July 2, 1940. A. H. HOOPER 2,206,826

COOLING MEANS FOR LIQUIDS

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FIG.1.

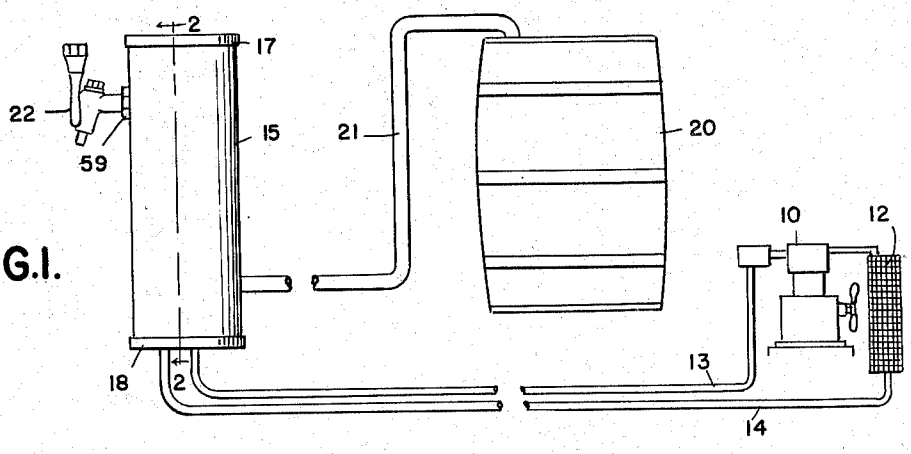


FIG.4.

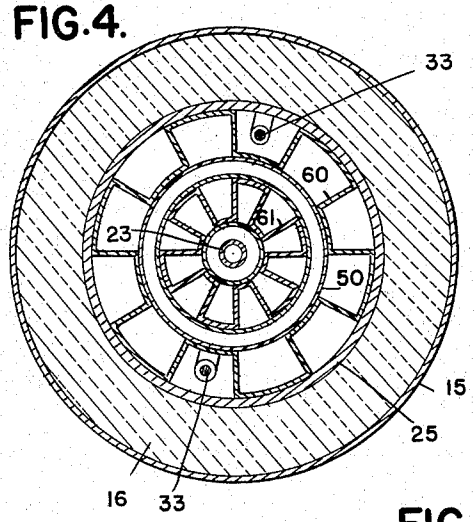


FIG.5.

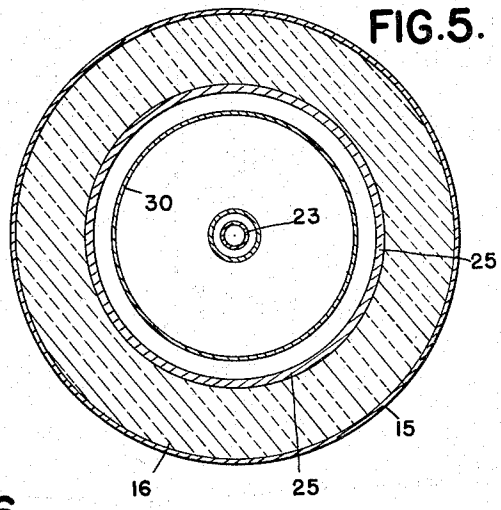
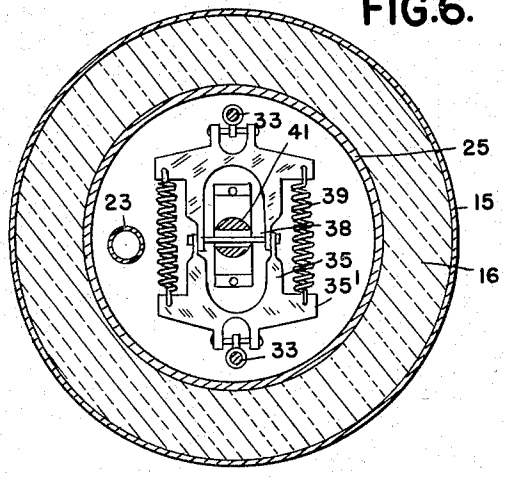


FIG.6.



