Aug. 14, 1951

K. D. HUFFMAN ET AL
REFRIGERATING APPARATUS INCLUDING
WATER CIRCULATING MEANS

2,563,935

Filed April 6, 1950

3 Sheets-Sheet 1

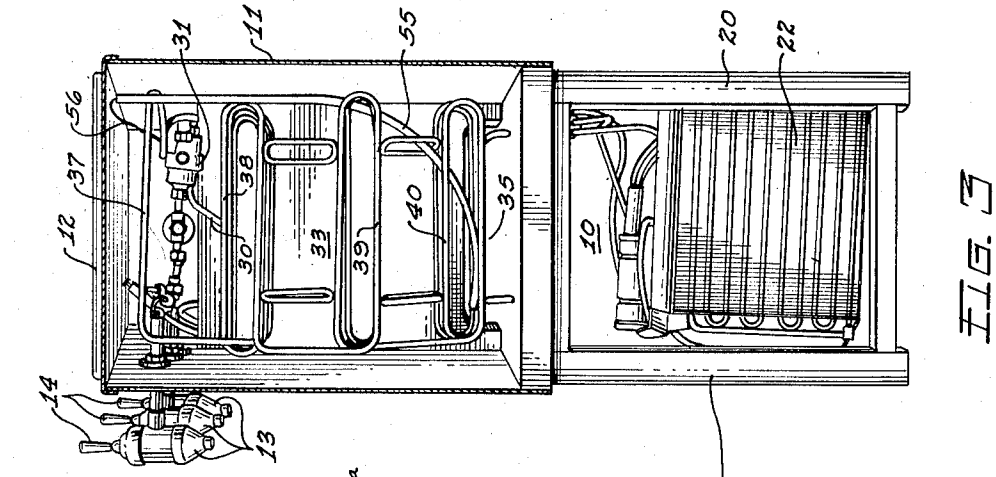

FIG. 3

