May 19, 1959 J. W. SMITHWICK ET AL 2,887,249

DISPENSING DEVICE TO DELIVER SINGLE MEASURED VOLUME

Filed Sept. 24, 1956 2 Sheets-Sheet 1

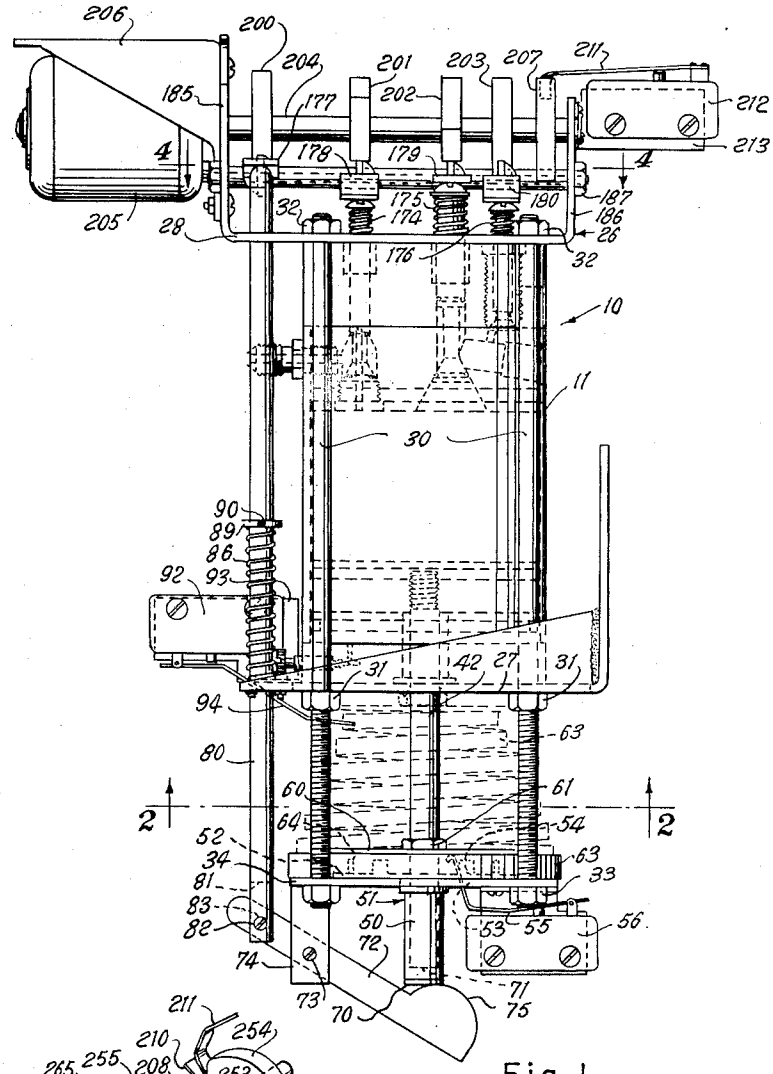

Fig. 1

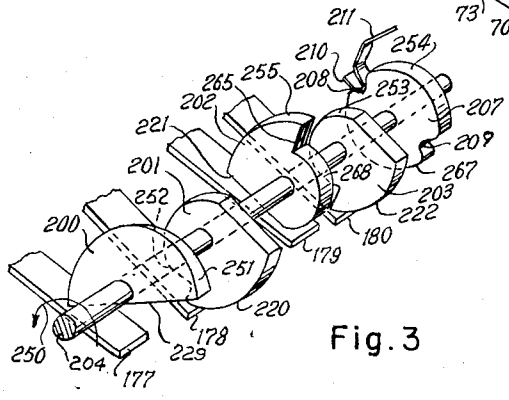

Fig. 3

INVENTORS
Jack W. Smithwick
Richard Ruff

BY Walter J. Jagmin

ATTORNEY

May 19, 1959 J. W. SMITHWICK ET AL 2,887,249

DISPENSING DEVICE TO DELIVER SINGLE MEASURED VOLUME

Filed Sept. 24, 1956 2 Sheets-Sheet 2

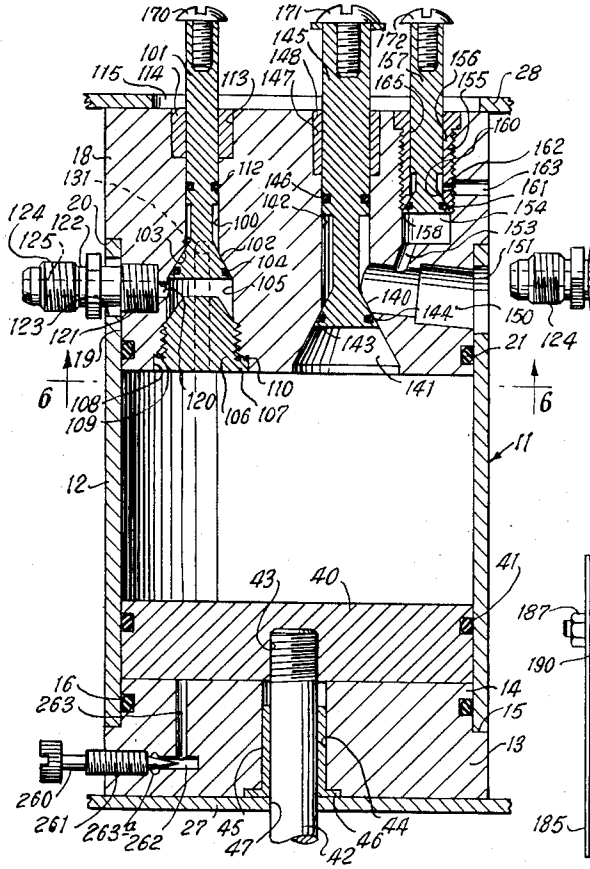

Fig. 5

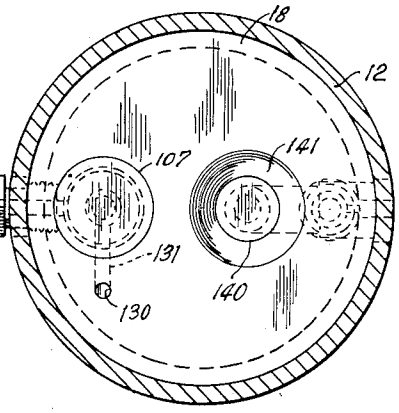

Fig. 6

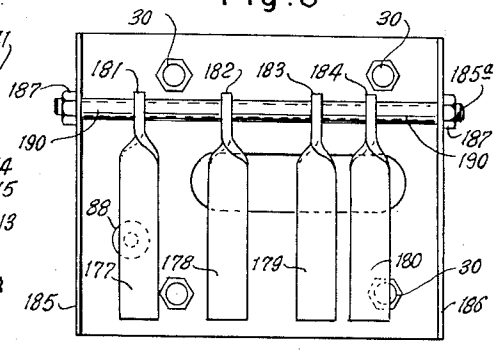

Fig. 4

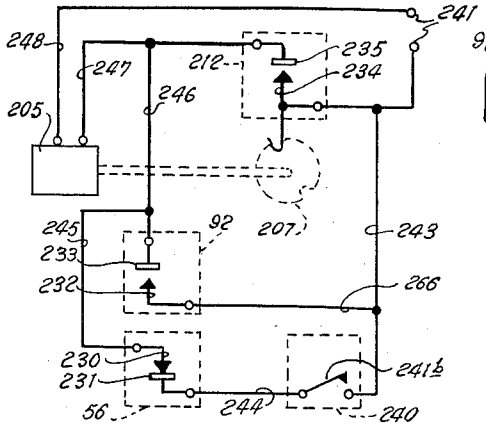

Fig. 7

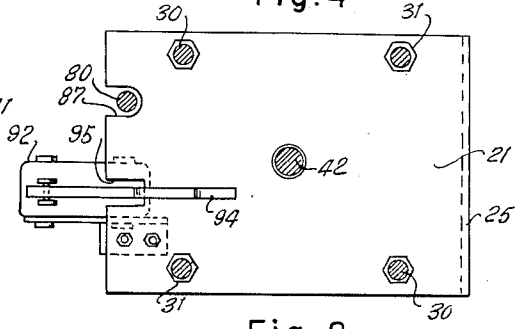

Fig. 2

INVENTORS
Jack W. Smithwick
Richard Ruff

BY Walter J. Jeagrin

ATTORNEY

United States Patent Office 2,887,249 Patented May 19, 1959

2,887,249

DISPENSING DEVICE TO DELIVER SINGLE MEASURED VOLUME

Jack W. Smithwick and Richard B. Ruff, Brady, Tex., assignors to Intercontinental Manufacturing Company, Inc., Garland, Tex., a corporation of Texas

Application September 24, 1956, Serial No. 611,646

7 Claims. (Cl. 222—63)

This invention relates to dispensing devices and more particularly to a device for dispensing liquid in predetermined quantities.

An object of this invention is to provide a new and improved dispensing device for dispensing predetermined quantities of liquid from a source wherein the liquid is maintained under pressure.

Another object of the invention is to provide a dispensing device, of the type described above, wherein the liquid is conveyed from its pressurized source to a tank from which it is dispensed in a measured quantity by a piston.

Still another object of the invention is to provide a new and improved dispensing device, of the type described above, where the degree of movement of the piston within the tank is controlled to predetermine or measure the amount of liquid dispensed during each dispensing operation of the device.

Another object of the invention is to provide a device, of the type described above, wherein the foaming of the liquid, which may be a carbonated beverage, is prevented or minimized by the control of the movement of the piston by a vent valve which maintains uniform the movement of the piston and thus prevents undue agitation of the liquid during the dispensing operation.

