March 5, 1940. R. E. TOBEY 2,192,850

REFRIGERATING APPARATUS

Filed Sept. 2, 1938 2 Sheets-Sheet 1

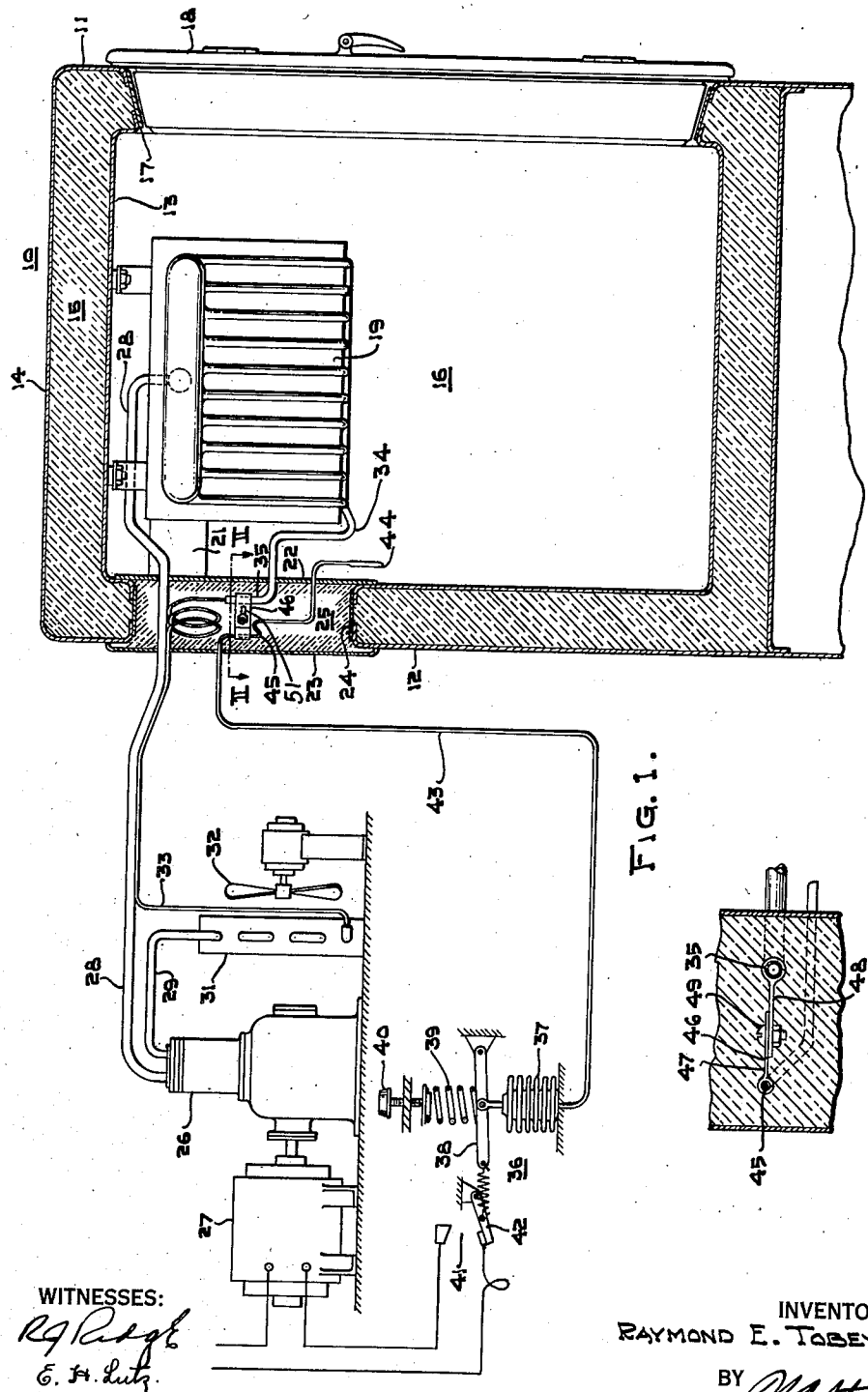


FIG. 1.

FIG. 2.

WITNESSES:

R. J. Rudge

E. H. Lutz.

INVENTOR

RAYMOND E. TOBEY.

