March 31, 1970

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ET AL

3,503,222

BIN ACTUATED STOP MOTION FOR ICE MAKING MACHINES

Filed Oct. 16, 1968

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ABSTRACT OF THE DISCLOSURE

A mechanism for controlling the level of ice discharged downwardly from an ice maker into a bin at the expiration of a predetermined time interval beginning with but longer than the ice harvesting phase. At the beginning of the harvesting phase, a felter engages the discharge emerging ice and to the rising ice level in the bin actuates a timer to start the time interval. If ice continues in contact with the feeler beyond the expiration of the time interval, the timer will cause a control switch to open and thereby interrupt or stop operation of the ice maker. If ice ceases contact with the feeler during the time interval, the timer will automatically reset itself for the succeeding harvesting phase thus permitting the ice maker control switch to remain closed.

The invention relates to control means for automatic reversible cycle ice making apparatus of the type disclosed in Patent No. 3,146,610 and in our copending application filed Sept. 11, 1968, entitled Cylindrical Heat Exchange Mechanisms for Ice Making Evaporators, and more particularly to a delayed bin actuated stop motion operable in timed relation to the ice harvesting phase of the cycle.

In conventional types of automatic ice making apparatus, water flows over a vertically disposed refrigerated surface of an evaporator during the freezing phase of the cycle and, upon accumulation of a certain ice thickness upon the surface, the harvesting phase begins during which the water flow ceases and the temperature of the iced surface is raised to release the ice therefrom into a chute and then into a bin therebelow. Various types of conventional control mechanisms have been employed for the purpose of interrupting or stopping the apparatus when the ice in the bin rises to a particular level. Such control mechanisms have not been entirely satisfactory in combination with the above-described types of ice makers because the operation thereof neglects factors other than but equally as important as the bin level.

It is therefore an object of this invention to provide a stop motion which, when combined with reversible cycle automatic ice making machines, will obviate the above-mentioned drawbacks.

It is another object of this invention to provide a stop motion for automatic reversible cycle ice making machines wherein a timed delay means is operable for a predetermined time interval beginning with but exceeding the duration of the ice harvesting phase, said delay means being operable to interrupt or stop the machine upon expiration of the interval if a certain ice level exists in the bin.

It is another object of this invention to provide a stop motion for ice making machines wherein a feeler is employed to detect the ice level rising from the bin into a chute thereabove, in combination with ice overflow means in the chute and disposed laterally adjacent the feeler to thereby prevent contamination and accumulation of ice above the feeler during the harvesting phase.

It is yet another object of this invention to provide an improved stop motion for reversible cycle ice making machines, which stop motion is insensitive to temperatures, simple in construction, efficient in operation and which lends itself to easy diagnosis of certain operational defects and failures.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds when taken in connection with the accompanying drawings, in which:

FIGURE 1 is a front elevational view of a part of the stop motion according to the invention in association with portions of an ice making evaporator and ice bin, and a chute for conveying the Ice from the evaporator to the bin, and

FIGURE 2 is a view looking at the right-hand side of FIGURE 1 and further showing in schematic form a time delay stopping means operatively associated with a conventional ice making refrigeration system.

Referring more particularly to the drawings, the numeral 10 denotes broadly a conventional reversible cycle refrigeration system as schematically illustrated in FIGURE 2. This system may comprise compressor 11, condenser 12, heat exchanger 13, surge tank 14, and an evaporator 15, said evaporator being connected to parts 11 through 14 in a manner more fully described in the aforementioned patent and copending patent application.

Parts 11 through 14 are connected as follows: High pressure discharge line 17 connects motor-driven compressor 11 to line 18; line 18 connects valve 19 to the upper portion of condenser 12; line 20 connects the lower portion of the condenser to the lower portion of heat exchanger 13; line 21 connects the upper portion of the heat exchanger to expansion valve 22; line 23 connects evaporator outlet 24 to surge tank 14; and line 25 extends downwardly from the surge tank through heat exchanger, and to the suction side of the compressor. A suitable coolant (usually water) from pipe 26 enters condenser coil 12a and leaves the coil through pipe 27.

During the ice freezing phase of the cycle, valve 19 is closed to cause the compressed hot gas refrigerant to flow from compressor 11, through lines 17 and 18 and associated condenser 12 where heat is extracted by the coolant flowing through coil 12a. From condenser 12, the refrigerant continues through heat exchanger 13, line 21, expansion valve 22, line 29, evaporator refrigerant chamber 30, line 23, surge tank 14, suction line 25 and back to compressor 11.

Concurrently with the flow of refrigerant as described above during the freezing phase, water is caused to trickle downwardly over evaporator surfaces 15a and 15b where a portion of the water is frozen and the remaining unfrozen portion continues downwardly through chute 33, grid 33a and into sump 35. Thus, layers of ice are formed upon surfaces 15a and 15b during the freezing phase, after which the harvesting phase begins.

