

[54] **FLOATING INGREDIENT TANK SOLD-
OUT SYSTEM FOR BEVERAGE
DISPENSING MACHINES**

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[22] Filed: **Aug. 18, 1970**
[21] Appl. No.: **64,693**

[52] U.S. Cl. **222/51, 137/408, 222/183**
[51] Int. Cl. **B67d 5/22**
[58] Field of Search **177/207; 222/23, 40, 41, 51,**
222/64, 65, 66, 160, 146, 183; 137/558, 408; 4/228,
53-55; 116/110; 73/296, 307-308, 309; 220/17;
114/16 E

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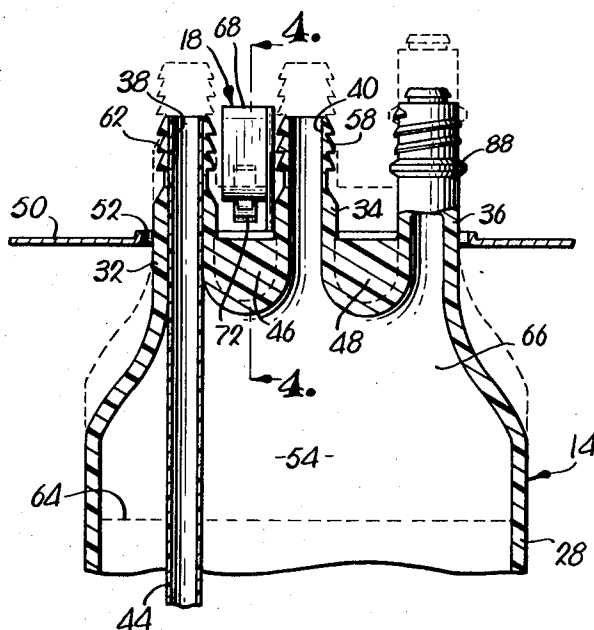
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[57] **ABSTRACT**

Apparatus for at least temporarily storing liquid material employs a container for such material that is "floated" in another body of liquid and shifts its position under the opposing influences of buoyancy and gravity in response to predetermined changes in the amount of material within the container, and sensing means for detecting such shifting of the position of the container to indicate the presence or absence in the container of a predetermined amount of the material.

The apparatus further provides means for controlling the temperature of the body of liquid in which the container is immersed to in turn control the temperature of material within the container through heat exchange. Although the apparatus is adapted for a variety of applications, a preferred embodiment disclosed for illustrative purposes is especially suited for use in beverage vending or dispensing machines to handle beverage syrups or other liquid beverage forming ingredients and to indicate a "sold-out" condition thereof.

13 Claims, 5 Drawing Figures



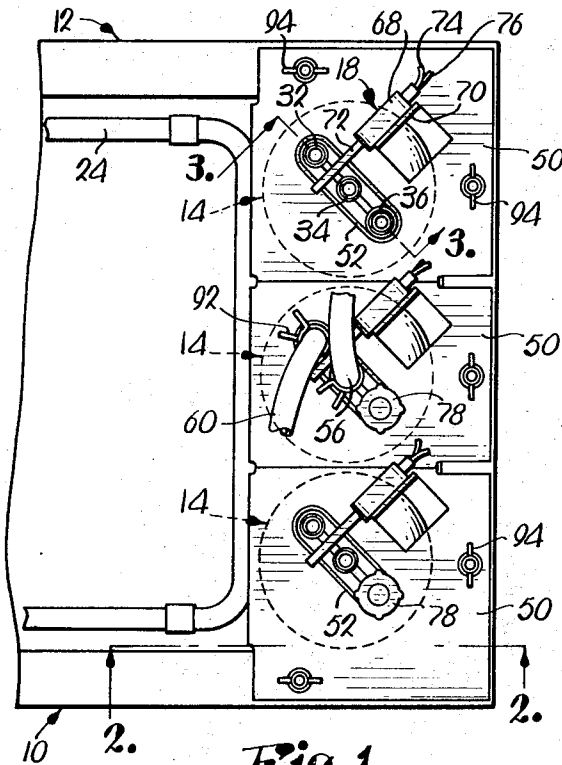


Fig. 1.

