

Sept. 4, 1951

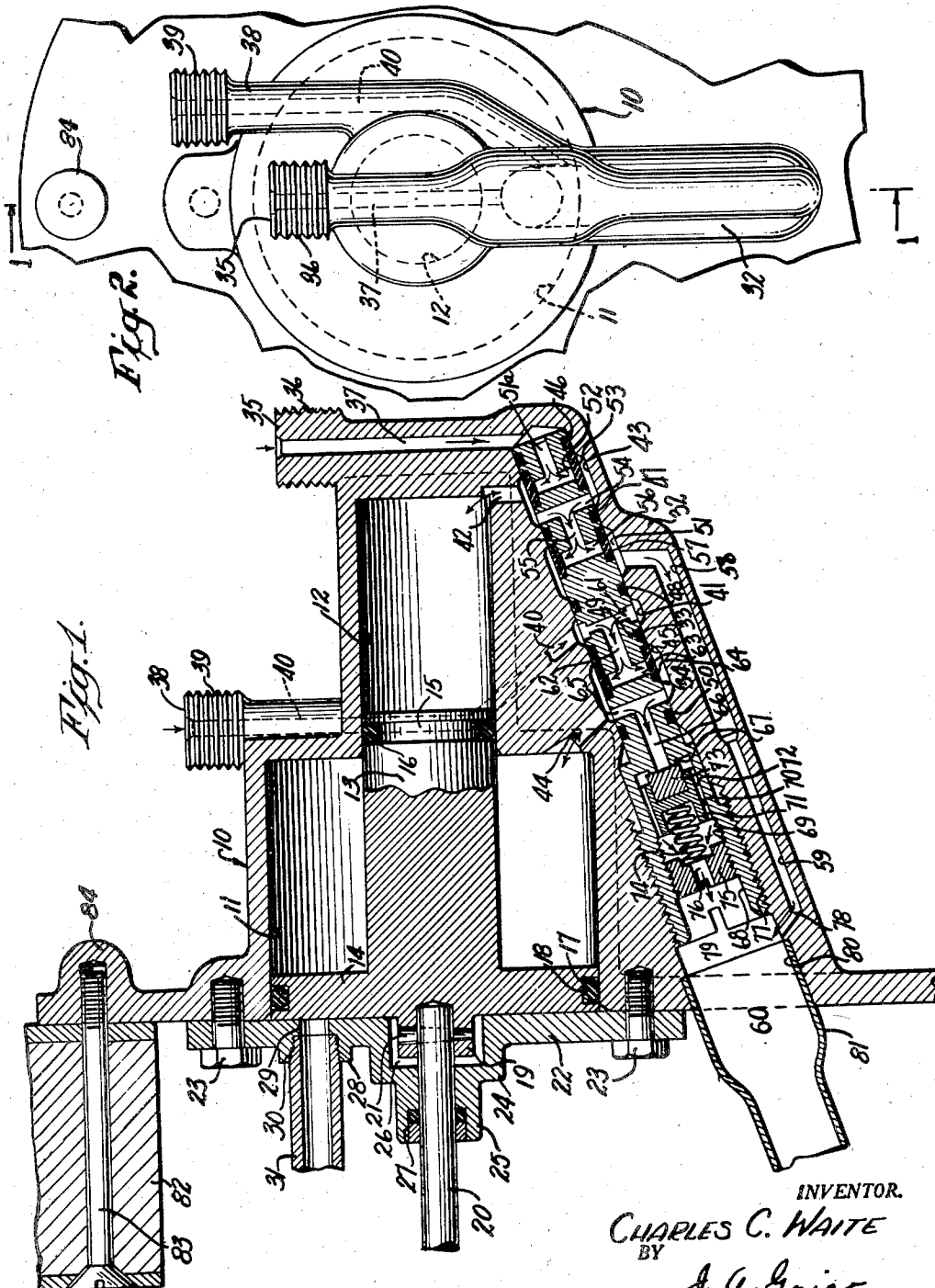
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2,566,436

