United States Patent

Kuckens

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[54] LIQUID-DISPENSING APPARATUS HAVING ELECTROMAGNETICALLY OPERATED VALVE

[72] Inventor: **Alexander Kuckens**, Belevue 20, 2 Hamburg 39, Germany

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[30] **Foreign Application Priority Data**

June 28, 1969 Germany ..... P 19 32 935.2

[52] **U.S. Cl.** **222/148**, 251/139

[51] **Int. Cl.** **B67d 1/08**

[58] **Field of Search** 251/139, 141; 222/129, 148, 222/54

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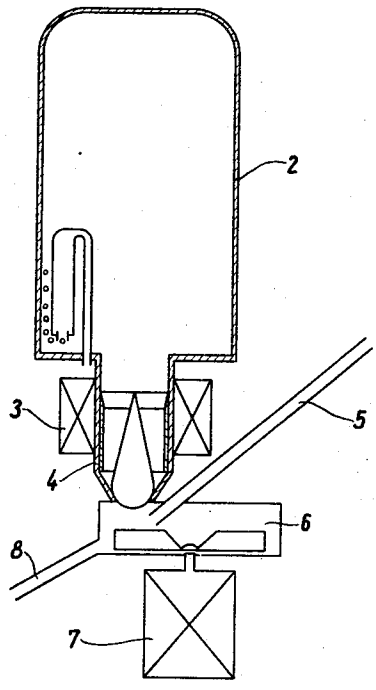
Primary Examiner—Stanley H. Tollberg
Attorney—Michael S. Striker

[57] **ABSTRACT**

A concentrate container has a downwardly directed outlet passage provided with an internal valve seat and an outlet downstream thereof. A valve member is accommodated in the outlet passage and consists of a tubular first portion of magnetizable steel within which but with clearance from the inner surface of which a valve seat engaging streamlined second portion is centered and positioned by sharp-edged struts or webs extending across the clearance. An electromagnetic device is so positioned as, when energized, to lift the valve seat engaging second portion out of contact with the valve seat so that concentrate can pass from the outlet under the influence of gravity. Means is provided for admixing water with the thus-dispensed concentrate to produce a beverage or other mixed liquid.

