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[54] **ICE DISTRIBUTION AND LEVEL CONTROL**

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[51] **Int. Cl.** **G01n 11/14**

[58] **Field of Search** 62/136, 137; 222/64; 200/61.2, 61.21; 73/59, 60

[56] **References Cited**

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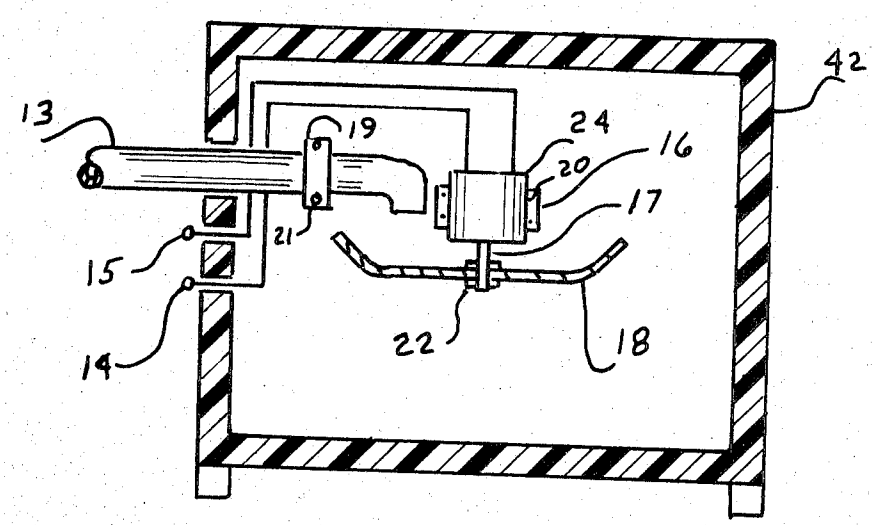
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Primary Examiner—William E. Wayner

[57] **ABSTRACT**

An apparatus for controlling filling of an ice bin from an ice refrigeration apparatus where the ice is added to the bin and distributed by a rotating slinger powered by an electric motor and including a switch in the refrigerator power supply. When ice accumulates in the bin, it drags the slinger and increases the power requirements to the motor. This is reflected as a current change. A level detector senses current flow outside a permitted range. The detected change opens the switch and turns off the refrigeration equipment.

