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AUTOMATIC ICE MAKER

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FIG. 1

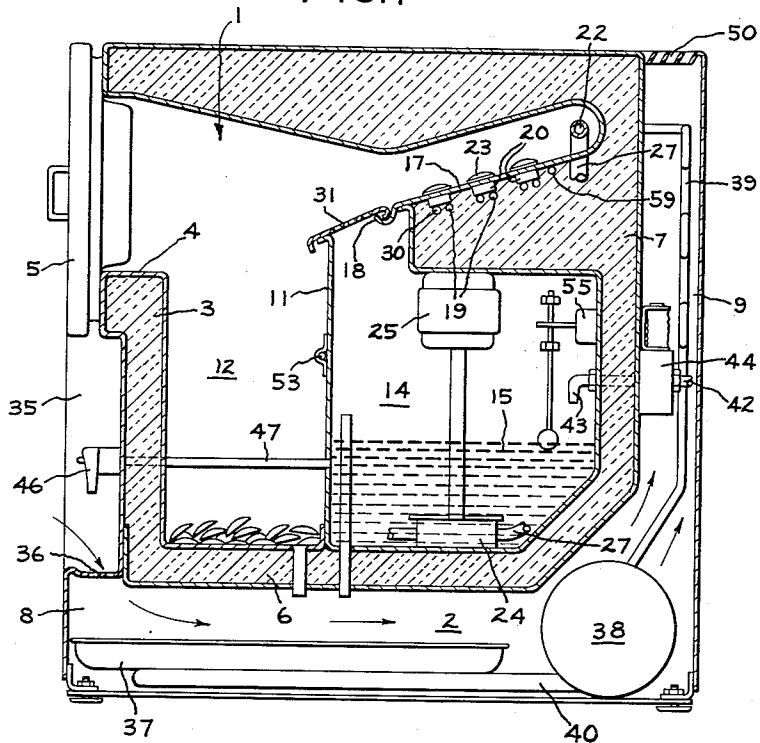
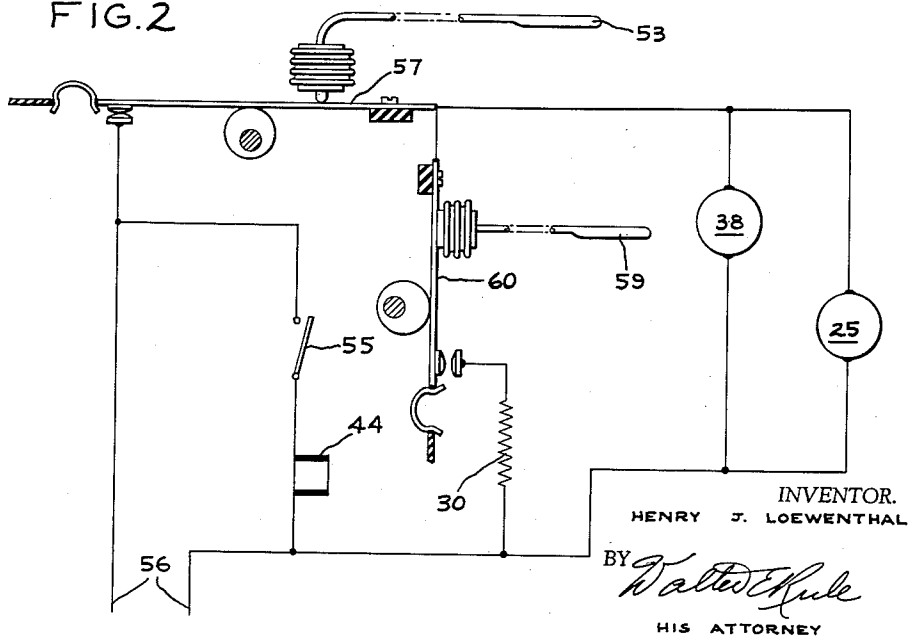


FIG. 2



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AUTOMATIC ICE MAKER

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3 Claims. (Cl. 62—344)

The present invention relates to an automatic ice maker and is particularly concerned with ice making apparatus designed for home use or for the manufacture and storage of relatively limited amounts of ice.

