

June 12, 1945.

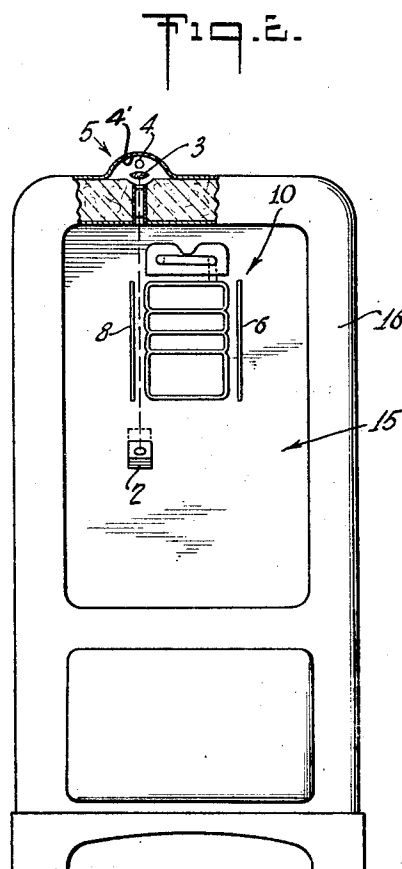
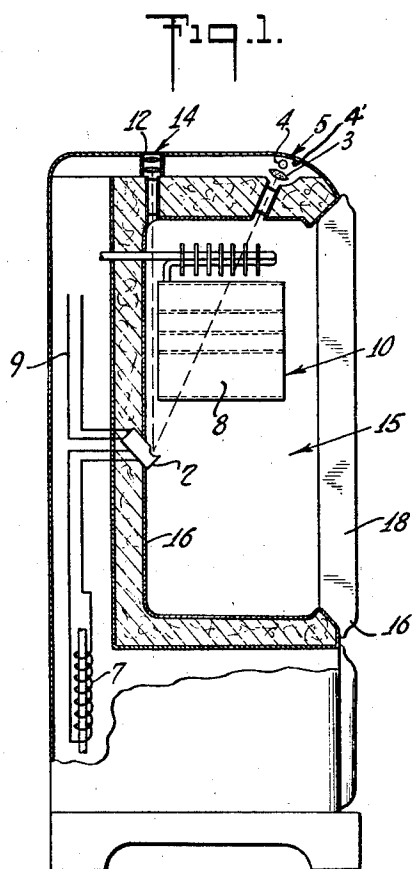
V. G. DREIER

2,377,926

REFRIGERATION

Filed July 22, 1941

2 Sheets-Sheet 1



INVENTOR
VICTOR G. DREIER.

BY

Blair, Curtis & Hayward
ATTORNEYS

June 12, 1945.