13 Claims, 5 Drawing Figures



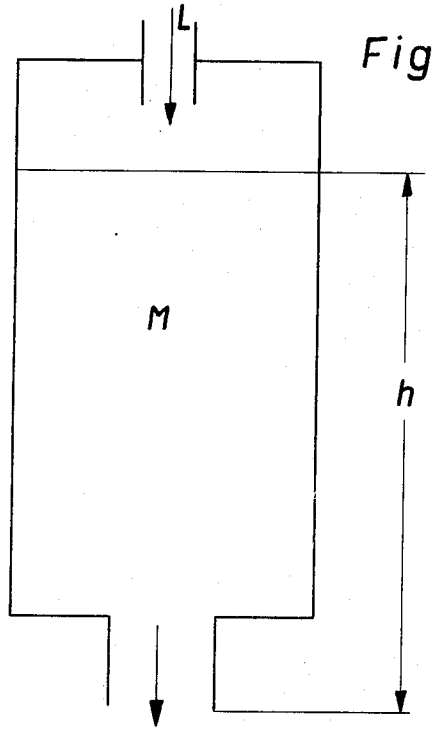


Fig.1

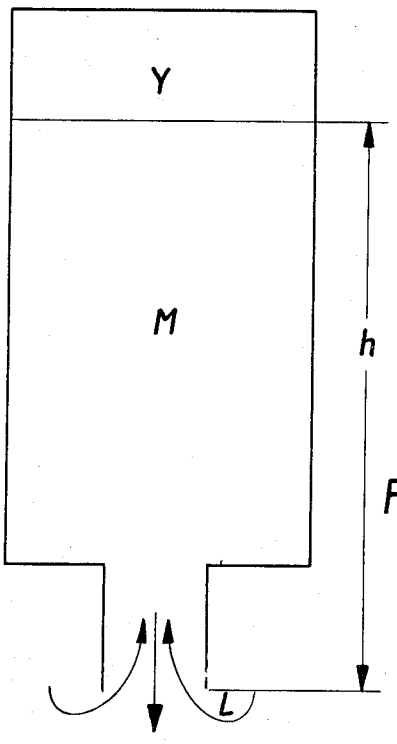


Fig.2

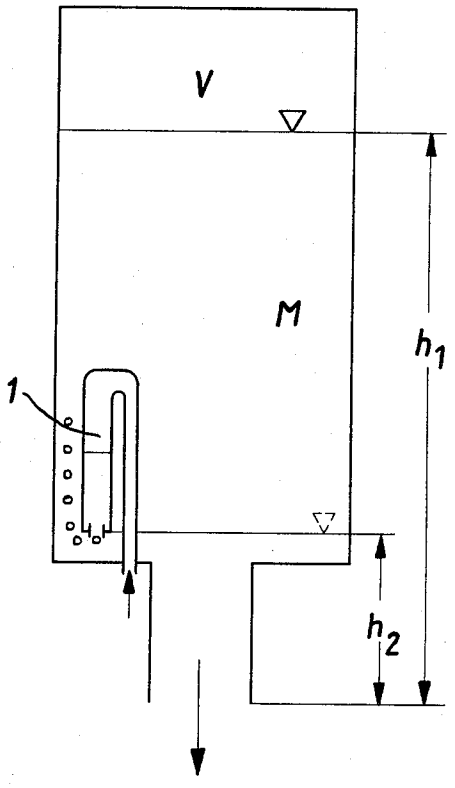


Fig.3

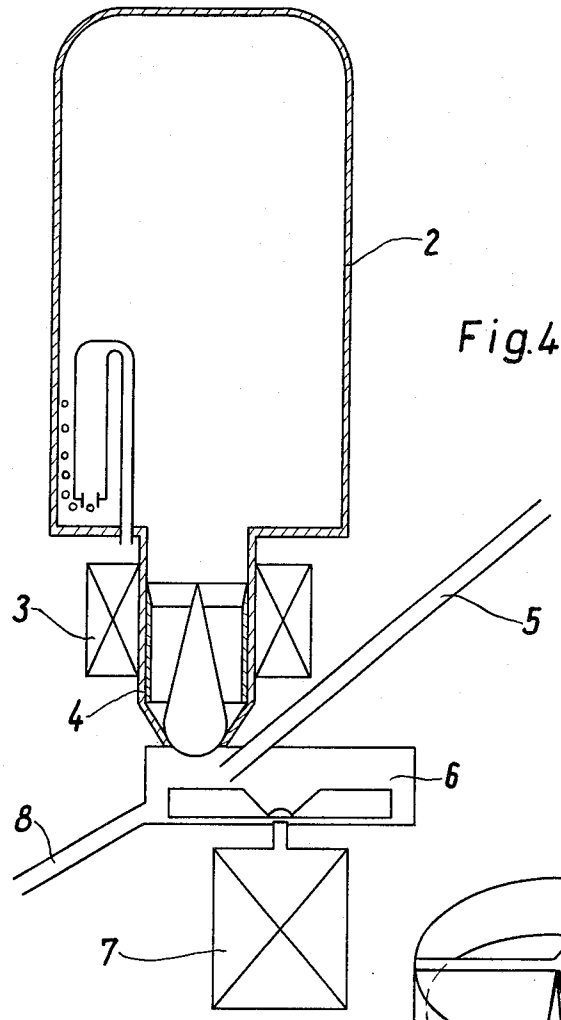


Fig.4

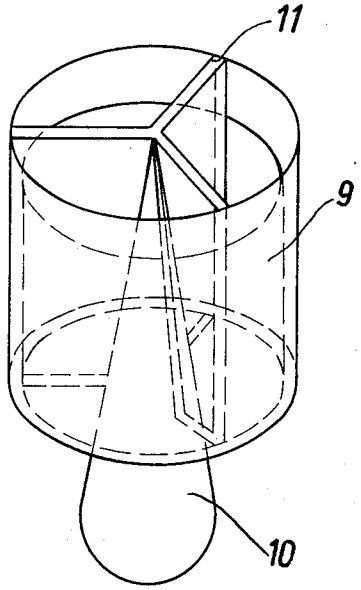


Fig.5

LIQUID-DISPENSING APPARATUS HAVING ELECTROMAGNETICALLY OPERATED VALVE

BACKGROUND OF THE INVENTION

The present invention relates generally to liquid dispensing devices, and more particularly to devices for dispensing drinks or the like. Still more specifically, the invention relates to devices for dispensing drinks produced by admixture of water or other liquids with concentrates having a high sugar content in excessive of 60 Brix points.

Dispensing devices of the general type and purpose here under discussion are of course already known. However, where liquid organic concentrates are to be dispensed whose sugar content is relatively high, the chance of so-called self-conservation is a factor which has not yet been overcome. By this it the making meant that the high sugar concentration in such concentrates results in an increasing viscosity of the concentrate which substantially reduces the ease and accuracy with which these concentrates can be dispensed. Known weight or volume measuring methods and devices which are conventionally employed in dispensing apparatus of the type here under discussion, will not operate properly with such concentrates because they are quickly fouled by various circumstances, including the strong schlieren formation on surfaces contacted by the concentrate and the encrustation of the heavily sugar-containing concentrate. If relatively small quantities of such concentrates are to be dispensed, as in the making of beverages from dispensing apparatuses, this causes substantial difficulties relating to problems of hygiene and to inaccuracies in the quantities dispensed.

The dispensing devices required in most applications are usually intended to be relatively small, for various reasons including the lack of available space. Assuming, therefore, that such dispensing devices are to be of small dimensions, then special pumps for dispensing metered quantities of the concentrate cannot be incorporated, aside from the fact that they add substantially to the expense of the dispensing devices which is also to be held low. A further problem in the use of special pumps is the fact that these complicated devices must be frequently cleaned and maintained, which presents a problem, because