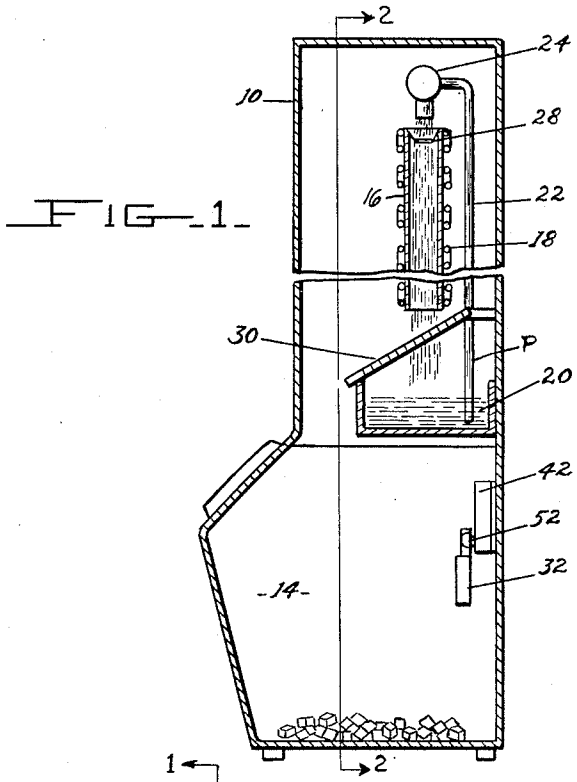
May 27, 1958 R. D. MORGAN 2,836,038

ICE MAKING APPARATUS

Filed March 1. 1954 3 Sheets-Sheet 1

FIG. 1



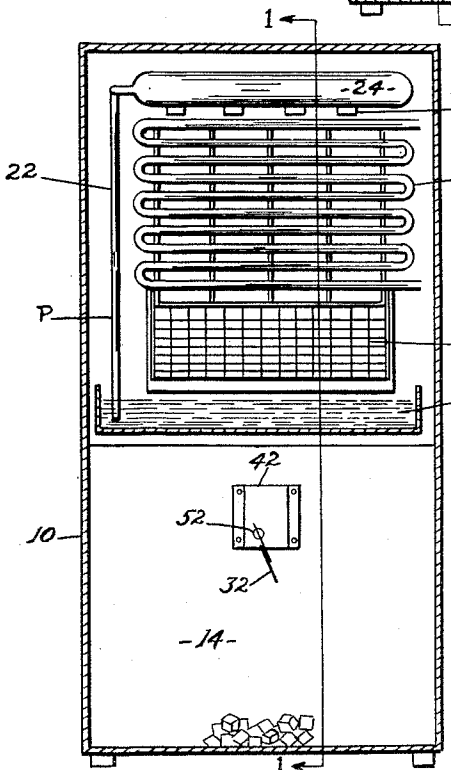


FIG. 2

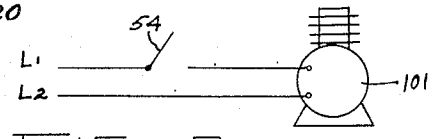


FIG. 3

INVENTOR.
Robert Dayton Morgan

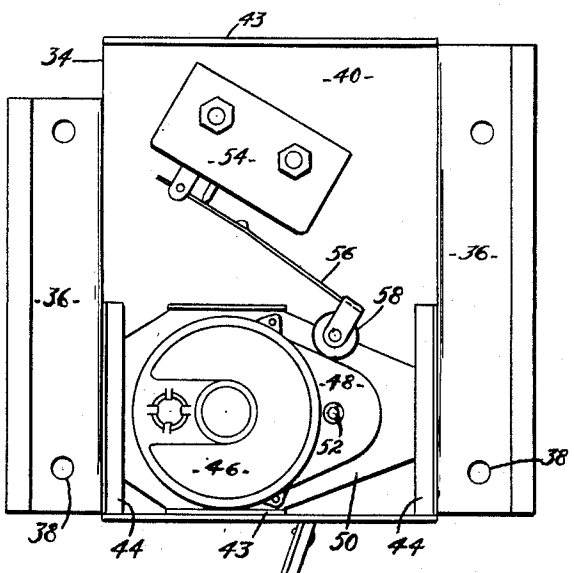
BY
Herman Seid
Atty.