BEVERAGE DISPENSING MACHINE

Filed Oct. 11, 1947

4 Sheets-Sheet 1



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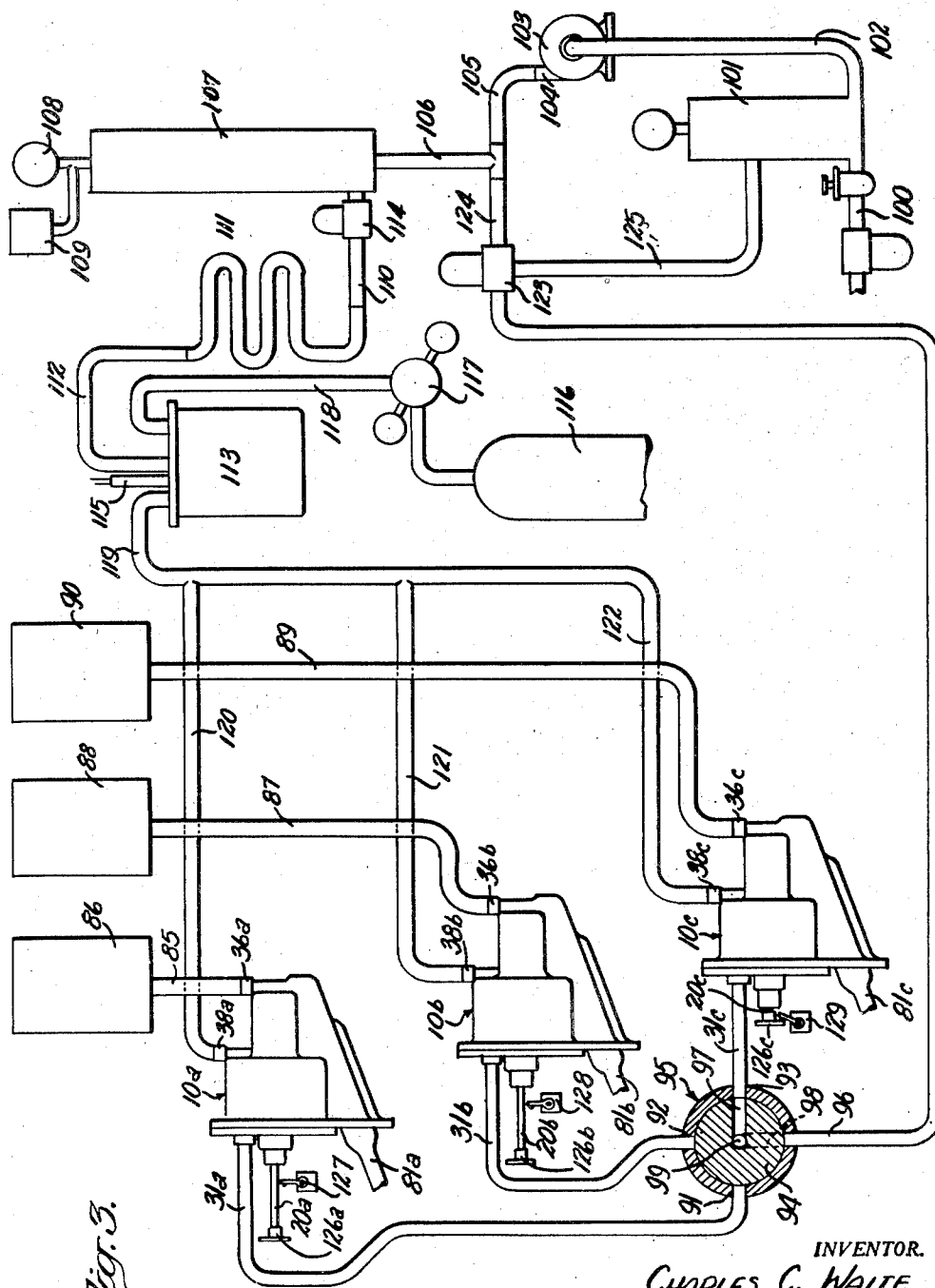


Fig. 3.

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Fig. 4.

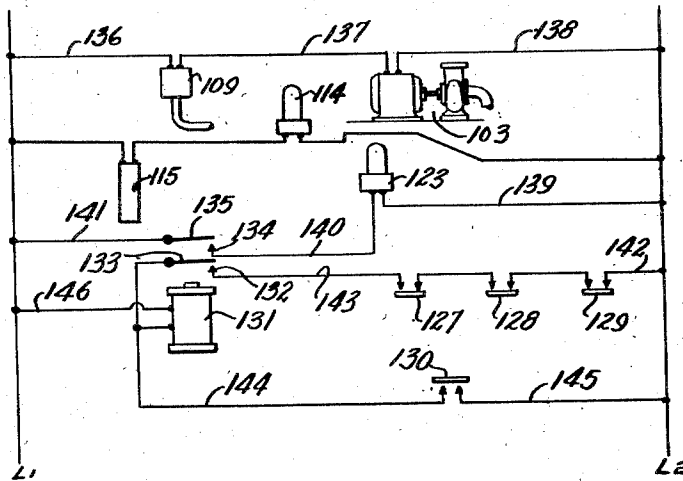
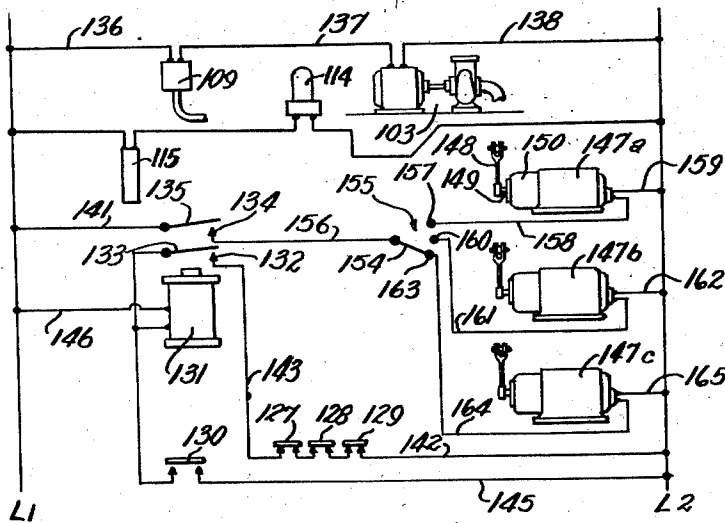


Fig. 6.



