April 25, 1961 R. W. FINK 2,981,079

ICE BODY MAKERS AND EJECTORS

Filed Sept. 13, 1956 3 Sheets-Sheet 1

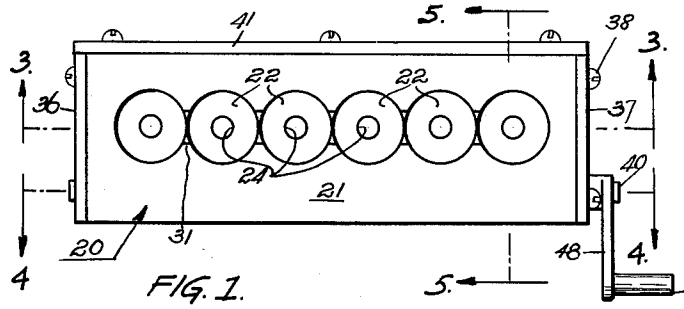


FIG. 1.

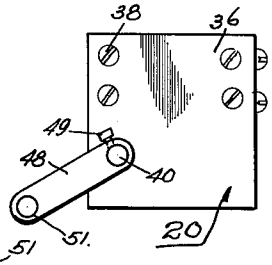


FIG. 2.

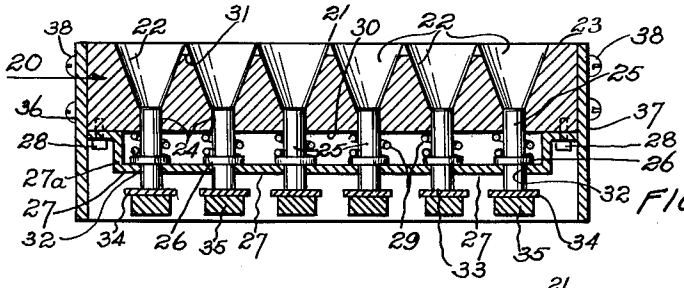


FIG. 3.

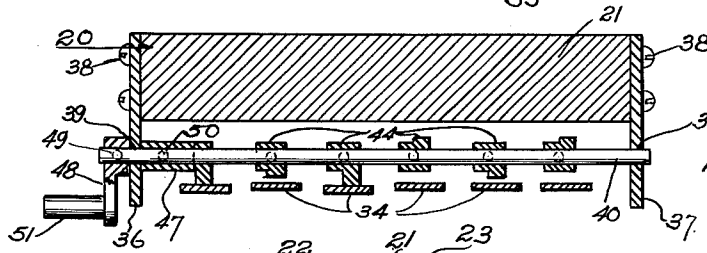


FIG. 4.

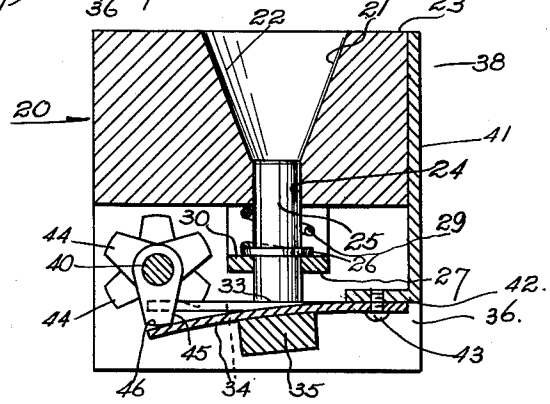


FIG. 5.

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ICE BODY MAKERS AND EJECTORS

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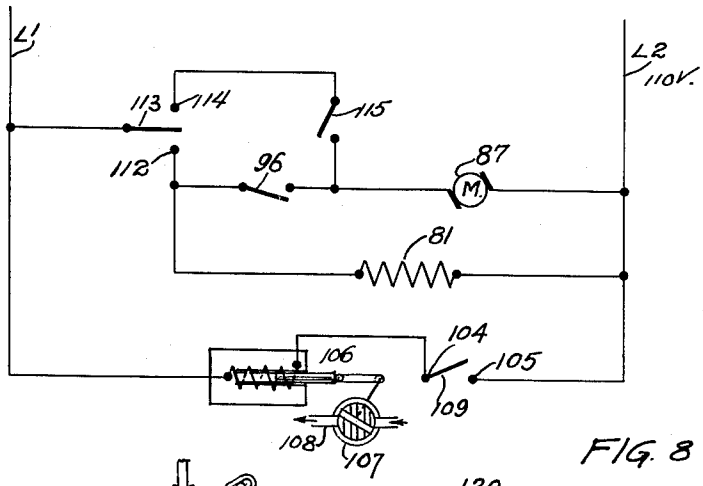


