July 24, 1962 R. F. TODD 3,045,444

ICE MAKING

Filed Dec. 19, 1960

2 Sheets-Sheet 1

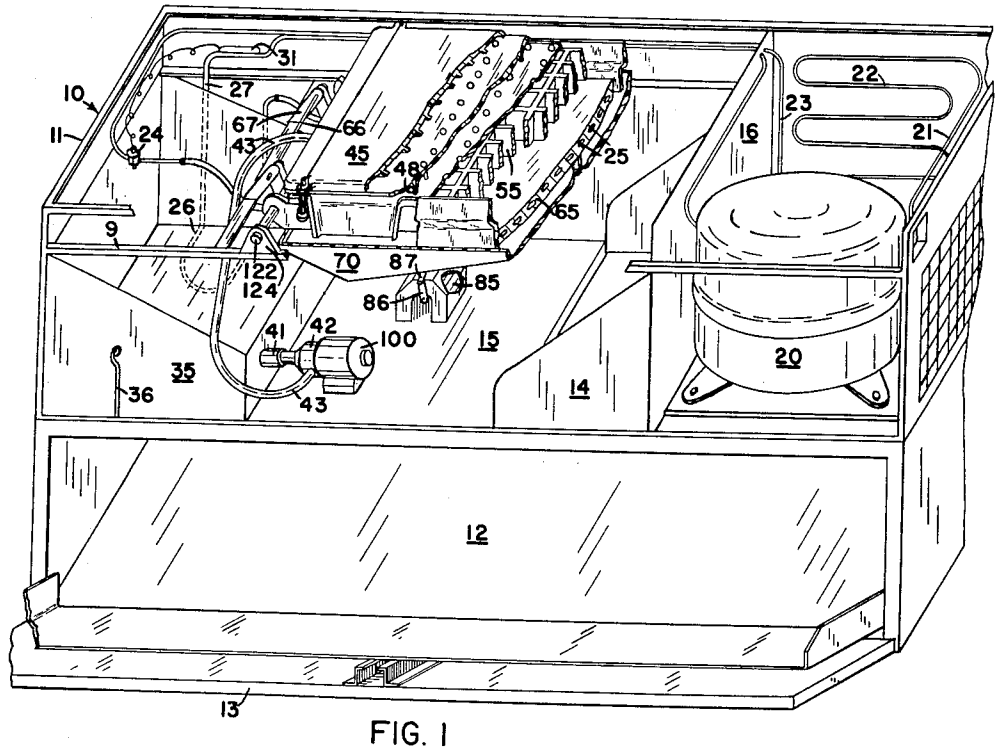

FIG. 1

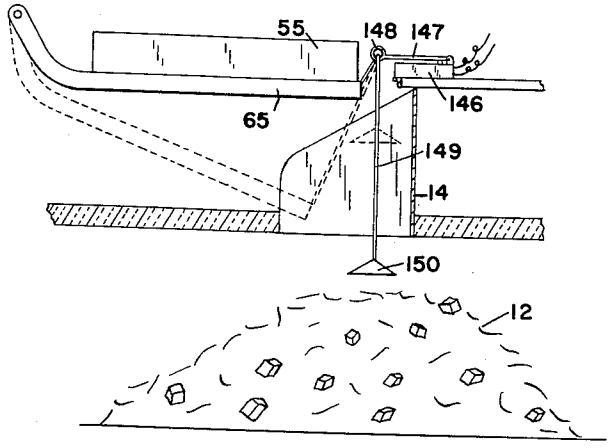

FIG. 2

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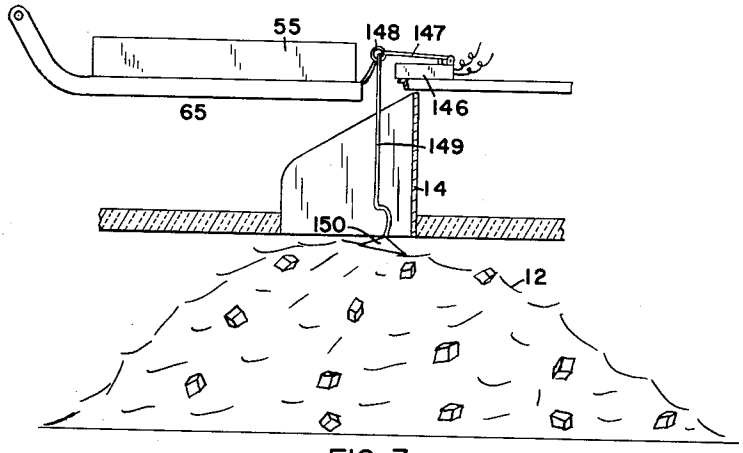