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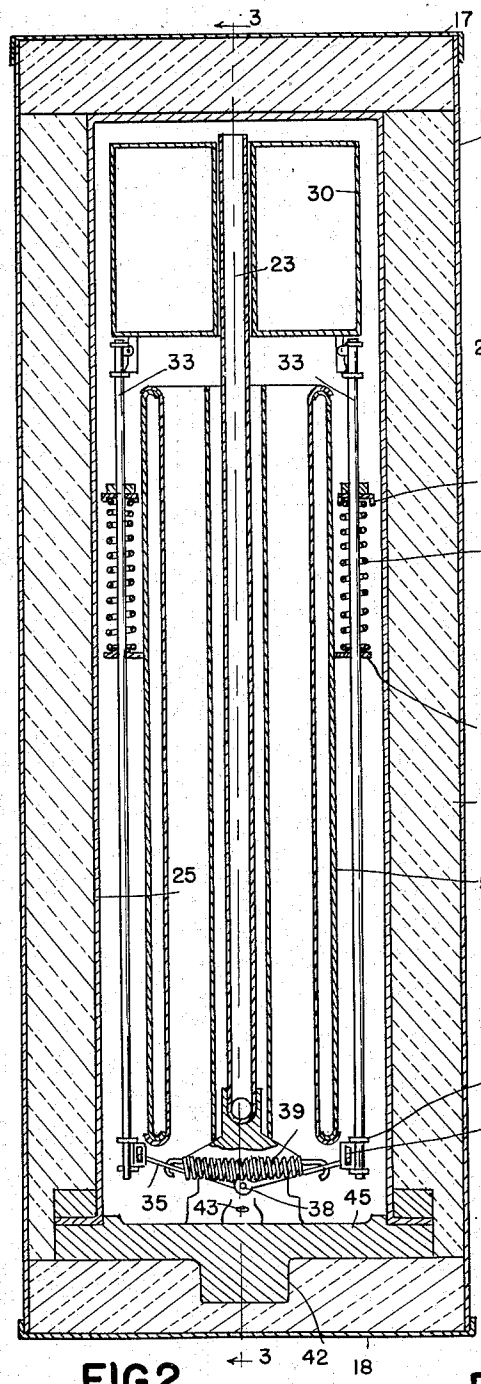


FIG.2.

