

May 26, 1959

W. M. THOMAS

2,887,852

ICE MAKER

Filed Sept. 14, 1956

3 Sheets-Sheet 1

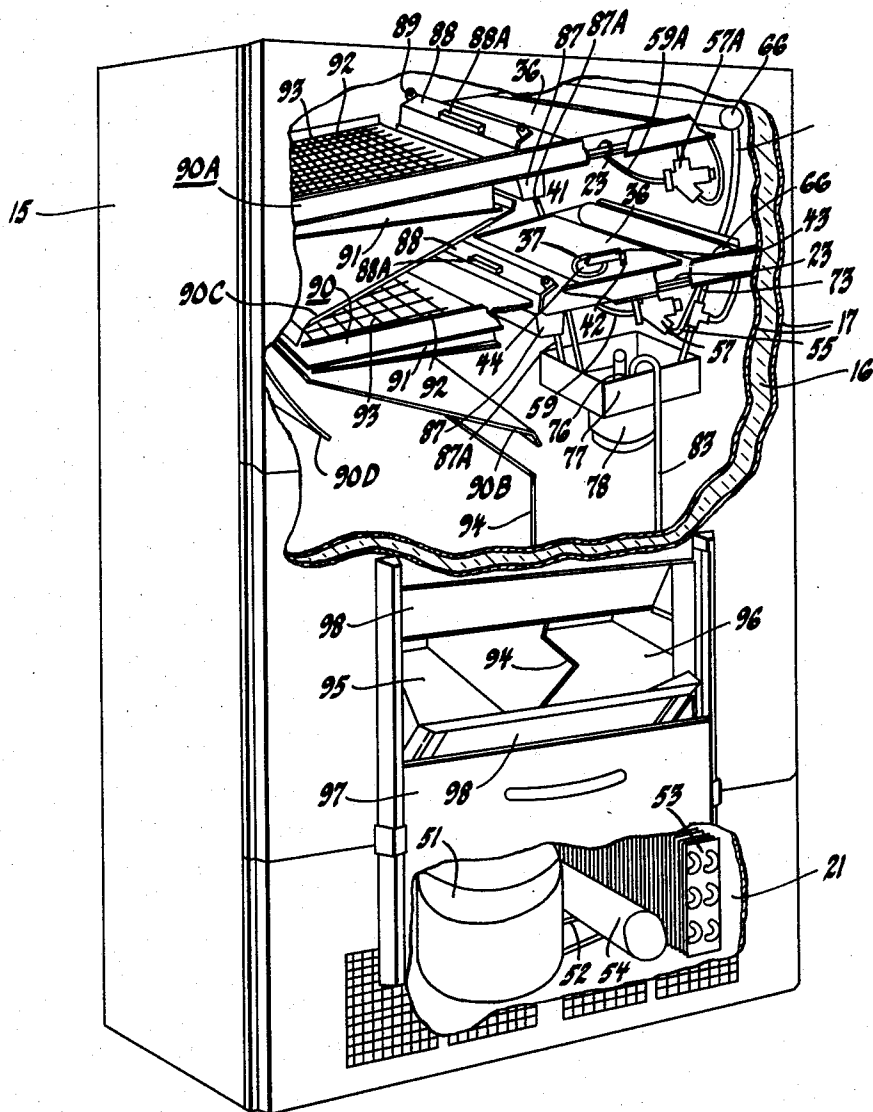


Fig. 1

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3 Sheets-Sheet 2

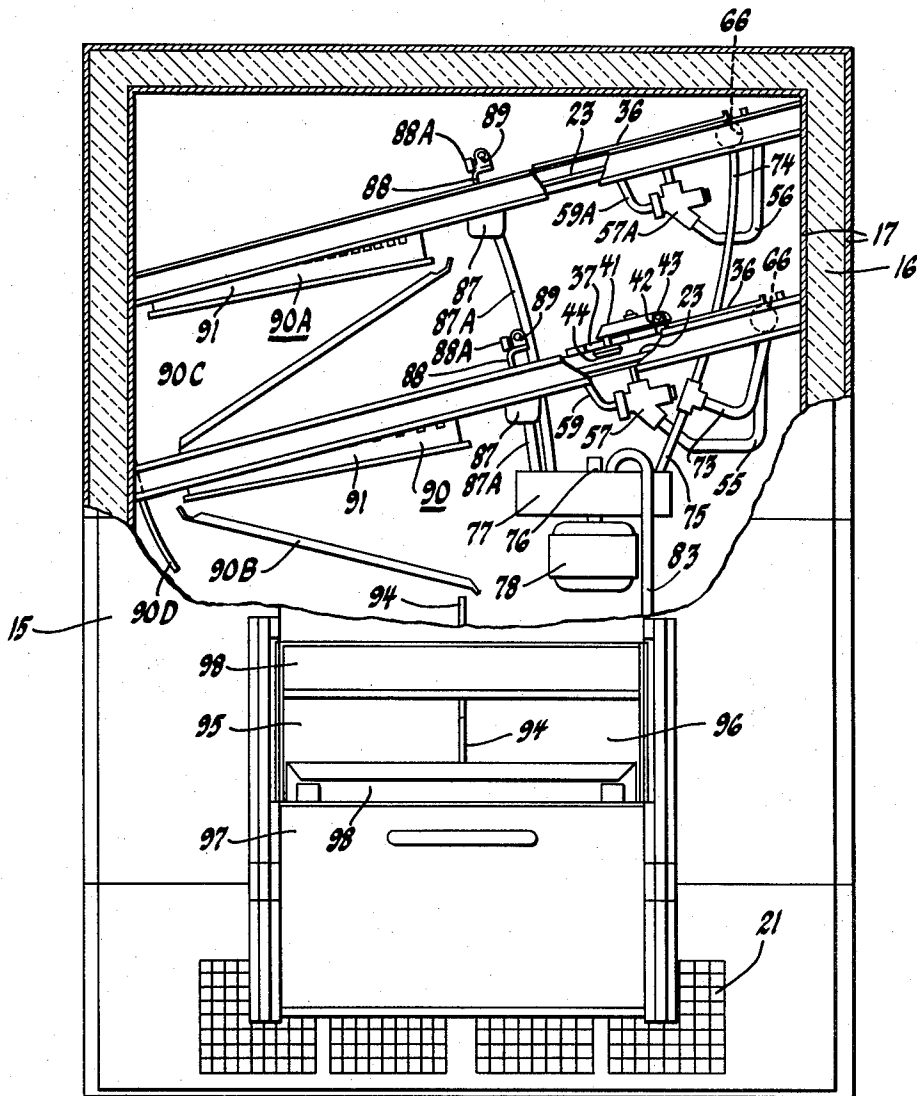


Fig. 2

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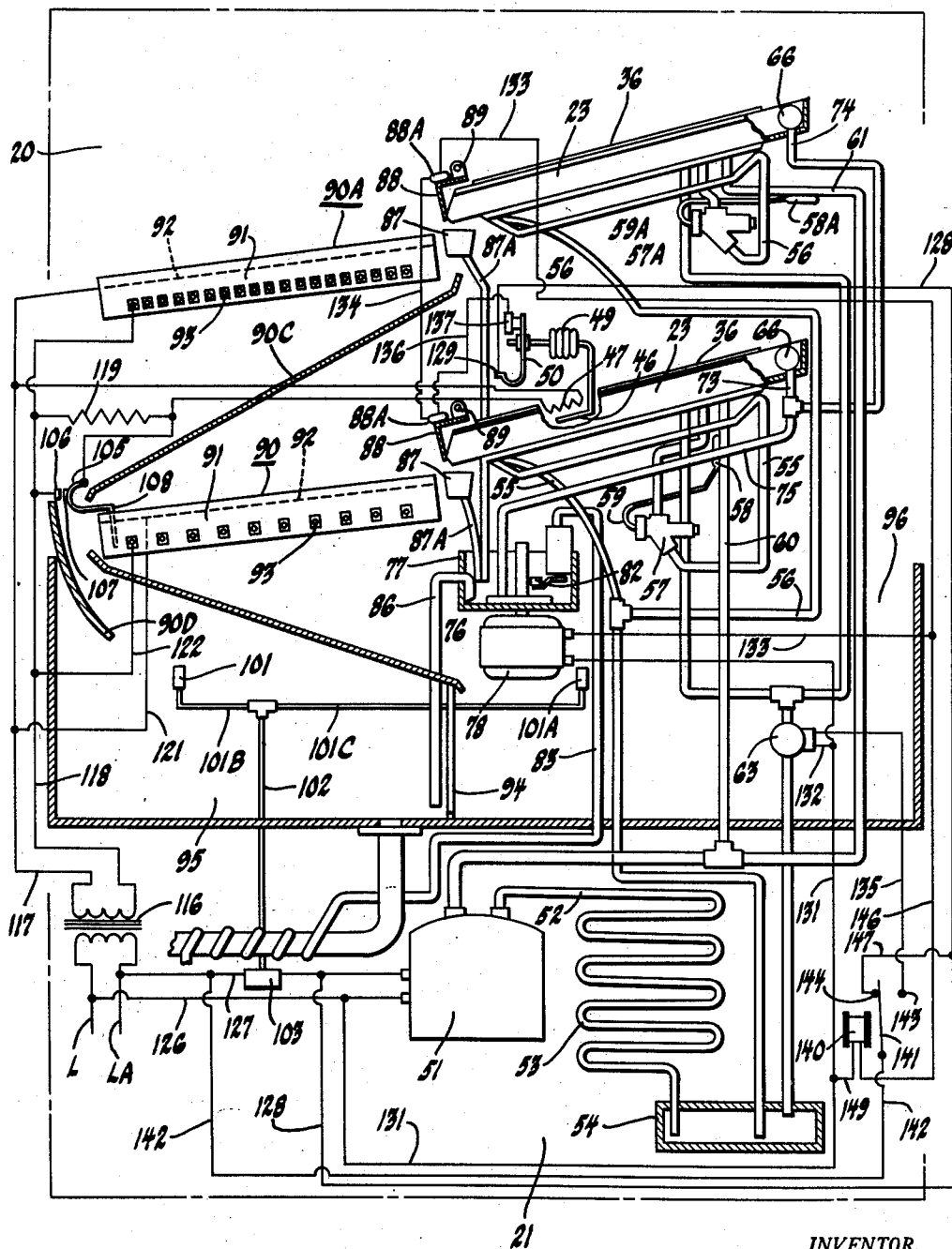


Fig. 3

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ICE MAKER

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Application September 14, 1956, Serial No. 610,021

2 Claims. (Cl. 62—135)

This invention relates to refrigeration and particularly to an apparatus for making ice blocks for table use in cooling drinks in glasses.