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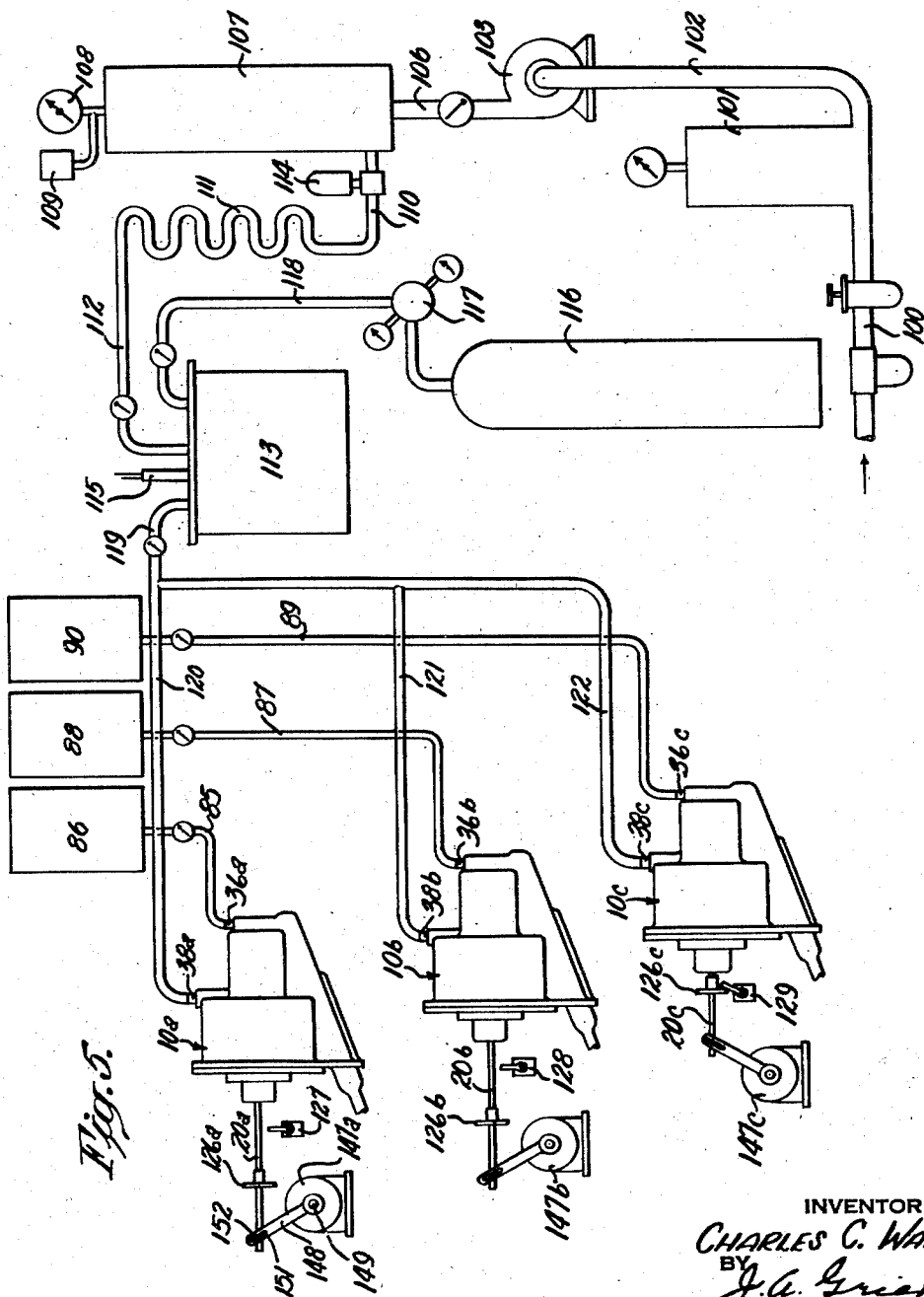


Fig. 5.

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BEVERAGE DISPENSING MACHINE

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7 Claims. (Cl. 225—21)

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The present invention relates to beverage dispensing machines and more particularly to a machine for mixing, measuring and dispensing a plurality of carbonated beverages selectively, said machine being of the automatic coin-operated type.

It is an object of the invention to provide such a device for measuring, mixing and dispensing a selected beverage from ingredients stored therein, which device is compact, easily cleaned and serviced, and is simple and exact in operation.

