CUBE TYPE ICE MAKER HAVING ELECTRIC HEATER AND CAM EJECTOR

Inventor:
Lyle F. Shaw

By: J. Schmidt Att'y
CUBE TYPE ICE MAKER HAVING ELECTRIC HEATER AND CAM EJECTOR

Lyle F. Shaw, Muskegon, Mich., assignor to Borg-Warner Corporation, Chicago, Ill., a corporation of Illinois

Filed Aug. 21, 1961, Ser. No. 132,938

5 Claims. (Cl. 62—137)

This invention relates to an ice maker and more particularly to an automatic ice maker of the type adapted to be installed in a refrigerator.

An object of the invention is to provide a new and improved control arrangement for an automatic ice maker.

Another object of the invention is to provide an improved control arrangement for an automatic ice cube maker including an ice cube forming mold; electrically-energizable heating means to free the ice piece from the mold; mechanical means, including a cam, operative to eject the ice piece from the mold; electrically-energizable power means operative to rotate the cam and thereby actuate the mechanical means to eject the ice piece from the mold; a first electric circuit to energize the power means and heating means and including a normally-open switch closable by a thermostat responsive to an ice-piece freezing temperature and operable by the thermostat when heated by the heating means; and a second electric circuit to maintain the power means and heating means energized, when the thermostat opens its switch, and including a normally-open switch closable by rotation of the cam by the power means during energization thereof by the first circuit.

Another object of the invention is to provide an improved control arrangement for an automatic ice maker as above described characterized by its simplicity wherein the thermostat and cam are independently operable in effecting the establishing of their respective circuits so that the thermostat is ineffective to exert any control over the establishing of the second circuit by the cam.

Other objects and advantages of the invention will be pointed out specifically or will become apparent from the following description when considered in conjunction with the accompanying drawings in which:

FIG. 1 is a partial front elevational view of a refrigerator provided with an automatic ice cube maker embodying the invention;

FIG. 2 is an enlarged top plan view of the ice maker;

FIG. 3 is an enlarged sectional side elevation of the ice maker illustrating the ice cube-forming mold structure, the ice cubes-raising and ejector lever mechanism, cam mechanism, and the fluid supply, together with electrical components for operation of the mechanisms and fluid supply, said section being taken on line 3—3 of FIG. 1;

FIG. 4 is a sectional view of the ice maker showing the cam and lever mechanisms, and electrical control components, said section being taken on line 4—4 of FIG. 5;

FIG. 5 is a sectional view taken on line 5—5 of FIG. 4;

FIG. 6 is a sectional view taken on line 6—6 of FIG. 5;

FIG. 7 is a fragmentary view illustrating the ejector lever mechanism, and also a feeler for controlling operation of the ice maker;

FIG. 8 is a fragmentary sectional view illustrating the ice mold structure, a lever-operated raker, and an electric heater coil, said section being taken on line 8—8 of FIG. 3;

FIG. 9 is a fragmentary view illustrating the lever and cam mechanism during their ice-cube ejection positions;

FIG. 10 is a schematic diagram of the electrical control arrangement for the ice maker.

Briefly, the ice maker illustrated in the drawings, comprises an ice cube-forming mold structure having a plurality of pistons, defining the bottoms of the ice cube-forming cavities in the mold structure, operated by a lever arrangement to eject the ice cubes from the mold upon heating of the mold by a heater to free the ice cubes from the mold, the pistons being simultaneously actuated by a lever mechanism controlled by a cam mechanism operated by an electric motor energizable by a thermostat responsive to the freezing temperature of the ice cube mold, the cam mechanism also being instrumental to cause motion of a raker to sweep the ice cubes from their raised positions into a receptacle and being further effective to control fluid supply to the molds for ice cube formation, all of the various functions of the ice maker being thermostatically, electrically, and cam, controlled.

Referring to FIG. 1, the refrigerator illustrated is of a well-known type and comprises a thermally insulated cabinet 10 having a frozen food compartment 11 provided with an evaporator or a cooling unit in the form of cooling refrigerant passages 12 (FIG. 2) in the liner 13 of the compartment to cool the air within the compartment 11 and thereby to freeze foods and water placed in the compartment. As it will be observed, the automatic ice cube maker of the invention, generally indicated at 15, is mounted in the compartment 11 in a manner to be described.