The present disclosure is an improvement over the ice making apparatus and ice maker shown in the patents to Marshall W. Baker, No. 2,784,563, dated March 12, 1957, and Joseph R. Pichler, No. 2,806,357, dated September 17, 1957, respectively, both of which patents are assigned to the assignee of this application. While the apparatus disclosed in the patents referred to have met with commercial success there are at times malfunctions in their operation which causes undesirable results, inefficient operation and user complaints. Under certain conditions during the use of these ice making machines a slab of ice is formed on the freezing plate of undesired or insufficient thickness which creates trouble and results in unsatisfactory operation, the production of slush ice and/or ice blocks of non-uniform size. For example if the ice block storage bin thermostat switch opens to stop operation of the continuously operated ice making machine when a slab of ice is of a thickness less than that desired or less than a predetermined thickness is formed or is being formed on the freezing plate and the switch subsequently closes to again start operation of the machine this less than the desired thickness of ice layer may be partially thawed and/or a portion only of it may be slid off the plate. Thus when the refrigerating system is placed in operation the partially thawed ice layer is refrozen on the plate and more ice thickness is added to the slab at various points throughout the area thereof resulting in an uneven thickness of the ice slab and consequently the production of ice blocks which are not of the desired size.

An object of my invention is to provide an improved, fully automatic, self contained ice block making and storage apparatus for producing clear solid ice blocks to be placed in glasses containing drinks to be chilled.

Another object of my invention is to provide a new and improved means for controlling the operation of an ice making machine which renders the machine substantially invulnerable to malfunctions in its use and at all times insures the production of ice blocks of predetermined size.

A further object of my invention is to provide an ice making apparatus with means whereby a slab of ice slid part way only off a freezing plate thereof prevents operation of the refrigerating system associated with the apparatus to produce a refrigerating effect until the slab is melted away or slid entirely off the plate and also stops flow of water over the freezing plate of the apparatus to conserve water.

A still further object of my invention is to provide an ice block making apparatus wherein a means responsive to a predetermined accumulation of ice pieces in a storage bin cannot stop operation of the apparatus at a time when water is being frozen on a freezing plate thereof and is effective only after a slab of ice of pre-

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determined thickness has been frozen on the plate and released or slid therefrom.

In carrying out the foregoing objects it is a more specific object of my invention to provide an ice block making machine which normally functions continuously under the control of an ice thickness responsive switch and has its continuous operation interrupted only by a means actuated in response to a predetermined accumulation of ice blocks stored in the machine with means which will cause the machine to complete at least one refrigeration cycle if the ice block storage bin means attempts to interrupt operation of the machine at a time when the freezing member thereof is in demand of refrigeration.

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 form of the present invention is clearly shown.

In the drawings:

Figure 1 is a perspective view of an ice block maker cabinet having portions thereof broken away to show the location and arrangement of various elements within the cabinet;

Figure 2 is an enlarged front view of the ice maker cabinet shown in Figure 1 partly in section and partly in elevation; and

Figure 3 is a diagrammatic view of various elements of the ice block maker and showing my improved electrical circuit therefore.

The present invention relates specifically to an improvement over the two ice block making apparatuses illustrated and fully described in the patents above identified. Reference to these patents is made for a clearer understanding of the ice block making apparatus herein more or less concisely shown and described. Certain features over those shown in the patents are herein disclosed and exemplified in order to accomplish the objects of the present invention in a particular type ice block maker.

Referring to the drawings I show, in Figure 1 thereof, an ice making apparatus of the type capable of producing small blocks of ice for table use including a cabinet 15 comprising a plurality of walls 17 having any suitable or conventional insulating material 16 therein forming an insulated chamber 20 within the cabinet. Chamber 20 is disposed over a non-insulated machine compartment 21 provided in the lower portion of cabinet 15. A plurality of separate unitary freezing members 23 are stationarily mounted, preferably at an angle, in the upper portion of chamber 20. The apparatuses in the patents above referred to create problems which are by the present disclosure overcome to render an ice block maker practical, efficient and devoid of malfunctions. The inclined freezing plate members 23 are disposed in spaced apart relationship one above the other and are refrigerant evaporators forming a part of a closed refrigerating system, to be hereinafter described, associated with cabinet 15. Both members 23 have flat upper surfaces and each is formed by superimposing a flat metal plate upon an embossed metal plate and brazing the plates together in a manner now well known to those skilled in the sheet metal evaporator art. The embossations in the one plate of each member 23 form refrigerant evaporating or expansion passages (not shown) within the members as disclosed in the patents referred to. A metal cover 36 is spaced from the flat upper surface of the lowermost member 23 and is provided with an opening 37 which receives a part of a thermostatic control means. This thermostatic control means comprises an adjustable arm 41 having its one end pivotally mounted to bracket 42, welded upon cover 36, by a pin 43. The other end of arm 41 carries a feeler receptacle 44 (see Figure 2) containing a coiled tube 46 and a coiled electric heat element 47 disposed thereabove

