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P. A. JOHNSON
EMPTY-SENSING AND PUMP APPARATUS FOR LIQUID
VENDING MACHINES

3,055,551

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2 Sheets-Sheet 1

Fig. 1.

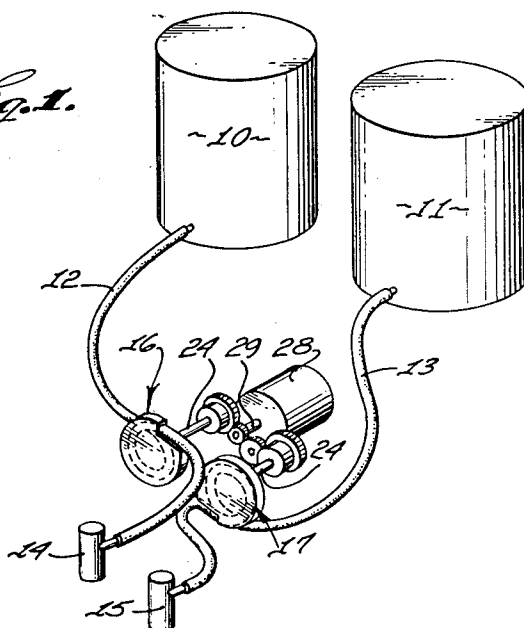
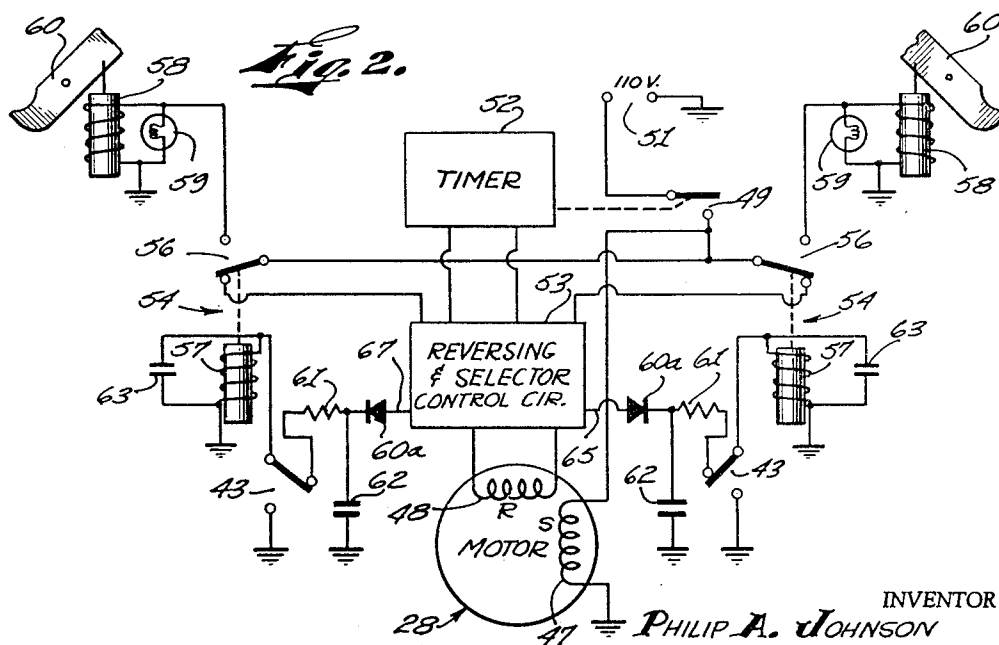


Fig. 2.



