DEFROST TIMER ARRANGEMENT FOR MAKING CLEAR ICE

Inventor: James A. Bright, Dayton, Ohio
Assignee: General Motors Corporation, Detroit, Mich.

Filed: Nov. 29, 1973
Appl. No.: 419,942

U.S. Cl. 62/137, 62/155, 62/233, 62/344
Int. Cl. F25c 5/18
Field of Search 62/137, 155, 233, 344

References Cited
UNITED STATES PATENTS
3,643,458 2/1972 Linstromberg et al. 62/155
3,659,430 5/1972 Nichols et al. 62/233
3,675,437 7/1972 Linstromberg 62/137
3,714,794 2/1973 Linstromberg et al. 62/137

Abstract
A clear cube ice maker has a control circuit incorporating the defrost timer of a freezer and a bistable relay switch in the harvest mechanism. The relay switch, in response to a signal from the defrost timer, conditions the ice maker for a deferred harvest when the weight switch is open (ice bucket full or ice bucket not in place) at the time of the signal or during the harvest. The relay switch is also in a circuit with an extra tray bottom heater to prevent the water from freezing to the bottom of the tray while awaiting the deferred harvest and is closed by the defrost timer and opened by a cam in the harvest mechanism.

5 Claims, 16 Drawing Figures
DEFROST TIMER CYCLE CHART

<table>
<thead>
<tr>
<th>CONTACTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

Fig. 16
DEFROST TIMER ARRANGEMENT FOR MAKING CLEAR ICE

This invention relates to apparatus for making clear ice of the type taught in my copending application Ser. No. 272,410, filed July 17, 1972 now U.S. Pat. No. 3,775,992 issued Dec. 4, 1973 and, more particularly, to a timing arrangement for controlling such apparatus through the defrost timer in a domestic refrigerator.

Clear ice has been a desire of users and a goal of manufacturers for years. Apparatus for making clear ice, however, has been cumbersome and suited only to commercial manufacture of ice. Heretofore, no one has simplified clear ice makers to the point where they are suitable in size, cost and operation to the relatively small confines of the freezer in a domestic refrigerator.

Accordingly, an object of this invention is the provision of a method and apparatus for making clear ice in a container in the freezer of a domestic refrigerator by containing water in a tray, heating the bottom of the tray to keep the lower portion of the water in a liquid state, freezing the top portion of the water starting at the interface between the water and freezer air and continuing to freeze water downwardly toward the bottom of the tray, periodically removing the frozen clear ice portion before it extends sufficiently toward the bottom of the tray to entrap gas and minerals in the water, and timing the periodic removal through a defrost timer for said freezer.

A further object of this invention is a timing arrangement for a clear ice maker in a freezer having an automatic defrost cycle and comprising a tray containing a body of water, a grid in said tray displacing said body of water into cavities in said grid, fan means distributing sub-freezing air over the top surface of said body of water in said grid whereby to initiate the freezing of clear ice along the interface between said air and said top surface, and a bucket for storing said clear ice, heating means to maintain said body of water in a liquid state adjacent said tray below said clear ice, harvesting mechanism for removing said grid from said tray and depositing said clear ice in said bucket, and a defrost timer for periodically defrosting said freezer, said heating means comprising a first heater for the sidewall of the tray and a second heater for the bottom wall of the tray, and control means providing for continuous energization of said first heater and energization of said second heater only when said bucket is full of clear ice or not in said freezer, said defrost timer having bistable means for initiating the operation of said harvesting mechanism.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

IN THE DRAWINGS

FIG. 1 is a fragmentary section through the freezer compartment of a domestic refrigerator showing in side elevation an automatic clear ice maker;

FIG. 2 is a front elevational view taken along line 2—2 in FIG. 1 with parts broken away to provide a schematic representation of the clear ice harvesting cycle;

FIG. 3 is a sectional view taken along line 3—3 in FIG. 2;

FIG. 4 is a fragmentary sectional view taken along line 4—4 in FIG. 3 and showing a portion of the water fill system;

FIG. 5 is a sectional view taken along line 5—5 in FIG. 3 and showing an insulated and heated water containing tray;

FIG. 6 is a fragmentary sectional view taken along line 6—6 in FIG. 4;

FIG. 7 is a perspective view of a side by side refrigerator freezer showing the clear ice maker installed in a portion of the freezer compartment;

FIG. 8 is a perspective view of the clear ice maker of this invention in an ice harvesting mode;

FIG. 9 is a sectional view with parts broken away taken along line 9—9 in FIG. 3 to show the ice harvesting mechanism and weight sensing means;

FIG. 10 is a side elevational view with parts broken away taken along line 10—10 in FIG. 9;

FIG. 11 is a sectional view of the ice harvesting mechanism taken along line 11—11 in FIG. 10 to show an ice making cycle timer and drive mechanism;

FIG. 12 is a perspective view from the front side with parts broken away to show ice harvesting mechanism for moving the ice grid and weight sensing means for sensing, first, the presence of an empty ice storage bucket and, secondly, a predetermined load of ice in the bucket;

FIG. 13 is a perspective view of the ice harvesting mechanism from the back side to show an ice making cycle timer and drive mechanism;

FIG. 14 is a sectional view of a water fill system suitable for use with this invention;

FIG. 15 is a schematic wiring diagram of a circuit arrangement including a defrost timer for controlling the ice making cycle in the improved manner of this invention; and

FIG. 16 is a timer cycle chart interpreting the operation of the defrost timer in FIG. 15.

GENERAL

In accordance with the teachings of the aforementioned copending application and with particular reference to FIG. 7, a domestic refrigerator 20 is shown. The refrigerator is of the side by side type wherein a right side portion encloses a refrigerated food compartment 22 and a left side portion encloses a lower freezer compartment 24 including a bottom freezer portion 26 enclosing the clear ice makes of this invention shown generally at 28. A vertical full length food 30 may be used to close both the upper and lower food compartments 24, 26.

In general, the clear ice maker 28 (FIGS. 1 and 8) includes a tray and heater assembly 34, an ice cube grid 36, an ice storage bucket assembly 38, a weight sensing means 39 for bucket and ice, an ice harvesting mechanism 40, and a water fill system 42.

TRAY AND HEATER ASSEMBLY

The tray and heater assembly 34 (FIGS. 4 and 5) is supported by bracket means 46 from a sideways 48 of the freezer compartment 26. The assembly includes a drawn sheet metal housing 50 forming on one side thereof a water containing tray 52 having a sidewall 54 and a bottom wall 56 and on the other side thereof a cavity filled with freon-filled urethane foam insulation 58. A pair of heaters 60, 62 surround the tray 52. Heater 60 is adapted for heating all four sidewalls 54...
of the tray and thereby normally exposes the bottom side of the tray (beneath the ice) to above-freezing temperature. This retains that portion of water along the bottom side of the tray in a liquid state. For this purpose, heater 60 is comprised of 90.8 inches of vinyl covered resistance wire rated at 115 volts, 6.5 - 7.5 watts, 250 ohms per foot reference.

Heater 62 is adapted for supplying additional heat to the tray bottom wall 56 under certain circumstances to keep ice from freezing all the way down to the bottom wall, and is comprised of 41.7 inches of vinyl covered resistance wire rated at 115 volts, 2.8 - 3.2 watts, 1,268 ohms per foot reference.

Heater 60 is sandwiched between a sheet 66 of 0.005 aluminum foil and a sheet 68 of 0.002 aluminum foil. Similarly, bottom wall heater 62 is sandwiched between a sheet 70 of 0.005 aluminum foil and a sheet 72 of 0.002 aluminum foil. The mating edges of foil sheets 66 and 68 are heat-sealed as are the mating edges of foil sheets 70 and 72. Both heater assemblies 60 and 62 are foamed in place between the tray and the urethane foam.

Also foamed in place is a tray fill tube 76 of polypropylene in heat transfer relation to heater 62 to prevent freeze-up and adapted to supply water to fill tray 52 through the bottom wall 56 of the tray. Electrical leads may enter the freezer through tubing 77.

WATER FILL SYSTEM

The water fill system 42 will now be described with reference to FIGS. 1 and 14. In general, water is supplied to tray 52 from a reservoir 78 defined by a water valve housing 80 attached to the back wall 82 of the refrigerator 20 behind the freezer compartment 26.

Water in reservoir 78 communicates with tray 52 through inlet 84 in the reservoir housing and tubing or conduit means 86 connecting outlet 84 with tray fill tube 76 through a protector tube base 90 (FIG. 4). Water contained in tray 52 seeks a common level with water in reservoir 78. Thus, the desired fill level in the tray is achieved by predetermining the water level in reservoir 78.

To control the level of water in reservoir 78, water valve housing 80 includes a float 94 pivotally attached at 96 to a wing hinge bracket 98. Top wall 100 of housing 80 carries a water valve assembly 102 including a water inlet 104 and a water outlet 106. A domestic supply of purified water may be connected to the inlet 104. Valve pin 108 (slidably supported on three ribs 109) has a rubber valve portion 110 adapted for closing against a valve seat 112. At the lower end of assembly 102, a valve pin actuator 114 pivots about axis 116 in response to the upward force of float 94 at one end 120 as balanced against a water level adjustment mechanism 122 at the other end 124. Water level may be adjusted by a remote knob 125 turning worm gears 126, 128 against spring 130.

The water level is adjusted at 125 in a manner to shut off the water supply at 110, 112 when the water level A (FIGS. 2 and 14) exists in both reservoir 78 and tray 52. In general, a fresh charge of water is supplied to tray 52 during an ice harvesting cycle when grid 36 is out of the tray. It should be noted that water level A will be raised to water level B when the grid is in the tray. The grid is constructed in a manner to displace substantially all water from the tray into the grid cavities for making clear ice. In this way, the water so disposed is available to form cubes in the grid cavities and, accordingly, does not form an adhesive film of ice between the grid and tray which resists the separation of grid and tray at the start of an ice harvesting cycle.

ICE CUBE GRID

Ice cube grid 36 (FIGS. 2, 3 and 8) has characteristics of poor heat conduction and good flexibility at low temperature with good ice release and return memory. It is comprised of a polypropylene housing 140 defining cavities 142 for a plurality of ice cubes. Each cavity 142 has an inverted truncated pyramidal shape. On the outside of the housing between the cavity forming portions thereof, a flexible filler 146 of RTV silicone rubber fills the space between the cube forming cavities on the outside of grid 36. The filler material should have an anti-stick characteristic to aid in the release of the grid from the tray during ice harvesting. It should be sufficiently flexible to distribute forces throughout the grid when the grid is warped for harvesting cubes. Aside from these characteristics, the filler 146 serves to force water in the tray upwardly into the cube forming cavities of the grid. Thus, with the grid in place in the tray (FIG. 2, solid line), water level A will become water level B.

ICE STORAGE BUCKET ASSEMBLY

The ice storage bucket assembly 38 will be described with reference to FIGS. 1 and 2. An ice container 150 of high impact polystyrene rests on a steel wire shelf 152. The shelf pivots about a support foot 154 on the bottom wall 156 of freezer portion 26 and includes an upright bracket 158 at the rear thereof which hangs from a weight sensing means 39 in a manner to keep the back 160 of the shelf spaced from the freezer wall 156. The ice container or bucket 150 is built up with a high wall 170 to catch the cubes falling from the grid 36 above. In general, the weight sensing means 39 will in one mode reflect the presence of ice container 150 on shelf 152 and, in another mode, the presence of a full load of ice cubes within the container 150.