Details of the construction of the ice cube maker are more clearly shown in FIGS. 2—9, inclusive. The ice cube maker comprises an aluminum mold block or structure 16 of rectangular box-like configuration having one side secured by bolts 17 passing through the mold and the liner 13 into the cabinet 10 to support the ice maker on the refrigerator as shown in FIG. 2 and for intimate heat exchanging contact with the liner 13 for thermal conduction relation to the mold structure 16 to insure freezing of water within the mold structure by the absorption of heat therefrom by the vaporizable refrigerants circulated through the evaporator passages 12 of the liner 13.

As seen in FIG. 2, the flat side wall 18 of the ice mold structure or block is spaced from the liner by a pair of spaced thermal-conductive pads 19 and also three thermal-insulating pads 20, disposed between the pads 19 and at opposite ends of the pads 19, the pads being engaged with the aluminum mold structure to space the mold structure from the liner. This arrangement is important as the thermal-conducting pads are located to conduct heat from the central cavity or mold 21 and the adjacent cavities or molds 22 and 23 to cause freezing of the fluid in these cavities into cubes prior to conducting heat from the end molds 24 and 25 to form ice cubes in the end molds, i.e., fluid in the central and its adjacent molds 21, 22, and 23 and will freeze into ice cubes prior to the freezing of the water in the end molds 24 and 25 so that ice cubes will be formed in all of the molds to close a thermostatic switch, located in proximity to the mold 24 to energize a motor and a heater as will later be described. It will be seen that pads 19 are positioned between the block and the liner and disposed in parallel vertical planes respectively extending between the central mold 21 and two molds 22 and 23 so that the adjacent-conducting pads to these molds will cause the water to be frozen into ice cubes prior to the ice cubes being formed in the end molds 24 and 25. This safety factor insures the thermostatic switch closing only when all of the ice cubes are formed in the molds.

As seen in FIGS. 2 and 3, the mold structure 16 is provided with each of its ice cube-forming molds being provided by vertical cylindrical pockets with each pocket being enlarged diametrically in cross-section from the bottom to the top thereof to provide the individual molds with an inverted frusto-conical shape for an ice cube of maximum size while permitting easy ejection of the cubes from the molds. As seen in FIGS. 2, 3, and 8, the walls 27 between and separating adjacent molds are interrupted by aligned vertical passages 28 for per-
mitting fluid entering the mold from a trough 29 mounted on the right end of the mold structure, as shown in FIGS. 2 and 3, the fluid flowing into the mold 25 and then through the connecting passages 28 consecutively to the molds 22, 23, 24 and 25. The entry of water into the molds is controlled by a valve 30 having a solenoid 31 which, when energized, opens the valve to permit fluid to enter the trough and the molds.

As shown in FIGS. 2, 3, 6, and 8, the molds 22, 23, 24, 25 have their bottoms closed by a plurality of piston-like plates 40 formed integral with the top of a thin elongated horizontal bar 33 received within the passages 28 of the mold structure and an elongate slot 34 in the block, and the central mold has its bottom closed by a solid piston 35 formed integral with the bar, so that the molds 21–25 and passages 28 are closed at their bottom ends. It may be noted that the passages 28 not only provide for the consecutive filling of the molds from right to left from the trough but also provide guides for the vertical movement of the bar 33 during raising and lowering of the ice-cube ejector assembly comprising the bar 33 and the pistons 32 and 33. As seen in FIGS. 2 and 3, the piston 35 of the ejector assembly has an opening extending vertically therethrough for receiving the reduced end 36 of the upper portion of a cylindrical pilot rod 37 of the ejector assembly, the rod having a shoulder abutting the bottom of the piston 35 for supporting the pistons and bar for compact movement, the top of the rod 37 being extended to provide a rivet 38 to secure the rod 37 to the piston 35. The rod extends through and is slidable supported in a cylindrical opening 39 in the mold structure and through a boss 40 extending downwardly of the mold, the upper end of the opening 39 being enlarged to receive a seal assembly 41 surrounding and slidably engaging the rod 37.