May 27, 1958 R. D. MORGAN 2,836,038

ICE MAKING APPARATUS

Filed March 1. 1954 3 Sheets-Sheet 2

FIG-3.



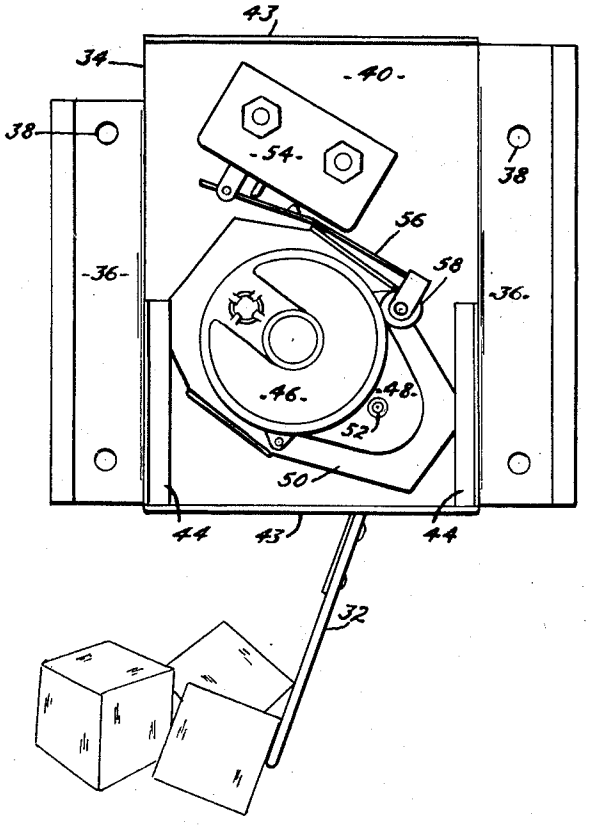


FIG-4.

INVENTOR.
Robert Dayton Morgan
BY
Herman Seid
Atty.

May 27, 1958 R. D. MORGAN 2,836,038

ICE MAKING APPARATUS

Filed March 1. 1954 3 Sheets-Sheet 3

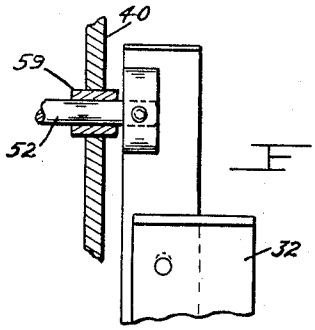


FIG. 5.

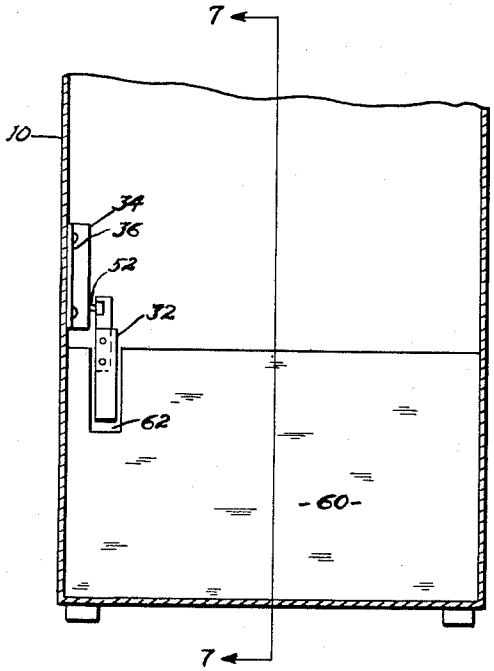


FIG. 6.

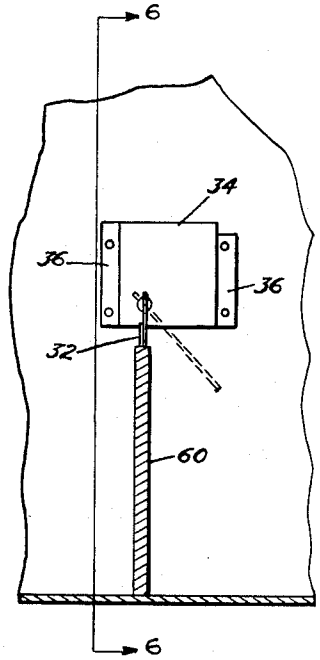


FIG. 7.

