Sept. 14, 1948. L. V. LUCIA 2,449,132

REFRIGERATOR FOR MAKING AND USING CRUSHED ICE

Filed Sept. 22, 1944 2 Sheets-Sheet 1

Fig. 1.

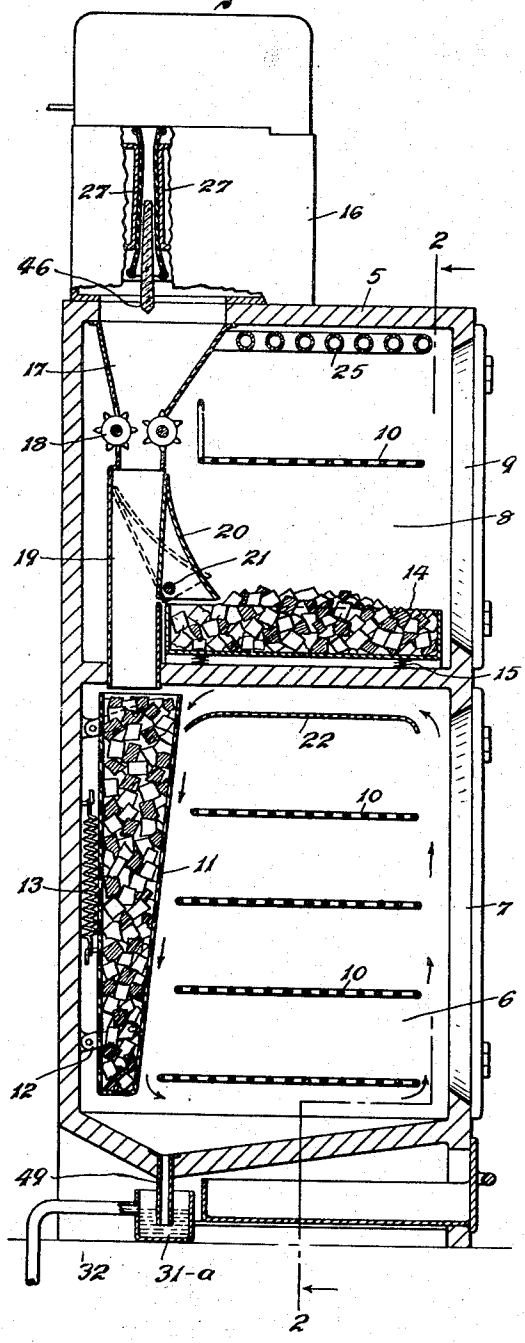
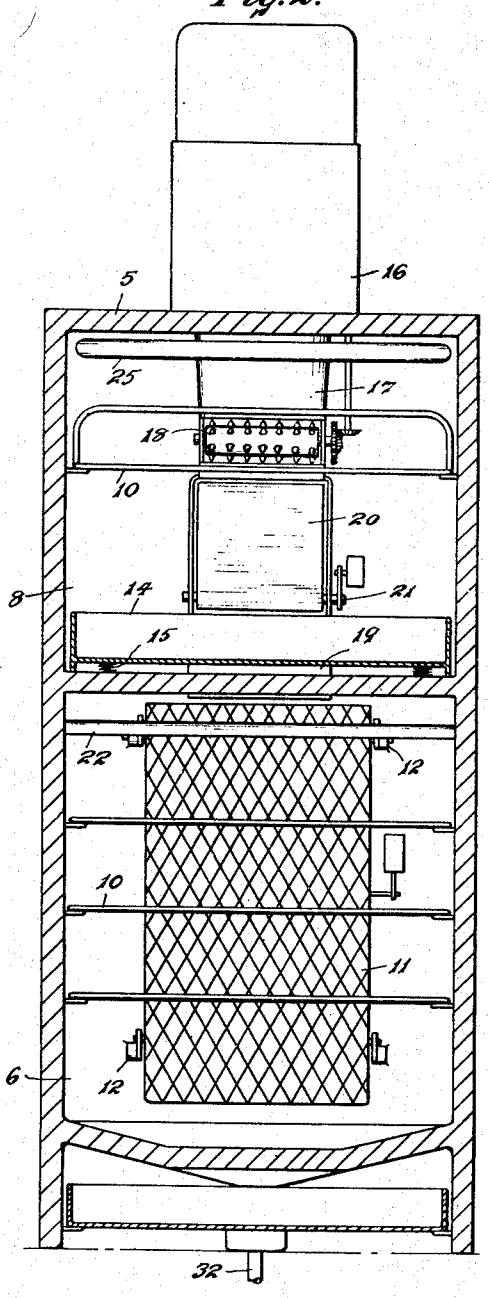


Fig. 2.