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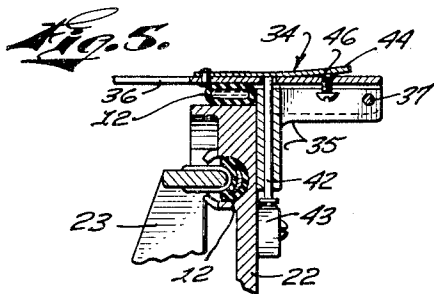
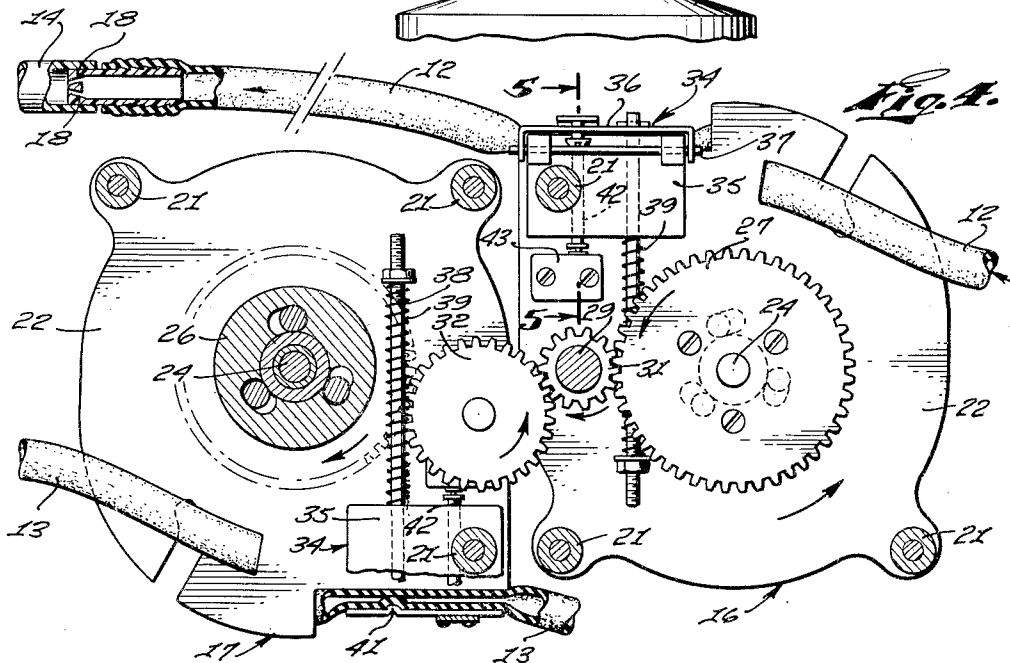
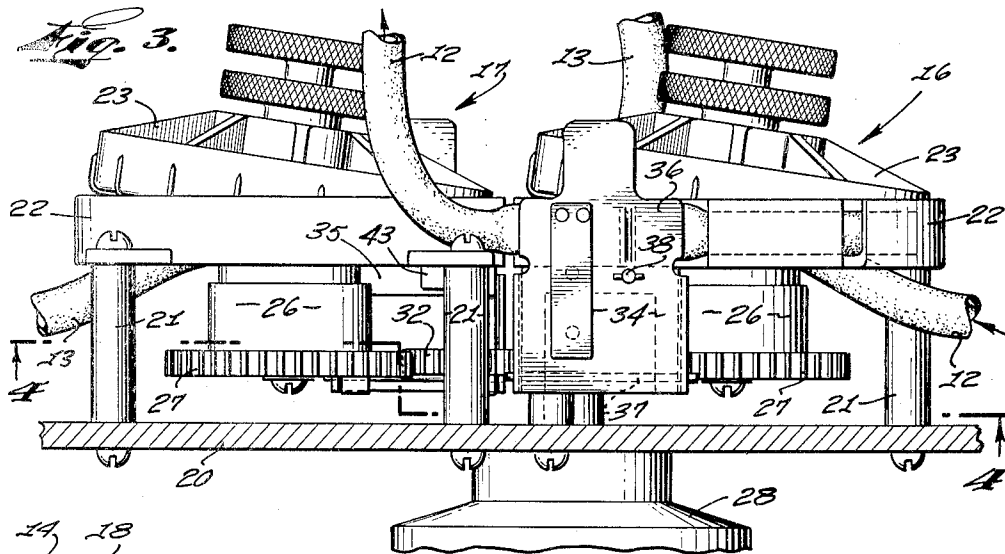
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2 Sheets-Sheet 2