FIG. 8

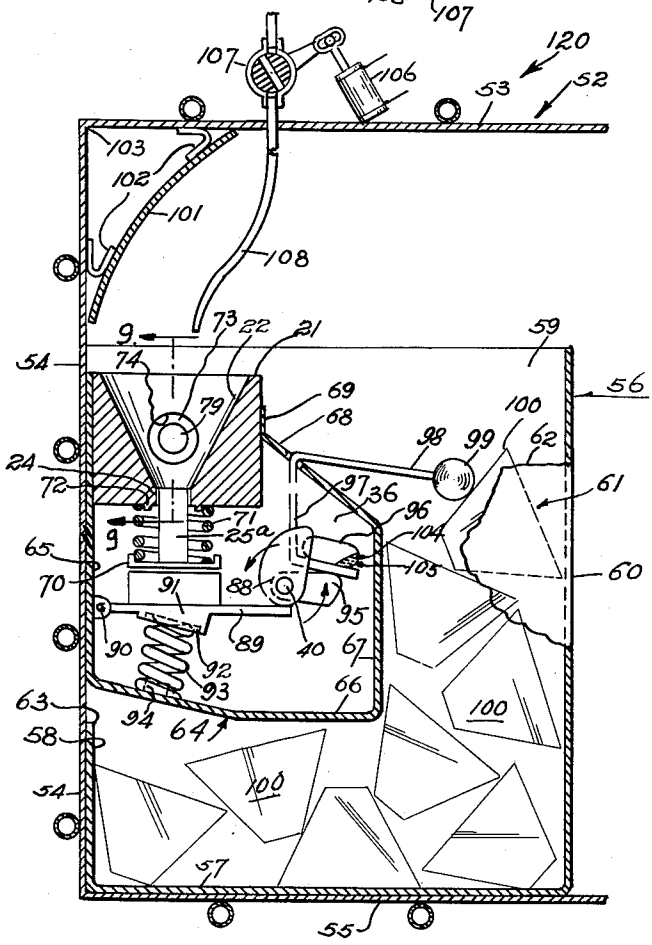


FIG. 6.

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ICE BODY MAKERS AND EJECTORS

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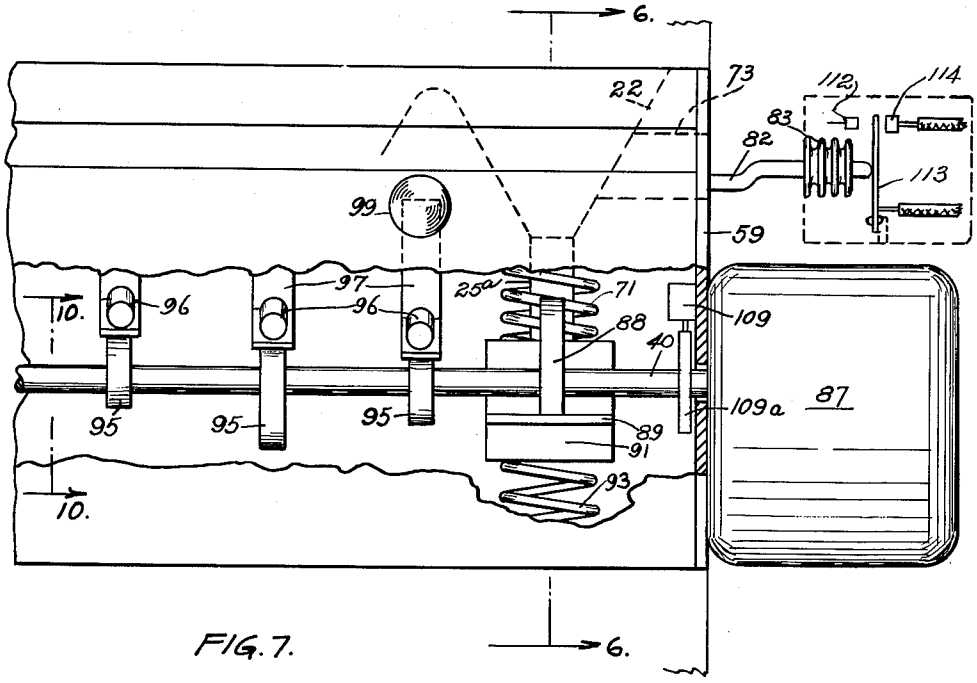


FIG. 7.

