Aug. 30, 1966 A. ARMSTRONG 3,269,606

LIQUID CHILLER AND DISPENSER

Filed March 3, 1964 3 Sheets-Sheet 1

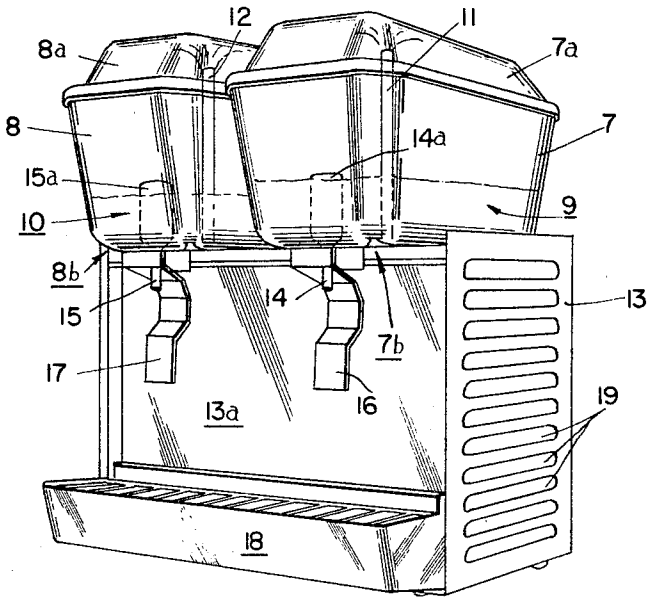


FIG. 1

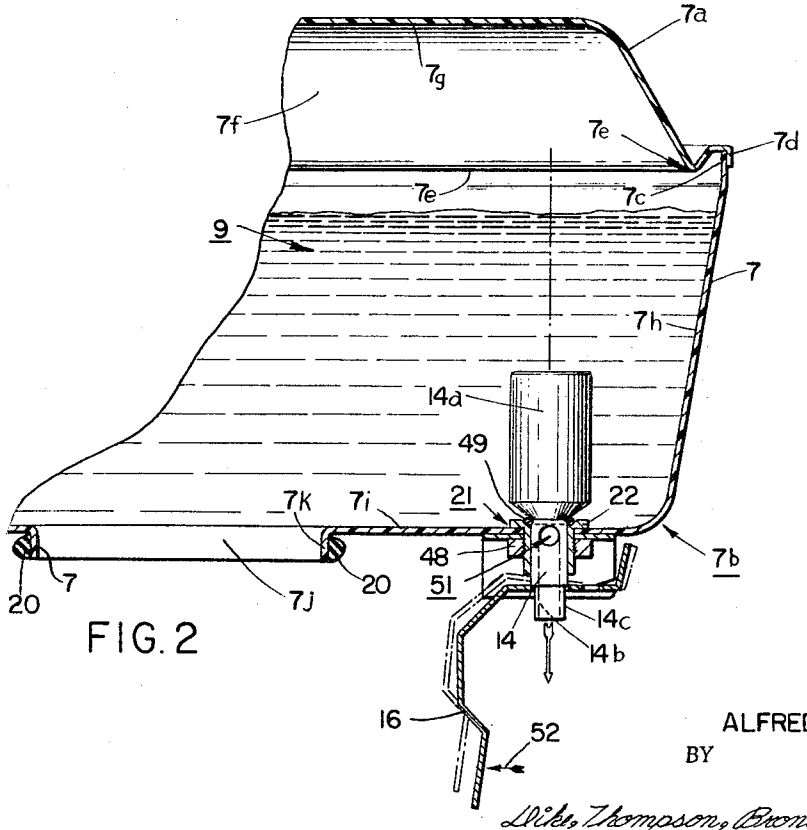


FIG. 2

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LIQUID CHILLER AND DISPENSER

