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ELECTRIC CONTROL CIRCUIT FOR AN AUGER TYPE ICE MAKER

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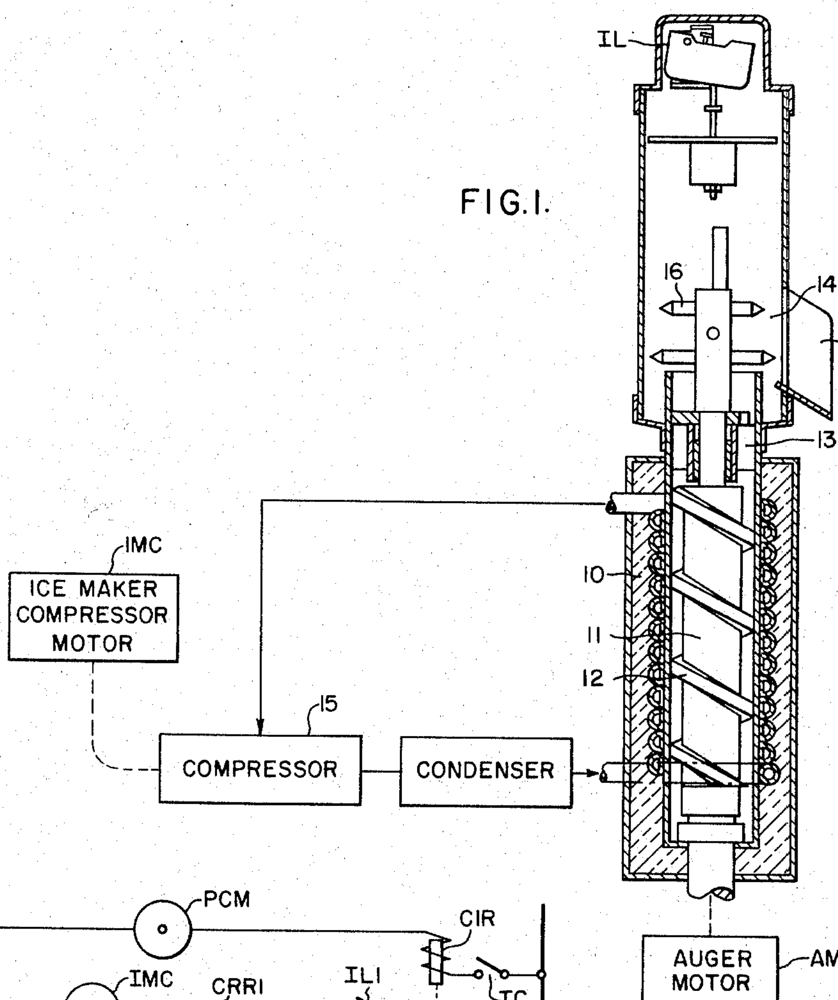

FIG. 1.

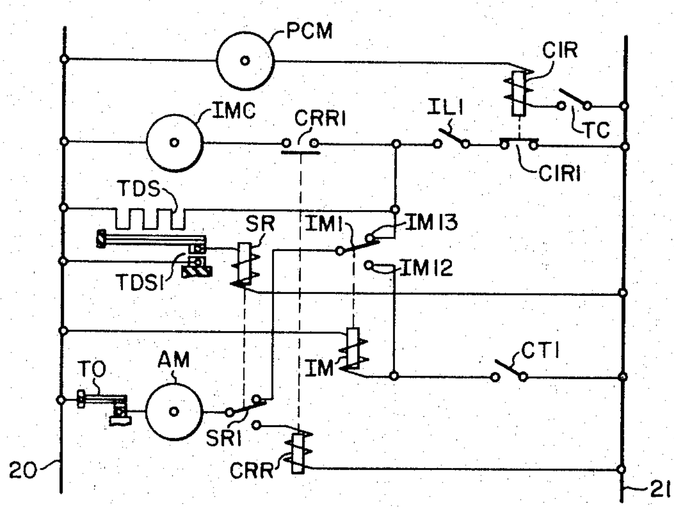

FIG. 2.

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ELECTRIC CONTROL CIRCUIT FOR AN AUGER TYPE ICE MAKER

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ABSTRACT OF THE DISCLOSURE

This invention relates to an electric control system for an auger type ice maker.

A slow operate and slow release switch is connected in circuit with the compressor motor for the refrigeration system of an auger ice maker to prevent energization of the compressor motor until after the auger motor is energized at the beginning of an ice making cycle and to maintain the energization of the auger motor until after deenergization of the compressor motor at the end of the cycle.