V. G. DREIER

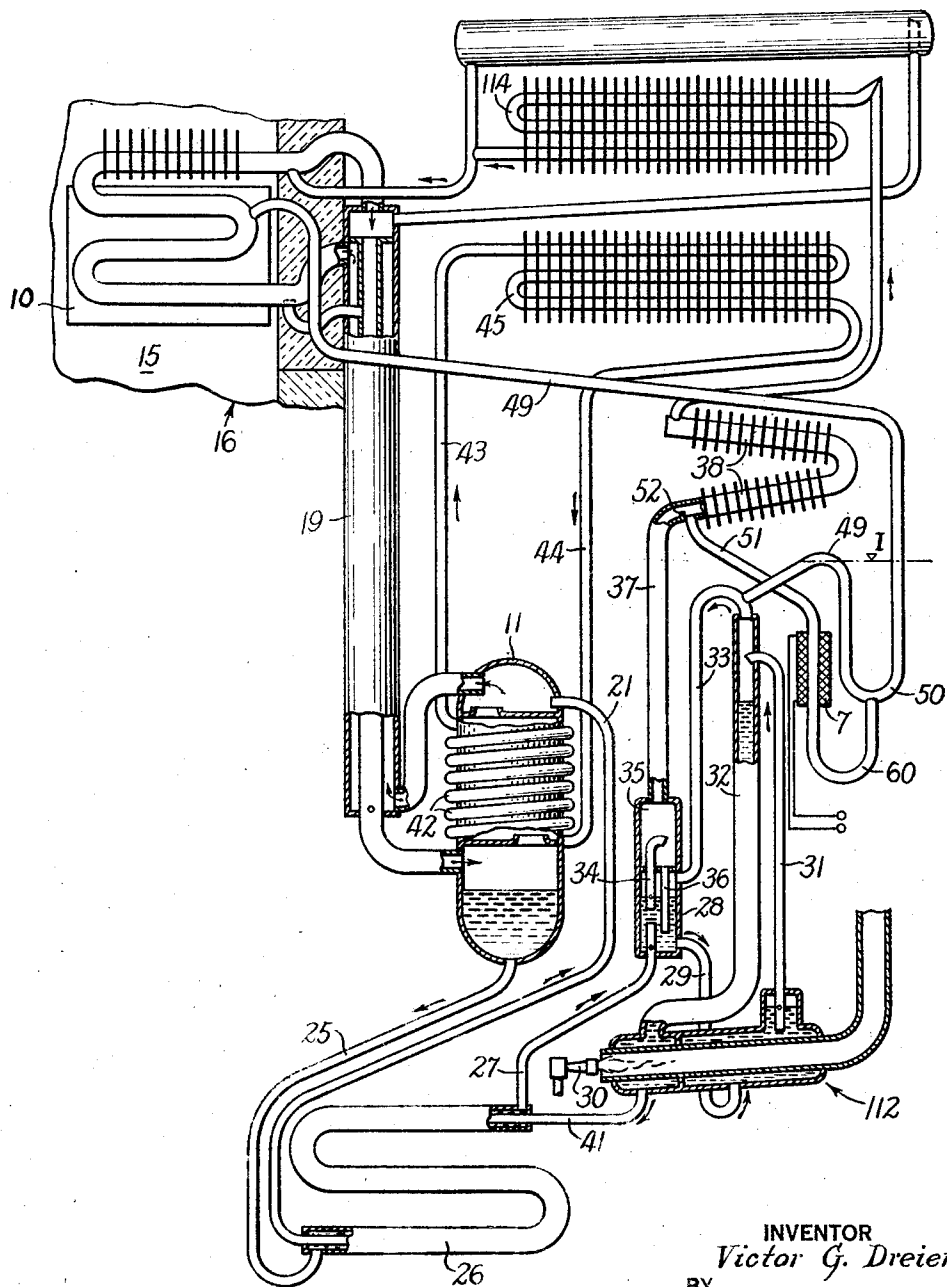
2,377,926

REFRIGERATION

Filed July 22, 1941

2 Sheets-Sheet 2

Fig. 3.



INVENTOR
Victor G. Dreier
BY *Clair, Curtis & Hayward*
ATTORNEYS

UNITED STATES PATENT OFFICE

2,377,926

REFRIGERATION

Victor G. Dreier, Evansville, Ind., assignor to
Servel, Inc., New York, N. Y., a corporation of
Delaware

Application July 22, 1941, Serial No. 403,487

6 Claims. (Cl. 62—1)

This invention relates to refrigeration and more particularly to defrosting the cooling element of a refrigerator.

It is an object of this invention to provide for the automatic defrosting of a cooling element of a refrigeration system when an objectionable amount of frost or ice has accumulated on the cooling element. A further object is to provide automatic means to defer the initiating of the defrosting operation if this operation would normally start during a period of active use of the refrigerator. A further object is to provide efficient and dependable means to control the defrosting operation so that it will occur at a time when it will interfere least with the normal use of the refrigerator.