It will be apparent that, in the position of the ejector assembly shown in FIG. 1, water entering from the trough 29 will flow into the mold 25 and consecutively into the molds 23, 21, 22 and 24 until the molds are filled with a predetermined quantity of fluid for freezing into ice cubes by the heat exchange relation of the mold and the liner 11 and that, when the ice cubes are formed, movement of the rod 37 upwardly will raise the bar 33 and its pistons 32 and 35 to eject the ice cubes from the molds.

A lever mechanism is provided for raising and lowering the ejector assembly and comprises a lever 42 having an arm 43 received within a slot 44 in the pilot rod 37 as shown in FIG. 3, the lever 42 being pivoted intermediate its end on 45 positioned eccentrically on the parallel ears 46, 46 of an end wall 47 of the casing 48 supporting the lever mechanism. The lever is adapted to rotate about the pin 45 by having its arm 49 operated by a cam mechanism, generally indicated at 50, effective to control such movement of the lever to raise the ejector assembly to raise the ice cubes and to thereafter lower the ejector assembly as shown in FIGS. 9 and 4, respectively.

The cam mechanism is instrumental in controlling, with a thermostatic control, the various functions of the ice cube maker. More particularly, the cam mechanism comprises a rotatable cam 51 connected to the driven shaft 52 of transmission gearing (not shown) which, in turn, is connected to the shaft of an electric motor 53 mounted on plate 54 connected by screws 55 and 56 to the casing walls 57 and 47, the gearing being adapted to provide a ratio of 32:2 of 3400:1 for rotating the shaft 53. As seen in FIG. 4, a headed threaded pin 58 secured to one side of the cam in spaced relation to the rotational axis of the cam and extends within an elongate slot 59 in the arm 49 of the lever 42 so that rotation of the cam will cause the pin 58 to travel along a slot 59 on the lever to move the lever about its pivot pin 45 to raise and lower the ejector assembly.

Referring to FIGS. 6 and 8, the mold block 16 has parallel grooves 60 formed in the bottom thereof for receiving the legs of a U-shaped aluminum sheathed electrical coil 61 capable of 300 watts at 115 volts to provide a heater for heating the body of the mold block so that heat conducted through the mold block to the ice cubes will melt the frozen bond between the ice cubes and the walls of the molds. As shown in FIGS. 3, 4, and 6, the ends of the coil extend through and are supported by, as at 62, the wall 47 of the casing.

Upon application of heat to the mold block by the heater coil, the heat will be conducted uniformly to all of the molds 21 to 25 to substantially simultaneously free the cubes from the mold and, due to the location of the thermal-insulating pads 29, very little heat will flow to and be conducted through the small area of the thermal-conductive pads 19 to the liner 13. Accordingly, it will require very little exertion or action by the ejector and cam mechanism and the motor to raise the cubes out of the mold.

Referring again to the cam mechanism, the cam mechanism also comprises means for actuating a lever 63 having at one end pivoted by a pin 64 on the plate 54 of the other end having a pin 66 for actuating the cam. The lever 63 is adapted to receive and be provided with an opening for receiving the lower laterally projecting end of a rod 65 for extending vertically upwardly and having its upper end also laterally offset to extend within an opening in the arm 66 of a lever 67. The body of the lever 67 is also provided with an opening for actuating a lever 66, the elongate rake or sweep 69, the cylindrical end 68 of the rake being knurled to conform to and tightly fit into the opening in the lever body to insure that rotation of the lever will also rotate the rake. The end 68 and the other end 70 of the rake 69 are offset from the body of the rake and extend respectively within openings in the wall 47 of the casing 48 and the wall 71 of the trough 29 to position the rake body in radially spaced relation to the pivotal axis of the rake as provided by the opposite mounted ends of the rake, to thus position the rake above and to one side of the mold so that the rake will not interfere with the upper ejecting movement of the ice cubes from the molds but the rake can rotate to sweep the raised cubes from the mold and into the basket 72 shown in FIG. 1.