Cross references to related applications

So far as is known, this invention is not related to any pending patent applications.

Background of the invention

Auger type ice makers are well known and are used almost without exception to provide ice particles to be dispensed with a cold drink in the cup type of cold drink vending machine. Such vending machines usually comprise a refrigerated cabinet in which the various drink ingredients are contained and the ice making machine including its own refrigeration system which is separate from the cabinet or product refrigeration system is also contained within the vending cabinet. Under these conditions of operation, difficulties have been experienced due to the accidental and unintentional freezing of the ice making auger causing a so-called rotating freeze when the normal slush ice within the auger chamber freezes solid to stop ice production. The conventional auger type ice makers to which this invention relates, have separate electric motors to rotate the ice maker auger and to rotate the compressor of the ice maker refrigeration system and such motors are cyclically operated since a storage hopper is provided to store the ice particles until they are dispensed. It is conventional to energize the auger motor each time a portion of ice is dispensed but the compressor motor for the ice maker refrigeration system is not energized until the level of stored ice decreases a certain amount. However, when the compressor motor for the ice maker refrigeration system is energized, it is also required that the auger motor be energized in order to prevent an accumulation of solid ice in the auger mechanism. As mentioned previously the refrigerated cabinet also has a refrigeration system which may be termed a product refrigeration system and its compressor may also be running at the same time that an ice making cycle is commenced so that the excessive load of electrical current that occurs when all three motors may be started substantially simultaneously might reduce the voltage across the auger motor to such an amount that it would fail to rotate properly. Such a failure for the auger motor to rotate adds to the possibilities of undesirable auger freeze-up. Thus, there are many occasions when, with conventional control circuits, the simultaneous start-up of the auger motor and the ice-maker compressor motor at the beginning of an ice making cycle would be disadvantageous. Additionally, to prevent the accumulation of excessive ice in the ice maker auger chamber, it has been found that the ice maker auger motor should continue to be operated for a period of time after the compressor motor for the refrigeration system of the ice maker has ceased to operate. Thus, the accumulation of ice within the ice maker auger chamber is prevented and the possibility of a so-called rotating freeze-up where a solid block of ice within the ice maker chamber that rotates continuously with the auger is prevented.

Prior art

Reference may be made to the following United States patents that disclose auger type ice makers and electrical control circuits therefor and these patents are classifiable in Class 62, Refrigeration, subclasses 71 and 320.

3,196,624—Reynolds—issued July 27, 1965
2,877,632—Chaplik—issued Mar. 17, 1959

Neither of the above patents disclose a control circuit for an auger type ice maker that delays the energization of the compressor motor until after the auger motor is energized to thus minimize current load and that also maintains the energization of the auger motor a predetermined time after the deenergization of the compressor motor to thereby clear the auger chamber of ice.

Summary

In order to prevent excessive current load at the beginning of an ice making cycle for an auger type ice maker, the electric control circuit of the invention is arranged to prevent the simultaneous start of both the refrigerant compressor motor and auger motor of the ice maker. However, to minimize the possibilities of freeze-up or other difficulties, the control circuit of the invention provides for a delay of about ten to thirty seconds before the compressor motor is started after the auger motor has been started and a particular feature of the invention is that the arrangement prevents the operation of the compressor motor at all times unless the auger motor is energized and running so that if during an ice making cycle, the auger motor should stop for any reason without flow of electric current therethrough such as would be obtained under thermal overload conditions, the compressor motor would stop and undesired build up of ice in the auger chamber would be prevented. Another very important feature of the invention is the circuit arrangement whereby at the end of an ice making cycle, the operation of the auger motor is maintained for about sixty seconds after the compressor motor has stopped operating, thus clearing the auger chamber of ice and further minimizing the possibilities of freeze-up. In accordance with the invention a single time delay switch having slow operate and slow release characteristics is effective to delay the start of the compressor motor until after the auger motor has started at the beginning of an ice making cycle and to also delay the deenergization of the auger motor for a predetermined period of time after the compressor motor has been deenergized at the end of an ice making cycle.

Brief description of the drawings

FIGURE 1 is a combined sectional view of an ice maker auger and storage chamber together with a block diagram of the refrigerant system therefor; and

FIG. 2 is an electrical circuit diagram of the invention.