The above and other objects and advantages of the invention will be apparent in the following description taken in connection with the accompanying drawings which forms a part of this specification and in which:

Figure 1 is a more or less schematic view partly in vertical section of a domestic refrigerator incorporating the present invention;

Figure 2 is a front elevation of the refrigerator with the upper central portion of the cabinet broken away to show details of construction; and,

Figure 3 is a more or less diagrammatic representation of the refrigeration system of the embodiment of Figures 1 and 2.

The illustrative embodiment of the present invention is applied to a refrigeration unit like that described in a copending application of Carl T. Ashby, Serial No. 306,258, filed November 27, 1939, entitled "Refrigeration"; this application has matured into Patent No. 2,285,884, granted June 9, 1942. Accordingly, that patent is incorporated herein, and reference may be had thereto for a more detailed consideration of certain features of the apparatus. The present application is also related to the copending application of Fritz A. Hedman, Serial No. 406,075, filed August 9, 1941, entitled "Refrigeration."

Referring to Figure 1 of the drawings, an evaporator or cooling element 10 is disposed in a refrigerated space 15 which is the food storage compartment of a domestic refrigerator the thermally insulated cabinet of which is indicated at 16. At the right, cabinet 16 is provided with a door 18, and at the bottom of the cabinet and at the left are positioned the other elements of a heat operated absorption refrigerator. This refrigerator is described in detail in the patent of Carl T. Ashby, referred to above. Essentially, this refrigeration unit is provided with a generator 112

which is heated by a gas flame 30 whereby liquid is raised in the generator through a tube 31 by vapor liquid lift action to the top of standpipe 32. The liquid flows back down the standpipe and the expelled vapor passes from the top of the standpipe through a conduit 33 to the lower chamber of an analyzer 28 where it passes in contact with the liquid flowing to the generator. In the analyzer, the expelled vapor passes through tube 34 to the upper chamber 35 and thence through conduit 37 to the rectifier 38 where the remaining water vapor is condensed. The pure refrigerant vapor passes to the condenser 114 where it is condensed and the liquid flows to the top of the cooling element 10 which is filled with hydrogen gas. Here the refrigerant evaporates to give the cooling effect and diffuses into the hydrogen gas and the gas mixture flows from the top of the cooling element 10 downwardly through heat exchanger 19 to the absorber 11.

In the absorber, the refrigerant vapor is absorbed by an absorption liquid such as water and the hydrogen gas flows back through the heat exchanger 19 to the cooling element 10. The absorbent liquid is delivered to the top of the absorber 11 from the generator through the conduit 21, heat exchanger 26, and conduit 41, and is the liquid from which the refrigerant vapor was initially separated in the generator. The absorbent liquid which is in the form of "strong liquor" cools in the bottom of the absorber and returns to the generator through conduit 25, heat exchanger 26, conduit 27, analyzer 28, and conduit 29. The absorber is cooled by a secondary heat exchange system formed by coil 42 connected through conduits 43 and 44 to looped coil 45.

As is well known in the art, there is a tendency for ice to accumulate upon the cooling element of a domestic refrigerator, and in this embodiment, when excessive ice has accumulated, it is removed by supplying hot vapors to the cooling element 10. The process of removing this ice or frost is referred to as "defrosting." Referring to Figure 2, mounted at the left along the side of cooling element 10 and spaced therefrom is a baffle plate 8, and at the right is a similar baffle plate 6. During normal operation the air within chamber 15 circulates naturally over the cooling element and is maintained in its refrigerated condition. Mounted at the top of the refrigerator near the front (see Figure 1) is a light directing assembly, indicated at 5 and comprising a bulb 4, a thermally insulating lens 3, and a reflector 4'. The light from the bulb is reflected downwardly and toward the rear of the refrigerator so that a

ray of light passes between cooling element 10 and baffle plate 8 in the manner shown in Figure 2. In line with this ray of light is the sensitive element of a photoelectric cell unit 2 which includes a relay switch which is normally held open. This relay switch is in series with a heating coil 7, and when the relay switch is closed, the heating coil is connected through a pair of leads 9 to a suitable source of electrical current. When this heating coil is energized, the defrosting operation is carried on by passing hot vapor to the cooling element in the manner outlined in the patent of Carl T. Ashby.

