

Oct. 8, 1935.

L. GREEN

2,016,327

REFRIGERATING APPARATUS

Filed July 7, 1933

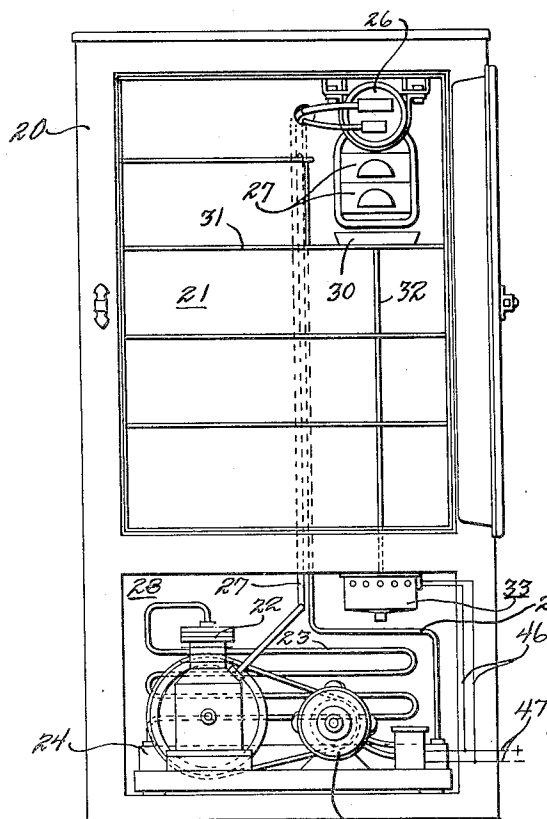


Fig. 1

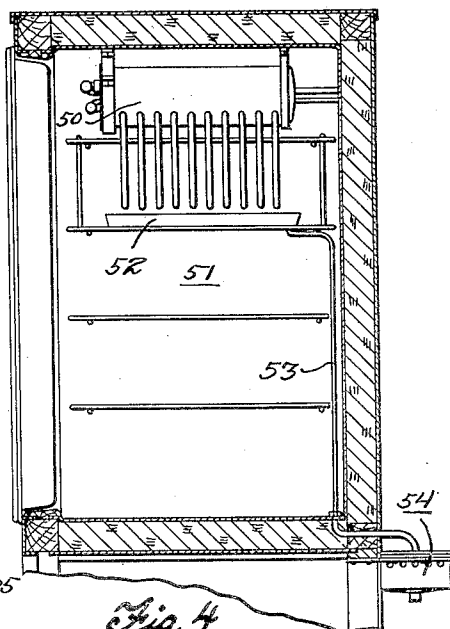


Fig. 4

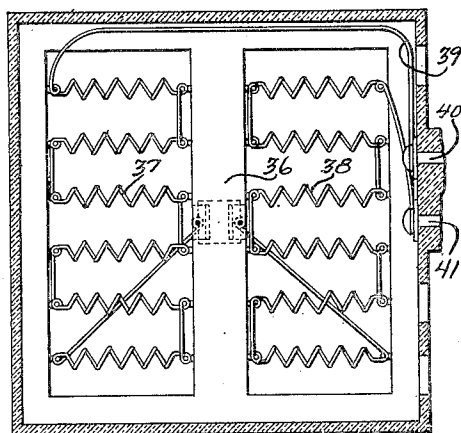


Fig. 3

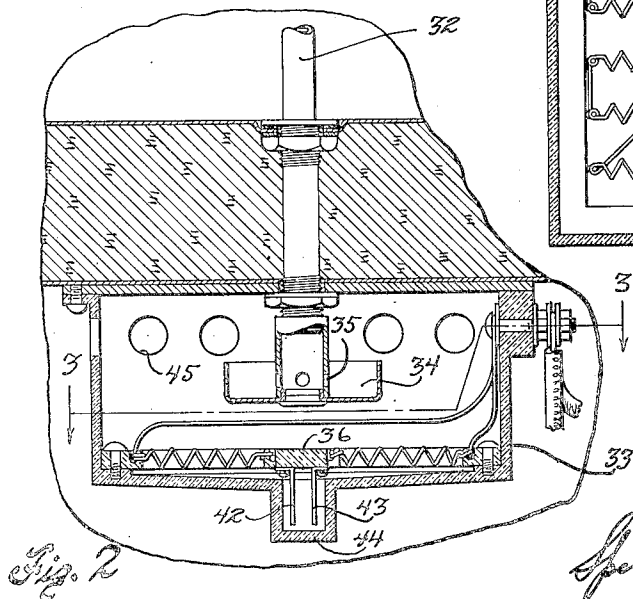


Fig. 2

INVENTOR
Leonard Green
BY
Spencer Hardman & The
ATTORNEYS

UNITED STATES PATENT OFFICE

2,016,327

REFRIGERATING APPARATUS

Leonard Green, Philadelphia, Pa., assignor, by
mesne assignments, to General Motors Corpo-
ration, a corporation of Delaware

Application July 7, 1933, Serial No. 679,284

21 Claims. (Cl. 62—2)

This invention relates to refrigeration and more particularly to a method of and apparatus for disposing of the water removed from the medium to be cooled by the refrigerating apparatus.

In producing refrigeration of air or gas, moisture is removed therefrom by reason of the fact that the cooling unit is maintained at a temperature below the temperature of the air or gas to be cooled. The amount of dehydration depends, of course, upon the difference in temperature between the cooling unit and the air or gas to be cooled. If the cooling unit is maintained at a temperature below 32°, the moisture removed from the air is collected on the cooling unit in the form of frost. If, on the other hand, the temperature of the cooling unit is maintained above 32°, the moisture removed from the air is retained in the form of water.

In either case it is necessary to provide means for disposing of the water removed from the air. Heretofore, this has been accomplished either by permitting the water to accumulate in a receptacle within the refrigerator or by means of a drain pipe communicating with the exterior of the refrigerator for draining the water from the cooling unit to the outside of the cabinet.