A further object is to provide such a device embodying a simple, inexpensive, unitary valve member having positive action and long-wearing, accessible and easily cleaned parts and to provide such a single unit to replace the multiplicity of valve units usually employed for such purposes.

In the drawing:

Figure 1 is a central section, on the line 1—1 of Figure 2, of the measuring cylinder and valve unit;

Figure 2 is a rear elevation of the device shown in Figure 1;

Figure 3 is a diagrammatic representation of a system employing a number of units forming apparatus for selectively dispensing beverages;

Figure 4 is a circuit diagram, showing controls for the apparatus shown in Figure 3;

Figure 5 is a diagrammatic representation of a system which constitutes a modification of the arrangement shown in Figure 3; and

Figure 6 is a circuit diagram of the controls for the system shown in Figure 5.

Referring to the drawings:

Figures 1 and 2 illustrate my way of example a measuring and dispensing device, which includes a housing 10 having cylinders 11 and 12 formed therein. The cylinder 11 is larger in diameter than the cylinder 12. A dual piston has a portion 13 which may form a working fit in the cylinder 12, and a portion 14 of larger diameter which forms a working fit in the cylinder 11.

The portion 13 has a peripheral groove 15 adjacent to the end thereof which carries a sealing ring 16, which may be formed of rubber-like material to effect a fluid-tight seal with the walls of the cylinder 12.

The portion 14 has a groove 17 formed in the periphery thereof which carries a sealing ring 18, which effects a fluid-tight seal with the walls of the cylinder 11.

A boss 19 on the left end of the cylinder has a central hole therein to receive the end of a piston

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rod 20, and this rod may be secured therein by means of a taper pin 21.

A cylinder head 22 forms a closure for the end of the cylinder 11, and is secured thereto by means of bolts 23 or any other suitable means. The cylinder head has stepped bosses 24 and 25. The boss 24 has a cavity 26 formed therein to clear the boss 19 on the piston. The boss 25 has formed therein a stuffing box 27 forming a seal with the piston rod 20.

The cylinder head 22 has a boss 28 formed thereon. A hole 29 formed in this boss communicates with the cylinder 11, and has a portion 30 enlarged and internally threaded to receive a pipe 31.

The piston may be reciprocated in the cylinders by any means connected or linked to the piston rod 20.

The arrangement shown in Figures 1, 2 and 5, contemplates reciprocating the piston by hydraulic means. The pipe 31 is connected to a source of hydraulic or other suitable fluid pressure. An angular boss or rib 32 formed integral with the housing 10 has a bore 33 therein to accommodate a cylindrical valve body or plug 34.

A boss 35 has external threads 36 formed thereon for use in connecting tubing or piping thereto, and an internal passage 37 therein communicates with the bore 33 at the right end thereof, as seen in Figure 1.

A second boss 38 on the housing 10 has external threads 39 formed thereon for connecting tubing or piping thereto, and an internal passage 40 therein communicates with the bore 33 at an intermediate point via an annular undercut 41. The cylinder 12 has a passage communicating with an annular undercut 43, and the cylinder 11 has a passage 44 communicating with an annular undercut 45. All of these undercuts are understood to be larger in diameter than and are preferably concentric with the bore 33.

The valve body 34 has a plurality of spaced annular grooves formed therein carrying rubber-like sealing rings 46, 47, 48, 49 and 50, which sealingly engage the walls of the bore 33.

The undercut 43 in the cylinder wall is between the rings 46 and 47; an undercut 51 is formed in the cylinder wall between the rings 47 and 48; the undercut 41 is between the rings 48 and 49; and the undercut 45 is between the rings 49 and 50.

The right end of the valve body 34 has a central axial hole 51a therein which communicates with a cross hole 52, the ends of which terminate in an annular groove containing a tubular ring

53 of rubber-like material forming a check valve, which allows syrup to pass from the passages 37, 51a and 52, to pass into the undercut 43 and into the cylinder 12 via the passage 42 when a suction is created in the cylinder, but prevents the syrup from passing in the opposite direction when the piston 13 is moving into the cylinder 12 and creating a pressure.

A cross-passage 54, formed in the valve body 34, communicates with an axial passage 55 which in turn communicates with a cross-passage 56, the ends of which terminate in an annular groove containing a tubular ring 57 of rubber-like material forming a check valve between the undercut 51 and the cross-passage 56.

A passage 58, formed in the web 32, communicates with a smaller or restricted passage 59 which in turn delivers syrup into a mixing chamber 60, to be presently described, angularly.

In the valve body between the rings 48 and 49 and communicating with the undercut 41 is a cross-passage 61 which communicates with an axial passage 62. The axial passage 62 communicates with a cross-passage 63, the ends of which terminate in an annular groove containing a tubular ring 64 of rubber-like material forming a check valve adapted to discharge into the undercut 45.

A cross-passage 65 in the valve body communicates with both the undercut 45 and an axial passage 66. The left end of the passage 66 is surrounded by an annular lip 67 which forms a valve seat.