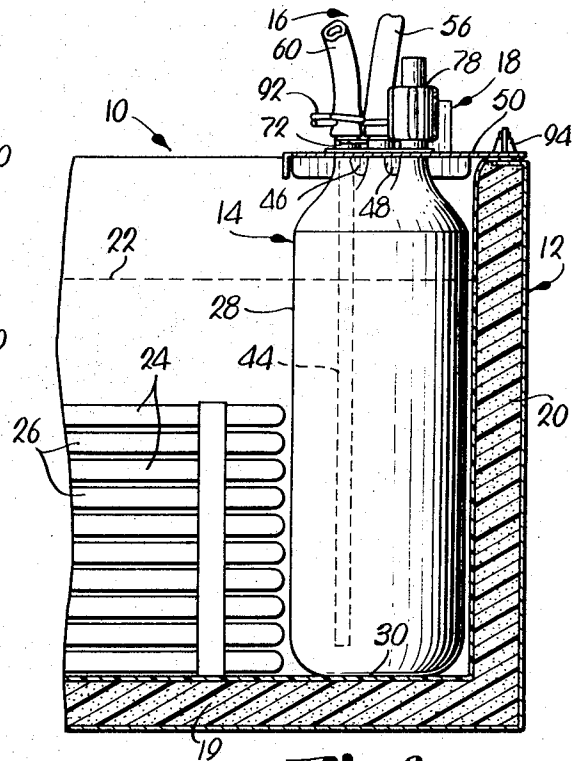


Fig. 2.

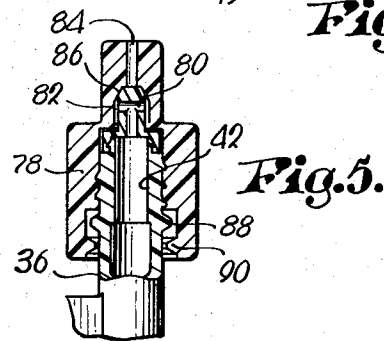


Fig. 5.

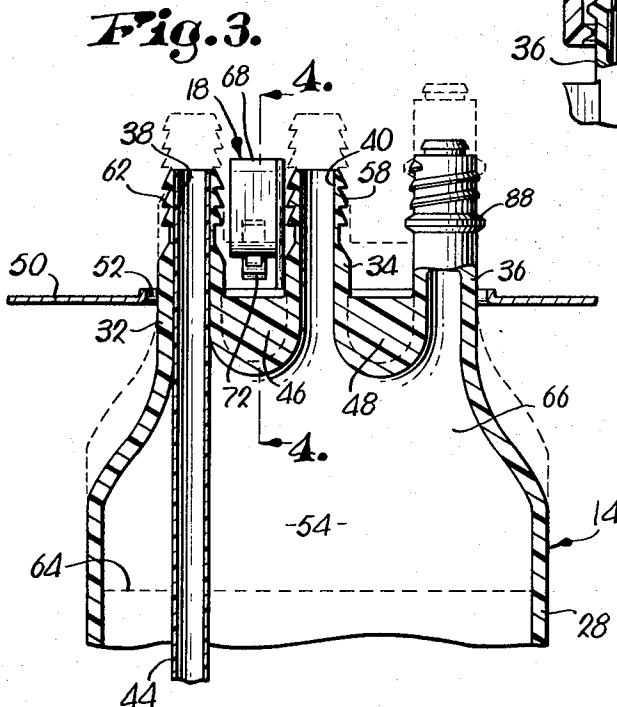


Fig. 3.

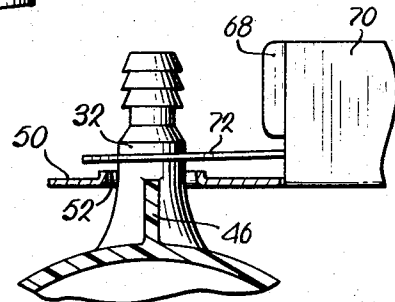


Fig. 4.

