United States Patent

[11] 3,591,051

[72] Inventors Orville Mitchell;
John D. Harris; Dudley C. Smith, all of Dallas, Tex.
[21] Appl. No. 807,494
[22] Filed Mar. 17, 1969
[45] Patented July 6, 1971
[73] Assignee John E. Mitchell Company
Dallas, Tex.

[54] **CONTROL TO PROPORTION INGREDIENTS SUPPLIED TO DRINK DISPENSERS**
9 Claims, 4 Drawing Figs.

[52] U.S. Cl. 222/56, 222/145, 222/249, 200/83
[51] Int. Cl. B67d 5/30
[50] Field of Search 222/56, 361, 453, 145, 249; 200/83

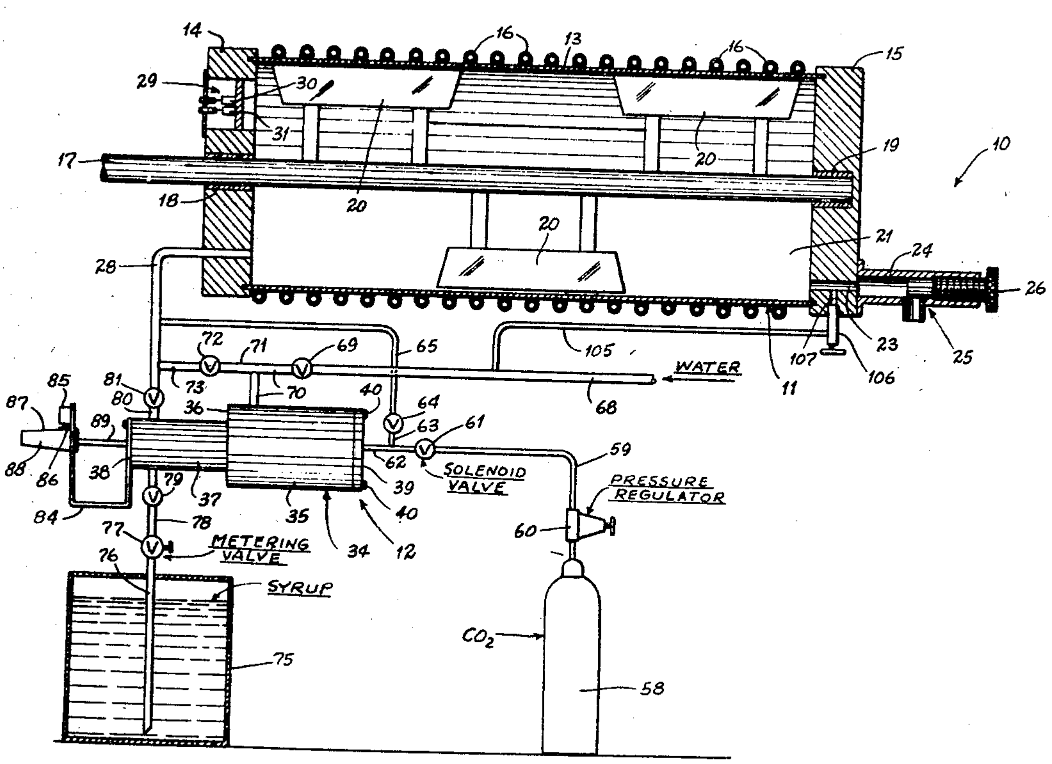
[56] **References Cited**

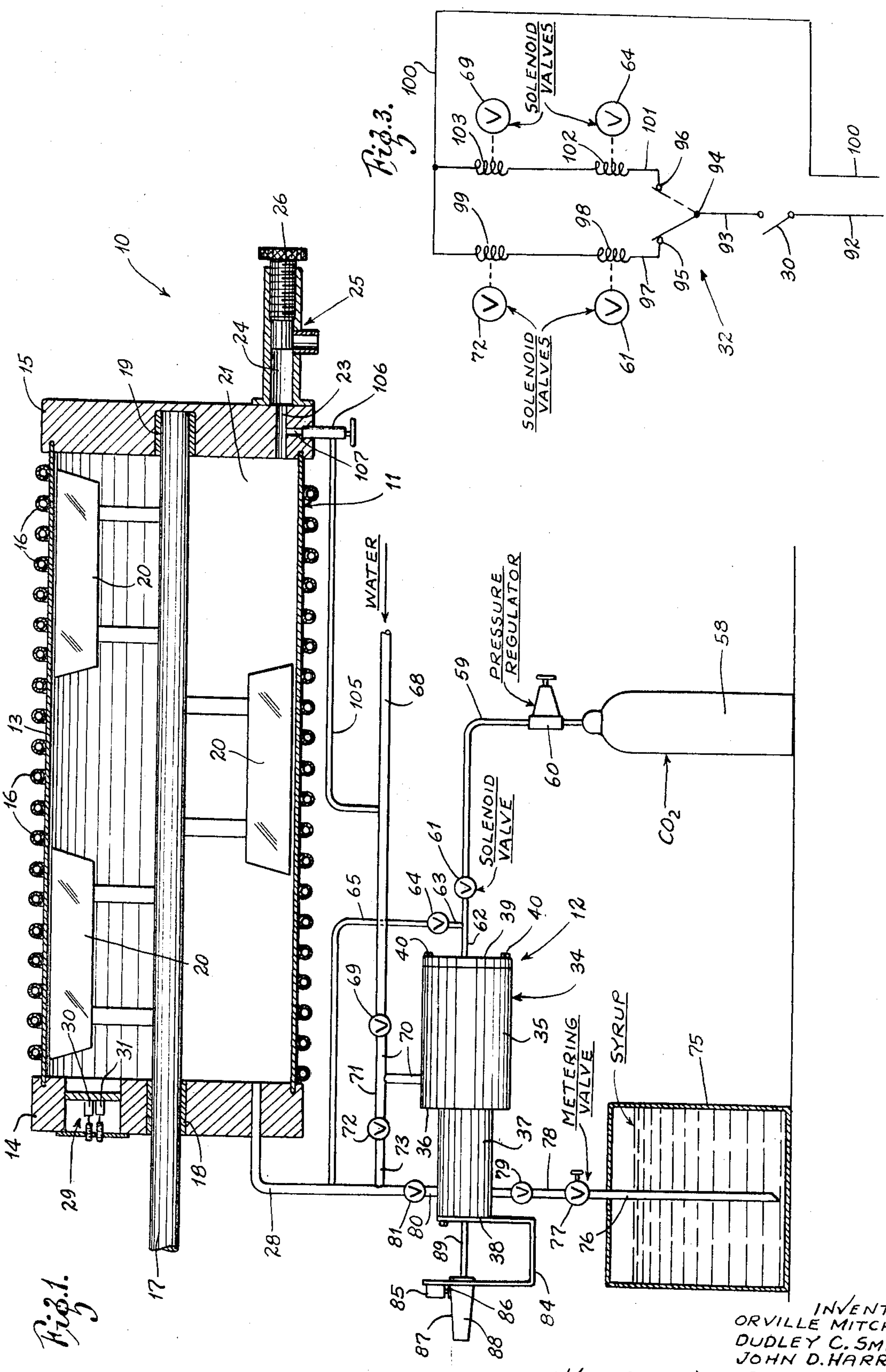
UNITED STATES PATENTS

2,261,338	11/1941	Carlson	222/145 X
2,542,855	2/1951	Willison	222/145 X
3,138,290	6/1964	Coulter	222/145 X
3,138,294	6/1964	Coulter et al.	222/145 X
3,355,561	11/1967	Eby et al.	200/83
3,394,847	7/1968	Garrard	222/56
3,398,991	8/1968	Compton	200/83 X

Primary Examiner—Samuel F. Coleman
Assistant Examiner—Norman L. Stack, Jr.
Attorney—Kingsland, Rogers, Ezell, Eilers and Robbins

ABSTRACT: A control for proportioning ingredients supplied to a drink dispenser. A housing having separate water, syrup and carbon dioxide chambers. A slide reciprocative within the housing and having walls defining a wall of each chamber. Reciprocations of the slide alternately expand and contract the volumes of the chambers while maintaining desired relative proportions of the water, syrup and carbon dioxide. Valves operate in response to reciprocation of the slide to control the introduction of ingredients to and the discharge from their respective chambers, the slide being reciprocative in response to alternate introduction of ingredients to respective chambers.





INVENTORS:
ORVILLE MITCHELL
DUDLEY C. SMITH
JOHN D. HARRIS
BY Kingsland, Rogers, Ezell, Eilers & Robbins
ATTORNEYS

Fig.2.