Accordingly, referring again to Figure 3, the central portion of the cooling element 10 is connected through a conduit 49 having a U-trap 50 therein to the top of the standpipe 32, and when there is no liquid in trap 50, hot vapor may pass directly from the top of standpipe 32 into the cooling element 10. However, except when defrosting is being carried on, trap 50 is filled with liquid and there is no flow through conduit 49. The bottom of trap 50 is connected to one end of a trap 60, the other end of which is connected through a conduit 51 to the bottom of rectifier 38. A dam 52 extends across the rectifier at the left of conduit 51 with the result that liquid which is condensed in rectifier 38 flows into conduit 51 and thence through trap 60 to trap 50. During normal operation, the liquid collects in trap 50 to the level indicated by the broken line A I, and liquid above this level flows down conduit 49 into the top of standpipe 32. With trap 50 thus filled, there is no flow of gas from standpipe 32 through conduit 49 to the cooling element 10 and the normal cycle is carried on as outlined above.

Surrounding conduit 51 is the heating coil 7 which is energized to pump or lift the liquid out of conduit 51 and from trap 50 through trap 60. When the cooling element 10 is to be defrosted, this coil 7 is energized, and as a result, the liquid is pumped from the top of conduit 51 into conduit 37 with the result that liquid drains from trap 50 into trap 60. Thus, conduit 49 and trap 50 are freed of liquid and the hot vapors flow from standpipe 32 to cooling element 10. The size and location of heating element 7 and the depth of trap 60 are such that liquid remains in trap 60 when heating element 7 is energized and cooling element 10 is being defrosted. The amount of this liquid is sufficient to prevent the flow of vapors through conduit 51 and trap 60 and all of the vapors flow through conduit 49 to cooling element 10. When the defrosting operation is completed, coil 7 is deenergized and liquid again collects in traps 60 and 50 with the result that the normal refrigeration cycle is restarted.

When there is light radiation on the sensitive element of the photoelectric cell, the relay switch of the photoelectric cell unit is held open so that the heating coil is not energized, and the defrosting operation is not initiated. Thus, the relay of light from the light directing assembly 5 (Figure 1) plays upon the photoelectric cell and thus holds the relay switch open until an excessive amount of ice accumulates in the space between cooling element 10 and baffle plate 8; at this time the ice cuts off the ray of light so that the relay switch is no longer held open by this ray.

Preferably the defrosting operation is carried on when defrosting would be most convenient to the user of the refrigerator. As stated in the above mentioned application of Fritz A. Hedman, the user of the cabinet ordinarily has no need

nor necessity to gain frequent access into the food storage compartment in the night. Accordingly, the defrosting operation is carried on only during the night when there is no light radiation at the exterior of the refrigerator. To obtain this result, a window 12 is provided in the top of the refrigerator cabinet, and a thermally insulating lens assembly 14 is mounted in this window to direct light from the exterior of the refrigerator onto the sensitive element of the photoelectric cell unit. When there is light at the exterior of the cabinet, the ray of light which is directed from window 12 prevents the initiating of the defrosting cycle even though ice has accumulated on the cooling element sufficiently to cut off the ray of light from the light directing assembly 5.

Thus, during normal operation the refrigeration cycle is carried on, and regardless of the presence of light at the exterior of the refrigerator, the ray of light from the light directing assembly 5 is effective to hold the relay switch open and prevent the energization of heating coil 7. When sufficient ice accumulates to intercept the beam of light from the light directing assembly, the relay switch is closed unless light is entering window 12, and if light is entering window 12, the relay is not closed. When neither ray of light strikes the sensitive element of the photoelectric relay unit, the relay switch is closed so that the heating coil 7 is energized and the defrosting operation is initiated.