The lever 63 is adapted to be rotated in a counterclockwise direction about its pivotal support 64 by a pin 73 (FIGS. 6 and 9) projecting from the side of the cam and engaging a semi-circular surface 74 of the lever being concentric to the axis of rotation of the lever and terminating at one end in a flat chordal surface 75 of a projecting portion 76 of the lever, the surface 75 being the center of a semi-circular surface and tangential to an arc struck from said axis, the other end of the surface 75 being in spaced relation to the adjacent end of the surface 74 to define an opening between the projecting portion 76 of the lever and the body of the lever. It will be apparent, upon rotation of the cam, that the pin 73 will ride along the surface 74 of the lever without actuating the lever but, upon the pin 73 engaging the surface 75, the pin will raise the lever to move the rod 65 to rotate the lever 67 in a clockwise direction (FIG. 5) and thereby the rake to cause the body of the rake to move about its ends to sweep the raised cubes from the molds. Referring now to FIGS. 4, 5, and 6, the lever 67 has an arm 68 disposed substantially at a right angle to the rake-operating arm 66, the arm 78 having an opening for receiving the offset end of an L-shaped shaped actuating rod 79 so that rotation of the lever 67 will cause the rod to be actuated. The other end of the rod 79 is also offset for reception within, and is normally disposed at one end of an elongate slot 89 in an arm 91 of a lever 83. The lever 83 has an opening receiving a knurled end 83 of a feeler 84 for contacting the rod 79 of the lever and, the end 83 extending through and being rotationally mounted as at 85 in the wall 47 of the casing 48. The offset end of rod 79 is normally maintained at the end of the slot in lever 82, as shown, by a spring 85.
having one end connected to the other offset end of the rod 79, and the other end of the spring is connected to a downwardly extending crank pin 86 of the lever 82, the crank pin being radially offset from the rotational axis of the lever, so that the spring is disposed within and positioned at the end of the slot 89 in arm 81 of lever 82.

The feeler 84 is bent vertically downwardly from its arm and from its rotative mounting in the casing wall 47 and is further bent horizontally at its lower extremity to provide a feeler arm 87 extending above the ice cube-receiving receptacle or basket. It will be apparent that, upon rotation of the cam, the pin 73 of the cam will engage the flat surface 75 of the lever 63 to rotate the lever upwardly to raise the rod 65 to rotate lever 67 so that its arm 78 will move rod 79 in an arcuate path to position the feeler arm 87 in front of the mold structure and above and at one side of the basket so that, at this time, the cubes, swept from the mold structure, can freely fall into the basket without being impeded by the feeler arm 87. It will be seen that, as the offset end of rod 79 is disposed within and positioned at the end of the slot 89 in arm 81 of lever 82 so that, this end of the rod can move along the slot and relative to the lever 82 by this lost motion connection between the rod 79 and lever 82, the spring 85 is positioned only to position the arm 81 of lever 82 to engage the end of rod 79 with the end of the slot when the feeler arm 87 is above and over the ice cube-receiving opening in the basket.

The arm 81 of lever 82 is also provided with a flat portion 88 disposed at a right angle to its crank pin 86 and engageable with the pushbutton of a stop switch 89 to open the normally closed contacts of this switch. It may be noted that the switch 89 is mounted on and secured to the wall 47 of the casing in a position to permit actuation of its pushbutton upon rotative movement of lever 63 to actuate rod 79. In the event the receptacle is filled with ice cubes to an extent that the feeler arm 87 is raised by the cubes, the lever 82 will not return to its normal position as shown but will be held, by the engagement of the feeler 84 with the ice cubes, in a position to continue operation of the pushbutton of the switch 89 to open the switch contacts, and despite operation of the spring 85 to return the lever 82 to its normal position as shown. It may be observed that, although the lever 67 can return to its normal position, that the end of the rod 79 will be disposed between the slot 89 in the lever 82.

Upon removal of a sufficient amount of the ice cubes from the receptacle, the feeler 84 will be rotated to its normal position above the basket by the action of spring 55 rotating lever 63 to its normal position shown to release engagement of the flat portion 88 of the lever 82 with the pushbutton of switch 89 to permit its contacts to close, this movement of the lever also causing the lever to be rotated to engage the offset end of rod 79 with the end of the slot in lever 82. The stop switch 89 is effective to provide a circuit to energize the electric motor to rotate the cam and, accordingly, when the contacts of switch 78 are open, the electric motor is energized under certain conditions to be later described with reference to the operation of the ice cube maker and the electrical control diagram of FIG. 10.