Still another object of the invention is to provide a device, of the type described above, wherein the interior of the tank between one end thereof and the piston is always full of liquid since the liquid is always maintained under pressure in the interior of the tank due to the action of a piston biasing means even when an inlet valve of the tank is in closed position shutting off the interior of the tank from the pressure of the source of liquid.

Another object of the invention is to provide a device, of the type described above, wherein the inlet valve is held open to permit fluid under pressure to enter into the interior of the tank to displace the piston downwardly to its lowermost position until the piston reaches its lowermost position.

Still another object is to provide a device, of the type described above, wherein the inlet valve is held closed and the outlet valve is held open until the piston has moved upwardly from its lowermost position during the dispensing operation to a predetermined higher position, thus insuring that the full predetermined quantity of liquid is dispensed during such movement of the piston.

A further object of the invention is to provide a device having a plurality of valves controlled by a single driver means to open and close the valves in predetermined sequence in order that a predetermined measured amount of liquid may be dispensed thereby.

A still further object of the invention is to provide a device of the type described above wherein a means is provided to jar the piston towards dispensing movement in order to free the piston should it be frozen in the tank.

A still further object of the invention is to provide a device of the type described above wherein liquid to be dispensed is introduced under pressure into a measuring chamber having a piston slidably mounted therein, which liquid under pressure forces the piston to a lowermost position against the force exerted by a spring during the filling operation of the tank and wherein the force of the spring is utilized to move the piston upwardly to force a predetermined amount of liquid out of a tank to a dispensing point.