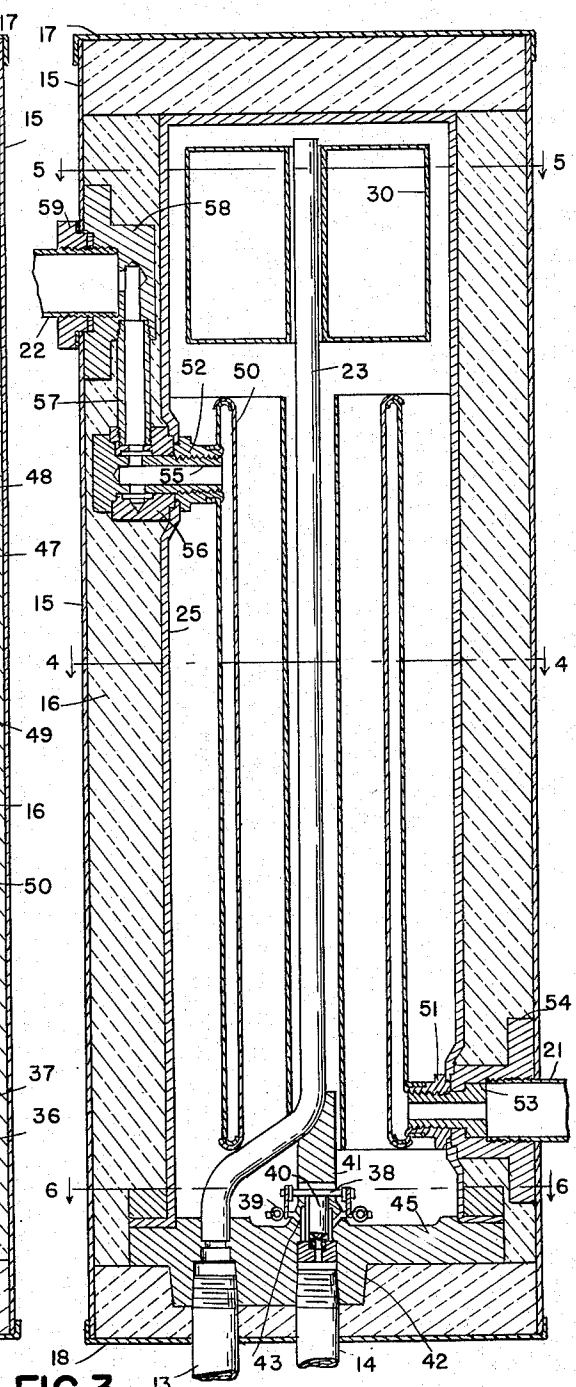


FIG.3.

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COOLING MEANS FOR LIQUIDS

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Application August 7, 1937, Serial No. 157,971

6 Claims. (Cl. 62—141)

This invention relates to cooling means for fluids, and particularly to the artificial cooling of beverages, and aims to provide an improved flash cooling apparatus of such nature that although the amount of cooled liquid stored therein is relatively small, perfectly cooled beverage or other liquid may be drawn therefrom, continuously if desired, the cooling means functioning as rapidly as the liquid will flow.

A further important object is the provision of such cooling apparatus capable of very accurately controlling temperature of a beverage and which prevents all possibility of unwanted freezing thereof.

Another object is the provision of such apparatus so constructed that it tends to remain clean, all of the surfaces contacted by the liquid being so formed that no accumulation of precipitated matter can occur.

Still another object is the provision of such apparatus of very compact character and neat appearance, and which constitutes as well a unique and efficient evaporator system for artificial refrigerating apparatus employed to absorb heat from the cooled liquid.

Still another object comprises the provision of such apparatus so constructed as to form the liquid being cooled into a thin sheet confined between relatively thin metal walls, the walls being surrounded upon all sides by and immersed in refrigerant which evaporates in direct contact therewith.

Another object is the provision of an improved cooling process for gas-charged beverages, which process tends to drive the gas into solution and eliminate from the finally delivered beverage bubbles of undesirably large size, whereby upon malt beverages such as beer an extremely persistent and creamy "head", composed entirely of very small bubbles, may be formed.

A further object is the provision of such apparatus incorporating novel means for controlling the valving and evaporating action of the refrigerant.

Other objects and advantages will be apparent from the following description, wherein reference is made to the accompanying drawings illustrating a preferred embodiment of my invention and wherein similar reference numerals designate similar parts throughout the several views.

In the drawings:

Figure 1 is a schematic diagram of a beverage dispensing and refrigerating system incorporating a combined evaporator, beverage cooling and dispensing unit constructed in accordance with the principles of this invention.

Figure 2 is a diametric section taken substantially on the line 2—2 of Figure 1, and looking in the direction of the arrows.

Figure 3 is a similar diametric sectional view taken substantially at right angles to Figure 2, and as indicated by the line and arrows 3—3 of Figure 2.

Figures 4, 5 and 6 are horizontal cross sections taken substantially on the lines 4—4, 5—5 and 6—6 respectively of Figure 3, and looking in the direction of the arrows.