9 Claims, 3 Drawing Figures



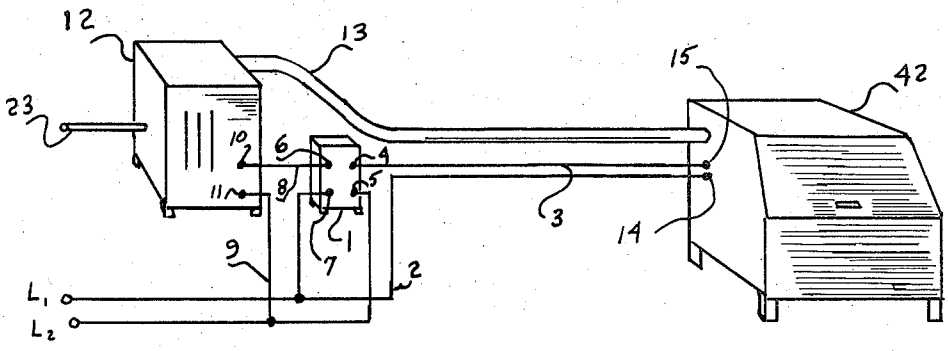


Fig 1

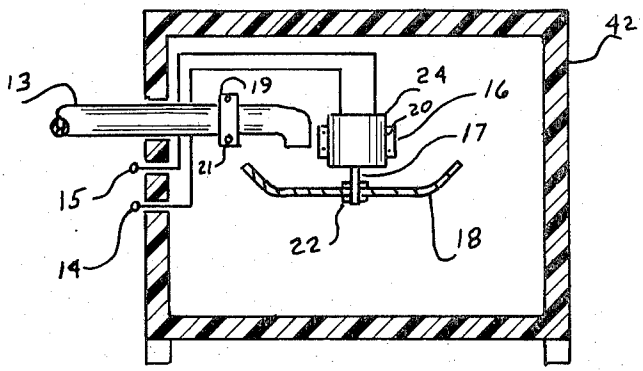


Fig 2

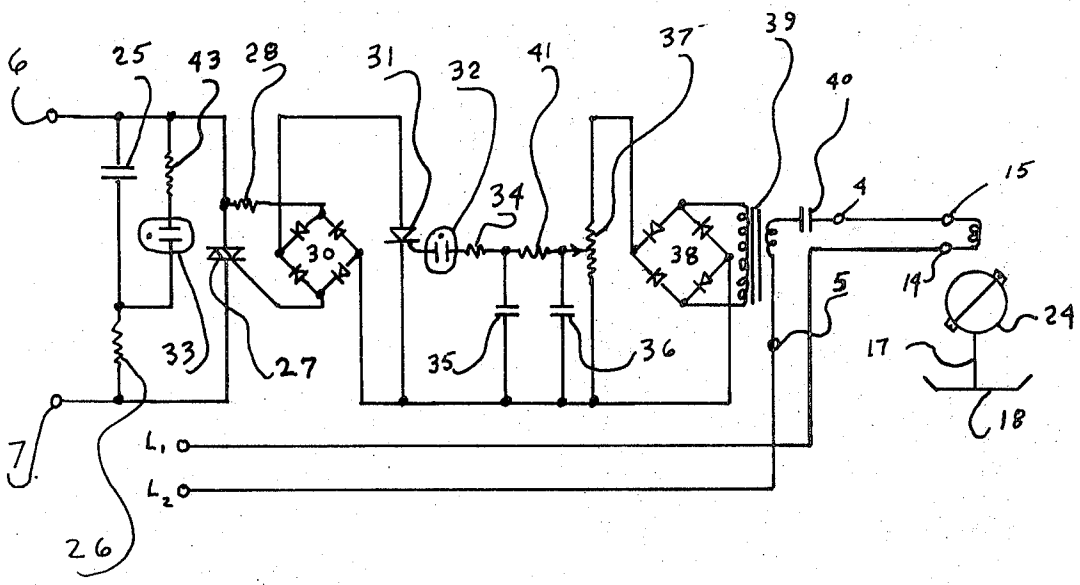


Fig 3

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ICE DISTRIBUTION AND LEVEL CONTROL

The present invention relates to ice machine distribution and level controls and more particularly, to cafe-type ice machines, remotely feeding ice storage bins. Still more particularly, this invention relates to ice machines feeding remotely located bins in which the control of the ice machine is located in and dependent on the level of ice in the remote ice storage bin. More particularly, this invention relates to electrically powered ice machines whose power is switched on or off by means located in and dependent on the level of ice in the remotely located ice storage bin.

General objects of the present invention are to provide for the distribution of ice in the remote bin in a level and uniform manner and to cause the ice machine to be turned on and off in a manner dictated by the level of ice in the bin and by this level of ice alone.

A more specific object of this device is to incorporate in the same simple element both the means for uniformly distributing the ice within the bin and the means for shutting off and turning on the ice machine, dependent only on the level of ice in the bin.

A more specific object of this invention is to provide an on-off control utilizing solid state switching techniques with increased reliability and life.

Another object of this invention is to provide a means of immediately switching the ice machine on as soon as the level of ice in the bin drops below a certain finite elevation,

Still another object of this invention is to provide a means of distribution and control of ice easily produced and installed on a large number of ice machines currently in use in cafes, lounges, hotels, theaters and the like, such installation being easily made at the location of the ice machine and with a minimum of disruption of the supply of ice used daily by the owner of the ice machine.

Other objects of this invention will in part become obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combination of elements and arrangement of parts, which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawing in which:

FIG. 1 is a perspective view of ice machine **12** connected by flexible delivery means **13** to ice storage bin **42** which may be located at a convienient point from which ice is to be dispensed. Ice machine **12** is also connected by pipe **23** to a water supply and electrical cable from terminal **11** to one side of a suitable power line, such cable is numbered **9** on FIG. **1**, and ice machine terminal **10** is connected by cable **8** to one terminal of control box **1**, hereinafter referred to as binfil. Terminal **6** of binfil is connected to terminal **10** of ice machine **12** and terminal **7** of binfil is connected to the other side of aforementioned power line. Thus it is seen that should terminals **6** and **7** of binfil be connected together, ice machine **12** would be connected across the line and caused to start. One side of power line L–1 is connected by conductor **2** to remotely located ice machine terminal **14**. The other side of the line is connected to terminal **5** of binfil. Terminal **4** of binfil is connected by conductor **3** to terminal **15** of binfil.