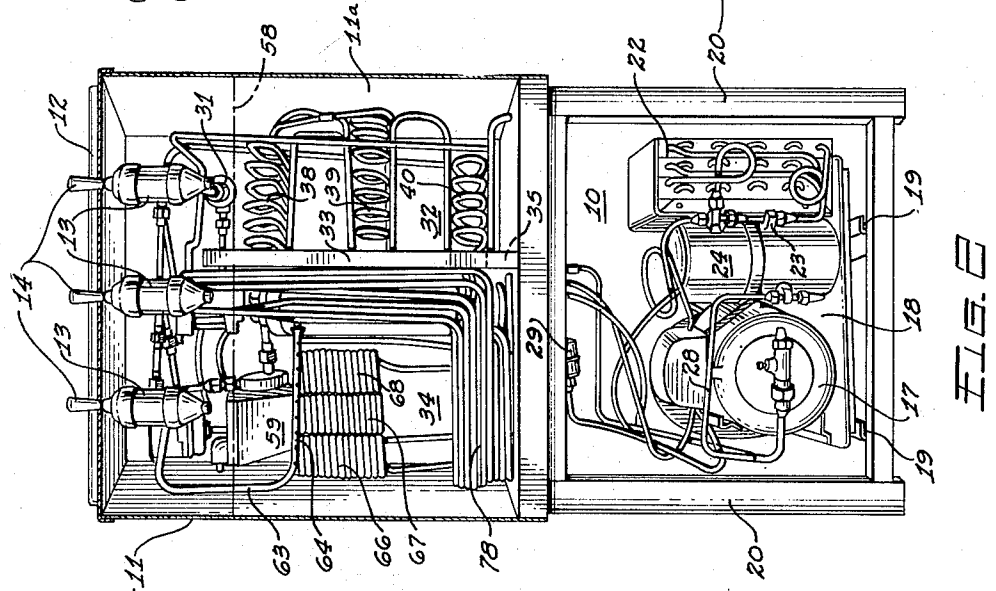

FIG. 2

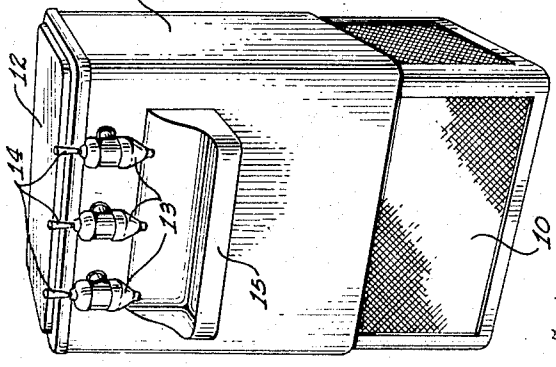

FIG. 1

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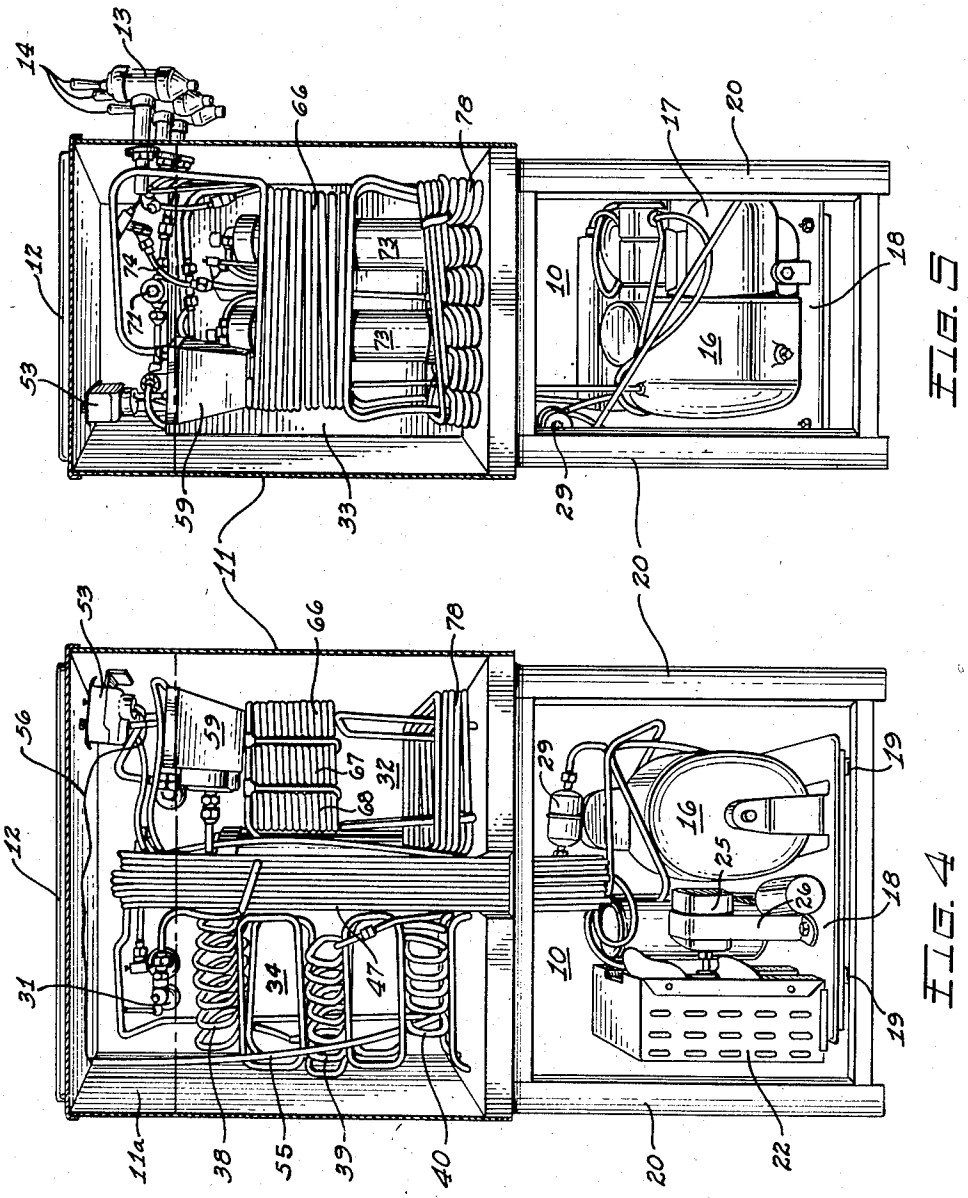