For a better understanding of the invention, reference may be had to the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

In the drawing,

Figure 1 is a side view of the dispensing device and the associated control mechanisms, showing the piston in its lowermost position;

Figure 2 is a sectional view taken on line 2—2 of Figure 1;

Figure 3 is a fragmentary perspective view of the various cams shown in the position prior to the commencement of a dispensing operation;

Figure 4 is a sectional view taken on line 4—4 of Figure 1;

Figure 5 is a vertical sectional view of the tank and valve assembly of the dispensing device;

Figure 6 is a sectional view taken on line 6—6 of Figure 5; and

Figure 7 is a schematic diagram of the electrical circuit for controlling operation of the valve.

Referring now to the drawing, the liquid dispensing device **10** includes a tank **11** having a tubular or cylindrical member **12** which is closed at the bottom end by a bottom cap **13** having a reduced upper portion **14** telescoped therein and which provides an upwardly facing annular shoulder **15** which abuts the lower end of the tubular member **12**. The reduced portion **14** of the bottom cap **13** is provided with an external annular groove or recess in which is disposed an annular sealing member **16** which seals between the bottom cap and the tubular member **12** to prevent flow of any fluid therebetween. The upper end of the tubular member **12** is closed by a top cap **18** having a reduced lower portion **19** which telescopes into the upper end of the tubular member **12** and also provides a downwardly facing annular shoulder **20** which abuts the upper end of the tubular portion **12**. The reduced portion **19** of the top cap **18** is also provided with an external annular recess or groove wherein is disposed an annular member **21** which seals between the top cap and the tubular portion **12** to prevent flow of fluid therebetween.

The bottom and top caps **13** and **18**, respectively, are held rigidly in the telescoped positions in the lower and upper ends of the tubular member shown in Figures 1 and 5, by means of a bottom bracket **25** and a top bracket **26** which have horizontal portions **27** and **28**, respectively, which abut the lower and upper surfaces of the bottom and top caps. Four tie rods **30** disposed outwardly of the tubular member **12** extend through registering apertures in the horizontal portions **27** and **28** of the bottom and top brackets **25** and **26**, respectively, and are provided with nuts **31** and **32** threaded on the lower and upper ends of the tie rods, respectively, and about the horizontal portions **27** and **28**, respectively, to hold the bottom and top caps rigidly telescoped in the lower and upper ends of the tubular member **12**. The lower threaded portions of the tie rods **30** extend below the lower bracket **25** and support, by means of nuts **33**, a substantially rectangular bottom bracket **34**.

A piston **40** is slidably mounted in the tubular member **12** of the tank assembly **11** between the bottom and top caps **13** and **18** and is provided with an external annular

recess in which is disposed an annular sealing member 41 which seals between the piston and the tubular member to prevent flow of fluid therebetween. The piston 40 is provided with a piston shaft 42 threaded in a central bore 43 thereof and extending downwardly through a central vertical bore 44 of the bottom cap and through a bushing 45 disposed therein. The bushing 45 is provided with an external flange 46 received in a suitable annular groove of the bottom cap 13. The horizontal portion 27 of the lower bracket 25 abuts the lower surface of the flange 46 to hold the bushing in place in the bottom cap 13. The piston shaft 42 extends through a suitable aperture 47 in the horizontal portion 27 and has its lower end disposed slidably in a sleeve guide 50 of a spring retainer 51.

The spring retainer includes a substantially circular plate 52 resting on the top surface of the bottom bracket 34 to which the upper end of the guide sleeve 50 is rigidly secured. The bottom bracket 34 and the plate 52 of the spring retainer 51 extends and bridges a central aperture 53 of the bottom bracket 34. An aperture 54 is provided in the plate 52 which registers with the central aperture 53, so that the actuating lever 55 of a switch 56 may extend through the apertures 53 and 54 of the bottom bracket 34 and the plate 52, respectively, to contact a disk 60 disposed on the piston shaft 42 above the bottom bracket and the spring retainer 51. The disk 60 is held against upward movement on the shaft 42 by a collar 61 rigidly secured in any suitable manner, as by a set screw, on the piston shaft 42.

A flat helical spring 63 rests on the bottom bracket 34 and is held against lateral movement by the upwardly extending lugs 64 of the spring retainer. The smaller inner end 65 of the spring bears against the disk 60 to urge the piston shaft and the piston upwardly. When the piston is moved to its upper position the helical spring 63 will assume the position shown in broken lines in Figure 1.

The bottom of the sleeve guide 50 of the spring retainer 51 is provided with an end plate 70 rigidly secured thereto in any suitable manner, as by welding, which engages the bottom 71 of the piston shaft 42 when the spring retainer is moved upwardly by a jack 72 which is pivotally mounted, as at 73, to a dependent arm 74 of the bottom bracket 34. The jack is provided with an arcuate cam surface 75 which is adapted to slide on the end plate of the spring retainer as the jack 72 is pivoted about its pivotal axis 73. When the end plate 72 engages the bottom 71 of the shaft 42, continued upward movement of the cam surface 75 will cause the piston shaft 42 to be moved slightly upwardly thus causing the piston 40 to be moved slightly upwardly in the tubular member 12. The co-action of the jack 72 with the spring retainer 51 serves to jar or free the piston for upward movement in the event that it is frozen or stuck in the tubular member 12 as may occur if the liquid within the tank 11 is very cold.

The outer end of the jack 72 is pivotally connected to the bottom end of a push rod 80 having a transverse downwardly open slot 81 in the lower end thereof in which is received the outer end of the jack. A screw or bolt 82 may extend through the lower end of the push rod and through an elongate slot 83 provided in the jack 72. The push rod is biased upwardly to the position shown in Figure 1 by a spring 86 disposed about the push rod and above the horizontal portion 27 of the lower bracket 25. The push rod extends through a slot 87 of the lower bracket and through an aperture 88 of the upper bracket. The lower end of the spring 86 bears against the lower bracket adjacent the slot 87 thereof and its upper end bears against a disk 89 rigidly secured to the push rod by any suitable means, as by a set screw 90.