Referring to FIG. 6, the cam control mechanism is further instrumental in sequentially actuating switches 90 and 91, the switch 90 being effective to control an energizing circuit for the electric motor, and the switch 91 being operative to control energization of the solenoid 51 of the water-fill valve 30. More particularly, the switches 90 and 91 are consecutively closed during rotation of the cam, the switches being provided by a plurality of contacts formed in an assembly generally indicated 92 mounted on the wall 54 of the housing, two of the contacts of respective switches being connected by an insulated stud 94 for unitary movement to engage the other contacts of the switches, as shown in FIG. 6. A flexible actuator arm 96 of the assembly is connected by an insulating pin to the stud 94 and extends downwardly therefrom for reception within a recess 95 of the cam (FIG. 6). The end of arm 96 is adapted to move away from the cam recess to engage the side of the recess-defining portion of the cam to close switch 90 to energize the motor. The cam periphery is also provided with a tab 100 projecting outwardly therefrom to engage the arm 96 to additionally energize solenoid 31 of valve 30 during rotation of the cam. As seen in FIG. 6, the tab 100 is adjustable mounted on the cam by a screw extending through an elongate slot in the tab and permitting adjustment of the tab on the cam to a position determinative of the time of occurrence of the energization of the water fill solenoid. It will be noted that the tab 100 of the cam, when the cam is rotated in a counterclockwise direction (FIG. 6), will engage the arm 96 just prior to its entry into the recess 95 of the cam so that, when the tab 100 closes switch 91, the ice cubes will have been previously ejected from the molds and the ejector assembly returned to the bottom of the molds to insure the molds being filled with water during operation of the tab to close switch 91 to energize solenoid 31 of valve 30. After the arm 96 has released its engagement with the tab 100, the motor-energizing switch 90 remains closed to rotate the cam until the arm 96 is positioned within recess 95 of the cam when both switches are opened to stop operation of the ice maker until the water in the molds form ice cubes. At this time, the motor is energized to operate the cam and lever mechanism to offset ejection of the cubes from the molds and into the basket. For this purpose, as shown in FIGS. 3 and 6, the mold is provided with a thermostatic switch 101 located in a cavity 102 in the end of the mold adjacent to but spaced from the mold 24 by a comparatively thin wall 103, defining a portion of the end mold 24 of the mold structure. The switch 101 is held with its thermostatically-responsive, contact-closing portion in engagement with this wall by a spring 104 compressed between the thermostatic switch and the wall 47 of casing 48. The switch contacts are adapted to open at 30°F. and to close at 5°F. The control thermostatic switch 101 is in a circuit to control energization of the electric motor in a manner to be later described. As a safety factor, a thermostatic switch 105 is mounted on the wall 47 of the casing 48 so that should an undesirable high temperature of the aluminum mold structure and wall 47 be had, during abnormal heating by the heater coil 61 in the event of malfunctioning of the control thermostatic switch 101, the switch will open its contacts to interrupt all circuits, including the heater coil circuit. The thermostat is effective to close its contacts below, and at, 40°F. and to open its contacts at a temperature rise to 60°F. This function of the switch 105 will be amplified in the description of the operation of the ice maker.

In the operation of the ice cube maker, it will be assumed the mechanical and electrical components of the ice cube maker are in the positions shown in FIGS. 1–8 and also referring to the electrical control diagram of FIG. 10. In addition, it will be assumed that the molds have been filled with water and the water frozen into ice cubes conforming to the frusto-conical shape of the molds. At this time, the contacts of the safety thermostatic switch 105 are closed and, as the temperature of the wall 47 of the casing is at or below 5°F., the contacts of the control thermostatic switch 101 have closed to provide a circuit to simultaneously energize the motor 53 and also the heater coil 61 so that the motor rotates the cam to cause arm 96 of the switch assembly 92 to close switch 90 to establish a circuit to maintain the motor energized, upon opening of the contacts of the
control switch 101 at or above 30° F. by heat conducted to the mold structure and casing wall 47 by energization of the heater.