Description of the preferred embodiment

Referring to the drawing the ice maker is shown to comprise a refrigerated auger chamber **10** containing a rotatable auger scraper **11** that is rotated by the auger motor AM. The rotatable auger **11** is provided with an upwardly inclined spiral scraping vane **12** which when the auger **11** is rotated scrapes slush ice that may be formed on the interior sidewalls of the auger chamber 10 and moves such slush ice upwardly through the extrusion head openings 13 into the ice storage hopper 14. An ice level switch IL at the top of the ice storage hopper 14 controls the operation of the refrigerant system for the ice maker so that when the ice hopper 14 is full of particles of ice to be dispensed the switch IL is operated to open the circuit to the ice maker compressor motor IMC and stop the running of the ice maker refrigerant system compressor 15. Thus, when the refrigerant system compressor 15 is not running the refrigerant that is cooling the interior walls of the ice maker auger chamber 10 increases in temperature and no further ice is formed within the auger chamber to be scraped by the auger 11 upwardly into the storage hopper 14.

A number of stirring rods such as shown at 16 are provided in the interior of the ice storage hopper 14 and these are connected to the shaft of the auger 11 in a manner to be rotated each time the auger 11 is rotated. Thus, whenever a quantity of ice is to be dispensed through the side opening 17 of the ice storage compartment 14, a circuit to the auger motor AM is completed to cause the auger 11 to rotate together with the stirrer 16 to move ice particles through the discharge opening 17 of the storage hopper 14. However, until the level of ice within the storage chamber 14 falls below a predetermined height, the ice level switch IL remains in the open circuit position so that the compressor motor IMC is not energized each time the auger motor AM is energized during an ice delivery cycle.

The electrical control circuit of the invention will now be described in particular reference to FIG. 2 of the drawing. Lines 20 and 21 are the conductors of a conventional alternating current circuit. For purposes of describing the electric control circuit of the invention it will be first assumed that the ice storage hopper 14 is full of ice particles and that the ice level switch contacts ILI are therefore open as shown. It will also be assumed that the refrigeration system for the vending machine cabinet is not operating and that its product compressor motor PCM is not energized since the thermostat control contacts TC for the vending machine cabinet are open as indicative of the desired low temperature of the interior of the vending machine cabinet. It will now be assumed that a customer desires a cold drink with ice that is to be dispensed from the storage chamber 14, upon the requisite deposit of coinage the cycle timer contact CT1 will close to energize the ice maker solenoid IM, switching contact arm IM1 to the lower contact IM12 and completing a circuit for the auger motor AM through operated cycle switch contacts CT1, operated contacts IM1, normal contacts SR1 and the thermal overload switch TO. Thus, the auger motor AM is energized at the beginning of an ice delivery cycle upon the closure of the cycle switch contacts CT1. At the end of the delivery cycle for the cold drink, the cycle contact CT1 again opens restoring the ice maker solenoid IM to the deenergized state switching arm IM1 back to the normal position shown in engagement with contact IM13. Thus, the previously established circuit to the auger motor AM is opened and the auger motor stops at the end of the ice delivery cycle. Of course if at any time during the ice making delivery cycle the thermal overload switch TO should open, the flow of current through the auger motor AM would be interrupted and it is of course understood that only conditions of motor failure or conditions of jamming in the auger chamber would cause the thermal overload switch TO to open.

The circuit arrangement thus far described above is conventional and reference will now be made to the novel features of the control circuit of the invention which are concerned primarily with the arrangements for controlling the auger motor and the ice maker compressor motor during an ice making cycle. An ice making cycle is initiated upon closure of the ice level switch contacts IL1 when the level of ice stored in the hopper 14 falls below the predetermined desired level. The closure of the ice level switch contacts IL1 completes a circuit through the normal switch position IM1 and the normal switch position SR1 to the auger motor AM to cause the auger motor to start to operate. However, the circuit to the ice maker compressor motor IMC is not at that time completed since the contacts CRR1 are open. The completion of the circuit to the auger motor AM upon the closure of the ice level switch contacts IL1 also completes the obvious circuit to the time delay switch TDS which is preferably a thermally operated switch requiring about five to thirty seconds time for current flow therethrough before its switch contacts will be operated to be closed and also requiring about sixty seconds after stoppage of current flow therethrough for the switch to cool sufficiently to open its contacts. Of course, other forms of slow operate and slow release time delay switches may be used in place of the thermally operated switch TDS that is shown in the drawing. The simultaneous closure of the circuit through the time delay switch TDS and the auger motor AM results in the closure of the TDS1 contacts a predetermined time after the auger motor AM has been energized and this time may be anywhere from five to thirty seconds in the preferred arrangement of the invention. The closure of the TDS1 contacts a predetermined time after the auger motor AM has been energized is effective to complete a circuit to the switching relay SR to move the SR1 contacts from the normal position shown to the operated position which switches the energization circuit from the auger motor AM from the circuit including the contacts IM1 and IL1 to a circuit including only the coil of a current responsive relay CRR in series with the thermal overload switch TO and the line conductors 20 and 21. Thus the auger motor AM continues to run but is no longer in circuit with the ice level switch IL1 or the compressor interlock relay contact CIR1 which may be occasionally opened momentarily when the refrigeration cabinet product compressor PCM motor is cyclically energized. The flow of current for the auger motor AM through the current relay CR causes its energization to close its contacts CRR1 and complete the circuit for energizing the ice maker compressor motor IMC through then closed contacts CRR1 and ice level switch contacts IL1 and normally closed compressor interlock relay contacts CIR1.