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FLOATING INGREDIENT TANK SOLD-OUT SYSTEM FOR BEVERAGE DISPENSING MACHINES

This invention relates to the field of liquid handling apparatus and, more particularly, to an arrangement having particular utility in beverage vending or dispensing machines for detecting the quantity of liquid within a reservoir container.

Although the principles of the invention have broader applicability, it will be described for illustrative purposes with reference to the use of the invention in connection with the means provided in beverage vending or dispensing machines for the storage of beverage forming syrups or other liquid ingredients.

Modern beverage vending or dispensing machines normally make provision for the dispensing of beverages of several different flavors. It is necessary, therefore, that the machine be provided with reservoir containers for storing syrups or other liquid beverage forming ingredients for each of the flavors of beverage to be dispensed. Moreover, it is desirable in such machines that means be provided for separately indicating a "sold-out" condition with respect to each different flavor of beverage being offered in order that the entire machine will not be rendered inoperative as to all flavors when the beverage forming ingredients for merely one flavor have been expended. Conventionally, the beverage forming syrups for each flavor are stored in the vending machine in relatively large and rugged tanks suitable for transportation from one vending machine location to another for servicing purposes. There has heretofore been no really satisfactory, reliable and economical means for sensing a condition of exhaustion of the beverage forming ingredient from one or more of such primary storage tanks.

Another problem in such beverage vending or dispensing machines has existed with respect to the desirability of serving most beverages in a cooled condition in the light of the difficulty of attempting to cool the syrup component of the beverage forming ingredients while the same is stored in the primary tanks. Conventional practice is, therefore, merely to attempt to cool the syrup during its passage through a portion of the syrup carrying conduit which is immersed in a cold water bath. Obviously, however, the quantity of syrup that can be thus maintained in a cooled condition, as well as the amount of cooling that can be imparted thereto, has been necessarily limited and found to be quite inadequate for machines employed at "high demand locations" where the apparatus may be required to deliver substantial quantities of beverage on a more or less continuous basis. An overall better beverage product results if all of the beverage forming components and ingredients can be thoroughly cooled prior to intermixing to present the product to be vended or dispensed.

Accordingly, it is the primary object of this invention to provide apparatus that accomplishes a practical and economic solution to both of the above-mentioned problems.

It is another important object of the invention to provide means for handling stored beverage ingredients or other liquids in a manner such that they may conveniently be subjected to effective cooling or other temperature treatment and involving an arrangement of parts providing a convenient and reliable indication of the quantity of stored liquid or some significant parameter of such quantity such as the depletion thereof below a predetermined amount.

It is another important object of the invention to provide liquid handling apparatus in which a beverage ingredient or other liquid is introduced into and incrementally discharged from a reservoir container that is at least partially immersed in an outer body of liquid, so that the position of the reservoir container under the opposing influences of buoyancy and gravity will provide an indication of the amount of liquid within the reservoir container at any given time.

It is still another object of the invention to provide such apparatus which includes means responsive to positioning of the reservoir container for sensing the quantity of liquid within the container or some particular quantitative condition thereof.

It is still another object of the invention to provide such apparatus which includes means for cooling or otherwise con-

trolling the temperature of the body of exterior liquid in which the reservoir container is immersed for maintaining the temperature of liquid within the reservoir container in a cooled or other wise non-ambient condition.

Still other objects of the invention will be made clear or become apparent from the accompanying drawing and the description of an illustrative embodiment of the invention that follows.

In the drawing:

FIG. 1 is a fragmentary, top plan view of a currently preferred embodiment of the invention illustrating the application of the principles of invention in a beverage vending or dispensing machine;

FIG. 2 is a fragmentary, cross-sectional view taken on line 2—2 of FIG. 1;

FIG. 3 is a fragmentary, cross-sectional view taken on line 3—3 of FIG. 1;

FIG. 4 is a fragmentary, cross-sectional view taken on line 4—4 of FIG. 3; and

FIG. 5 is a fragmentary, cross-sectional view showing the detail of the closure cap employed on the vent port of one of the liquid containers forming a part of the apparatus to be described.