it is desirable that the dispensing devices be capable of undergoing usual maintenance functions by semi-skilled personnel. It has therefore been recognized that concentrates of the type under discussion can be economically and practically dispensed only under their own static pressure, namely by letting them become dispensed under the influence of gravity and such dispensation is to take place independently of and without weight and volumetric measurements of the quantities being dispensed. On the other hand, if such dispensation is to be carried out independently of the filling status of the concentrate container, that is independently of the static pressure in the container, then the problem exists of providing a dispensing device which is capable of dispensing large as possible quantities of concentrate in the shortest possible time and with exact proportioning. This includes, of course, the provision of an outlet valve which not only fulfills the aforementioned requirements, but also which prevents the formation of concentrate encrustations, adhering of the valve member to the seat, difficulties during cleaning and the like.

Tests and long experience have shown that the dispensing devices and associated valves which are available commercially, and in fact any which are known to me from the prior art, for the use in such dispensing devices, cannot fulfill their intended purposes properly if they are employed in dispensing highly viscous substances, such as concentrates for flavoring and other purposes. This is particularly true if the dispensation is to take place only as a function of gravity, because the known valves in dispensing devices either strongly prevent the concentrate to be dispensed from proper outflow because the sealing requirements of the valves make it necessary to provide the valve seat and outlet with small dimensions, or else in that there is drawn into the container during the dispensation as a result of pumping effect in direction opposite to the outflow of the concentrate. It is for instance known to provide a gravity dispensing apparatus wherein a magnetizable valve member is lifted off its valve seat under the influence of a temporarily energized electromagnet. It has been found, however, that during such opening air can be drawn into the container which, once included in the viscous concentrate, will form air bubbles which tend to rise slowly in upwardly direction and to interfere with proper dispensing and proportioning of dispensed quantities.