FIG. **2** is modified cross section of ice bin **42**. Flexible delivery means **13** enters into interior of ice bin **42** and is held by bracket **19** which in turn is fastened by fastening means **21** to an inside wall of ice bin **42** in a position to downwardly direct the ice discharge onto revolving distributing means **18**. In the embodiment shown, the end of flexible delivery means **13** is bent to more convieniently deposit the incoming ice at a point close to the center of revolving distributing means **18**. This is certainly not the only manner in which the ice may be deposited on said revolving distributing means. For example, it may be more convienient in a given installation to bring the flexible delivery means **13** in from the top of ice bin **42**. In this case there would be no necessity for bending the end of the delivery means. In the preferred embodiment, the location of motor **24** is as high a point as is practical in the ice bin **42** in order to provide for maximum ice storage capacity below the horizontal revolving distributing means **18**. Motor **24** is therefore mounted by means of brackets **16** and attachment means **20** to the interior of ice bin **42** in a manner to allow free revolving of revolving distributing means **18**. Leads from motor **24** are brought through walls of ice bin **42** to terminals **14** and **15** and for connection to an electrical distribution system. All motor leads are insulated from each other and from any contact with walls of ice bin **42**. Motor shaft **17** is threaded and extends through a hole of slightly larger size in revolving distributing means **18**. This hole is located in the center of distributing means **18**. The motor shaft **17** is attached to revolving distributing means **18** by a lock nut threaded onto motor shaft **17** on either side of revolving distributing means **18**. It is concievable that motor **24** may in some instances be mounted exteriorly to ice bin **42** and shaft **17** in this instance would have to be long enough to pass through the wall of ice bin **42** and thence be attached to revolving ice distributing means **18**. It is also possible that revolving distributing means may take the form of a drum revolving on a horizontal axis rather than a vertical as shown in this embodiment. In this case, the ice would be distributed in one direction rather than in a full circle as is shown in this embodiment.

FIG. **3** is a circuit schematic of the binfil located within control box **1**. **6** and **7** are the ice machine control terminals and **4** and **5** are the signal input terminals from shaded pole motor **24**. The inductance of motor **24**, the capacitance of oil-filled capacitor **40** forming creative element and the inductance of primary of transformer **39** form a series circuit in which the current is a function of the values of the inductances and capacitances therein. Since the inductance of a shaded pole motor increases with increasing speed of rotation, which corresponds with a reduction of load, it is evident that with a fixed line frequency, a value of capacitor **40** may be chosen to produce a current flow which results in substantially line voltage appearing at terminals **14** and **15** of motor **24** when motor **24** is revolving at its full speed and at no other time. Hence, when distributing means is substantially free to turn, current flow is sufficient to cause a high signal voltage to appear across the secondary of transformer **39**. On the other hand, if distributing means is restrained from reaching full speed such as will be occasioned by the friction of ice already distributed in the bin, voltage across secondary of transformer **39** will be low. The changes in voltage level are supplied to a detector

means to detect significant changes. This signal voltage is rectified by full wave bridge rectifier **38,** tapped by potentiometer **37,** filtered by filter network **34, 35, 36** and **41.** Capacitors **35** and **36** are of sufficient value such that minor speed variations of revolving distributing means **18** such as might be caused by large "slugs" of ice being discharged are integrated and operation is continued. When signal voltage is high, neon bulb **32** which forms a voltage level means, is caused to ionize and go into conduction caused by the positive potential at the juncture of **34** and **41** and the negative potential of the cathode of SCR **31.** This positive potential may be raised or lowered by means of potentiometer **41.** With positive bias applied to its gate terminal, SCR **31** goes into heavy conduction, effectively shorting full wave bridge rectifier **30** and causing TRIAC **27** to be turned "on" through resistor **28.** Since TRIAC **27** is a bi-directional device, it conducts at a very early point in the alternating current cycle as long as signal voltage is high. It should be noted that TRIAC **27** also turns off every time the ac voltage goes thru zero. This is insured by dv/dt preventer network of capacitor **25** and resistor **26.** Thus, TRIAC **27** behaves as a static switch, being turned on or off in accordance with the magnitude of signal voltage the TRIAC **22** provides a binary off-on signal and always being switched at a point close to zero voltage. There exists enough ripple present at the neon bulb to tend to synchronize the ionization of neon bulb **32** to the rising voltage of the AC cycle.