Filed March 3, 1964 3 Sheets-Sheet 2

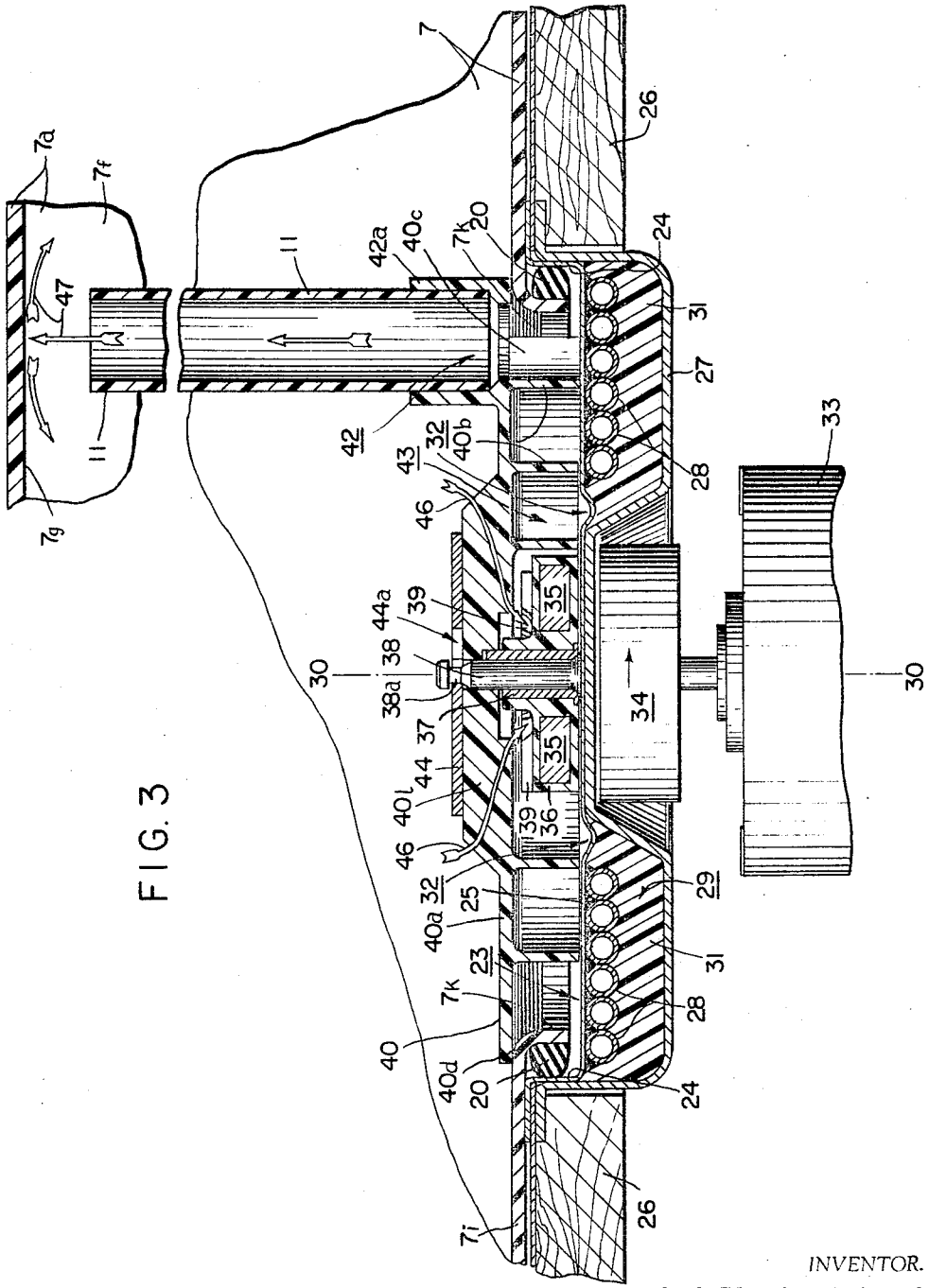


FIG. 3

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LIQUID CHILLER AND DISPENSER

Filed March 3, 1964 3 Sheets-Sheet 3

FIG. 4

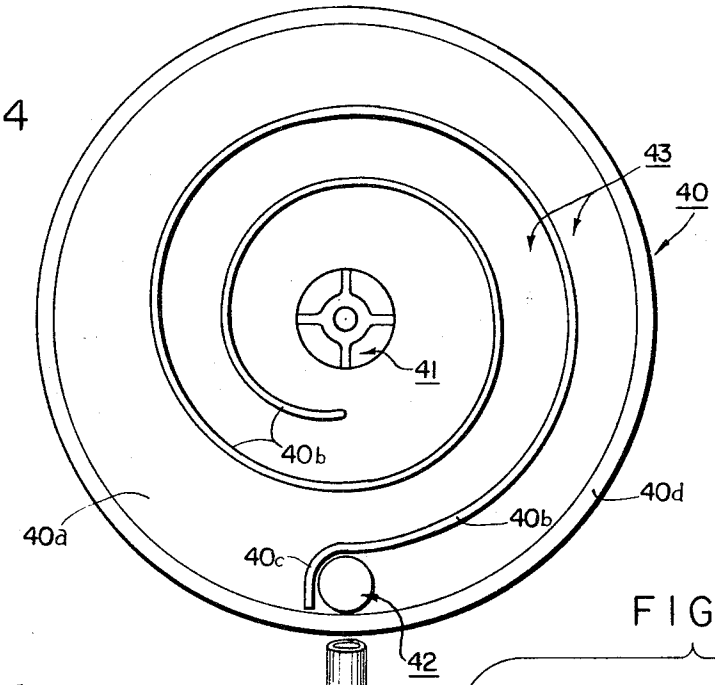


FIG. 5

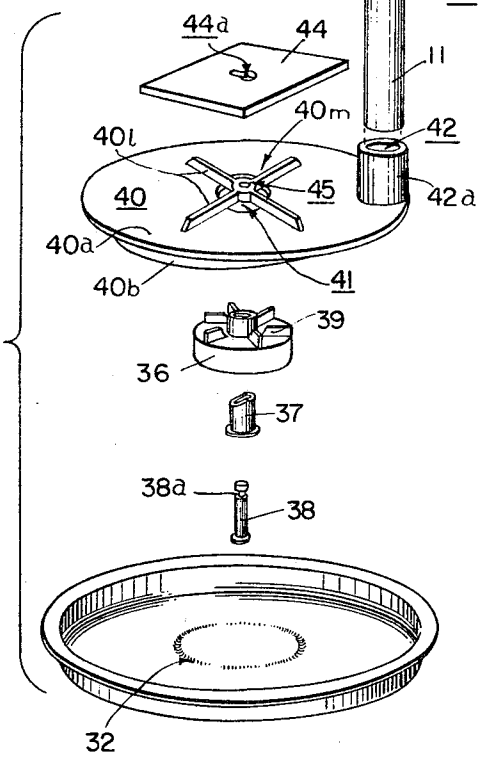
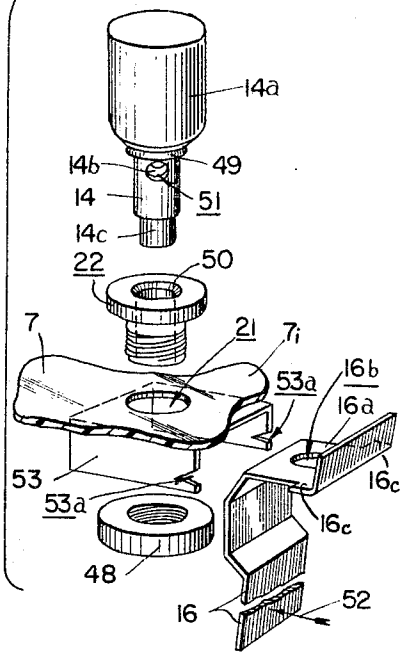


FIG. 6



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LIQUID CHILLER AND DISPENSER

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Filed Mar. 3, 1964, Ser. No. 348,937
16 Claims. (Cl. 222—146)

The present invention relates to improvements in the conditioning, storage and dispensing of liquids and, in one particular aspect, to novel and improved apparatus of uncomplicated construction which efficiently chills and dispenses liquids and which may be easily maintained and used.