SUMMARY OF THE INVENTION

It is, accordingly, an object of the present invention to overcome the aforementioned disadvantages of the prior art.

More particularly, it is an object of the present invention to provide, in an apparatus for dispensing liquids, a construction wherein the aforementioned disadvantages are overcome.

In pursuance of the above objects, and others which will become apparent hereafter including the object that the apparatus is to be simple in its construction and therefore easy to operate and maintain, the invention resides in one embodiment, briefly stated, in an apparatus for dispensing liquids composed of an admixture of water and a flavoring concentrate, particularly a concentrate containing sugar in excess of 60 Brix points, in a concentrate container having a downwardly directed outlet passage provided with an internal valve seat and an outlet downstream thereof. A valve member is accommodated in the outlet passage and comprises a tubular first portion of magnetizable material, a valve-seat engaging streamlined second portion centered in the first portion and projecting in part downwardly beyond the same for normally engaging the valve seat under the influence of gravity, and a plurality of web-shaped third portions mounting and centering the second portion in the first portion with clearance from the latter and having sharp edges. Electromagnetic means is positioned and energizable in a sense effecting displacement of the valve member upwardly away from and out of engagement with the valve seat.

The invention is based upon the realization that the purposes according to the present invention can be achieved by assuring that the valve member remains completely and entirely surrounded by the concentrate to be dispensed until the concentrate is dispensed from the container entirely and completely. This prevents the formation of encrustations and adhesions in and on the valve member. At the same time, the apparatus according to the present invention is recognized as being necessarily precluded from the use of any devices such as springs which draw the valve back to engagement with the valve seat or the like, because the high sugar content of the concentrate to be dispensed will make such springs or analogous means inoperative or improperly operative.

In order to rise properly and quickly when the electromagnetic means is energized, the valve member must be so constructed that the mass of the valve member is in most advantageous position with reference to the magnetic field which is established, and for all intents and purposes, no pumping effect occurs when the valve member is lifted off the valve seat, that is no air is drawn into the container as this takes place.

It was found that to meet these requirements the valve member would have to be tubular for magnetic and hydrodynamic reasons. On the other hand, a tubular valve member has rather large surface areas and this provides difficulties is establishing a proper seal with the valve seat. Therefore the invention provides a hydrodynamically configurated inner sealing portion which contacts the valve seat and provides for simpler sealing and more reliable sealing, and which is first to perform all movements which are performed by the tubular valve member. It is necessary in accordance with a concept of the present invention that this valve seat engaging portion be a member which is either of teardrop shape, of conical or cigar-shaped configuration. It is centered and maintained in position with clearance with reference to the tu-

bular valve member by means of one or several web-shaped struts whose free edges are sharp, that is configurated in a sense as knife edges, so as to provide the minimum amount of resistance to their passage through the highly viscous concentrate when they move upwardly or downwardly, but particularly upwardly out of engagement with the valve seat. The tubular valve member itself consists of magnetizable material, preferably magnetizable steel, and is also provided at its opposite axial ends with knife edges for the same reason as those provided on the struts. The sealing portion itself which engages the valve seat may be made of a different material which need not be magnetizable, for instance of a synthetic plastic material, but of course it can also be made of metal.