While these methods and apparatus for removing the water have been successful to a certain extent, they are objectionable in that they require constant attention if trouble from overflowing is to be avoided.

My invention aims to overcome all these prior difficulties and provides a method of and apparatus for automatically disposing of the water as fast as it accumulates.

The objects of my invention include a method of and apparatus for utilizing electrical means for vaporizing or otherwise disposing of the water removed from the air or gas to be cooled by the cooling unit.

A further object of my invention includes the method of and apparatus for collecting the water accumulated on the cooling unit, removing the water to a point outside of the cabinet, and automatically initiating the operation of a heating device for evaporating the water as soon as a certain amount of water has accumulated.

A still further object of my invention includes the method of and apparatus for automatically causing an electric current to flow through the body of collected water through resistance heaters located in heat exchange relation with the water in order to cause the water to vaporize

and dissipate to the atmosphere outside the cabinet.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing, wherein a preferred form of the present invention is clearly shown.

In order to illustrate my invention, I have shown various modifications of apparatus for carrying out the process.

In the drawing:

Fig. 1 discloses a refrigerator incorporating one form of apparatus carrying out my novel combination of steps;

Fig. 2 is a fragmentary sectional view of a portion of the water disposing apparatus shown in Fig. 1;

Fig. 3 is a sectional view along the line 3—3 of Fig. 2; and

Fig. 4 is a vertical sectional view showing a modified form of water disposing apparatus.