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(see Figure 3). Heating element 47 is a one-half to five watt capacity electric heater. The feeler receptacle 44 is preferably made adjustable in any suitable manner relative to the flat upper surface of the lowermost freezing member 23 so as to vary the thickness of a slab of ice formed on the top surface of this member and, consequently, on the top surface of the other or uppermost of the members 23. Tube 46 has its end at the coiled portion thereof sealed and has its other end connected to an expansible and contractable element 49 located in a suitable or conventional electric snap switch 50 (see Figure 3). The construction and arrangement of control or switch 50 with respect to the lower freezing member 23 is clearly shown and more fully described in the patent to M. W. Baker hereinbefore referred to. A volatile fluid is sealed in tube 46 and element 49 so as to render switch 50 thermally responsive. The coiled heating element 47 has wire connections, to be hereinafter described, with a low voltage electric circuit. As before stated, the two vertically spaced apart freezing members or plates 23 form refrigerant evaporating portions of a closed refrigerating system and each has a plurality of conduit connections with a refrigerant translating device of the refrigerating system mounted in the machine compartment 21 and comprising a motor-compressor unit 51 (see Figure 3) connected, by a conduit 52, with a condenser 53 which may be cooled in any suitable or conventional manner. Condenser 53 is connected to a receiver 54 and conduits 55 and 56 connect this receiver in parallel circuit relation with the refrigerant evaporating passages within the two freezing plate members 23. Thermostatic expansion valves 57 and 57A are interposed in conduits 55 and 56 respectively and each has a thermal bulb 58 and 58A connected thereto by a tube 59 and 59A respectively for operating the valves 57 and 57A as is conventional in the art. Bulbs 58 and 58A are secured to the parallelly connected gaseous refrigerant return conduits 60 and 61, leading to unit 51, and are thermally responsive to the temperature of these conduits. The outlets of the separate plate evaporators 23 are connected by the conduits 60 and 61 and a main or common conduit to the intake side of the compressor of the motor-compressor unit 51. A conduit 62 extends from the top of receiver 54 and is connected to a solenoid operated valve 63 having branch pipes connecting the same directly to the refrigerant expansion passages in the two plate evaporator members 23. Valve 63 normally closes conduit 62 to prevent its communication with the refrigerant passage in members 23 during a refrigerating cycle of operation of the refrigerating system.

Means is provided for flowing a film of water across or over each of the spaced apart freezing plate evaporators 23 from a main or supply pipe containing water under pressure. This means comprises manifolds in the form of headers 66 one of which is located at the upper end of each inclined member 23 and provided with small holes or orifices for distributing water over or across the freezing plate members 23. Headers 66 have supply conduits 73 and 74 connected thereto and these conduits connect with a common pipe 75 which communicates with a centrifugal water pump 76 located in the bottom of a water sump or reservoir forming receptacle 77. A motor 78 located below receptacle 77 is employed to operate the water pump 76. A valve 81, actuated by a float 82, controls the flow of water through a water main or supply pipe 83, containing water under pressure, into the sump or reservoir 77. Receptacle or reservoir 77 is also provided with a siphon pipe 86 which periodically draws water out of the receptacle 77 to aid the apparatus in producing clear ice blocks. A trough 87 is located below the lower end of each of the members 23 and these troughs each have a pipe 87A connected thereto and extending into the receptacle 77. The troughs 87 receive excess water directed across the plate members 23 and convey this water into the sump or reservoir receptacle. A baffle

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88 is located at the lower end of each member 23 to direct water flowing therefrom into the trough 87 and for preventing excessive water splash. These baffles 88 are each hingedly mounted so as to be swingably moved out of the path of slabs of ice released and sliding from the members 23. For example the baffles 88 are herein disclosed as being provided with upstanding ears at their ends each having a pin or stud 89 passing therethrough and secured to the front and back walls of the cabinet respectively. A suitable mercury switch 88A, forming a part of the present invention, is mounted in any desirable or conventional manner on each of the pivotal baffles 88 so as to be swung or tilted therewith and these switches 88A are connected in the electric circuit of the ice making apparatus in a manner and for a purpose to be hereinafter described. Each switch 88A may be a tubular-like glass member having liquid mercury and electrical contacts sealed therein.

In the upper left hand portion of chamber 20 there is mounted two inclined ice cutters, grids or dissectors 90 and 90A. The dissectors 90 and 90A are disposed in spaced apart relationship one above the other at the lower side of the freezing plate members 23 and each is adapted to receive a slab of ice from the plate freezer member with which it is associated. Each dissector 90 and 90A comprises a frame 91 having sets of spaced apart wires 92 and 93 extending thereacross in opposite directions to one another. The lower portion of insulated chamber 20 forms storage means for ice blocks and this storage means has a partition 94 therein dividing same into separate side by side ice block storage compartments or bins 95 and 96. The ice block storage means, bins or compartments are normally closed by an insulated vertically slidable door structure 97 and inner tiltable guards or retainers 98 (see Figures 1 and 2) arranged as desired and which may be opened or tilted angularly automatically in response to sliding door 97 into open position to afford access to ice blocks in the storage means. The bins 95 and 96 are adapted to receive ice blocks severed by the dissectors 90 and 90A in a manner to be hereinafter described. A drain pipe 99 leads from the bottom of the ice block storage means to convey water, entering same from the siphon 86 associated with receptacle 77 and water resulting from melting ice in the storage means, out of the cabinet.