FIG. 3

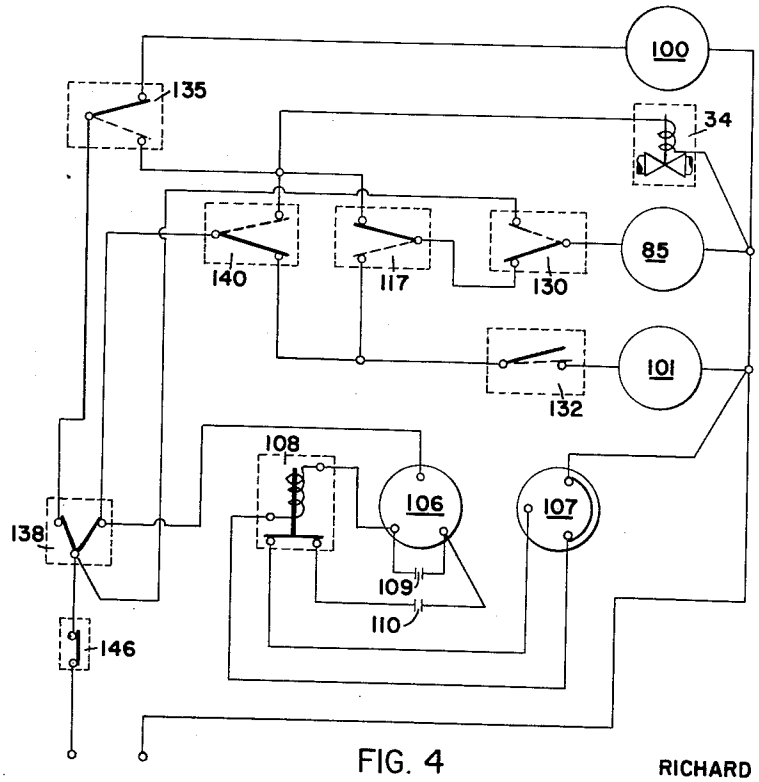

FIG. 4

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3,045,444

ICE MAKING

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7 Claims. (Cl. 62—137)

This invention relates to ice making, more particularly to means for regulating the operation of an ice making apparatus in response to the quantities of ice produced.

A variety of ice making apparatus has been evolved for the relatively continuous production of desired quantities of ice. It is generally desired that the ice be of uniform size and quality. The formed ice particles which may take a variety of shapes are hereinafter referred to as cubes. These cubes are collected in a storage bunker for subsequent use. Typical of the ice forming apparatus here referred to are the grid and platen types of ice making equipment more fully disclosed in co-pending application S.N. 40,719 filed by William L. McGrath. A grid containing cells of the desired volumetric configuration of the ice particles to be formed is fixedly secured to a frame. A movable platen is arranged to retain liquid to be frozen within the grid cells, and to implement the harvesting or discharge of the formed ice from the cells to the storage bunker. An appropriate refrigeration system is employed for effecting freezing of the liquid in the grid cells.

The apparatus continues to operate through its cycles of freezing of liquid and harvesting of the formed ice cubes to produce the ice cubes at a relatively continuous rate. The situation often arises where sufficient ice for a given use has been produced, and it is thus no longer necessary to continue cycling of the ice making apparatus.

It is with the above problems and desiderata in mind that the present means have been evolved, means including both method and apparatus controlling the operation of an ice making apparatus so as to discontinue the production of ice when a given quantity of ice has been collected in the storage bunker.

It is accordingly a primary object of this invention to provide an ice making apparatus with an improved control means.

Another object of the invention is to provide control means for regulating the operation of an ice making apparatus in response to the quantities of ice produced thereby.

A further object of the invention is to provide control means regulating the operation of an ice making apparatus to discontinue the operation of said apparatus when a given available supply of ice has been produced thereby.

It is also an object of the invention to provide means detecting the available supply of ice produced by an ice making apparatus.