INVENTOR.
Robert Dayton Morgan

BY
Herman Seid
Atty.

United States Patent Office 2,836,038 Patented May 27, 1958

2,836,038

ICE MAKING APPARATUS

Robert Dayton Morgan, Syracuse, N. Y., assignor to Carrier Corporation, Syracuse, N. Y., a corporation of Delaware

Application March 1, 1954, Serial No. 413,273

2 Claims. (Cl. 62—7)

This invention relates generally to ice making apparatus and more specifically to a control for use with automatic ice making equipment wherein ice is alternately formed and harvested in a predetermined cyclical manner, the control being adapted to prevent an accumulation of ice in the storage compartment in excess of the capacity thereof.

Still more specifically this invention relates to a control for discontinuing the automatic operation of an ice making machine once a sufficient quantity of ice has been deposited in the storage compartment of the machine. While the control contemplated by this invention may be used in many different forms of ice making apparatus, it is particularly suited for use with automatic ice making equipment of the type having an ice forming compartment and a storage compartment in communication therewith. Apparatus of this type may include, in the ice forming compartment, a plurality of hollow members, open at both ends, provided with refrigerated inner surfaces over which a quantity of water is continuously circulated. During the circulation of the water, portions thereof are formed into ice, and subsequently harvested, preferably by introducing hot compressed gas into an evaporator coil that surrounds the members and refrigerates them during the ice making cycle.

As the ice is harvested, it passes by gravity into a storage compartment and is maintained therein until removed by one having a use for the ice. Inasmuch as the operation of the machine is entirely automatic, it will be appreciated that a control designed to terminate the operation once an adequate supply of ice has been deposited in the storage compartment is necessary. Heretofore it has been suggested that a thermal responsive bulb capable of actuating a switch in the circuit controlling the compressor motor of the refrigeration system be employed.

Once the ice in the storage compartment builds up to the extent that portions thereof engage the bulb and so lower its temperature, a switch under the influence of the bulb is opened and operation of the compressor motor in the rerigeration system is terminated.

Some of the disadvantages of the use of the thermal responsive bulb include, the influence of different barometric pressures on the operation of the bulb, the possibility of damage to the control, difficulties in obtaining a temperature rise in the storage compartment of the nature necessary to re-initiate the operation of the machine and when the control is used under circumstances where ice in chip or flake form is manufactured, the ice adheres to the bulb and prevents normal operation thereof.

In order to overcome the difficulties presented by the use of the thermal responsive bulb, this invention contemplates the use of an arm, mounted for continuous movement in a predetermined path within the storage compartment, that controls a switch in the circuit of the refrigerator system compressor motor. In the event resistance to movement is encountered, as will occur when the ice accumulates to the extent that a portion of the supply extends into the path of movement of the arm, the

circuit, mentioned above is opened and operation of the refrigeration system ceases.

An object of this invention is the provision of an improved control, for use in an automatic ice making machine, operable in response to the amount of ice stored within the machine for terminating the operation of the machine.

A further object of the invention is the provision of a control means of the type referred to above that is assembled from parts economical in cost yet dependable in operation.

Further objects and advantages of the invention will be apparent from a consideration of the ensuing specification and drawings in which:

Figure 1 is a diagrammatic view partly in section taken along lines 1—1 on Figure 2 of an ice making machine and the control means illustrating the invention;

Figure 2 is a view similar to Figure 1 taken along lines 2—2 on Figure 1 showing the ice making machine and control;

Figure 3 is a side view, from the rear, of a switch showing one form of a control means illustrating the invention;

Figure 4 is a view similar to Figure 3 showing the operating parts of the switch in a different position;

Figure 5 is a fragmentary view illustrating the manner in which the prime mover is secured to the mounting bracket in the control device;

Figure 6 is a partial view taken along lines 6—6 on Figure 7 illustrating the control as applied to an ice maker having a storage compartment capable of storing and accommodating ice in different forms;

Figure 7 is a view similar to Figure 6 taken along lines 7—7 on Figure 6; and

Figure 8 is a schematic wiring diagram of a circuit which may be used to deenergize the compressor motor of the ice making machine when the ice storage bin has been filled to the desired extent.