The ice slab cutting or severing wires 92 and 93 of the uppermost dissector 90A of the dissectors are spaced apart a shorter distance than these wires of the lowermost dissector 90. This closer spacing of the wires of the dissector 90A relative to the spacing of wires of the other dissector 90 causes dissector 90A to sever ice blocks from a slab of ice received thereon of a different or smaller size than ice blocks severed by the two dissectors 90 and 90A into the storage means within chamber 20, cooled by the freezing plate 23, at two spaced apart points or at two sides thereof regardless of whether or not the ice blocks are of different size. Such will scatter or spread out the heap of ice blocks and increase the ice block storage capacity of the storage means. Obviously if the two dissectors 90 and 90A are to sever batches of ice blocks of different size these batches of different sized ice blocks should be kept separate from one another and stored in segregated fashion in the bins 95 and 96 for harvesting therefrom. I stationarily mount a baffle 90A at an angle within chamber 20 beneath dissector 90 and this baffle 90A receives the larger batches of ice blocks severed by dissector 90 and directs them laterally thereof, over the top of partition 94, and into the one side of the storage means or into bin 96. I also stationarily mount a second baffle 90C within chamber 20 intermediate the dissectors 90 and 90A and incline same in a direction opposite the angled mounting of baffle 90B. Baffle 90C receives the smaller batches of ice blocks severed by dissector 90A and directs these smaller blocks laterally thereof over and to the oppo-

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site side of dissector 90 into the other side of the storage means or into bin 95. I further provide a deflector 90D at the one side of chamber 20 opposite and slightly below dissector 90 which directs the smaller batches of ice blocks falling from baffle 90C to a central part of bin 95. In this manner either ice blocks of the same size produced by the apparatus may be distributed or discharged into two sides of the storage means or batches of ice blocks of different size simultaneously produced by the apparatus can be kept separated and discharged into the ice block storage bins 95 and 96. I provide each bin 95 and 96 with a thermal bulb 101 and 101A respectively which are connected by tubes 101B and 101C to one end of a conduit 102. The other end of conduit 102 is connected or sealed to an expansible and contractable bellows mounted in a bin thermostatic electric switch 103 of any desired or conventional construction. The bulbs 101 and 101A, tubes 101B and 101C and the bellows in switch 103 are charged with a volatile fluid and then sealed to form a temperature responsive unit for actuating switch 103. The bulbs 101 and 101A may be placed at any desired height within chamber 20 to maintain a predetermined supply of ice blocks in the compartments or bins 95 and 96. When, however, ice blocks accumulate in either one of the storage bins up to or above the bulb therein to contact same the bulb responds to the temperature of the ice and will, after certain conditions, as shall be explained in the description of operation of the apparatus, have been fulfilled, cause switch 103 to shut down or render the refrigerating system inoperative to produce ice on the freezing plate members 23. The apparatus further includes a switch 105 having contacts 106 and 107 one of which is mounted on a movable arm 108, associated with the lower side of ice cutter or dissector 90. Arm 108 is disposed in the path of and is adapted to be struck or engaged and moved by a cake or slab of ice released from or slid off the lowermost of the freezing plate members 23 and slidable therefrom onto cutter 90 for a purpose to be hereinafter described.

Electrical circuit

The one hundred and fifteen volt power mains indicated at L and LA (see Figure 3) lead to a low voltage, say, for example, an eleven volt, transformer 116. A wire 117 leads from transformer 116 to the heater 47 of thermostatic control switch 50. A wire 118 leads from transformer 116 to contact 106 of switch 105. When contacts 106 and 107 are closed wire 118 leads to the other side of heater 47 of switch 50. A resistance jumper wire 119 bypasses switch 105 in wire 118 and continuously energizes heater 47 with approximately one-half watt current. This is an auxiliary feature and provides the feeler receptacle 44, of the ice thickness thermostat, with a small amount of heat to at all times insure that the interior thereof will remain dry. A branch wire 121 leads from wire 117 to wires 92 of the lower ice cutter or dissector 90 and a branch wire 122 leads from wire 118 to wires 93 of this lower dissector, which are connected in series with wires 92, to continuously energize the dissector or ice severing grid 90. A branch wire 123 leads from wire 117 to wires 92 of the upper ice cutter or dissector 90A and a branch wire 124 leads from wire 118 to wires 93 of this upper dissector, which are also connected in series with wires 92 thereof, to continuously energize the dissector 90A. The wires and connections just described complete the low voltage circuit incorporated in the ice block maker. The one hundred and fifteen volt circuit includes a wire 126 branched from power main L and leading directly into the motor-compressor unit 51. Another wire 127 branches from power main LA and leads into the bin switch 103. The wire 127 extends from switch 103 to the electric motor of the motor-compressor unit 51 to cause continuous operation of this unit which may be interrupted at times by