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3,055,551 EMPTY-SENSING AND PUMP APPARATUS FOR LIQUID VENDING MACHINES

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6 Claims. (Cl. 222-63)

This invention relates to an apparatus for indicating the empty condition of a portion of a liquid vending machine, such as a milk shake vending machine, when such portion is empty and not before. The invention also relates to an apparatus for effecting selective operation of two different pump means by a single motor.

An object of the present invention is to provide an effective, practical and sanitary apparatus for determining when a container of liquid and its connected drain hose are substantially completely empty, such apparatus being independent of the quantity of liquid which was initially contained in the container.

A further object is to provide an apparatus for indicating the empty condition of a portion of a vending machine when there is no longer available liquid in the container associated with said portion, and not before, and for disabling such portion when such empty condition exists.

A further object of the invention is to provide a vending apparatus adapted to deliver all of the stored liquid to the customers, and to return the price of a drink to a customer receiving less than a full glass of liquid.

Another object is to provide a liquid vending apparatus adapted to vend several types of liquids, and incorporating only a single motor adapted selectively to operate the pumps for both of said types of liquids.

These and other objects and advantages of the invention will be more fully set forth in the following specification and claims, considered in connection with the attached drawings to which they relate.

In the drawings:

FIGURE 1 is a schematic perspective view indicating the containers, pumps, aerators and drive motor in a system constructed in accordance with the present invention;

FIGURE 2 is a schematic wiring diagram of the electric circuit portion of the apparatus;

FIGURE 3 is a top plan view illustrating two pumps and the associated single drive motor;

FIGURE 4 is a transverse section taken on line 4-4 of FIGURE 3; and

FIGURE 5 is a fragmentary section on line 5-5 of FIGURE 4.

Referring to the drawings, and particularly to FIGURE 1, the system may be seen to comprise two storage containers 10 and 11 adapted to contain liquids (such as milk shake mix) of different flavors. Drain hoses 12 and 13 are connected, respectively, to containers 10 and 11 and extend to aerator valves 14 and 15 which are mounted over the glasses into which the liquids are discharged. Hose-type pumps 16 and 17 are associated with the hoses 12 and 13, respectively, to pump the liquids therethrough and to meter the amount of liquid discharged. Each pump 16 and 17 may be of the type described in my co-pending application Serial No. 740,268, filed June 6, 1958, now Patent No. 2,958,294, issued November 1, 1960, for a Hose-Type Pump, and will not be described in detail herein. It is pointed out, however, that pumps of this type work on the external surface of the tube to force the liquid therethrough without coming into contact with the liquid, so that a sanitary condition is maintained.

Each aerator 14 and 15 may be of the type described in my co-pending application Serial No. 787,984, filed January 20, 1959, now Patent No. 3,003,705, issued

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October 10, 1961, for an Aerator, and will not be described in detail herein. Referring to FIGURE 4, it is pointed out that each aerator incorporates restricted orifice means 18 through which the liquid is forced when the associated pump is operating. This restricted orifice means performs an important function in the present invention, as will be described hereinafter.

It is conventional in the present art to throw away the drain hoses 12 and 13, which are rubber tubes, and the associated valves 14 and 15 after the containers 10 and 11 become empty. Only the containers are then returned to the dairy for sterilization and re-use. The vending apparatus incorporates means, not shown, to maintain the liquid under refrigeration.