These and other objects of the invention which will become hereafter apparent are achieved by provision of a novel probe element depended within the ice storage bunker of an ice making apparatus. The probe element is arranged to determine the level of ice within the storage bunker and is coupled to an apparatus control switch so as to deenergize the circuit of the ice forming apparatus. Thus upon the accumulation of a given quantity of ice within the storage bunker the ice making apparatus is deactivated pending the depletion of the formed ice below a given level, at which time the operation of the ice making apparatus is reinitiated.

An important feature of the invention resides in the fact that the novel probe element contacting the ice is formed of a non-porous inert material such as nylon or the like which is not subject to contamination whereby quality of the ice is not affected. Additionally the mechanical forces exerted by the probe on the ice are

negligible thereby preventing physical damage of the formed ice so that the quality of the ice will not be harmed.

A further feature of the invention resides in the fact that the probing action of the probe element is deactivated during the harvesting of the formed ice whereby the accuracy of the probing action will not be affected by the ice being deposited in the storage bunker.

The specific details of a preferred embodiment of the invention, and their mode of functioning will be made most manifest and particularly pointed out in clear, concise, and exact terms in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a perspective view with parts broken away of a grid and platen type of ice making machine in conjunction with which the instant control means may be employed;

FIGURE 2 is a schematic view of the novel control means shown as applied to a grid and platen type of ice forming apparatus with the apparatus components shown in solid line in an ice forming position and shown in dotted line in a harvesting position;

FIGURE 3 is a schematic view similar to FIGURE 2 with the apparatus components shown in a condition indicating the accumulation of sufficient ice in the storage bunker to warrant discontinuance of the ice making operation; and

FIGURE 4 is a schematic circuit diagram of a control circuit in which the switch of the instant control means is shown arranged for effecting ice making apparatus control.

Referring now more particularly to the drawings, like numerals in the various figures will be taken to designate like parts.

The novel ice making machine to which the instant control system is applied is more fully described in the aforementioned co-pending application S.N. 40,719. The ice making apparatus **10** here shown in FIG. 1 is arranged within a rectangular housing **11** formed of sheet metal, or the like relatively rigid sheet material supported on a frame **9** of angle iron or the like. A storage bunker **12** is formed at the bottom of the housing **11**, and provided with a hinged door **13** permitting access to the interior of the bunker **12**. Leading to the bunker is a chute **14**, extending from an opening in horizontal partition **15** arranged above the bunker **12**. Partition **16** separates the heat dissipating components of the refrigeration system, to be later described, from the ice forming equipment and water supply system, as seen to the left in FIGURE 1.

The refrigeration system which may here be employed with optimum effectiveness comprises a compressor **20** constituted by a sealed motor compressor unit such as is conventionally employed in compression refrigeration systems. The compressor is coupled via discharge line **21** to condenser **22** which is connected via liquid refrigerant line **23** through thermal expansion valve **24** to primary platen evaporator **25** in series with secondary evaporator **26**, from which suction line **27** extends back to compressor **20** to complete the closed fluid circuit.

Expansion valve **24** is controlled by means of thermostatic bulb **31** arranged in heat exchange relation with suction line **27** so that the amount of refrigerant flowing from the condenser **22** to the evaporator is regulated in response to the temperature of refrigerant in the suction line.

The refrigeration system includes a bypass line (not shown) extending from discharge line **21** from a point before condenser **22** to evaporator **25**, permitting the flow of compressed refrigerant directly from the compressor to the evaporator. Regulation of the flow of refrigerant through the bypass line is effected by a solenoid valve **34**, the operation of which is more fully de-

scribed in the aforementioned copending application Serial No. 40,719.

A water supply circuit includes a water storage sump 35 to which water is fed by water main connection 36 which feeds water to sump 35 through any desired control valve means. Sump discharge line 41 leads the water from the sump through pump 42 via flexible water header supply line 43 to water distribution header 45. The water header distributes the water to the cells of the ice forming grid 55.

Rods 122 mounted in brackets 124 extend through projections from the corners of grid 55 and support the grid on framework 9.

A platen 65 is pivotally mounted on rod 66 carried in bearings 67 on framework 9 to close off the bottom of the grid cells so that liquid to be frozen may be retained therein. The particular ice making apparatus here employed is provided with a platen arranged beneath the grid cells, and with liquid to be frozen supplied to the grid cells via nozzles 48 on a water header 45, and with a water collection pan 70 beneath the grid and platen as more fully described in the aforementioned co-pending application S.N. 40,719. It will, however, be appreciated that a variety of other grid and platen types of refrigeration apparatus may be employed.