Broadly, the apparatus of the invention contemplates the employment of a reservoir container at least partially immersed in a body of liquid in such manner that the container will tend to float under the influence of its buoyancy as it is emptied but will remain immersed under the influence of gravity while filled to at least a predetermined extent, so that detection of significant changes in the position of the container, for example, when it moves from a "sinking" condition to a "floating" condition, may be used as an indication of a corresponding change in the quantity of liquid held by the container.

The invention further contemplates that the temperature of the body of liquid within which the container is immersed may be controlled for maintaining a desired temperature condition in the liquid within the container. The invention further contemplates that the liquid within which the container is immersed may be held by an outer tank providing a frame of mechanical reference for detecting changes in the position of the container, as well as providing a support for sensing mechanism adapted to respond to changes in position of the container and produce an intelligible action indicative thereof.

The invention still further contemplates that various means for altering the amount of liquid material within the container, through introducing liquid into the container, dispensing liquid from within the container or both, may be provided depending upon the particular application involved, so that the apparatus may be adapted for indicating a variety of conditions respecting the quantity of liquid within the container, such as the depletion of such liquid to a predetermined extent, the filling of the container with such liquid to a predetermined extent, etc. Accordingly, it will be apparent to those skilled in the art that the invention is adapted for application in a variety of fields and for a variety of specific purposes. It will be further understood, therefore, that the detailed showing and description of a preferred embodiment of the invention as applied in a beverage vending or dispensing machine is intended to be illustrative rather than restrictive in character.

Referring to the drawing, the preferred illustrative embodiment of the apparatus of the invention is broadly designated by the numeral 10 and broadly includes main tank means 12, a plurality of reservoir container means 14, means broadly designated 16 for altering the quantity of a liquid material adapted to be held by the container means 14, and means 18 for sensing the position of each container means 14 relative to the tank means 12.

The tank means 12 includes a preferably heat insulated bottom wall 19 and sidewalls 20 and is substantially filled with a liquid substance, such as water, as at 22. A heat exchanger such as a coil 24 is disposed within the tank 12 below the sur-

face of the liquid substance 22, and it will be understood that the coil 24 is adapted to be kept charged with a refrigerating fluid for cooling the body 22 of liquid substance within tank 12 in machines for the dispensing of cooled beverages, but could be supplied with a heated fluid in a machine for dispensing hot beverages or in other applications where heating rather than cooling of the contents of the container means 14 is desired. In a typical machine for dispensing cooled beverages, a second coil 26 may be disposed within the body 22 of liquid substance adjacent the convolutions of coil 24 for the purpose of cooling water or carbonated water to be used in mixing the final beverage product. It will be noted that one extremity of the coils 24 and 26 is preferably spaced from the adjacent sidewall 20 of tank 12 so as to provide a space therebetween for receiving the lower portions of the tank means 14 to prevent any extensive lateral movement of the latter when under the influence of their buoyancy.

The reservoir container means 14 may each preferably be formed of a suitable plastic material adapted to permit heat exchange between the contents of the containers 14 and the body of liquid substance 22 in tank 12. Each container 14 includes a vertically elongated sidewall 28, a bottom wall 30, a plurality of necks 32, 34 and 36 presenting respectively a material outlet port 38, a fluid inlet port 40, and a venting port 42, which are required in the preferred beverage vending machine application but might not all be necessary in certain other applications. An outlet tube 44 extends downwardly from the outlet port 38 in neck 32 to a position slightly above the bottom wall 30 of each container 14. Each container 14 is provided with a rib portion 46 extending across between the lowermost parts of necks 32 and 34 and with a rib 48 extending across between the lowermost parts of necks 34 and 36 for a purpose hereinafter to be described.