Referring particularly to FIGURES 3-5, the apparatus may include a fixedly-mounted support plate 20 which is connected through posts 21 to the back-up housings 22 of the pumps 16 and 17. Pumps 16 and 17 include, in addition to the back-up housings 22, impellers 23 which are caused to wobble in response to rotation of shafts 24 as described in the above-cited co-pending application. A drain tube is mounted between the back-up housing and the wobbling impeller of each pump, the relationship being such that the wobbling causes forcing of liquid through the tube in a direction to pump the liquid from the container to and through the connected aerator.

A one-way clutch 26, for example of the illustrated sprag type, is mounted on each of the shafts 24 for impellers 23, the drive portion of each such clutch being driven by a spur gear 27. A reversible electric motor 28 is mounted on support plate 20 and has a shaft 29 on which a small spur gear 31 is provided as shown in FIGURE 4. Spur gear 31 meshes directly with the spur gear 27 for pump 16, and is associated through a suitable idler gear 32 with the gear 27 for pump 17.

Because of the presence of idler 32, the driving portion of the one-way clutch for motor 17 will be rotating clockwise when the corresponding driving portion of the clutch for motor 16 is rotating counterclockwise, and vice versa. Furthermore, each clutch is so associated with its shaft 24 that it only effects rotation of such shaft when the driving portion of the clutch is rotating counterclockwise as viewed in FIGURE 4. Thus, assuming that the motor shaft 29 is rotating clockwise as viewed in FIGURE 4, the one-way clutch for pump 16 will be rotating counterclockwise and therefore will effect operation of the pump 16. However, since the one-way clutch for pump 17 is then rotating clockwise the connection between it and the shaft 24 for pump 17 will be broken, and the pump 17 will not be operating. When the motor shaft 29 rotates in the reverse direction, pump 17 operates and pump 16 does not.

It is an important feature of the present invention that means are provided to sense whether each hose 12 and 13 is pumping liquid, particularly relatively viscous liquid such as milk shake mix, or air. Such means includes the restricted orifice means 18, previously indicated, which has such a size as to present a substantial resistance to flow of liquid but to present a relatively small resistance to flow of air. It follows that when a pump is pumping liquid, a very substantial pressure will be built up in the portion of each hose between the pump and the restricted orifice means 18, such pressure tending to force the hose to maintain a maximum-diameter condition. On the other hand, when a pump is pumping air there is relatively little pressure in the hose portion between it and the restricted orifice means 18, so that there is relatively little tendency for such hose portion to remain in maximum-diameter condition.

A means 34 to sense the diameter of the portion of each tube between its associated pump and aerator is provided, and may be referred to conveniently as a clamp

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or pinch-switch means. Each such means comprises a mounting bracket 35 which is fixedly supported on the associated back-up housing 22, and a clamping member 36 hinged to bracket 35 for pivotal movement about an axis 37. A biasing rod 38, connected to clamping member 36, is extended slidably through each mounting bracket 35 and has a compression spring 39 mounted thereon, the relationship being such that the spring strongly biases the clamping member to clamping position. When in such clamping position, the clamping member pinches a section of the associated hose 12 or 13 against a flat spot on the back-up housing 22. The clamping member has a transverse bead portion 41 (FIGURE 4) which effects complete pinching or shut-off action when the pump is not operating.

A plunger 42 is slidably mounted in each bracket 35 and bears at one end against a sensitive switch 43. The other end of each plunger extends through an opening in clamping member 36 and bears against an adjustable leaf 44 the position of which may be adjusted minutely by means of a screw 46 as illustrated in FIGURE 5.

The arrangement of the parts, and the adjustment of screw 46, are such that when a pump is pumping air after its associated container becomes empty, the hose portion between the pump and its restricted orifice means 18 will become sufficiently small in diameter or pinched, due to the action of clamping member 36 and spring 39, that switch 43 will be shifted to one of its positions which may be referred to as the empty or off position. On the other hand, when the pump is operating and is pumping liquid, switch 43 is shifted to its other or liquid-pumping position due to the expansion of the hose portion 12, which expansion is sufficient to effect outward pivoting of the clamping plate 36 despite the bias of spring 39. In the described manner, therefore, each clamping or pinch-switch means 34 senses whether the associated pump is pumping liquid or air. Furthermore, each such means 34 effects complete pinching or shut-off of liquid flow when the pump is not running, this being due to the presence of the bead 41 shown in FIGURE 4.