When signal voltage is low as occasioned by the slowing or stalling of motor **24** due to the friction of distributed ice on revolving distributing means, there is no longer a high enough voltage to maintain ionization of neon bulb **32** and it ceases to conduct. This removes the forward bias from TRIAC **27** which reverts to its blocking or off condition on the next ac cycle. Neon bulb **33** and resistor **43** provide a source of light when TRIAC **27** is in its blocking or "off" state. This source of light tends to stabilize the firing or ionizing point of neon bulb **32** since the two neon bulbs are physically located adjacent to one another.

Thus it is seen that ice machine **12** is turned on or off by the level of ice in ice bin **42.** It is also seen that ice machine **12** will be turned "on" as soon as enough ice has been removed or has melted to free revolving distributing means **18.** Thus the ice machine **12** is turned "on" or "off" directly by the level of ice in ice bin **42.**

In the preferred embodiment, all the circuitry shown on FIG. **3** is incorporated on a plug-in circuit board with the exception of motor **24,** shaft **17** and revolving distributing means **18** which are shown for illustration. It should be pointed out that the ionizing or "firing" voltage of neon **32** is on the order of 10 volts higher than the "maintaining " voltage of this neon bulb. This "electrical overtravel" results in a degree of immunity from sudden voltage drops caused by the sudden load imposed by the turning on of ice machine **12.** It also results in the revolving distributing means reaching a high rotational speed to iniate turning on of ice machine and a low, approaching stall, rotational speed to iniate turning off of ice machine **12** resulting in positive overall action of binfil.

Refering again to FIG. **1,** the arrangement and relative position of ice machine **12** control box **1,** power line L-**1** and L-**2** and ice bin **42** are diagramatic only and are in no way intended to limit this invention to that shown on the drawing.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above construction and installation and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown on the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An apparatus cooperative with an ice storage bin which is filled from an electrically powered ice refrigeration machine wherein the ice is stored in the bin by the present apparatus, comprising:

an electric motor having a shaft;

an ice distributing means operatively connected to said shaft;

an electrical distribution system connected to said motor for providing current thereto for its operation;

detector means cooperatively arranged relative to said electrical distribution system, said detector means detecting a change in the operative condition of said motor as will occur on accumulation of ice in the bin to a level to interfere with operation of said ice distributing means;

said detector means comprising

a reactive circuit element cooperatively connected relative to said motor and said electrical distribution system as to form a signal which varies with load on said motor;

level means connected to said circuit element for rejecting varying signals outside a specified range and accepting signals in a specified range; and,

switch means operated by the signal from the level means of said detector means and adapted to be wired to the ice refrigeration machine for turning it on to make ice, said switch means turning the ice refrigeration machine on and off by providing thereto a binary signal as determined by said level means.

2. The apparatus of claim **1** wherein said reactive circuit element is a capacitor serially connected to said motor.

3. The apparatus of claim **1** including a transformer connected as an input for said detector means, and said detector means is input to a rectifier circuit which forms a DC level input to said level means.

4. The apparatus of claim **3** wherein said level means is a neon lamp which blocks its output and the output thereof is connected to a silicon controlled rectifier.

5. The apparatus of claim **4** including side by side rectifiers in an AC circuit which is adapted to be connected to the ice refrigeration machine.

6. The apparatus of claim **5** wherein said rectifiers form a triac.

7. The apparatus of claim **1** including in said switch means an electronically triggered component having a

pair of terminals adapted to be connected in series to a voltage source and the electrically powered ice refrigeration machine.

8. The apparatus of claim 1 wherein said distributing means comprises a disc shaped slinger mounted on a shaft below an opening means where ice is dropped onto said slinger and is thrown by the rotation thereof into the storage bin until said slinger encounters difficulty in rotating and then slows said motor to alter the current flow thereof.

9. The apparatus of claim 1 including a disc mounted on said motor shaft.

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