While I have shown and described one embodiment of my invention, it will be apparent to those skilled in the art that modifications and changes may be made without departing from the spirit and scope of the invention. Thus, the photoelectric cell unit may control any type of defrosting mechanism, whether it be on an absorption type or compression type refrigerator. Furthermore, the defrosting operation may be of the type herein disclosed where the ice is melted from the cooling element by heated vapors, or it may be merely the act of disconnecting the refrigerator from its source of power. I therefore do not wish to be limited to the embodiment shown in the drawings and described in the specification and aim in the following claims to cover all of the modifications and changes which fall within the true spirit and scope of the invention.

I claim:

1. In refrigeration apparatus, the combination of, a refrigerator cabinet, a refrigeration unit including a cooling element positioned in said cabinet, a baffle means extending along the side of said cooling element in spaced relationship with respect thereto to thereby form a gap between the baffle means and the cooling element, means directing a light ray through said gap, a photoelectric cell unit positioned in the path of the light ray produced by said light ray directing means, and defrosting means controlled by said photoelectric cell unit and effective to initiate defrosting of said cooling element when the light ray is intercepted by ice forming in said gap.

2. Apparatus as claimed in claim 1 and including means constituting a window through which light from the exterior of said refrigerator cabinet is directed onto said photoelectric cell unit to prevent the initiation of the defrosting means when there is light at the exterior of the refrigerator cabinet.

3. In refrigeration apparatus, the combination of, a household refrigerator including a thermally insulated cabinet and a refrigeration unit having

a cooling means positioned in the top of said cabinet, means to effect defrosting of said cooling element, a light directing assembly positioned above the forward end of said cooling element including a lens unit and a light unit for directing a ray of light downwardly and rearwardly along a surface of said cooling element, a photoelectric cell unit positioned in the rear wall of said cabinet adjacent said cooling element and in the path of the light ray directed by said light directing assembly, means constituting an insulated window in the top of said refrigerator cabinet including a lens assembly directing light from the exterior of the cabinet onto said photoelectric cell unit, and control means associated with said photoelectric cell unit responsive to the interruption of the ray of light from said light assembly unit by frost accumulating on said cooling element and to the absence of light from the exterior of the refrigerator to initiate the defrosting operation by said defrosting means to defrost said cooling element.

4. In a refrigerator including a cooling element subject to the formation of frost or ice thereon during the normal operation of the refrigerator, and structure to modify the operation of said refrigerator to effect defrosting of said cooling element to cause melting of the frost or ice accumulated thereon, a control device associated with said modifying structure including sensitive means responsive to the projection of a ray thereon and effective to prevent the operation of said modifying structure when the ray is projected thereon, said control device including means to

project a ray upon said sensitive means along a path, the formation of a predetermined layer of frost or ice on said cooling element being adapted to interrupt the ray projected along said path to render said control device ineffective to prevent defrosting from being initiated.

5. A method of refrigerating a food storage cabinet with the aid of a refrigerating system having a cooling element located in said cabinet which comprises normally flowing liquid refrigerant to the cooling element for evaporation therein to produce refrigeration, intermittently defrosting the cooling element by reducing the normal flow of liquid refrigerant to the cooling element and introducing hot vaporous refrigerant into the cooling element to cause defrosting of said cooling element, projecting a ray along a path adjacent to the cooling element, effecting the defrosting when the ray is blocked by a layer of frost or ice on said cooling element and restricting the defrosting operation so long as the light intensity in the vicinity of the food storage cabinet is at or above a predetermined value.

6. In refrigeration apparatus, the combination of a refrigerator cabinet, a cooling element positioned therein, means to defrost said cooling element, a control means responsive to the interruption by ice formation of a ray passing along said cooling element to initiate the operation of the defrosting means, and means to prevent the initiation of the operation of the defrosting means when there is light at the exterior of the refrigerator.

VICTOR G. DREIER.