FIG. 5

FIG. 4

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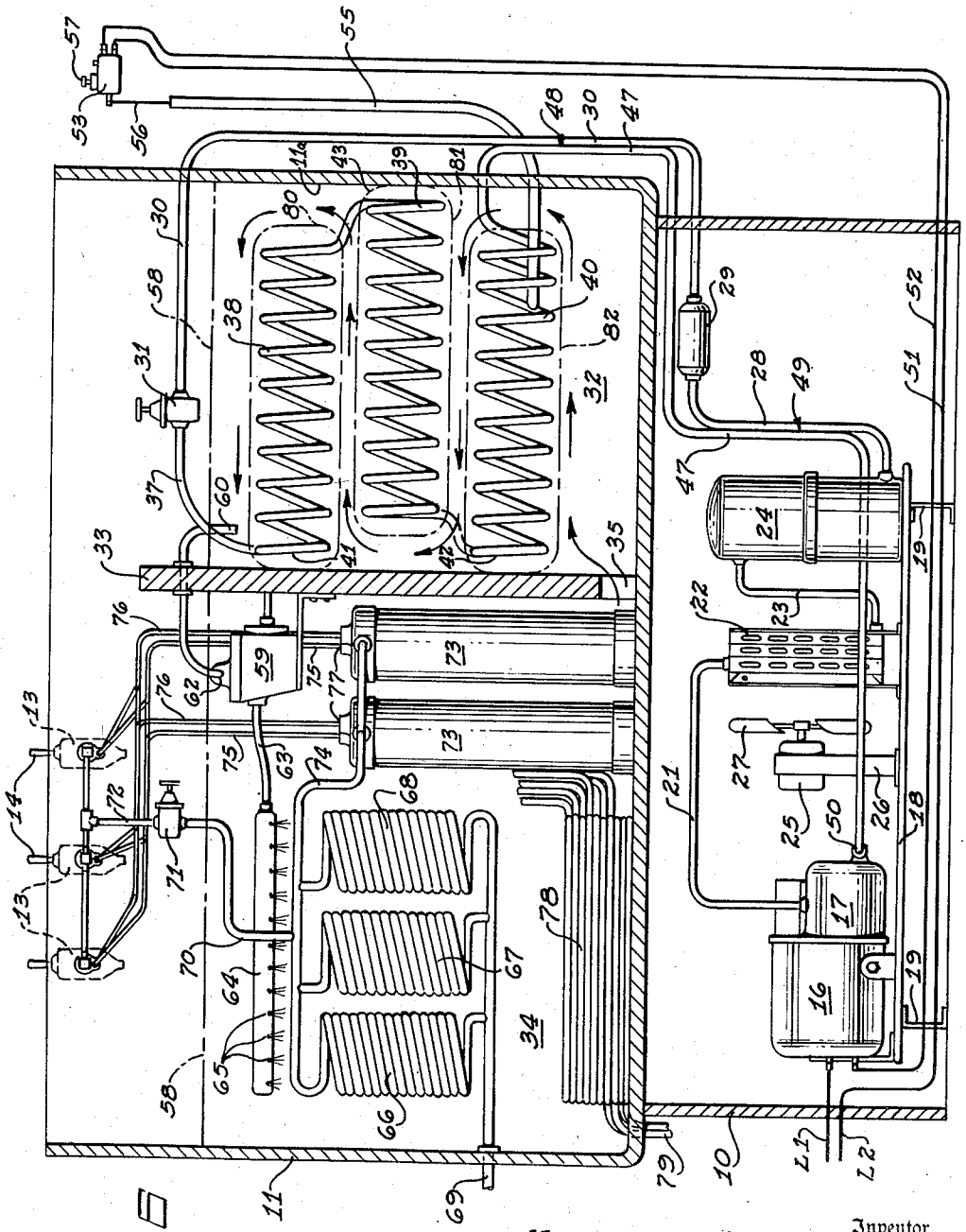

FIG. 6

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REFRIGERATING APPARATUS, INCLUDING WATER CIRCULATING MEANS

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1 Claim. (Cl. 62—7)

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This invention pertains to improvements in refrigeration systems and more particularly to an arrangement of such a system whereby an economy of size and capacity of apparatus is effected.