The valve body 34 has a central passage extending from the left end thereof and terminating slightly beyond the lip 67. This passage is fabricated as follows: beginning at the left end is a straight portion 68 which communicates with an internally threaded portion 69 slightly smaller in diameter, and the portion 69, in turn communicates with a straight portion 70. Slidably carried in the portion 70 is a plug member 71, the exterior of which has a plurality of longitudinal flutes 72 formed therein to form fluid passages.

The right end of the plug member 71 has a counterbored hole therein carrying a disc 73 of seating material adapted to cooperate with the lip 67. The left end of the plug member is cupped to receive the right end of a spring 74, the left end of which extends into a socket in a threaded bushing engaging the threads in the portion 69 and having a passage 76 therethrough.

The left end of the valve body 34 is enlarged and threaded to engage a correspondingly threaded enlarged portion 77 of the bore 33. To the left of the threaded portion 77 is a chamber 79 with which a counterbore 80, provided with a conduit 81 communicates.

Operation

Assuming that a conduit leading from a source of carbonated water under pressure is connected to the boss 38, and a second conduit leading from a source of syrup is connected to the boss 35 (the syrup may be either under pressure or under the urge of the force of gravity) the pressure forces the carbonated water via the passage 40 into the cross-passage 61, thence via the passages 62 and 63 and via the check valve 64 into the counterbore 45 and, via passage 44, into the right end of the cylinder 11. This causes the piston 14 to move to the left and the cylinder fills with carbonated water, because

the urge of the spring 74 against the plug member 71 and the disc 73, carried thereby, against the lip 67, is slightly greater than the pressure of the carbonated water against the area of said disc at the left end of the passage 66.

Since the piston 14 and the piston 13 move in unison, the movement of the piston 13 toward the left end of the cylinder 12 creates a partial vacuum in the latter and the cylinder 12 is filled with syrup as follows: syrup via the passage 37 passes into the passage 51a and thence via the cross-passage 54 and the check valve 53 into the undercut 43. From this undercut, the syrup passes via the passage 42 and into the cylinder 12.

Thus, the cylinder 11 is filled with carbonated water and the cylinder 12 is filled with syrup, and the device is ready to dispense both the water and the syrup, co-mingling them while they are being discharged.

Assuming that the pipe 31 is connected to a source of hydraulic pressure with a suitable control valve (not shown) therebetween, the control valve may be turned to subject the left face of the piston 14 to this pressure, and the pistons start moving toward the right. Thus, the piston 14 forces the carbonated water out of cylinder 12 via the passage 44, and the piston 13 forces the syrup out of cylinder 12 via the passage 42.

As the carbonated water is forced into the undercut 45, it is prevented from entering the passage 63 by the check valve 64, and therefore it must go via the cross-passage 65 and the central passage 66 to the valve 67, 73, thereby unseating the valve—due to the fact that the pressure on the carbonated water, due to the forcing of the water by the piston 14, is substantially greater than the carbonated water source. Water passing through the valve 67, 73 passes via the flutes 72 and the passage 76 and into the chamber 79.

Syrup in the cylinder 12 is forced via the passage 42 and the cross-passage 54 into the passages 55 and 56 and via the check valve 57 into the undercut 51.

From the undercut 51, the syrup passes via the passage 58, 59, 78 into the chamber 79, 60 where it meets and is co-mingled with the carbonated water and they both pass in a mixed state via the conduit 81 to a point of use.

As soon as the hydraulic pressure upon the piston 14 is relieved, the pressure of the carbonated water again forces the piston toward the left and the cylinders 11 and 12 again fill with carbonated water and syrup respectively.

If it is desired to operate the device mechanically, suitable mechanical elements may be connected to the rod 20, so as to move it, and the pistons connected thereto, to the right for discharging the carbonated water and the syrup from the cylinders 11 and 12, respectively, and causing them to meet in the chamber 79.

The member 10 may be suitably mounted on a support, for example, a support 82, by means of screws, such as the screw 83 engaging a threaded hole in a boss 84 formed on the body member 10.

Referring to Figure 3, which is diagrammatic, a system is shown whereby a plurality of different flavors of drinks may be dispensed. Although the system shown only provides for three, it is obvious that the arrangement may be extended to provide for as many different flavors as desired.

A piston unit 10a (like that shown in Figures 1

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and 2) has its syrup connection 36a connected by a conduit 85 to a syrup tank 86 containing one of the wanted flavors. A second piston unit 10b has its syrup connection 36b connected via a conduit 87 to a syrup tank 88 containing another wanted flavor, and a third piston unit 10c has its syrup connection 36c connected via a conduit 89 to a syrup tank 90 for containing a third desired flavor.

The hydraulic connection 31a leads to a point or position 91 on a hydraulic valve 95. Likewise, the hydraulic connections 31b and 31c lead respectively to points or positions 92 and 93 on the valve 95. The valve has a rotor 94 which has a radial passage 97 which communicates with a hydraulic fluid supply pipe via an axial hole 99 and a radial hole 98. The hydraulic valve 95 is the selector valve.

