United States Patent

Linstromberg

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[54] WATER FILL SHUT-OFF CONTROL FOR A DOMESTIC ICEMAKER

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[73] Assignee: **Whirlpool Corporation**

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[52] **U.S. Cl.** **62/137**, 62/155, 62/233

[51] **Int. Cl.** **F25d 21/00**, F25c 1/10

[58] **Field of Search** 62/137, 233, 234, 155

[56] **References Cited**

UNITED STATES PATENTS

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[57] **ABSTRACT**

A control for shutting off an automatic ice maker in a refrigeration apparatus, such as a refrigerator-freezer. The ice maker apparatus is driven by an electric motor which is permitted to run continuously and thereby provide additional timing functions for other controls in the refrigeration apparatus. The ice maker mechanism is caused to be inoperative for purposes of providing ice bodies such as when the level of collected ice bodies in a storage bin reaches a preselected full level. The ice maker mechanism is made inoperative for providing ice by preventing delivery of water to the ice maker freezing mold under such conditions.

7 Claims, 4 Drawing Figures

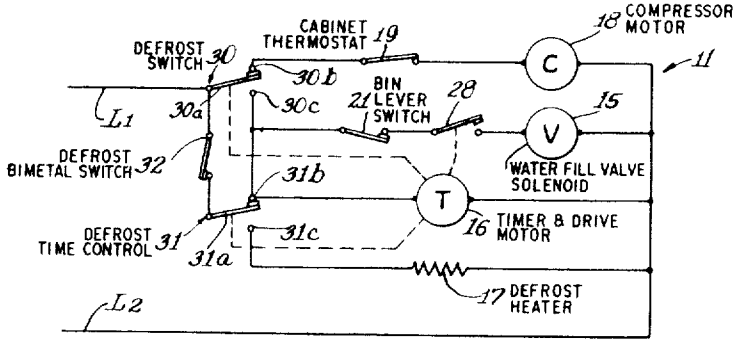


Fig. 1.

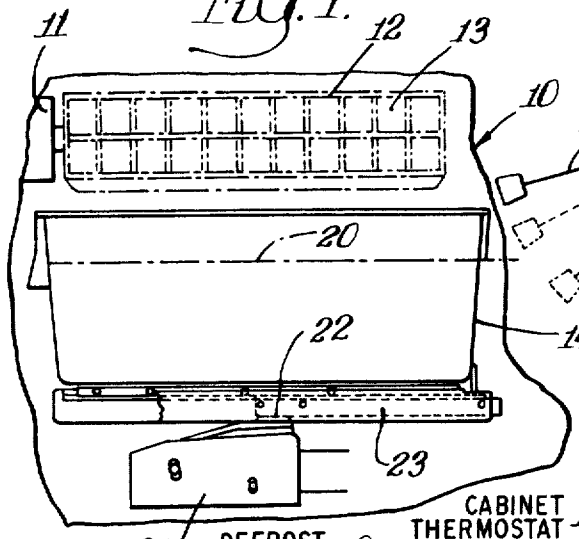


Fig. 2.

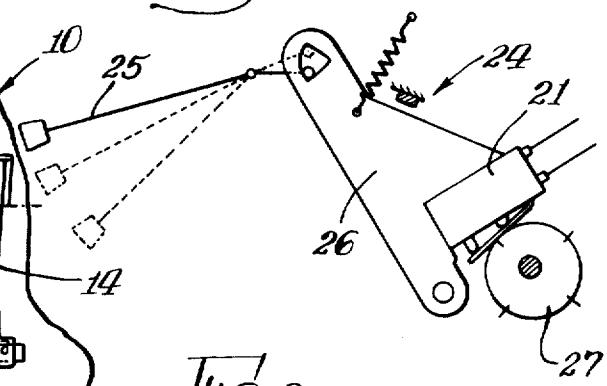


Fig. 3.