A normally open switch 92 is mounted on the horizontal portion 27 of the lower bracket 25 by means of

a supporting bracket 93 and is provided with an actuating arm 94 which extends downwardly through a second slot 95 of the lower bracket to contact the piston disk 60 when the piston has moved to its uppermost position. The actuating arm or lever 94 of the switch 92 closes the switch 92 when the piston reaches its uppermost position in the tubular member 12. The switch 56 mounted on the bottom bracket 34 is likewise a normally open switch and is closed when the piston moves to its lowermost position shown in solid lines in Figure 1 and engages the lever arm 55 of the switch to close the switch.

The top cap 18 is provided with a longitudinal bore 100 in which is slidably disposed the shank 101 of a valve 102. The longitudinal bore 100 is provided with a downwardly and outwardly beveled portion 103 which forms a valve seat for the valve 102. The valve 102 is provided with an annular external recess in which is disposed an annular sealing ring which seals between the valve seat 103 and the valve. The lower enlarged portion 105 of the longitudinal bore is closed by a plug 106 threaded therein. The plug 106 is provided with an external flange 107 received in a recess 108 formed by an enlargement of the longitudinal bore 100. An annular sealing means 109 is interposed between the external flange 107 of the plug 106 and the downwardly facing annular shoulder 110 of the top cap to seal therebetween and prevent flow of fluid between the plug and the top cap.

The shank 101 of the valve 102 is provided with an annular recess in which is disposed the annular sealing member 112 which seals between the valve shank and the top cap to prevent flow of fluid therebetween. The upper end of the longitudinal bore 100 may be enlarged as at 113 to receive a bushing 114 through which the upper end of the valve shank 101 may extend. The shank 101 also extends through an oval recess or slot 115 in the horizontal portion 28 of the top bracket, 26.

A lateral bore 120 communicates with the enlarged portion 105 of the longitudinal bore above the plug 106 and is enlarged and threaded to receive the threaded portion 121 of an inlet fitting 122 which extends laterally outwardly through an aperture 123 in the tubular member 12. The fitting 122 is also provided with an external threaded portion 124 by means of which a suitable conduit may be secured to the fitting 122 through which fluid or liquid under pressure may be admitted to the enlarged portion 105 of the longitudinal bore 100 through the lateral aperture 120 and the longitudinal internal bore 125 of the fitting.

The top cap is also provided with a vertical aperture or bore 130 which extends parallel to the bore 100 and has a horizontal angular portion 131 which opens into the longitudinal bore 100 adjacent the upper end of the valve seat 103. It will thus be apparent that when the valve 102 is moved downwardly to a position wherein it approaches the upper end of the plug 106, fluid or liquid may flow through the longitudinal bore 125 of the fitting 122 into the lateral aperture 120 and thence through the beveled portion 103 of the longitudinal bore 100 to the horizontal angular extension 131 of the bore 130 and thence through the bore 130 into the interior of the tubular member below the top cap 18. It will thus be apparent that a valve 102 is an inlet valve controlling the introduction of liquid into the interior of the tubular member 12.

An outlet valve 140 is disposed in the cone shaped lower end portion 141 of a longitudinal bore 142 of the top cap 18. The valve 140 seats on the upper beveled surface 143 of the bore 142 which thus serves as a valve seat for the valve 140. The valve 140 is provided with an annular external recess or groove in which is disposed an annular sealing member 144 which seals between the valve and the valve seat when the valve is in the upper closed position shown in Figure 5.

The outlet valve is provided with a shank 145 which is

slidably disposed in the longitudinal bore **142** and is provided with an external annular recess in which is disposed an annular sealing member **146** which seals between the top cap and the valve stem. The upper end of the longitudinal bore **142** may be enlarged as at **147** to receive the bushing **148** through which the valve shank **145** slides.

The top cap is provided with a downwardly and outwardly extending outlet passage **150** which communicates with a lateral aperture **151** of the tubular member **12** and with the longitudinal bore **142** above the valve **140**. It will thus be apparent that when the valve **140** is moved downwardly liquid may flow from the interior of the tubular member **12**, when the liquid is moved upwardly by the upward movement of the piston **40**, and then laterally and downwardly through the outlet passage **150** and the lateral aperture **151**. A suitable outlet conduit not shown, may be telescoped in the outlet passage **150** to direct the dispensed liquid to a cup or any other suitable receptacle.

In order to vent the upper end of the outlet passage **150** an upwardly extending vent aperture **153** is provided which communicates with the upper portion of the outlet passage **150** and with the lower end of a longitudinal bore **154** of the top cap. The longitudinal bore **154** is provided with an intermediate threaded portion **155** which receives a bushing **156** in which is slidably mounted a valve shank **157** whose lower end is provided with a valve **158**. The lower end of the bushing **156** is beveled downwardly and outwardly to provide an annular valve seat **160** against which the valve **158** may seat. The valve **158** is provided with a suitable external annular recess in which is disposed a resilient annular sealing member **161** which seals between the valve seat **160** and the valve **158**. The bushing **156** is provided with a lateral aperture **162** which communicates with a lateral aperture **163** of the cap **18**. It will now be seen that when the valve **158** is moved downwardly from the valve seat **160** air will be free to move into the upper end of the outlet passage **150** through the lateral aperture **163** of the top cap, the lateral aperture **162** of the bushing, the longitudinal bore **165** of the bushing, the longitudinal bore **154** of the top cap and the vent aperture **153**. The valve shanks, **101**, **145**, and **157** extend through the slot **115** of the upper bracket **26** and are provided with threaded bores in the upper ends thereof in which are received screws **170**, **171** and **172**, respectively, which serve to retain springs **174**, **175** and **176**, respectively, which are disposed about the shanks **101**, **145**, and **156**. The springs bias the valves upwardly towards closed positions.

The push rod **80** and the valve shanks **101**, **145** and **156** are moved downwardly against the yielding resistance of their respective springs by means of fingers **177**, **178**, **179** and **180**, respectively, which have flat substantially horizontal portions which abut the upper ends of the screws **170**, **171**, and **172** and the upper rounded end of the push rod **80** and are twisted to provide substantially vertical portions **181**, **182**, **183** and **184**, respectively, which are provided with lateral apertures through which extends a rod **185***a*. The rod **185***a* extends through aligned lateral apertures in the flanges **185** and **186** of the top bracket **26** and are secured thereto by nuts **187** threaded on opposite ends of the rod **185***a*. The fingers are held in properly spaced relationship to one another and to the flanges **185** and **186** by means of spacer sleeves **190** which are disposed on the rod **185** therebetween.

The fingers are pivoted downwardly about the rod **185***a* by cams **200**, **201**, **202** and **203**, respectively, rigidly mounted on a shaft **204** journaled in the flanges **185** and **186** of the top bracket **26** and rotated by an electric motor **205** rigidly mounted on the flange **185** by means of its mounting bracket **206**. Also, rigidly mounted on the cam shaft **204** is a switch cam disk **207** provided with a pair of depressions **208** and **209** in which is received the rounded end **210** of a switch operating lever **211** of the switch **212**. The switch **212** is mounted on the side of the flange **186** by means of a suitable bracket **213**.

If it is now assumed that the piston **40** is in the lowermost position shown in broken lines in Figure 1, it is held there by the pressure of the fluid to be dispensed, exerted through the longitudinal bore **125** of the inlet fitting, against the resistance of the spring **63**. The valve **102** is now in its lower open position since the portion **220** of the cam **201** is now in contact with the finger **178** and is holding the finger in its depressed position. The outlet valve **140** is now in closed position since the flat or straight surface **221** of the cam **202** is adjacent the finger **179** and is actually not engaging the finger **179**. The vent valve **158** is now in open position since the curved surface **222** of the cam **203** is engaging the finger **180** and holding it in a depressed position. The push rod **80** is in its raised position since the flat surface **229** of the cam **200** is now barely engaging its finger **177**. The operating lever **55** of the switch **56** is now held in depressed position by the disk **60** and the movable contact **230** of the switch **56** now engages the stationary contact whereby the switch is closed. The switch **92** is open with the movable contact **232** thereof remote from its stationary contact **233** since the operating lever **94** of the switch **92** is now in its lowermost position. The switch **212** is now open since the operating lever thereof is in the depression **208** of the cam **207** whereby its movable contact **234** is remote from its stationary contact **235**.

If the switch **240**, which is connected in series with the switch **56**, is now closed, it connects the motor **205** across the source of electrical current **241** through the conductors **242** and **243**, the movable contact **241***b* of the switch **240**, the conductor **244**, the stationary contact **231** and the movable contact **230** of the switch **56**, the conductors **245**, **246**, **247** and **248**. When the motor is thus energized, the shaft **204** is rotated in the direction indicated by the arrow **250** in Figure 3. Such rotation of the cam shaft **204** now causes the arcuate surface **251** of the cam **200** to engage the finger **177** and move the push rod **80** downwardly whereby the jack **72** is pivoted in a counter clockwise direction, Figure 1, and moves the spring retainer **51** upwardly whereby the piston shaft is moved upwardly to free it should it be frozen in the tubular member **12**. Simultaneously, the arcuate surface **220** of the cam **201** now moves past the end of the finger **178** and the finger **178** snaps upwardly to contact the rounded inner surface **252** of the cam **201** thus freeing the inlet valve **201** to move upwardly to closed position, so that no further flow of liquid may take place into the interior of the tubular member **12** through the fitting **125**. Also, simultaneously, the curved surface **222** of the cam **203** is moved out of contact with the finger **180** which permits the finger **180** to snap upwardly to contact the rounded surface **253** of the cam **203**. The vent valve **158** is thus closed and no communication is now possible between the upper end of the outlet aperture **150** and the vent aperture **163** of the top cap. The rotation of the cam **207** also moves the depression **208** past the rounded end **210** of the operating lever **211** of the switch **212** so that the rounded end now rides on the arcuate surface **254** of the cam **207** thus closing the switch **212** by moving the movable contact **234** into engagement with the stationary contact **235** thereof.

When the inlet valve **102** and the vent valve **158** are in closed positions, and the switch **212** is closed, further rotation of the cam shaft **204** causes the curved surface **255** of the cam **202** to engage the upper surface of the finger **179** and depresses the latter to move the outlet valve **144** to open position. The piston **40** will now begin to move upwardly under the influence of the spring **63** which biases it upwardly since the counter balancing pressure of the fluid which is in the longitudinal bore **125** of the inlet

fitting 122 is now shut off from the interior of the tubular member 112 by the closing of the inlet valve 102.

The piston 40 will then slowly move upwardly forcing the liquid which was trapped in the tubular member 12 between the piston and the top cap 18 outwardly through the longitudinal bore 141 and the outlet passage 150. The rate of travel of the piston 40 is controlled by a needle valve 260 threaded in a lateral bore 261 of the bottom cap which controls the effective orifice of the bore 262 which communicates with both a vertical bore 263 which extends to the top surface of the bottom cap and with a transverse bore 263 which extends laterally thru the bottom cap 13 to the atmosphere. As the piston 40 moves at a slow controlled rate upwardly in the tubular member 12, the cam shaft continues to rotate until the rounded end 210 of the operating lever 211 of the switch 212 drops into the recess or depression 209 of the cam 207. This causes the movable contact 234 of the switch 212 to move out of engagement with the stationary contact 235 and the motor 204 is now disconnected from its source of current because as the piston 40 moved upwardly, the disk 60 which moves therewith moved out of engagement with the operating lever 55 of the switch 56 and thus caused the movable contact 230 of the switch 56 to move out of engagement with the stationary contact 231. The switch 240 is open since the movable contact 241 of the switch 240 is closed only momentarily when it is desired to initiate operation of the vending dispensing device. The depression 209 is so disposed that the switch 212 is opened when the cam 202 has been rotated to such a position that the curved surface 255 thereof next to the step 265 engages the finger 179 and holds it in a depressed position. The outlet valve will thus be held in open position even though the motor 205 is not energized until the piston 40 has moved to a predetermined upper position wherein a predetermined amount of liquid has been forced out through the longitudinal bore 141 past the outlet valve 140 and through the dispensing lateral passage 150 of the top cap at which point the disk 60 engages the lower end of the operating lever 94 of the switch 92 which causes the movable contact 232 thereof to engage the stationary contact 233. As a result the motor 205 is again connected across the source of current 241 through the conductors 242, 243 and 266, the movable contact 232 of the switch 92, the stationary contact 233 thereof, the conductors 246, 247 and 248. The motor again being energized continues the rotation of the shaft 204 causing the rounded end 210 of the operating lever 211 to ride out of the recess 209 and on to the curved or rounded surface 267 of the cam 207 whereby the switch 212 is again closed. The continued rotation of the cam 202 then causes its rounded surface 255 to move out of engagement with its finger 179 causing the free end of the finger 179 to snap upwardly past the step 265 to engage the other rounded surface 268 thereof. Such upward movement of the finger 179, of course, permits the outlet valve 140 to move upwardly to its closed position. Simultaneously, the curved surface 220 of the cam 201 now moves into engagement with the finger 178 and the curved surface 222 of the cam 203 moves into contact with its finger 180 thus causing the fingers 178 and 180 to be depressed and move the inlet valve 102 and the vent valve 158 to open position. Opening of the vent valve 158 to open position permits venting of the upper end of the outlet passage 150 of the top cap thus permitting evacuation of any liquid trapped in the upper end of the outlet passage 50. Opening of the inlet valve 102, of course, permits liquid under pressure to move through the bore 125 of the fitting and through the bores 120, 105, 130 and 131 of the top cap into the interior of tubular member 12 whereby the pressure of such fluid causes the piston 40 to be moved slowly downwardly, the rate of movement of the piston being determined both by the pressure of the fluid entering the inlet fitting and the effective orifice of the vent bores 262, 263 and 263*a*.

As the piston 40 moves downwardly the switch 92 will again open since the disk 60 will move out of engagement with the operating lever 94 thereof. The switch 56 will also be open since the disk 60 is now moving downwardly towards the operating lever 55 thereof. The cam shaft 204 then continues to operate until it reaches the beginning position illustrated in Figure 3 with the rounded end 210 of the operating lever 211 of the switch 12 again disposed in the recess 208 of the cam 207 whereby the switch 212 is again opened. The motor 205 cannot again be energized until the switch 56 is again closed which can occur only when the piston has moved to the lowermost position wherein the disk 60 engages the operating lever of the switch 56 to close the latter. At this stage the closing of the contact 241*b* of the switch 240 will again initiate the above sequence of operation.

The provision of the fingers between the cams and the piston shanks of the valves 102, 140 and 158 provides for a snap action closing of these valves since the fingers snap up when the cams rotate to move the steps 265 thereof past the ends of the fingers. The fingers also act as levers to provide a mechanical advantage to the action of the cams since the cams contact the fingers remote from the rod 185*a* about which the fingers pivot and the upper ends of the valve shanks engage the fingers adjacent the rod 185*a*.

It will now be seen that a new and improved dispensing device 10 for dispensing predetermined amounts of liquid has been illustrated and described which includes a tank 11 having a piston slidably mounted therein and biased upwardly by a spring 63. It will also be seen that the device includes an inlet passage and an outlet passage and that liquid may be introduced into the interior of the tank above the piston through the inlet passage and that the pressure of the liquid so admitted into the interior of the tank forces the piston 40 downwardly to its lowermost position against the resistance of the spring 63. It will also be seen that when the inlet valve 102 is closed and the outlet valve 140 is open the force exerted by the spring is instrumental in moving the piston upwardly to force the liquid in the tank 11 through the outlet passage 150 to a dispensing point. It will also be apparent that the outlet passage is inclined downwardly and outwardly from the passage 141 and that the upper end of the outlet passage 150 is vented by the opening of the vent valve 158 whenever the outlet valve 140 is closed, whereby the outlet passage 150 is always fully evacuated at the end of each dispensing operation.

It will be seen that the initiation of operation of the dispensing device is controlled by the closing of the switch 240, which may be a suitable coin controlled switch, which closes momentarily whenever a coin is inserted in a suitable coin receptacle of a beverage vending machine.

It will be further seen that the dispensing operation can commence only when the tank 11 is completely filled with beverage and the piston is in the lowermost position due to the provision of the switch 56 which is connected in series with the control switch 240.

It will also be seen that the dispensing operation once commenced, must be completed before any other operation can commence due to the provision of the switch 92 which must be closed by contact with the disk 60 when it reaches the predetermined upper position before the filling operation can be commenced by the closing of the outlet valve 140 and the opening of the inlet valve 102.

It will be further seen that the switch cam 207 stops the operation of the motor 205 after the outlet valve 102 has been opened and the inlet valve 140 has been closed until the piston 140 has been moved to its lowermost position and the switch 56 is closed.