A water pipe 100, connected to a source of supply, delivers water to a low pressure surge tank 101, and a pipe 102 connects it to the inlet of a motor-driven pump 103. The discharge port 104 of this pump is connected via pipes 105 and 106 to a high pressure surge tank 107 which receives the water under high pressure from the pump 103. The tank 107 may be provided with a gauge 108 and a pressure controlled switch 109 which controls the motor-driven pump 103 to maintain a predetermined pressure in the tank 107.

Water passes from this tank via pipe 110 to a refrigerated coil 111 and thence via pipe 112 to a carbonator 113.

A solenoid controlled valve 114 is included between the pipe 110 and the tank 107 for controlling the flow of water via the coil 111 into the carbonator, and a member 115 controls the supplying of current to the valves 114 so that a predetermined level of liquid is maintained in the carbonator 113.

A CO₂ gas tank 116 is connected via a pressure reducing valve 117 and a pipe 118 to the carbonator 113.

A pipe 119, leading carbonated water from the carbonator has a branch pipe 120 extending to the carbonated water connection 36a on the device 10a; a branch pipe 121 connecting to the carbonated water connection 36b on the device 10b; and an extension 122 connecting to the carbonated water connection 36c on the device 10c, so that carbonated water is supplied to all of the devices.

The pipe 96, described above as connected to the selector valve 95, has its other end connected to a solenoid operated valve 123 which also connects via a pipe 124 and the pipe 106 to the high pressure surge tank 107. A pipe 125 connects to the low pressure tank 101 and also the solenoid valve 123. The valve 123 under certain conditions establishes communication between the pipes 96 and 124, and when these conditions terminate, interrupts communication between pipes 96 and 124, and establishes communication between pipes 96 and 125.

Each piston rod carries a flanged actuating member for actuating a control; for example, the piston rod 20a carries a flanged actuating member 126a which actuates a limit switch 127; the piston rod 20b also carries a flanged actuating member 126b which actuates a limit switch 128; and the piston rod 20c carries a flanged actuating member 126c which actuates a limit switch 129.

Referring to Figure 4, which shows diagrammatically the control circuits of the system shown

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in Figure 3, L₁ and L₂ represent two lines, connected to a source of current. The pressure controlled switch 109 is connected via a wire 136 to L₁ and is connected via a wire 137 to the motor of the pump unit 103, and the motor is connected via a wire 138 to L₂. When the pressure in the tank 107 falls to a predetermined pressure, the switch 109 closes and the pump unit operates to pump water into the tank 107 until a predetermined higher pressure (depending on the differential of the pressure control) is attained in said tank, whereupon the switch 109 opens.

The solenoid of the solenoid operated valve 123 has one terminal connected via a wire 139 to L₂ and its other terminal connected via a wire 140 to a contact point 134 of a relay 131. A contact arm 135 of the relay, adapted to contact the point 134, is connected via a wire 141.

The limit switches 127, 128 and 129 are normally closed, and are connected in series. One terminal of the switch 129 is connected to L₂ via a jumper 142, and one terminal of the switch 127 is connected via a wire 143 to a contact point 132 of the relay 131. A contact arm 133, adapted to cooperate with the contact point 132, is connected via a wire 144 to one terminal of the winding of the relay 131 and to one terminal of a coin operated switch 130, and the latter is in turn connected via a wire to the line L₂. The other terminal of the winding of the relay is connected via a wire 146 to L₁.

When the switch 130 is closed by a coin, the winding of the relay 131 is energized and the contact arms 133 and 135 are respectively brought into contact with the points 132 and 134.

The circuit established by contact of the arm 133 with the point 132 constitutes a "sticking" circuit through the series limiting switches 127, 128, 129 which keeps the winding of relay 131 energized until one of said limiting switches is opened by the movement of one of the piston rods 20a, 20b, 20c. The coin operated switch 130 does not remain closed except for a few seconds after it is actuated by the coin, so the "sticking" circuit is "set" by the coin switch and "disabled" by the flange member 126 carried on the piston rod 20 at the completion of the stroke of the pistons.

The circuit established by contact of the arm 135 with the contact 134 energizes the solenoid of the valve 123, and water at an elevated pressure from the tank 107 is delivered via the pipe 96 to whichever cylinder is selected by the customer by setting the selector 99. At the end of the delivery operation when the winding of the relay 131 is deenergized by the engagement of the flange 126 of the unit 10 selected, with its associated limit switch 127, 128 or 129, the circuit of the solenoid of the valve 123 is opened. As soon as this occurs, the valve shifts so as to deliver the water which actuated the cylinder into the low pressure tank 101. The return of this water is abetted by the action of the carbonated water via one of the pipes 120, 121, or 122 (depending on which unit 10 was selected for the operations above described) in refilling the cylinder 11 of the unit. The movement of the piston unit 14, 13 at the same time causes the cylinder 12 to fill with syrup, and the unit is ready for the next operation.