Referring to the drawing and more particularly to Fig. 1, there is shown a refrigerator cabinet 20, having a food compartment 21 which is provided with a cooling means in the form of a refrigeration system. This refrigeration system comprises a compressor 22, for compressing the refrigerant and for forwarding the compressed refrigerant to a condenser 22 where the compressed refrigerant is liquefied and collected in a receiver 24. From the receiver 24 the liquid refrigerant is forwarded through a supply conduit 25 to an evaporating means or cooling unit 26 located within the food compartment 21. The liquid refrigerant within the evaporator 26 evaporates and absorbs heat from the air within the food compartment and is returned through the return conduit 27 to the compressor 22. The compressor 22 is driven through pulley and belt means by an electric motor 29 which is connected to an electrical supply circuit 47. The compressor, condenser, and receiver are located within the machine compartment 28 located beneath the food compartment 21 but insulated therefrom.

The evaporation, which takes place within the cooling unit 26, normally maintains the temperature of the cooling unit a considerable amount below the temperature of the air within the food compartment 21. This temperature is normally below the dew point of the air within the food compartment 21 and therefore moisture from the air is caused to condense upon the surfaces of the cooling unit 26. The cooling unit 26 is provided with ice cube trays 27 and for

this reason, at least when it is desired to freeze water within these trays, it is necessary that the temperature of the cooling unit be maintained below the freezing point. This causes the moisture, which condenses upon the surfaces of the cooling unit 26, to freeze thereon in the form of frost.

Inasmuch as this frost acts as an insulating means and lowers the efficiency of the apparatus, it is necessary that this frost be removed. In order to remove this frost, some suitable means or method is used to increase the temperature of the cooling means above the freezing point so that this frost will melt from the surfaces of the cooling unit. It thus becomes necessary to provide for the collection and disposal of this melted frost.

Heretofore this has been done ordinarily by merely providing a dish or tray beneath the cooling unit so as to collect this melted frost. But this requires constant attention so as to prevent the dish or tray from running over and requires that the tray be emptied as often as is necessary. In order to overcome this objectionable situation, I provide a collecting means in the form of a tray 30 which is supported directly beneath the cooling unit 26 by means of the shelf 31. The moisture or frost which melts from the surfaces of the cooling unit is often termed drip water. This drip water which is collected by the tray 30 is conducted by the tube 32 to a receptacle 33 located within the upper portion of the machine compartment 28.

Referring now more particularly to Fig. 2, there is shown a receptacle 33, formed of a suitable insulating material, such as hard rubber, which is fastened to the top of the machine compartment 28. The tube 32 has its lower end extending into the interior of the receptacle 33. The lower end of this tube is provided with a liquid trap 34 in the form of a cup-shaped member into which the drip water is fed through apertures 35. This trap prevents the flow of warm air from the receptacle and from the machine compartment up through the tube 32 into the food storage compartment 21.

The drip water overflows from the trap 34 into the receptacle 33. The receptacle 33 is provided with a porcelain supporting plate or grid 36 at its bottom portion. The porcelain grid is provided with a plurality of coiled electrical resistance wires, one portion 37 of which is situated upon one side and the other portion 38 of which is situated on the other side. One end of the coiled wires forming the portion 37 is connected by means of an electrical conductor 39 to a suitable binding post or terminal 40 while one end of the resistance wires forming the portion 38 is connected to a binding post or terminal 41. The opposite ends of the resistance wires forming these portions are connected to a plurality of electrodes 42 and 43. These electrodes project downwardly into a depressed portion 44 at the bottom of the receptacle 33. These electrodes 42 and 43 are separated and insulated from each other. Thus, there is a gap in the electric circuit which includes the electrodes, the resistance wires forming the portions 37 and 38, and the electrical conductors 46 which connect to the supply circuit 47. In this way, the electrodes are maintained constantly charged with electric energy but no current flows as long as the gap is present.