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actuation of switch 103 in response to a predetermined accumulation of ice blocks within the storage means or bins 95 and 96. A branch wire 128 leads from wire 127, between switch 103 and unit 51, and is connected to a movable arm 129 of the ice thickness thermostat control switch 50. Another branch wire 131 leads from wire 126, and is connected to a wire 132 which enters one side of a solenoid in valve 63. Wire 132 extends beyond valve 63 to the water pump motor 78. A wire 133 extends from pump motor 78 and is connected to one terminal of the upper mercury switch 88A. The other terminal of upper mercury switch 88A is connected, by a wire 134, with one of the terminals of the lower mercury switch 88A. A wire 136 connects the other terminal of the lowermost mercury switch 88A with a contact 137 of switch 50. A branch wire 135 leads from wire 133 through a coil 140 of a conventional relay switch and by way of wires 149, 131 and 126 back to the power main L. The contact on arm 129 of switch 50 is adapted to alternately engage and disengage or move away from the contact 137 in response to temperature conditions in the feeler receptacle 44 associated with the lowermost freezing member 23. The improvement disclosed in the present application includes the provision in the electric circuit of the ice making apparatus of an electromechanical device such as the relay switch just mentioned which functions for purposes to hereinafter be disclosed. This relay includes a switch having a movable or pivoted arm 141 with a wire connection 142 thereto and leading back to the power main LA, through live wire 127, in advance of bin thermostatic switch 103. The relay switch also includes two stationary contacts 143 and 144. Contact 143 is connected, by wire 146, to the side of the solenoid of valve 63 opposite the wire side 132 thereof. Contact 144 on the relay is connected by a wire 147 to the wire 128 which leads back to that portion of wire 127 intermediate bin switch 103 and the motor-compressor unit 51. As before stated coil 140 of the relay switch has the wire connection 149 to wire 131, which leads to power main L through live wire 126, and the other connection 135 to wire 133. Thus the two mercury switches 88A and the electromechanical relay connected in the apparatus as described constitutes the essence of the present invention and function as means to overcome objections in the operation of former ice block making machines.

Operation

Assume that the ice block maker is properly connected to a source of water supply, to a drain and its electric circuit, including the mains L and LA, is now energized by plugging an extension cord, leading from the cabinet, into an electric outlet and that the ice thickness thermostat switch 50 is closed. Electric current flows from the mains L and LA through wire 127 and closed bin switch 103 and through wire 126 to the motor-compressor unit 51 to cause operation thereof. Simultaneously therewith electric current flows from transformer 116 through wires 117 and 118 and branch wires 121, 122, 123 and 124 to continuously energize both of the ice cutters or dissectors 90 and 90A by directing thirty to thirty-five watts of current into the resistance wires 92 and 93 of each to heat these wires. A small amount of current, one-half watt, flows through by-pass restrictor 119, to the heating element 47 in the ice thickness feeler member or receptacle 44. At this time electric current also flows through wire 128, arm 129, of the ice thickness thermostat switch 50, contact 137 then through wires 136, 134 and switches 88A to wire 133 to the water pump motor 78. The circuit is completed back to the power main L from motor 78 through wires 131 and 126. Also at this time electric current simultaneously flows through wires 135, 149, 131 and wire 126 to main L to energize coil 140 of the relay switch to hold its arm 141 in engagement with contact 144. Coil 140 of the relay switch is

thus connected in parallel circuit relation with the water pump motor 78. Water fills receptacle 77 to a predetermined level under control of float valve 81. Solenoid valve 63 is closed while motor 78 operates. The pump 76 lifts water, from receptacle 77, by way of the superimposed freezing plate members 23. Water is distributed in the form of a film simultaneously upon each freezing plate surface of members 23 by the outlet openings in the manifolds or headers 66. The compressor of unit 51 withdraws refrigerant vapor from the expansion passages in the plate portion of both members 23, to cause chilling of these plates, compresses the same and forwards the compressed refrigerant to condenser 53 wherein it is cooled and liquefied in any suitable manner, such as by forced circulation of air over the condenser. Refrigerant liquefied in condenser 53 flows into receiver 54 where it is further cooled and collected. Liquid refrigerant enters the conduits 55 and 56 and flows to the expansion valves 57 and 57A. This liquid refrigerant is directed into the passages of both plate members 23, by the expansion valves, where it evaporates, in removing heat from the plates, and the evaporated or gaseous refrigerant is returned through conduits 60 and 61, to the compressor unit 51. The refrigerating effect produced by members 23 causes water from the film thereof flowing across or over the plates to freeze and accumulate thereon in the form of thin cakes or slabs of ice. When the thickness of the cake or slab of ice on at least the lowermost of the freezing plates 23 reaches the feeler receptacle 44 its temperature overcomes the small amount of heat imparted to heating element 47, by resistor 119, and cools the coiled portion of tube 46. The temperature of tube 46 is lowered to the desired point, in accordance with a predetermined thickness of accumulated ice on lower member 23, and element 49 of switch 50 will contract and cause movement of switch arm 129 away from contact 137. When arm 129 disengages contact 137, of switch 50, the circuit to the water pump motor 78 is opened and the pump stops operating. Switch 50 serves as a means for simultaneously stopping the flow of water over or across both freezing plates 23 while the motor compressor continues to operate. The opening of thermostatic switch 50 also breaks the electric circuit through wires 133, 135 and coil 140 back to power main LA through wires 149 and 131. This deenergizes coil 140 of the electromechanical relay switch and the arm 141 thereof is shifted, preferably by its own weight or by a spring, in a direction laterally away from coil 140 and contact 144 into engagement with the contact 143 of the relay switch. Engagement of arm 141 with contact 143 now causes electric current to flow through wire 142, arm 141, contact 143, wire 146 to the solenoid valve 63 and from the valve back to power main L by way of wires 132 and 131. Energization of the solenoid in valve 63 opens this valve and hot gaseous refrigerant is circulated from the receiver 54 and condenser 53, through conduit 62, valve 63 and the branch conduits leading therefrom directly into the passages in both of the freezing plates 23 and thence back to the compressor unit 51 which continues to operate at this time. Thus switch 50 also serves as the means rendering the refrigerating means ineffective and for initiating heating of the plates by rendering the heating means, hot gas lines 62, effective. Heat of the gaseous refrigerant flowing through the passages in plate members 53 thaws and substantially simultaneously breaks the bond between both plate members and the slab of ice previously formed thereon. The foregoing is a normal full refrigerating and defrosting operation of the ice making apparatus. The slabs of ice released from the lower and upper plates 23 are adapted to slide therefrom onto the inclined ice dissectors 90 and 90A respectively associated therewith. The sliding slabs of ice engage and move the baffles 88 about their pivotal mounting 89 out of the path of movement of the ice. The mercury switches will be operated by the swinging

of baffles 88 but since the circuit in which they are connected is broken at this time their operation is ineffective to now produce any result. As the slabs of ice slide off the freezing plates 23 onto the dissectors 90 and 90A the one or lower slab strikes the movable arm 108 of switch 105 and causes the contact 107, carried on arm 108, to engage contact 106. Closing of contacts 106 and 107 causes the flow of about five watts of electric current, around resistor 119, through wires 117 and 118 to the heating element 47 of the ice thickness thermostat. Heat generated by the electrical heating element 47 rapidly warms the coiled portion of tube 46 to thereby cause expansion of element 49 of switch 50. This reduces to a minimum the interval of time between the removal of slabs of ice from both members 23 and a subsequent ice slab freezing cycle since arm 129 of switch 50 will be quickly moved to engage contact 137 after the slabs of ice leave the members 23. Return movement of arm 129 into engagement with contact 137 of switch 50 again completes the electric circuit to coil 140 of the relay switch and this coil causes the arm 141 thereof to be drawn back, away from contact 143, into engagement with contact 144. This deenergizes the solenoid valve 63 to cause it to close and the engagement of arm 129 with the ice thickness switch contact 137 again energizes the water circulating pump motor 78. Heat of the sets of wires 92 and 93 in each dissector 90 and 90A cuts or severs the slabs of ice received therein into a plurality of ice blocks. Ice blocks severed by the lowermost dissector 90 fall upon baffle 90B and are directed laterally thereof, over partition 94, to the one side of the ice block storage means or into bin 96. Ice blocks severed by the uppermost dissector 90A fall upon baffle 90C, located between the dissectors, and are directed laterally across the top of dissector 90 into the other side of the ice block storage means or into compartment or bin 95. In the case of the dissectors 90 and 90A severing different size ice blocks these different blocks are prevented from becoming mixed together and are stored in segregated fashion in the separate bins 95 and 96. The freezing cycles and the ice releasing cycles continue uninterrupted alternately until such time as one of the ice block storage bins becomes substantially filled with ice blocks.

A two-fold advantage is derived by providing the apparatus with the mercury switches 88A and the electromechanical relay switch and permit the carrying out of the objects of the present invention. As before mentioned the primary purpose of the relay switch is to insure that slabs of ice, regardless of whether or not they are to be severed into small and large ice blocks of substantially cubelet and cube form respectively and segregated into batches of same, formed on the freezing plates will at all times throughout operativeness of the apparatus be of the desired and uniform thickness. In order to accomplish this primary purpose the electromechanical switch is arranged in the electric circuit so that it can at certain times take control of the apparatus away from the bin thermostat switch 103 and place the apparatus under its own control. Thus if the ice block storage bin switch 103 should open, in response to a sufficient supply or accumulation of ice blocks in the bin, at a time when water is being frozen on the freezing plates or the thickness of slabs of ice thereon is only a portion of that of a predetermined thickness of a slab of ice to be formed the relay switch takes over control of the apparatus to cause the refrigerating system thereof to continue to produce refrigeration and complete a refrigerating cycle to make the predetermined thickness ice slabs. For example should a bin thermostat open switch 103, in an attempt to interrupt flow of electric current to unit 51 when the ice thickness switch 50 is closed, in response to the lower freezing plate 23 demanding refrigeration, coil 140 of the relay is energized and holds arm 141 in engagement with contact 144. Electric current now flows from power

main L through wires 126 and 131, to the water pump motor 78 and through switch 50, wires 136, 134 and mercury switches 88A. This current continues to flow through wires 133, 128, 147 and relay switch arm 141 back to power main LA by way of wire 142. In other words the bin thermostat switch 103 is shorted out of the circuit and electric current is by-passed around same to cause the motor-compressor to continue to operate on a refrigerating cycle. The relay switch prevents energization of the solenoid valve 63 and no defrost cycle can occur until after the ice slabs on the plates 23 have been built up to the desired predetermined thickness. If at the time this refrigerating cycle is completed and there is no demand for ice blocks in the storage bins 95 and 96 the bin thermostat switch 103 remains open to deenergize portions of the high voltage electric circuit whereby arm 141 of the relay shifts from contact 144 into engagement with contact 143 to complete a circuit to valve 63 for holding it open until the bin thermostat switch again closes, in response to a diminishing accumulation of ice blocks in the bins 95 and 96, whereafter said portions of the circuit are reenergized to render the motor-compressor unit operative. Thus the relay switch prevents malfunction in the operation of the present ice maker apparatus and insures the production of at least two more batches of ice blocks of a desired size even after the bin thermostat switch 103 attempts to render the apparatus inoperative. The electromechanical relay switch also provides another advantage in the present ice block making apparatus particularly when used in conjunction with the mercury switches 88A in the electric circuit. If a slab of ice should, at any time the apparatus is operative, fail to slide all the way off a freezing plate 23 and become caught thereon or in the upper part of the cabinet its partial movement relative to a plate 23 will tilt or swing a baffle 88 about its pivotal mounting 89 and such tilting will cause the mercury switch 88A associated with the tilted baffle to open. Opening of a switch 88A interrupts the flow of electric current through wires 128, and 136, to wire 134, and consequently through wires 133, 135 and 131 whereupon coil 140 of the relay switch is deenergized. Arm 141 of the relay switch then moves away from contact 144 into engagement with contact 143 to complete a circuit from power main LA through wires 142, 135, solenoid valve 63, and wire 131 back to the power main L to thus open valve 63. The circulation of water is stopped, by opening of switch 88A, because motor 78 is idled since no electric current can now flow from power main L, through wires 126, 131, 147, 133 and to the other power main LA, but motor-compressor unit 51 continues to operate at this time and directs hot refrigerant through the plates 23 whereby their temperature is increased and the slab of ice caught on a plate or in the upper part of the cabinet, beneath a baffle 88, is warmed and thawed. As the caught slab of ice melts away the baffle 88 will swing back to its normal position, about the pivot 89, to again close mercury switch 88A carried thereon. Ice thickness thermostat switch 50 is closed at this time, due to warming of plates 23, and thus reclosing of the opened mercury switch 88A will reestablish flow of electric current through coil 140 of the relay switch by way of wires 133, 135, 131 and 128. Flow of current through wire 146 to solenoid valve 63 is now interrupted to terminate this safety or precautionary defrosting cycle and to return the apparatus to its regular ice producing refrigerating and defrosting cycles.

From the foregoing it should be apparent that I have provided improvements in an ice maker which in addition

to rendering same fully automatic under substantially all conditions also increases the efficiency thereof and prevents delivery of slush ice or malformed ice pieces to its ice block storage bin. By my invention I control an ice block making apparatus in an improved fashion so that at least one complete refrigerating cycle is carried through even though a bin thermostat attempts to interrupt continuous operation of the apparatus. By preventing the bin thermostat from rendering the ice making apparatus inoperative after a layer of ice has begun to be formed on a freezing plate I insure the delivery only of ice blocks or pieces of the desired size to the storage bin of the apparatus. By providing means whereby the compressor and water pump is stopped and the apparatus is caused to produce a defrosting cycle to melt away a slab of ice which may become caught or hung up therein I, in addition to eliminating waste of water, also prevent another malfunction in the operation of the apparatus. While I have disclosed my improvement in conjunction with an ice block making machine wherein two freezing plates are employed it is to be understood that the improvements are applicable to machines employing a single or more than two freezing plates.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. An ice making apparatus for cyclically freezing water into ice and releasing the ice comprising in combination, a freezing plate, means for circulating a film of water across said plate, means for refrigerating said plate to freeze water circulated thereacross into a layer of ice thereon, means for heating said plate to loosen the layer of ice therefrom thereby it gravitationally slides off the plate in the form of a slab, a thermal element associated with said freezing plate and adapted to be directly contacted by the thickness of a layer of ice formed thereon, a switch operable by said element controlling said apparatus for initiating alternate ice freezing and ice releasing cycles thereof of normal duration, means actuated in response to a predetermined position of movement of a loosened ice slab with respect to said plate and caught thereon against sliding off same for rendering said switch ineffective to initiate a freezing cycle of said apparatus and for maintaining said heating means effective over an abnormal period of time relative to an ice releasing cycle of said normal duration to melt the caught ice slab from said position, and the melting of said caught slab of ice thereafter rendering said switch effective to control said apparatus throughout cycles of said normal duration.

2. The combination defined by claim 1 wherein the water circulating means is stopped simultaneously with the rendering of the switch ineffective.

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2,575,509	Bayston	Nov. 20, 1951
2,593,874	Grandia	Apr. 22, 1952
2,595,588	Lee	May 6, 1952
2,672,016	Muffy	Mar. 16, 1954
2,682,155	Ayres	June 29, 1954
2,693,680	Lee	Nov. 9, 1954
2,717,498	Shagaloff	Sept. 13, 1955
2,723,534	Wilbushewich	Nov. 15, 1955
2,741,096	Fitzner	Apr. 10, 1956
2,786,335	Cary	Mar. 26, 1957