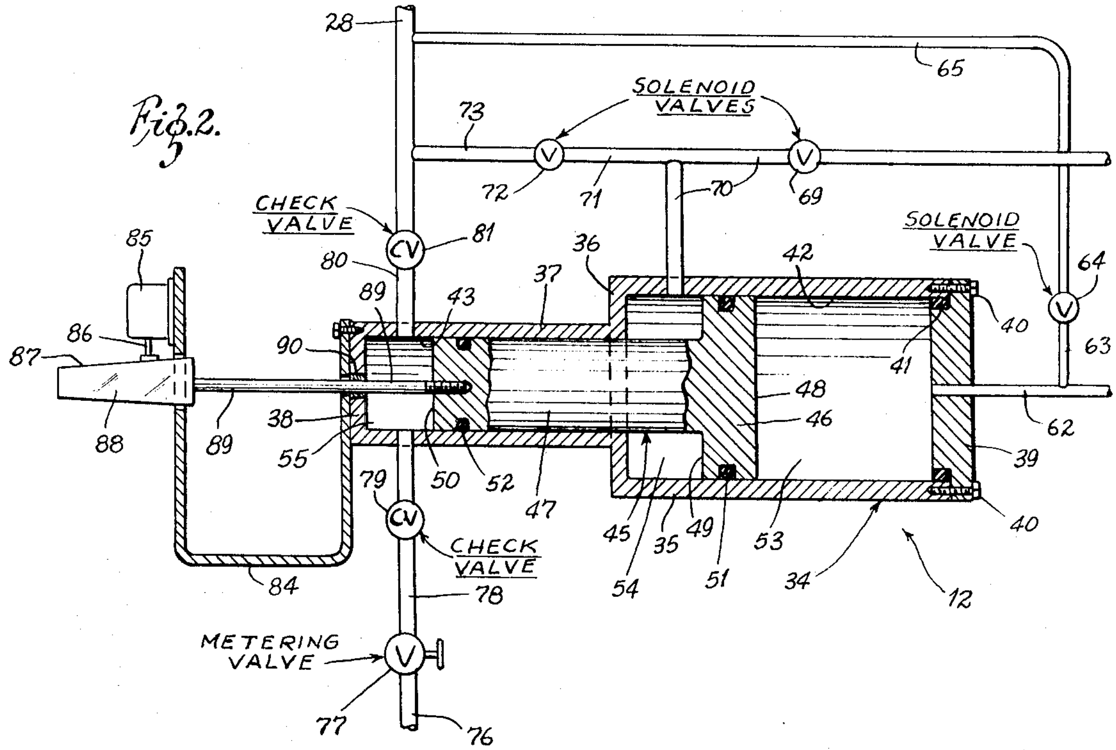
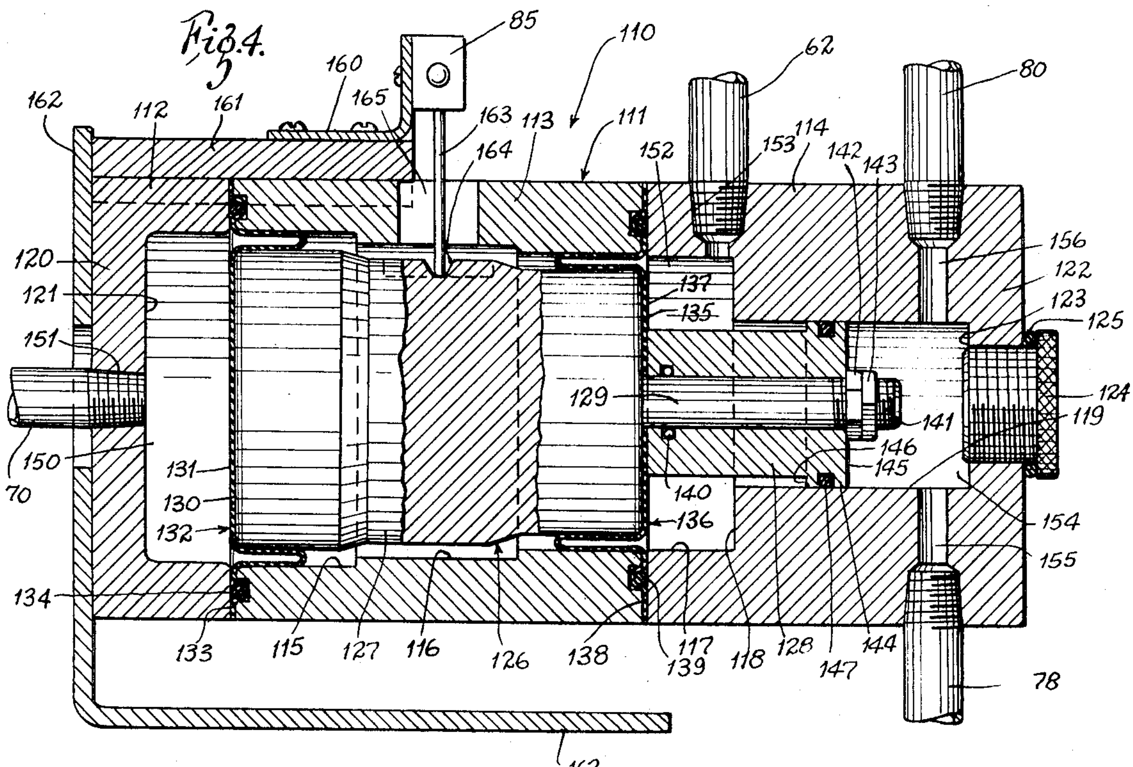


Fig.4.



INVENTORS:
ORVILLE MITCHELL
DUDLEY C. SMITH
JOHN D. HARRIS

BY Kingsland, Rogers, Ezell, Eilers & Robbins
ATTORNEYS

CONTROL TO PROPORTION INGREDIENTS SUPPLIED TO DRINK DISPENSERS

BRIEF DESCRIPTION OF THE INVENTION

Although this invention may be used to proportion the delivery of ingredients to any drink dispenser, it is especially suitable for use with a machine for dispensing semifrozen carbonated drinks or confections of the kind set forth in Mitchell, et al. application Ser. No. 770,640, filed Oct. 25, 1968. In this control system, a slide is reciprocative in a slide housing. The slide has various piston faces that provide moving walls, one piston face defining a side of a carbon dioxide chamber, another piston face defining a side of a water chamber, and a third piston face defining a side of the syrup chamber. As the slide reciprocates, these piston faces are moved, thereby varying the volumes of the respective ingredient chambers. Tubes are provided for delivering carbon dioxide at a regulated pressure to the carbon dioxide chamber, for delivering water to the water chamber, and for delivering syrup to the syrup chamber. Tubes are also provided for discharging carbon dioxide from the carbon dioxide chamber to a drink dispenser for delivering water from the water chamber to the drink dispenser, and for delivering syrup from the syrup chamber to the drink dispenser. There are solenoid valves appropriately placed in the carbon dioxide carrying pipes and the water carrying pipes, and there are check valves in the syrup carrying pipes. Operation of these solenoid valves is controlled by movements of the slide back and forth within its housing. Upon actuation of the solenoid valves in predetermined order responsive to reciprocations of the slide, carbon dioxide and water are alternately admitted to their chambers. The supply pressures of the carbon dioxide and water are greater than the pressure within the dispenser so that the admission of carbon dioxide forces the slide to move in one direction whereas the admission of water forces the slide to move in the opposite direction. As the slide reciprocates, it alternately sucks syrup into the syrup chamber and drives syrup from the syrup chamber to the dispenser.

In one embodiment of the illustrated control, the slide is a two-step piston that establishes the carbon dioxide chamber at an expanded volume substantially equal to the combined expanded volumes of the water and syrup chambers. In this embodiment, the carbon dioxide is admitted to the carbon dioxide chamber at approximately 2 atmospheres of pressure so that, at atmospheric pressure, the volume of the compressible carbon dioxide will be twice the combined volumes of the relatively incompressible water and syrup. The ratio of syrup to water is controlled primarily by the relative volumes of the syrup and water chambers, and is finely adjustable by a suitable regulator.