The containers 14 are disposed in side-by-side relationship within the tank 12 and extend downwardly into the body 22 of water or other liquid substance in tank 12, with the lower portions of the containers 14 loosely confined against lateral movement in one direction by their side-by-side disposition and in the other direction by their positioning between the coil 24 and the sidewall 20 of the tank 12. The tank 12 is provided with inwardly extending plate means 50 at the top thereof for each of the containers 14, and the plate means 50 are provided with an elongated slot 52 therein for clearing the necks 32, 34 and 36 of each corresponding container 14. The disposition of the necks 32, 34 and 36 in position extending upwardly through the slots 52 serves both to confine the upper portion of the containers 14 against lateral movement and to permit convenient coupling of the means 16 for introducing and discharging liquid to and from the interior of each container 14 through the ports 38 and 40 defined by necks 32 and 34. It will be noted, however, that the slots 52 sufficiently clear the necks 32, 34 and 36 to permit free upward and downward movement of the container means 14 relative to the liquid body 22 and the tank 12 responsive to the opposing influences of buoyancy and gravity upon the containers 14 and the contents of the latter.

The interior of each of the containers 14 presents an internal storage chamber generally designated 54 into which a liquid material being handled may be introduced through the inlet or filling port 40 or/and from which such liquid material may be dispensed or discharged through the outlet tube 44 and outlet port 38. The means 16 for altering the quantity of liquid material within the chamber 54 of each container 14 would typically include in the preferred embodiment an inlet conduit 56 fitted over a series of flanges 58 on the neck 34 to provide a fluidtight coupling, and an outlet conduit 60 similarly fitted over flanges 62 on the neck 32 to provide a fluidtight coupling with the outlet port 38 and the outlet tube 44. In one typical and preferred embodiment, the inlet conduit 56 is adapted for coupling with a main storage tank or source of liquid beverage syrup or other ingredient material (not shown), which conventionally may comprise the ordinary main supply tank in which such ingredient is transported and

stored in bulk, with a source of carbon dioxide or other edible gas under pressure (not shown) coupled with the main ingredient supply tank to move the liquid ingredient material under pressure through the conduit 56 and into the corresponding container 14 through inlet port 40, whenever a corresponding amount of liquid material has been discharged from that container 14 through the outlet tube 44 and outlet port 38. Similarly, the outlet conduit 60 is adapted to lead to a control valve (not shown) for delivering incremental amounts of the liquid material from container 14 to a mixing or dispensing station (not shown) as required in the vending or dispensing operation. It will be understood that, with the mentioned arrangement, the supply of liquid material in conduit 56 is under pressure and always ready to enter the container 14 to replace any liquid material that is discharged from the container 14 through the outlet conduit 60, so that, as long as material is available from the main source thereof coupled with the supply conduit 56, the container 14 for that particular liquid material will remain essentially filled. Because of the weight and density of the liquid material introduced into a container 14 and the influence of gravity thereon, the effects of buoyancy upon that container 14 resulting from its immersion in the body of liquid substance 22 will be overbalanced and that container 14 will sink or remain in a sunken position as illustrated in FIG. 2 in which the bottom wall 30 of the container 14 is resting upon the bottom wall 19 of the tank 12. Whenever the supply of liquid material from the source thereof coupled with supply conduit 56 is exhausted, however, the level of the liquid material, which is indicated at 64 in FIG. 3, will be lowered within the container 14 and the upper portion of chamber 54 will be filled with carbon dioxide gas as at 66 coming in through the conduit 56. When the level of the liquid material 64 within the container 14 has been sufficiently lowered, by depletion of the amount of liquid 64 in the container 14 by virtue of discharging of quantities thereof through the outlet conduit 60, the effects of buoyancy upon that container 14 will overcome the influence of gravity upon the weight of that container 14 and its remaining contents of material 64, whereupon that container 14 will "float" or rise within the tank 12 and relative to the latter and the body of liquid substance 22.