Referring to the electrical control diagram of FIG. 1, it will be apparent 60 that the circuit is completed including line L4, closed contacts of the safety switch 105, the closed contacts of the control switch 101, conductor C1, closed contacts of the stop switch 89, conductors C2 and C3, winding of the motor 53, conductor C4, to line L2. A circuit is simultaneously established to energize the heater coil 61 including conductors C2 and C5, the heater coil 61, conductor C4 to line L2.

As the heat penetrates the mold block, the control switch 101 opens its contacts at or above 30° F. but, at this time, the cam has been rotated by the motor to activate arm 66 of the switch assembly 92 to close switch 98 to continue establishment of circuits to maintain the motor and electric coil energized during the entire operation of the machine. The motor-energizing circuit includes line L1, closed contacts of switch 105, conductor C6, closed contacts of switch 99, conductors C7, C2, C3, winding of motor 53, conductor C4 to line L2. At this time, the switch 99 also establishes a circuit to the heater coil including line L1, conductor C6, switch 90, conductor C7, conductor C2, conductor C5, heater coil 61, conductor C4 to line L2.

Due to the frozen bond between the ice cubes and the sides of the molds, operation of the ejector mechanism does not occur and, accordingly, the motor will stall until a predetermined period of time has elapsed during which the temperature of the block rises to free the ice cubes from their bond with the molds. At this time, the motor renews operation to cause the cam to rotate to move pin 58 along the slot 59 in lever 49 to slowly move the lever in a clockwise direction (FIG. 6) about its pivot pin 45 to raise the arm 42 of the lever and thereby the pilot rod 37 and thereby the pistons upwardly to the position shown in dotted lines in FIG. 3 to remove the loosened ice cubes from the molds. This movement of the cubes takes a 50 second time period, and the cubes are held in their raised position for approximately 15 to 20 seconds so that water on the outer surfaces of the cubes will be frozen to prevent congealing connections of the cubes to each other when they are swept into the tank by the rake 69.

At the conclusion of this time, the motor rotates the cam to the position shown in FIG. 9 in which its pin 73 is engaged with the flat chordal surface 75 of the lever 63 so as to raise the free end of the lever, by rotation of the lever in a counterclockwise direction (FIG. 9), to move the rod 65 to rotate lever 67 to cause the body of the rake to pivot about its ends to sweep the ice cubes from the mold structure and into the basket.

During actuation of the rake and prior to engagement of the rake with the cubes, the lever 67 operates rod 79 which, in turn, rotates lever 82 to move the feeder 84, from its normal position above and over the basket, rearwardly of the basket so that the ice cubes may fall freely into the basket when the rack is operative to remove the raised ice cubes from the mold structure. When the pin 73 of the cam is positioned within the space between the portion 37 and the body of the lever, the pin 58 of the cam has been effective to rotate lever 42 to move the ejector mechanism, including the piston, their supporting bar, and the pilot rod, to the lowered positions shown in FIGS. 1–8.

As the cam continues to rotate, the tab 100, projecting outwardly of the periphery of the cam, will engage the arm 96 of the switch assembly 92 to continue closing the contacts of switch 90 for energizing the motor and, in addition, will cause the contacts of switch 91 to close the solenoid 31 of the water valve 30 to cause water to flow into trough 29 and into the molds for an amount of time determined by the energization of the tab 100 with the arm 96 to fill the molds with water. As the tab 100 of the cam releases its engagement with the arm 96 of the switch assembly, the arm 96 of this assembly will continue to close the contacts of the solenoid 43 to continue energization of the motor and heater coil until the arm 96 is positioned within the recess in the cam to open the switch 90 and thereby effect deenergization of the motor and the heater coil. The motor for energizing the water valve solenoid 31 includes line L2, the closed contacts of the safety thermostat switch, conductor C6, closed contacts of switch 98, closed contacts of switch 91, conductor C8, the winding of the water valve solenoid 31, conductor C4 to line L2.

In the event the receptacle should be filled with ice cubes to an extent that the feeder fails to return from its raised positions to its lowered position above and over the basket, the contacts of the stop switch 89 will remain open, as previously described, so that, at the end of the normal cycle of operation of the machine when the switch 90 is opened, freezing of the ice cubes and closing of contacts of thermostatic switch 101 will not establish a circuit to the motor and heater coil as this circuit requires the contacts of the stop switch 89 to be closed.