It will further be seen that the switch cam also stops operation of the motor 205 after the outlet valve 140 has been opened and the inlet valve 102 has been closed until the piston 40 has moved from its lowermost position to a predetermined upper position, which is predetermined

by the position of the disk **60** on the piston shaft **42** and the position of the lower end of the operating lever of the switch **92**.

It will further be seen that the liquid to be dispensed is held under pressure throughout the dispensing cycle of operation since when the inlet valve is in open position the liquid is held under pressure of its source since the outlet valve **140** is always in closed position when the inlet valve is open and the spring **63** always holds the piston biased for upward movement.

It will further be seen that during the upward movement of the piston **40** the liquid is still maintained under pressure since the orifice of the outlet passage **141** is relatively small as regards the cross sectional area of the piston.

It will be further seen that the movement of the piston **40** is uniform and smooth due to the provision of a vent **263** which controls the escape of the air trapped between the piston **40** and the bottom cap **13** during filling operations of the tank **11** and also controls the upward movement of the piston **40** by controlling the introduction of air behind the piston **40** into the tank **11** as the piston moves upwardly in the tank.

It will be apparent that various changes in the construction of the device can be made without departing from the invention and it is intended, therefore, to cover in the appended claims all such changes or modifications as fall within the true spirit and scope of the invention.

What we claim is new and desire to secure by Letters Patent is:

1. A dispensing device comprising a tank having closed opposite ends, a piston slidably mounted in the tank and biased towards movement towards one of said ends of said tank, one of said ends having an inlet passage closed by an inlet valve whereby liquid under pressure may be introduced into the interior of said tank to move said piston from said one end and to fill the tank, said one of said ends of said tank being provided with an outlet passage closed by an outlet valve for permitting flow of the liquid from the interior of the tank when the piston moves towards said one of said ends, means for closing said outlet valve when said inlet valve is open and for closing said inlet valve when said outlet valve is opened, a vent passage in the other of said ends of said tank communicating with the interior of said tank and the exterior of the tank, means for adjustably varying the effective orifice of said vent passage, said one of said ends being provided with a second vent passage communicating with the upper end of the outlet passage and the atmosphere, said second vent passage being closed by a vent valve, said outlet valve, said inlet valve, and said vent valve having shanks extending outwardly of said one of said ends, cam means disposed adjacent the valve shanks for sequentially moving said valve shanks inwardly to move said valves to open positions during the cycle of operation of said dispensing device, biasing means associated with said valves for biasing said valves towards closed positions, said cams being rigidly secured to a rotatable shaft, said shaft being rotated by an electrically driven means, a switch cam mounted on said rotatable shaft and operatively associated with a first switch for controlling the closing of said first switch during each rotation of said shaft, said first switch interrupting the energization of said electrically driven means when said shaft has been rotated to a position wherein the outlet valve is closed and said inlet valve is open, a second switch means responsive to the position of the piston for energizing said electrically driven means when said piston has been moved to one extreme position wherein the tank is completely filled with the liquid to be dispensed whereby the shaft is caused to be rotated to cause the inlet valve to close and said outlet valve to open, said switch cam causing said first switch to open to stop rotation of said shaft when said inlet valve is closed and said outlet valve is open, and a third switch responsive to the position of the piston for energizing the electrically driven means when said piston is in a position remote from its said extreme position whereby the shaft is rotated to close the outlet valve and open the inlet valve to complete the cycle of operation.

2. A dispensing device comprising a tank having closed opposite ends, a piston slidably mounted in the tank and biased towards movement towards one of said ends of said tank, one of said ends having an inlet passage closed by an inlet valve whereby liquid under pressure may be introduced into the interior of said tank to move said piston from said one end and to fill the tank, said one of said ends of said tank being provided with an outlet passage closed by an outlet valve for permitting flow of the liquid from the interior of the tank when the piston moves towards said one of said ends, means for closing said outlet valve when said inlet valve is open and for closing said inlet valve when said outlet valve is opened, a vent passage in the other of said ends of said tank communicating with the interior of said tank and the exterior of the tank, means for adjustably varying the effective orifice of said vent, said one of said ends being provided with a vent passage communication with the upper end of the outlet passage and the atmosphere, said vent passage being closed by a vent valve, said outlet valve, said inlet valve, and said vent valve having shanks extending outwardly of said one of said ends, cam means disposed adjacent the valve shanks for sequentially moving said valve shanks inwardly to move said valves to open positions during the cycle of operation of said dispensing device, biasing means associated with said valves for biasing said valves towards closed positions, said cams being rigidly secured to a rotatable shaft, said shaft being rotated by an electrically driven means, a switch cam mounted on said rotatable shaft and operatively associated with a first switch for controlling the closing of said first switch during each rotation of said shaft, said first switch interrupting the energization of said electrically driven means when said shaft has been rotated to a position wherein the outlet valve is closed and said inlet valve is open, a second switch means responsive to the position of the piston for energizing said electrically driven means when said piston has been moved to the one extreme position wherein the tank is completely filled with the liquid to be dispensed whereby the shaft is caused to be rotated to cause the inlet valve to close and said outlet valve to open, said switch cam causing said first switch to open to stop rotation of said shaft when said inlet valve is closed and said outlet valve is open, a third switch responsive to the position of the piston for energizing the electrically driven means when said piston is in a position remote from its said extreme position whereby the shaft is rotated to close the outlet valve and open the inlet valve to complete the cycle of operation, and a fourth switch connected in series with said second switch for initiating the cycle of operation of the dispensing device.

3. A dispensing device comprising a tank having closed opposite ends, an operative means mounted in the tank and biased towards movement towards one of said ends of said tank, one of said ends having an inlet passage closed by an inlet valve whereby liquid under pressure may be introduced into the interior of said tank to move said operative means from said one end and to fill the tank, said one of said ends of said tank being provided with an outlet passage closed by an outlet valve for permitting flow of the liquid from the interior of the tank when the operative means moves towards said one of said ends, and means for closing said outlet valve when said inlet valve is open and for closing said inlet valve when said outlet valve is opened, and means operatively associated with said operative means and said control means for positively moving the operative means toward said one of said ends when said inlet valve is initially opened.