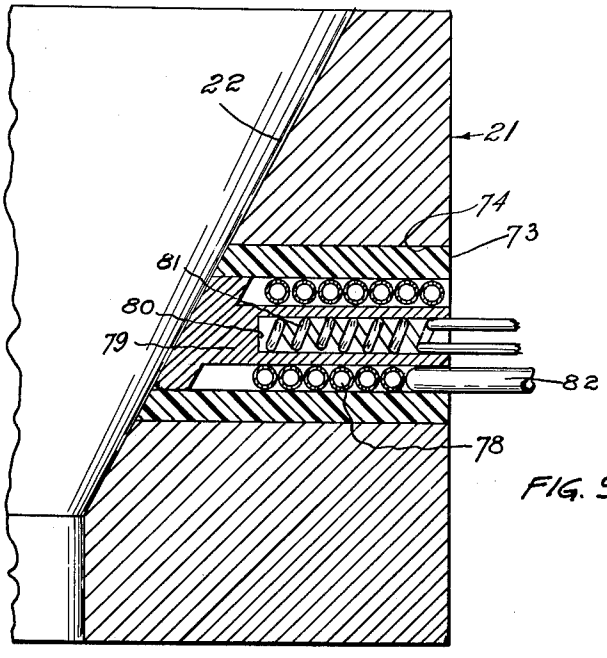


FIG. 9.

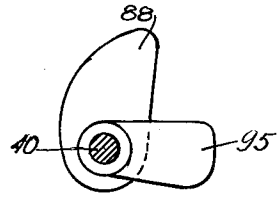


FIG. 10.

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# ICE BODY MAKERS AND EJECTORS

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4 Claims. (Cl. 62—353)

The present invention relates to automatic ice body makers, and is particularly concerned with the provision of automatic mechanism for forming frozen ice bodies and automatically ejecting them into a storage bin.

One of the objects of the invention is the provision of improved apparatus for freezing water in a mold and thereafter ejecting the ice bodies from the mold and delivering them into a storage bin.

Another object of the invention is the provision of a convenient and inexpensive method of making ice for home consumption.

Another object of the invention is the provision of improved forms of molds for freezing water into ice, from which the formed ice bodies of complementary shape may be easily ejected by an ice ejection mechanism provided for each individual mold.

Another object of the invention is the provision of an improved ice making apparatus which is simple, durable, capable of economical manufacture, adapted to be operated automatically, and which includes ice ejector members which are positive in their action, and which result in the removal of the ice substantially without breakage.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which similar charatcers of reference indicate similar parts throughout the several views.

Referring to the three sheets of drawings accompanying this specification,

Fig. 1 is a plan view of an apparatus for making ice bodies embodying the invention, said apparatus being equipped with a manual ejecting mechanism;

Fig. 2 is an end elevational view, taken from the right end of Fig. 1;

Fig. 3 is a fragmentary sectional view, taken substantially along the line 3—3 of Fig. 1;

Fig. 4 is a fragmentary sectional view, taken substantially along the line 4—4 of Fig. 1;

Fig. 5 is a sectional view, taken substantially along the line 5—5 of Fig. 1;

Fig. 6 is a fragmentary sectional view of a modified form of apparatus embodying the invention, taken substantially along the line 6—6 of Fig. 7, said modified form of apparatus including a motor driven mechanism for effecting ice ejection and control of the apparatus;

Fig. 7 is a fragmentary elevational view of the mechanism shown in Fig. 6, with portions thereof broken away;

Fig. 8 is a wiring diagram of the electrical control circuitry thereof;

Fig. 9 is a fragmentary sectional view, taken substantially along the line 9—9 of Fig. 6; and

Fig. 10 is a fragmentary sectional view, taken substantially along the line 10—10 of Fig. 7.