Proceeding next to a description of the electric circuit means shown in FIGURE 2, the motor 28 is schematically represented as having a starting winding 47 and a running winding 48. The starting winding 47 is connected between ground and a suitable start-stop switch 49 which is connected in series with a suitable source 51 of current. Since one terminal of source 51 is grounded, it will be understood that the closing of switch 49 effects energization of starting winding 47. Opening of switch 49 is effected automatically by a suitable timing mechanism 52 which is adapted to permit the switch 49 to remain closed a time period calculated to effect filling of a single glass with the beverage being vended by the apparatus.

Both the timer 52 and the running winding 48 are connected to a suitable reversing and selector control circuit which is indicated schematically at 53. Such circuit 53 contains a reversing switch adapted to reverse the direction of flow of current through the running winding 48, in response to performance of a control operation (such as pressing of a selector button) by the customer and in accordance with whether it is desired to receive beverage from container 10 or 11 (FIGURE 1). Such control operation also closes switch 49. Circuit 53 also includes suitable coin mechanism means, etc., which prevent operation unless the required price of the drink has been inserted. After the selection has been made, and after the price of the drink has been inserted and switch 49 closed, circuit 53 initiates operation of timer 52 and also determines the direction of current flow through running winding 48.

The circuit of FIGURE 2 further includes two D.C. relays 54 which are of a suitable latching or self-holding variety in order that they will remain in shifted position, until manually reset by a service man, after the

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contacts have shifted. Each such relay 54 includes single-pole double-throw contacts 56 and an energizing coil 57. The poles of the contacts 56 of the two relays 54 are connected to each other and also to the start-stop switch 49, so that such poles of both relays 54 are energized when switch 49 is closed. When in the normal positions, the poles of contact 56 are closed to terminals, as illustrated, which are connected to the reversing and selector control circuit 53. When in the shifted positions, the poles of contacts 56 are closed to terminals effecting energization of coin-return solenoids 58 and empty-indicating means 59 (such as lights connected in parallel therewith). Each solenoid 58 is associated with a suitable device 60 adapted to return the price of one drink to the customer when such solenoid is energized as will be described subsequently.

The reversing and selector control circuit 53 is connected through rectifiers 60a and resistors 61 to the previously-described switches 43 forming parts of the clamp switch means 34. Thus, a direct current is delivered to each such switch 43, the direct current being made relatively sinusoidal by the presence of a capacitor 62 which is connected between ground and the junction between each rectifier and resistor.

When each pump is at a rest, or is pumping air, the associated switch 43 is in the illustrated position with its contacts closed to effect energization of the coil 57 of the associated latching relay 54. However, when each pump is pumping liquid, the enlargement of the portion of tube 12 or 13 between the pump and restricted orifice means 18 causes shifting of the associated switch 43 to a position at which it is closed to ground, no power then being supplied to the relay coil 57. The first-mentioned position of switch 43 is the "empty" position, and the latter is the "liquid pumping" position.

It is an important feature of the invention that means are provided to delay operation of each latching relay 54 until the pump has been pumping liquid for a period of time sufficiently long to effect shifting of switch 43 to its "liquid-pumping" position. In the illustrated form, such means comprises not only the resistor 61 but also a capacitor 63 which is shunted across the coil 57 of each relay. The time delay may be, for example, $\frac{3}{10}$ of a second.

The reversing and selector control circuit 53 is provided with suitable switch means for alternately disconnecting the circuits to the rectifiers, in accordance with the control operation performed by the customer to whom liquid is being vended. More specifically, circuit 53 is provided with means to disconnect lead 65 when lead 67 is connected, and to disconnect lead 67 when lead 65 is connected.