In refrigerating systems comprising evaporators, compressors and condensers, it is the usual practice to design the equipment to meet the peak demand with the result that the system is usually operated at much less than full load capacity. This, for example, is particularly true in insistence design for cooling beverages in restaurants, drive-ins and the like which have widely spaced peak periods and in which their use takes place only during a relatively small part of an entire day and seldom at peak capacity.

As a result of these unusual requirements resulting in a decrease in operating efficiency the first cost of such apparatus has been heretofore high and the operating cost has also been beyond reasonable good practice.

Therefore, one of the objects of this invention is to provide an improved refrigeration system capable of taking care of peak demands at widely spaced intervals while at the same time having low initial cost and low operating cost.

Another object of this invention is to provide an improved refrigeration system including a circulating water bath wherein an ice bank is formed to be utilized as a reserve for peak periods of cooling.

Another object of this invention is to provide in a refrigeration system an arrangement in which the water in a water bath is picked up directly off of the cake of ice formed by the mechanical refrigerating apparatus, by a pump and transferred to the center of cooling coils containing the liquids to be chilled, including means for jetting out the water with sufficient velocity to thoroughly agitate the water in the center of the cooling coils to thereby create a maximum transfer of heat through these cooling coils.

It is also an object of this invention to provide an arrangement in a refrigeration system above mentioned in which the water is returned by natural gravity down to the bottom of a tank and then passed under a dividing baffle in the tank and then drawn upwardly past the freezing or cooling coils containing blocks of ice so arranged as to slow down the water flow and cause a rubbing action of the water against the surface of the ice on the cooling coils.

It is also the object to have the circulating water above described melt away and control the thickness of the ice formed on the freezing coils in a labyrinth path over said ice chunks.

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It is also an object to arrange the freezing coils in such a manner that regardless of how much ice is melted away, water must still flow under, around and over the blocks of ice in labyrinth path to effect the proper chilling of the cooling water.

It is also a further object in connection with this refrigerating system to provide an arrangement so that ice is formed on the freezing coils in such a manner that it is controlled by an automatic expansion valve to insure a solid continuous block of ice across the full width of the water bath, thereby assuring that the water will at all times flow in the desired direction.

Still another object of this invention is to provide a control in conjunction with the aforementioned refrigeration system to control the block of ice formed on the freezing coils by thermostatic control which utilizes a bulb placed at the end of the block and in operation, is completely enclosed in ice and activated by the refrigerant temperature in the coil for the cut off point. The cut in point is set so that the control bulb must be partly exposed by the melting of the end of the ice block.

It is also contemplated in the aforementioned refrigeration system to utilize a continuously circulating system for the cooling water circulating over the coils to cool the fluids desired and over the freezing coils in a continuous uninterrupted manner.

Further features and advantages of this invention will appear from a detailed description of the drawings in which:

Figure 1 is an outside perspective view of a beverage cooling unit containing the features of this invention.

Figure 2 is a front view of the apparatus of Figure 1 shown with the cabinet removed.

Figure 3 is a right hand side elevational view similar to Figure 2 showing the apparatus with the cabinet removed.

Figure 4 is a rear view of the apparatus with the cabinet removed.

Figure 5 is a left hand side elevation of the apparatus shown in Figure 2 with the cabinet removed.

Figure 6 is a circuit diagram of the apparatus.

For exemplary purposes this invention is shown applied to a beverage cooling device such as shown in Figure 1 which comprises a screened in base portion 10 containing the compressor and condenser unit and the upper portion 11 comprising a tank containing the refrigerating apparatus incorporating the features of this invention. The tank portion 11 is provided with an

access lid 12 by which the various pieces of apparatus in the tank may be inspected, installed or removed for service. The unit has a series of beverage dispensing heads 13, preferably of conventional four way type which are each operated by means of appropriately shifting the control levers 14 located on top of the valves. A suitable drip pan 15 connected to a drain may be provided on the front face of the tank portion 11 of the unit.