However, when the defrosting of the cooling unit occurs, the drip water flows down through the tube 32 and overflows from the trap 34 into

the bottom of the receptacle 33. This causes the lower portion of the receptacle 33 to be filled and the water bridges the gap between the electrodes 42 and 43 and thus permits an electric current to flow through the electric circuit which includes the resistance wires forming the portions 37 and 38. When the current flows through the resistance wires and also from one electrode to another, evaporation takes place by means of the heat produced by the flow of electric energy through the resistance wires and also by the electric current flowing through the water from one electrode to another. The evaporated moisture leaves the receptacle 33 through the apertures 45 provided in the side walls thereof. This evaporation continues as long as the electrodes are immersed within the water. As soon as the electrodes are uncovered, the electric circuit is broken and the current no longer flows through the circuit to cause heating or evaporation. In this way the electrodes in connection with the water form and automatic control for the heat and the drip water in the receptacle whereby heating begins as soon as the electrodes 42 and 43 are immersed in the water and terminates as soon as the electrodes are uncovered.

In Fig. 4 there is shown a modified form in which the cooling means is not provided with ice trays. It is therefore permissible to operate this cooling means or cooling unit 50 at temperatures above the freezing point so that moisture which is condensed from the air in the food compartment 51 will not form frost but will collect in the form of water or dew and be immediately collected within the tray 52 which is connected by means of the tube 53 to a receptacle 54 which is identical to the receptacle 33 with the exception that it is provided with a cover and is located at the back of the cabinet instead of being located within the machine compartment. With this form of apparatus, the flow of drip water into the receptacle 54 is more constant than that in the form shown in Fig. 1. In this apparatus the contacting of the drip water with the electrodes to close the electric circuit also controls the evaporation of the moisture in a manner similar to that shown and described with reference to Figs. 1 to 3, inclusive.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In the art of refrigeration wherein heat is removed from air to be kept cool by a cold body which causes condensation of moisture upon the cold body, the process which comprises automatically initiating the heating of the moisture to cause evaporation thereof whenever the moisture has accumulated to a certain amount.

2. In the art of refrigeration wherein heat is removed from air to be kept cool by a cold body which causes condensation of moisture upon the cold body, the process which comprises automatically initiating the heating of the moisture to cause evaporation thereof whenever the moisture has accumulated to a certain amount and automatically terminating the heating of the moisture whenever the amount of moisture has been reduced to a desired extent.

3. In the art of refrigeration wherein heat is removed from air to be kept cool by a cold body which causes condensation of moisture upon the cold body, the process which comprises collect-

ing the moisture from the cold body, and automatically initiating the heating of the collected moisture to cause evaporation thereof when the collected moisture has accumulated to a certain extent.

4. In the art of refrigeration wherein heat is removed from air to be kept cool by a cold body which causes condensation of moisture upon the cold body, the process which comprises collecting the moisture from the cold body and automatically initiating the heating of the collected moisture to cause evaporation thereof when the collected moisture has accumulated to a certain extent and automatically terminating the heating when the accumulation of collected moisture has been reduced a desired amount.

5. In the art of refrigeration wherein heat is removed from air to be kept cool by a cold body which causes condensation of moisture upon the cold body, the process which comprises collecting the moisture from the cold body and automatically initiating the heating of the collected moisture to cause evaporation thereof when the collected moisture has reached a certain level.

6. In the art of refrigeration wherein heat is removed from air to be kept cool by a cold body which causes condensation of moisture upon the cold body, the process which comprises collecting the moisture from the cold body and automatically initiating the heating of the collected moisture to cause evaporation thereof when the collected moisture has reached a certain level and automatically terminating the heating when the level of the collected moisture has been reduced.

7. In the art of refrigeration wherein heat is removed from air to be kept cool by a cold body which causes condensation of moisture upon the cold body, the process which comprises collecting the moisture and applying heat to the moisture under the control of the moisture to cause evaporation thereof.

8. A refrigerator having a compartment to be kept cool, a cooling means for cooling the compartment, said cooling means being adapted to condense moisture from the air in the compartment, means for collecting the condensed moisture, and means responsive to the accumulation of the moisture for heating the accumulated moisture to cause evaporation thereof.