Let it be assumed that the right half of the diagram of FIGURE 2 is associated with container 11, hose 13 and aerator 15 as well as pump 17. Conversely, the left half of the circuit of FIGURE 2 is associated with container 10, hose 12, aerator 14 and pump 16. This being the case, the right switch 43 shown in FIGURE 2 is that one which is mounted on pump 17, whereas the left switch 43 in FIGURE 2 is mounted on pump 16. Furthermore, the parts are correlated in such a manner that circuit 53 causes closing of the connection to lead 65 when the direction of current flow through running winding 48 is such that motor 28 operates in a direction effecting pumping operation of pump 17. Conversely, circuit 53 closes the circuit to lead 67 when the direction of current flow through running winding 48 is such as to effect pumping operation of pump 16.

Operation

Let it be assumed that the service man has initially stocked the vending machine with liquid containers 10 and 11 which may be either full or partially empty. The service man also primes the pumps, sets the relays 56 to the illustrated positions, and places the price of a single drink in each of the devices 60.

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Let it next be assumed that a customer wishes to obtain a drink from the container 11. He therefore puts the necessary coins in the machine, and operates the reversing and selector control 53 (as by pushing a button) to set up the system for operation by the right half of the circuit shown in FIGURE 2. Such operation also effects closing of switch 49 as previously stated.

Closing of switch 49 completes a circuit to the starting winding 47 of the motor, and also completes circuits through both of the sets of contacts 56 to the circuit 53. Current then flows to the timer 52 to effect opening of switch 49 at the expiration of a predetermined time interval sufficient to effect filling of one glass with beverage, and effects flow of current through running winding 48 in the direction adapted to cause operation of the pump 17 associated with the switch 43 (forming part of clamp switch means 34) illustrated in the right portion of FIGURE 2. Furthermore, a circuit is completed through the rectifier 60a and the resistor 61, and through switch 43, to the coil 57 of the latching relay 54 illustrated in the right portion of FIGURE 2, no such circuit being completed to the left latching relay 54 due to breaking of the circuit to lead 67 as described heretofore.

Despite creation of the circuit to the right latching relay 54, such relay does not shift due to the fact that the associated resistor 61 and capacitor 63 delay shifting thereof for a sufficient period of time to permit the pump 17 to begin operating and shift the switch 43 to "liquid pumping" position. The apparatus therefore continues operating until the timer 52 effects opening of switch 49 to stop the motor and reset the circuit for another cycle of operation.

Let it next be assumed that during a given operating cycle of pump 17 the associated container 11 and hose 13 become empty, so that pump 17 is pumping air instead of liquid. The resulting reduced pressure in the portion of hose 13 between the pump and the associated aerator valve 15 will thus cause the clamp switch means 34 to operate in a manner effecting shifting of switch 43 to the illustrated "empty" position. A circuit is therefore completed to the coil 57 of the right latching relay 54, so that at the end of a predetermined time interval such latching relay will shift.

When the relay 54 shifts, an energizing circuit is completed to the associated coin-return solenoid 58 and empty light 59. The price of the drink is therefore refunded to the customer, who received less than a full glass, and the empty light 59 is energized to warn the customer that no additional attempts should be made to obtain beverage from that particular portion of the machine. It is pointed out that, because of the parallel circuit through the left contacts 56 illustrated in FIGURE 2, the control circuit 53 remains energized until operation of timer 52 re-opens the switch 49. Thus, even though the right container 11 is empty a customer may still obtain beverage from the left container 10.

The reverse occurs when the customer desires to obtain a beverage from the left container 10, except that in this instance the left side of the diagram of FIGURE 2 becomes operative, and the direction of current flow through running winding 48 is such as to effect operation of the motor in the reverse direction so that the left pump 16 is operated instead of the right pump 17.