Referring now to the drawings, it will be seen that in Figure 1 I have diagrammatically shown a simple refrigerating system consisting of a compressor 10 and condenser 12, connected by high and low side tubing 13—14 to an evaporator of novel construction incorporated in an insulated container 15, which container also constitutes the beverage cooling unit. The beverage is supplied as from a keg 20 through a tube or pipe 21. The same tank-like container 15 may also carry the dispensing tap 22 for the cooled beverage. The container is preferably of the double walled type, the details of its construction being shown in Figures 2 to 6 inclusive. The inner wall 25 constitutes the evaporator tank, while between the outer and inner shells 15—25 insulation as 16 is provided. Shell 15 is shown as a simple sheet metal cylinder provided with top and bottom sheet metal caps 17—18 respectively, the latter being provided with apertures (undesignated), for the lines 13—14 to and from the compressor and condenser.

The evaporator is of the flooded type, in the form of a vertical cylindrical tank, the inlet or expansion valve, which will presently be described in greater detail, being located at the bottom, controlled by a float 30 acting through rods 33. The float, comprising a hollow sheet metal cylinder, is guided upon the refrigerant outlet tube 23, which, forming a continuation of outlet tube 13, projects upwardly substantially axially of the tank, to a position near its top.

From points near the periphery of the float, the valve operating rods 33, secured thereto, extend downwardly to positions near the bottom of the tank, where they are articulated to valve actuating arms 35. Lost motion between the float and valve actuating arms is provided by vertical slots 36 in the brackets 37 which, secured to the bottoms of the rods 33, provide connection between the latter and the arms. The valve actuating arms are centrally pivoted to a cross pin

38 which is in turn connected to and serves to actuate the valve 40. The cross pin and valve are capable of vertical movement in a valve casing portion 41, formed integrally with the bottom plate 45 of evaporator tank 25. Such plate is preferably a forging as I find it of less porosity than a casting. An over-center snap action is given the valve by tensile springs 39 extending across and hooked in the opposite arms 35 near their outer ends. The arms are provided with ears 35 for the purpose.

The valve 40, pointed at its bottom, acts against a seat 42 carried in the valve casing section directly above the refrigerant inlet tube 14, to open and close communication between such inlet and the interior of tank 25, passages 43 being provided between the space directly above the valve and the interior of the tank.

The operation of the evaporator portion of the apparatus will be readily apparent from the foregoing. The valve opens as soon as the refrigerant level has fallen sufficiently to allow the float to drop and to impose upon the arms 35 weight enough to overcome the resistance of springs 39 and to carry the latter past the axis of pin 38, whereafter the springs tend to throw the valve open with a snap action. The valve remains open until the lift of the entering refrigerant, acting upon the float, gives the latter sufficient buoyancy to again raise the arms 35 until the axes of springs 39 pass the axis of pin 38, whereupon the springs again snap the valve positively to closed position. If desired the weight of the float may be partially counterbalanced as by springs 47, which encircle rods 35 and bear upwardly against retaining brackets 48 carried thereby. The springs are bottomed against lugs 49 projecting outwardly from the exterior of the beverage cooling tank 50. Regardless of the details of arrangement of these parts, however, a predetermined travel of the float will be seen to be necessary to actuate the valve.

As clearly shown in Figures 2 and 3, the beverage cooling tank consists of a thin walled hollow cylinder formed of inner and outer sheet metal tubes which are but slightly spaced from each other. At their ends the tubes forming the walls of the cooling unit are expanded and brazed or welded together. The tubes are seamless, and my preferred material therefor is stainless steel, the inner surfaces contacted by the liquid being highly polished, so that no irregularities or recesses are presented which might tend to accumulate sediment. The cooling tank is arranged concentrically within the evaporator tank 25, and its radius is approximately half that of the evaporator tank. Beverage inlet and outlet nipples 51—52 are tightly expanded into the outer wall of the cooling unit and also sealed in the openings (undesignated), provided in the wall of tank 25. The inlet is connected by coupling means as 53, 54 to the beverage supply tube 21, which enters the cooling unit at the bottom, while the outlet coupling includes a central sleeve 55 threaded into the nipple 52 and provided at its outer end with a head adapted to receive a wrench, and so disposed that when secured in place it tightly clamps against the outer surface of tank 25 a take-off coupling block 56 through which the liquid is conducted from the tube 55 and delivered to a connecting tube 57 which extends upwardly to connect with an outlet coupling assembly 58—59, the last two mentioned parts being tightly secured against the inner and outer surfaces of the casing 15 to support and deliver fluid to the draw-off tap 22, which is shown only fragmentarily in Figure 3.