Beverage dispensers are known in a variety of forms lending themselves to attractive counter-top display of their contents for merchandising to customers in stores, restaurants, soda fountains, and the like. Self-contained apparatus of this type which is employed for the vending of cool beverages commonly incorporates an electrically-powered miniaturized refrigeration system which chills the continuously-circulated contents of an exposed transparent storage tank. It has been found particularly effective, both from aerating and aesthetic standpoints, to develop a continuous fountain-like spray of the stored liquid within the dispenser tank, and the necessary pumping for this purpose has been advantageously induced by an impeller magnetically coupled with an electric drive motor which remains mechanically isolated from the stored liquid.

Efficiency of cooling has required that relatively large heat-exchange areas be in contact with the liquid, and, in the past, the exposed or jacketed refrigerating coils have occupied undesirably large volumes in the storage tanks, have cooled with diminished efficiency when stored liquid level became low, and have complicated cleaning operations. Another difficulty has been that of avoiding stagnation areas where liquid might not be well circulated, and where certain amounts of the liquid, particularly those within a tap site, may not be fully chilled when dispensed to the consumer. In the latter connection, prior efforts have been directed to the high-velocity circulation of cooled liquid through the tap mechanisms, for example, although this approach involves complex valving and circulation structure, and tends to develop unwanted high liquid velocities and pressures at the tap. Disadvantages of the aforesaid character are overcome in accordance with the present teachings by chilling and recirculating the stored beverage through use of a simple and yet highly efficient and compact unit which simultaneously functions to cool and pump the beverage, and which is confined to the very bottom of the storage tank where it occupies little space and operates efficiently upon whatever volume of beverage is present. In cooperation with this assembly, an improved form of gravity-actuated lift valve of low-cost construction serves to release from circulated storage only such amounts of the beverage as are intended to be dispensed and, in addition, is automatically maintained well cooled throughout.

It is one of the objects of the present invention, therefore, to provide novel and improved liquid conditioning and dispensing apparatus of economical uncomplicated construction possessing mechanical niceties promoting efficient circulation of stored liquid and facilitating maintenance and sterilizing.

Another object is to provide improved beverage dispensers wherein unique and efficient pumping and heat-exchange effects are developed simultaneously by mechanisms which occupy little space, are readily accessible for periodic cleaning, and operate very effectively on small as well as large volumes of stored beverage.

A further object is to provide a novel chilled beverage dispenser of simple form wherein efficiently cooled and

circulated beverage is continuously available for precise dispensing.

Still further, it is an object to provide improved cooling and pumping in small self-contained beverage display and dispensing apparatus of relatively high storage capacity which well lends itself to dismantling and re-assembly for cleaning and maintenance purposes, and in which improved gravity-actuated valving promotes non-drip and non-splashing cold dispensing of beverages.

By way of a summary account of practice of this invention in one of its aspects, a stand incorporating a common type of miniature refrigeration system is provided near its top surface with a recessed horizontal and generally circular metal cooling plate of magnetically permeable material below which refrigeration tubing is coiled in intimate heat-exchange contact. A motorized magnetic clutch element is rotated at high speed below and centrally of the cooling plate and, in turn, through magnetic coupling, rotates a spindle-mounted centrifugal impeller which is collinearly disposed on the opposite side of the plate. Atop the plate, and in coaxially surrounding relationship to the impeller, there is fitted a shallow spirally-ribbed annular pump plate, the ribbing of which abuts the cooling plate to develop a substantially closed multi-turn spiral flow channel about the impeller; the spiral channelling thus formed has an upwardly-extending outlet through the pump plate near its outer periphery, and a separable vertical spray tube extends upwardly from the outlet to carry discharged liquid to a higher level. Liquid admitted to the impeller from above near the center of the pump plate is thus rotated at a high angular velocity and is caused to flow through the spiral channel, where it is brought into lengthy heat-exchange communication with the cooling plate and where its linear velocity is materially increased upon its travel radially outward from the site of the impeller. Ejection from the spray tube may thus occur with substantial force. An open-topped transparent plastic bowl of generally rectangular outline and having a circular rimmed opening through its base is set into and is mated in sealed relationship with the upper recess in the stand; the upstanding spray tube extends above the level of this bowl, into close proximity with a removable convex bowl cover. At its forward end, which overhangs the support stand housing the refrigeration system, and which is separate from the rimmed opening, the bowl exhibits a further opening in its base, and a vertically slidable lift valve member is there supported in a guide bushing which provides a valve seat for a circular seal on the valve member. The lower outlet end of the valve member is tubular and merges with liquid-admitting openings just below the circular seal, while the upper end of the same member is in the form of a large-area mass which gravitationally depresses the valve member and is also immersed in and thus in a heat-exchange relationship with the beverage in the bowl. A valve-operating lever is disposed for actuation by the positioning of a beverage cup below the tubular valve outlet.

Although the aspects of this invention which are believed to be novel are set forth in the appended claims, additional details as to preferred practices of the invention and as to the further objects, advantages and features thereof may be most readily comprehended through reference to the following description taken in connection with the accompanying drawings, wherein:

FIGURE 1 is a pictorial representation of a twin-bowl beverage conditioner and dispenser of the type in which the present teachings are exploited to particular advantage;

FIGURE 2 provides a cross-sectioned side view of the forward portion of a beverage storage tank in which the invention is practiced;

FIGURE 3 is a partly cross-sectioned side view of a

combined heat-exchanger and pump assembly in association with fragments of the bowl and stand mechanisms of the apparatus shown in FIGURES 1 and 2;

FIGURE 4 illustrates the spirally-ribbed pump plate of the assembly in FIGURE 3, viewed from below;

FIGURE 5 is an exploded view of elements of the pump and heat-exchanger assembly portrayed in FIGURE 3; and

FIGURE 6 is an exploded view of the tap valve appearing in the FIGURE 1 and 2 illustrations.