9. A refrigerator having a compartment to be kept cool, a cooling means for cooling the compartment, said cooling means being adapted to condense moisture from the air in the compartment, means for collecting the condensed moisture, a plurality of electrodes insulated from each other, means for maintaining an electrical potential between the electrodes, and means for conducting the moisture into contact with the electrodes to cause evaporation thereof.

10. Refrigerating apparatus including a compartment to be kept cool, cooling means for cooling the air within the compartment, said cooling means having water dripping therefrom, an electric circuit having a gap therein, and means for bridging the gap with the drip water to close the electric circuit.

11. Refrigerating apparatus including a compartment to be kept cool, cooling means for cooling the air within the compartment, said cooling means having water dripping therefrom, an electric circuit and means for closing the electric circuit with the drip water.

12. Refrigerating apparatus including a compartment to be kept cool, cooling means for cooling the air within the compartment, said cool-

ing means having water dripping therefrom, an electrical refrigerant liquefying means connected to the cooling means, electrical means for removing the drip water, and a common electric circuit for supplying electric energy to the first and second named electrical means.

13. Refrigerating apparatus including a compartment to be kept cool, cooling means for cooling the air within the compartment, said cooling means having water dripping therefrom, a receptacle for collecting the drip water, and means responsive to the accumulation of water in the receptacle for removing the water therefrom.

14. Refrigerating apparatus including a compartment to be kept cool, cooling means for cooling the air within the compartment, said cooling means having water dripping therefrom, a receptacle located outside the food compartment for collecting the drip water, means for conducting the drip water to the receptacle, said last mentioned means including a trap for preventing the flow of air through the conducting means to the food compartment, and means responsive to the accumulation of water in the receptacle for removing water therefrom.

15. A refrigerating apparatus including a cabinet, means for cooling air adapted to flow thereover mounted in said cabinet, said cooling means having moisture dripping therefrom, means for collecting the drip water from said cooling means, means normally ineffective and rendered effective in response to a predetermined accumulation of drip water in said collecting means for causing evaporation and removal of drip water from said collecting means.

16. A refrigerating apparatus including a cabinet, means for cooling air adapted to flow thereover mounted in said cabinet, said cooling means having moisture dripping therefrom, means for collecting the drip water from said cooling means, a heating element for causing evaporation and removal of drip water from said collecting means, and means responsive to a predetermined accumulation of drip water in said collecting means for rendering said heating element effective.

17. A refrigerating apparatus including a cabinet, means for cooling air adapted to flow thereover mounted in said cabinet, said cooling means having moisture dripping therefrom, means for collecting the drip water from said cooling means, an electrically energized heating element for causing evaporation and removal of drip water from said collecting means, and means responsive to a predetermined accumulation of drip water in said collecting means for rendering said heating element effective.

18. In the art of refrigeration wherein heat is removed from air by a cold body to cool the air and cause condensation of moisture from the air upon the cold body, the process which comprises collecting the moisture from the cold body and disposing of the collected moisture by means rendered effective in response to a predetermined amount of the collected moisture.

19. A refrigerating apparatus comprising in combination, means for cooling air adapted to flow thereover, said cooling means being adapted to collect moisture thereon and to have moisture dripping therefrom, means for catching the drip water from said cooling means, and means normally ineffective and rendered effective automatically in response to a predetermined accumulation of drip water in said catching means for causing evaporation of drip water from said catching means.

20. A refrigerating apparatus comprising in combination, a casing having a cooling element therein adapted to cool air flowing thereover, said cooling element being adapted to collect moisture thereon and to have moisture dripping therefrom, means for conveying the drip water out of said casing, means for catching the drip water conveyed from said casing, and means normally ineffective and rendered effective automatically in response to a predetermined accumulation of drip water in said catching means for causing

evaporation of drip water from said catching means.

21. Apparatus comprising in combination, means for dehumidifying and collecting moisture from air, and means normally ineffective and rendered effective automatically in response to a predetermined accumulation of moisture by said first named means for evaporating the collected moisture.

LEONARD GREEN. 10