WEIGHT SENSING MEANS

The weight sensing means 39 (FIGS. 1, 9 and 15) is comprised of a nylon weight shaft 176 having a hooked portion 178 for gripping a loop in the upright shelf bracket 158. The weight shaft is connected to a stainless steel container weigh bar 188 which pivots about 198 and is electrically connected to terminal 190 by resting thereon. An ice weigh bar 192, also stainless steel, is disposed above the container weigh bar and pivots about a brass pin 194. The other end of ice weigh bar 192 normally rests in electrically conducting relationship against a brass weigh bar stop and terminal 196. The container weigh bar includes a terminal 198 which cooperates with terminal 196 to comprise a weigh switch. In brief, the presence of container 150 on shelf 152 will cause the weight shaft 176 to pull down in a manner to cause container weigh bar 188 to touch ice weigh bar 192 and complete a circuit between terminals 198 and 196. When container 150 fills up with a predetermined full load of ice cubes, the further downward movement of weight shaft 176 will cause container weigh bar 188 to force ice weigh bar 192 out of electrical contact with terminal 196 thereby breaking the circuit.
HARVESTING MECHANISM

The harvesting mechanism 40 will now be described with reference to FIGS. 9, 10, 11, 12, 13 and 15. With particular reference to FIGS. 12 and 13, the harvesting mechanism is comprised of a box-like plastic casing 210 defining a compartment 212 for the grid pivoting and twisting gears on one side of a gear mounting plate 214. On the other side of the mounting plate 214, the housing is divided into a drive compartment 216 and a cam compartment 218.

The means for pivoting or removing and twisting or warping grid 36 are disposed in gear compartment 212. A cam and crank gear 220 is rotatably mounted on plate 214 and is rotatably driven from the other side of the plate by a pair of worm gears 222, 224 which are, in turn, driven by drive motor assembly 226. The cam and crank gear 220 is comprised of a cam portion 230 and a gear portion 232. The cam 230 cooperates with a timer holding switch 234 through a switch actuator 236 so that the timer holding switch is closed when the switch actuator 236 rides the outer periphery of the cam. Timer holding switch 234 is in shunt with weight switch 196, 198. In the position of FIG. 12, switch actuator 236 is disposed in a notched portion of the cam periphery to open switch 234. Gear 232 directly drives a cam gear 240 and includes a crank portion 242 in a slot 244 of segment gear 246. Thus, one rotation of crank and cam gear 220 will cause the segment gear 246 to rock back and forth about its pivot point 250.

The segment gear is drivably connected to grid drive gear 252 which extends outside the mechanism casing 210 where a D socket 254 is adapted for connection with a similarly shaped stud on grid 36 as at 256 (FIG. 3).

Cam gear 240 is pivotally mounted on mounting plate 214 and extends therethrough for directly driving cam 260 and cam 274. Cam 260 operates a second timer holding switch 262 through a switch actuator 264 so that the timer holding switch is closed when the switch actuator rides the outer periphery of the cam. Thus, switch 262 is shown in its open position.

In accordance with this invention, an ice making cycle is timed and controlled through a defrost timer 268 which otherwise has the conventional function of periodically defrosting the refrigerator.

OPERATION

An ice making cycle in accordance with the teachings of this invention will now be described. Water level in reservoir 78 is adjusted by means of water level adjustment 125 to provide a predetermined water level A when grid 36 is not in tray 52. Once the adjustment is made, water valve 110, 112 will be opened and closed by the action of float 94 and lever 114 to rapidly return to this water level during the time that grid 36 is being rotated out of tray 52 during an ice harvesting cycle.