The liquid cooler and dispenser apparatus depicted in FIGURE 1 is of a relatively small and lightweight form intended for attractive counter-top display and service of chilled juices, syrup drinks, or other beverages. Aesthetic appeal which aids in merchandising of such beverages is promoted through use of transparent or translucent storage tanks, such as the twin plastic bowls **7** and **8**, which expose their continuously-circulated liquid or liquid-solids contents, **9** and **10**, to customer view. Removable plastic covers, **7***a* and **8***a*, for these storage bowls protect their contents and provide access for refilling and cleaning purposes; in the illustrated construction, these covers also serve to deflect upwardly-sprayed recirculated liquid forcefully discharged from the tops of vertical spray tubes **11** and **12** which project above the highest possible levels of liquid contained within the storage bowls. As is described later herein, the bowl and cover structures are of configurations promoting substantially continuous flow of the circulated liquid across their internal surfaces, without involving pressure-tight seals, such that solids contents are continuously washed back into the stored reservoirs of liquid and unwanted surface deposits are avoided. Both tanks are of generally rectangular outline and are fitted atop a supporting enclosed stand, **13**, with their forward ends **7***b* and **8***b* slightly overhanging the front **13***a* of the enclosure to afford unobstructed access, from below, to the tap valve outlets, **14** and **15**, respectively, in their bases. These valves are of a gravity-actuated type which involve masses **14***a* and **15***a* disposed within the stored liquids for chilling purposes, and beverage is dispensed automatically and without appreciable after-drip when beverage containers are pressed lightly against the depending dispensing levers **16** and **17**, respectively. Removable tray **18** conveniently collects any beverage overflow, and side louvers **19** in the enclosure permit efficient circulation of air needed for efficient operation of a conventional type of miniaturized refrigeration system (not shown) housed within enclosure **13**.

The bowl **7**, and its cover **7***a*, are preferably fitted together without involving the use of auxiilary seals. For this purpose, the upper edge **7***c* of bowl **7** is simply formed to lie in one horizontal plane, and the depending flange **7***d* of cover **7***a* overhangs this edge, all as shown in FIGURE 2. Inwardly of edge **7***c* and flange **7***d*, the cover **7***a* possesses a downwardly-directed inner rim **7***e*, which is laterally spaced from and extends sufficiently below the level of bowl edge **7***c* to avoid the possibility of leakage from the joint between the cover and bowl as the recirculated beverage courses downwardly along the inner surfaces **7***f* of the cover after being ejected upwardly against the top inner surfaces **7***g* from the spray tube **11** (FIGURE 1). Instead, the recirculated beverage drips either directly into the reservoir **9** from the bottom of rim **7***e*, if the bowl **7** is nearly full, or, alternatively, drips onto and thus continuously washes the inwardly-sloping walls **7***h* of the bowl when the latter is not nearly full.

Base **7***i* of bowl **7** is substantially flat, except that the large circular opening **7***j* therein is surrounded by a short downwardly-extending cylindrical rim **7***k*, which is intended to be mated within the upper recess of the stand where the cooling plate and shallow spiralled pumping assembly are disposed. A deformable sealing ring **20**, preferably of substantially D-shaped cross-section, is tightly fitted about rim **7***k*. Forwardly of this, a second, smaller base opening **21** is occupied by the valve seat bushing **22** and by part of the mated lift valve member **14**. Upper cylindrical recess **23** in the enclosed stand **13** is designated in FIGURE 3, where the rimmed opening in the base of bowl **7** is mated and sealed with it, and where elements of the improved chilling and pumping mechanisms are shown in assembled relationship. Gasket **20** is preferably thick and formed of a low-durometer material, such as soft rubber, which permits it to be somewhat compressed radially and thus sealed tightly against the inner substantially cylindrical surface **24** projecting upwardly around the periphery of the generally flat and circular cooling plate **25**. The D-shaped cross-section of this gasket, which is evident in the drawings, is advantageous in that it inhibits rolling and twisting of the gasket as the bowl is fitted into place on the stand by bowl manipulations involving both downward thrusts and angular oscillations. Before the bowl is so fitted, the gasket **20** is first stretched slightly and affixed dry to the dry outside of the bowl rim **7***k*, being originally of slightly smaller inner diameter than the outer diameter of that rim so that a tight, leakproof, and non-slipping fit will be produced between the gasket and bowl rim. Subsequently, the outside of the gasket and the interior surface **24** of the stand recess are wet with water or other non-toxic and non-contaminating liquid, to provide both lubrication and improved sealing when these surfaces are mated. The outer diameter of stretched gasket **20** is somewhat larger than the diameter of surface **24**, thus insuring that essentially pure radial compresson of the soft gasket will develop tight sealing between it and surface **24**.

Metal cooling plate **25** is recessed downwardly from the metal-sheathed upper surfaces of the sturdy top **26** of the enclosure **13**, and it is nested with a plastic member **27** which both provides certain reinforcements and aids in enclosing and isolating the refrigeration coils **28**. The latter coils are wound in a flat annular spiral array, and are soldered to the under side of cooling plate **25** to develop an optimum heat-exchange relationship with it. Centrally, the plate **25** and nested member **27** are in abutting relationship, but an annular space **29** housing the coils is formed between them at further radial distances from a central axis **30—30**. A foamed insulating plastic, such as an expanded polyurethane foam **31**, fills the voids within the annular space **29**, thereby strengthening and improving the thermal characteristics of the assembly. Fabrication of the large cylindrically-rimmed thin circular cooling plate as a strong large-area flat member is aided by the inclusion of an annular depression **32** or, alternatively, a raised annular ridge, inwardly of the annular site where the refrigeration coils are located. In the usual manner, a refrigerant is passed through coils **28**, which are part of a conventional type of refrigeration system contained within the enclosed bowl stand **13**. Within the same stand there is also mounted an electric motor **33** which rotates a magnetized clutch member **34** about axis **30—30** and below the cooling plate **25** and the cooperating plastic member **27**. The magnetic field from clutch member **34** penetrates the magnetically permeable and substantially non-conductive (electrically) material, such as stainless steel, of which the cooling plate is formed, and interacts with the magnetic or magnetized core material **35** embedded within the relatively small plastic impeller **36** located above the cooling plate. In turn, this magnetic interaction causes high-speed rotation of the impeller on a bearing sleeve **37** about the upstanding stationary central stud **38** affixed to the center of plate **25**. Centrifugal impeller **36** carries an array of blades or vanes **39** at the top, where stored beverage from above may be received and spun to assume high angular and radial components of velocity about axis **30—30**.

Substantially all of the liquid acted upon by the centrifugal impeller is constrained to travel at high speed in a highly elongated spiral path in proximity with the cool-

ing plate **25**. This has two important results: first, the pumped liquid has advantageously prolonged and high-speed contact with all cold parts of the cooling plate, so that thorough chilling is insured; and, second, the pumped liquid reaches a desirably high linear velocity before it is returned to the reservoir. Both of these effects are promoted by the separable pump member **40** which is closed at its top **40***a*, except for a central fluid-admitting opening **41** (FIGURE 5) and a peripheral fluid outlet **42**, and which includes integral depending vertical ribbing **40***b* in spiral form of more than one turn. Spiral ribbing **40***b* commences near the central impeller and terminates near the periphery of pump member **40**, at an outwardly-turned end **40***c* near the outlet **42**. Vertical depth of the spiral channel **43** formed between turns of ribbing **40***b* is generally about the same as the depth of the shallow cylindrical recess above cooling plate **25**; the channel is closed at the top by part **40***a* and substantially closed at the bottom by cooling plate **25**. For the latter purpose, the lower end of ribbing **40***b* extends into close proximity with cooling plate **25**. Near its outer periphery **40***d*, the pump member rests upon the interior of bowl base **7***i*, about the circular opening **7***j*, and unintended escape of liquid directly back into the reservoir **9** is effectively suppressed there without use of other sealing provisions. Pump member **40** is removably held in operating position (FIGURE 3) by a lock washer member **44** having a locking keyway **44***a* which permits it to engage and secure itself to the spindle **38** about a reduced-diameter section **38***a* near its upper end. Central opening **41** in the pump member is kept in free communication with the beverage reservoir by the clearance provided between legs **40***l* of an integral upper support web **40***m* which has a central guide hole **45** (FIGURE 5) for orienting the pump member properly on the spindle **38**.

Arrows **46** in FIGURE 3 characterize beverage flow from the reservoir to the center of the centrifugal impeller; this liquid is rotated at high angular velocity and courses through the spiral cavity **43** at high linear speeds until finally it escapes upwardly through the short standpipe **42***a* surrounding outlet **42**. Sufficient head is developed in this pumping to force the beverage out of the top of spray tube **11** and against the bowl cover, as designated by arrows **47**. The long-distance spiral flow of the pumped beverage brings various unit volumes of beverage into prolonged high-velocity heat-exchange relationship with cooling plate **25** and thereby effects a thorough chilling before the outlet spray returns the beverage to the reservoir. Pump member **40**, being open at the bottom, can be readily cleaned, and other elements of the pumping and cooling assembly (bushing **37**, impeller **36**, lock member **44**, and spray tube **11**) are also easily separated and re-assembled for the same purpose.

The entire reservoir of beverage **9** is maintained well chilled at all times as a result of the aforementioned operation. This chilled beverage may be directly dispensed from the reservoir to the consumer without further cooling or other safeguards so long as no stagnation or undue warming can occur in the dispensing valve. FIGURES 2 and 6 provide details of the simple type of valve which is used for cold dispensing. Hollow guide bushing **22**, which is exteriorly threaded and held in tightly sealed relationship with the bowl base by lock nut **48**, is mated with the coaxially slidable lift valve member **14**. Together, these elements close the base opening **21**, through the intermediary O-ring seal **49** which is firmly fitted about the valve member **14** and seats against the conical seating surface **50** of the bushing. At its upper end, valve member **14** is united with a relatively large cylindrical mass **14***a* having the dual effects of gravitationally depressing valve member **14** and preserving it cool by virtue of its chilling by the cold beverage in which it is immersed. Below the level of O-ring seal **49**, the valve member is hollow, to form a dispensing outlet pipe or tap, and the vertical interior passage **14***b* communicates with the outside of member **14** by way of one or more side openings, such as opening **51**. The latter opening or openings are disposed below the level of the seal **49**, such that beverage can enter and drain through the hollow outlet pipe whenever the valve is raised. Lifting of the valve member **14** is accomplished by applying pressure backwardly against lever arm **16**, in the direction of arrow **52**; advantageously, this occurs automatically whenever a beverage container is positioned below the outlet tap and is pressed against the lever arm. A broad portion of arm **16** hangs somewhat vertically downwardly at a position to the rear of tap member **14**, from a forwardly-extending portion **16***a* which has an aperture **16***b* through which the reduced-diameter lower end **14***c* of tap member **14** extends. Integral laterally-extending tabs **16***c* at the front of lever portion **16***a* are hung in notches **53***a* of a U-shaped hinge bracket **53** secured to the under side of the bowl by the lock nut **48**. Lever aperture **16***b* is only slightly larger than the reduced-diameter end **14***c* of the lift valve member, such that the lever is held against dislodging from the hinge notches so long as the lift valve member **14** remains in place. Backward pressure on the lever arm causes it to tilt in the hinge notches and to lift member **14** from its seat. The lever and valve member both drop back to their lowermost positions when the pressure is removed. Outlet passage **14***b* is substantially vertical, and short, with the result that substantially no beverage can remain trapped in the valve, and no significant after-drip can occur following any dispensing action. The valve parts remain well chilled, due largely to conduction paths involving the cooled mass **14***a*. As in the case of the pumping and cooling assembly, the dispensing valve operates well even with low levels of liquid in the bowl. Moreover, the beverage is discharged at only relatively low pressure and velocity, such that splashing or spraying is avoided during the dispensing operations.

