CONTROL APPARATUS FOR MIXING TWO INGREDIENTS IN DEFERRERENTS

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This invention relates to control apparatus and more specifically to a liquid dispenser for mixing a liquid concentrate with a liquid diluent in a given ratio. The invention finds particular application in liquid food dispensers such as those which mix a concentrate with a diluent at the time of demand. Exemplary of the type of machines in which this invention finds application is a fruit juice dispenser wherein a refrigerated concentrate and a chilled water are mixed upon demand to provide a drink which tastes very much like fresh fruit juice.

Various types of dispensing apparatus have been used in the past for mixing and dispensing liquid foods. These include the type wherein the flow of water through an aspirator causes the flow of concentrate therewithin to a mixing chamber. Another arrangement has a metering device wherein a fixed quantity of the concentrate is supplied each time the device is actuated and then the diluent is simply added to it. One of the chief disadvantages of the aspirator arrangement is the dimensional criticalness of the elements of the aspirator and the problems in keeping them clean. The second type of device offers another disadvantage in that it must generally be set to dispense only a particular quantity each time the device is actuated. In other words, the measured quantity must be mixed with only a certain quantity of diluent if the resulting drink is to have the desired strength.

We have provided, by our invention, a dispensing arrangement which is extremely simple, which is easy to clean, and which provides the proper mixture of concentrate to diluent regardless of the quantity of the mixture withdrawn in a single actuation. This is accomplished by utilizing a means for storing the concentrate at substantially atmospheric pressure and providing a constant rate pump operable to convey concentrate to a mixing area. The diluent is supplied at a substantially constant pressure and is supplied to the mixing area through a control valve and metering arrangement wherein, when the control valve is open, the water is supplied to the mixing area due to its own pressure, at a rate selected with respect to the pumping rate of the concentrate pump, such that the desired ratio of concentrate to diluent is supplied to the mixing area when both the pump and the diluent control valve are actuated simultaneously.

Various objects and advantages of our invention will become apparent upon reading the following detailed description of a preferred embodiment thereof wherein reference is made to the drawing, the single figure of which discloses a liquid food dispenser constructed according to our invention.

Referring to the drawing, reference numeral 10 generally designates a liquid food dispenser which is housed in an appropriate housing or case, such as that shown in phantom outline and designated by the numeral 11. Inside the housing 11 there is provided concentrate storing means, such as tank 12 which is adapted to contain a supply of liquid food concentrate 13 at substantially atmospheric pressure. Also contained in casing 11 is a diluent supply means 14 which preferably includes a storage tank 15 having an inlet pipe 16 which is adapted to be connected to a source of liquid diluent, such as water, preferably provided at a substantially constant pressure, greater than atmospheric. To assure that a substantially constant pressure is maintained, a pressure regulator valve 17 may be connected in inlet line 16. Since the use of such a regulator to assure constant pressure is well known, the regulator shall not be considered a part of the "diluent supply means" as the term is used in the claims hereof. Rather, it shall be considered a part of the "source of liquid diluent" to which the diluent supply means is adapted. A refrigeration unit 20 is also mounted in housing 11 and is shown schematically in the drawing. The exact construction of this refrigeration unit is not a part of the invention and it may be any commercially available refrigeration unit having two evaporators. In this particular case, one of these evaporators includes a plurality of coils 21 wrapped around the diluent tank 15 and the second evaporator includes a plurality of coils 22 wrapped around the concentrate tank 12 to keep it at the desired temperature.

The dispenser includes a dispensing nozzle 23 which preferably includes a mixing chamber or area 24 connected to an outlet chamber or area 25 by a restricted passage 26. If it is desired to arrest the mixed liquid, as is necessary in dispensing many beverages, an aeration unit 27 may be placed immediately downstream of the restricted passage 26. A concentrate conduit 30 connects concentrate tank 12 with mixing chamber 24 and includes a portion 31 which extends into the lower portion of tank 12. Con- nected in conduit 30 is a pump 32 which is operable to pump concentrate from tank 12 to mixing area 24 at a constant predetermined rate. Pump 32 is preferably, but not necessarily, of the compressible-tube type. This type of pump is well known in the prior art and may be, for example, of the general type shown in the De Baey Patent No. 2,018,998. This type of pump utilizes a flexible tube 33 which is compressed by a roller 34 which passes over it to positively displace fluid through the flexible tube. Roller 34 is driven by a rotary motor 35 connected to it through appropriate gearing or the like, shown schematically at 36.