Referring more particularly to Figures 2 through 6 inclusive, the refrigeration system comprises the hermetically sealed drive motor 16 and compressor 17 which are mounted on a suitable supporting base 18 carried on the cross members 19 fixed to the base frame 20 of the unit. Discharge from the compressor 17 is carried through the line 21 to the condenser 22 also mounted on the base plate 18 and the discharge from the condenser 22 is conducted through the line 23 to the receiver 24 supported on the base plate 18. A suitable fan motor 25 is mounted on a support 26 on the base plate 18 and has a fan 27 to provide for circulation of air through the condenser 22.

Discharge from the receiver 24 passes out through the line 28 and then upwardly to the tank compartment 11 through the dehydrator 29 and then the line 30 connected to the automatic constant pressure expansion valve 31 contained in the right hand compartment 32 formed in the tank 11 by a baffle 33 separating the compartment 32 from the compartment 34. The compartment 32 may be termed the freezing or ice making compartment while the compartment 34 may be considered the cooling compartment where the various fluids and beverages are to be chilled, the two compartments being in communication with each other through a narrow horizontal slot 35 formed through the bottom of the baffle 31 adjacent the bottom 36 of the tank compartment 11.

Discharge from the automatic constant pressure expansion valve 31 passes out through the line 37 to a series of three ice making or freezing coils 38, 39, and 40. It will be noted that the coil 38 and the coil 40 are each closely nested against the baffle 33 at the points 41 and 42 respectively while the coil 39 is closely nested to the outside wall 11a of the tank 11 at the point 43. It will also be noted that the input from the line 37 is connected to the coil 38 at its point adjacent the baffle 33 and that the discharge line 44 from the coil 38 is connected at 45 to the coil 39 where it is adjacent at the point 43 to the wall 11a. Further discharge from the coil 39 passes out through the line 46 to be connected to the input of the coil 40 at its point 42 adjacent the baffle 33. The final discharge from the series connected coils 38, 39, and 40 passes out through the line 47 which line 47 is in thermal contact with the line 30 to act as a heat exchanger at 48 and which line 47 also is in contact with the line 28 to act as a heat exchanger at the point 49. The line 47 then returns to the input 50 of the compressor 17 to thus complete the refrigeration circuit.

The compressor motor 16 receives power supply from the lines L1 and L2 which are controlled through the leads 51 and 52 by suitable electrical control apparatus from the thermostat 53 suitably carried in a convenient location under the access lid 12 in the compartment 34 of the tank unit 11. The usual sensitive control bulb 54 is mounted in a suitable tube 55 adjacent the output line 47 from the coil 40 and is connected by suitable leads 56 to the thermostat 53. An adjusting knob 57 on the thermostat 53 may be set to the desired degree of refrigeration.

The tank unit 11 is kept filled with water to a water level 58 and is circulated from the chamber 32 through the chamber 34 and back again to the chamber 32 by means of a continuously running water pump 59 which has a suction inlet pipe 60 which receives a flow of water from just below the water line 58 and at a point 61 near the input line 37 of the coil 38 and adjacent the baffle 33. Fluid coming in through the line 60 passes over to the inlet 62 of the pump 59 which is submerged just below the water line 58 in the compartment 34. Discharge from the pump 59 passes out through the line 63 to a submerged manifold 64 which has a series of laterally disposed horizontal jet openings 65 which cause agitation and rapid movement of the fluid in the chamber 34 to produce an aspirator effect in this compartment.