4. A liquid dispensing device for dispensing predeter-

mined quantities of liquid from a pressurized source of the liquid comprising: a tank having closed opposite ends, one of said ends having an inlet passage connectable to the pressurized source of the liquid for conveying the liquid into the tank and an outlet passage for conveying liquid from the tank to a dispensing point, an inlet valve for closing the inlet passage and an outlet valve for closing the outlet passage, a piston slidably mounted in the tank for movement between the ends of the tank, means for biasing the piston for movement toward said one of said ends and away from the other of said ends, and an operative means for sequentially moving said inlet valve to open position while said outlet valve is in closed position to permit liquid to flow through the inlet passage into the tank and move the piston toward the other of said ends, moving the inlet valve to closed position and then moving the outlet valve to open position whereupon the biased piston moves toward said one of said ends forcing the liquid from the tank through the outlet passage to the dispensing point, said operative means including a rotatable shaft, a plurality of cams mounted on said shaft for sequentially moving said valves to open positions, said valves having means biasing said valves toward closed posistions, and driver means for rotating said shaft, and control means for said driver means responsive to the position of said piston for de-energizing said driver means when said outlet valve is closed and said inlet valve is open during the tank filling phase of the cycle of operation of the device until said piston is moved to an extreme position and said tank is filled with liquid.

5. A liquid dispensing device for dispensing predetermined quantities of liquid from a pressurized source of the liquid comprising: a tank having closed opposite ends, one of said ends having an inlet passage connectable to the pressurized source of the liquid for conveying the liquid into the tank and an outlet passage for conveying liquid from the tank to a dispensing point, an inlet valve for closing the inlet passage and an outlet valve for closing the outlet passage, a piston slidably mounted in the tank for movement between the ends of the tank, means for biasing the piston for movement toward said one of said ends and away from the other of said ends, and an operative means for sequentially moving said inlet valve to open position while said outlet valve is in closed position to permit liquid to flow through the inlet passage into the tank and move the piston toward the other of said ends, moving the inlet valve to closed position and then moving the outlet valve to open position whereupon the biased piston moves toward said one of said ends forcing the liquid from the tank through the outlet passage to the dispensing point, said operative means including a rotatable shaft, a plurality of cams mounted on said shaft for sequentially moving said valves to open positions, said valves having means biasing said valves toward closed positions, and driver means for rotating said shaft, and control means for said driver means responsive to the position of said piston for de-energizing said drive means when said outlet valve is open and said inlet valve is closed during the tank emptying phase of the cycle of operation of the device until a predetermined quantity of liquid is dispensed from the tank by the piston.

6. A liquid dispensing device for dispensing predetermined quantities of liquid from a pressurized source of the liquid comprising: a tank having closed opposite ends, one of said ends having an inlet passage connectable to the pressurized source of the liquid for conveying the liquid into the tank and an outlet passage for conveying liquid from the tank to a dispensing point, an inlet valve for closing the inlet passage and an outlet valve for closing the outlet passage, a piston slidably mounted in the tank for movement between the ends of the tank, means for biasing the piston for movement toward said one of said ends and away from the other of said ends, and an operative means for sequentially moving said inlet valve to open position while said outlet valve is in closed position to permit liquid to flow through the inlet passage into the tank and move the piston toward the other of said ends, moving the inlet valve to closed position and then moving the outlet valve to open position whereupon the biased piston moves toward said one of said ends forcing the liquid from the tank through the outlet passage to the dispensing point, said operative means including a rotatable shaft, a plurality of cams mounted on said shaft for sequentially moving said valves to open positions, said valves having means biasing said valves toward closed positions, and driver means for rotating said shaft, and control means for said driver means responsive to the position of said piston for de-energizing said driver means when said outlet valve is closed and said inlet valve is open during the tank filling phase of the cycle of operation of the device until said piston is moved to an extreme position and said tank is filled with liquid, and control means for said driver means responsive to the position of said piston for de-energizing said driver means when said outlet valve is open and said inlet valve is closed during the tank emptying phase of the cycle of operation of the device until a predetermined quantity of liquid is dispensed from the tank by the piston.

7. A liquid dispensing device for dispensing predetermined quantities of liquid from a pressurized source of the liquid comprising: a tank having closed opposite ends, one of said ends having an inlet passage connectable to the pressurized source of the liquid for conveying the liquid into the tank and an outlet passage for conveying liquid from the tank to a dispensing point, an inlet valve for closing the inlet passage and an outlet valve for closing the outlet passage, a piston slidably mounted in the tank for movement between the ends of the tank, means for biasing the piston for movement toward said one of said ends and away from the other of said ends, and an operative means for sequentially moving said inlet valve to open position while said outlet valve is in closed position to permit liquid to flow through the inlet passage into the tank and move the piston toward the other of said ends, moving the inlet valve to closed position and then moving the outlet valve to open position whereupon the biased piston moves toward said one of said ends forcing the liquid from the tank through the outlet passage to the dispensing point, said operative means including a rotatable shaft, a plurality of cams mounted on said shaft for sequentially moving said valves to open positions, said valves having means biasing said valves toward closed positions, and driver means for rotating said shaft, and means operable by said shaft for moving the piston a short distance toward said one end at the commencement of the tank emptying phase of the cycle of operation of the device.

References Cited in the file of this patent

UNITED STATES PATENTS

1,979,428	Wheeler	Nov. 6, 1934
2,824,585	Andres	Feb. 25, 1958