It should be understood that the invention contemplates and is adapted to operate with other methods of introducing or removing liquid material 64 to and from the containers 14. For example, the chamber 54 of a container 14 may simply be filled or initially charged with a desired supply of material 64 through the conduit 56 or the inlet port 40, and the conduit 56 may then be coupled with any suitable source of fluid under pressure, which would preferably comprise either carbon dioxide gas, compressed air or some other edible or nontoxic fluid depending upon the nature and intended usage of the material 64, whereupon the fluid pressure applied to the chamber 54 through the inlet port 40 would provide for the discharge of material 64 through the outlet port 38 or/and outlet conduit 60 as required and subject to conventional control by valving (not shown). As a further alternative, it will be apparent to those skilled in the art that, in an application in which the relative position of a container 14 is to be utilized to indicate the accumulation of a certain amount of liquid material 64 therein, it would be necessary merely to introduce liquid material 64 through the inlet port 40 of a container in initially "floating" condition in any suitable fashion, whereupon the "sinking" of the container 14 would indicate the accumulation of a predeterminable quantity of the material 64 within the chamber 54.

The means 18 for sensing the position of each container 14 relative to the tank 12 may comprise any suitable indicator but, in the preferred embodiment for application in vending machines, it has been found desirable to employ an electrical switch 68 for each container 14 mounted on the plate 50 by a bracket 70 and provided with an actuating arm 72 extending across the corresponding slot 52 between a pair of the necks 32 and 34 and in overlying relationship to the rib 46

therebetween. Each switch 68 is provided with a pair of electrical leads 74 and 76 adapted for coupling with any suitable indicating device or control circuit. When a particular container 14 is in its sunken condition with the bottom wall 30 thereof resting upon the bottom wall 19 of the tank 12, the actuating arm 72 of switch 68 will be spaced above the rib 46, as best shown in FIGS. 3 and 4; however, when the container 14 is in its "floating" condition, the rib 46 will rise into engagement with the arm 72 to actuate the switch 68. The actuation of the switch 68 may, as those skilled in the art will appreciate, be utilized in a vending machine to operate components of the latter such as a "sold-out" sign for the particular flavor in question or could, if desired, also be employed for performing other control functions employed either in a vending machine or in the particular environment in which the apparatus 10 is being utilized.

The sunken condition of the container 14 is illustrated in solid lines in FIG. 3, and a floating condition thereof is generally indicated in dotted lines in that Figure.

Referring to FIG. 5, it will be seen that in the preferred embodiment for application in vending machines, the venting neck 36 is provided with a cap 78 thereon for opening or closing the vent port 42. The vent port 42 discharges through a lateral passage 80 in the top of neck 36 into an adjacent cavity or chamber 82 formed in the cap 78. The chamber 82 communicates with a venting passage 84 formed in the cap 78. However, the cap 78 and the neck 36 are provided with juxtaposed, annular valving surfaces as at 86, which are interengaged to close the path between chamber 82 and passage 84 of the cap 78 when the latter is tightly screwed down upon the neck 36. When the cap 78 is loosened upon the neck 36, however, the seal at 86 is broken and the chamber 82 is restored to its communication with the passage 84 for venting the chamber 54 to the atmosphere through the vent port 42. Juxtaposed flanges 88 and 90 on the neck 36 and cap 78 respectively may be provided to retain the cap 78 upon the neck 36, while permitting the degree of relative movement therebetween required for the venting action just mentioned. It will be understood that it is normally necessary to vent a container 14 only when and prior to the uncoupling of one or both of the conduits 56 and 60 therefrom, such as may be required for removal of a container 14 for cleaning or sanitary purposes or when the conduit 56 is to be disconnected from an exhausted main supply tank of liquid material and reconnected to a new main supply tank during servicing. Without such venting, there would be a tendency for the pressure existing within chamber 54 to discharge liquid material 64 through the outlet port 38 as soon as the conduit 60 was removed, whereas the provision of the venting port 42 and cap 78 permit a serviceman to vent pressurized gas from the top of the chamber 54 through a limited orifice prior to removing the conduits 56 and 60.