It is an object of the present invention to provide an improved automatic ice maker of simple and compact construction.

A further object of the present invention is to provide an ice maker including self-contained means for disposing of waste water and drippage.

Another object of the invention is to provide an automatic ice maker including a cold water dispenser, the apparatus being so designed that drippage and waste water from the dispenser are automatically disposed of during operation of the apparatus.

Further objects and advantages of the invention will become apparent as the following description proceeds and the feature of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

Briefly described, the ice maker of the present invention comprises a cabinet including insulated walls defining an ice making compartment having an access opening thereto in the upper portion of the front wall of the cabinet. A partition within the ice making compartment divides that compartment into an ice storage bin and a water reservoir, the partition being non-insulating so that ice stored in the ice bin will cool the water in the storage reservoir. An ice making element is arranged in the upper part of the ice making compartment in the form of an inclined plate having its lower edge overlying the water reservoir so that water circulated from the reservoir will flow downwardly over the inclined plate and back into the reservoir. For directing ice periodically released from the ice making element into the ice storage bin, there is provided a grille extending downwardly from the lower edge of the inclined plate and over the partition. An evaporator in heat exchange relationship with the lower surface of the ice making element for refrigerating that element is connected to a refrigerant condensing unit disposed in a machine compartment which compartment includes a first section extending along the bottom of the cabinet beneath the ice making compartment and a second section extending upwardly along the rear wall of that compartment. To dispose of ice pieces and water spillage from the access opening, the front of the cabinet below the access opening to the ice making compartment is recessed and the bottom wall of the recess which also forms the top wall of the adjacent portion of the machinery compartment is perforated or in the form of a grate so that water collecting on the grate passes through the grate and into the machinery compartment. For the purpose of evaporating and thereby disposing of this waste water, there is provided a drain pan positioned in the machinery compartment beneath the grate to catch this waste water. By placing the drain pan in heat exchange relationship with the portion of the condensing unit, the evaporation of the water of collecting is ac-

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celerated. In order to remove the evaporated moisture from the machinery compartment, means including the grate at the front of the lower section of the machinery compartment and an opening at the top of the rear or second section of the machinery compartment respectively provide inlet and outlet openings for the air circulation. In a preferred embodiment of the invention, there is also provided a water tap disposed in the recess at the front of the cabinet and connected to the reservoir for dispensing cold water, waste or overflow water from the use of this tap being disposed of by means of the same drain pan.

For a better understanding of the invention reference may be had to the accompanying drawing in which:

Fig. 1 is a vertical sectional view of the ice making apparatus of the present invention; and

Fig. 2 is a view illustrating a control circuit suitable for the automatic control of the apparatus of Fig. 1.

Referring to Fig. 1 of the drawing, there is shown an ice maker cabinet comprising an ice making compartment 1 and a machinery compartment 2. The ice making compartment 1 is formed by a plurality of insulated walls, the front wall 3 of which has an access opening 4 communicating with the ice making compartment and closed by an insulated door 5. The bottom wall 6 and the rear wall 7 of the ice making compartment separate the ice making compartment 1 from the machinery compartment 2, the latter compartment comprising a first section 8 extending along the bottom of the cabinet below the ice making compartment 1 and a second vertical section 9 functioning also as a flue extending upwardly along the rear of the ice making compartment 1.

A partition 11 disposed within the ice making compartment 1 divides that compartment into an ice storage bin 12 which is accessible through the access opening 4 and a water reservoir 14. A body of water 15 stored in the water reservoir 14 and cooled by the ice pieces stored in the ice bin 12 is employed for the manufacture of ice.