Diluent tank 15 is connected to mixing chamber 24 by a diluent conduit 40. This conduit may extend around tank 15 in a coil adjacent the coils 21 of the evaporator so that the water is additionally chilled as it leaves tank 15 and moves towards mixing chamber 24. Disposed in conduit 40 is an electrically operated, normally closed, control valve 41, having an operator 41a. Also provided is a means for metering the water as it flows through conduit 40 so that, when valve 41 is open, water flows to mixing chamber 24 at a rate chosen with respect to the pumping rate of pump 32 such that the desired ratio of concentrate to diluent is supplied to the mixing chamber. This may be obtained by choosing conduit 40 such that flow therethrough would be just adequate, with the conditions under which the dispenser is to operate, so that flow therethrough would be properly matched with respect to the pumping rate of pump 32. Preferably, however, some type of restriction is placed in conduit 40. In the preferred embodiment, this is an adjustable restriction so that the ratio of concentrate to diluent can be easily changed if necessary. In the preferred embodiment we use an adjustable needle valve 42 which may be a separate valve, as shown in the drawing or it may be built right into on-off valve 41.

Power for activating motor 35 and operator 41a, as well as refrigeration unit 20, is supplied by a pair of conductors 44 and 45 which are adapted to be connected to an appropriate power supply. Refrigeration unit 20 is connected directly across these two conductors while the motor and valve operator are connected thereto through an appropriate switch 46. Switch 46 is operable by a manual actuator 47 which may take the form of a paddle-like member positioned so that when a glass is placed
under the dispensing nozzle, the glass may be pressed against actuator to close switch. Motor 35 and operator are connected electrically in parallel so that closing the switch results in energization of both the motor and the valve operator.

Various additional equipment may be provided in the dispenser but since these items form no part of the present invention, they have been omitted for simplicity.

The operation of the dispenser will be readily apparent from the above description of the elements thereof and, therefore, will be described only briefly herein. As indicated, the liquid diluent, such as water, is supplied at a substantially constant pressure greater than atmospheric while the concentrate is stored in tank under the dispensing nozzle. With switch open, valve is closed to interrupt the flow of water from tank to mixing chamber. When roller 34 of pump 32 is stationary, it acts as a valve to block off the passage of fluid through the mixing chamber and also prevents concentrate in conduit 30, between tank and pump, from flowing back into tank.

When actuator is operated to close switch, motor 35 and the operator 41 are simultaneously activated. Valve 41 opens and water begins to flow, at a rate determined by the position of needle valve 32, to mixing chamber. At the same time, motor 35 begins to drive roller 34 in a clockwise direction to pump concentrate to mixing chamber. Preferably, motor 35, and consequently roller 34, operates at a fixed rate so that whenever the motor is energized, concentrate is pumped at a constant rate per unit time. Needle valve 42 is adjusted so that the rate of flow of water through conduit 40, when valve 41 is open, is such that the ratio of diluent to concentrate, when the pump is operating and valve 41 is open, is exactly the desired ratio. Should it be desired to change the ratio of these two constituents it is only necessary to readjust needle valve.

As concentrate and water enter mixing chamber, considerable turbulence results so that good mixing of the two is obtained. The mixture then passes through the restricted passage and, due to the low pressure immediately on the opposite side of the restriction, air is drawn in through an opening to aerate the mixture which then passes through the outlet to the glass or other vessel which is to be filled.

Since valve 41 and pump 32 continue to operate simultaneously so long as actuator is held in a position to close switch, any desired quantity of mixture may be withdrawn in a single actuation. Regardless of the quantity withdrawn, the desired ratio of concentrate to diluent is maintained.

As indicated previously herein, we have disclosed only a preferred embodiment of our invention and various changes may be made without departing from the spirit of the invention. For example, the specific type of pump used is not critical although we have found that the compressible type pump is particularly advantageous in that it is simple and inexpensive, relatively easy to clean, and reliable. Also, the particular manner in which the metering of the diluent is accomplished is not critical but an adjustable orifice is preferable so that the ratio of the two constituents can be varied when necessary. The exact structure of the dispensing nozzle forms no part of this invention, it being required only that this nozzle provide adequate mixing and aeration. There is no necessity that our invention be used only in a dispenser wherein the liquids are cooled and, obviously, the particular type of liquids which are used is of no consequence to the invention. Since various modifications may be apparent to those skilled in the art in view of our disclosure herein, it is to be understood that our invention is not limited to the specific embodiment disclosed, but rather by the scope of the appended claims.

We claim as our invention:

1. A liquid food dispenser for selectively mixing a liquid food concentrate with a liquid diluent in a given ratio, comprising:
   - concentrate storing means;
   - diluent supply means adapted to be connected to a substantially constant pressure source of liquid diluent;
   - mixing means for mixing the concentrate and the diluent;
   - constant rate pumping means operable to convey concentrate from said storing means to said mixing means at a predetermined rate;
   - liquid conduit means connecting said diluent supply means to said mixing means, said conduit means including control means normally-closing said conduit means operable to open said conduit means to permit flow of said diluent due to pressure and at a substantially constant rate which is selected with respect to said predetermined rate at which concentrate is conveyed by said pumping means so that when said pumping means and said control means are operated simultaneously, concentrate and diluent are supplied to said mixing means in said given ratio; and
   - actuator means connected in controlling relationship with said pumping means and said control means and selectively operable to effect simultaneous operation thereof.