In a construction according to the above considerations, the valve member has a highly advantageous relationship in the position of its mass with reference to the magnetic field which develops during energization of the electromagnetic means provided for the valve opening purpose, and therefore with reference to the lifting force acting upon the valve member. On the other hand, the undesired pumping effect which in the prior-art constructions has served to draw air into the interior of the concentrate container, is to all intents and purposes eliminated. A further advantage is that for return to closed or sealing position, the valve member has hydrodynamically the most advantageous configuration and possibility of movement due to its relative configuration. It will be appreciated, of course, that in an apparatus according to the present invention, there must be provided means for mixing the dispensed concentrate with water or another liquid in order to provide a beverage or the like. The water may be hot or cold, and the beverage may be a drink, a soup or the like. The mixing must of course be facilitated by mechanical means provided for this purpose, such as a known mixing device and the dispensed concentrate and quantities of water or similar liquid are admixed and homogenized. It is further advantageous that the device be so constructed in accordance with the present invention that the incoming water or liquid to be admixed with the dispensed quantities of concentrate, first flow over the outlet associated with the valve construction to prevent the formation of dried encrustations in the surfaces bounding the outlet. To prevent possible difficulties upon immergence of the highly viscous dispensed concentrate, and consequent inaccuracies in the dispensed quantities, the invention provides for a rotating mixing device in conjunction with the aforementioned measures so that the dispensed quantity of concentrate is immediately transported away from the outlet in order to be flung under the influence of centrifugal force against the circumferential wall bounding the mixing device or mixing chamber. The same takes place with the incoming water or liquid which is to be admixed with the concentrate and which initially is also flung against the wall of the mixing device bounding the mixing chamber,whereby an intimate admix and homogenization of water or similar liquid with the dispensed concentrate is assured.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a diagrammatic elevational view showing a prior-art dispensing device;

FIG. 2 is a view similar to FIG. 1 illustrating a further prior-art dispensing device;

FIG. 3 is a view similar to FIG. 2 illustrating still another prior-art dispensing device;

FIG. 4 is a diagrammatic sectional side elevational view illustrating a device according to the present invention; and

FIG. 5 is a perspective detailed view on an enlarged scale of a valve member used in the embodiment of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

It is thought advantageous to first discuss the operation of the prior-art devices shown in FIGS. 1–3, for a better understanding of the problems which are overcome with the present invention. In the prior-art embodiment of FIG. 1 there is provided a dispensing container of known construction into which air enters in the direction illustrated by the arrow and from which the medium to be dispensed exits in downward direction again as illustrated by the other arrow. In other words, air enters at the top and medium to be dispensed issues at the bottom of the illustrated container. The height h is indicated in FIG. 1 for the container and this height determines the static pressure at the outlet for the concentrate to be dispensed. If an outlet valve were to be provided at this outlet, which opens the outlet at predetermined times, then the dispensed quantity of concentrate or medium would decrease with static pressure in the container.

In the embodiment of FIG. 2, also a prior-art embodiment, the container is closed at the top but is again filled with medium to be dispensed to the level indicated by the dimension h which is measured between the outlet and the level of medium to be dispensed. This is the same as in FIG. 1. If the container in FIG. 2 is filled to the same level as that in FIG. 1 (as a comparison between the two Figures will show) and assuming that the same medium is used, then opening of the valve at the bottom outlet of the container in FIG. 2 will permit air to enter in the direction of the curved arrows into the interior of the container whereas the dispensed medium will exit in counterflow. The entering air, however, will cause eddies in the medium which flows out and turbulences which are uncontrollable so that differences will inevitably exist in the quantities of medium which are dispensed during individual opening periods of the valve.

FIG. 3, finally, shows another prior-art construction analogous to that of FIG. 2 in that it is closed at the top and only has a bottom outlet. It is assumed, again, that the container in FIG. 3 is filled with the same medium as in FIGS. 1 and 2 and to the same level h_1. Of course, as in FIG. 2, the container in FIG. 3 must first be turned around so that its outlet faces upwardly before it can be filled. Subsequently, with the valve closed, it is then inverted to the illustrated position. In FIG. 3, however, the container is provided with an air inlet enclosure 1 in which the air enters in the direction of the arrow. When the container in FIG. 3 is inverted to the illustrated position, then the medium therein first attempts to enter the enclosure 1 and and rises therein until a vacuum develops above the medium. If the valve is now opened, then it is no longer the height h_1, but instead the height h_2 which determines the static pressure acting upon the contents of the container because the quantity of medium of the level h_2 is in effect maintained counterbalanced by the vacuum V. This means that the quantity of medium dispensed in a given period of time for which the valve is opened is determined exclusively by the size of the air bubbles which now exit at the enclosure 1 into the interior of the container, and the time period for which the valve is opened. The dispensing process is started independently of the filling condition of the container by opening the value, so that first the enclosure 1 will empty because here air can be permitted to enter in the direction of the ingoing arrow, while the vacuum V becomes replaced only after the first air bubbles have passed through the surface of the medium at the level h_1.