The control circuit illustrated diagrammatically in FIG. 4 and more fully explained in the aforementioned copending application S.N. 40,719 of William L. McGrath controls the operation of the refrigeration system, water supply system and grid and platen ice forming components to attain a continuous supply of uniform ice of desired quality and quantity. An electrical circuit as shown in FIG. 4 couples pump motor 100, platen moving gear motor 85 and refrigeration system compressor motor 106.

Coupled to the compressor motor is an overload relay 107, a starting relay 108, a running capacitor 109, and a starting capacitor 110 such as conventionally employed in refrigeration system motor compressor units.

The gear motor 85 utilized for effecting movement of the platen with respect to the plate is coupled to the plate via a crank arm 86 and connecting rod 87 such as more fully described in co-pending application S.N. 40,584, filed by Carl G. Alt.

In addition to the gear motor cam switch 117, the gear motor energizing circuit is provided with a gear motor manual switch 130. Control of the condenser fan motor 101 is provided by means of a condenser fan switch 132 arranged in the circuit of condenser fan motor 101. Switch 132 is of a single pole single throw pressure sensitive type. Ranco switch 010–2005 is found suitable for the purpose.

A platen switch 135 of a single pole double throw lever action type is arranged in the circuit of pump motor 100 and solenoid valve 34. This platen switch 135 is arranged so as to close the circuit to the pump motor 100 when the platen is in contact with the grid.

A manual control switch 138 is arranged in the circuit to compressor motor 106, pump motor 100, solenoid valve 34, gear motor 85 and condenser fan motor 101. Manual control switch 138 is a three position switch which permits manual control of the ice making apparatus components so as to permit: complete shut off of the unit (when neither contact arm engages a contact); operation of only pump motor 100 (when the left contact is engaged by the left contact arm and the right contact is open); or operation of all components (when each contact arm engages a contact).

Main control switch 140 serves to automatically control the cycles of operation of the ice making apparatus in response to pressure and temperature conditions. Switch 140 is preferably of the Ranco dual control single pole double throw type.

A novel bin switch apparatus is mounted in the ice storage bin or bunker and is arranged to control the operation of the ice making apparatus in response to the quantities of ice produced. This switch apparatus as best seen in FIGS. 2 and 3, comprises a lever action single pole single throw switch 146 having a lever arm 147 spring biased to open the switch 146. An eyelet 148 is secured on the lever arm and a flexible connector 149, preferably formed of a relatively inert non-absorbent corrosion and mold resistant material such as nylon cord or the like is passed therethrough. To reduce wear between the flexible connector 149 and the eyelet 148 it is preferred that the bearing surface of the eyelet and the connector be fabricated from the same material, preferably nylon. If the eyelet is made from metal, an O-type insert of the same material as the flexible connector may be placed within the eyelet 148. One end of connector 149 is secured to platen 65 as seen schematically in the drawing. At the other end of connector 149 a weight or probe 150 of an inert material like that of the connector is depended in the bunker overlying the ice cubes accumulated therein. The magnitude of weight 150 is such as to maintain connector 149 under tension.

The novel control means here disclosed functions to regulate the operation of an ice making apparatus in response to the available supply of ice produced by the apparatus. The supply of ice available for use is retained in the storage bunker 12 formed at the bottom of the housing of the apparatus.

The probe 150 is formed of an inert corrosion resistant and mold resistant material such as nylon or the like suspended from flexible connector 149 coupled to switch arm 147 of lever action single pole single throw switch 146. The free end of connector 149 is connected to the platen 65 so that movement of the platen effects movement of the probe.

As viewed in FIG. 2, the ice making apparatus will continue through its operative cycles since switch 146 is maintained in a circuit making position as a result of the pressure exerted on switch arm 147 by probe 150 which hangs taut on connector 149. As the quantity of formed ice in the storage bunker accumulates above a given height, the probe 150 is raised to the FIG. 3 position permitting the spring-biased switch lever arm 147 to move upwardly causing opening of switch 146 which breaks the energizing circuit of the ice forming apparatus discontinuing the production of ice.