Soldered or otherwise suitably secured to both the inner and outer walls of cooling unit 50 are sheet metal fin portions 60—61, shown best in Figure 4, such fin portions serving to position the cooling unit in the evaporator tank and to provide for more rapid heat conduction between the cooled liquid and the refrigerant.

Inlet coupling portion 53 will be seen to somewhat restrict and so increase the velocity of the inflowing liquid. Thus if the cooled substance is a beverage containing gas, such as a carbonated or malt beverage, while it may tend to enter the cooling unit charged with relatively large bubbles of gas, its discharge through bushing 53 against the inner wall of the cooling unit effects a breaking up of the bubbles into much finer form. Thereafter the beverage rises in the unit in a more quiescent state, because the total cross sectional area of the cooling unit is greater than the inlet, the bubbles having opportunity to collapse and due to the flash cooling, to be re-dissolved and decrease in size as the beverage rises. The beverage, as drawn from the tap, contains only extremely fine bubbles, and in accordance with the manner in which the tap is manipulated, the beverage may be delivered either relatively free of bubbles, or with a rich "head" composed of extremely fine and accordingly persistent bubbles.

The volume of the cooling unit or cell 50 may actually be less than the volume of beverage drawn off at one time, as cooling takes place as rapidly as the beverage can flow through the unit. This rapid heat absorption, taking place suddenly and while the beverage is rising in a relatively thin film, promotes very effective reabsorption of gas by the liquid, preventing the discharge of large bubbles from the tap.

While it will be apparent that the illustrated embodiment of my invention herein disclosed is well calculated to adequately fulfill the objects and advantages primarily stated, it is to be understood that the invention is susceptible to variation, modification and change within the spirit and scope of the subjoined claims.

What I claim is:

1. A cooling assembly for gas-charged liquids, comprising a cooling cell having relatively thin and close liquid-confining walls and having an inlet at one end and an outlet at the other, a flooded evaporator enclosing said cell, said evaporator having inlet and outlet portions at corresponding ends of the assembly, a circulatory refrigerating system connected to said evaporator, whereby it may act to absorb heat from the cell and from liquid within the latter, means for supplying liquid to be cooled to the inlet of said cell, means for withdrawing cooled liquid from the outlet thereof, said cell and evaporator being of elongated form and substantially concentric in arrangement, the inlets of the cell and of the evaporator being located relatively close to each other, and heat transferring fin portions carried by the cell and extending into the evaporator to contact refrigerant in the latter.

2. A cooling assembly for gas-charged liquids, comprising a cooling cell having relatively thin and close liquid-confining walls and having an inlet at one end and an outlet at the other, a flooded evaporator enclosing said cell, said evaporator having inlet and outlet portions at corresponding ends of the assembly, a circulatory refrigerating system connected to said evaporator, whereby it may act to absorb heat from

the cell and from liquid within the latter, means for supplying liquid to be cooled to the inlet of said cell, means for withdrawing cooled liquid from the outlet thereof, said cell walls comprising a pair of spacedly interfitted tubular portions, the space therebetween being closed at the ends to form an enclosure, while the space within the inner tubular portion is open at the ends to permit flow of refrigerant both outside the outer wall and inside the inner wall, said cell and evaporator being substantially concentric in arrangement, and heat transferring fin portions extending inwardly from the inner wall and outwardly from the outer wall for contact with refrigerant in the evaporator.