As pointed out above this invention may be used in many different ice making machines, however, a machine of the kind set forth in co-pending patent application 171,593, filed July 1, 1950, in the name of D. E. MacLeod, now Patent No. 2,775,098, will be described generally in order to provide an environment for the accommodation of the invention. In Figures 1 and 2 there is shown an ice maker 10 adapted to form ice in cube form with an opening, which may best be described as "hour-glass" in configuration extending through the longitudinal axis of the cube. The ice maker is shown having an ice making or forming compartment 12 and an ice storage compartment 14 in communication therewith.

Briefly, ice is formed on the inner surfaces of a plurality of hollow members 16, having an evaporator coil 18, of a refrigeration system assembled about the exterior thereof in heat exchange relation therewith. It will readily be appreciated that the usual conventional components of a refrigeration system such as a motor driven compressor, condenser, expansion valve and accumulator are all utilized in the normal manner so that refrigerant is vaporized in the evaporator coil 18 by extracting heat from the surrounding area. A quantity of water is continuously circulated over the refrigerated surfaces through a cycle including sump 20, line 22, header 24, spouts 26, and dispersion plates 28 to the sump through the use of pump P. During the circulation of the water through the cycle described certain portions thereof are formed into ice so that after flow through the members 16 is restricted to a certain degree a control is actuated which in effect terminates the circulation of the water and initiates a harvesting cycle wherein hot compressed gas is introduced into coil 18 so as to produce a thawing action in the ice forming members. The particular control means per-

forming this function is described in detail in the above mentioned co-pending application.

The thawing action will cause the ice to drop onto deflection grid 30 so as to be directed to the storage compartment 14. Once the ice has been harvested in the manner described, a thermal responsive control located on the suction line of the refrigeration system causes a switch to be actuated that terminates the harvesting cycle with its flow of hot, compressed gas through the evaporator coil and re-initiates the freezing cycle and circulation of water as described above.

This cycle of operation continues over a period of time so that a considerable quantity of ice accumulates in the storage compartment. To prevent the introduction into the storage compartment of an amount of ice in excess of the capacity of the compartment, a device of the type shown in Figures 3 and 4 is mounted on one of the walls of the storage compartment. Broadly the device includes a feeler element 32, preferably formed of resilient material such as rubber, adapted to be continuously moved through a predetermined path and so constructed that when resistance to the movement, in the form of a layer of deposited ice, is encountered, certain operating mechanism opens a switch in the circuit of the compressor motor and further operation of the machine is prevented.

The control essentially consists of a mounting bracket 34, having opposed wall engaging flanges 36, provided with fastener accommodating apertures 38, a central portion 40, lying in a plane, offset from the plane containing the flanges 36, and side portions 42, see Figure 2, connecting the flanges 36 and the central portion 40. End members 43 are secured to the top and bottom edges of portion 40 and side portion 42 so that the bracket forms an enclosure when mounted on the compartment wall in the manner shown in Figure 2. Intermediate the ends of the side portion 42 are positioned retainers 44 for a purpose to be later described. To provide the feeler element or arm 32 with the movement mentioned above, a motor is employed. In the construction illustrated, a small motor 46 of the type used in timing operations is shown with a gear reduction housing 48 mounted on a plate 50. The gear reduction unit has a power transmitting shaft 52 extending through a bushing 59 or the like, secured to the central portion 40 of the mounting bracket with the ends thereof projecting from opposite side of portion 40. One end of the arm 32 is secured to the extending shaft 52 and rotates therewith. A switch 54, having one end of an actuating lever 56 of resilient material such as spring steel pivoted thereto, is secured to the bracket in spaced relation to the motor. The other end of the lever 56 has provided thereon a roller 58 adapted to engage the side of the housing 48 in the manner shown in Figures 3 and 4.

A particular feature of the invention resides in the manner in which the subassembly comprising motor 46, gear reduction unit 48 and plate 50 are mounted on the bracket 34. As best shown in Figures 3, 4 and 5 the subassembly is connected to the bracket 34 only at the location of shaft 52 so that it may be considered as "floatingly" mounted with the ends of the plate 50 underlying the retainers 44 and the subassembly resting on bottom member 43.