In some instances, it can be advantageous to mold elements corresponding to the guide bushing **22** and notched hinge bracket **53** integrally with the bowl, rather than to supply these as separate parts. Injection molding techniques permit the seating and guide surfaces of the bushing to be formed with the requisite precision.

Based upon the recognitions and teachings described herein, liquid-handling apparatus may be produced in different sizes and forms for a variety of applications. Accordingly, it should be understood that the specific embodiments herein disclosed are intended to be of a descriptive rather than a limiting character, and various modifications, combinations and substitutions may be effected in practice of these teachings without departing either in spirit or scope from this invention in its broader aspects.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. Liquid-processing apparatus, comprising a container for a quantity of a liquid, a heat-transfer plate having at least a substantially flat annular portion, a centrifugal impeller mounted for rotation in close proximity with and about an axis substantially normal to one side of said heat-transfer plate centrally of and coaxially with said annular portion, motive means on the other side of said heat-transfer plate coupled with and rotating said impeller, substantially flat annular refrigeration means mounted in intimate heat-exchange relationship with said other side of said annular portion of said heat-transfer plate, shallow pump means having a substantially spiral liquid flow passageway coaxially about and communicating with said impeller and exposed along one side for substantially its full length to said one side of said annular portion of said heat-transfer plate, means admitting liquid from said container to said impeller near said axis, and means for discharging accelerated liquid from said passageway into said container.

2. Liquid-processing apparatus, comprising a container for a quantity of a liquid, a substantially flat heat-transfer plate, a centrifugal impeller mounted for rotation in close proximity with and about an axis substantially normal

to one side of said heat-transfer plate, motive means on the other side of said heat-transfer plate coupled with and rotating said impeller, a substantially flat annular array of refrigeration coils mounted in intimate heat-exchange relationship with said other side of said heat-transfer plate, shallow pump means having a substantially spiral liquid flow passageway of more than one turn coaxially about said impeller and exposed along one side for substantially its full length to said one side of said heat-transfer plate opposite said refrigeration coils, means admitting liquid from the bottom of said container to said impeller near said axis, means for discharging accelerated liquid from said passageway into said container above the level of liquid therein, and means for withdrawing chilled liquid directly from said container at a position remote from and independently of said pump means.

3. Liquid-processing apparatus, comprising a container in the form of a bowl having a substantially flat bottom, a cooling plate having at least a substantially flat annular portion, a centrifugal impeller mounted for rotation in close proximity with and about an axis substantially normal to one side of said cooling plate centrally of and coaxially with said annular portion, motive means on the other side of said cooling plate coupled with and rotating said impeller, substantially flat annular refrigeration means mounted in intimate heat-exchange relationship with said other side of said annular portion of said cooling plate, shallow pump means having a substantially spiral liquid flow passageway coaxially about and communicating with said impeller and exposed along one side for substantially its full length to said one side of said annular portion of said cooling plate, means admitting liquid from the bottom of the bowl to said impeller means near said axis, means for discharging accelerated liquid from said passageway into the bowl above the level of liquid therein, and means for tapping liquid directly from the bottom of the bowl at a position remote from said admitting means.

4. Liquid-processing apparatus, comprising a liquid storage bowl having a relatively large opening through the bottom thereof, a support for said bowl, said support including a substantially horizontal cooling plate near the top thereof disposed to appear opposite said opening when said bowl is set on said support, said cooling plate having at least a substantially flat annular portion, a centrifugal impeller mounted for rotation in close proximity with and about an axis substantially normal to the top of said cooling plate centrally of and coaxially with said annular portion, motive means mounted on said support below said cooling plate coupled with and rotating said impeller, substantially flat annular refrigeration means mounted in intimate heat-exchange relationship with the bottom of said annular portion of said cooling plate, shallow pump means having a substantially spiral horizontal liquid flow passageway coaxially about and communicating with said impeller and exposed along the bottom thereof for substantially its full length to the top of said annular portion of said cooling plate, means admitting liquid from said bowl to said impeller near said axis, means for discharging accelerated liquid from said passageway into the bowl above the level of liquid therein, and means sealing said bowl in relation to said cooling plate radially outwardly of said annular portion thereof.

5. Liquid-processing apparatus, comprising a liquid storage bowl having a relatively large circular opening through the bottom thereof, a support for said bowl having a substantially circular cooling plate near the top thereof exposed to said opening when said bowl is set on said support, said cooling plate having at least a substantially flat annular portion, a centrifugal impeller mounted for rotation in close proximity with and about an axis substantially normal to the top of said cooling plate centrally of and coaxially with said annular portion, motive means mounted on said support below said cooling plate, magnetic means coupling said motive means in driving relationship with said impeller through said cooling plate, a substantially flat annular refrigeration coil mounted in intimate heat-exchange relationship with the bottom of said annular portion of said cooling plate, shallow pump means having a substantially spiral horizontal liquid flow passageway coaxially about and communicating with said impeller and exposed along the bottom thereof for substantially its full length to the top of said annular portion of said cooling plate, said passageway having an outlet at the top of said pump means near the outer periphery thereof, means admitting liquid from said bowl to said impeller near said axis, a spray tube "projecting from said outlet substantially vertically through the liquid in said bowl, and means sealing the bottom of said bowl around said opening in relation to said cooling plate radially outwardly of said annular portion thereof.

6. Liquid-processing apparatus as set forth in claim 5 wherein said cooling plate has an upstanding rim about the periphery thereof, wherein said bowl has a rim projecting downwardly about said opening which is of slightly smaller cross-section than that of said upstanding rim, and wherein said sealing means includes a radially-compressible gasket member interposed between said rims, said gasket having a transverse cross-section normally greater than the radial separation between said rims.

7. Liquid-processing apparatus as set forth in claim 6 wherein said downwardly-projecting rim of said bowl is substantially cylindrical, wherein said gasket is formed of elastic material and has an inner diameter normally less than the outer diameter of said bowl rim and is stretched onto said bowl rim, and wherein said gasket is normally substantially cylindrical along the inner diameter thereof and is normally convex in curvature along the outer diameter thereof.

8. Liquid-processing apparatus, comprising a container for a quantity of a liquid, a substantially flat heat-transfer plate, a centrifugal impeller, motive means for rotating said impeller in close proximity with and about an axis normal to said heat-transfer plate, shallow spirally-ribbed pump means open along one side mounted with the ribbing exposed along the open side thereof disposed substantially in abutting normal relationship to one side of said heat-transfer plate and coaxially surrounding said impeller, said heat-transfer plate and pump means together forming a substantially spiral fluid passageway around said impeller wherein the liquid is in heat-transfer relationship with said plate and is accelerated to a relatively high linear velocity, means admitting liquid from said container to said impeller near the center thereof, means discharging the accelerated liquid from the spiral passageway at the outer end thereof, into said container and heat-exchanger means in intimate heat-exchange relationship with the other side of said heat-transfer plate.

9. Liquid-processing apparatus, comprising a container for a quantity of a liquid, a substantially flat heat-transfer plate, a centrifugal impeller mounted for rotation in close proximity with and about an axis normal to said heat-transfer plate, shallow spirally-ribbed pump means coaxial with said impeller and closed on one side except for a relatively small central opening and a small opening near the pheriphery thereof, said pump means being mounted with the ribbing thereof exposed on the other side substantially in abutting normal relationship to one side of said heat-transfer plate, said heat-transfer plate and pump means together forming a substantially spiral fluid passageway around said impeller wherein the liquid is in heat-transfer relationship with said plate and is accelerated to relatively high linear velocities, means admitting liquid from said container to said impeller near the center thereof through said central opening in said pump means, means discharging the accelerated liquid from said opening near the periphery of said pump means into said container, an annular array of refrigeration coils in intimate heat-exchange relationship with the other side of said heat-transfer plate opposite said spiral passageway, and motive means on said other side of said heat-

transfer plate coupled with and rotating said centrifugal impeller.

10. Liquid-processing apparatus, comprising a container for a quantity of a liquid, a substantially flat heat-transfer plate, a centrifugal impeller, motive means for rotating said impeller in close proximity with and about an axis normal to said heat-transfer plate, substantially spirally-ribbed pump means in coaxial surrounding relationship with said impeller, the ribbing of said pump means being of substantially uniform height and extending substantially normal to said heat-transfer plate along one side thereof for more than one turn about said axis, said pump means including portions closing the other side of the ribbing at a substantially uniform distance from said heat-transfer plate to form a substantially spiral fluid passageway coaxially around said impeller and in heat-transfer relationship with said heat-transfer plate, means admitting liquid from said container to said centrifugal impeller near said axis, means discharging liquid at relatively high linear velocity from the passageway through said pump means near the periphery thereof, and heat-exchanger means in intimate heat-exchange relationship with said heat-transfer plate on the side thereof opposite that to which the ribbing extends.

11. Liquid-processing apparatus, comprising a liquid storage bowl having a relatively large circular opening through the substantially flat bottom thereof, a support for said bowl having a substantially circular cooling plate of magnetically permeable metal near the top thereof exposed to said opening when said bowl is set on said support, shallow pump means atop said cooling plate including a rotatable impeller and means forming a substantially closed spiral pumping flow passageway coaxially around said impeller and directly exposed substantially fully along the bottom thereof to the top of said cooling plate, refrigeration means mounted on said support and having refrigerating coils in intimate heat-exchange relationship with the bottom of said cooling plate, motive means mounted on said support below said cooling plate, magnetic means coupling said motive means in driving relationship with said impeller through said cooling plate, means admitting liquid from said bowl to said impeller near the center thereof, a substantially vertical fluid outlet tube projecting substantially vertically upwardly above the liquid level in said bowl from a position near the outer periphery of said spiral passageway in said pump means, and means sealing said cooling plate with said bowl about said opening through said bowl.

12. Liqiud-processing appartus, comprising a liquid storage bowl having a substantially flat bottom with a relatively large opening and a relatively small opening therethrough, a support mounting said bowl with a portion thereof having the relatively small opening therethrough in overhanging relationship to the front of said support, said support having a substantially circular cooling plate near the top thereof exposed to the relatively large opening when said bowl is mounted on said support, shallow pump means atop said cooling plate including a rotatable impeller and means forming a substantially closed spiral pumping flow passageway coaxially around said impeller and directly exposed substantially fully along the bottom thereof to the top of said cooling plate, refrigeration means mounted on said support and having a flat array of refrigerating coils in intimate heat-exchange relationship with the bottom of said cooling plate, motive means mounted on said support below said cooling plate and rotating said impeller, means sealing said bowl with said cooling plate about the large opening, means admitting liquid from said bowl to said impeller near the center thereof, means discharging liquid from a position near the outer periphery of said spiral passageway into said bowl, and lift valve dispensing means normally closing the relatively small opening through the bottom of said bowl, said lift valve means including means providing a hollow valve seat around said small opening, a vertically slidable weighted valve member mated coaxially with said valve seat means for seating and sealing therewith at an upper position, said valve member having a reduced cross-sectional area below said upper position to permit drainage of liquid when said valve member is raised, and pivoted lever means outside of said bowl for lifting said valve member to dispense liquid from said bowl.

13. Liquid-processing apparatus, comprising a liquid storage bowl having a bottom with a relatively large opening and a relatively small opening therethrough, a support mounting said bowl with a portion thereof having the relatively small opening therethrough in overhanging relationship to the front of said support, said support having pumping and refrigerated cooling equipment at the top thereof exposed to the relatively large opening when said bowl is mounted on said support, means sealing said bowl with said support about the relatively large opening, means providing a hollow valve seat around said small opening, and a fluid-dispensing lift valve normally closing the relatively small opening through the bottom of said bowl, said lift valve including vertically slidable valving means mated with and slidable coaxially within said hollow valve seat means and having valving surfaces for seating and sealing with said valve seat means at an upper position, said valving means further including an enlarged portion at the top thereof and disposed in the bowl, said enlarged portion being of relatively large mass which gravitationally depresses said valving means into seating and sealing with said valve seat means and being of relatively large surface area through which said valving means is chilled by exposure to the liquid in the bowl, and said valving means further having a reduced cross-sectional area below said valving surfaces thereof permitting drainage of liquid through said valve seat means when said valving means is raised, and pivoted lever means outside of said bowl for lifting said valving means to dispense liquid from said bowl.

14. Liquid-processing apparatus as set forth in claim 13 wherein said valving means includes a lower end projecting downwardly of the bottom of said bowl through said small opening, wherein said pivoted lever means comprises a lever member having the general shape of an inverted L, with the substantially vertical portion thereof disposed rearwardly of and below the front of the overhanging part of the front of the bowl, and with the substantially horizontal portion thereof extending forwardly thereof, and separable means hinging the front of said horizontal portion for pivotal movement about a transverse horizontal axis, said separable hinging means including bracket means fixed with the bottom of said bowl and having horizontally-aligned notches open at the front thereof, and cooperating horizontally-extending hinge means on said horizontal portion of said lever member disposed for separable engagement with said bracket means by way of the notches therein, said horizontal portion of said lever member being disposed to engage and lift said lower end of said valving means when said vertical portion is pressed rearwardly toward the front of said support.

15. Liquid-processing apparatus, comprising a liquid storage bowl having a relatively large circular opening and a spaced relatively small circular opening through the substantially flat bottom thereof, said bowl having a short downwardly-extending substantially cylindrical integral rim about said relatively large opening, a support for said bowl having a substantially circular and flat cooling plate of magnetically permeable material at the top thereof exposed to said relatively large opening when said bowl is set on said support, and mounting said portion of said bowl having the relatively small opening therethrough in overhanging relationship to the front of said support when said bowl is set on said support, said cool-

ing plate having a short upstanding substantially cylindrical rim about the periphery thereof of inner diameter slightly greater than the outer diameter of the rim on said bowl and surrounding the latter rim when said bowl is set on said support, shallow pump means atop said cooling plate including a central rotatable impeller separable from said plate and separable means forming a substantially closed spiral flow passageway of more than one turn coaxially around said impeller and open at the bottom to expose said passageway fully along its length to the top of said flat cooling plate, refrigeration means on said support including refrigeration coils in intimate heat-exchange relationship with the bottom of said cooling plate, motive means mounted on said support below said cooling plate, magnetic means coupling said motive means in driving relationship with said impeller through said cooling plate, means admitting liquid from said bowl to said impeller near the center thereof, a substantially vertical liquid spray outlet tube projecting upwardly above the liquid level in said bowl from a position near the outer periphery of said spiral passageway, a removable cover fitting the top of said bowl and extending above the level of said spray tube, a radially-compressible elastic gasket stretched over said rim of said bowl, said gasket having a transverse cross-section of radial thickness normally greater than the annular clearance between said rims, and lift valve dispensing means normally closing the relatively small opening through the bottom of said bowl, said lift valve means including guide bushing means providing an annular valve seat around said small opening, vertically slidable weighted valve means mated coaxially within said guide bushing means, said slidable means having a weight portion at the top disposed within the bowl for chilling by the liquid, a seal below said weight portion for seating and sealing with said annular valve seat, and a cylindrical tubular top portion mated with said bushing and open laterally below said seal to admit flow of liquid therethrough when said slidable means is raised, and valve lifting means outside said bowl and in front of said support for selectably lifting said slidable means to dispense liquid from said bowl.

16. Liquid-processing apparatus, comprising a liquid storage bowl having a bottom with a relatively large opening and a relatively small opening therethrough, a support mounting said bowl with a portion thereof having the relatively small opening therethrough in overhanging relationship to the front of said support, said support having pumping and refrigerated cooling equipment at the top thereof exposed to the relatively large opening when said bowl is mounted on said support, means sealing said bowl with said support about the relatively large opening, means providing a hollow valve seat around said opening and including means forming a tubular guide about said opening and having a valve seat portion at the top disposed at a level substantially the same as that of the inner bottom surface of said bowl and further including a subtially cylindrical guide passage portion extending downwardly therefrom, lift valve dispensing means normally closing the relatively small opening through the bottom of said bowl, said lift valve means including a vertically slidable weighted valve member having a sealing portion at an upper position disposed for seating and sealing with said valve seat means and having a cylindrical portion below said sealing portion closely mated coaxially with said cylindrical guide passage portion and slidable therein, said cylindrical portion of said valve member having a longitudinal drain opening therein merging with at least one lateral opening through the side of said cylindrical portion of said valve member below said sealing portion, said valve member having a weight portion disposed in the bowl for exposure to and chilling by the liquid therein, and pivoted lever means outside of said bowl for lifting said weighted valve member to dispense liquid from said bowl, said pivoted lever means comprising a lever member having the general shape of an inverted L with the substantially vertical portion thereof disposed rearwardly of and below the front of the overhanging part of the front of the bowl, and with the substantially horizontal portion thereof extending forwardly thereof, said horizontal portion of said lever member having an opening therein slightly larger than said cylindrical portion of said valve member and disposed with said cylindrical portion of said valve member passing therethrough, said cylindrical portion of said valve member having an enlarged shoulder disposed to be engaged and lifted by the top of said horizontal portion of said lever member when said vertical portion is pressed rearwardly toward the front of said support, and means hinging the front of said horizontal portion for pivotal movement about a transverse horizontal axis, said hinging means including notched hinge bracket means fixed with the bottom of said bowl, said front of said horizontal portion of said lever member being engaged in notches of said hinge means for said pivotal movement.

References Cited by the Examiner

UNITED STATES PATENTS

2,710,707	6/1955	Persak	141—362 X
2,775,877	1/1957	Bruntjen.	
3,060,702	10/1962	Price	62—392

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