3. A cooling assembly for gas-charged liquids, comprising a cooling cell having relatively thin and close liquid-confining walls and having an inlet at one end and an outlet at the other, a flooded evaporator enclosing said cell, said evaporator having inlet and outlet portions at corresponding ends of the assembly, a circulatory refrigerating system connected to said evaporator, whereby it may act to absorb heat from the cell and from liquid within the latter, means for supplying liquid to be cooled to the inlet of said cell, means for withdrawing cooled liquid from the outlet thereof, said cell walls comprising a pair of spacedly interfitted tubular portions, the space therebetween being closed at the ends to form an enclosure, while the space within the inner tubular portion is open at its ends, whereby refrigerant may flow both outside the outer wall and inside the inner wall, but not between the walls, snap-acting valve means for controlling the inlet of the evaporator, and float means at the opposite end of the assembly responsive to the level of refrigerant therein for controlling the action of the valve.

4. A cooling assembly for gas-charged liquids, comprising a cooling cell having relatively thin and close liquid-confining walls and having an inlet at one end and an outlet at the other, a flooded evaporator enclosing said cell, said evaporator having inlet and outlet portions at corresponding ends of the assembly, a circulatory refrigerating system connected to said evaporator, whereby it may act to absorb heat from the cell and from liquid within the latter, means for supplying liquid to be cooled to the inlet of said cell, means for withdrawing cooled liquid from the outlet thereof, said cell and evaporator being substantially concentric and upstanding in arrangement, the cell being of double-walled hollow form, the double walls being sealed together and the hollow interior being open top and bottom, whereby refrigerant may flow upwardly both outside the outer of such double walls and inside the inner wall thereof, the liquid to be cooled flowing upwardly between such walls, valve means at the lower end of the assembly for controlling admission of refrigerant to the evaporator, the refrigerant outlet including an outlet pipe extending upwardly substantially centrally of the assembly and having an open end near the top thereof, and float means for controlling said valve means guided by said pipe above the cell.

5. A cooling assembly for gas-charged liquids, comprising a cooling cell having relatively thin and close liquid-confining walls and having an inlet at one end and an outlet at the other, a flooded evaporator enclosing said cell, said evaporator having inlet and outlet portions at corresponding ends of the assembly, a circulatory refrigerating system connected to said evaporator, whereby it may act to absorb heat from the cell and from liquid within the latter, means for supplying liquid to be cooled to the inlet of said cell, means for withdrawing cooled liquid from the outlet thereof, said cell and evaporator being substantially concentric and upstanding in arrangement, the cell being of double-walled hollow form, the double walls being sealed together and the hollow interior being open top and bottom, whereby refrigerant may flow upwardly both outside the outer of such double walls and inside the inner wall thereof, the liquid to be cooled flowing upwardly between such walls, valve means at the lower end of the assembly for controlling admission of refrigerant to the evaporator, the refrigerant outlet including an outlet pipe extending upwardly substantially centrally of the assembly and having an open end near the top thereof, float means for controlling said valve means guided by said pipe above the cell, means providing lost motion connection between the float and valve extending downwardly through the evaporator.

6. A cooling assembly for gas-charged liquids, comprising a cooling cell having relatively thin and close liquid-confining walls and having an inlet at one end and an outlet at the other, a flooded evaporator enclosing said cell, said evaporator having inlet and outlet portions at corresponding ends of the assembly, a circulatory refrigerating system connected to said evaporator, whereby it may act to absorb heat from the cell and from liquid within the latter, means for supplying liquid to be cooled to the inlet of said cell, means for withdrawing cooled liquid from the outlet thereof, said cell walls comprising a pair of spacedly interfitted tubular portions, the space therebetween being closed at the ends to form an enclosure, while the space within the inner tubular portion is open at the ends whereby refrigerant may flow upwardly both outside the outer wall and inside the inner wall, the liquid to be cooled flowing upwardly between such walls, snap-acting valve means at the lower end of the assembly for controlling admission of refrigerant to the evaporator, the refrigerant outlet being located at the top of the assembly, float means also located near the top of the assembly for controlling said valve means, and lost motion connection between the float and the valve means extending downwardly through the evaporator.

ARCHIBALD H. HOOPER.