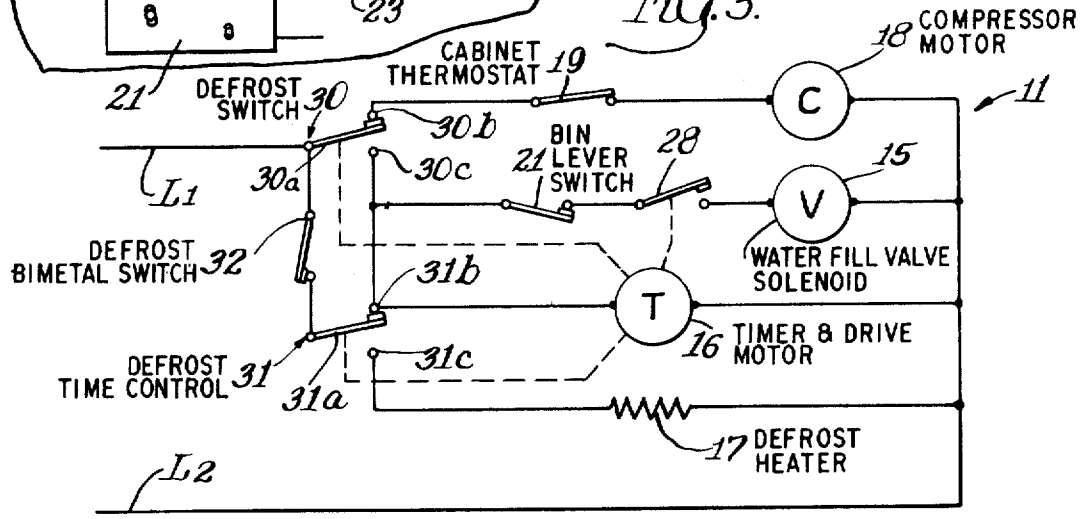
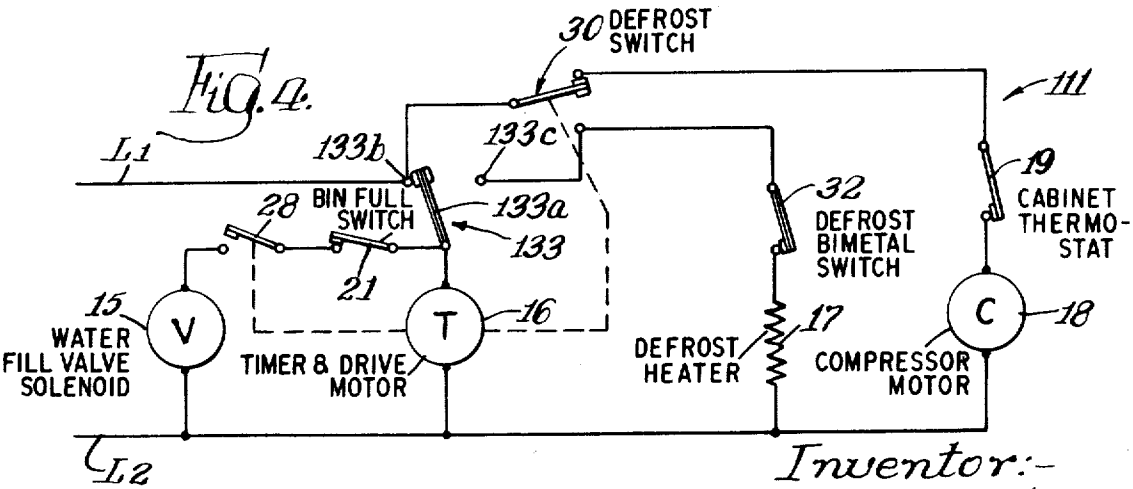


Fig. 4.



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WATER FILL SHUT-OFF CONTROL FOR A DOMESTIC ICEMAKER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a refrigeration apparatus and in particular to apparatus for automatically making ice bodies in an apparatus such as a refrigerator-freezer.