Arranged within the ice making compartment 1 and above the reservoir 14 is an ice making element 17 in the form of an inclined plate, the lower edge 18 of which is disposed above the reservoir 14. A refrigerant evaporator 19 in heat exchange with the plurality of pads 20 contacting plate 17 serves to refrigerate spaced areas on the plate 17 so that water flowing downwardly over the plate from a feed line 22 is cooled to form a plurality of spaced ice buttons 23 on the plate 17. The excess water from the plate 17 flows over the lower edge 18 thereof back into the reservoir 14.

Means for flowing water from the reservoir 14 over the plate 17 comprises a pump 24 immersed in the body of water 15 and driven by a motor 25, the pump 24 being connected by means of a conduit 27 to the line 22. Upon operation of the motor 25 water is pumped continuously from the reservoir 14 to a point above the upper part of plate 17 from which it flows downwardly over the plate including the refrigerated areas so that ice pieces 23 form in a manner well known in the art. When the ice pieces 23 have reached a predetermined size, a heater 30 contacting the pads 20 overrides the refrigerating effect of the evaporator 19 and causes the individual ice pieces to melt free from the plate 17. These pieces thereupon slide downwardly along the inclined plate and over a grille 31 bridging the gap between the lower edge 18 of the plate and the partition 11 so that the ice pieces are deposited in the ice storage bin 12 while water flows through the grille and into the reservoir.

It will be seen that with the ice in the ice bin 12 in heat exchange relationship with the water in the reservoir 14, the ice pieces in the ice bin are stored at approximately their melting point or in other words as wet pieces. Hence, as the ice pieces are removed from the bin through an

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access opening 4 water is likely to drip from the pieces and flow down over the front wall 3 of the cabinet. Since the ice maker of the present invention is primarily designed for home use, it is desirable that means be provided for catching this drippage and for disposing of it along with other waste water from the ice maker. To this end, a recess 35 is formed in the front cabinet wall below the access opening 4 and is so positioned that water flowing or dropping downwardly from the access opening 4 over or in front of the face of the cabinet will collect on a grate 36 forming the bottom of the recess 35 and will pass through the grate into the machinery compartment.

In order to dispose of this drippage and also waste water draining from the ice in bin 12 or overflowing through the standpipe in the reservoir 14 without connecting the ice maker to the household drain system, there is provided a drain pan 37 positioned within the machinery compartment and having its forward edge disposed below the grate 36 where it will receive the water flowing through the grate. Also to aid in the evaporation of the water collected in the drain pan 37, this pan is disposed in heat exchange relationship with a portion of the refrigerant condensing unit arranged in the machinery compartment 2 and comprising a compressor 38 in the first section 8 of the machinery compartment and a condenser 39 extending vertically along the second or vertical section 9 of the machinery compartment. In the illustrated modification of the invention the drain pan 37 rests on and is heated by an oil cooler tube 40 which is connected to the compressor case and serves to cool the oil employed to lubricate the compressor unit 38 in a manner more fully described and claimed in Patent 2,776,547, issued on January 8, 1957, in the names of Ralph E. King and Earl F. Hubacker and assigned to the same assignee as the present invention.

The condensing unit is connected to the evaporator 19 in the usual manner so that the compressor unit 38 withdraws refrigerant through a suction conduit (not shown) from the evaporator 19 and discharges the compressed refrigerant into the condenser 39. From the condenser 39, liquified refrigerant flows through suitable flow restricting means (not shown) to the evaporator where it vaporizes and refrigerates that plate.

In order to provide a supply of water in the reservoir 14, the ice maker is designed to be connected to a source of fresh water by means of a conduit 42 having its outlet end 43 within the water reservoir 14, the flow of water through the conduit 42 being controlled by a solenoid valve 44 arranged within the second section 9 of the machinery compartment. Since the water contained within the reservoir 14 is normally maintained at about freezing temperatures, this body of water forms a convenient source of cold drinking water and for the purpose of making this water available there is provided a water tap 46 mounted in the recess 35 on the front of the cabinet and connected to the reservoir by means of a conduit 47. It will be noted that the tap 46 is also disposed above the grate 36 so that any water spillage from this tap will also drain into the drain pan 37 and be disposed of by evaporation.

