may be manually set by means of knob 49. Contact 50 is the common terminal for the switch. As shown in FIG. 1, each contact 47 on the manual switch is electrically connected to a contact 43 on the servoswitch assembly 42. It will be understood that each contact 43 corresponds to a particular displacement of piston 26; therefore each contact 47 on the manual selector 46 corresponds to the displacement represented by the contact 43 to which it is connected. The selector switch may be located remotely from the remainder of the apparatus and preferably is in a position convenient to the delivery end of the outlet conduit 30, so that the operator may set the volume desired as he positions the glass or other receptacle 31 to receive the liquid.

As seen in FIG. 1, operation of the dispensing system is controlled by an electrical circuit which provides immediate response and accurate metering. The circuit elements of FIG. 1 and mechanical elements of FIG. 2 are shown in their rest positions, awaiting actuation to deliver a preselected amount of liquid to the receptacle 31.

The operator first adjusts switch 46 to select the amount of liquid to be delivered. Each of the contacts 47 is electrically connected to a contact 43 on the servoswitch assembly 42 and thus corresponds to a predetermined displacement of the piston 26. Then, with the power on, as indicated by the lighted condition of the bulb 57, the operator momentarily depresses pushbutton 51. This completes a circuit for the coil of latching relay 55 from the power source through the reed switch 22, the common terminal 45 and movable contact 44 on servoswitch 42.

Energization of the coil of relay 55 moves its armature 56 to the position indicated by dotted line, where it remains until the coil is again energized. In its lower (dotted) position, armature 56 connects power from the source to the solenoid 36. Actuation of the latter moves valve sleeve 53 to its left-hand position, coupling input line 54 to the conduit 34. Lamp 52 is also energized during actuation of the solenoid 36 to advise the operator that the apparatus is in the dispensing portion of its cycle.

Also connected across the power source upon energization of latching relay 55 is solenoid valve 29 at the outlet of the chamber 24.

With pressurized fluid now coupled into conduit 34, pressure is applied to the rear face of piston 26 to move it towards the outlet end of the cylinder. Valve 29 is now open and movement of the piston delivers liquid through conduit 30 to the receptacle 31. As will be seen, spring 32 is compressed by this movement of the piston.

Advance of the piston 26 and piston rod 28 also moves rack gear 38, causing pinion gear 41 to rotate in a counter-clockwise direction. Movable contact 44 on the servoswitch is then rotated in the same direction to successively wipe over fixed contacts 43. Upon contact 44 leaving its home position, push button 51 is disabled. When movable contact 44 reaches contact 43*a*, a circuit is completed from one terminal of the power source, through common terminal 45, movable terminal 44 and fixed contact 43*a* on the servoswitch assembly 42, over the conductor connecting contact 43*a* to contact 47*a*, and then through rotatable contact 48 and common terminal 50 on switch 46, through the coil of relay 55 and reed switch 22 to the other terminal of the power source. Relay 55 is thereby energized to move its armature 56 to its upper (full line) position, de-energizing solenoid 36 and solenoid valve 29, and extinguishing indicator lamp 52.

De-energization of solenoid 36 returns sleeve 53 to the position shown in FIG. 1, allowing the pressurized air behind piston 26 to exhaust through conduits 34 and 86. Spring 32 returns piston 26 to its rest position as in FIG. 2, and during this return motion, rack 38 rotates pinion 41 in a clockwise direction to return movable contact 45 to its rest or home position, enabling pushbutton switch 51.

Return of the piston 26 to its rest position creates a vacuum or suction force in the chamber 24 which draws liquid from the reservoir 11 into the chamber through duct 18 and inlet valve 25. Thus, the chamber 24 is refilled after each delivery. The apparatus is now ready for another delivery cycle upon actuation of push button 51.

To monitor the amount of liquid dispensed over a number of operating cycles, a counter 90 may be provided. The counter is energized each time latching relay 55 is operated to initiate delivery.

Operation of the apparatus is prevented when the reservoir 11 is empty by means of the magnetic element 21 and the reed switch 22. When the reservoir is substantially empty, the float 19 is in a position such that the magnet 21 causes reed switch 21 to operate, opening the connection from the power line to the terminal of the coil of latching relay 55 and completing a connection to the indicator lamp 23. The disconnection prevents actuation of the delivery mechanism and the lamp apprises the operator of the lack of liquid supply.

As indicated hereinabove, the present invention enables reliable, accurate delivery of small amounts of liquid. It has been found that the apparatus is capable of selectively delivering amounts varying by as little as one-eighth of a fluid ounce. It will be recognized that the amounts represented by the available positions on manual selector switch 46 will depend on the number of available contacts 43 on servoswitch assembly 42 and accordingly, the arrangement is susceptible to a wide range of calibration. The precise and wide range

of control available makes the apparatus particularly adaptable to delivery of small amounts of liquid, such as would be required in dispensing of alcoholic beverages.

It will be understood that various modifications of the disclosed structure will occur to those skilled in the art and it is intended that the invention be limited only in accordance with the appended claims.

I claim:

1. Apparatus for dispensing fluids comprising a housing including an elongated chamber having inlet and outlet valves at one end thereof, means for coupling a supply of fluid to be dispensed to said inlet valve, a piston in said chamber adapted to move longitudinally therein towards and away from said one end, a piston rod connected to said piston and extending longitudinally of said chamber through the housing at the other end thereof, controllable means for supplying pressurized fluid to said chamber to move said piston towards said valve end, spring means coupled between said piston rod and said housing for urging said piston away from the valve end of the chamber, and manually adjustable electric circuit means for actuating said controllable means to supply pressurized fluid to said chamber to move said piston towards said valve end a predetermined distance corresponding to the manual adjustment of said electric circuit means, said electric circuit means being responsive to said piston moving said predetermined distance to actuate said controllable means to stop said supply of pressurized fluid to said chamber and to exhaust the pressurized fluid already supplied, said spring means thereafter being effective to return said piston to a rest position adjacent said other end of the chamber.

2. The apparatus of claim **1** wherein said controllable means comprises a solenoid valve coupling said chamber alternately between a source of pressurized fluid and exhaust means.

3. Apparatus for dispensing fluids comprising a housing including an elongated chamber having inlet and outlet valves at one end thereof, means for coupling a supply of fluid to be dispensed to said inlet valve, a piston in said chamber adapted to move longitudinally therein towards and away from said one end, a piston rod connected to said piston and extending longitudinally of said chamber through the housing at the other end thereof, controllable means including a solenoid valve coupling said chamber alternately between a source of pressurized fluid to move said piston towards said valve end and exhaust means, spring means coupled between said piston rod and said housing for urging said piston away from the valve end of the chamber, a source of electrical energy, latching switch means for actuating said solenoid valve to supply pressurized fluid to said chamber upon manual actuation, first multi-position switch means having a plurality of fixed contacts and a movable contact coupled to said piston rod for conjoint movement, means for selectively enabling a desired one of said fixed contacts corresponding to a predetermined longitudinal displacement of said piston, and further circuit means coupling said first multi-position switch means to actuate said solenoid valve to connect said chamber to said exhaust means, said spring means thereafter being effective to return said piston to a rest position adjacent said other end of the chamber.

4. The apparatus of claim **3** wherein said outlet valve is of the solenoid operated type and is connected to said latching switch means for operation in conjunction with said solenoid valve whereby said outlet valve is opened to permit fluid flow while pressurized fluid is being supplied to said chamber and closed to fluid flow while said chamber is connected to said exhaust means.

5. The appartus of claim **3** wherein said selective enabling means includes a second multi-position switch means having a plurality of fixed contacts and a manually positionable movable contact, and means connecting the fixed contacts of said second switch means to selected fixed contacts of said first switch means, whereby manual positioning of the movable contact of said second multi-position switch means is effective to predetermine the extent of longitudinal displacement of the piston.

6. The apparatus of claim **5** wherein said first multi-position switch is of the rotary type and is mounted on said housing with said movable contact secured to a rotatable shaft, and said means coupling said movable contact to said piston rod comprises pinion gear means secured to said shaft and rotatable therewith, and rack gear means secured to said piston rod for longitudinal movement therewith adapted to mesh with said pinion gear means.

7. The apparatus of claim **6** further comprising counter means coupled to said latching switch means for recording the movement of said piston.

8. Apparatus for selectively dispensing predetermined amounts of alcoholic beverages and the like comprising, reservoir means for storing a quantity of the liquid to be dispensed, pump means including a cylinder and piston, said cylinder having at one end thereof an inlet valve coupled to said reservoir and an outlet valve coupled to a delivery conduit, said piston adapted to move longitudinally in said cylinder and having a front surface facing the valve end of the cylinder and a rear surface facing the other end of the cylinder, a piston rod extending from said rear face and through the wall of said cylinder, coil spring means coupling said cylinder and said piston rod to maintain said piston normally adjacent to but slightly spaced from said other end of said cylinder, conduit means coupled through said cylinder wall and into the space between the rear surface of said piston and the other end of said cylinder, solenoid valve means coupling said conduit means selectively to a source of pressurized fluid and exhaust means, said conduit normally being coupled to said exhaust means, a source of electric power, latching switch means coupling said power source to said solenoid valve, first multi-position switch means mounted exteriorly of said cylinder and having a plurality of fixed contacts and a movable contact, means coupling said movable contact to said piston rod for conjoint movement, second multi-position switch means having a plurality of fixed contacts and a manually positionable movable contact, means connecting the fixed contacts of said second switch means to selected fixed contacts of said first switch means, push-button means for actuating said latching switch means to operate said solenoid valve to couple pressurized fluid to said conduit, thereby to move said piston towards the valve end of said cylinder and discharge liquid in said cylinder through said outlet valve and delivery conduit, said movable contact on said first switch means being moved conjointly with said piston rod, and

further circuit means operable upon said movable contact of said first switch reaching the fixed contact connected to the fixed contact of the second switch on which the movable contact of the latter has been manually positioned to actuate said latching switch means to operate said solenoid valve means to change the connection of said conduit from said source of pressurized fluid to said exhaust means, whereby forward motion of the piston ceases and the spring means is effective to return the piston to its normal position, the return movement of said piston creating a suction force operable to draw liquid from said reservoir through said inlet valve to fill said cylinder.

9. The apparatus of claim **8** further comprising means coupled to said reservoir for indicating an empty condition and for disabling said dispensing apparatus.

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