The harvesting phase continues for a time interval sufficiently long to permit the ice on surfaces 15a and 15b to be released and to fall into the chute 33 and bin 36 therebelow, said phase being measured in a predetermined manner. During the harvesting phase, valve 19 is open to permit the hot gasified refrigerant to flow from compressor 11, through lines 17 and 18, valve 19, line 29, evaporator chamber 30, line 23, surge tank 14, line 25 and back to compressor 11 to thereby thaw the bond between the ice and evaporator surfaces 15a and 15b. Thereafter, the ice falls into chute 33, upon toothed breaker cylinder 34, and into the ice bin 36.

The stop motion hereinafter described is responsive to conditions which prevent the feeler mechanism 38 from returning to normal position prior to the expiration of a selected time interval beginning with but longer than the above-mentioned time interval associated with the harvesting phase. The most frequently occurring condition which actuates the stop motion is the result of a predetermined high ice level in bin 36 and chute 33. Upon occurrence of such conditions after the selected time interval expires, the
stop motion will effect stoppage of the ice making machine. Briefly stated, the stop motion is composed of an ice forming and removing mechanism or clock 39, a clock controlling switch assembly 40 responsive to the feeler mechanism, and a clock controlled switch assembly 41 for interrupting or stopping the compressor 11 upon occurrence of certain conditions.

More specifically, feeler mechanism 38 comprises a vane 43 fixedly secured upon shaft 44 and oscillatable therewith from a fixed line position transversely of the chute 33 to dotted line position substantially parallel to the chute. A counterweight 45 attached to shaft 44 normally biases vane 43 toward the bold line transverse position. The feeler mechanism, when in the dotted line position, permits actuation of a suitable switch assembly 40 through a connecting linkage consisting arm 46 cantilevered from shaft 44, and a vertically disposed rod 47 resting upon the free end of arm 46. An arm or lever 50 fixed upon shaft 51 has its free end normally resting upon the upper end of rod 47, said rod being mounted for reciprocation in sleeve 48 attached to chute 33. It will be noted that the downward movement of rod 47 limited by a collar 49 fixedly secured upon the rod and engageable with the upper end of the sleeve. Vertical reciprocation of rod 47 oscillates lever 50, shaft 51 and the switch assembly 40 on the shaft.

Assembly 40 comprises a mercury switch as shown, or a suitable equivalent type, designated by reference character 54, said switch being adapted to connect and disconnect conduits 55 and 56 which are included in a circuit for supplying current to synchronous motor 57 of the time delay mechanism 39. In the bolt line position of switch 54, the last-named circuit is opened and in the dotted line position the circuit is closed. During the ice harvesting phase, the falling ice rotates vane or feeler 43 from bold line position to dotted line position thereby permitting rod 47 to fall until collar 49 limits its downward movement, and further permitting switch 54 to rotate to closed dotted line position to energize motor 57.

The time delay assembly is conventional per se and, therefore, it is illustrated schematically to disclose the broad principle involved. It will be evident to those skilled in this art that numerous variations or mechanical equivalents of timer mechanisms are currently available for the specific purpose of automatically measuring a selected time interval and for resetting itself to the starting position.

Motor 57 is electrically connected to shaft 51 upon which disc 58 is fixedly mounted, said disc having peripheral notches 58a therein. A radially disposed arm 60 has one end thereof rotatably mounted upon shaft 59 and its intermediate portion selectively engageable at 60a with notches 58a to thereby set the arm in a position corresponding to the expiration of the time interval measured. As shown in FIGURE 2, the point 60a on arm 60 engages a notch 58a opposite the numeral “1” on the disk dial face, this position indicating the beginning of the selected time interval. As the disk rotates in a counterclockwise direction, the outermost end of arm 60 will rotate therewith until the dots 60c on arm 60 is in line with the number 65, at which time the normally closed switch 41 will be opened, that is, rotated from bold line to dotted line position.

Switch 41 comprises an actuating arm 41a, a pivot 41c, a feeler mechanism 38, a time delay mechanism 39, and an oppositely extending contact arm 40. Current supplying conduits 62 and 63 are part of conventional circuitry (not shown) for automatically controlling the operation of the reverse cycle ice making apparatus, the conduit 62 being connected to one side of the motor of compressor 11 and the conduit 63 to the other side as described below.

The circuitry controlled by switch assembly 40 to intermittently operate the synchronous motor 57 of time delay assembly comprises conduit 64 connecting motor 57 to supply conduit 62; conduit 56 connecting the other side of switch 54 to motor 57; and conduit 64 connecting motor 57 to the other supply conduit 63.