It is hardly necessary to emphasize that the disadvantages which have been briefly outlined with respect to all three of the prior-art constructions in FIGS. 1–3 are not acceptable where the dispensing of strongly viscous substances, particularly fruit juice or other concentrates having a sugar content of at least 60 Brix points, is involved. Hence the present invention.

An exemplary embodiment of an apparatus according to the present invention is shown in FIGS. 4 and 5. FIG. 4 shows a concentrate container 2 which may have any desired configuration and which is provided with a tubular outlet passage

which conically tapers in direction towards the outlet and is identified with reference numeral **4**. It is interiorly provided with a valve seat. Reference numeral **3** identifies a circular electromagnet which surrounds the outlet passage **4** exteriorly thereof and which, when energized, will result in the development of a magnetic field.

Reference numeral **5** identifies a conduit for water or the like, reference numeral **6** a mixing device accommodated in a suitable housing and driven by a motor **7**, and reference numeral **8** an outlet through which the mixed beverage —that is the mixture of dispensed concentrate and water or similar liquid admitted via the conduit **5**— can be withdrawn from the mixing device.

According to the present invention, I provide a valve member which is accommodated in the interior of the passage **4** and which normally closes the same under the influence of gravity, that is under the influence of its own weight. This valve member according to the invention comprises a tubularly configurated first portion **9** of magnetizable material, preferably steel, and a valve seat-engaging second portion **10** which may consist of synthetic plastic material or another material and which is accommodated within the circumferential confines of the tubular first portion **9** with clearance from the inner circumferential surface of the latter. It is centered with respect to the tubular portion **9** and secured to the latter by webs or struts **11** which have sharp edges, just as the axial ends of the tubular first portion **9** are provided with sharp edges, the purpose being to provide as little resistance as possible to the movement of the valve member shown in FIG. **5** through the highly viscous concentrate in the container **2**. The second valve seat-engaging portion **10** in the illustrated embodiment is shown to be of upwardly convergent tear-drop shape configuration, but it could be of another hydrodynamically advantageous configuration, such as upwardly convergent conical shape or upwardly and downwardly convergent cigar-shaped configuration. Of course, its portion which projects from the lower open end of the tubular first portion **9** engages the valve seat in the manner diagrammatically illustrated in FIG. **4**. A more detailed illustration is not believed to be necessary because the engagement of the valve seat will be evident to those having ordinary skill in the art. Similarly, the showing of the motor **8** and of the mixing device **6** is diagrammatic because such devices and components are known in the art.

Being of magnetizable material, the first portion **9** will be attracted in upward direction upon energization of the electromagnet **3**, thereby freeing the valve seat for outflow of a quantity of concentrate from the interior of the container **2** — which latter is provided with an air inlet arrangement similar to those shown in the prior-art embodiment of FIG. **3** —which quantity will be metered as a function of the static pressure within the container **2** and of the time period for which the valve is in open position.

The outlet of the water or the liquid supply conduit **5** is advantageously so arranged that the incoming stream of water will flow over the outlet of the passage **4**, washing away any quantities of the concentrate that might tend to adhere and form encrustations. The dispensed quantities of concentrate and the incoming water are flung by the impeller in the mixing device **6** against the circumferential wall bounding the mixing chamber and undergo thorough admixture and homogenization before the resulting beverage or other mixture is dispensed through the outlet **8**.

It is advantageous to provide means for maintaining the contents of the container **2** —that is the concentrate— at constant temperature. Such means are not illustrated because they may be of conventional type and they serve either to cool, to heat or to both to cool and to heat the contents. They must, however, include suitable thermostatic means for maintaining the temperature of the concentrate in the container **2** constant in order to thereby maintain the viscosity of the concentrate constant. Otherwise, even small temperature fluctuations result in a change in the viscosity of the concentrate — particularly because of the postulated high sugar content thereof— whereby the flow speed and thereby the once-selected metered quantity to be dispensed is varied. Furthermore, temperature fluctuations would permit variations in the vacuum above the upper level of the concentrate in the container **2** in dependence upon coefficient of similar expansion and this would again cause variations in the quantity being dispensed.

If the time for which the valve is opened is constant in each valve opening episode, the concentrate is maintained constant, with the homogeneity of the concentrate also remaining constant with the cross sections of the air inlet and of the concentrate outlet remaining unchanged, then the device according to the present invention assures that to all intents and purposes, no variations in the quantity of concentrate dispensed during any individual valve-opening episode will take place.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions differing from the types described above.

While the invention has been illustrated and described as embodied in an apparatus for dispensing liquids, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention. The quantities are measured only by the opening times of the valve according to U.S. Pat. No. 3,258,166.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

1. In an apparatus for dispensing liquids composed of an admixture of water and a flavoring concentrate, particularly a concentrate containing sugar in excess of 60 Brix points, in combination, a concentrate container having a downwardly directed outlet passage provided with an internal valve seat and an outlet downstream thereof; a valve member accommodated in said outlet passage and comprising a tubular first portion of magnetizable material, a valve-seat engaging one-piece streamlined second portion centered in said first portion and projecting downwardly beyond the same for normally engaging said valve seat under the influence of gravity, and a plurality of web-shaped third portions mounting and centering said one-piece second portion in said first portion with clearance from the latter, and having sharp edges; stationary electromagnetic means surrounding said second portions and being energizable in a sense effecting displacement of said valve member upwardly away from and out of engagement with said valve seat; and an air-inlet enclosure into which air enters during outflow of fluid through said outlet means.

2. In an apparatus as defined in claim **1**, wherein said first portion consists at least in part of steel.

3. In an apparatus as defined in claim **1**, wherein said second portion is of upwardly convergent tear-drop shaped configuration.

4. In an apparatus as defined in claim **1**, wherein said second portion is of upwardly convergent conical configuration.

5. In an apparatus as defined in claim **1**, wherein said second portion is of upwardly and downwardly convergent substantially cigar-shaped configuration.

6. In an apparatus as defined in claim **1**, wherein said outlet passage is tubular and has a lower end portion provided with said valve seat, and wherein at least said lower end portion is downwardly convergent.

7. In an apparatus as defined in claim **1**, wherein at least said second portion of said valve member consists at least predominantly of synthetic plastic material.

8. In an apparatus as defined in claim 1; further comprising mixing means positioned to directly receive quantities of concentrate dispensed from said container; and water-supply means arranged to supply water into said mixing means for admixture with said concentrate.

9. In an apparatus as defined in claim 8, said water supply means being positioned so as to eject water for initial contact with and cleaning of said outlet preliminary to entry of the ejected water into said mixing means.

10. In an apparatus as defined in claim 1; and further comprising temperature regulating means associated with said container for maintaining constant the temperature and thereby also the viscosity of concentrate therein.

11. In an apparatus as defined in claim 10, said temperature regulating means comprising cooling means.

12. In an apparatus as defined in claim 10, said temperature regulating means comprising heating means.

13. In an apparatus as defined in claim 8, said mixing means comprising a mixing receptacle for said water and said dispensed concentrate, and said receptacle having a bottom wall portion provided with discharge means for discharging of the mixed liquid.

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