To aid in the removal of the evaporated moisture from the machinery compartment 2 and also to accelerate the evaporation of the water in the drain pan 37, means are provided for assuring the circulating of air through the machinery compartment and particularly over the pan 37. In accordance with the present invention, the grate 36 positioned above the pan forms the air inlet to the compartment 2 and as shown by the arrows in Fig. 1 of the drawing, air flowing downwardly through the grate is caused to flow directly over the surface of the water in the pan 37 so that it will sweep the vapor out through the second or flue section 9 of the machinery compartment which is provided at its upper end with an outlet opening 50. By arranging the condenser 39 in this vertical por-

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tion of the machinery compartment, the heat of the condenser 39 will effect a natural draft through the machinery compartment so that additional air circulating means such as a fan need not be employed.

Since, after continuous operation of the ice maker for some time, the bin 12 may become relatively full of ice, means are also provided for stopping the operation of the ice maker when a predetermined quantity of ice has been collected in the bin 12. For this purpose there is provided switch means operated by a thermally responsive element 53 mounted on the partition 11 which is designed to open the energizing circuit to the ice maker when the quantity of ice has reached the point where the element 53 is cooled to approximately freezing temperatures by contact with the ice in the storage bin 12.

For a better understanding of the control function performed by the element 53 and of the manner in which the ice maker of the present invention is designed to operate, reference may be had to Fig. 2 of the drawing in which there is diagrammatically shown a suitable control circuit. With reference to Fig. 2 of the drawing, it will be seen that both the compressor 38 and the water pump motor 25 are connected directly across the supply lines 56 so that the operation of both of these elements is controlled only by the switch 57 which is normally closed and which is designed to open only when the control bulb 53 indicates that the ice bin 12 is filled. In other words, so long as the bin is only partially filled, both the compressor 38 and the pump motor 25 will be energized so that the ice making plate 17 is refrigerated and water is continuously circulated downwardly over the plate. With this continuous operation of the pump and compressor, the ice pieces 23 forming on spaced areas of the plate 17 will gradually grow and in order to release the ice pieces from the plate for discharge into the bin 12 when pieces of the desired size have been formed, a sensing element 59 is arranged adjacent one of the refrigerated areas as shown in Fig. 1 of the drawing. When this element senses a decrease in temperature as a result of the growth of the ice piece into cooling contact therewith, it closes a switch 60 to energize the heater 30 connected across the supply lines 56. The heater, which is designed to override the refrigerating effect of the evaporator 19, melts the ice pieces free of the plate 17 so that they slide downwardly over the grille 31 and into the bin 12. Upon freeing of the ice pieces 23, the temperature sensing element 59 becomes warmer and re-sets or opens the switch 60 to de-energize the heater 30 whereupon another ice making cycle is initiated. The size of the ice pieces can, of course, be controlled by making element 59 adjustable so that it can be moved closer to or farther away from the adjacent refrigerated area.

Since at all times there should be available a supply of drinking water in reservoir 14 regardless of whether or not the ice maker is operating, the solenoid valve 44 is connected to the power supply so that its operation is independent of the operation of the ice maker. As shown in Fig. 2, the valve 44 is connected to the supply lines 56 ahead of the switch 57 and its operation is controlled solely by a float valve switch 55 (Fig. 1) which closes the valve when the water level within the reservoir 14 has reached a predetermined maximum and opens the valve 44 when the water level falls to a given minimum level.

While there has been shown and described a particular embodiment of the present invention it will be understood that modifications may be made by those skilled in the art without actually departing from the invention. It is intended therefore in the appended claims to cover all such variations as come within the true spirit and scope of the invention.