The circuitry whereby the operation of compressor 11 is controlled by timer arm 60 and switch assembly 41 comprises conduit 66 which connects one side of the switch contact arm 41b as at 41d to the motor of compressor 11; the current supply conduit 62 connected to the other side of the compressor motor; and conduits 64, 67 connecting the other side of contact arm 41b as at 41c to supply conduit 63.

As stated in detail above, the feeler vane 43 will be depressed to the open dotted line position by the falling ice during the harvesting phase thereby permitting the normally open switch 54 to assume the dotted line closed position whereupon the time motor 57 will be energized to cause shaft 59 and arm 60 to begin rotation in a counterclockwise manner. Should the chute 33 and bin 36 become filled to approximately the level indicated at 36a before the end of the harvesting phase, and if this level is maintained until the expiration of the longer selected time interval when arm 60 contacts switch arm 41a, the vane 43 will remain in dotted line position, the switch 54 will remain closed, and the control switch contact arm 41b will become disengaged from contact 41d to open the circuit controlling the operation of compressor 11.

When the ice is removed from feeler obstructing position, as by emptying the bin 36, the feeler or vane 43 will return to bold line position causing the ice maker to re-start.

During the harvesting phase, and in the absence of filled or substantially filled bin, the total accumulation of ice upon surfaces 15a and 15b during a freezing phase falls into the bin without rising to the level 36a; and unless other conditions exist to prevent operation of the stop motion, the feeler or vane will resume its normal bold line position concurrently with the return of switch 54 and arm 60 to their respective bold line positions to begin a freezing phase.

During the harvesting phase, and especially when the ice level is sufficiently high in the chute 33 to rise above vane 43, the accumulated ice above the vane would clog and congeal within the chute unless some means of escape is provided. Such an ice accumulation would be difficult to remove and, moreover, would prevent normal operation of the feeler mechanism 38 of which vane 43 is a part. Accordingly, an opening 69 is provided in chute 33, said opening being preferably located slightly above and laterally adjacent the feeler mechanism so that the above-mentioned excess accumulation and congealing of ice in the chute will be prevented.

In the drawings and specification a preferred embodiment of the invention has been disclosed, and although specific terms are employed these are used in a generic sense and not for purposes of limitation, the scope of invention being defined in the following claims:

We claim:

1. In combination with a reverse cycle refrigeration system having an ice bin, means for producing ice during one phase of the cycle, and means for discharging the ice downwardly from said producing means into said bin during the succeeding cycle whereby the accumulating ice level in the bin will rise upwardly along the ice discharging path, a stop motion comprising time delay means operable for a predetermined time interval beginning with and exceeding the duration of said succeeding phase, movable means for detecting the presence of ice along said path, and means operable upon detection of ice by said movable means to inject time delay means for a predetermined time interval for interrupting the operation of said system.

2. The combination as defined in claim 1 and further comprising means operable upon the absence of ice detection by said movable means during that portion of the time interval in excess of the succeeding phase for terminating said time interval.

3. The combination as defined in claim 1 wherein said interrupting means includes an electrical circuit for said system, a switch in said circuit, and time delay means responsive to said detecting means.
4. The combination as defined in claim 2 wherein said interrupting means includes an electrical circuit for said system, a switch in said circuit, and time delay means responsive to said detecting means.

5. The combination as defined in claim 3 wherein said time delay means includes a second electrical circuit, a second switch and a motor in said second circuit, and means driven by said motor for opening said first switch upon expiration of said predetermined time interval.

6. The combination as defined in claim 1 and further comprising an elongated chute enclosing said downward ice path and having the lower end thereof terminating adjacent the upper portion of said bin, and wherein said detecting means is movable transversely of said chute, said chute having an opening therein disposed laterally adjacent said detecting means to thereby permit said discharging ice to escape from the chute when said level rises above said detecting means.

7. The combination as defined in claim 2 and further comprising a vertically disposed elongated chute enclosing said downward ice path, and wherein said detecting means is mounted in said chute, said chute having an opening therein disposed laterally adjacent said detecting means to thereby permit said discharging ice to escape through when said level rises above said detecting means.

8. The combination as defined in claim 3 and further comprising a vertically disposed chute enclosing said downward path, wherein said detecting means is mounted in said chute, said chute having an opening therein disposed laterally adjacent said detecting means to thereby permit escape of said discharging ice when said level rises above said detecting means.

9. The combination as defined in claim 4 and further comprising an elongated chute enclosing at least a portion of said downward ice path, and wherein said detecting means is mounted in said chute, said chute having an opening therein disposed laterally adjacent said detecting means to thereby permit escape of said discharging ice when said level rises above said detecting means.

10. The combination as defined in claim 5 and further comprising an elongated chute enclosing at least a portion of said ice path, and wherein said detecting means is mounted in said chute, said chute having an opening therein above said detecting means for the escape of discharging ice accumulated above the level of said detecting means.

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U.S. Cl. X.R.

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