2. Description of the Prior Art

In controlling conventional automatic ice body makers means have been provided for de-energizing the drive motor thereof when the collected ice bodies reach a preselected level. The control means is arranged to automatically re-initiate the ice body making process when the level is lowered such as by the user withdrawing some or all of the collected ice bodies from a storage bin. Such refrigeration apparatuses further incorporate additional controls such as defroster controls which periodically defrost the refrigeration means so as to maintain the apparatus effectively frostfree. Such defroster controls normally require a timer to automatically time their operations. Heretofore separate timer motors have been employed for controlling the defroster means.

SUMMARY OF THE INVENTION

The present invention comprehends providing an improved control means in a refrigeration apparatus permitting a single motor to be utilized both for cyclically operating an automatic ice body maker and controlling the operation of a defroster means. In the present invention the ice body maker mechanism is permitted to be driven continuously through its normal cycle except that under certain conditions, delivery of water for forming ice bodies in the freezing mold is prevented. More specifically, when the ice bodies collected in the ice storage bin reach a preselected level, control means associated with the ice body maker effectively preclude further delivery of water to the ice body forming mold until such time as the level of ice in the storage bin is lowered below the preselected level. When the level is so lowered, the mechanism is reestablished for automatic production of ice bodies.

Thus, the motor driving the ice body maker mechanism is permitted to run continuously and to serve as the timer motor for the defrost control.

The means for sensing the level of ice bodies in the harvesting bin may comprise sensing arm means, weight responsive means, etc. The sensing means may be arranged to operate a separate control switch or may be arranged to mechanically affect the water fill control switch as desired.

BRIEF DESCRIPTION OF THE DRAWING

Other features and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawing wherein:

FIG. 1 is a fragmentary front elevation of a refrigeration apparatus having a control means embodying the invention, a modified form of level responsive means being shown in dotted lines therein;

FIG. 2 is a fragmentary view illustrating another means for sensing the ice body level in the harvesting bin suitable for use in the control of the invention;

FIG. 3 is a schematic electrical wiring diagram illustrating one embodiment of the invention; and

FIG. 4 is a schematic electrical wiring diagram illustrating another embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the exemplary embodiments of the invention as disclosed in the drawing, an ice body maker generally designated **10** for automatically making ice bodies is shown to include a control mechanism **11** for rotatably cycling a mold **12** defining a plurality of ice body forming cavities **13**. Ice bodies formed in cavities **13** are delivered therefrom to a subjacent collecting bin **14** in an automatic harvesting operation. Control **11** may be of suitable conventional construction adapted to control the delivery of water to the mold cavities through a solenoid valve **15** (FIG. 3). The control includes a drive motor **16** which in the present embodiment is caused to run continuously and which thereby is available to control the periodic energization of a suitable defrost heater **17** for automatically defrosting the refrigeration apparatus.

The refrigeration apparatus may further include a conventional motor compressor **18** for effecting suitable refrigeration to form ice bodies in mold **12**. The motor compressor is controlled by a conventional cabinet thermostat switch **19**.

Control **11** as operated by motor **16** normally functions to harvest successive batches of ice bodies from the mold **12** by repeated cycling of the ice body mechanism. However, when the ice bodies in bin **14** reach a preselected level, such as level **20** (FIG. 1), control **11** causes ice maker **10** to discontinue further production of ice bodies until such time as the level is reduced to below level **20**. Herein the discontinuation of the ice body forming process is caused by preventing energization of solenoid valve **15** to starve the ice maker of water.

The sensing of the level of ice bodies in bin **14** may be effected by suitable means such as weight responsive device including a switch **21** having an actuator **22** engaged by a bin support **23** and spring biased so that switch **21** is operated to open when the weight of the ice bodies in the bin reaches a weight corresponding to a full level condition thereof. Alternatively, as shown in FIG. 2, the sensing of the ice body level may be by means of a sensing arm mechanism **24** having an arm portion **25** arranged to sweep through the collecting bin and control switch **21** by means of a cooperating spring biased carrier **26** and timing cam **27**. A bin control utilizing the weight responsive means of FIG. 1 is illustrated in U.S. Pat. No. 3,474,637 issued to W. J. Buchser on Oct. 28, 1969 for "Bin Control for an Ice Maker". A sensing arm control means such as shown in FIG. 2 is illustrated in U.S. Pat. No. 3,040,542 issued to W. J. Linstromberg on June 26, 1962 for "Product Level Control for Ice Maker". Each of these patents is owned by the assignee hereof and reference may be had thereto for a detailed description of the structure and functioning of the level sensing devices as used in apparatus **10** hereof.