A modified form of the device of Figure 3 is shown diagrammatically in Figure 5, and a modification of the circuits therefor is shown in Figure 6, which is similar in some respects to the circuit shown in Figure 4.

Referring first to Figure 5, the arrangement is similar to the arrangement shown in Figure 3 except that the pistons are actuated mechanically, to deliver a desired beverage, instead of hydraulically. In Figure 5, like elements to those shown in Figure 3 are given the same numerals. Electric motor and magnetic clutch units 147a, 147b and 147c are linked respectively to the piston rods 20a, 20b, and 20c for moving the latter.

The linkages are all alike, so the description of one of them should suffice. The motor clutch unit 147a, for example, has a shaft 149 projecting from the gear reduction end 150. Within the end of the casing 150 is an element of a magnetic clutch secured on the shaft 149. The other element is on a shaft (not shown) within the casing, driven through the gear reduction at reduced speed, and a magnetic winding carried on one of the clutch members is energized to drive the other member.

The outer end of the shaft 149 has keyed thereto arm 148 having an elongated slot 151 formed therein and engaging a pin 152 in the piston rod 20a. As soon as energy is supplied to any one of the units 147a, 147b or 147c, its motor starts operating and its clutch is also energized, so that the arm 148 is moved in a clockwise direction. Thus, the pistons 14, 13 connected to the piston rod so moving, discharge the carbonated water and the syrup from the unit selected for operation.

When the piston rod has been thus moved to its extreme position (where all the carbonated water and syrup are discharged) such position being like the position of the piston rod 20a of Figure 5, the flange member 126c engages and actuates the limit switch 129. This effects deenergization of the motor and clutch unit 147, and the pistons 14, 13, the piston rod 20 and the arm 148 return to their normal positions under the urge of carbonated water under pressure entering the cylinder 11 of the unit 10 which was discharged by the above described operation. At the same time, the cylinder 12 is filled with syrup.

Since the piston rods 20 are actuated mechanically, the connections 31, 96, the valve 123 and the return pipe 125 are eliminated, together with the selector valve 95.

Referring now to Figure 6, the circuit for the motor driven pump 103 is identical with the corresponding circuit in Figure 4. In both these circuits, the liquid level controlled switch 115 is shown as in series with the solenoid valve 114 and opens the valve when the liquid level in the carbonator 113 reaches a predetermined low level, and closes it when the liquid level reaches a predetermined higher level, consequently a desired liquid level is maintained in the carbonator.

The switch 130 is closed by the insertion of the coin in the machine. This energizes the winding of the relay 131, causing the members 132 and 133 to establish a "sticking" circuit through the normally closed limit switches 127, 128 and 129, as was the case in Figure 3. The members 134 and 135 are also brought into contact, thereby supplying energy from L₁ via the wire 141, contacts 135, 134 and the wire 156 to a contact arm 154 of a selector switch 155. The selector switch 155 has: a contact point 157 connected via a wire 158 to the motor clutch unit 147a, which is in turn connected to L₂ via a wire 159; a second contact point 160 connected via a wire 161 to the motor-clutch unit 147b, which is in turn connected to L₂ via a wire 162; and a third contact point 163 connected via a wire 164 to the motor-

clutch unit 147c, which is in turn connected to L₂ via a wire 165.

Thus, the purchaser can select the flavor of the beverage he wants by positioning the selector switch arm 154 on the contact point corresponding to the flavor desired. When the beverage is delivered, the limit switch associated with the unit 10 selected opens, causing the relay 131 to open and interrupt the circuit between L₁ and the selector switch arm 154. As soon as this occurs, the cylinders of the unit refill with carbonated water and syrup in the manner repetitively described above.

Although I have described a preferred embodiment of my new and improved dispensing machine and a modification, many changes may be made in the arrangements shown within the scope of the appended claims.

I claim:

1. In a beverage dispenser, a structure including at least a cylinder for measuring carbonated water, a port in said cylinder via which fluids may be admitted and rejected, a piston in said cylinder, a head for said cylinder, a piston rod extending through a stuffing box in said head, a conduit secured to said head and communicating with said cylinder and with a source of hydraulic pressure via a magnetically controlled valve, actuating means carried on said piston rod, a limit switch in the path of said actuating means, a source of carbonated water connected to said port via a one-way valve, circuit means for supplying energy to the winding of said magnetic valve and including said limit switch, whereby hydraulic pressure moves said piston away from said head until said actuating means deenergizes said winding, the carbonated water content of said cylinder being discharged by said movement, and other carbonated water from said source being adapted to force said piston toward said head and refill said cylinder after said winding is deenergized.