There is a tube connected from the water source (or it may be connected from the tube that delivers the combined drink or confection ingredients to the dispenser) leading to a manually operable valve. The manually operable valve is located adjacent the end of the dispenser that delivers drink or confection ingredients to an outlet faucet. Since the dispenser is of the kind that makes semifrozen carbonated beverages, there are sometimes small ice particles or ice jams developed near the outlet faucet. The manually operable valve is useful to squirt warm water or warm ingredients into the area where these ice jams occur to melt the frozen particles.

In a second illustrated embodiment, the slide is a three-step slide and rolling diaphragms are used instead of O-rings to maintain fluidtight seals between the water and carbon dioxide chambers. An O-ring seal is used between the carbon dioxide and syrup chambers, but since this O-ring seal is on a smaller piston, minimum friction is produced as the slide reciprocates. In addition, in this embodiment, the size of the carbon dioxide chamber is reduced relative to the sizes of the water and syrup chambers to accommodate higher carbon dioxide pressures and still maintain the desired ratio of carbon dioxide to liquid at approximately two to one.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of the control system with the freeze chamber and syrup tank shown in section.

FIG. 2 is an enlarged sectional view of the control portion of the system.

FIG. 3 is a schematic diagram of an electric circuit for the control.

FIG. 4 is an enlarged sectional view of a modification of the control portion of the system.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1, the drink dispenser system **10** has a freeze chamber **11** to which the control system **12** is connected. The freeze chamber **11** comprises a cylindrical barrel **13** having endwalls **14** and **15**. A cooling coil **16** surrounds the barrel **13** and is connected to a suitable refrigeration system (not shown) which circulates cooling fluid through the coil **16** to refrigerate contents within the barrel **13**. An agitator shaft **17** is driven by a suitable motor (not shown) to rotate within suitable bearings **18** and **19** in the end walls **14** and **15**. A plurality of agitator and scraper blades **20** are connected to the shaft **17** to be revolved in close proximity to the inner wall of the barrel **13** to agitate the contents and scrape any frozen particles from the wall of the barrel **13**.

An outlet passage **23** extends through the lower side of the end wall **15**. The passage **23** leads to a chamber **24** within a dispenser faucet **25** of any conventional design that may be actuated, such as by a knob **26**, to permit product to pass from the chamber within the barrel **13** through the passage **23** to be dispensed from the faucet **25**.

An ingredient supply tube **28** extends through the other end wall **14** into communication with the chamber **21**. The ingredient supply tube **28** supplies confection or drink ingredients to the chamber **21** according to the demand within the demand within the chamber **21** for additional ingredients.

Control of the supply of confection or drink ingredients to the chamber **21** (and control of operation of the refrigeration system to circulate cooling fluid through the coils **16**) may be by any conventional means. It has been determined that such controls which are operable in response to variations in pressure within the chamber **21** are suitable, and controls such as are set forth in Mitchell, et al., application Ser. No. 770,640, filed Oct. 25, 1968, may be used. As is described in that application, a dual action pressure switch **29** is mounted in the end wall **14**. Switches **30** and **31** (corresponding to the switches **45** and **46** respectively of the aforesaid Mitchell, et al. application) are actuated in response to variations in pressure within the chamber **21** to respectively control the supply of ingredients through the tube **28** to the chamber **21**, and to control the circulation of cooling fluid through the coil **16**. The dual action pressure switch is fully described in the aforesaid Mitchell, et al. application, and for the purpose of the present invention, it need only be mentioned that the switch **30** closes to close a circuit **32** (shown in FIG. 3 and to be described hereinafter) when the pressure within the chamber **21** drops to a predetermined level indicating additional ingredients should be supplied to the chamber, and the switch **30** opens when the pressure within the chamber **21** rises to a predetermined level indicating that the chamber **21** is filled to capacity.

As shown in FIG. 2, the control system **12** has a proportioning device that comprises a slide housing **34** having a large diameter cylinder **35** joined by a radial wall **36** to a smaller diameter cylinder **37**. An end wall **38** closes the end of the smaller diameter cylinder **37**. An end wall **38** closes the end of the smaller diameter cylinder **37**. An end wall **39** is connected by suitable bolts **40** to the opposite end of the large diameter cylinder **35**, with an O-ring **41** providing a liquid seal. The large diameter cylinder **35** has a cylindrical inner wall **42** having an internal diameter of approximately 1⅛ inch. The smaller cylinder **37** has an inner cylindrical wall **43** having an internal diameter of approximately one-half inch.

A slide 45 is positioned within the slide housing 34. The slide 45 has larger diameter piston head 46 and a smaller diameter piston stem 47. The larger diameter piston head 46 has a flat face 48 facing the end wall 39 and an annular flat face 49 facing the radial wall 36. The surface area of the piston face 48 is substantially equal to the cross-sectional area defined by the inner cylindrical wall 42. The area of the piston face 49 is equal to the area of the piston face 48 minus the cross-sectional area of the piston stem 47.

The end of the piston stem 47 has a stem face 50. The surface area of the stem face 50 is substantially equal to the cross-sectional area defined by the inner cylindrical wall 43 of the smaller diameter cylinder 37.