Solenoid valve **15** is controlled by a water fill switch **28**. In the present embodiment, shut-off switch **21** and water fill switch **28** are connected in series with the solenoid of valve **15** as shown in FIG. 3 of the drawing. In normal operation, assuming that the level of ice bodies in bin **14** is below the preselected full level, switch **21** is closed and once during each ice body forming cycle, switch **28** is closed by a cam, not shown, driven by timer motor **16** for a preselected period of time to deliver a suitable amount of water to cavities **13** of mold **12** for forming a batch of ice bodies therein. When, however, switch **21** is opened as a result of the level of ice bodies reaching full level **20**, the closing of switch **28** has no effect on the solenoid valve **15** whereby the ice body maker mechanism dry cycles without further production of ice bodies.

As shown in FIG. 3, the control circuit for the refrigeration apparatus may be fed from suitable power supply leads L1 and L2. The circuit includes a pair of defrost switches, defrost switch **30** and defrost switch **31**. Switch **30** comprises a single pole, double throw switch having its moving contact **30***a* connected to power supply lead L1, a first fixed contact **30***b* connected to cabinet thermostat switch **19** and a second fixed contact **30***c* connected to shut-off switch **21** and timer motor **16**. Defrost switch **31** comprises a single pole, double throw switch having its moving contact **31***a* connected through a normally closed defrost bimetal switch **32** to power supply lead L1, a first fixed contact **31***b* connected to fixed contact **30***c* of switch **30**, and a second fixed contact **31***c* connected to the defrost heater **17**. The other side of each of compressor **18**, water valve solenoid **15**, timer motor **16** and defrost heater **17** are connected to power supply lead L2. Thus, in operation, the control **11** functions to cycle the ice maker mechanism by

causing the refrigeration of the space in which the mechanism is provided by the operation of compressor motor **18** under the control of the cabinet thermostat **19**. As long as the collecting bin **14** is not filled to the level **20**, Bin Full switch **21** remains closed and water fill valve solenoid **15** is energized by the closing of switch **28** subsequent to a harvesting of ice bodies from mold **12** so as to provide a subsequent batch of ice bodies **13** in the mold. Motor **16** serves to drive the mold through the rotational positions thereof for effecting such harvesting and ice body formation operations.

When the timer motor **16** times out to initiate a defrost operation, it effects a throwing of switches **30** and **31** from the position of FIG. 3 into contact with fixed contacts **30***c* and **31***c*, respectively. Thus, operation of the compressor is prevented at this time and energization of the defrost heater is effected through switch **31** and normally closed switch **32**. In the event that the temperature sensed by switch **32** does not reach a preselected high temperature during the defrost timing period, motor **16** eventually causes switch **31** to be thrown back to the position of FIG. 3 terminating the defrost heating cycle and re-establishing the circuit for further ice body formation and harvesting cycles. While the switch **30** is thrown to fixed contact **30***c*, the timer motor remains energized therethrough and water fill valve solenoid may be energized when the timer reaches the point wherein switch **28** is closed thereby.

The defrost operation is effected by a throwing of switches **30** and **31** from the position shown in FIG. 3 to the opposite position wherein moving contact **30***a* contacts fixed contact **30***c* and moving contact **31***a* contacts fixed contact **31***c* of switches **30** and **31** respectively. In this arrangement of the control the compressor **18** is prevented from operating while power is maintained to timer motor **16** from power supply lead L1 while defrost heater **17** is energized through switch **31**. Resultingly, timer motor **16** may be utilized as a continuous timer motor to control switches **30** and **31** to effect the automatic defrosting cycle notwithstanding the opening of the circuit to water fill solenoid **15** preventing further forming of ice bodies.