In order to deactivate the instant control during periods of ice harvesting, since the deposit of ice in the bin might affect the probe to move same to an apparatus de-energizing position, the probe is elevated by the action of platen 65 as viewed in FIG. 2. In FIG. 2 the platen is shown schematically and in dotted line in an ice harvesting position. In this position the movement of the platen serves to elevate the probe from the bunker tensioning the connector to insure that the switch remains in a circuit making condition. Additionally ice particles being deposited into the bunker are prevented from influencing the position of switch arm 147.

The inert nature of the probe and its connector are such as to prevent contamination of the probe with resultant contamination of the ice particles; and the lightweight nature of the probe is such as to prevent damage of the ice particles by the probe. Additionally the non-corrosive nature of the probe prevents damage thereof by water or the like.

It is thus seen that a simple sensing control has been provided for use in regulating the operation of an ice forming apparatus in response to the quantities of ice available for use by the users of the apparatus. The novel control is simple in construction and maintenance, does not effect the quality of ice produced and permits normal functioning of the apparatus until desired quantities of ice are made available thereby.

The above disclosure has been given by way of illustration and elucidation, and not by way of limitation, and it is desired to protect all embodiments of the herein dis-

closed inventive concept within the scope of the appended claims.

I claim:

1. In an ice making apparatus, the combination of a grid containing cells within which liquid to be frozen is confined; a platen positioned adjacent the grid to retain the liquid to be frozen in the grid cells, said platen being movable from a liquid retaining position adjacent the grid to a position remote from the grid permitting harvesting of the formed ice; an ice storage bunker for maintaining a supply of the formed ice; and an apparatus control comprising: a switch member arranged in the electrical circuit energizing the apparatus; a switch arm normally biased to cause said switch to assume an apparatus de-energizing position; a flexible connector secured to said platen and engaging said arm; and a dependent probing weight secured to said flexible connector to bias same along with said switch arm to cause said switch to assume an apparatus energizing position, said probing weight positioned in the storage bunker over the ice maintained therein, whereby upon movement of said platen away from said grid, the probing weight will be raised from the surface of the ice accumulated in the bunker and will exert a force on said flexible connector to maintain said switch in an apparatus energizing condition and upon movement of said probing weight by the ice beyond a given datum, said switch will assume its normal apparatus de-energizing position.

2. Ice making apparatus as in claim 1 in which said probe weight is formed of an inert corrosion and mold resistant material.

3. Ice making apparatus as in claim 1 in which said probe weight rests above the ice stored in the bunker.

4. Ice making apparatus as in claim 1 in which said connector is formed of an inert mold and corrosion resistant material.

5. Ice making apparatus as in claim 1 in which said switch member is a single-pole single-throw switch; and guide means on said switch arm guides the movement of said flexible connector.

6. In an ice making apparatus, the combination of a grid containing cells within which liquid to be frozen is confined; a platen positioned adjacent the grid and movable from a liquid retaining position adjacent the grid to a harvesting position remote from the grid; an ice storage bunker for maintaining a supply of the formed ice; and means for controlling the operation of the apparatus in response to the quantities of ice available in the ice storage bunker; said means comprising probe means sensing the quantity of ice in the bunker, switch means arranged in the electrical circuit energizing the apparatus, and flexible connector means fastened to said means, probe means and to said platen, said flexible connector means being operatively connected to said switch means, whereby upon movement of said probe means by ice beyond a predetermined level, the switch means will assume an apparatus de-energizing position.

7. Means for controlling the operation of an ice making apparatus in response to the available supply of ice produced by the apparatus, said means comprising dependent probing means sensing the quantity of ice available for use; switch means controlling energization of the operating circuit of the ice making apparatus, said switch means having an actuating arm; and flexible connector means connected at one end to said probe means and connected at the other end to a movable component of the ice making apparatus, said component being movable from an ice forming position to an ice harvesting position, said flexible connector means being operatively connected to the actuating arm for normally maintaining the switch means in operating circuit energizing position and for permitting the switch means to move to operating circuit de-energizing position when the probe means sense the availability of a given quantity of ice, whereby the operation of the ice making apparatus will be discontinued when a given supply of ice is available for use, and will be reinitiated upon a depletion of the ice supply.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,045,444 July 24, 1962

Richard F. Todd

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 6, line 10, strike out "means,"; line 13, after "by", second occurrence, insert -- the --.

Signed and sealed this 20th day of November 1962.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents