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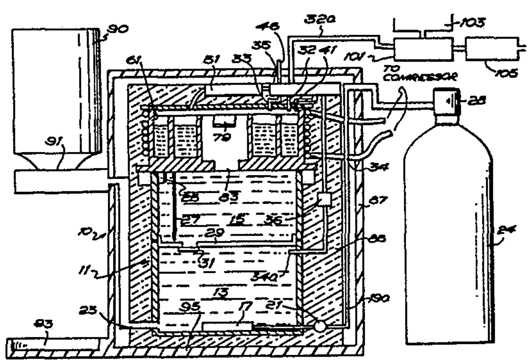
(54) Refrigerated drink dispenser.

(57) A refrigerated drink dispenser includes a continuous carbonator with a closed carbonating tank containing therein a carbon dioxid diffuser, an inlet for carbon dioxide to the diffuser and an outlet for carbonated water from the carbonating tank, a closed still water tank vertically disposed above the carbonator tank, the still water tank having an outlet coupled to supply water by gravity to the carbonator tank, a check valve between the still water tank and the carbonator tank to prevent backflow, a high and low level water sensor in the still water tank, a vent outlet from the still water tank a water supply inlet to the still water tank, with the valves for equalizing the pressure between the carbonator tank and still water tank, valves responsive to the high and low level sensors to: when the water level is between the upper and lower level to open the equalizing valves and to close the vent and to close the water inlet, when the low level is reached, to close the equalizing valve, to open the vent, and to open the water inlet to refill the still water chamber; and to sense when the high level is reached and to return to the condition where the equalizing valve is opened and the vent and the supply are closed; and a spiral ice bank interposed between the water inlet and the still water tank, the incoming water adapted to run over ice in the ice bank to be cooled as it is supplied to the still water tank.



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Refrigerated Drink Dispenser

This invention relates to drink dispensers in general and more particularly to a simple compact self-contained cold drink dispenser in which a concentrate such as a syrup is mixed with a diluent, such as carbonated water.

Most dispensers for dispensing carbonated drinks which are connected to the mains water supply and which continuously carbonate and also refrigerate are relatively complex and bulky. As a result, they are also expensive. There are requirements in smaller establishments such as small restaurants for drink dispensers which dispense soft drinks and mixers, for example, where the quantity of drinks dispensed is not large enough to justify buying the more expensive equipment available. In addition there is a need for beverage dispensers of this type for in-home use.

Realizing that there was such a need for drink dispensers for use in the home, I developed an in-home drink dispensing system which is disclosed in United States Patents 4,408,701; 4,328,909 and 4,363,424 and in my copending applications Serial Nos. 393,298; 393,299 and 310,488. My in-home system utilizes a unique method of dispensing and mixing in which the carbonated water and syrup do not come in contact with each other until they reach a cup or a glass. In fact, the syrup is dispensed directly from the syrup container or cartridge with the necessary metering of the syrup taking place within the container. The system is one which dispenses continuously. That is to say, the carbonated water and syrup are continuously metered so that a drink of any desired size may be provided. However, the carbonating system utilized in my in-home dispenser is not suitable for a commercial establishment, nor for continuous use in-home.

Typical dispensing systems now available are of the type in which the syrup and carbonated water are mixed in a mixing head. This means that there is diluted syrup which can lead to the growth of mold. As a result, constant cleaning is required.

Another problem with present systems is in the manner in which refrigeration is carried out. Generally, rather complex systems are required to insure that ice does not build up within a carbonator tank which could cause destruction of the tank if the build-up expands too greatly. Typically, the various types of sensors are used to sense ice build-up leading to a rather complex system.

In United States Patent No. 4,520,950, an in-home drink dispenser is disclosed which utilizes a carbonator tank which carries out batch carbonation. Each time the carbonator is emptied, it must be removed and refilled with still water which then must be carbonated. Carbonation takes a fixed amount of time and during that time the dispenser may not be used.

In some commercial soft drink dispensing machines and the like, it is the common practice to connect a carbonator to the water mains and to place in the carbonator high and low level sensors. Fresh, still water is filled into the carbonator until the high level is reached whereupon this is sensed and the water supply turned off. Carbon dioxide under pressure is then supplied to the carbonator to carbonate the water. Carbonated water is then dispensed until the low level is reached, whereupon refilling and recarbonation again takes place. Although such carbonators avoid the problem of manually filling the carbonator tank, there is still a problem in that, while filling, dispensing cannot take place and in the period immediately after refilling, full carbonation will not have been reached and dispensing of a drink at that time will result in a drink with carbonated water which is not fully carbonated. Venting is required to refill causing a waste of carbon dioxide gas. Other systems use pumps to overcome the gas pressure to refill the tank. This last type of system does give continuous service but at a high cost.

In view of these various problems in prior art apparatus, there is, thus, a need for a simple, compact refrigerated drink dispenser which can be inexpensively produced.

More specifically, there is a need for such system which avoids the problems of prior art dispensers of dilute syrup within the system, of complex carbonation systems and of complex refrigeration systems.

There is also a need for a carbonator which does not suffer from the deficiencies of the abovementioned carbonators but which can be connected to the water mains and provide a more or less continuous supply of carbonated water without a pump. In addition, there is a need to supply such carbonated water, at a low temperature both to improve carbonation and avoid the need for adding ice when drinks are dispensed.

The present invention provides such a refrigerated machine. To carry out dispensing in such a manner as to avoid having to dilute syrup within the machine, it preferably utilizes the dispensing system disclosed in my aforementioned patents and patent applications. This offers the further advantage of having interchangeable syrup cartridges. Although the machine can be made with as many dispense heads as are desired, in a practical sense, the number of dispense heads should be limited to two or three. However, the ease of interchangeability of syrup cartridges means that the user can have available a large variety of different types of syrups to make any type of drink desired.

In the drink dispenser of the present invention, a novel pneumatic drive is shared between two dispense heads.

The present invention also provides a carbonator which continuously supplies carbonated water. This is accomplished by providing a dual chamber carbonator with an intermittently pressurized still water chamber with level sensors which is filled and emptied periodically. When pressurized, the water from the still water chamber drains under gravity into a carbonating chamber where the water is carbonated. On dispensing, water is drawn out of the bottom of the carbonator chamber. As long as water remains in the still water tank above the low level sensor, each time a drink is made and carbonated water is drawn from the outlet, the carbonator chamber refills at the top with still water, which is then carbonated with fresh CO_2 entering through a diffuser in the carbonator. A volume of gas corresponding to the volume of liquid dispensed is supplied to the still water chamber to maintain a pressure balance. During refilling of the still water chamber, the carbonator chamber is isolated and remains under pressure allowing dispensing to continue uninterrupted.

Water passes from the still water chamber to the carbonated water chamber by means of a check valve. A valving arrangement external to the carbonator insures that proper pressure relationships exist between the two chambers to carry out the desired sequence of operation.

Above the still water chamber is a spiral ice bank over which incoming water must flow. The water is, thus, cooled as it enters the chamber. The still and carbonated water are maintained cool by heat transfer to the ice bank and its cooling coils within an insulated compartment surrounding the whole assembly. Ice freezes from the outside to the inside of the spiral, aiding in avoiding damage from ice expansion. The ice bank spiral is self regulating avoiding any damage of over growth of ice as in some prior art systems.

Since the quantity of cooled water which can be supplied in a given amount of time is limited by the refrigeration capacity, an auxiliary water supply is provided for use during periods of high demand, such as during a party. Normal capacity is based on normal usage rates. Also, to insure that incoming water is properly cooled, a pressure regulator and sized orifice are used to control the flow rate of the water reaching the ice bank.

All of the above aspects of the invention are novel individually and furthermore may be employed in any combination to form further aspects of the invention.

Embodiments of the aspects of the invention will now be described, by way of example, with reference to the accompanying drawings, wherein:-

Fig. 1 is a cross section through the dispenser of the present invention;

Fig. 1a is a cross section of a check valve for use between the still water chamber and carbonator;

Fig. 1b is a diagram showing the various connections to the still water and carbonating members;

Fig. 2 is a diagrammatic plan of the dispenser of Fig. 1;

Figs. 3 and 4 are views of the control valve in its open and closed states respectively;

Fig. 5 is a plan view of the ice bank of the carbonator of Fig. 1;

Fig. 6 is a cross sectional view of the auxiliary water tank and associated valving;

Fig. 7 is a cross section of the water regulator valve;

Fig. 8 is a bottom view of the dispense head, partially cut away;

Fig. 8a is a diagrammatic perspective view of elements of the dispense head of Fig. 8;

Fig. 9 is a transverse cross section through the dispense head;

Fig. 10 is a longitudinal section through the dispense head;

Fig. 11 is a section through the slide valve for controlling the dispense head;

Fig. 11a is a sectional plan of an alternative form of dispensing head;

Fig. 11b is a sectional view of the dispense head of Fig. 11a, the section being taken on the line A - A of Fig. 11a;

Fig. 12 is a front view showing the CO_2 weighing system;

Fig. 13 is a view of the level sensor for the still water chamber; and

Fig. 14 is a block-logic diagram of the control and indicator circuits.

The dispenser of the present invention, as illustrated in Fig. 1, includes a vessel 10 which comprises a carbonator tank 11 which is divided into a carbonated water section 13 and a still water chamber or reservoir 15. The carbonated water section 13 includes a conventional diffuser 17 which is supplied with carbon dioxide gas under pressure via a line 19a. A pressure operated check valve 21 is inserted in line 19a prior to the diffuser 17. CO_2 gas under pressure is supplied from a bottle 24, through a regulator 28 to line 19a leading to valve 21. A carbonated water outlet 23 is provided at the bottom of the carbonated water section 13 and leads to dispense head 91 on which are mounted syrup containers 90.

In the still water section 15 of the carbonator, a high level sensor 25 and low level sensor 27 of conventional design may be provided. Preferably, the magnetic sensor illustrated in Fig. 13 and described below will be used. Separating the chambers 15 and 13 is a wall 29 containing therein a check valve 31, shown as a flap valve. However, this may also be a ball check valve. The water inlet is via a line 32a which couples into the top of the tank through valve 35. A connecting line 34 between chambers is coupled through valve 35 into line 41 and then the chamber 15. To improve carbonation, a slow feed valve 36 of the type disclosed in my copending application Serial No. 550,455 may be inserted in line 34. A vent outlet pipe 33 leads from chamber 15 to valve 35 and thence to vent pipe 46. A relief valve 45 set, e.g., 5 psi, below the water mains pressure is situated in vent line 46.

Water flows into chamber 15 over an ice bank disposed thereabove.

Fig. 1a shows an alternate to flap valve 31. A tubular member 29 extends vertically downward and then upward at an angle. Within the angular part a seat 30 is formed. A ball 37 rests against seat 30. The end of tubular member 28 is covered by a perforated cover 20.

Fig. 2 is a schematic plan view of the system of Fig. 1. In addition to illustrating the carbon dioxide bottle 24 and carbonator 10, shown in block diagram form on the drawing, is a compressor 26 of conventional design to carry out refrigeration described below. The power line 22 supplies power to the compressor and to sensing circuits in the carbonator 10, etc. also to be described below. The dispense head 91 containing thereon syrup bottles 90 is also visible.

Lines from the carbon dioxide cylinder to the carbonator and to dispense head are labelled 19a and 19b, respectively. The dispense heads can be pneumatically operated or electrically operated and constructed in accordance with my aforementioned patent No. 4,408,701, the disclosure of which is hereby incorporated by reference. Also shown in Fig. 2 is the water supply line 32a from the water mains.

Line 32a, as can be seen from Fig. 1, is coupled to the outlet of valve mechanism 101 which permits supplying ice water from an auxiliary container 103. The mains inlet to valve assembly 101 is through a regulating valve 105.

As illustrated by Fig. 3, valve 35 includes a valve block 36 which a bore 37 containing a valve spool 38 with six O-rings 39. The three valves, 35a, 35b and 35c described herein are thus formed. In the position shown in Fig. 3, narrowed portion 40 of spindle 38 is connecting line 34 to line 41 through open valve 35c. Flow through valve 35b from line 32a to line 32 and valve 35a connecting line 33 to line 46 is prevented and thus, these valves are closed.

Assume that in this condition the chamber 15 is filled with still water to the level of sensor 25 and the chamber 13 also filled with water. The valve 35c being open allows flow of gas through line 34 resulting in an equalization of the pressure in the chambers 15 and 13. As a result, when carbonated water is drawn out of the outlet 23, still water fills into chamber 13 through the check valve 31. Additional carbon dioxide flows through the diffuser 17 carbonating this water and replacing the volume which flowed out of section 15 under gravity. Operation continues in this manner until the low level is reached.

When the low level is reached, this is sensed by sensor 27. This sensing is used, via a control circuit 50, to operate solonoid 51 which opens valves 35a and 35b and closes valve 35c. This condition is shown in Fig. 4. With valve 35c closed, and hence connection of each chambers 13 and 15 through line 34 prevented, and valve

35a opened, the gas in chamber 15 vents through valve 35a and the relief valve 45 to the atmosphere. The pressure in chamber 13 is now greater than the pressure in chamber 15. As a result, check valve 31 closes so that backflow of the carbon dioxide gas into the chamber 15 is not possible while dispensing is still possible. Water fills into the chamber 15 via the line 32, flowing over the ice bank and into opening 83, until the high level, as detected by the sensor 25, is reached. Through all this time, venting is taking place via the relief valve 45 to maintain the pressure in chamber 15, e.g., 5 psi, below the water mains pressure. When the high level is sensed, this causes the solonoid 51 to be turned off. Valve 35b closes to stop the flow of water, valve 35a closes to stop the venting, and valve 35c opens to equalize the pressure between the two chambers via line 34.

For the purpose of cooling the water, the ice bank arrangement is provided above and in direct communication with the chamber 15. The ice bank arrangement includes a casting of aluminium or the like with a cylindrical outer wall 61 also shown in Fig. 5. Embedded in and surrounding the outer wall are cooling coils 63 coupled to refrigeration compressor 26 of Fig. 2 in conventional fashion. Inward of the wall 61 and of the same height is a spiral wall 65. Walls 61 and 65 form a spiral space 67 which terminates in a weir 79. The inlet tube 32 is located at one end of the chamber 67. Water flows in filling up the space 67 finally flowing over the barrier 79 and through an opening 83 into the upper still water chamber 15.

As water is supplied to the system, the space 67 becomes filled with water up to a level determined by the weir 79. Once the spiral is filled, additional water overflows and begins filling the still water compartment 15. When the high level is reached, as sensed by the sensor 25, filling stops. The space in the ice bank system will remain filled to its appropriate level. The cooling coils will cause the water in the space to freeze. In addition, because the whole arrangement is surrounded with insulation 85 and disposed within an outer casing 87, heat will be removed from the water in the carbonator in compartments 13 and 15 and it too will become cooled. Once the system has reached this equilibrium after initial start-up, as dispensing takes place and the upper compartment 15 is refilled, it will always be refilled with cold water, since the incoming water will flow over the ice, melt part of the ice and become cooled so that the water reaching the compartment 15 will be cold. The water then in the ice bank space will be refrozen until the next filling cycle takes place. Flow is regulated to about 200ml/min in the illustrated embodiment, by means of regulating the incoming mains water pressure and passing the water at this controlled pressure through a controlled orifice or flow path.

The water inlet line 32a is preferably coupled through a valving arrangement 101, which permits providing input from an auxiliary tank 103 in addition to providing an input from the water mains. In addition, at the inlet of the valving arrangement 103 there is disposed a pressure regulator 105. This pressure regulator can essentially take the form of the gas regulator described in my previous U.S. patent application Serial No. 508,558. Its construction will be described in more detail below.

Fig. 6 is a cross-sectional view of the valving arrangement for the auxiliary tank. The auxiliary tank is an open tank into which may be placed ice water, i.e. a mixture of ice and water. Formed in the bottom of the auxiliary tank 103 is a cylindrical projecting member 106 with a central opening 107 leading to a bore 109 in the cylindrical member 106. At the base of the bore is a seat 111 for a ball check valve formed by ball 113 biased by spring 115. The spring is retained in place by a member 117 inserted into the opening 107 in the base of the auxiliary container 103. Retainer 117 contains a central opening 119 through water may flow.

Normally, when the tank is not in use and is detached from the valving arrangement 101, the spring 115 will bias the ball 113 against the seat 111 preventing the flow of liquid out of the auxiliary tank. However, when the tank is inserted into the auxiliary valving mechanism 101 as shown, a spool valve member 121 via an upper portion 123 thereof porjects through the member 106, saling with O-ring 112 to the inside of bore 109 below seat 111, and moves the ball upward against the biasing force of the spring. The top upper portion 123 has cut outs 123a and these permit water flow through the portion 123 into a central bore 125 of spool valve member 121. The spool valve member 121 is divided into a number of sections. It includes a lower section separated by two O-ring seals 127 and 129. These O-ring seals seal off bore 148 from the inlet bore 131 which is at the outlet of the regulating valve 105 coupled via a coupling which is sealingly threaded into a threaded portion of bore 131 provided for that purpose. The second section is between O-ring 127 and an O-ring 133. This is sealing across, in the position shown, the outlet passage 135 leading to the line 32a of Fig. 1. Line 32a of Fig. 1 contains an appropriate fitting which is sealingly threaded into a threaded portion of the outlet bore 135. The passage 125 connects with a radially extending passage 137 which, in the position shown, is in communication with the bore 135. In the position shown, liquid from the tank 103 can flow through the passages 123, bore 125 bore 135, bore 137 and into the line 32a as necessary to refill the ice bank and still water chamber. Flow is basically unrestricted since it is gravity flow. The container 103 is held in place by means of a bayonet fitting. Pins 141 are inserted in appropriate bores in the valve mechanism 101 and mate with slots 143 extending radially and circumferentially inconventional fashion to secure the container 103 in place. The valve member 121 also contains a flange 142 on top, which limits its upward and downward motion and controls the distant member 123 moves ball 113 off seat 111. To insure proper alignment of the radial bore 137 with the outlet bore 135, a pin 144 rides in a bore provided alongside the bore in which spool valve member 121 is situated for that purpose. Valve member 121 may be biased upwardly by means of a spring 146, and is biased upwardly, when the water mains is connected, by the water pressure entering the spring chamber 122.

When the auxiliary tank is detached, spool member 121 moves upwardly under the action of spring 46, and passage 137 moves out of registry with passage 135, but bore 148 is uncovered allowing free communication between passage 131, chamber 122 and bore 148.

During normal operation, i.e. the tank 103 is not used and is disconnected, as tank 103 is only necessary where the drink consumption is so high that the cooling system cannot keep up with it or when the unit is not connected to the mains water supply. In that case, the biasing spring 146 or water pressure moves the valve member 121 upwardly so that the bottom of the valve member 121 is now above the further bore 148 leading from the bore for the slide valve 121 to the outlet bore 135, this bore now being sealed off by O-rings 127 and 129 from the auxiliary inlet port. The bore 148 is of a narrow dimension to control flow rate. The control of presure to this restricted area along with the sizing of this portion will result in a control of the water flow rate into the ice bank. It is desired in the present case to have a flow of the order of less than 200 millilitres per minute. The flow rate will, of course, in each instance, depend on the size of the components, in particular, the ice bank size. It is necessary that the water flow be fast enough to melt a portion of the ice to be cooled as it does so. If the water flows too quickly, it will not be sufficiently cooled. On the other hand, if the water flows too slowly, it will freeze before it reaches the outlet of the ice bank, causing an undesirable buildup of ice.

Fig. 7 shows the regulator valve 105. The valve includes an inlet 151 and an outlet 153, the outlet 153 being coupled to the inlet port 131 of the auxiliary tank valve mechanism 101 of Fig. 6. The valve has a body which is made up of parts 155 and 157. The outlet port is formed in part 155. The two parts are threaded together by means of threads 158 as illustrated. Part 157 is provided with an internal bore 159 into which there is inserted a piston member 161. Piston member 161 has an outer end 163 of diameter matching the diameter of the bore 159. Extending from portion 163 which is cup-like, is a tubular member 165. Member 165 slides sealingly within an O-ring 167 provided in the part 155 in the vicinity of the outlet 153. A spring 169 acts between part 155 and part 163 to bias the piston to the right. Travel of the piston to the right is limited by a flange 171 formed in bore 159 in part

157. Thus, when assembling the apparatus, the parts 155 and 157 will be apart. The piston 161 is inserted into the bore 159 whereupon after placing spring 169 over tube 165, the part 155 is screwed into place.

The inlet port 151 is formed in another part 173 which forms a quick disconnect connection with the part 157. This is accomplished with a bayonet-type fitting with pins 175 extending from the wall of a bore 177 at the end of part 157 and engaging in appropriate slots 179 formed on a cylindrically extending portion 181 of part 173. Adjacent portion 181 is a portion 183 of smaller diameter, which includes an O-ring seal 183 of smaller diameter, which includes an O-ring seal 187 by means of which it seals inside the bore of the cuplike portion 163 of piston 161. Contained within the member 173 is an internal bore 191 threaded to receive a Schrader-type check valve 193. Valve 193 has a projecting stem 195 which when pushed inwardly of valve 193 will open the valve and permit water passing through the inlet 151 to escape into the chamber formed within piston 163. In the centre of the piston 163 is a pin 197 supported on legs 199 at the tubular portion 165. This portion 197 acts to push in on the pin 195 to open the Schrader valve and allow a flow through the internal portion of piston 163, and outlet tube 165 to the outlet 153. However, as pressure builds up inside portion 163, this pressure acts against the biasing spring 169, tending to move the piston 161 to the left. As this occurs, valve 193 tends to close. This operation of the opening and closing of the valve 193 as the pressure changes, is utilized to give a pressure regulation so that a predetermined pressure determined by the amount biasing force on the spring 169 controls the pressure at the outlet 153. Adjustment of the pressure is accomplished by means of screwing the parts 155 and 157 closer together or further apart as the case may be.

Figs. 8, 8a, 9 and 10 illustrate a construction of the dual dispense head 93 utilized with the present invention. In general, this has similarity of operation to the construction described in my prior United States Patent 4,408,701. However, there are some differences which permit operation of dual dispense heads in a particularly simple manner. The dispense heads are pneumatically driven by a piston 201 disposed in the cylinder 203. The piston is capable of being driven in either direction by means of supplying gas through inlets 205 and 207, although as explained, the piston always starts from the same position, that shown in Fig. 8a. A shaft 209 of the piston extends from both sides of the cylinder 203. The shaft extends through an O-ring 211 on one side of the cylinder and through an O-ring 213 in a retaining disk 215 sealingly threaded into the cylinder at the other end, this being necessary for insertion of the piston. The piston, itself, has surrounding it a quad ring 217. At each end of the piston rod 209 is a rack 219 (not shown in Fig. 8A). Each rack 219 is adapted to engage a half pinion 221 (only one shown) which is hinged to the rotary portion 223 of a rotary valve assembly 225 of the general type disclosed in my aforementioned patent. As previously described therein, there is a carbonated water inlet 227 which becomes aligned with a sealed outlet 229 in the body of the valve member as the rotary valve member 223 is rotated. Water under pressure from the carbonator then flows through an expansion chamber 231 to an outlet spout 233. As previously explained, a syrup container is retained within rotary valve member 223 and rotation thereof opens the valve in the syrup package to cause dispensing of syrup directly from the container directly into a cup. Expansion chamber 231 is an improvement on the expansion chamber shown in my aforementioned patent, in that it is a gradually expanding curved chamber with no sharp edges so that expansion takes place gradually, without loss of carbonation.

A valve 241 shown in section in Fig. 11 is provided to control the operation of the piston 201 in cylinder 203. Valve 241 includes a square sectioned bore 243 and a square sectioned slide 245. Slide 245 is biased in an upward direction by a spring 247. When biased upwardly an outlet 250 radially extending from slide 245 and surrounded by an O-ring 251 will supply gas to a line 249 leading the port 207 to move the piston to the right in Fig. 8a. In operation, as a two armed Z shaped lever 253 pivoted at a point 255 (see fig. 8a) is pushed down, this lever having an arm 254 engaging slide 245 in a notch 246 provided for that purpose, the outlet 250 is moved to a position where O-ring 251 surrounds an outlet 252 leading to inlet port 205 of cylinder 203 to move the rod 209 to the left in Fig. 8a rotating the dispense valve and opening the valve. Gas is supplied to the slide 243 via line 257.

Fig. 8a shows the manner in which, when the slide valve 241 is operated, the pinions 221 are brought into engagement with the racks 219. The pinions 221 are hinged to the rotating valve members 223 at hinge points 221A. In the normal at rest position they are located below the rack 219 as shown in Figs. 8a and 9. When it is desired to dispense a drink from one side, the machine being designed so that unless synchronized only one side at a time operates, a glass is pushed up against a lever 271 (Fig. 10) at that side. Each level is hinged at 272 and has a downwardly extending preferably curved flange 273 against which the glass rests. Pushing upwardly on this lever 271 causes a pin

275 to move upwardly. The pin 275 engages the other arm 276 of lever 253 which is hinged at point 255 causing such arm 276 to lift upwardly in Fig. 8a, which in turn lifts the pinion 221 so that its teeth are in engagement with rack 219, and which also causes the other arm 254 to tilt downwardly and displace the slide 245 of the slide valve to move downwardly. Thus, moving the lever 276 upwardly, will move the slide valve downwardly causing the piston 209 to move to the right driving the now elevated pinion 221 to be engaged by rack 219 as shown by arrows 221B in Fig. 8a. Preferably, the rack contains, along its base, a solid portion 281 which prevents bringing the pinion into engagement with the rack other than at the start of rotation. Thus, once movement is started, one cannot at the same time try to dispense from the other head. In effect, the second head is locked out.

It should be noted that the valve 241 is operated in the same fashion regardless of which lever 271 is operated and that the piston 201 starts from the same position when either lever 271 is so operated, and returns to that position when the appropriate lever is released. Because of this, it is possible (although unlikely to be used in practice) that both dispensing valves can be operated simultaneously by pushing both levers 271 upwardly at the same time. When either lever 271 is operated however, the sequence of operations is as follows:

The lever 271 is pushed upwards. This lifts the arm 276 of the associated lever 253 and the pinion 221 thereabove so that its teeth engage the rack 219. The other arm 254 of the lever moves the slide 245 downwards so that the supply of pressure gas in line 257 is directed to line 205 and line 207 is vented to atmosphere through a notch 245A (Fig. 8a) in slide 245 and the piston 201 moves left in Fig. 8a opening the appropriate dispensing valve, and dispensing of carbonated water and concentrate takes place, these being caught in the glass held against the lever 271. When the glass is removed, spring 247 returns the lever 253 to the initial position, the supply of pressure is returned to line 249 and line 207, whilst line 205 is connected to atmosphere through passage 250A (Fig. 11) and piston 201 returns to the position shown in Fig. 8a, closing the dispensing valve and finally the piston 221 drops out of engagement with the rack 219.

An alternative mechanism for controlling the operation of the dispensing valves is shown in Figs. 11a and 11b. In Fig. 11a, manifold 100X houses two of the dispensing valves 102X and 104X having generally similar construction and operation to those described in United States Patent 4,408,701 in that each has a rotary valve member 106X and 108X respectively. The rotary valve member has a key slot 110X and 112X in a central aperture 114X, 116X in the valve member for the reception of an appropriate drive key on a syrup container which as explained in the said U.S. Patent is for insertion into the rotary valve member. A cover portion 118X of the manifold 100X also has apertures in register with the apertures 114X and 116X, and similarly although not shown has key weirs for engagement with drive tabs on the syrup packages. As explained in the said U.S. Patent these components are constructed in this fashion so that when a syrup package is placed in operative position in each dispensing valve, and the rotary valve member 106, 108 is rotated in the manifold, there is relative rotation between the package cap and the body and this has the effect of allowing syrup or concentrate to flow directly from an outlet in the package into a cup or other collecting vessel. At the same time, a carbonated water outlet is coupled to a feed passage contained in the rotary valve member 106, 108 which although not shown in Fig. 11a, is indicated in Fig. 8 by reference 231, and this causes carbonated water to flow from the outlet, through the passage in the rotary valve member, and out of an outlet spout, such as spout 233 as shown in Figs. 8 and 10 so that the water and syrup are caught in the same drinking cup.

For the selective operation of the rotary valve members 106X, 108X, there is provided a slide valve 120X which comprises a cylinder 122X housing a piston 124X. The piston 124X is fast with a piston rod 126X which extends beyond the ends of the cylinder 122X, and is provided with notches 128X and 130X for a purpose to be explained.

The piston 124X has a sealing ring 132X whilst the end of the cylinder 122X is closed by a sealing disc 134X having sealing rings 136X and 138X.

The respective sides of the piston 124X are pressurised during the operation of the sliding valve through gas pressure lines 140X and 142X in order to reciprocate the piston 124X in the cylinder 122X, and to move the piston rod 126X in a reciprocating stroking motion. The supply and exhaust of pressure gas through the lines 140X and 142X is controlled electrically by means of a suitable solenoid valve, from the actuation of button actuators 144X and 146X which are arranged to operate microswitches of which only one, 148X is shown in Fig. 11b. Upon depression of either button 144X or 146X the appropriate microswitch such as microswitch 148X is actuated, which in turn controls the condition of an electric solenoid. That solenoid is positioned so as to cause pressure gas, specifically the CO_2 gas used in the machine for carbonating water, is supplied to line 140X and line 142X is vented to atmosphere. This causes the piston 132X to reciprocate downwards in Fig. 11a to the other end of this cylinder 122X and, by a means to be explained, the appropriate rotary valve member 106X or 108X, depending upon which button is depressed is rotated to effect the dispensing of syrup in carbonated water as described above. When the button is released, the gas pressure is returned to line 142X and line 140 is vented, causing the piston 124X to return to the position shown in Fig. 11a.

The method of effecting the drive of the rotary valve members 106X, 108X, will now be described in relation to Fig. 11b. When the button 146X is depressed, it is depressed against the action of compression spring 150X. The button is attached to a thrust body 152X having a T-slot 154X in which is located a T-coupling member 156X of a drive body 158X. The drive body 158X contains an elongated slot 160X in which is slidably contained the piston rod 132X. A drive pin 162X is carried by the drive block and extends across the slot 160X as shown in Fig. 11b in a direction at right angles to the piston rod 132X.

The T-portion 156X is received in T-slot 154X with clearance as shown clearly in Fig. 11b so that when the button 146 is depressed (in the direction of arrow 164X) there will be no movement of the drive block 158X until the lost motion between the T-slot 154X and the T-portion 156X is taken up, following which the drive block will be pushed inwardly in the direction of arrow 164X until in fact the drive pin 162X engages in the cutter 128X (see Fig. 11a) establishing positive drive between the piston rod 126X and the drive block 158X. The drive block therefore moves with the piston rod 126X and it will also be noticed that at the opposite side from the T-portion 156X, the drive block 158X is provided with drive teeth 166X which engage drive teeth

168X on the rotary valve member 106X. As the drive block moves with the piston rod therefore, the rotary valve member 106X is rotated in order to effect the dispensing hereinbefore described. It should be noted from Fig. 11a that the manifold 100X is cut away as shown in Fig. 11a at 170X to receive the appropriate drive block 158X when it moves with the piston, in order to trap the drive block in the position in which the drive pin 162X engages the appropriate cut out 128X, 130X and as the drive block 158X is longer than said cut out 170X, when the drive block is in this cut out 170X, it will hold the push button 146X in the depressed position. When the piston is returned to the position shown in Fig. 11a, as soon as the drive block 158X is clear of the cut out 170X by virtue of the spring 150X the push button 146X will spring to the outer position shown in Fig. 11b as will the drive block 158X, thereby completing a cycle of operations.

It will be appreciated that the system described above provides a simple and effective method of controlling the operation of the rotary valves 106X, 108X and such construction alone can constitute an inventive concept of the present invention.

Referring to Fig. 12, the CO_2 cylinder 24 engages with its regulator 28 by means of a quick disconnect fitting 300. The quick disconnect fitting and regulator are hung from springs 301 such that, when the tank is completely full, it will be resting on tbe base 75 but as it begins to lose weight, it will move upwardly. Attached to the regulator mechanism 28 is a light guide 303 or painted indicator which moves opposite an appropriate slot 305. Gradations can be placed on the wall to indicate the amount of carbon dioxide gas remaining.

This indicator and a carbonator water level indicator are shown schematically in Fig. 14. A light source 307 provides a light to light guide 303 and to another light guide 309. Light guide 309 enters through the wall of the carbonator and is attached to a prism 311 at the inner end of the carbonator. Because of the indicies of refraction, when there is liquid present in the tank at the prism 311, light is not reflected to another light guide 313 and a colour indicator 315 installed in an appropriate location where the operator can see it, as shown in Fig. 12, is dark. As the liquid level drops below prism 311, the index of refraction is such that the light is reflected to the light guide 313, and the indicator is lighted. This indicates that there is no water in the carbonator tank, and it must be refilled. Finally, there is a further indicator in the form of light 321 driven by a suitable a/c to d/c rectifier 323 through a switch 325, which is mechanically coupled to valve 35 by a mechanical link 327, to indicate the state of valve 35.

Fig. 13 shows a preferred form of high low level sensor to be utilized in the still water container 15. This sensor comprises a pair of reed switches 451 and 453 attached to the outside of the stainless steel wall 455. Inside the tank, suspended from above on a pivot point 457 is a rod 459 having on one end a magnet 461 and on the other end a flat float 463 pivoted at 462. The float has sufficient weight to just counterbalance the magnet to cause it to follow the level of water 465. Thus, as the water level increases and decreases, the magnet 461 moves up and down. At the low level, it is adjacent reed switch 451 and will cause that switch to operate. At the high level, it is adjacent reed switch 453 and will cause that switch to close.

Fig. 14 shows a preferred method of utilizing this type of sensing. The output of switch 451 is provided to the set input and the output of switch 453 to the reset input of a flip-flop 471 through OR gates 452 and 454, respectively. The Q output of flip-flop 471 contains a driver 473, which drives a solonoid air valve 475 to supply air to a pneumatic actuator 477 which drives the valve 35, i.e. preferably a pneumatic actuator is utilized rather than the direct solonoid drive 51 of Fig. 3. In other respects, the valve is the same. Also shown coupled at the output of the valve and mechanically linked thereto, is the switch 325 for the indicator light 321. In operation, when valve 451 closes indicating a low level, air valve 475 is actuated to drive the pneumatic actuator 477 to operate the valve 35, to cause the condition shown in Fig. 4 to exist in which filling of the still water tank takes place in the manner described above and the tank is vented to atmosphere. Light 321 is on. When the high level is reached, switch 453 closes, at least momentarily, resetting flip-flop 471. The Q output disappears, the air valve closes, or switches to the opposite state, causing the pneumatic actuator to move in the opposite direction either under air pressure or biasing spring force to move the valve 35 to the other position as shown in Fig. 3 in the pressures in section 13 and chamber 15 are equalised, in the manner described previously.

An ice sensor 501 and water sensor 503, e.g. thermistors are located at outlet 83 of the ice bank. It is desired that water be cooled to at least 35°F when leaving the ice bank and that the ice temperature at the exit from the ice bank never drop below 28°F. The output of sensor 501 is provided to comparators 505 and 507. Comparator 505 has a reference input corresponding to 31°F, and 507 a reference input corresponding to 28°F. These, respectively, are the set and reset inputs to a flip-flop 509 which controls the compressor so as to switch it on and off to ensure that the ice temperature does not drop below 28°F. The output of sensor 503 is provided to a comparator 511 having a reference corresponding to 35°F. The output of comparator 511 is an input to OR gate 454 and will reset flip-flop 471. Thus, if water temperature out of the ice bank exceeds 35°F, flow is terminated. When the temperature drops, the output of comparator 511, which has a hysterisis, through inverter 512 AND gate 452 sets the flip-flop to continue the filling operation.

Dimensions of the ice chamber, still water chamber and carbonator are best selected depending on the desired throughput. Typical dimensions of the carbonator and ice bank will be an overall height of 152 mm and a diameter of 152mm. The carbonator space 13 typically might be designed to hold one to two litres of carbonated water with the reservoir 15 containing one-half to one litre and the ice bank also containing about one-half litre. The outlet from the carbonated water is provided to dispense heads 91 located above a drip tray 93 on the base of the apparatus 95, the base also supports the CO_2 cylinder 24.

The aforementioned design of the ice bank prevents problems with ice building up to too great a thickness and causing damage and thus, eases control problems. The simple temperature sensors described above may be used to control operation of the refrigeration system. One does not have to worry about the ice growing and causing damage. All of the water within the ice bank portion is supposed to freeze.

The novel aspects of this invention and described by embodiments shown in the drawings include; the utilization of two water chambers in the carbonator; the control and design of the ice bank; the control of operation of the carbonator; the control of the supply of water and auxiliary tank; the pneumatic system for operating the dispensing valves and any combination of these aspects or specific features thereof.

CLAIMS

1. A continuous carbonator for a carbonated beverage dispenser comprising:

(a) a closed carbonating tank;

(b) an inlet for carbon dioxide to and an outlet for carbonated water from said carbonating tank;

(c) a closed still water tank disposed above said carbonator tank, said still water tank having an outlet coupled to supply water by gravity to said carbonator tank;

(d) a check valve between said still water tank and said carbonator tank to prevent backflow;

(e) closeable means for permitting water to be supplied to said still water tank and for venting said tank during the time said water is supplied; and

(f) means including a line and a valve for equalizing the pressure between said carbonator tank and still water tank.

2. Apparatus according to claim 1 wherein said closeable means comprise:

(a) a closeable vent outlet from said still water tank; and

(b) a closeable water supply inlet to said still water tank.

3. Apparatus according to claim 2 and further including:

(a) a high and low level water sensor in said still water tank; and

(b) means responsive to said high and low level sensors to:

(i) when the water level is decreasing between said upper and lower level to open said valves in said means for equalizing pressure, to close said vent and to close said water inlet;

(ii) when the low level is reached, to close said means for equalizing, to open said vent, and to open said water inlet to refill said still water chamber; and

(iii) to sense when said high level is reached and to return to the condition where said means to equalize are opened and said vent and said supply are closed.

4. Apparatus according to claim 3, wherein said still water tank and carbonator tank comprise a single tank having a dividing wall therein dividing said single tank into said carbonator tank and still water tank and wherein said check valve comprises a ball check valve in said dividing wall.

5. Apparatus according to claim 4, wherein said valve means responsive to said sensors comprises a solonoid operated valve having three valve sections, one valve section for coupling the water supply, one valve section for venting and one valve section for pressure equalizing.

6. Apparatus according to claim 5, and further including a pressure relief valve in the vent outlet whereby the pressure in said still water tank will be reduced only to an amount sufficient to permit refilling thereby avoiding excessive loss of pressurizing carbon dioxide.

7. Apparatus according to claim 5 and further including a slow feed valve in said line in said equalizing means.

8. Apparatus according to claim 4, and further including ice bank cooling means interposed between said water inlet and said still water tank, said incoming water adapted to run over ice in said ice bank to be cooled as it is supplied to said still water tank.

9. Apparatus according to claim 8, wherein said ice bank cooling means comprise means defining a spiral chamber with a weir forming an outlet from said ice bank to said still water chamber; and cooling coils, surrounding said means, for freezing water which remains in said chambers whereby water introduced at said inlet will run over said spiral as it goes from inlet to outlet contacting the ice therein in the process becoming cooled.

10. Apparatus according to claim 9, wherein said ice bank apparatus comprises an essentially hollow cylindrical casting having a cylindrical sidewall and a bottom, an opening formed in said bottom, said opening comprising the outlet from said ice bank; a spiral wall radially inward of said cylindrical wall forming therewith and with itself a chamber; said inlet opening into the spiral at said cylindrical wall an opening in the innermost part of said spiral wall forming a weir to permit flow out of said chamber to the opening in the bottom of said cylindrical casting; and said cooling coils surrounding said cylindrical casting.

11. Apparatus according to claim 9, and further including an outer casing enclosing said carbonator; and heat insulating material disposed between said outer casing and said carbonator.

12. Apparatus according to claim 6, and further including a base on said outer casing, said base

supporting a carbon dioxide bottle coupled to said diffuser and a dispensing head coupled to the carbonated water outlet from said carbonating tank.

13. Apparatus according to claim 1, and further including a pressure relief valve in the vent outlet whereby the pressure in said still water tank will be reduced only to an amount sufficient to permit refilling thereby avoiding excessive loss of pressurizing carbon dioxide.

14. A carbonated beverage dispenser comprising:

(a) a source of carbon dioxide;

(b) a supply of a concentrate;

(c) means, having an inlet for carbonated water for simultaneously dispensing carbonated water and concentrate from said supply, both at a metered rate;

(d) a closed carbonating tank containing therein a carbon dioxide diffuser;

(e) an inlet for carbon dioxide to said diffuser and an outlet for carbonated water from said carbonating tank;

(f) a closed still water tank vertically disposed above said carbonator tank, said still water tank having an outlet coupled to supply water by gravity to said carbonator tank;

(g) a check valve between said still water tank and said carbonator tank to prevent backflow;

(h) a high and a low level water sensor in said still water tank;

(i) a closeable vent outlet from said still water tank;

(j) a closeable water supply inlet to said still water tank;

(k) means for equalizing the pressure between said carbonator tank and still water tank;

(l) valving means responsive to said high and low level sensors to:

(i) when the water level is between said upper and lower level to open said means for equalizing pressure, to close said vent and to close said water inlet;

(ii) when the low level is reached, to close said means for equalizing, to open said vent, and to open said water inlet to refill said still water chamber;

(iii) to sense when said high level is reached and to return to the condition where said means to equalize are opened and said vent and said supply are closed; and

(m) means for cooling water supplied to said still water tank.

15. Apparatus according to claim 14, and further including a pressure relief valve in the vent outlet whereby the pressure in said still water tank will be reduced only to an amount sufficient to permit refilling thereby avoiding excessive loss of pressurizing carbon dioxide.

16. Apparatus according to claim 11, wherein said means for cooling comprise ice bank cooling means interposed between said water inlet and said still water tank, said incoming water adapted to run over ice in said ice bank to be cooled as it is supplied to said still water tank.

17. Apparatus according to claim 16, wherein said ice bank cooling means comprise means defining a spiral chamber with a weir forming an outlet from said ice bank to said still water chamber; and cooling coils, surrounding said means, for freezing water which

remains in said chambers whereby water introduced at said inlet will run over said spiral as it goes from inlet to outlet contacting the ice therein in the process becoming cooled.

18. Apparatus according to claim 17, wherein said ice bank apparatus comprises an essentially hollow cylindrical casting having a cylindrical sidewall and a bottom, an opening formed in said bottom, said opening comprising the outlet from said ice bank; a spiral wall radially inward of said cylindrical wall forming therewith and with itself a chamber; said inlet opening into the spiral at said cylindrical wall an opening in the innermost part of said spiral wall forming a weir to permit flow out of said chamber to the opening in the bottom of said cylindrical casting; and said cooling coils surrounding said cylindrical casting.

19. Apparatus according to claim 16, and further including an outer casing enclosing said carbonator; and heat insulating material disposed between said outer casing and said carbonator.

20. Apparatus according to claim 19, and further including a base on said outer casing, said base supporting a carbon dioxide bottle coupled to said diffuser and a dispensing head coupled to the carbonated water outlet from said carbonating tank.

21. Apparatus according to claim 16 and further including an auxiliary ice water tank and valving means to cut off the mains water supply when said auxiliary tank is mounted thereto.

22. Apparatus according to claim 16 including a regulating valve in said water line and a passage between said regulating valve and said ice bank inlet

of controlled size to control the rate of flow into said ice bank.

23. An ice bank for cooling water supplied to a drink dispenser comprising means forming a chamber of extended path length having an inlet at one end and a weir forming an outlet at the other and refrigeration means for freezing water contained in said chamber.

24. Apparatus according to claim 23, wherein said ice bank cooling means comprise means defining a spiral chamber with a weir forming an outlet from said ice bank; and cooling coils, surrounding said means, for freezing water which remains in said chambers whereby water introduced at said inlet will run over said spiral as it goes from inlet to outlet contacting the ice therein in the process becoming cooled.

25. Apparatus according to claim 24, wherein said ice bank apparatus comprises an essentially hollow cylindrical casting having a cylindrical sidewall and a bottom, an opening formed in said bottom, said opening comprising the outlet from said ice bank; a spiral wall radially inward of said cylindrical wall forming therewith and with itself a chamber; said inlet opening into the spiral at said cylindrical wall an opening in the inner must part of said spiral wall forming a weir to permit flow out of said chamber to the opening in the bottom of said cylindrical casting; and said cooling coils surrounding said cylindrical casting.

26. Apparatus according to claim 25 and further including means for sensing the temperature at said outlet and control means responsive thereto to turn said refrigeration system on when the temperature exceeds a predetermined valve and to turn it off, when said temperature drops below a predetermined valve.

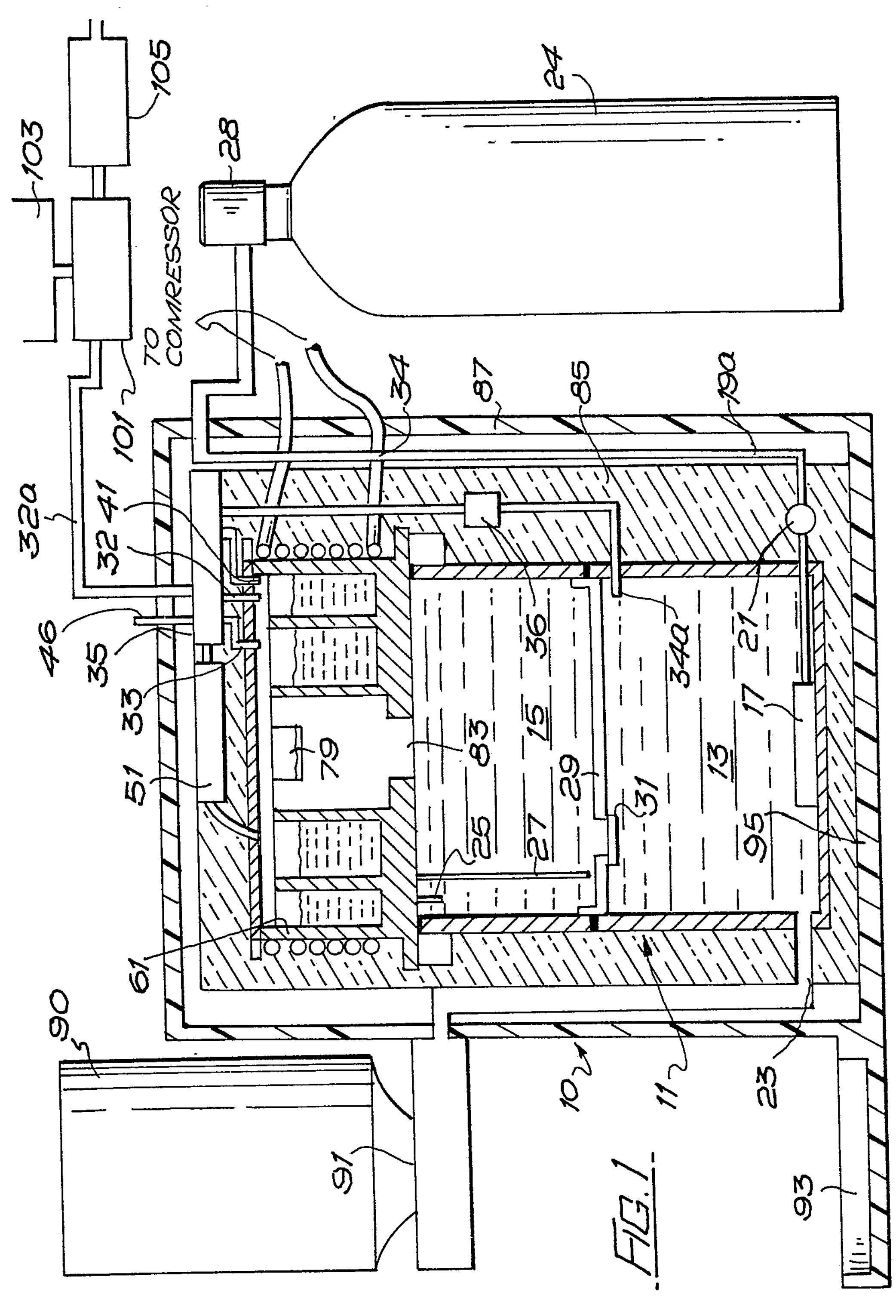
105
103
28
24
TO COMRESSOR
101
32a
32
41
46
35
33
51
79
83
15
36
34
87
85
19a
21
34a
17
13
29
31
25
27
95
61
90
91
10
11
23
93

FIG. 1

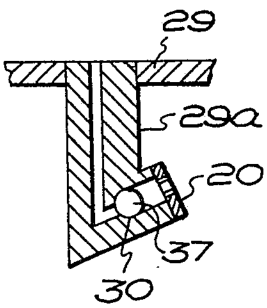

FIG. 1a

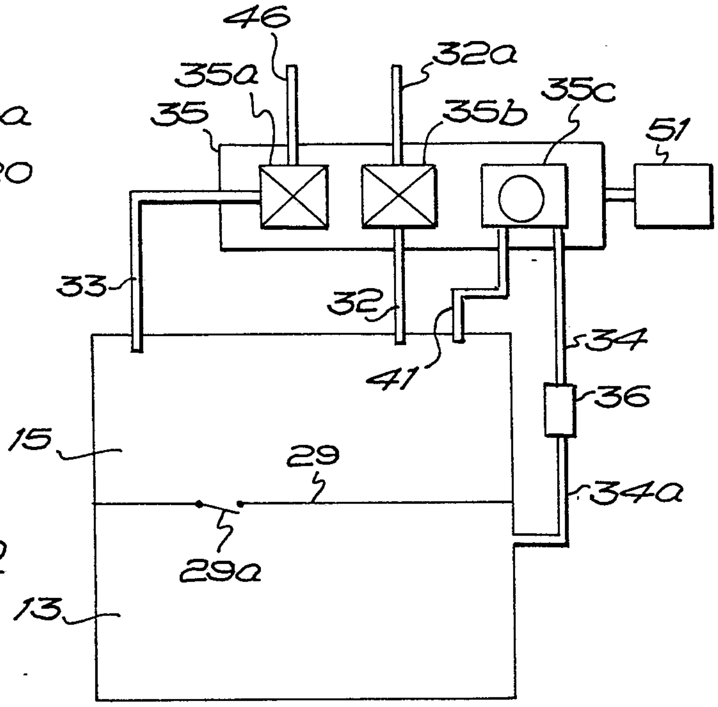

FIG 1b

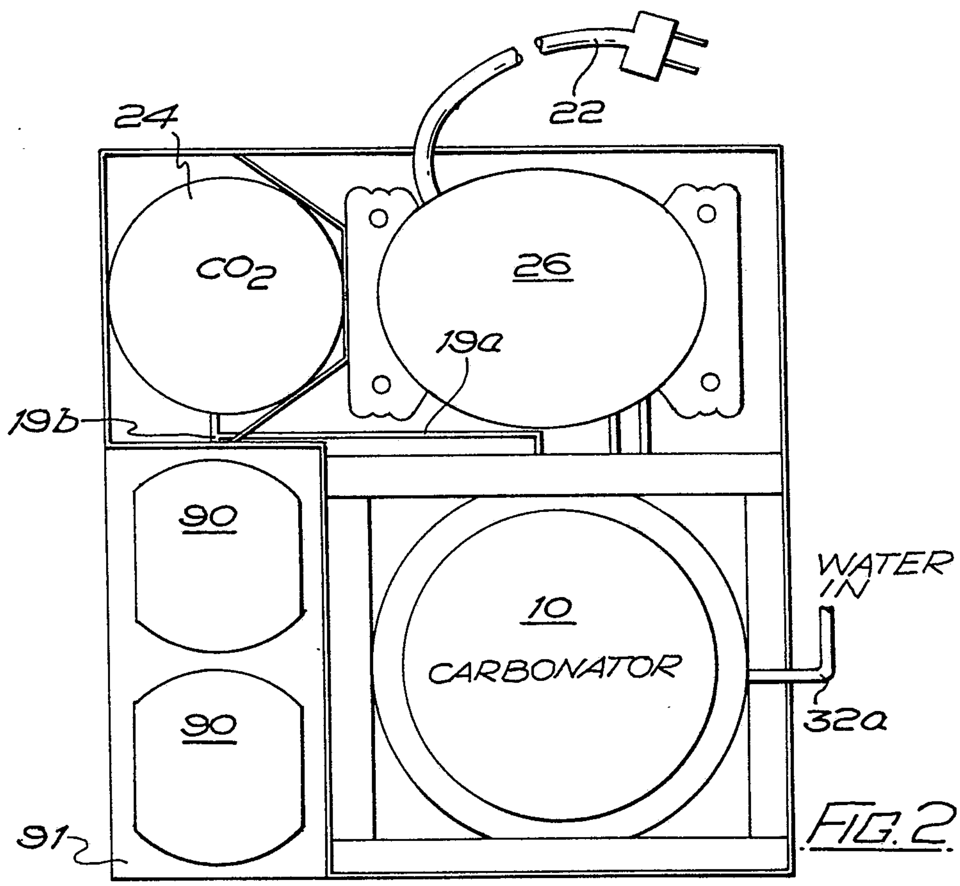

FIG. 2

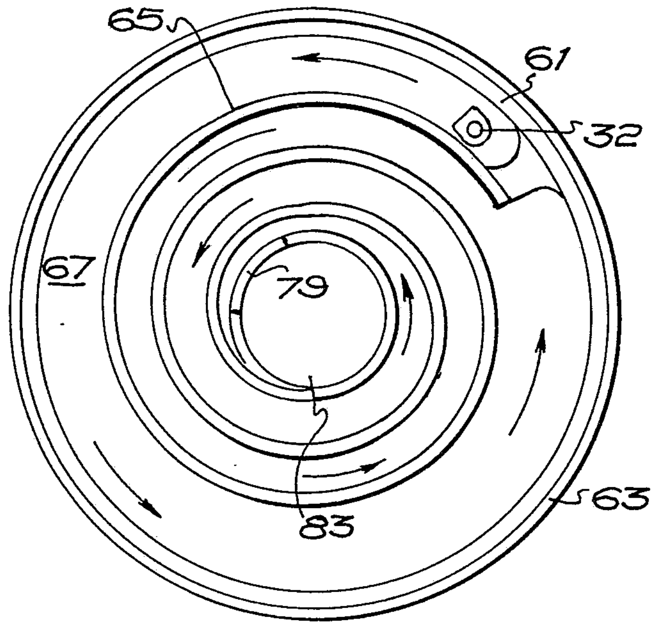
65
61
32
67
79
83
63

FIG.5

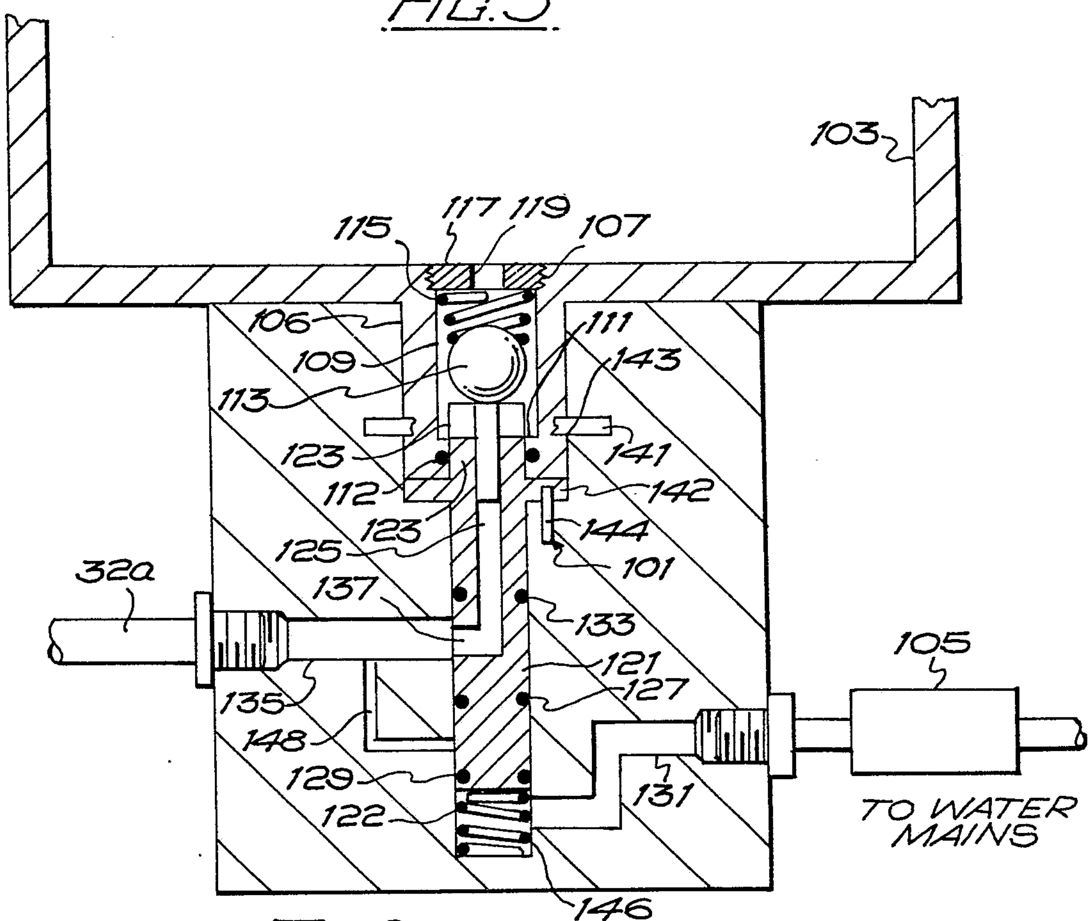
103
115
117
119
107
106
109
111
143
113
123
141
112
142
123
144
125
101
32a
137
133
121
105
135
127
148
129
131
122
TO WATER MAINS
146

FIG.6

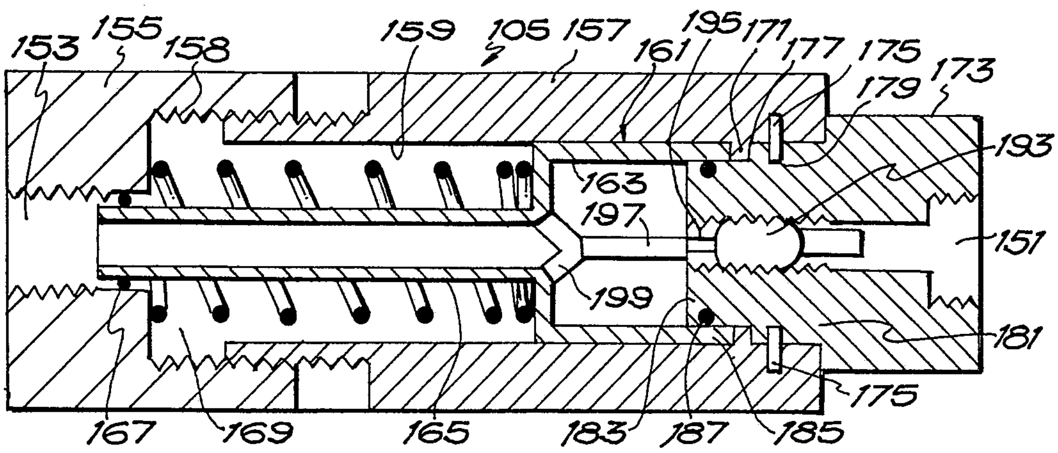

FIG. 7

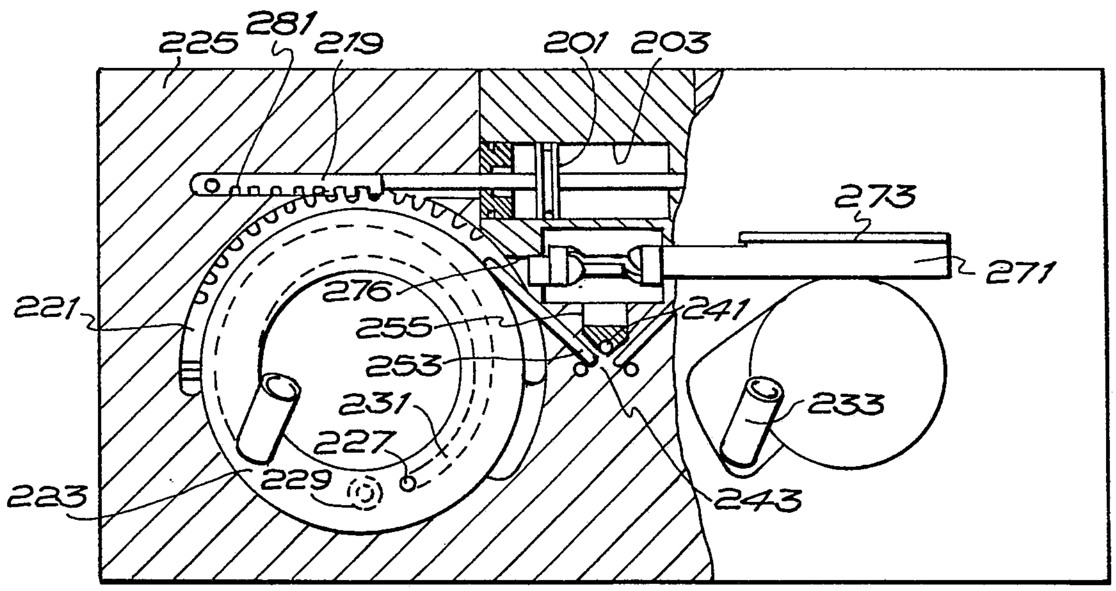

FIG. 8

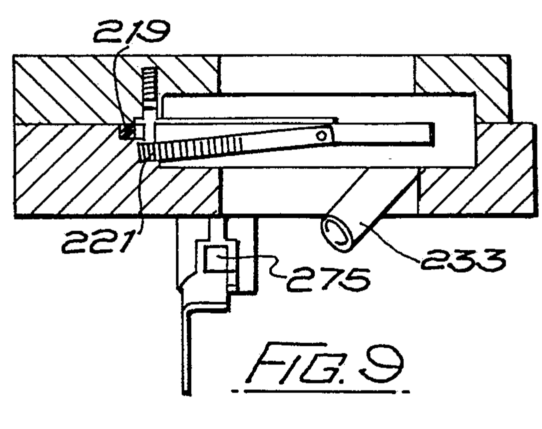

FIG. 9

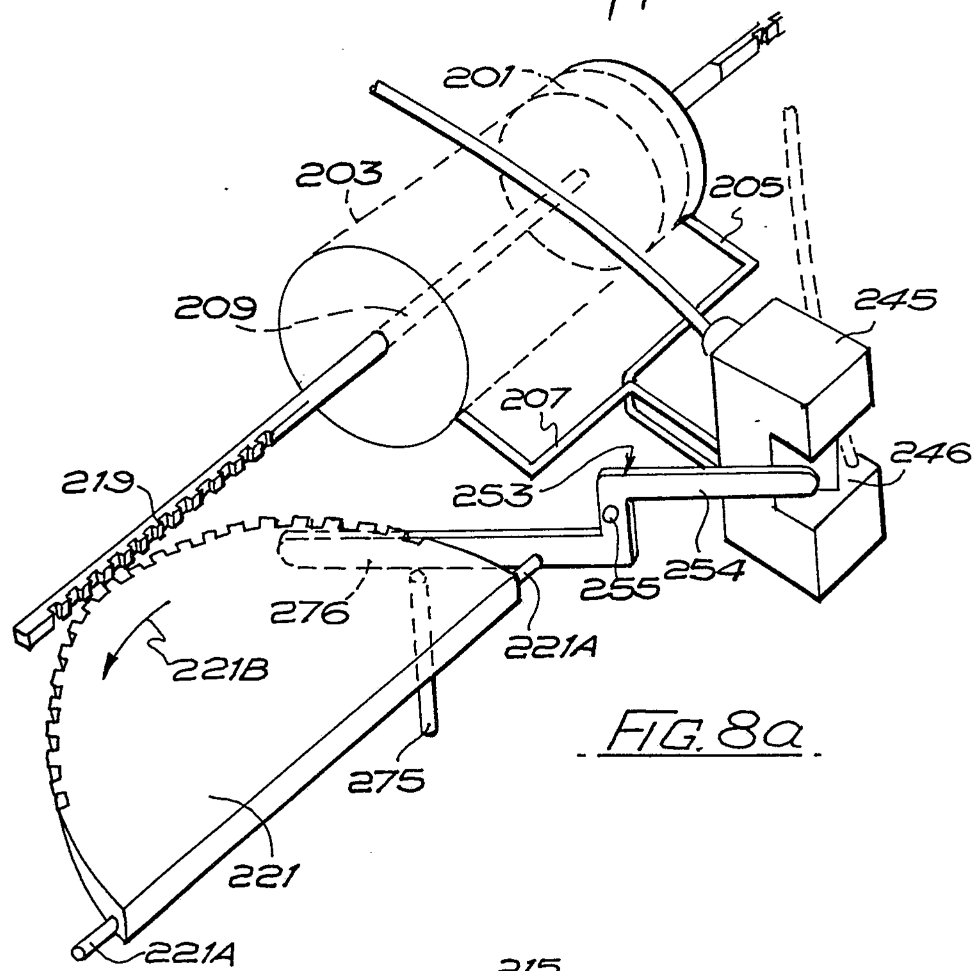

FIG. 8a

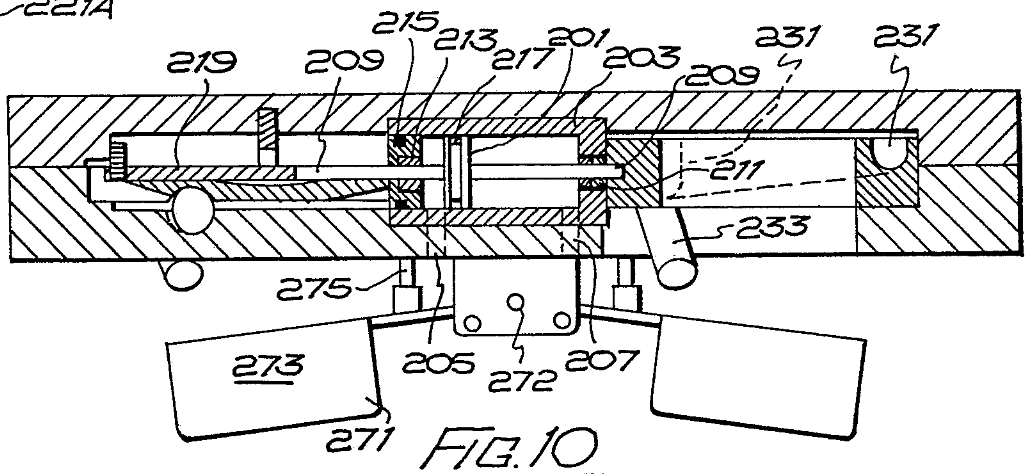

FIG. 10

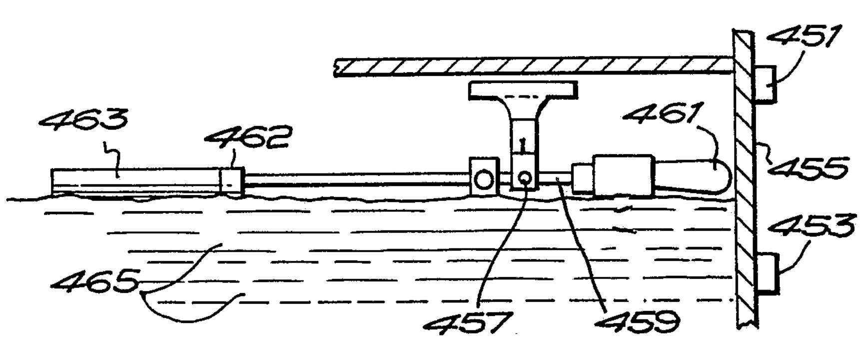

FIG. 13

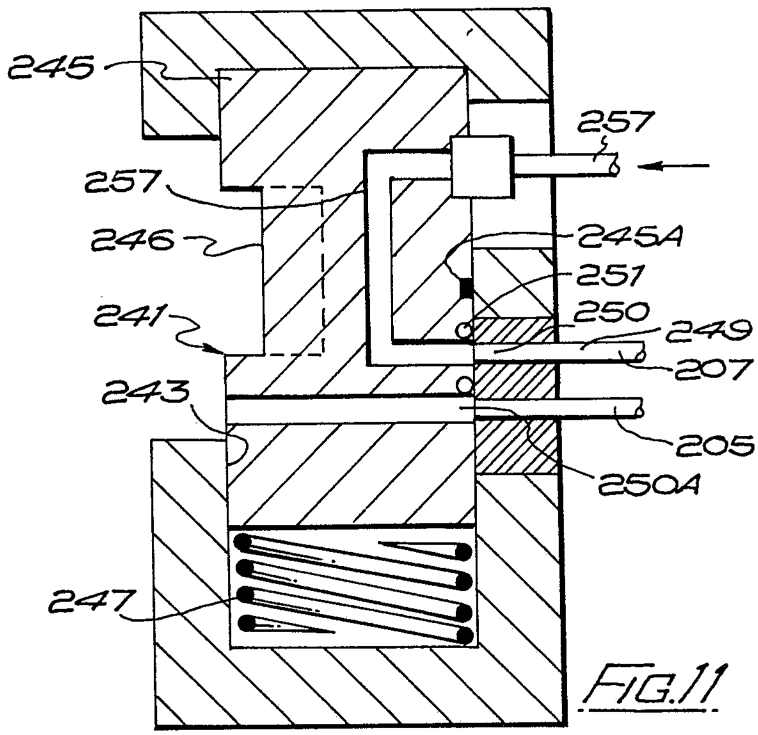
245
257
257
246
245A
251
241
250
249
207
243
205
250A
247

FIG.11

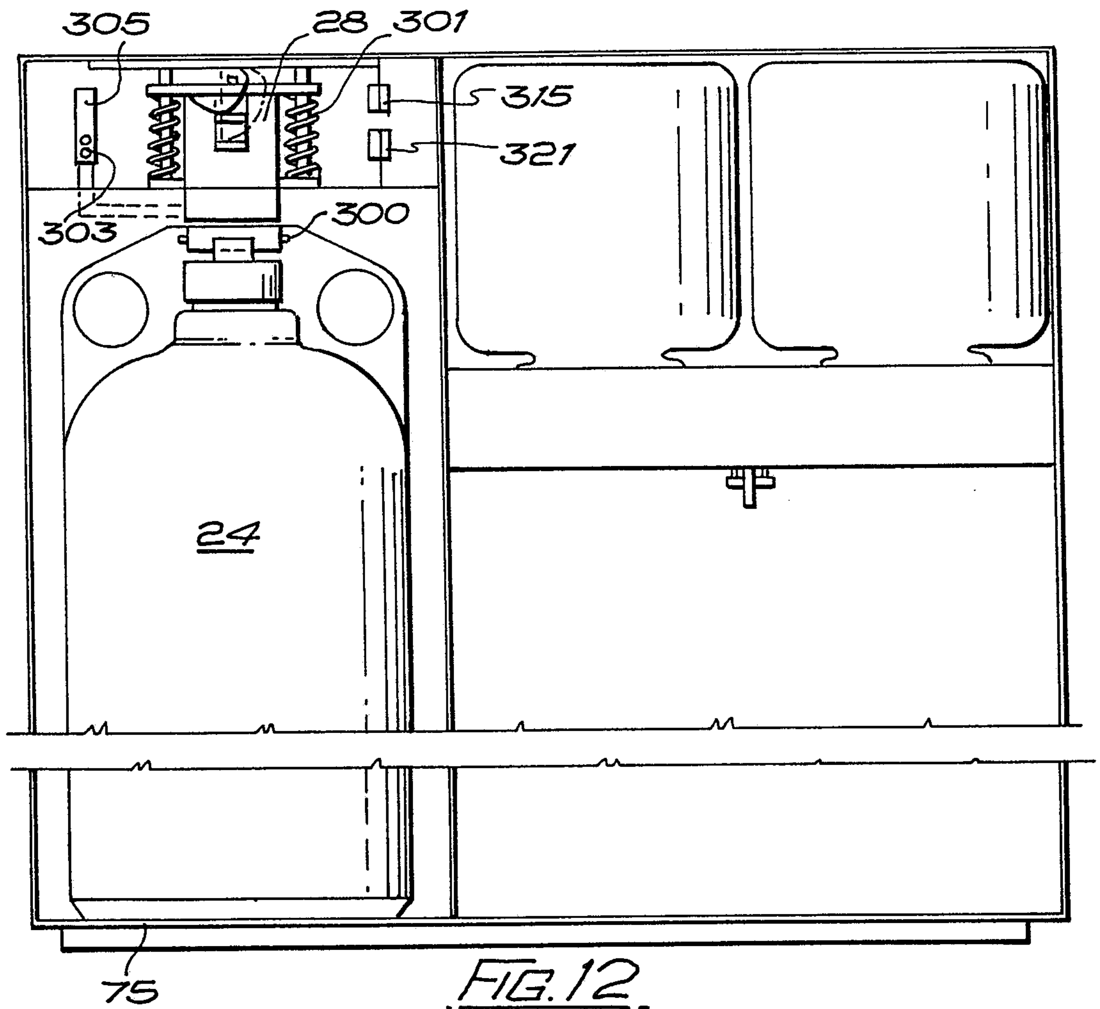
305
28
301
315
321
303
300
24
75

FIG.12

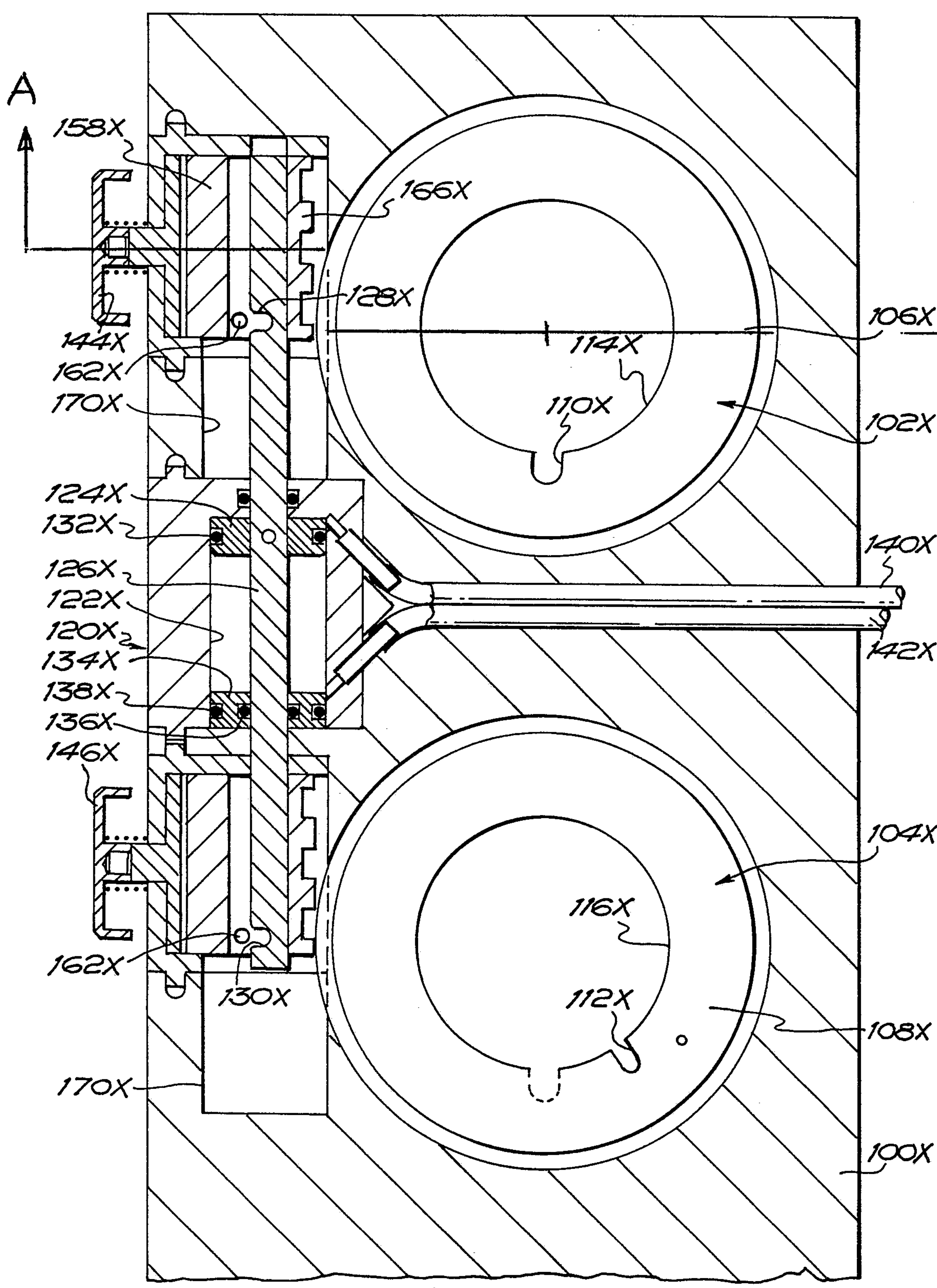
A
A
158X
166X
128X
106X
144X
162X
114X
170X
110X
102X
124X
132X
140X
126X
122X
120X
134X
142X
138X
136X
146X
104X
116X
162X
130X
112X
108X
170X
100X

FIG.11A

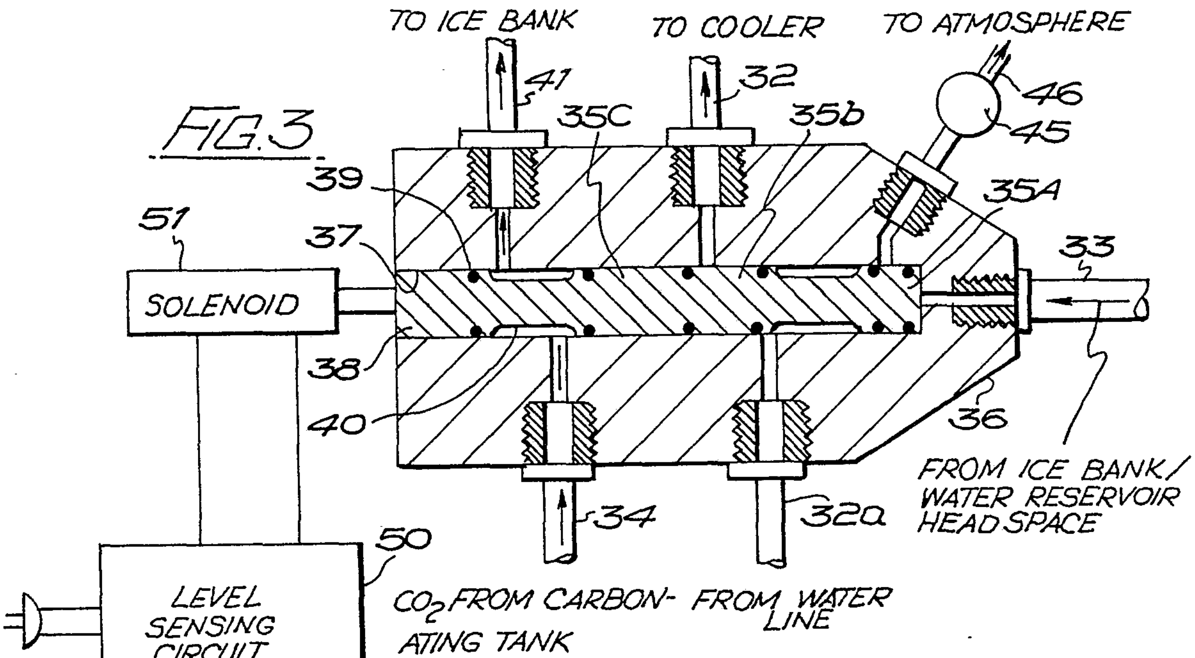

FIG. 3

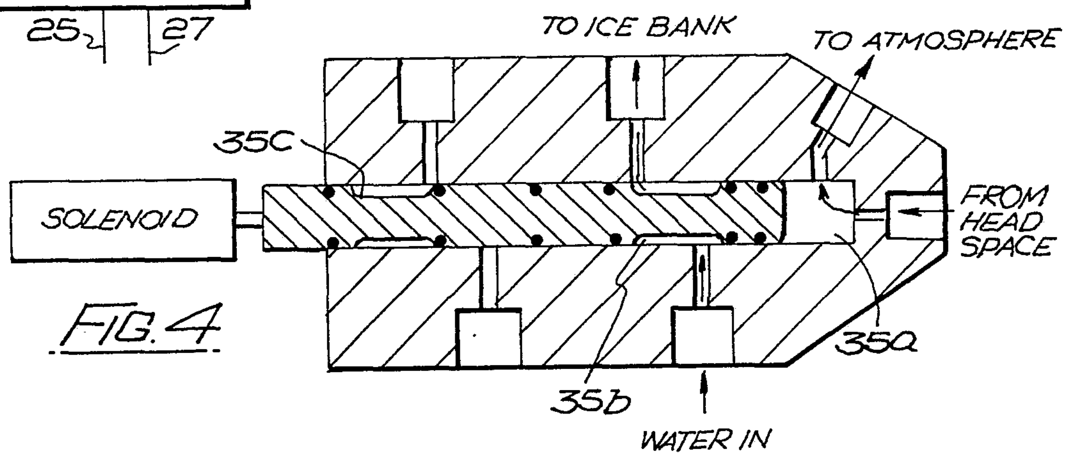

FIG. 4

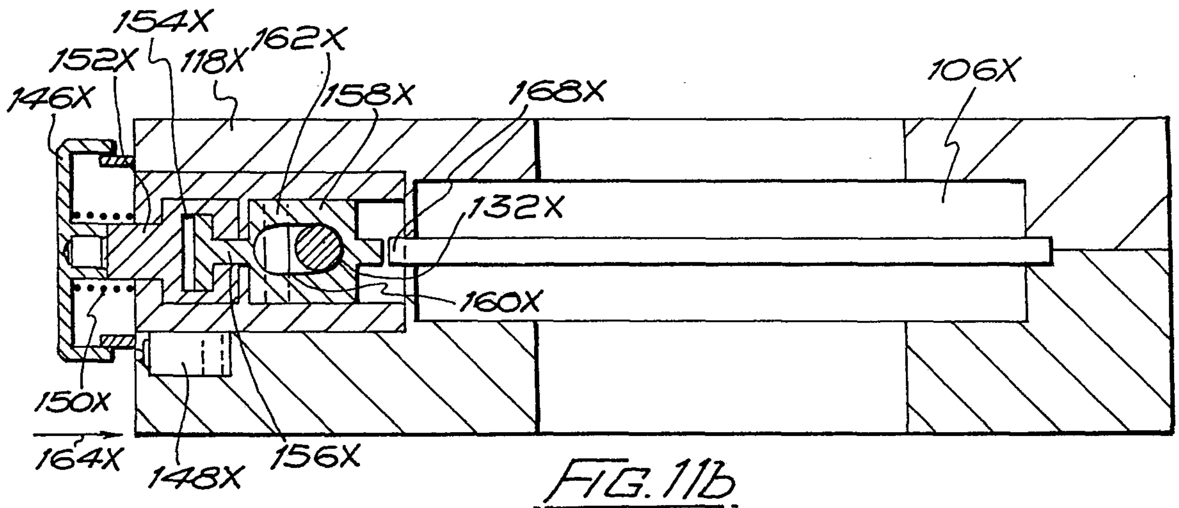

FIG. 11b

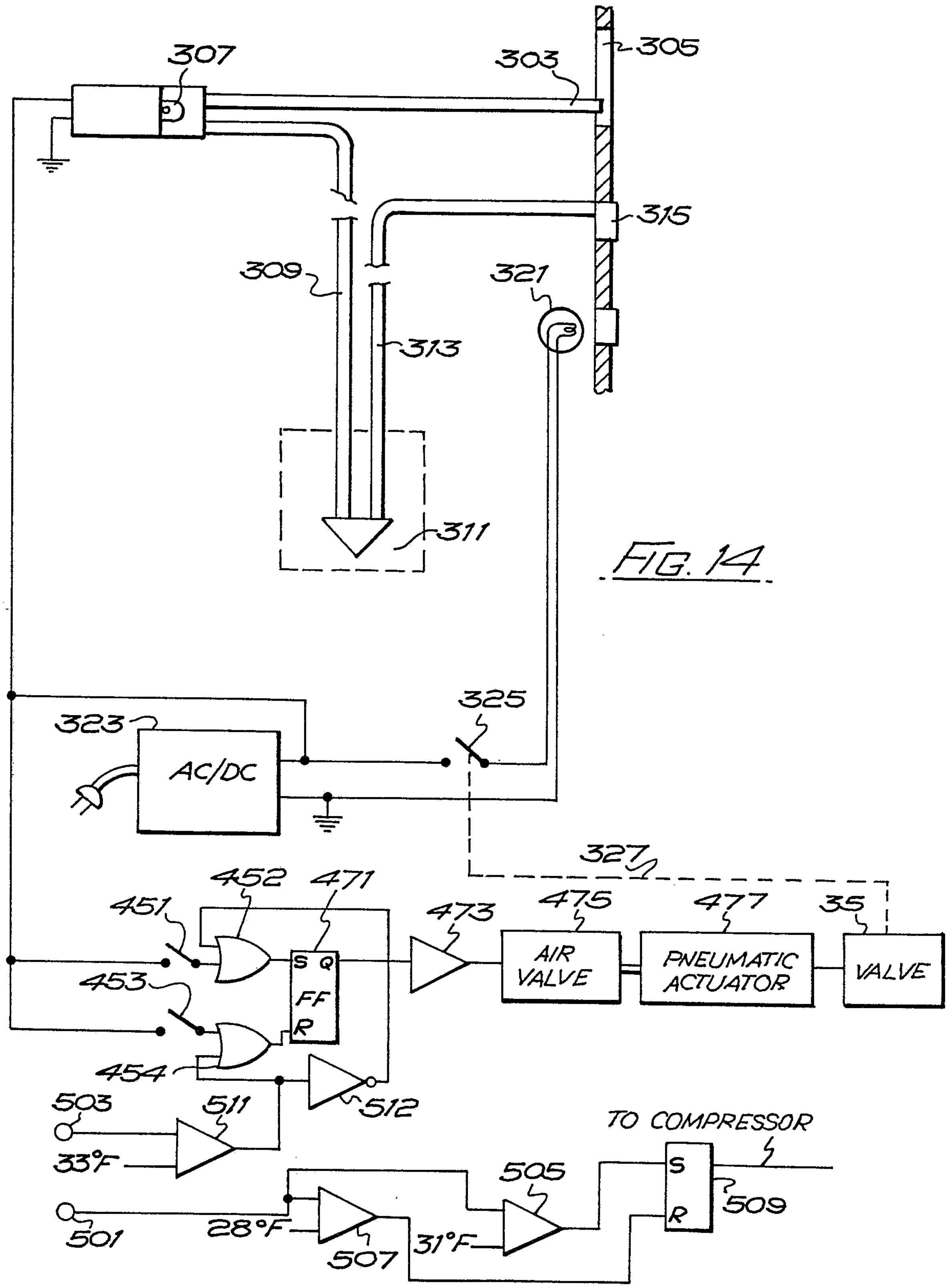
307
303
305
315
309
321
313
311
323
AC/DC
325
327
452
471
451
473
475
477
35
S Q
FF
R
AIR VALVE
PNEUMATIC ACTUATOR
VALVE
453
454
512
503
511
33°F
TO COMPRESSOR
505
S
R
509
501
28°F
507
31°F

FIG. 14