Directly below the manifold 64 are three sets of parallel connected tap water cooling coils 66, 67, and 68, the inlets of which are each connected to the warm water line 69 from the usual water tap. The discharges of each coil are connected to the cold water outlet 70 which in turn is connected to the water pressure regulating valve 71 the discharge from which is connected to the line 72 to the central dispensing valve head 13. Thus a set of large capacity parallel connected water coils are provided to receive the aspiration from the jets 65 in the manifold 64 to obtain a maximum heat exchange and cooling of tap water especially during maximum peak loads. Also mounted in the chamber 34 is the usual pair of carbonator tanks 73 which are connected through the line 74 to the cold water discharge from the coil 66, 67, and 68. These carbonators are connected in the usual manner through lines 75 and 76 from the control valve 77 to the dispensing heads 13, the carbonator tank 73 preferably resting on the bottom 36 of the compartment 34 and being completely immersed are thoroughly cooled by the solution in the chamber 34.

In order to cool the various syrups and flavorings to be utilized in connection with the carbonated drinks there is provided a series of syrup cooling coils 78 which are connected by suitable line 79 to the syrup tanks in the well known manner, the discharge from these coils being connected in the usual way to the dispensing heads 13.

Thus, with water pump 59 continuously operating water is forced out through the jet 65 into the chamber 34 where the aspirating jets force the water over the coils 66, 67, and 68 to get a maximum of heat transfer for rapid cooling of tap water. The water continues downward through the coils 66, 67, and 68 over the carbonating tank 73 and down over the syrup cooling coil 78 where it then passes out through the slotted portion 35 in the bottom of the baffle 33 and out under the coil 40. The coils 38, 39, and 40 in the chamber 32 are normally formed with a solid cake of ice respectively at 80, 81, and 82. The coils 38, 39, and 40 are so arranged that their cakes of ice just mentioned extend the full width of the compartment 34 so that the water is forced to flow out under the coil and its chunk of ice 82 till it reaches the extreme end thereof at 83 where it then proceeds upwardly striking the underside of the cake of ice 81 of the coil 39 which then forces the flow to reverse its direction as indicated by the arrow

84 to again flow back toward the baffle 33 where it then passes around the end of the chunk of ice 81 on the coil 39 and upwardly till it strikes the underside of the cake of ice 80 on the coil 38 again causing the flow to be reversed as indicated by the arrow 85 until it finally comes out the end of the cake of ice 80 and then finally upwardly to the top of the tank 11 and its compartment 32. At this point the water flow is again picked up by the intake 61 from the pump 59 to complete this continuous circulation. The pump 59 is at all times operating continuously so that during slack periods or during inactive periods at night the refrigeration system is constantly functioning as described to accumulate blocks of ice 80, 81, and 82 on the respective coils so as to build up a residual supply of ice capable of cooling the water being circulated by the pump 59 at a very rapid rate when tap water is being rapidly passed to the coil 66, 67, and 68, when new carbonators are being installed or used or when syrups are being rapidly dispensed through the coils 78. Thus, by means of a relatively small compressor and condenser unit in the compartment 10 a large residual capacity for peak use can be readily obtained due to the afore mentioned efficiency in the circulation and arrangement of this novel refrigerating system.

Having thus fully described this invention and its numerous attendant advantages, it is obvious that many changes may be made in the form, construction and arrangement of the parts without departing from the spirit or scope of the invention or sacrificing its attendant advantages, the form herein described being a preferred embodiment for purposes of exemplifying this invention.

What is claimed is:

In an ice storage refrigeration system having, a water tank, a plurality of freezing coils submerged in said water tank extending horizontally and mounted one above the other, means for connecting said coils in series, means for mounting the input ends of each of said coils adjacent a wall of said water tank, refrigerating apparatus for energizing said coils to cause ice blocks to form on said coils, thermostatic control means for automatically regulating the size and extent of the ice blocks formed on said coils, and water pump means for causing the upward flow of water over said coils so that the water must move horizontally under the ice block of each of said coils in a labyrinth path until the water arrives at the top of said coils, means forming a second compartment, a baffle between said compartments, a passageway through the bottom of said baffle, said water pump means receiving fluid from the top surface of the water of said first mentioned compartment and discharging said water through jet means below the surface of the water in said second mentioned compartment, and liquid cooling coils in said second compartment located to receive the jet flow from the discharge from said water pump to effect a maximum heat transfer to said cooling coils.

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