With grid 36 in tray 52, substantially all of the water comprising water level B will be forced through the open bottom of each grid cavity 142 to form a water level B near the top of the grid cavities. This water level B will provide in the embodiment shown a water depth of approximately one inch in the tray. Fan means 285 (FIG. 15) blows air through and includes a duct 290 on the back wall of the freezer compartment 26 which distributes a quantity (10 to 15 cubic feet per minute) of below-freezing air (minus 10°F. to minus 12°F.) uniformly over the exposed top planar surface of water filling each cube cavity 142. Ice thickens from this top surface progressively downwardly. During the generation of this ice, heater 60 is energized to heat the body of water in each cube cavity below the ice forming along the top surface of the body of water in each cube cavity. Periodically (see FIGS. 15 and 16), defrost timer 268 initiates a harvest cycle. This occurs when the clear ice is in the form of a cube 296 approximately one-half inch thick. With the ice maker in a 0°F. freezer and the refrigerator in a 70°F. room ambient, compressor 286 in the freezing system normally operates 60 – 70 percent of the time. These parameters provide for freezing clear ice ½ inch thick in about 2½ hours. Thus, defrost timer 268 is designed to initiate three harvest cycles in the 8 hour program of the defrost timer.

Generally, by adding cam 260 to the harvest mechanism and ice maker switch 261 and contact 5 to the defrost timer 268, the clear cube ice maker can be timed and controlled with the defrost timer. The harvest can also be timed and oriented with respect to the defrost cycle. The ice maker contact 5 (FIGS. 15 and 16) must be closed long enough for the ice harvest mechanism 40 to close cam operated timer switches 234 and 262 but must open before the mechanism has completed its harvest cycle (10 minutes). FIG. 16 shows a suitable 8-hour cycle chart for defrost timer 268. A defrost cycle is initiated once every 8 hours when contact 4 is closed to energize defrost heater 287. The defrost cycle terminates when temperature responsive limiter switch 288 opens. As aforesaid, three harvest cycles are initiated during an 8 hour period, i.e., when contact 5 is closed for 4 minutes at the beginning of the period, after 3 hours and again after 5 ¼ hours. As can be seen in FIGS. 15 and 16, the defrost timer motor 269 runs continuously (contact 1 energized) and the compressor 286 and fan 285 are deenergized during defrost (contact 2 open when contact 4 closed).

More particularly, the ice maker switch 261 and contact 5 in the defrost timer energizes a relay coil 270 which closes a bistable timer switch 272 in the harvest mechanism. Bistable means that timer switch 272 has the characteristic of stability in both its open and closed positions. Thus, bistable timer switch 272 remains closed (even after the relay coil is deenergized when switch 261 in the defrost timer opens after 4 minutes) until the harvest mechanism is operated through its harvest cycle by drive motor 226. Half way through the harvest cycle, a cam 274 in the harvest mechanism pushes switch 272 open. Cam operated timer switches 234 and 262 are closed at the time switch 272 is pushed open to allow the mechanism to complete the harvest cycle by maintaining the energization of driver motor 226. Timer switch 272 remains open until the defrost timer ice maker switch 261 closes again for 4 minutes at its next following point (after 180 minutes in the
timer cycle chart. The bistable relay switching arrangement prevents the ice maker from missing a harvest cycle when the defrost timer switch 261 closes at the same time the weigh switch contact 196 is open due to the bucket being full or removed from the freezer. Moreover, as long as timer switch 272 in the mechanism is closed, the extra tray bottom heater 62 will be energized thus preventing the water in the tray from freezing to the bottom if the harvest cycle is to be delayed. This is the primary purpose for the bistable relay switching arrangement when using the defrost timer to time the clear ice ice maker.

With reference to FIGS. 2 and 3, grid 36 starts to rotate with substantially ½ inch cubes 296 of clear ice in the top portion only of each cavity 142. Unfrozen water 298 beneath the cubes remains in tray 52 in a liquid state. Tray housing 50 includes an upstanding flange 300 journalling a stud 302 projecting from one corner of the grid. A stud at the same corner on the opposite end of the grid (not shown) fits in the D socket 254 of grid drive gear 252. As grid 36 rotates from the installed position X (FIG. 2) through the upright position Y to the harvesting position Z, the grid will engage a raised boss 304 which halts the pivoting motion of the grid at its outer end. However, the harvesting mechanism continues to drive the grid causing the end nearest the driving mechanism to continue rotation to warp the grid in a manner to release clear ice cubes 296 from the grid. The released cubes fall into the ice bucket 38 therebelow.

After the cubes are harvested, the continued rotation of crank gear 232 operating through its crank 242 in the slot of segment gear 246 will return the grid to its installed position X.

While the embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is:

1. A clear ice maker for a freezer having defrost means and a defrost timer for periodically defrosting said freezer, said ice maker comprising a tray having walls adapted to contain a body of water, a grid in said tray having cavity-forming means for displacing the body of water contained by said walls into the cavity, means distributing subfreezing air over the top planar surface of said body of water in said grid cavity for a sufficient period to initiate the freezing of clear ice in said grid cavity along the interface between said air and said top planar surface and to continue the freezing of clear ice downwardly in said grid cavity, and a bucket for storing said clear ice in said freezer and being removable from said freezer, tray heating means energizable to maintain said body of water in a liquid state adjacent said tray below the freezing clear ice, and harvesting mechanism operable in a harvest cycle by a drive motor for removing said grid and clear ice from said tray before the freezing of clear ice downwardly in said grid cavity reaches the bottom wall of said tray and for depositing said clear ice in said bucket, said harvesting mechanism including a weigh switch, a bistable first timer switch and said drive motor in series electrical flow relationship, said first timer switch having the characteristic of stability in both its open and closed positions and operating in its closed position to enable the initiation of said harvest cycle by operating said harvesting mechanism when said weigh switch is closed, said weigh switch having a closed position when said bucket is empty and an open position when said bucket is full of clear ice or removed from said freezer.

2. In a clear ice maker for a freezer having defrost means and a defrost timer including means for periodically defrosting said freezer, said ice maker including a tray having side and bottom walls adapted to contain a body of water, a grid in said tray having cavity-forming means for displacing the body of water contained by said walls into the cavity, fan means distributing subfreezing air over the top planar surface of said body of water in said grid cavity for a sufficient period to initiate the freezing of clear ice in said grid cavity along the interface between said air and said top planar surface and to continue the freezing of clear ice downwardly in said grid cavity, a bucket for storing said clear ice in said freezer and being removable from said freezer, and tray heating means energizable to maintain said body of water in a liquid state adjacent said tray below the freezing clear ice, the improvement comprising harvesting mechanism operable in a harvest cycle by a drive motor for removing said grid and clear ice from said tray before the freezing of clear ice downwardly in said grid cavity reaches the bottom wall of said tray and for depositing said clear ice in said bucket, said harvesting mechanism including a weigh switch, a bistable first timer switch and said drive motor in series electrical flow relationship, said first timer switch having the characteristic of stability in both its open and closed positions and operating in its closed position to enable the initiation of said harvest cycle by operating said harvesting mechanism when said weigh switch is closed, said weigh switch having a closed position when said bucket is empty and an open position when said bucket is full of clear ice or removed from said freezer, said harvesting mechanism having a second timer switch in shunt with said weigh switch and a third timer switch in shunt with said first timer switch, said drive motor operating to actuate said second and third timer switches to maintain the operation of said drive motor and harvesting mechanism once said harvest cycle is initiated irrespective of said weigh switch and said first timer switch, said drive motor operating to actuate said second and third timer switches to terminate said harvest cycle, and said drive motor operating to move said first timer switch to its stable open position after said second and third timer switches have been actuated to maintain the operation of said drive motor and before said harvest cycle is terminated, said heating means comprising a heater for a wall of the tray in shunt with said weigh switch and said second timer switch and in series electrical flow relationship with said first timer switch, said defrost timer including ice maker means initially operable to move said first timer switch to its stable closed position when said freezer is not being defrosted and subsequently operable to permit the movement of said first timer switch to its stable open position whereby said heater is adapted for temporary energization when a harvest cycle is initiated by the movement of said first timer switch to its stable closed position and said bucket is either full of clear ice or removed from said freezer, said temporary energization continuing until said bucket is replaced in said freezer and is no longer full.
said drive motor in series electrical flow relationship, said drive motor operating to close said second and third timer switches to maintain the operation of the harvesting mechanism once said harvest cycle is initiated irrespective of said weigh switch and said first timer switch, said drive motor operating to open said second and third timer switches to terminate said harvest cycle, and said drive motor operating to move said first timer switch to its stable open position after said second and third timer switches are closed and before said harvest cycle is terminated, said heating means comprising a heater for said tray in shunt with said weigh switch and said second timer switch and in series electrical flow relationship with said first and third timer switches, said defrost timer including ice maker means initially operable to move said first timer switch to its stable closed position when said freezer is not being defrosted and subsequently operable to facilitate the movement of said first timer switch to its stable open position whereby said heater is adapted for temporary energization when a harvest cycle is initiated by the movement of said first timer switch to its stable closed position and said bucket is either full of clear ice or removed from said freezer, said temporary energization continuing until said bucket is replaced in said freezer and is no longer full.

3. The improved harvesting mechanism of claim 2 wherein said ice maker means comprises a timer switch in said defrost timer and a relay coil for moving said first timer switch to its stable closed position.

4. The improved harvesting mechanism of claim 2 wherein said harvest cycle is substantially 10 minutes and said defrost timer is adapted to operate said ice maker means to initiate said harvest cycle substantially three times in an 8 hour period.

5. A clear ice maker for a freezer having defrost means and a defrost timer including means for periodically defrosting said freezer by energizing said defrost means, said ice maker comprising a tray having side and bottom walls adapted to contain a body of water, a grid in said tray having cavity-forming means for displacing the body of water contained by said walls into the cavity, fan means distributing subfreezing air over the top planar surface of said body of water in said grid cavity for a sufficient period to initiate the freezing of clear ice in said grid cavity along the interface between said air and said top planar surface and to continue the freezing of clear ice downwardly in said grid cavity, and a bucket for storing said clear ice in said freezer and being removable from said freezer, tray heating means energizable to maintain said body of water in a liquid state adjacent said tray below the freezing clear ice, and harvesting mechanism operable in a harvest cycle by a drive motor for removing said grid and clear ice from said tray before the freezing of clear ice downwardly in said grid cavity reaches the bottom wall of said tray and for depositing said clear ice in said bucket, said harvesting mechanism including a weigh switch, a bistable first timer switch and said drive motor in series electrical flow relationship, said first timer switch having the characteristic of stability in both its open and closed positions and operating in its closed position to enable the initiation of said harvest cycle by operating said harvest mechanism when said weigh switch is closed, said weigh switch having a closed position when said bucket is empty and an open position when said bucket is full of clear ice or removed from said freezer, said harvesting mechanism having a second timer switch in shunt with said weigh switch and a third timer switch in shunt with said first timer switch, said second and third timer switches and said drive motor being in series electrical flow relationship, said drive motor operating to close said second and third timer switches to maintain the operation of the harvesting mechanism once said harvest cycle is initiated irrespective of said weigh switch and said first timer switch, said drive motor operating to open said second and third timer switches to terminate said harvest cycle, and said drive motor operating to move said first timer switch to its stable open position after said second and third timer switches are closed and before said harvest cycle is terminated, said heating means comprising a first heater for the sidewall of the tray in shunt with said weigh switch and said first, second and third timer switches and a second heater for the bottom wall of the tray in shunt with said weigh switch and said second timer switch and in series electrical flow relationship with said first and third timer switches, said defrost timer including ice maker switch means closable to move said first timer switch to its stable closed position when said freezer is not being defrosted and openable before said first timer switch is moved to its stable open position whereby said first heater is adapted for continuous energization and said second heater is adapted for temporary energization when a harvest cycle is initiated and said bucket is either full of clear ice or removed from said freezer, said temporary energization continuing until said bucket is replaced in said freezer and is no longer full and the delayed harvest cycle thus initiated is subsequently terminated.

* * * * *