The slide 45 is reciprocative within the slide housing 34, with the piston head 46 being slidable within the larger diameter cylinder 35 and the piston stem 47 being slidable within the smaller diameter cylinder 37. An O-ring 51 provides a substantially fluidtight seal between the piston head 46 and the inner cylindrical wall 42. An O-ring 52 provides a substantially fluidtight seal between the piston stem 47 and the inner wall 43 of the smaller diameter cylinder 37. As the slide 45 reciprocates within the slide housing 34, it varies the volume of a carbon dioxide chamber 53 that is defined by the inner cylindrical wall 42, the end wall 39 and the moving piston face 48, and it varies the volume of a water chamber 54 that is defined by the inner cylindrical wall 42, the radial wall 36, the portion of the stem 47 that projects beyond the radial wall 36, and the moving piston face 50. A syrup chamber 55 of variable volume is defined by the inner cylindrical wall 43, the end wall 38 and the moving stem face 50.

Carbon dioxide is supplied from a carbon dioxide tank 58 through a pipe 59 that has a suitable pressure pressure regulator 60 connected in it. There is also a solenoid valve 61 connected in the pipe 59 to block and unblock the flow of carbon dioxide through the pipe 59. This solenoid valve 61 is normally closed. Another pipe 62 extends downstream of the solenoid valve 61 through the end wall 39 to communicate with the carbon dioxide chamber 53.

A branch pipe 63 communicates with the pipe 62 and leads to a normally closed solenoid valve 64. A pipe 65 leads from the solenoid valve 64 to the ingredient supply tube 28.

Water is supplied from a water source (not shown) through a pipe 68 that leads to a normally closed solenoid valve 69. Another pipe 70 is connected from the solenoid valve 69 through the wall of the larger diameter cylinder 35 to communicate with the water chamber 54. A pipe 71 branches from the pipe 70 and leads to a normally closed solenoid valve 72. A pipe 73 leads from the solenoid valve 72 to communicate with the ingredient supply tube 28.

Syrup is supplied from a syrup tank 75 through a dip tube 76. The dip tube 76 may lead to a manually controllable metering valve 77 for fine adjustments of the rate of flow of syrup, as will be described, or preferably another kind of syrup volume control as described in connection with FIG. 4, or any other control may be used instead of the metering valve 77. A pipe 78 leads from the metering valve 77 (if there be one) through the wall of the smaller diameter cylinder 37 into communication with the syrup chamber 55. There is a check valve 79 in the pipe 78 to permit the flow of syrup from the syrup tank 75 to the syrup chamber 55, but block reverse flow of syrup. Another pipe 80 communicates with the syrup chamber 55 and extends through the sidewall of the smaller diameter cylinder 37 to communicate with the ingredient supply tube 28. There is a check valve 81 in the pipe 80 which permits syrup to flow from the syrup chamber 55 to the ingredient supply tube 28, but block reverse flow of syrup.

A bracket 84 is connected to the end wall 38 of the slide housing 34. The bracket 84 supports a three-pole double-throw switch 85 having a plunger-type switch actuator 86. The switch actuator 86 is in constant contact with an inclined surface 87 of an actuator plate 88. The actuator plate 88 is connected to a rod 89 that extends through a liquid seal bearing 90 in the end wall 38 and is threaded into the end of the slide stem 47. When the inclined wall 87 has slid to or beyond the position illustrated in FIGS. 1 and 2 as a result of sliding of the slide 45 to the left, the switch actuator 86 is depressed to switch the switch 85 to one condition. When the slide 47 slides to a predetermined position to the right of the one illustrated, the inclined surface 87 moves to the right and permits the spring biased actuator 86 to fall to a position at which it switches the switch 85 to a second switch condition.

FIG. 3 illustrates a circuit 32 that has the switches 30 and 85 connected to operate the solenoid valves 61, 64, 69 and 72. The switch 30 is connected in one conductor 92 that is connected to one side of a power supply. Closing of the switch 30 establishes contact between the conductor 92 and another conductor 93. The conductor 93 is connected to one pole 94 of the three-pole switch 85. The switch 85 is movable alternately between second and third poles 95 and 96. A conductor 97 leads from the pole 95 through a pair of solenoid coils 98 and 99 and thence via a conductor 100 to the other side of the power supply. The solenoid 98, when energized, opens the solenoid-controlled valve 61 and the solenoid 99, when energized, opens the solenoid-controlled valve 72. A conductor 101 is connected from the third switch terminal 96 through a pair of solenoid coils 102 and 103 and thence to contact with the conductor 100. When the solenoid 102 is energized, it opens the solenoid-controlled valve 64 and when the solenoid 103 is energized, it opens the solenoid-controlled valve 69.

A tube 105 branches from the water supply pipe 68 upstream of the valve 69. The tube 105 leads to a small pushbutton valve 106 that has an outlet 107 leading to the outlet passage 23 through the end wall 15 of the freeze barrel 11. Whenever this pushbutton valve 106 is actuated, a squirt of relatively warm water, probably about 70° F. in the summertime and 50° F. in the wintertime, is squirted into the confection or drink product adjacent the outlet faucet 25. This pushbutton valve 106 thus enables hot product to be introduced for melting any ice jams that sometimes occur at the faucet. These ice jams occur because the temperature adjacent the faucet is usually the coldest as distinguished from the temperature adjacent the end wall 14 near the place where relatively warmer fresh ingredients are being supplied from the ingredient supply tube 28. Sometimes the ice particles build up to an ice jam adjacent the faucet 25 and prevent the dispensing of confection or drink product.

In addition to breaking up the ice jam, the warmer fluid injected by the pushbutton valve 106 slightly elevates the pressure sure within the freeze barrel 11. Since the refrigeration system operates in response to a switch 31 that in turn responds to pressure within the freeze barrel 11, as described in the aforesaid Mitchell et al. application, Ser. 770,640, this slight increase in pressure within the freeze barrel 11 is usually enough to open the switch 31 and discontinue the circulation of cooling fluid through the coil 16. As a result, refrigeration of the ingredients within the chamber 21 is interrupted at a time that helps the operator break up the ice jam. This system for breaking up the ice jam is more effective then, and avoids the interruption that otherwise results from, the standard method of cycling the refrigeration system to a defrost cycle.

OPERATION

The switch 30 is open so long as the pressure within the chamber 21 is at a high level indicating the chamber 21 is filled to capacity with confection or drink ingredients. Upon the dispensing of one or more drinks, the pressure within the chamber 21 drops to a predetermined lower value, closing the pressure-responsive switch 30. When the switch 30 closes, it closes the circuit to the switch terminal 94, enabling the switch arm 85 alternately to energize the solenoid coils 98 and 99 and the solenoid coils 102 and 103.

The switch 85 is controlled by the position of the sliding plate 88. The position of the sliding plate 88 is controlled by the position of the slide 45. In the position illustrated in FIG.

1, the slide 45 has slid to or near its maximum left-hand position and has moved the plate 88 to or near its extreme left-hand position. In the maximum left position, the inclined surface 87 raises the actuator 86 sufficiently to actuate the switch 85 to the solid line position illustrated in FIG. 2. This closes the circuit to the solenoid coils 98 and 99 leaving the circuit to the solenoid coils 102 and 103 open. When the coils 98 and 99 are thus energized, they open the valve 61 and 72. With the solenoid coils 102 and 103 deenergized, the valves 64 and 69 remain closed.

Since the valve 61 is open, carbon dioxide flows under the regulated pressure set by the regulator 60 (approximately 50 p.s.i.) through the pipe 59, the solenoid valve 61 and the pipe 62 to the carbon dioxide chamber 53. Since the solenoid valve 64 is closed, all the carbon dioxide flowing through the solenoid valve 61 must enter the chamber 53. The pressure of carbon dioxide against the piston face 48 drives the slide 45 to the left as viewed in FIG. 1, with the piston face 49 and the stem face 50 expelling water and syrup respectively from the water chamber 54 and the syrup chamber 55. Since the solenoid valve 69 is closed, the water which flows from the water chamber 54 is driven through the pipe 71, the solenoid valve 72 (which is open), and the pipe 73 to the ingredient supply pipe 28. Since the check valve 79 prevents syrup from flowing from the syrup chamber 55 into the pipe 78, the syrup is driven past the check valve 81 and through the pipe 80, to the ingredient supply tube 28.

As carbon dioxide continues to flow into the carbon dioxide chamber 53, it continues to drive water and syrup to the ingredient supply tube 28 until the entering volume of carbon dioxide pushes the slide 45 to or past the position illustrated in FIG. 1. As the slide moves to the extreme left-hand position, the plate 88 is moved to its extreme left-hand position, with the inclined surface 87 pushing the switch actuator 86 upwardly to throw the switch member 85 from the solid line position to the dotted line position illustrated in FIG. 2. This energizes the coils 102 and 103 to open the solenoid-controlled valves 64 and 69 and deenergizes the coils 96 and 97 to close the valves 61 and 72. With the valve 61 closed, carbon dioxide can no longer flow from the carbon dioxide tank 58 to the carbon dioxide chamber 53, but with the solenoid valve 64 now open, carbon dioxide can flow from the carbon dioxide chamber 53 through the pipe 65 to the ingredient supply tube 28. Likewise, with the valve 72 closed, water cannot flow through the pipe 73 to the ingredient supply tube 28. With the valve 69 now open, water at city water supply pressure, usually between 30 and 80 p.s.i., flows through the pipe 68, the valve 69 and the pipe 70 to the water chamber 54. This water being forced into the water chamber 54 acts against the piston face 49 to drive the slide 45 to the right from the position illustrated in FIG. 1. As the slide 45 is driven to the right, the piston face 48 moves to the right to reduce the size of the carbon dioxide chamber 53 and force carbon dioxide from the chamber 53 through the pipe 62, the valve 64 and the pipe 65 to the ingredient supply tube 28. At the same time, the stem face 50 in moving to the right produces a pressure reduction within the syrup chamber 55 that sucks syrup through the dip tube 76, the metering valve 77 (if there be one), the pipe 78 and the check valve 79 into the syrup chamber 55. This suction pressure within the chamber 55 cannot draw any product from the ingredient supply tube 28 or the pipe 80 because of the one-way check valve 81. Thus, in this stroke of the slide 45, water and syrup are being replenished to the water and syrup chambers 54 and 55, and carbon dioxide is being expelled from the carbon dioxide chamber 53 to the ingredient supply tube 28.

The ingredients that are forced into the ingredient supply tube 28 flow into the freeze barrel chamber 21. The pressure within the chamber 21, approximately 20 p.s.i., is below the regulated carbon dioxide supply pressure and is below the water supply pressure.

It is desirable that the ratio of carbon dioxide to liquid be approximately 2 to 1 at atmospheric pressure. This ratio is achieved by supplying the carbon dioxide at a pressure that is approximately twice atmospheric pressure. Since the carbon dioxide is a gas and is therefore compressible, carbon dioxide at 2 atmospheres of pressure is compressed within the carbon dioxide chamber 53 so that when it is released to atmospheric pressure it would occupy twice the volume of the carbon dioxide chamber 53. Since the water and syrup are liquids, they are substantially incompressible when they are admitted to the water and syrup chambers 54 and 55. Since the volume of the water chamber displaced by movement of the piston head 46 is a function of the difference between the cross-sectional area of the larger diameter cylinder 35 and the smaller diameter cylinder 37, and since the volume of the syrup chamber 55 displaced by the piston stem 47 is a function of the diameter of the smaller diameter cylinder 37, the combined volumes of the water chamber 54 and the syrup chamber 55 as displaced by the slide 47 are equal to the volume of the carbon dioxide chamber 53 as displaced by the piston head 46. Hence, as the slide 47 reciprocates through one cycle, it first delivers a volume of carbon dioxide at 2 atmospheres of pressure from the chamber 53 to the ingredient supply tube 28 that is equal to the combined volumes that it next displaces from the water and syrup chambers 54 and 55 to the ingredient supply tube 28. Since the carbon dioxide was compressed at 2 atmospheres of pressure within the chamber 53, approximately twice the volume of carbon dioxide to liquid is supplied through the ingredient supply tube 28 to the freeze barrel chamber 21. This volume ratio may be varied by varying the pressure of the carbon dioxide supplied to the carbon dioxide chamber 53. This pressure variation is accomplished by adjusting the regulator 60.

The ratio of syrup to water is also adjustable. The metering valve 77 adjusts the rate of flow of syrup to the syrup chamber 55. If this metering valve 77 is turned down, there may be a partial vacuum within the chamber 55 as the slide 45 moves to the right. This partial vacuum may result in some leakage of water from the water chamber 54 past the O-ring 52 to the syrup chamber 55 but, taking such leakage into account, the metering valve 77 may be adjusted for any desired ratio of syrup to water ultimately supplied to the ingredient supply tube 28. As already stated, the control illustrated in FIG. 4 about to be described is preferable to the metering valve 77 to avoid the aforesaid leakage of water.

DESCRIPTION OF THE MODIFICATION OF FIG. 4

FIG. 4 illustrates a modified control system 110 that may be used in place of the control system 12. The control system 110 has a slide housing 111 comprised of three sections 112, 113 and 114 held together by suitable bolts (not shown). The slide housing 111 has a large diameter internal cylinder 115 leading through a step down cylinder 116 to an intermediate diameter cylinder 117. The intermediate diameter cylinder 117 is joined by a radial wall 118 to a small diameter cylinder 119. The slide housing section 112 has an end wall 120 having an inner surface 121. The slide housing section 114 has an end wall 122 having an internal surface 123. An access plug 124, provided with an O-ring seal 125, is threaded into a central opening in the end wall 122.

A slide 126 is slidable within the slide housing 111. The slide 126 comprises a large piston 127 with a smaller piston 128 being slidably mounted on a stud 129 that projects from the large piston, as will be described in more detail hereinafter.

The large piston 127 has a face 130 against which the central portion 131 of a rolling diaphragm 132 is adhered. The outer periphery 133 of the rolling diaphragm 132 is wrapped about an O-ring seal 134 that is positioned between the abutting ends of the slide housing sections 112 and 113. The piston 127 has another face 135 that is annular because of the projecting central stud 129. Another rolling diaphragm 136 has a central portion 137 adhered to the piston face 135 and clamped between the pistons 127 and 128. The outer periphery 138 of the rolling diaphragm 136 is wrapped about an O8ring 139 that is clamped between the abutting ends of the slide housing sections 113 and 114.

As mentioned, the small piston 128 is slidably mounted on the stud 129. An O-ring 140 in the stud 129 provides a liquid seal between the stud 129 and the slidable piston 128. The end of the stud 129 has threads 141, and a nut 142 and locknut 143 are adjustable on the threads 141 of the stud 129.

The piston 128 has a head 144 on its end with a face 145 directed toward the end wall surface 123, and an annular face 146 directed toward the piston face 137. An O-ring 147 provides a fluidtight seal between the piston head 144 and the inner cylindrical surface 119.

A water chamber 150 of variable volume is defined by the inner cylindrical wall 115, the end wall surface 121, the face 130 of the piston 127 (as covered by the central portion 131 of the diaphragm 132, and the rolling portion of the diaphragm surrounding the piston 127). A port 151 opening through the end wall 120 communicates with the water chamber 150.

A carbon dioxide chamber 152 is defined by the cylindrical wall 117, the radial wall 118, the side of the piston 128, the annular face 146 of the piston head 144, the face 135 of the piston 127 (as covered by the central portion 137 of the rolling diaphragm 136, and the rolled portion of the diaphragm 136 surrounding the piston 127). A port 153 extending through the wall of the housing section 114 communicates with the carbon dioxide chamber 152.

A syrup chamber 154 is defined by the inner cylindrical wall 119, the face 123 of the end wall 122 (including the inner face of the plug 124), and the face 145 of the piston 128. An inlet port 155 extends through the wall of the housing section 114 and communicates with the syrup chamber 154. An outlet port 156 also extends through the wall of the housing section 114 and also communicates with the syrup chamber 154.

The pipe 62, which is shown in FIG. 1, is connected to the port 153 in communication with the carbon dioxide chamber 152.

The pipe 78 is connected to the syrup inlet port 155 that communicates with the syrup chamber 154 (no metering valve 77 is used), and the pipe 80 is connected with the syrup outlet port 156. The pipe 70 is connected to the port 151 that communicates with the water chamber 150. All these pipes 62, 70, 78 and 80 are connected to the ingredient sources and have the branch pipes and valves that are illustrated in FIG. 1. Also, the control circuit for the valves is as illustrated in FIG. 3. The only difference is that the switch 85 is reversed in its operation.