Referring to Figs. 1–5, these views illustrate a simple manual form of ice ejector, in which 20 indicates the assembly, which may include an ice mold 21, comprising a block of highly thermally conductive metal, such as aluminum, of parallelepiped shape and having a multiplicity of frusto-conical cavities 22 opening through its upper face 23 and having an included taper angle of over 45°.



The cavities narrow inwardly and communicate at their inner ends with coaxial cylindrical bores 24. In each bore 24 is slidingly received a cylindrical plunger 25. Each cavity is adapted to form one ice body at a time and is tapered all the way from top to bottom for easy ejection of the ice body formed therein. Each of the plungers 25 is provided with an annular flange 26 for engaging a guide bracket 27, which bracket is spaced from the block 21 by attaching flanges 27*a* and attached thereto by screws 28.

A coil spring 29 extends concentrically around each plunger and is compressed between the bottom face 30 of the block 21 and the annular flange 26, urging the plunger to the position of Fig. 3 wherein the upper end of each plunger is flush with the bottom of the associated cavity 22.

The upper face 23 of block 21 is cut away at 31 between adjacent cavities 22 so that water may flow from the top of one cavity into the next one, filling all cavities in one pouring. The plungers 25 extend through cylindrical bores 32 in the guide bracket 27 and their lower ends 33 engage respectively a plurality of leaf springs 34.

Each leaf spring carries a block of metal 35 serving as a hammer. The block 21 may be provided at its ends with a pair of frame members 36, 37 secured thereto by screw bolts 38. The frame members 36, 37 have aligned through bores 39 in which are journalled the opposite ends of a cam shaft 40. Block 21 may also have a side frame member 41 extending the full length of the block and having an inwardly bent flange 42 which carries the leaf springs 34.

Each leaf spring may be secured by a screw 43 threaded into flange 42. The leaf springs are long enough to extend below the cam shaft 40 to which is fixed a multiplicity of cams 44. The cams extend in different radial directions so that only one cam acts on a leaf spring 34 at a time; and each cam has an abruptly dropping edge 45 comprising its trailing side, and a curved surface 46 on its end.

The cam shaft 40 carries a thrust bearing sleeve 47 and a crank 48 on the opposite sides of the frame member 36 and secured to the shaft by set screws 50 and 49 respectively. The crank 48 is provided iwth a handle 51.

The action of the ejecting mechanism is as follows:

After ice has been formed in the cavities 22, the crank 48 may be given one turn during which the cams 44 will sucessively retract the springs 34 from the plungers 25 to permit the springs 34 to snap back, carrying with them the metal blocks 35 for increasing the momentum and causing a sharp impact on the end of each plunger. The plungers loosen the ice bodies in the respective frusto-conical molds and cause the ice bodies to fly into the air in such manner that they may be directed into a storage bin.

Referring to Figs. 6–10, these are views of a modification in which an ice ejecting equipment 120 is driven by a motor, which may also control certain energizing switches by means of cams.

The mechanism of Figs. 1–5 and of Figs. 6–10 may be placed in any evaporator. In Fig. 6, 52 indicates a freezing evaporator in a household refrigerator, a fragment of which is shown, including the top wall 53, side wall 54, and bottom wall 55.

The mechanism of the ice ejecting apparatus 120 may be enclosed in a sheet metal bin 56 preferably made of highly heat conductive metal, such as aluminum, having a bottom wall 57 and a side wall 58 in heat conducting relation with the evaporator walls 55 and 54 respectively.

The bin 56 further may have a rear end wall 59, a side wall 60, and a front end wall 61, the upper edge 62 of which may be lower than the upper edges of the other walls to make the ice bodies visible and permit the insertion of the hand into the bin.

Bin left wall 58 is cut down to the point 63 to clear an auxiliary housing 64 which carries the ejecting mechanism, so that the bin may be entirely removed by moving it toward the right (as seen in Fig. 6). The auxiliary housing 64 is of aluminum and has a side wall 65, a bottom wall 66, another side wall 67, and a diagonal wall 68 extending upwardly from wall 67 toward wall 65.

The ice mold 21 is secured between the walls 65 and 68 by being attached to the wall 65 and to an attaching flange 69 on wall 68 by welding or other convenient fastening means. The cam shaft 40 is rotatably mounted in the two end walls 59 and 61 corresponding to the end plates 36 and 37 previously described.

The plungers are indicated at 25*a*. Each plunger is provided with a cup shaped spring seat 70 fixedly secured on the end of each plunger for receiving the springs 71.

The mold body has a projecting annular rim 72 about each bore 24 for holding the respective springs concentric with each plunger.

The conical cavities are indicated at 22. One of the cavities may be provided with a plug 73 fixedly mounted in a bore 74 for supporting a thermostat structure shown in Fig. 9. The plug may comprise a plastic sleeve extending from the outside of the mold 21 to be flush with the walls of the cavity 22.

A capillary tube 78, having its end closed, is wrapped around a brass plug 79 in a tight helix to serve as a bulb for a thermostatic control switch. The plug 79 has cylindrical bore 80 within which is located a re-set heater 81 arranged in the form of a helix. The inner surface of the brass plug 79 is flush with the wall of the mold cavity.

As best seen in Fig. 7, capillary tube 78 has its open end brought out at 82 and connected to a bellows 83 for moving a switch arm 113 which closes with a "warm" contact 114 upon increase of temperature. Upon cooling, arm 113 breaks with contact 114 and closes with a "cold" contact 112. The end plate 59 supports an electric motor 87. The electric motor 87 has its drive shaft connected through suitable gearing to the cam shaft 40 which carries the cams 88 that are arranged to actuate the spring hammers one after another.

The spring hammers may comprise pivoted levers 89 (Fig. 6) extended into engagement with the cams 88 and pivoted at 90 on the housing wall 65. A mass on each lever 89 may comprise a block 91 located above an integral spring seat 92 for receiving a coil spring 93 which is held by a lug 94 on the bottom wall 66.

A control cam 95 may be mounted on cam shaft 40 in position to lift and tilt a mercury switch 96 mounted on an angular arm 97 having a generally horizontally extending portion 98 with a ball 99 engaging the ice bodies 100.

One or more series connected mercury switches 96 and control arms 98 with balls 99 may be used. Each mercury switch 96 may be held open by its associated arm when the ball thereon engages pieces of ice located beneath the ball.

The evaporator 52 may be provided with a curved partially cylindrical shield 101 secured by brackets 102 in the upper corner 103 above the cavities 22 so that the ejected ice bodies will be directed over into the right side of the bin 56, as seen in Fig. 6. Every time the cam shaft 40 turns and ejects the ice bodies, the cam 95 also lifts the mercury switch 96, permitting the ice bodies 100 to get under the ball 99.

When the level of the ice bodies in the bin has arrived at a height so that ball 99 is prevented from moving fully downwardly, the mercury switch 96 is maintained tilted in the open circuit position, breaking the circuit at its contacts 104, 105.

The wiring circuit for this device is shown in Fig. 8, in which the symbols L1 and L2 indicate a 110 volt, 60 cycle line. 106 indicates a solenoid for actuating a water valve connected to a water supply, and having a spout 108 for discharging water into the mold cavities.

109 indicates a water valve switch, which is cam actuated by a cam 109*a* on the shaft 40. The solenoid 106 is connected across the leads L1 and L2 in series with the water valve switch 109 which is closed once for each cycle of its associated cam. The re-set heater 81 is connected to the "cold" contact 112, which may be engaged by the thermostat switch arm 113.

The warm contact is connected through an off switch 115 to the motor 87, and the other side of the motor is connected to the lead L2. The "cold" contact 112 is connected through the bin switch 96 to the motor 87.

The operation is as follows:

Assuming that the bin control switch 96 is in its down, or closed, position, the off switch 115 is open from the end of the previous cycle, and the thermostat is in the warm position.

When the water freezes in the cavities 22, the thermostat switches to the "cold" position wherein arm 113 engages contact 112. The motor and reset heater circuits are closed. Thus, the motor runs and drives the cam shaft 40, thereby closing the off switch 115 and then opening the bin switch 96 by raising the control arm. Thus, the motor stops and does not start again until the reset heater causes the thermostat switch to move to the "warm" position wherein arm 113 engages contact 114. The shaft 40 is then further rotated and the ice bodies are ejected, the control arm portion 98 then being lowered and closing the bin switch, and then closing water valve 109, causing water to enter the mold cavity 22. Shortly after, the water valve switch 109 and the off switch 115 are opened by the cams, terminating the cycle.