INVENTOR.

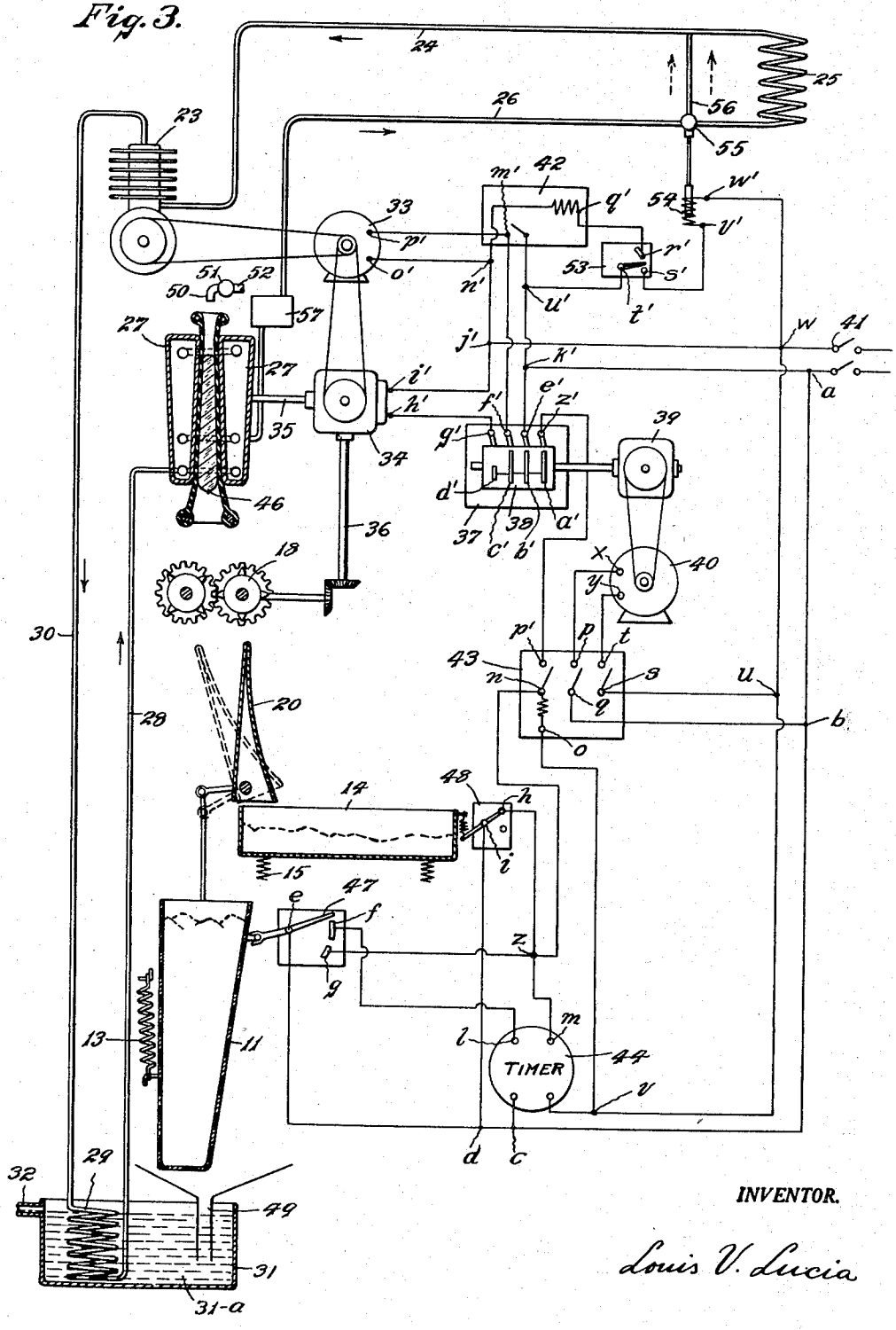
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Fig. 3.



Patented Sept. 14, 1948

2,449,132

UNITED STATES PATENT OFFICE

2,449,132

REFRIGERATOR FOR MAKING AND USING CRUSHED ICE

Louis V. Lucia, West Hartford, Conn.

Application September 22, 1944, Serial No. 555,275

5 Claims. (Cl. 62—2)

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This invention relates to a Refrigeration system and more particularly to a system for cooling storage compartments of refrigerators used for the preservation of foods and the like.

It is well known that, when such compartments are cooled by automatic refrigeration using a system of tubes, which in turn are cooled by a refrigerant such as ammonia, freon or the like, a great deal of dehydration takes place in the foods. This is particularly true with meats and the like where the dehydration is responsible for a considerable loss in the weight of the meats and their nutritional values.

It is also well known that the most satisfactory and efficient manner of cooling such refrigerator compartments is by ice, because practically no dehydration can take place in refrigerators that are so cooled, due to the humidity that is supplied by the ice itself, and the melting ice carries away odors and dirt from the compartment.

An object of this invention, therefore, is to provide a system for cooling a refrigerator compartment with ice that is produced and delivered to said compartment automatically by an ice making device or machine.

A further object of this invention is to provide a refrigerator box having a cooling compartment which is adapted to receive ice from an ice making device.

A further object is to provide such a box having a cooling compartment which is cooled by ice that is automatically supplied thereto as needed, and a separate compartment for storing surplus quantities of said ice.

A further object is to provide such a refrigerator box having two compartments adapted to contain ice therein and means for automatically controlling the distribution of ice between said compartments.

Further objects and advantages of this invention will be more clearly understood from the following description and from the accompanying drawings in which:

Fig. 1 is a side view, partly in central vertical section, through a refrigeration box embodying my invention.

Fig. 2 is a front view thereof on line 2—2 of Fig. 1.

Fig. 3 is a diagrammatic view illustrating my novel refrigeration system with the electric circuits and devices for automatically controlling said system.

As shown in the drawings, the numeral 5 denotes a box, such as usually provided for commonly known refrigerators, which may be of well known construction having walls suitably insulated for high operating efficiency.

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In the embodiment illustrated, the said box is preferably provided with a lower compartment 6 having a door 7 and an upper compartment 8 having a door 9.

Each of said compartments may have shelves 10 for suporting foods or articles to be cooled or preserved therein.

The bottom compartment 6 is provided with a bin, preferably in the form of a basket 11 which is suspended on hinged brackets 12 by means of a spring 13. The upper compartment 8 is provided with a tray or a basket 14 which may also be suspended upon springs 15 resting upon the bottom of the compartment 8.

A machine for automatically producing ice, such as fully described in my co-pending application Serial No. 526,724, filed March 16th, 1944, now Patent No. 2,435,285 granted Feb. 3, 1948, is mounted upon the top of the said cabinet, as indicated at 16, for producing cakes of ice and supplying them to said cabinet in the manner to be more fully described hereinafter.

As shown, the refrigerator cabinet is provided with a hopper 17 having a suitable breaker mechanism 18 positioned thereunder and a chute 19 below said mechanism. A deflector 20 is provided at one side of said chute and pivoted, as at 21, for deflecting ice into the upper compartment 8.

It will be noted that the lower compartment is provided with a baffle 22 which aids in circulating the air in the direction of the arrows and past the ice containing bin 11 as shown in Fig. 1.

As illustrated in Fig. 3, my improved system may include a compressor 23 which is connected in a refrigeration circuit extending from said compressor, through a conductor 30 to the condenser coil 29 which may be cooled by air, by the melted ice, 31*a*, or by other suitable means, then from said coil, through a conductor 28 to the freezing members 27 of said ice machine. From said members the refrigeration circuit extends through a conductor 26 to a cooling coil 25 or a by-pass 51 and, from said coil or by-pass, back to the compressor 23 through the conductor 24. It will be noted that a container 31 having an overflow pipe 32 may be provided to receive liquid from the ice, as it melts in the bin 11, and retain said liquid to aid in cooling the condenser 29 which is immersed therein.

The compressor 23 is driven by a motor 33 which also drives the speed reducer 34 for oper-

ating the freezing unit, as fully described in said co-pending application, by means of the shaft 35. A shaft 36 also extends from said speed reducer for driving the breaker mechanism 18. If desired, a controller such as indicated at 37, may be provided for automatically controlling the operation of the freezing unit and refrigeration system by means of a rotor 38 which is driven by a speed reduction unit 39 that in turn is driven by a motor 40.

When the switch 41 is closed, current will flow through the controller 37 to the motors 33 and 40 through the relays 42 and 43. If desired, a timer, indicated at 44, may be employed for switching the mechanism into an off-peak supply of current for the purpose of economy in the operation of the system.

The operation of my improved refrigerating system is as follows:

The ice is formed in the automatic machine indicated at 16 in the form of cakes or plates as indicated at 46. The said plates are released from the machine, as fully described in the above mentioned co-pending application, and delivered therefrom into the hopper 17. As they enter said hopper, they are received by the breaker mechanism 18 and broken up thereby into small pieces. The pieces of ice will then pass downwardly through the chute 19 and into the bin or basket 11. When the said basket has been filled with ice to a predetermined weight, the spring 13, extending under said weight, will cause operation of the deflector 20 to the position indicated in dotted lines in Fig. 3, so that subsequent pieces of ice will be deflected from the chute into the basket 14.

When both the said bin 11 and basket 14 are filled to capacity, they will operate to open the switches 47 and 48 to thereby stop further production of ice by the machine 16. When either the basket 14 or the bin 11 call for ice, the circuit will be closed by either the switch 47 or the switch 48 and production of ice by the machine 16 will again be resumed.

In order to maintain the compartment 8 at a much cooler temperature than the compartment 6, so that it may be used as a freezing compartment, I prefer to locate the coil 25 therein. Thus, the ice in the tray 14 will be prevented from rapid melting and, at the same time, the said ice will act to prevent dehydration within said compartment 8 while it is being stored therein for subsequent removal upon being needed for serving.

As the ice in the bin 11 melts, the liquid therefrom will pass through the drain tube 49 into the container 31, 31—*a*, and out of said container through the drain pipe 32.

Referring more in detail to Fig. 3, the electrical circuits shown operate in the following manner.

The switch 41 connects the refrigerator to the power circuit in the building. The current is conducted from the junction points *a* and *w* to junction points *b* and *u* which lead the current to the switch terminals *s* and *q*. When switch 43 is closed, these make contact with points *t* and *p*, leading current to the binding posts *x* and *y* of the motor 40. The motor 40 then operates gear reducer 39 which in turn rotates the cycle contact drum 38.

In order to initiate the operation of motor 40, current must be brought to the contacts *o* and *n* of the switch 43 operating coil. One terminal of this switch coil is connected permanently to the junction point *v* on one side of the main electrical circuit. The other side, *n*, is connected to the junction point *z*, which has a further 3-way connection thereto.

As shown in said Fig. 3 the ice basket 11 is full and there is no contact from the *a* side of the line and the pivot point *e* of switch 47 with either the "satisfactory" contact *f* or the "low" contact *g*. If the contact *a* were in direct connection with the "low" contact *g*, as when the quantity of ice in basket 11 is at an unsatisfactory low level, and it is desired to make ice regardless of the time of day, current flows from the *a* side of the line through *e*, *g*, *z*, *n*, *o*, *v*, and *w*, thus closing the switch 43 and starting the rotation of cycle contact drum 38—and, in consequence, the ice producing cycle. If, however, there is a satisfactory amount of ice in basket 11, the contact *e* will be in contact with *f* and the current will flow through the timer 44 by way of the conductors *f*—*l*. Since said timer is arranged to close the circuit only in "off-peak" hours and consequently at a lower electrical rate, this circuit will be completed only when the electrical rate is favorable and the current will flow through *m*, *z*, *n*, *o*, *v*, and *w* to start the ice-making cycle. During other hours of the day, the timer 44 will interrupt the circuit and prevent ice-making for refilling basket 11 until it gets to a "low" level.

If, at any time, however, the supply of ice, for use as such, is low in the tray or basket 14, switch 48 is closed with a snap action making a circuit from the *a* side of the line through junction point *d*, pivot *i*, contact *h*, junction *z*, and *n*, *o*, *v*, and *w*, back to the line. This closes switch 43 and starts the ice-making cycle. If, at the completion of the cycle, basket 14 is adequately filled, the ice-making cycle will stop. If, however, the supply in 14 is still inadequate, the cycle will be repeated until the contact between *i* and *h* is broken.

Thus it will be seen that the supply of ice in either basket 11 or tray 14 will control the operation of the ice-making machine 27 to automatically replenish the supply of ice and, in the case of basket 11, the main supply of ice will be replenished mainly in "off-peak" times in order to utilize the low electrical rates.

It will be noted that once an ice-making cycle is started, current from the *w* side of the line will pass through the circuit *v*, *o*, *n*, *p'*, *z'*, *a'*, *b'*, *e'* to *k'* on the *a* side of the line so that, until drum 38 has completed a turn, which is sufficient to complete one ice-making cycle, the circuit through the holding coil switch 43 will remain complete and cannot be interrupted by breaking of the circuit in either switch 47 or switch 48.

When the cycle contact drum 38 has started its rotation, current will flow from the *a* side of the line through *k'*, *e'*, *b'*, *c'*, *f'*, *m'*, to *p'*, which is one terminal of motor 33 that actuates both the compressor 23 and the gear box 34. The other terminal *o'* of motor 33, returns the current through *j'* to the *w* side of the line. Thus as long as drum 38 is in rotation, motor 33 will remain in operation. The gear box 34, which actuates both the releasing of ice cake 46 and the operation of crushing rollers 18, is actuated by current from contact arc *d'* through *g'*, *h'*, *i'*, and *j'* back to the *w* side of the line.

An electric clutch, not shown, is provided in the gear box 34 between the terminals *i'* and *h'* but said clutch does not operate until a substantial length of time after the initiation of the ice-making cycle. This permits the ice to be frozen hard

and dry prior to its release from the ice-making machine 27.

Water is replenished to the ice-making machine from a nozzle and measuring device fed by a water supply as indicated respectively at 50, 51 and 52. These may be of any suitable type.

It will further be noted that the expanded vapor from the ice-making machine 27 passes through pipe 26 and coil 25 before returning to the compressor by way of pipe 24. If the thermostat 53 indicates that the temperature in the freezing compartment is adequately low, the valve solenoid 54 opens the by-pass valve 55, which is normally closed, and permits the cold gasses to pass through by-pass 56 instead of through coil 25. This prevents the freezing compartment from reaching too low a temperature. The thermostat circuit is controlled by current from the *a* side of the line through *k'*, *u'*, *t'*, and either *r'* or *s'*, depending upon the temperature, *v'*, *w'*, and back to the *w* side of the line. Completion of this circuit will by-pass the cold gasses around the freezing compartment coil 25. If, however, the thermostat is closed on the circuit *t'—r'* by too warm a condition in the freezing compartment, the current will flow through *q'*, *n'*, *j'*, and back to the *w* side of the line. This closes switch 42 to the terminal of motor 33, starting the compressor in order to obtain additional refrigeration in coil 25.

Although the refrigerant may pass through the ice-making machine 27 and cool the water therein, should a solid cake of ice 46 be therein no harm will result and evaporation will not take place to any material extent. However, the evaporation normally takes place in the receiver 57 if not in the machine 27 so that liquid refrigerant will not pass over to the compressor. When a predetermined "satisfactory" condition has been achieved in the freezing compartment, the contact between *t'* and *r'* is broken, thus stopping the compressor 23 and shutting off the cooling cycle.

From the above, it will be clearly understood that I have provided a novel automatic refrigeration system for cooling a refrigerator box by means of ice which is produced automatically by a machine that is closely associated with said refrigerator. My improved system will therefore eliminate the common and serious objections to automatic refrigeration, which are due to the causing of dehydration and the retention of odors and dirt by foods while, at the same time, affording all of the advantages of fully automatic refrigeration plus an emergency supply of ice which will prevent food spoilage even if the electric power supply should be cut off for several days.

I claim:

1. In a refrigerating system, the combination of a cabinet having a storage compartment and a cooling compartment therein, an electrically operated machine for producing ice positioned above said cabinet and adapted to deliver pieces of ice through an opening in the top of said cabinet, a chute extending downwardly within said cabinet, means in said storage compartment for receiving ice from said chute, and means in said chute responsive to the quantity of ice in said compartments for deflecting the ice from said chute.

2. In a refrigerating system, a cabinet having a storage compartment and a cooling compartment, a chute leading from the top of said cabinet to one of said compartments, means for deflecting ice from said chute to the other compartment, a machine for producing ice located in the upper portion of said cabinet and adapted to deliver ice therefrom into said chute, the said deflecting means being responsive to the weight of ice in one of said compartments for directing the supply of ice through said chute.

3. In a refrigerating system, the combination of a cabinet having a plurality of compartments therein, a breaker mechanism, containers in said compartments for containing broken ice, means for producing pieces of ice and delivering same to said containers through said breaker mechanism, and switching means responsive to the weight of ice in said containers for controlling the distribution of broken ice into said compartments after its passage through said breaker mechanism.

4. In a refrigerator comprising a cabinet having a plurality of compartments therein, mechanism for producing pieces of ice located upon the top of said cabinet and adapted to deliver said pieces through an opening therein, means for automatically directing said ice into one of said compartments when a predetermined amount of ice is contained within another compartment, and a breaker mechanism for breaking said pieces of ice before reaching said distributing means.

5. In a refrigerating system, the combination of means for producing ice including a compressor, a cabinet having a compartment therein, means for delivering ice from said ice producing means to said compartment for cooling the compartment, a sump at a level below said compartment for receiving the liquid from ice melting therein, and a pipe connection to said compressor including a cooling coil located within said sump for cooling the material passing through said pipe connection.

LOUIS V. LUCIA.

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