Miscellaneous features of the construction preferred for application of the invention in a vending machine include the employment of spring clamps 92 for holding the conduits 56 and 60 upon the flanges 58 and 62 of necks 34 and 32, so as to permit rapid and convenient removal and positive replacement of the conduits 56 and 60 whenever required during servicing. Also, the plate 50 may be formed, as illustrated in FIG. 1, with a plurality of sections corresponding to the respective containers 14 to be accommodated, and such sections of the plate 50 may be mounted upon the tank 12 by means of wing nuts 94 to permit easy removal of any container 14 during servicing.

Accordingly, it should be clear that the apparatus 10 of the invention is ideally adapted for accomplishing the aforesaid and other objects of the invention. Those skilled in the art will appreciate, however, both that various minor modifications and changes could be made from the preferred construction disclosed for illustrative purposes without departing from the principles of the invention and that such principles may be readily applied in applications and environments other than in the vending machine application specifically shown and

described for illustrative purposes while still utilizing the substance and essence of the invention. Accordingly, it should be understood that the invention is to be deemed limited only by the fair scope of the claims that follow and mechanical equivalents thereof.

I claim:

1. Apparatus for handling a liquid material comprising: tank means;

a body of a liquid substance within said tank means;

container means extending into said body and adapted to

hold a variable amount of said liquid material therein,

said container means being shiftable relative to said body and said tank means responsive to the opposing influences of gravity and buoyancy and dependent upon the amount of said liquid material held by said container means;

means communicating with said container means for altering the amount of said liquid material therein; and

means including structure on said tank means for sensing the position of said container means relative to said tank means as indicative of the amount of said liquid material in said container means.

2. The invention of claim 1, wherein is provided means for maintaining the temperature of said body at a level other than ambient, whereby to control the temperature of said material within said container means.

3. The invention of claim 2, wherein said temperature maintaining means includes refrigerating means in heat exchanging relationship with said body for cooling the latter to refrigerate said material.

4. The invention of claim 1, wherein said sensing means includes electrical control switching means mounted on the tank means and having associated structure disposed to be actuated whenever said container means rises relative thereto sufficiently to indicate the presence within said container means of less than a predetermined amount of said material.

5. The invention of claim 1, wherein said altering means includes material outlet means communicating with said container means adjacent the lower part of the latter, a material delivery conduit coupled with said material outlet means and extending above the level of material within said container means, a fluid inlet communicating with said container means, and means coupled with said fluid inlet for introducing fluid under pressure into said container means to force material from the container means through said material outlet and into said material delivery conduit.

6. The invention of claim 5, wherein said fluid introduced into said container means through said fluid inlet includes an initially introduced first fluid and a subsequent introduced second and different fluid.

7. The invention of claim 6, wherein said first fluid is a liquid and said second fluid is a gas.

8. The invention of claim 7, wherein said first fluid is said material.

9. The invention of claim 8, wherein said material is of greater density than said liquid substance.

10. The invention of claim 7, wherein said container means is provided with a venting port and means for closing said port.

11. The invention of claim 1, wherein said material is of greater density than said substance, and there is provided means for maintaining any portion of the interior of said container means not occupied by said material filled with a fluid of lesser density than said material and said substance.

12. The invention of claim 1, wherein said altering means includes means for permitting introduction of said material into said container means until the latter is filled with a predetermined quantity of said material, and means for delivering incremental quantities of said material from said container means; and said sensing means operates responsive to a predetermined rise in the position of said container means to indicate substantial exhaustion of said material from said container means.

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13. The invention of claim 1, wherein said apparatus constitutes part of a liquid beverage dispensing or vending machine; said substance is water; refrigerating means are provided in heat exchanging relationship with said body of water to cool the same; said container means is in heat exchanging relationship with said body of water to maintain said material in said container means in cooled condition; said container means is provided with material outlet means communicating with said container means adjacent the lower part of the latter and a fluid inlet communicating with said container means adjacent the top of the latter; said material is an edible beverage

component with a density greater than water; means adapted for coupling said fluid inlet with a carbon dioxide gas pressured source of said component material are provided for forcing quantities of said beverage component material out of said container means and through said material outlet means; and said sensing means includes an electrical control switch operated by a predetermined rise in the position of said container means responsive to substantial exhaustion of said beverage component from said container means.

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