Thus the mold cavities are automatically filled with water; the water is frozen into conical ice bodies, within the mold cavities; the ice bodies are automatically ejected from the cavities and delivered to a storage bin; and the cycle is repeated until the bin is full, whereupon the ball 99 is held in such position that switch 96 is maintained in the open position.

The purpose of the plastic sleeve between the mold body 21 and bulb 78 is to enable the thermostat bulb to distinguish between the constant low temperature of the mold and the temperature of the water or ice in the mold.

The thermostat bulb 78 is wound around the plug 79 which contains the re-set heater 81 so that the heater may warm the bulb more readily.

The advantages of the above ejecting mechanism are as follows:

(1) The ice maker may be installed as a package unit.

(2) No mold heater is required for ice removal, thus eliminating any melting, and giving dry ice cubes.

(3) A very short freezing time can be realized because of the lack of a mold heater.

(4) The motor may be of a simple type, having no special features, such as overload windings or reversing circuit means.

(5) The mold walls defining the cavities 22 require no special coating, as the taper of the cavities permits easy ejection of the ice bodies.

(6) The device is simple in construction and capable of economical manufacture.

It will thus be observed that the present ice body freezing mechanism and ejector is adapted to make ice bodies in a minimum length of time, to eject them quickly and surely into a bin. The device is simple in construction and may be manufactured very economically.

While I have illustrated certain embodiments of my

invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all the changes within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. Ice molding and ejecting apparatus, comprising: a mold having a plurality of upwardly opening frusto-conical cavities; means for ejecting ice bodies formed in said cavities comprising a plurality of plungers associated one each with said cavities, each plunger being movable through and normally closing the lower, small diameter end of the associated cavity; a plurality of elements associated one each with the respective plungers for delivering an impact force to each plunger causing the plunger to break the ice body free of the wall of the cavity and eject it upwardly through the upper, large diameter end of the cavity; a bin for receiving and storing the ice bodies ejected from said cavities; a plurality of level detecting devices operated seriatim with the operation of each element to detect the level of ice bodies in said bin subsequent to each ejection; and means associated with the detecting device for precluding further operation of the ejecting means when the level of ice bodies in the bin becomes greater than a preselected level.

2. Ice molding and ejecting apparatus, comprising: a mold having an upwardly opening frusto-conical cavity, the included taper angle of which is greater than 45°; means for ejecting an ice body formed in said cavity comprising a plunger movable to apply ejecting force to the lower small diameter end of the cavity; a movable mass adjacent said plunger; distortable means urging said mass toward said plunger; and means for first moving said mass away from said plunger against the urging of the distortable means to storage energy in the distortable means and then operatively releasing said mass to deliver an impact force to the plunger by reason of said stored energy to break the ice body free of the mold and eject it upwardly from the cavity.

3. Ice molding and ejecting apparatus, comprising: a mold having an upwardly opening frusto-conical cavity, the included taper angle of which is greater than 45°; means for ejecting an ice body formed in said cavity comprising a plunger movable to apply ejecting force to the lower small diameter end of the cavity; a movable mass adjacent the plunger; a spring urging said mass toward said plunger; means for storing substantial energy in the spring by urging said mass away from the plunger; and means for releasing said mass to permit the potential energy stored in the spring to be converted into a high inertia impact on the plunger causing the plunger to first break the ice body free of the wall of the cavity and then eject it upwardly through the upper, larger diameter end of the cavity.

4. In an automatic ice maker having a motor for operating mechanism for ejecting ice bodies from a mold cavity, means for controlling the motor comprising: a first thermostatic switch means having a movable contact connected to a power supply lead, a first fixed contact engaged by the movable contact when the temperature of the cavity is above a preselected value, and a second fixed contact engaged by the movable contact when the temperature of the cavity is below a preselected value; a second switch connected in series between said first fixed contact and one side of the motor, a third switch connected in series between said second fixed contact and said one side of the motor; means connecting the other side of the motor to an opposite power supply lead; means for opening said second switch as a result of an operation of the motor resulting from said first switch movable contact engaging said first fixed contact and said second switch being closed; means for opening said third switch as a result of an operation of the motor resulting from said first switch movable contact engaging said second fixed contact and said third switch being closed; and a heater connected between said second fixed contact and the opposite power supply lead in heat transfer association with the thermostatic switch means for causing the movable contact to engage said first fixed contact subsequent to its engagement with the second contact.

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