The control circuit 53 is such that once a latching relay 54 has shifted, the motor 28 may not thereafter run in the direction effecting operation of the pump associated with said latching relay. This prevents a customer from losing his money should he disregard a warning light 59 and attempt to obtain a drink from an empty portion of the machine.

When each switch 43 shifts away from the illustrated position, the associated capacitor 63 becomes completely discharged. This prevents variation of the time delay period due to building up of charge on the capacitor.

Various embodiments of the present invention, in addi-

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tion to what has been illustrated and described in detail, may be employed without departing from the scope of the accompanying claims.

I claim:

1. In a beverage vending apparatus, storage container means to store a beverage, a flexible elastomeric tube connected to said storage container means to drain the same, hose-type pump means to operate on the external surface of said tube and force liquid therethrough from said storage container means to the discharge end of said tube, means provided downstream from said pump means to restrict the flow of liquid through said tube, said restrictor means being adapted to cause the pressure in a downstream portion of said tube to be substantially higher when the pump means is pumping liquid than when the pump means is pumping air, means to return the price of a single drink of beverage to a customer, and means to actuate said last-named means in response to continuance during operation of said pump means of a pressure in said downstream tube portion which is lower than the normal pressure therein when said pump means is continuously pumping liquid.

2. In a beverage vending apparatus, a storage container to store a beverage, a flexible elastomeric tube connected to said storage container to drain the same, a hose-type pump to operate on the external surface of said tube and force liquid therethrough from said storage container to the discharge end of said tube, restrictor means provided downstream from said pump and communicating with said tube, said restrictor means being adapted to cause the pressure in the downstream portion of said tube to be substantially higher when the pump is pumping liquid than when the pump is pumping air, clamp means provided on said downstream tube portion to maintain the same in a relatively pinched condition when the pump is pumping air and in a relatively unpinched condition when the pump is pumping liquid during continued operation of said pump, a switch associated with said clamp means for operation thereby, said switch being in a first position when said clamp means is pinched on said tube during pumping of air therethrough or during cessation of pump operation and being in a second position when the pump is operating normally and pumping liquid, and means responsive to shifting of said switch to said first position during operation of said pump and for a time period longer than required to build up operating pressure in said downstream tube portion when said pump is pumping liquid to set up the vending apparatus for an empty condition.

3. The invention as claimed in claim 2, in which said last-named means includes a time delay relay associated with said switch and adapted to operate upon being energized continually for a time period longer than the time period required by said pump to achieve substantially normal operating condition, and circuit means to effect energization of said time delay relay through said switch upon energization of said pump.

4. The invention as claimed in claim 2, in which said apparatus additionally includes a second pump, storage container, hose, restrictor means and switch, and in which motor means and one-way clutch means are provided to effect alternate operation of said first-mentioned pump and said second pump in response to operation of said motor means in opposite directions.

5. A vending apparatus, which comprises first and second storage containers for beverage, first and second elastomeric hoses connected to said storage containers to drain beverage therefrom, first and second hose-type pumps adapted to operate on the respective hoses to force beverage therethrough from said storage containers to discharge points, a reversible electric motor, one-way drive means to connect said motor to both of said pumps to effect alternate operation of said pumps in accordance with the direction of operation of said motor, and means responsive to reduction in the pressure in at least one of said

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hoses downstream from the associated pump to set up the corresponding portion of the vending apparatus for empty condition.

6. In a beverage vending machine, first and second storage containers for beverage, first and second pumps respectively adapted to pump beverage from said storage containers to discharge points above glasses to be filled with beverage, a reversible electric motor, means to connect said motor to both of said pumps and to effect operation of only one of said pumps by said motor when said motor is operating in a first direction and only the other of said pumps by said motor when said motor is operat-

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ing in a second direction, and selector circuit means to control the direction of operation of said motor and thereby determine the container from which beverage is drawn.

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