Referring now to FIG. **4**, a modified control generally designated **111** includes a single pole, double throw defrost switch **30** connected in series with the cabinet thermostat switch **19** and the motor compressor **18** across power supply leads L1 and L2. The control further includes a single pole, double throw ice maker bimetal switch generally designated **133** having its moving contact **133***a* connected to timing motor **16**, a first fixed contact **133***b* connected to power supply lead L1, and a second fixed contact **133***c* connected to defrost bimetal switch **32** which in turn is connected to defrost heater **17**. Moving contact **133***a* of switch **133** is further connected through a series arrangement of shut-off switch **21** and water fill switch **28** to solenoid valve **15**.

Thus, operation of control **111** is similar to control **11** as discussed above in that timing motor **16** is energized continuously across power supply leads L1 and L2 notwithstanding an opening of shut-off switch **21** to discontinue the delivery of water to the mold **12**. Switch **133** functions to prevent operation of the apparatus in the event that the temperature rises to an abnormally high level such as above freezing thereby to prevent dumping of water into the harvesting bin **14** as a result of a failure to form ice bodies in the mold **12** during the ice forming period. Such interruption of the timing motor operation is an abnormal condition and under the conditions causing such throwing of switch **133** the need for defrosting is correspondingly eliminated so that such interruption in the operation of timing motor **16** does not affect the defrost operation necessary to maintain the apparatus frostfree. Thus, timing motor **16** is effectively continuously operated during all normal operation of the ice body forming apparatus.

The foregoing disclosure of specific embodiments is illustrative of the broad inventive concepts comprehended by the invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Refrigeration apparatus comprising: cooling means; a drive motor; means for automatically making ice bodies including a mold, means for delivering water to the mold for cooling thereof by said cooling means to form ice bodies in said mold, and means driven by said motor for cyclically harvesting the ice bodies from said mold including a collecting bin for removably storing the harvested ice bodies; means for defrosting the cooling means including a control terminating the defrosting operation in response to a high temperature condition corresponding to a completed defrost operation or in response to a preselected time of defrost operation in the event said temperature condition is not reached during the defrost operation; means for timing the interval after said high temperature condition is terminated between successive defrosting operations of said defrosting means from said drive motor, said control causing said drive motor to be operated continuously during each said interval; and means preventing operation of said water delivery means whenever the level of ice bodies in said collecting bin is at a preselected full level thereof to permit continued operation of the ice making means by said drive motor while preventing forming of ice bodies thereby.

2. The refrigeration apparatus of claim **1** wherein said water delivery means includes a solenoid valve, and said means preventing operation of the water delivery means comprises a control switch controlling the electrical feed to said solenoid valve arranged to prevent operation of the valve when the bin ice body level is above said preselected level.

3. The refrigeration apparatus of claim **2** including means responsive to the weight of said collected ice bodies to prevent said valve operation when the bin ice body level is above said preselected level.

4. The refrigeration apparatus of claim **2** including a sensing arm movable through the space in said collecting bin to sense the upper level of collected ice bodies and mechanism controlled by said arm to prevent said valve operation when the bin ice body level is above said preselected level.

5. The refrigeration apparatus of claim **1** wherein said water delivery means includes a solenoid valve, and said means preventing operation of the water delivery means comprises a control switch controlling the electrical feed to said solenoid valve arranged to prevent operation of the valve when the bin ice body level is above said preselected level.

6. The refrigeration apparatus of claim **1** including means responsive to the weight of said collected ice bodies to prevent said valve operation when the bin ice body level is above said preselected level.

7. The refrigeration apparatus of claim **1** including a sensing arm movable through the space in said collecting bin to sense the upper level of collected ice bodies and mechanism controlled by said arm to prevent said valve operation when the bin ice body level is above said preselected level.

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