In FIG. 4, this switch 85 is mounted on a bracket 160 that is connected by suitable means to frame members 161 and 162 mounted on the slide housing 111. The switch 85 has a depending actuator arm 163 the lower end of which rides in a slot 164 in the piston 127. The actuator arm 163 extends through a slot 165 in the housing section 113 so that it is free to pivot as the slide 126 reciprocates. When the slide 126 reciprocates to an extreme left-hand position, the switch 85 is switched to the dotted line position illustrated in FIG. 3 to energize the coils 102 and 103 and open the valves 64 and 69. Since the coils 98 and 99 are deenergized, the valves 61 and 72 remain closed. This condition of the valves admits water to the water chamber 150 and blocks the admission of carbon dioxide to the carbon dioxide chamber 152. The water at between 30 and 80 p.s.i. enters the chamber 150 and drives the slide 126 to the right, expelling carbon dioxide from the carbon dioxide chamber 152 and syrup from the syrup chamber 154 as has been described in connection with the control assembly 12. When the slide 126 moves to an extreme right-hand condition, the actuator arm 163 swings to the right and actuates the switch 85 to the solid line position illustrated in FIG. 2. This closes the circuit to energize the coils 98 and 99 and opens the circuit to deenergize the coils 102 and 103. Consequently, the valves 61 and 72 are opened and the valves 64 and 69 are closed. Now, carbon dioxide is supplied to the carbon dioxide chamber 152 whereas the supply of water to the water chamber 150 is blocked. As carbon dioxide is admitted to the carbon dioxide chamber 152, it drives the slide 126 to the left, expelling water from the water chamber 150 and sucking syrup into the syrup chamber 154. The switch has a conventional detent (not shown) to hold the arm 163 in either the solid or dotted position until moved by the external force of contact with an edge of the slot 164 in the piston 127. Therefore, the switch 85 is actuated only upon reciprocation of the piston 127 to its extreme left and right positions.

The advantages of the control system 110 are that it reduces the size of the carbon dioxide chamber 152 relative to the combined volumes of the water chamber 150 and syrup chamber 154 to accommodate higher carbon dioxide pressures above 2 atmospheres, such as pressures in the range of 50 p.s.i.g. Also, the rolling diaphragms 132 and 138 provide absolute seals against fluid leakage and at the same time eliminate friction that is caused by O-rings seals. Since there is an absolute fluid seal produced by the rolling diaphragms 132 and 138, it is possible to mount the switch 85 as illustrated in FIG. 4 for direct actuation by the contact between the actuator arm 163 and the V-groove 164.

The sliding piston 128 of FIG. 4 replaces the metering valve 77 of FIGS. 1 and 2. In FIG. 4, the plug 124 is manually removable to provide access to the nut 142 and locknut 143. These nuts 142 and 143 can be adjusted to adjust the distance the small piston 129 can slide on the stud 129, thereby adjusting the net stroke of the small piston 128. The result is an adjustment of the pumping capacity of the small piston 129 to adjust the ratio of syrup to water.

Various changes and modifications may be made within this invention as will be readily apparent to those skilled in the art. Such changes and modifications are within the scope and teaching of this invention as defined by the claims appended hereto.

What we claim is:

1. A control for supplying ingredients to a drink dispenser the control comprising a slide housing, a slide reciprocative within the slide housing, the slide having first, second and third faces, the first face cooperating with walls of the slide housing to define a carbon dioxide chamber, the second face cooperating with walls of the slide housing to define a water chamber, the third face cooperating with walls of the slide housing to define a syrup chamber, means to supply carbon dioxide to the carbon dioxide chamber for driving the slide in one direction of reciprocation, means to supply water to the water chamber to drive the slide in an opposite direction of reciprocation, means to deliver carbon dioxide from the carbon dioxide chamber to the drink dispenser, means to deliver water from the water chamber to the drink dispenser means to deliver syrup to the syrup chamber, means to deliver syrup from the syrup chamber to the drink dispenser, valve means operable in response to reciprocations of the slide for blocking the admission of water to the water chamber and unblocking the delivery of water from the water chamber to the dispenser when carbon dioxide is admitted to the carbon dioxide chamber and vice versa, and valve means for blocking the supply of carbon dioxide to the carbon dioxide chamber and unblocking the delivery of carbon dioxide from the carbon dioxide chamber to the dispenser when water is supplied to the water chamber and vice versa.

2. The control of claim 1 with check valves in the syrup-delivering means to prevent reverse flow of syrup.

3. The control of claim 1 including a diaphragm extending between the first face of the slide and the slide housing and a diaphragm extending between the second face of the slide and the slide housing.

4. The control of claim 1 wherein the maximum volume of the carbon dioxide chamber is substantially equal to the combined maximum volumes of the water and syrup chambers, and means to regulate the supply pressure of carbon dioxide to the carbon dioxide chamber to about twice the pressure within the dispenser.

5. The control of claim 1 including means to regulate the supply pressure of carbon dioxide supplied to the carbon dioxide chamber in predetermined relationship to the pressure in the dispenser and to the volume of the carbon dioxide relative to the volumes of the water and syrup chambers.

6. The control of claim 1 including means responsive to movements of the slide to reverse movement of the slide at each end of reciprocation thereof.

7. The control of claim 6 wherein the means to reverse movement of the slide includes a switch actuated by a lever arm, and means on the slide to move the lever arm.

8. The control of claim 1 wherein the slide comprises first and second pistons, the first and second faces being on the first piston and the third face being on the second piston, and means for mounting the second piston for sliding movement relative to the first piston.

9. The control of claim 8 including means to adjust the distance of sliding movement of the second piston relative to the first piston to adjust the volumetric rate of pumping syrup relative to the volumetric rate of pumping water.