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

1. An automatic ice maker comprising a cabinet in-

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cluding insulated walls defining an ice making compartment having a front wall including an access opening in the upper portion thereof, a noninsulated partition in said compartment dividing said compartment into an ice storage bin to which access can be had through said access opening and a water reservoir for the cooling and storage of water, an ice making element in said compartment comprising an inclined plate, an evaporator contacting the lower surface of said plate for refrigerating spaced areas on said plate, means including a pump for withdrawing water from said reservoir and flowing it over said plate for the formation of ice pieces on said spaced areas, the lower edge of said plate terminating over said reservoir, a sloping grille extending from said lower edge downwardly over said partition whereby water flowing from said plate returns to said reservoir while ice pieces periodically released from said plate slide downwardly over said grille and into said ice storage bin, a machinery compartment including a first section below said ice making compartment and a second section extending upwardly behind said ice making compartment and having an opening at the top thereof, a refrigerant condensing unit in said compartment for supplying refrigerant to said evaporator, a recess in the front of said cabinet above said machinery compartment and below said access opening, a cold water tap mounted in said recess, a line connecting said tap to said reservoir for the supply of water to said tap, a grate between said recess and said machinery compartment, said grate forming the bottom wall of said recess whereby waste water from said tap flows through said grate into said machinery compartment, a drain pan in said first section of said machinery compartment below said grate for receiving said waste water, said drain pan being in heat exchange relation with a portion of said condensing unit for the warming of the waste water collected in said pan to aid in the evaporation thereof, said grate forming an air inlet and said opening adjacent the top of said second section of said machinery compartment forming an outlet for natural draft circulation of air over said drain pan and through said machinery compartment to remove the evaporated water from said machinery compartment.

2. An automatic ice maker comprising a cabinet including insulated walls defining an ice making compartment having a front wall including an access opening in the upper portion thereof, a non-insulated partition in said compartment dividing said compartment into an ice storage bin to which access can be had through said access opening and a water reservoir for the cooling and storage of water, an ice making element in said compartment comprising an inclined plate, an evaporator contacting the lower surface of said plate for refrigerating spaced areas of said plate, pump means for withdrawing water from said reservoir and flowing it over said plate for the formation of ice pieces on said spaced areas, the lower edge of said plate terminating over said reservoir, a sloping grille extending from said lower edge downwardly over said partition whereby water flowing from said plate returns to said reservoir while ice pieces periodically released from said plate slide downwardly

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over said grille and into said ice storage bin, a machinery compartment including a first section below said ice making compartment and extending from the front of said cabinet to the rear thereof and second section extending upwardly behind said ice making compartment, a refrigerant condensing unit in said compartment for supplying refrigerant to said evaporator, said unit including a condenser disposed in said second section, a recess in the front of said cabinet below said access opening and above said machinery compartment, a cold water tap mounted in said recess, a line connecting said tap to said reservoir for the supply of water to said tap, a grate forming the bottom wall of said recess and a portion of the top wall of said machinery compartment for collecting waste water from said tap and discharging it into said machinery compartment, and a drain pan in said first section of said machinery compartment for receiving said waste water, said drain pan being in heat exchange relation with a portion of said condensing unit for the warming of the waste water collected in said pan to aid in the evaporation thereof, and an opening adjacent the top of said second section of said machinery compartment above said condenser whereby the heat of the condenser will effect a natural draft of air through said grate as an air inlet and said opening in said second section as the air outlet for circulating air over said drain pan and through said machinery compartment to remove the water vapor from said machinery compartment.

3. An ice maker comprising a cabinet including insulated walls forming an ice making and ice piece storage compartment having an access opening at the front thereof, a machinery compartment in said cabinet below said ice making compartment, said cabinet having walls defining a recess in the front wall of said cabinet below said access opening and above said machinery compartment, said recess including a perforated bottom wall between said recess and said machinery compartment and forming a portion of the top wall of said machinery compartment through which water dripping from ice pieces during removal thereof through said access opening flows into said machinery compartment, a drain pan in said machinery compartment below said perforated bottom wall for receiving said water, means for heating said drain pan to evaporate the contents thereof and means including said perforated bottom wall for circulating air into and through said machinery compartment to facilitate said evaporation.

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