2. The liquid food dispenser of claim wherein said control means includes a normally closed valve and said conduit means includes flow restriction means to establish the rate of flow of diluent when said valve is open.

3. The liquid food dispenser of claim wherein said flow restriction means is adjustable to vary the ratio of concentrate to diluent.

4. The liquid food dispenser of claim wherein said pumping means is a rotary compressible-tube pump, said control means includes a normally closed valve, and said actuator means is connected to effect simultaneous rotation of said pump and opening of said valve.

5. The liquid food dispenser of claim wherein said pump rotates at a fixed rate and said conduit means includes flow restriction means which is adjustable to vary the ratio of concentrate to diluent.

6. A liquid food dispenser for selectively mixing a liquid food concentrate with a liquid diluent in a given ratio, comprising:
   - concentrate storing means;
   - diluent supply means adapted to be connected to a substantially constant pressure source of liquid diluent;
   - mixing means for mixing the concentrate and the diluent;
   - a rotary compressible-tube pump operable to convey concentrate from said storing means to said mixing means at a predetermined rate;
   - a rotary electric motor operably connected to said pump and operable to rotate said pump at a fixed rate;
   - liquid conduit means connecting said diluent supply means to said mixing means, said conduit means including a normally closed valve normally closing said conduit means and having an electromagnetic actuator operable to open said valve to permit flow of diluent due to pressure and at a rate which is selected with respect to said predetermined rate at which concentrate is conveyed by said pump so that when said pump and said valve are operated simultaneously, concentrate and diluent are supplied to said mixing means in said given ratio;
   - flow restriction means in said conduit means and adjustable to select the rate of diluent flow and thereby the ratio of concentrate to diluent;
   - and the liquid means including electric circuit means having switch means connected in controlling relationship with said motor and said valve actuator, and selectively operable to simultaneously connect
said motor and said valve actuator to a source of electrical power.

7. A liquid dispenser for mixing a liquid concentrate with a liquid diluent in a predetermined ratio, comprising: a tank for storing concentrate at atmospheric pressure; 5 diluent supply means adapted to be connected to a source of liquid diluent at a substantially constant pressure greater than atmospheric; means providing a mixing area wherein concentrate and diluent are combined;

concentrate conduit means connecting said tank to said mixing area;
a positive displacement pump connected in said concentrate conduit means and effective, when activated, to pump concentrate to said mixing area at a uniform time rate;
diluent conduit means connecting said diluent supply means to said mixing area;
valve means connected in said diluent conduit means and operable between a normal condition wherein the connection between said supply means and said mixing area is interrupted and an activated condition wherein said supply means and said mixing area are connected so that diluent flows to said mixing area due to its pressure;
metering means in said diluent conduit means and regulating the flow of diluent therethrough to a rate such that upon operation of said pump, when said valve means is in said activated condition, concentrate and diluent are supplied to said mixing area in said predetermined ratio;
and actuating means selectively operable to effect simultaneous activation of said pump and said valve means.

8. The dispenser of claim 7 wherein said pump is an electric motor driven compressible-tube pump and said valve means has an electric operator energizable to operate said valve from said normal condition to said activated condition.

9. A liquid dispenser for mixing a liquid concentrate with a liquid diluent in a predetermined ratio, comprising: a tank for storing concentrate at atmospheric pressure; diluent supply means adapted to be connected to a source of liquid diluent at a substantially constant pressure greater than atmospheric;

means providing a mixing area wherein concentrate and diluent are combined;
concentrate conduit means connecting said tank to said mixing area;
am electric motor driven compressible-tube pump connected in said concentrate conduit means and effective, when activated, to pump concentrate to said mixing area at a uniform time rate;
diluent conduit means connecting said diluent supply means to said mixing area;
valve means connected in said diluent conduit means and operable between a normal condition wherein the connection between said supply means and said mixing area is interrupted and an activated condition wherein said supply means and said mixing area are connected so that diluent flows to said mixing area due to its pressure, said valve means having an electric operator energizable to operate said valve means from said normal condition to said activated condition;
metering means in said diluent conduit means and regulating the flow of diluent therethrough to a rate such that upon operation of said pump, when said valve means is in said activated condition, concentrate and diluent are supplied to said mixing area in said predetermined ratio;
and actuating means including electric circuit means adapted to connect said pump motor and said valve operator to a source of electrical energy, and a manually operable switch connected in said circuit means in controlling relationship with said motor and said valve operator and selectively operable to effect simultaneous activation of said pump and said valve means.

10. The dispenser of claim 9 wherein said pump operates at a substantially fixed rate and said metering means is adjustable to vary said predetermined ratio of diluent to concentrate.

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