Now, as described, it will be appreciated that both the auger motor AM and the ice maker compressor motor IMC are energized and operating. Should an unintentional difficulty arise to cause the auger motor to stop running by opening of its thermal overload switch contacts TO, the current through the current sensitive relay CRR would of course cease to flow and such relay would become deenergized to open its contacts CRR1 and stop the ice maker compressor motor IMC. For example, if a freeze-up should occur within the auger motor chamber to bind the auger motor AM to a condition such as to cause excessive current drain, the thermal overload switch TO would open and the current responsive relay CRR would be deenergized and the ice maker compressor motor IMC would be thereby deenergized thus allowing the auger chamber to increase in temperature and the freeze-up to be thereby relieved. Thereafter, should the thermal overload switch TO again close the auger motor will resume operation and its current flow therethrough will cause the current responsive relay CRR to again operate and again complete the energization circuit for the ice maker compressor motor IMC. In other words, the operation of the switching relay SR upon the closure of the time delay switch contacts TDS1 switches the auger motor to a circuit including the current responsive relay which assures that the ice maker compressor motor IMC cannot run unless the auger motor AM is energized by current flowing through the coil of current responsive relay CRR.

At the end of the ice making cycle, when the ice level switch IL is again operated to open its contacts IL1, the energization circuit for the ice maker compressor is immediately opened in view of the opening of the ice maker switch contacts IL1. However, the auger motor continues to be run, since it is energized through normally closed thermal overload contacts TO and operated contacts SR1. The switching relay SR and its contacts SR1 remain in the operated condition until the time delay switch contacts TDS1 are opened. The previously mentioned opening of the ice level switch contacts IL1, in addition to opening the circuit to the ice maker compressor motor IMC also opens the circuit to the time delay switch thermal operating unit allowing the time delay switch TDS to begin to cool. After a period of about sixty seconds sufficient to cool the time delay switch TDS, its contacts TDS1 are opened thus deenergizing the switching relay SR1 and switching the auger motor operating circuit back to the normal position shown with an operating circuit including the normal contacts IM1 and the then open ice level switch contacts IL1 to deenergize the auger motor AM.

Thus the provision of the single time delay switch TDS1 is effective to delay the energization of the ice maker compressor motor IMC until after the auger motor AM is energized and current is flowing therethrough while on the other hand it is effective to maintain the energization of the auger motor AM at the end of an ice making cycle until a predetermined time after the ice maker compressor motor IMC has been deenergized.

Various modifications will occur to those skilled in the art and it should be obvious that the control circuit of the invention may be used with any of the various known types of ice making machines having a separate ice harvesting motor and refrigerant system compressor motor.

I claim as my invention:

1. An electric control system for an ice making machine of the type having an electric motor driven ice making auger unit with a thermal overload switch together with an ice storage hopper with an ice level switch and a refrigeration system therefor including an electric motor driven compressor comprising, first auger motor

control circuit means including the contacts of said ice level switch for energizing said auger motor when the level of ice in said storage bin is below a predetermined level, a slow operate and slow release time delay switch connected in parallel with said auger motor circuit to be energized to close its contacts to complete a timing circuit to energize said compressor motor a predetermined time after said auger motor has been energized, said timing circuit having a switching relay energized to switch said first auger motor control circuit to a second auger motor operating circuit responsive to be energized so long as said time delay switch contacts are closed whereby said auger motor will continue to be energized for a predetermined time after said compressor motor circuit and time delay relay are deenergized upon the opening of said ice level switch contacts and the slow release of the time delay switch.

2. The invention of claim **1** in which said time delay switch is a thermally operated switch.

3. The invention of claim **1** in which said timing circuit includes a current responsive relay and circuit therefor in series with said auger motor to be energized responsive to the energization of said second auger motor operating circuit and the flow of current to said auger motor whereby the opening of the thermal overload switch for the auger motor will cause said current responsive relay to be deenergized to open the circuit to said compressor motor.

4. The invention of claim **3** in which said time delay switch is a thermally operated switch.

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