An additional safety factor has been previously mentioned in the form of the safety thermostatic switch 105 which as shown in FIG. 10 is directly connected to the line L1 so that the temperature of the temperature rise during the heating of the mold block 16 by the heater coil 61, the safety switch will operate to open its contacts to immediately interrupt any circuits energizing the motor or any of the electrical components of the machine. This safety factor is of considerable value in preventing continued operation of the heater coil, for example, when the temperature of the mold rises to an extent that any ice cubes in the molds may be substantially melted, or the water in the molds may be vaporized.

It may be noted that a distinct advantage resides in the provision of the heater coil being energized during the water fill of the molds and ejection of the ice cubes as any water, entering between the pistons and mold walls and also into the elongate seat in the mold structure for the piston-supporting bar, if frozen to provide an ice bond between the mold and these described components of the ejector mechanism, which again be converted into water upon energization of the heater coil and conduction of heat into the mold structure so that no remnants or slivers of ice remain to impede the movements of the ejector mechanism.

While I have described a specific embodiment of the ice cube maker forming the invention, it is to be clearly understood that modifications may be made of the various mechanical and electrical arrangements of the ice cube maker and which may fall within the scope of the appended claims.

I claim:

1. In a control arrangement for an automatic ice maker having successive operations including a first operation for forming ice-pieces in a mold, a second operation for heating the mold for loosening the ice pieces in the mold, a third operation for harvesting ice pieces in the mold, and a fourth operation for introducing fluid into the mold while heating said mold to prevent freezing of the fluid, and including a mold for receiving fluid; means for freezing the fluid in said mold to provide ice-pieces in said mold during said first operation; electrically-energizable heating means for heating said mold during said second and fourth operations; mechanical means, including a rotatable cam, operative to eject the ice pieces from the mold, and including a mechanism for receiving ice-pieces from the mold, during the third operation; electrically-energizable power means for rotating said cam to oper-
3,163,018

state said member; thermostatically-operated means responsive to an ice-piece freezing temperature to control energization of said heating means and power means during said second and third operations; means for supplying fluid to said mold during said fourth operation and including a valve, and electrically-energizable means for opening said valve and first and second circuits in parallel relation and alternately establishable for continuously energizing both said heating means and said power means during said second, third, and fourth operations.

2. In a control arrangement for an automatic ice maker as defined in claim 1 including a third circuit for energizing said electrically-energizable means for operating said valve during said fourth operation and including a normally-open switch closable by said cam during establishment of one of said first and second circuits.

3. In a control arrangement for an automatic ice maker as defined in claim 1 including a third circuit for energizing said electrically-energizable means for operating said valve during said fourth operation and including a normally-open switch closable by said cam during establishment of one of said first and second circuits.

4. In a control arrangement for an automatic ice maker having successive operations including a first operation for forming ice-pieces in a mold, a second operation for heating the mold for loosening the ice pieces in the mold, a third operation for harvesting ice-pieces in the mold, and a fourth operation for introducing fluid into the mold while heating said mold to prevent freezing of the fluid, and including a mold for receiving fluid; means for freezing the fluid in said mold to provide ice-pieces in said mold during said first operation; electrically-energizable heating means for heating said mold during said second and fourth operations; mechanical means, including a rotatable cam, operative to eject the ice-pieces from the mold, and including a member operable by said cam for applying force to said ice-piece to harvest the ice-pieces from the mold; during said third operation; electrically-energizable power means for rotating said cam to operate said member; thermostatic means responsive to an ice-piece freezing temperature; means for supplying fluid to said mold during said fourth operation and including a valve, and electrically-energizable means for opening said valve; and first and second circuits in parallel relation and alternately establishable for continuously energizing both said heating means and said power means during said second, third, and fourth operations, said first circuit including a normally-open switch closable by said cam during closing of said second switch by said cam.

References Cited by the Examiner

UNITED STATES PATENTS

2,259,066 10/41 Gaston ------------------ 62--115
2,970,453 2/61 Harle ------------------ 62--115
3,028,733 4/62 Mateski ------------------ 62--115

ROBERT A. OLEARY, Primary Examiner.