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ICE MAKING APPARATUS

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This invention relates to a device for freezing successive charges of liquid and dispensing the frozen charges and more particularly to a device for freezing and dispensing ice cubes for domestic use.

Many efforts have been made to provide automatic ice cube dispensing units for home refrigerators; however, most attempts have resulted in a rather bulky and cumbersome unit which not only takes up much room in a refrigerator but also is rather costly. It is therefore the primary object of the present invention to provide an improved cube-freezing and automatic dispensing assembly which not only is of a durable construction and can be economically produced but also consists of a minimum number of parts thereby taking up a minimum amount of space in a refrigerator and a minimum amount of installation time.

Some attention has been given to automatic cube dispensing units in which a warm refrigerant is passed over an ice tray to free the cubes. Although these assemblies have enjoyed some success, they have proved disadvantageous not only because of the additional cost but also because of the space consumed by the extra lines and valves needed to carry and control the warm refrigerant. It is another object of the present invention therefore to alleviate these prior art shortcomings by providing freezing trays formed of a heat-conductive material and disposed in heat-transferring contact with one another so that the heat from a new charge of liquid will be transferred through the trays and melt the tray contacting portions of a charge of liquid which has already been frozen.

Another object of the present invention is to provide a pair of trays which are mounted in a generally horizontal plane and have a common bottom disposed therebetween, and a means for automatically rotating the trays 180° about their transverse horizontal axes upon a charge of liquid being frozen in the uppermost tray so that the other tray is rotated into a filling position while the frozen charge is being discharged from the first mentioned tray.

Another object of the present invention is to provide a cube-storage container which allows the cube forming and discharge unit to operate continuously, however, with means to stop the dispensing and freezing assemblies when the storage container is filled to a predetermined level.

Other objects and advantages will be apparent from the following more detailed description of a preferred embodiment of the invention read in connection with the accompanying drawings in which:

Figure 1 is a vertical sectional view through the freezing compartment of a refrigerator showing a freezing container and ice cube receiving receptacle in elevation;

Figure 2 is a vertical sectional view taken on line 2—2 of Figure 1;

Figure 3 is a vertical sectional view taken on the line 3—3 of Figure 1;

Figure 4 is a vertical sectional view taken on the line 4—4 of Figure 1;

Figure 5 is a wiring diagram, and

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Figure 6 is an enlarged detail of the connection between the supply valve and the float.

In order to facilitate an understanding of the present invention, reference is now made in more detail to the drawings. An ordinary refrigerator is designated generally by the reference numeral 10. The refrigerator can be of any conventional type and has a top wall 11, a rear wall 12, and a front and bottom wall not illustrated. The freezing compartment of the present invention is designated generally by the reference numeral 13, and has a bottom wall 14, a front wall 15 and a rear and top walls in common with the walls 12 and 11 of the refrigerator. It should be understood of course that the freezing compartment can be positioned within the refrigerator at any suitable place. The temperature within the freezing compartment is controlled by any conventional refrigerating system and since it forms no part of the present invention is not illustrated herein.

As can best be seen in Figure 1, a shaft 16 is supported in the rear wall 12 of the refrigerator and extends therefrom in a generally horizontal direction. Shaft 16 is rotatably supported in the rear wall of the refrigerator by means of bearings or other suitable means. The freezing container of the present invention is designated generally by the reference numeral 17. The preferred embodiment of the freezing container comprises an upper tray portion 18 and a lower tray portion 19. The upper tray has side walls 20 and 21 while the lower tray has side walls 20' and 21'. As can best be seen in Figure 5, side walls 20 and 21 are longer than side walls 20' and 21' so that the common bottom wall 22 which is disposed between the upper and lower trays is slanted at a slight angle for purposes hereinafter referred to. The upper and lower trays also have slanted partitions 23 and 23' for purposes hereinafter described.

The freezing container is supported on shaft 16 with the shaft extending substantially through the center of the common bottom 22 and extending substantially the length of the freezing container. The liquid which is to be frozen is supplied to the uppermost portion of the container by means of a pipe 24 which is connected to a water supply tank 25. Pipe 24 extends through and is supported in an opening 26 in the rear wall 12 of the refrigerator and is connected to the bottom wall 28 of the supply tank 25 with its opening in registry with the opening 27 formed in the bottom wall of the tank. Water is supplied to the supply tank 25 by means of a water line 29 which has one end connected to a valve housing 30 connected to the ordinary house water supply. Valve housing 30 has a second opening in registry with an opening 31 formed in the lower wall of the tank. The flow of water into the supply tank is controlled in any conventional manner with an ordinary float control being illustrated herein. A valve 30' ordinarily is seated in the valve housing to prevent the flow of water into the tank. Valve 30' has a stem 32 extending upwardly therefrom which is pivotally connected at 33 to a horizontal rod member 34. Rod member 34 pivots about pin 35 which is fixed to a wall of the tank. A lost motion link 36 has a vertical portion 36' which is pivotally connected to the free end of rod 34 by means of a pivot pin 37. Link 36 has a horizontal arm 38 extending from the free end of portion 36' and an arm 39 extending upwardly therefrom. Lost motion link 36 terminates in a second horizontal arm 43 which extends from the free end of arm 39 and lies substantially above horizontal arm 38. A rod 40 lies in the same plane as vertical portion 36' of the lost motion link 36 and terminates in a horizontal arm portion 41 which lies directly above arm 38. Arm 41 has an aperture 41' through which the vertical arm 39 freely extends. Rod 40 extends through an opening 44 in horizontal arm 43 and is pivotally connected at its

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upper end to an arm 45 by means of a pivot pin 46. Arm 45 is pivoted at a point intermediate its ends about the pin 47 which is fixed to the tank. A float 48 is connected to the free end of arm 45 and floats on the surface of the water.

It is readily seen therefore that as the level of water in the tank goes down, the float causes the arm 45 to pivot around point 47, thereby moving rod member 40 upwardly. Rod 40 moves freely upwardly through the opening 44 in horizontal arm 43 until the horizontal arm 41 extending from rod 40 strikes the horizontal arm 43 of link 36 at which time link 36 is moved upwardly. Movement of link 36 upwardly causes the end of rod member 34 which is remote from the valve stem 32 to move upwardly, causing the rod to pivot about its pivotable point 35 thereby forcing valve stem 32 downwardly and valve member 30' downwardly to an unseating position. Water can now flow into the tank thereby causing the float to rise and as it rises the reverse procedure is effected, that is, arm 45 pivots about its pivotal point 47 causing rod member 40 to move downwardly until its horizontal arm portion 41 strikes horizontal arm portion 38 of link 36 thereby forcing link 36 downwardly and valve stem 32 upwardly. Valve 30' again seats itself and closes off any supply of water.

As can be seen best in Figure 1, shaft 16 has a portion 49 which extends rearwardly from the back wall 12 of the refrigerator. A disc 50 is integrally secured to the extended portion 49 of the shaft and has diametrically opposite portions cut away so as to form shoulders 51. A locking arm 52 is urged by a spring 53 toward and into engagement with the disc 50. Since as aforementioned the common bottom member 22 is slanted at a slight angle, the weight of the liquid charge in the right-hand side of the upper tray as viewed in Figure 4 being greater than the weight to the left of the shaft 16, the freezing container tends to pivot around shaft member 16 in a clockwise direction (counter-clockwise as viewed from the rear in Figure 3). It is apparent therefore that shoulder 51 will abut stop 52 and prevent the freezing container from pivoting.

A second rotary disc member 54 is secured to the outermost end of extension 49 of the shaft and carries shoulders 55 on diametrically opposite sides thereof for purposes hereinafter described. An auxiliary housing having side walls 95, top wall 96, back wall 97, and bottom wall 98 is connected to the back portion of the refrigerator to house the shaft extension as well as the supply tank. The bottom wall 98 is formed with an opening 99 formed therein. An inlet pipe 100 is connected to the bottom wall having its opening in registry with the opening 99. The warm air which is conventionally channeled from the compressor unit of the refrigerator is let through the inlet pipe 100 into the auxiliary housing. The heated air thereby raises the temperature of the water in the supply tank for purposes hereinafter described. Small openings 101 are formed in the top wall 96 and act as vents.

Since the freezing container is prevented from moving about its pivotal axis, it is apparent that the uppermost tray will remain upright to allow a charge of water which is placed therein to freeze. A pair of brackets 56 and 56' is integrally connected to the shaft 16 at a point adjacent the rear wall 12 of the freezing unit. These brackets 56 and 56' terminate in horizontal portions 57 and 57' which are bent to form eyes 58 and 58' respectively. Plungers 59 and 59' are supported within the eyes 58 and 58' for vertical reciprocating movement therein. The lower end of the plungers 59 and 59' have an enlarged portion 60 and 60' while the other ends thereof have contact means 61 and 61'. A bracket 62 is mounted on the rear wall 12 of the freezing unit and terminates in two contact points 63 and 64. These contact points are wired as can be seen in Figure 5 di-

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rectly to the solenoid 65 which is integrally connected to the stop member 52. The enlarged portion 60 of the uppermost plunger normally rests on the top of the uppermost portion 18 of the freezing container. It is readily understood, therefore, that as the liquid in the upper tray of the freezing container freezes, it expands and as it expands it forces plunger 59 upwardly, thereby causing contact 61 to make contact with the contact points 63 and 64. The circuit is thereby completed and the solenoid 65 energized. As the solenoid 65 is energized it retracts stop member 52 and because, as before mentioned, the weight is not evenly distributed over shaft 16, the freezing container will pivot about the shaft. As the freezing container begins its pivoting movement, contact is broken between contact points 61 and 63 and 64, thereby breaking the circuit, de-energizing solenoid 65, and allowing spring 53 to urge stop 52 toward the disc 50. It is apparent therefore that after the disc has rotated 180° stop 52 will engage the next shoulder 51 to stop pivotal movement of the container.

As the shaft rotates the disc 54 rotates therewith and protrusion 55 engages a roller 66' on the lower end of a link 66. The roller 66' rides up over protrusion 55 thereby forcing link 66 upwardly. Link 66 is supported for vertical reciprocating movement by the brackets 67 and 68 which are mounted on the rear wall 12 of the freezing unit. Link 66 is pivotally connected to a horizontal rod 69 intermediate the ends thereof by means of a pin 70. Rod 69 is pivotally connected at 71 to a bracket 72 which is secured to the side wall 95 of the auxiliary housing while the other end of rod 69 terminates in a loop 73. A chain 74 has one end connected to the loop 73 and its other end connected to a valve stem 75 of valve 78 which normally seats in the opening 27 in the bottom wall 28 of the supply tank to stop the flow of water from the supply tank. Brackets 79 and 80 which are mounted on a side wall of the supply tank guide valve stem 75 so as to prevent any horizontal movement thereof. It is apparent therefore that as the rod member 66 is forced upwardly rod 69 is forced to pivot upwardly about its pivotal point 71, thereby moving valve stem 75 upwardly causing valve 78 to be raised from its seat to allow water to flow out of the supply tank.

The rotation of the freezing container from the position shown in the drawings to its inverted position 180° removed therefrom takes place in a very short time. Thus, by the time the water flows from the tank 25 through the lines 24 the lowermost tray of the freezing container is swung into the place previously occupied by the upper tray as shown in the drawings to thereby receive a new charge of liquid. As the freezing container rotates, plunger 59' will strike against a guide 81 which is fixed to bracket 62 and thereby force the plunger downwardly to its normal position resting on top of the freezing tray 19. Valve 78 is of the conventional flush type valve, being buoyant enough to remain raised from its seating position due to the pressure of the water from below and thereby does not close until the tank is emptied. The float 48 is so adjusted that the tank contains the predetermined amount of water that is necessary to fill one freezing tray. It is readily seen that the distance between the horizontal arms 38, 41, and 43 of the lost motion linkage can be so regulated so as to allow substantially all of the water to flow from the supply tank before valve 30' is opened to allow more water to flow into the supply tank.

With the freezing container now in an inverted position from that shown in the drawings, and the water flowing into the tray 19, the heat from the water entering compartment 19 will be transferred by conduction through the common bottom member 22. Because the partitions 23 are positioned at a slant, the surface 82 at which the frozen liquid contacts the common bottom

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member 22 is very small. Because of this small contacting surface and the fact that the water has been heated to a temperature substantially above room temperature, it takes but an instant to free the ice along the portion 82 from the common bottom 22.

A basket 83 is supported on the bottom wall 14 of the freezing unit to collect the ice which falls from the freezing trays. A guide member 84 is secured to the rear wall of the freezing compartment and is positioned at a slant to help guide the falling ice into the basket. The basket is mounted on a plate 85 which has downwardly extending flanges 86. The plate 85 is pivotally supported adjacent its rearward end by means of pivot pins 87 passing through the flanges 86 and secured in brackets 88 which are fixed to the bottom wall 14 of the freezing unit. A spring 91 has one end secured to the bottom wall 14 of the freezing unit and has its other end bearing against the under surface of plate 85 as at 90. Plate 85 terminates at its outer end in an upturned lip 89 which prevents the basket from sliding outwardly.

Adjacent the rearward end of plate 85 there is provided downwardly extending flanges 92 having contact surfaces 93. Contacts 93 are normally in contact with a contact 94 provided in the circuit leading from the freezing container to the solenoid. It is apparent therefore that when a predetermined amount of ice is deposited in the basket 83, the basket will overcome the upward force of the springs 91 and thereby compress the springs causing the basket to pivot about its pivotal point 89. As the basket continues to move downwardly at its outer end, the contact surfaces of the depending flanges 92, 93 of the bracket supporting the basket, slide along the contact 94 which is fixed in the electrical circuit until the contact 93 slides past the contact 94 thereby breaking circuit. When a plunger 59 or 59' is now forced upwardly by the expanding ice in the uppermost freezing tray to have its contact 61 or 61' contact the contact points 63 and 64 in the electrical circuit, it is readily seen that the solenoids will not be energized to retract the stop member 52 since the circuit will have been broken. It is apparent, therefore, that the freezing container will be locked in position until such a time as enough ice is removed from the basket to allow the spring 91 to force the outer end of the basket upwardly thereby pivoting the rearward end of the basket downwardly and bringing the contact 93 into contact with contact member 94 to thereby complete the circuit. Once again, since the circuit is now completed the cycle begins all over with the solenoid 53 retracting the stop 52 thus allowing the freezing container to pivot about its axis 16.

The automatic freezing and discharging device as illustrated and described above is by way of example only, and any changes which might occur to one skilled in the art are contemplated by the present invention, within the scope of the following claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A device for producing automatically successive units of frozen liquid, comprising a supply of liquid, a compartment, having front, back, side, top and bottom walls, which is subject to below freezing temperature, a generally horizontal shaft mounted for turning in one of said compartment walls, a pair of freezing containers

formed of heat-conductive material and having a common bottom disposed therebetween, said freezing containers being mounted on said shaft with said shaft extending longitudinally through substantially the midpoint of said common bottom, each said container being formed with a greater volumetric capacity on one diametric side of said shaft than on the other, whereby the contents of said container will be acted upon by gravity to pivot the container about the axis of said shaft, means for holding said containers against pivotal movement, means for transferring a charge of liquid from said supply to the uppermost of said containers whereby said charge is frozen to a solid state within the container, means for withdrawing said holding means whereby said containers are gravitationally pivoted to bring the empty container to the uppermost position, means for transferring a charge of liquid to the empty container whereby the heat from the new charge is transferred through the walls of the containers to incipiently melt the container contacting portion of said charge and loosen it for discharge from said first container.

2. A device for producing automatically successive units of frozen liquid as set forth in claim 1 in which said shaft has a portion extending rearwardly from said one of said compartment walls and said holding means comprises a disc mounted adjacent the end of the shaft extension and a stop member abutting said disc to prevent rotation of the same.

3. A device for producing automatically successive units of frozen liquid as set forth in claim 2 in which said means for withdrawing said holding means comprises a bracket mounted on said shaft, a plunger reciprocally mounted in said bracket, one end thereof normally resting on the upper surface of said uppermost container and the other end having contact means for contacting a means for withdrawing the stop member from disc abutting relation.

4. A device for producing automatically successive units of frozen liquid as set forth in claim 3 in which said last mentioned means comprises contacts mounted for contacting engagement by said plunger contacts, and a solenoid wired to said mounted contacts and being connected to said stop member.

5. A device for producing automatically successive units of frozen liquid as set forth in claim 1 and in addition thereto means for collecting and storing said discharged frozen charge, said last mentioned means having means for rendering inoperative said means for withdrawing said holding means upon said collecting and storing means being filled to a predetermined level.

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