2. In a beverage dispenser, a plurality of sets of dual measuring cylinders, each having a two-step piston therein and each piston having a piston rod extending therefrom and carrying actuating means; one cylinder in each set being connected to measure carbonated water and its piston being motivated thereby, the other cylinder in each set being connected to measure syrup, and the measured carbonated water and syrup discharged from each set being adapted to commingle; a hydraulic distributor functioning as a selector, individual connections between several positions or stations on said distributor and said sets, connections between said distributor and a source of water under a pressure lower than the pressure of said carbonated water, a two-way magnetic valve included in said last connection, a source of water under a pressure higher than the pressure of said carbonated water also connected to said valve and adapted to be placed in communication with said distributor when the winding of said valve is energized and thereby said source of water of lower pressure is disassociated from said distributor, relay means for supplying energy from a source to the winding of said valve, and a sticking circuit in said relay including a series of limit switches, one for each set and each adapted to be opened by the actuating means of its set.

3. In a beverage dispenser, a structure including a carbonated water measuring cylinder, a syrup measuring cylinder in axial alignment therewith, pistons in said cylinders interconnected

within said structure to move in unison, a port in said first cylinder for connection to a source of carbonated water, whereby said cylinder may be filled by the carbonated water displacing its piston, a port in said second cylinder to be connected to a source of syrup, whereby the latter may fill said second cylinder under the urge of suction created therein by the movement of its piston, a piston rod connected to one of said pistons and extending outside said structure, and motor driven means operatively connected to said piston rod for forcing said pistons in one direction only to discharge the contents of said cylinders.

4. A beverage dispenser according to claim 3, in which settable means partly on said piston rod and partly on said structure are provided to cause said motor-driven means to cease operating when a predetermined quantity of carbonated water and syrup have respectively been discharged from said cylinders.

5. In a beverage dispenser, a structure including, a carbonated water measuring cylinder, a syrup measuring cylinder in axial alignment therewith, pistons in said cylinders interconnected within said structure to move in unison, a port in said first cylinder for connection to a source of carbonated water, whereby said cylinder may be filled by the carbonated water displacing its piston, a port in said second cylinder to be connected to a source of syrup, whereby the latter may fill said second cylinder under the urge of suction created therein by the movement of its piston, a piston rod connected to one of said pistons and extending outside of said structure, motor-driven means operatively connected to said piston rod for forcing said pistons in one direction only to discharge the contents of said cylinders, and switching means controlling said motor-driven means and actuated to cause said motor-driven means to cease operating when said pistons have reached a predetermined position during their movement in said direction.

6. In a beverage dispenser, in combination, a carbonator, a tank of CO₂ gas connected thereto, a pumping system connected to a source of water and adapted to deliver water to said carbonator at a higher pressure than the pressure of the CO₂ gas therein, measuring means including a cylinder directly connected to said carbonator and also including a second cylinder connected to a source of syrup, piston means in each cylinder, said two piston means being interconnected, whereby the piston means in said first cylinder is displaced as such cylinder fills with carbonated water, the second cylinder meanwhile filling with syrup, means for subjecting the piston means in the first cylinder to the influence of water at said higher pressure to simultaneously eject the carbonated water content and the syrup content, respectively, from said cylinders, the piston means in said first cylinder having a piston rod connected thereto which extends beyond the head of such first cylinder, engaging means secured to said piston rod and movable therewith, magnetic valve means connected to said pumping system, to said first cylinder, and to a bypass leading to the inlet of said pumping system, a normally closed limit switch positioned

in the path of said engaging means, a circuit including the winding of said magnetic valve means, said limit switch and a source of current, and means to energize said circuit to cause said valve means to shift from communication with said bypass to communication with said first cylinder, whereby both of said piston means are caused to eject the contents of said cylinder until said engaging means opens said switch, thereby causing the water at higher pressure to pass from said first cylinder to the inlet of said pumping system.

7. In a beverage dispenser, in combination, a carbonator, a tank of CO₂ gas connected thereto, pumping system connected to a source of water and adapted to deliver water to said carbonator at a higher pressure than the pressure of the CO₂ gas therein, a plurality of measuring means, each for a different flavored beverage and each including a cylinder directly connected to said carbonator and a second cylinder connected to a source of syrup, piston means in each cylinder of each measuring means, the two piston means of each measuring means being interconnected whereby the piston means in the first cylinder of each measuring means is displaced as the cylinder fills with carbonated water, the second cylinder of such measuring means meanwhile filling with syrup, a piston rod carried by the piston means in the first cylinder of each measuring means, an engaging means carried by each such piston rod, a normally closed limit switch for each such piston rod in the path of its engaging means, magnetic valve means connected to said pumping system, to the first cylinder of each measuring means, and to a bypass leading to the inlet of said pumping system, all said limit switches being connected in series with one another, with the winding of said magnetic valve means and with a source of current, a selector valve which the operator may set for a beverage of a selected flavor from one of said measuring means, whereby each time said magnetic valve means is energized to effect delivery of a beverage of a selected flavor, water at said higher pressure actuates the piston means of the measuring means containing the selected flavor, and upon delivery of the same, the engaging means of the piston rod of such measuring means opens the limit switch in its path, thereby causing said higher pressure water to pass from said first cylinder of the selected measuring means to the inlet of said pumping system.

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