During the operation of the automatic ice making machine, quantities of ice are alternately formed and harvested in the manner described above. It will be obvious that a substantial amount of ice will eventually be collected in the storage compartment. When the accumulation of ice in the storage compartment builds up to the extent that a portion of the ice formation extends into the path of movement of the area so as to prevent further movement of the arm, a force, acting in opposition to the normal forces of torque generated by the motor 46, is created. In an attempt to overcome this force the motor 46 continues to exert a force on the shaft 52. Inasmuch as the arm 32, secured to shaft 52, is unable to move due to the presence of the ice, the entire assembly including motor 46, housing 48 and support 50 is caused to rotate about the shaft to the position shown in Figure 4, into engagement with the switch actuating arm 56, depressing the switch and opening the circuit controlling the compressor motor in the refrigeration system. A circuit which may be used for deenergizing compressor motor 101 of the refrigeration system is shown in Figure 8 wherein compressor motor 101 is coupled across leads L_1 and L_2 and wherein switch 54 is positioned in lead L_1. The circuit controlling the operation of motor 46 is separate from the circuit controlled by switch 54 so that the motor 46 remains energized. Upon removal of the ice from the path of movement of the arm 32, the motor drops by gravity to the position shown in Figure 3, lower member 43 limiting the downward movement of the motor. The resilient nature of arm 56 causes the roller 58 to remain in engagement with the housing 48.

It will thus be appreciated that by virtue of the ability of the motor and its associated parts to rotate, it is displaced radially about the shaft 52. If the motor were secured to the bracket 34 it would not rotate. The action herein described is analogous to that occurring if one grasps the power shaft of a motor with force enough to overcome the rotation, then if the motor is not secured to a mounting bracket or other similar support, it will tend to rotate. It is this particular action that is utilized in the present invention.

Summarizing it may thus be seen that the resistance, as exemplified by that portion of the ice that projects into the path of the arm so as to obstruct further movement thereof, sets up a force in the form of counter torque on the motor shaft that causes radial displacement of the motor assembly which in turn effects operation of the switch 54.

Thus it may be seen that an effective arrangement for preventing overloading of the storage compartment of an ice making machine is provided. It will be obvious that the position of the control device may be changed within the storage compartment so that different amounts of ice within the compartment will control the operation of the machine. Also the mounting bracket may be constructed so that the connecting portions 40 are lengthened so as to permit the arm to extend toward the center of the compartment 14. Also for example if storage compartment includes a partition 60, defining separate chambers for the reception of either ice in cube form, or ice in chip form, then the arm 32 may be mounted to rotate through a slot 62 extending from the top of the partition and so be responsive to quantities of ice in either chamber. Other constructions and modifications within the scope of the invention will suggest themselves to those skilled in the art, it being understood that the described embodiment is presented for purposes of illustration only and is not to be regarded in a limiting sense.

I claim:

1. In an ice making machine, the combination of means for forming ice, means for harvesting the formed ice, a storage bin placed below the ice forming means for receiving and collecting the harvested ice, and means responsive to the collection of a predetermined supply of ice in the storage bin for discontinuing operation of the machine, said last mentioned means comprising a supporting bracket, motor means normally supported in a first position and pivotally mounted for movement in a substantially vertical direction on said bracket, an arm connected to the motor means for movement in a substantially vertical direction, a switch in the control circuit of the machine mounted in operative relation to the motor means, obstruction of the movement of said arm by a predetermined accumulation of ice in said storage bin pivotally moving said motor means in said substantially vertical direction from the first position to a second position to actuate the switch to discontinue

operation of the machine, removal of said obstruction returning the motor means by forces of gravity from said second position to said first position to re-initiate said ice making operation.

2. An ice making machine according to claim 1 wherein said motor means includes a prime mover having a power transmitting shaft, means for connecting said shaft to said bracket, and a member connected to said bracket, said last mentioned means and said member serving to support said motor means on said bracket when the motor means is in its first operating position.

References Cited in the file of this patent

UNITED STATES PATENTS

2,077,820	Arp	Apr. 20, 1937
2,400,141	Shaffer	May 14, 1946
2,595,588	Lee	May 6, 1952
2,685,952	Hamlin	Aug. 10, 1954
2,717,496	Anderson	Sept. 13, 1955

FOREIGN PATENTS

486,075	Great Britain	May 30, 1938