BY Masteson

ATTORNEY

March 5, 1940. R. E. TOBEY 2,192,850

REFRIGERATING APPARATUS

Filed Sept. 2, 1938 2 Sheets-Sheet 2

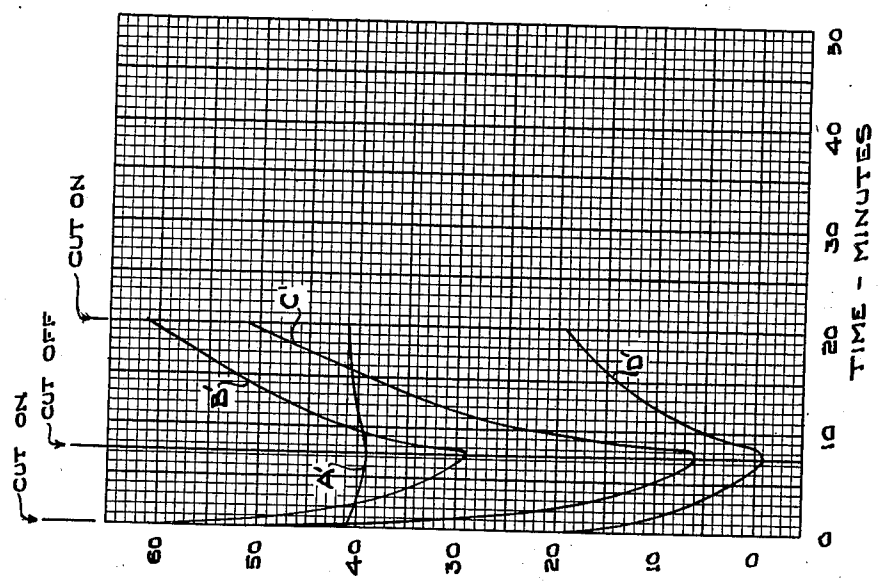


FIG. 4.

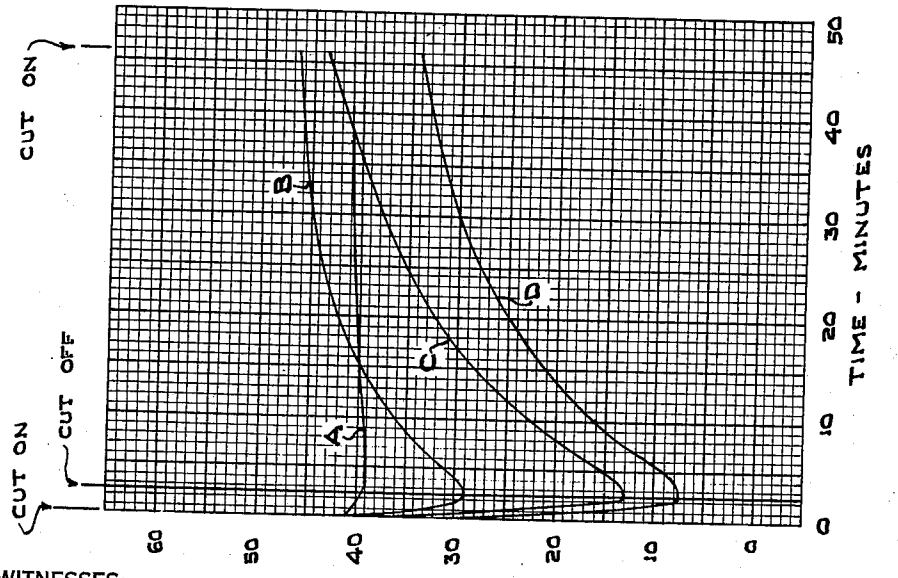


FIG. 3.

WITNESSES:
R. G. Ridge
E. H. Lutz.

INVENTOR
RAYMOND E. TOBEY.

BY
ATTORNEY

Patented Mar. 5, 1940 2,192,850

UNITED STATES PATENT OFFICE

2,192,850

REFRIGERATING APPARATUS

Raymond E. Tobey, Springfield, Mass., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application September 2, 1938, Serial No. 228,072

17 Claims. (Cl. 62—4)

My invention relates to refrigerating apparatus and has for an object to provide improved apparatus of this kind.

It is a further object of my invention to maintain the mean temperature of the air in a refrigerated zone substantially constant irrespective of changes in temperature of the air exteriorly of the zone and the different rates of heat leakage into the zone which accompany such temperature changes.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in accordance with the accompanying drawings, in which:

Fig. 1 is a diagrammatic view of a refrigerating machine constructed and arranged in accordance with my invention;

Fig. 2 is an enlarged sectional view of a detail taken along the line II—II of Fig. 1; and

Figs. 3 and 4 are charts showing temperatures of several elements of the apparatus when cycled under two different ambient temperatures.

Reference will now be had to Figs. 1 and 2 of the drawings wherein I have shown my invention applied to a refrigerator of the domestic type and including an insulated cabinet structure 10 having a front wall 11 and a rear wall 12. The various walls of the cabinet structure 10, including the front wall 11 and rear wall 12, are defined by inner and outer shells 13 and 14, having heat insulating material 15 disposed therebetween.

The cabinet structure 10 embodies a chamber 16 for storing the food to be refrigerated. An access opening 17 is provided in the front wall 11 and is closed by a suitable insulated door structure 18. Heat is abstracted from the air in the chamber 16 by means of an evaporator 19 which may be of conventional construction and supported in any well known manner. As shown, the evaporator 19 is carried by a bracket 21 secured to a plate 22, the latter being carried by the rear wall 12 of the cabinet within the chamber 16.

The plate 22, in cooperation with a plate 23 carried on the outside of the rear wall 12, closes an opening 24 formed in the rear wall through which the evaporator 19 is passed during its assembly to the cabinet structure. Heat insulating material 25 is disposed between the plates 22 and 23 for retarding the flow of heat from the ambient atmosphere through the opening 24 as is well understood.

Circulation of refrigerant through the evaporator 19 is effected by a compressor 26, driven by an electric motor 27. Refrigerant vaporized in the evaporator 19 is withdrawn by the compressor 26 through a suction conduit 28 and compressed to a relatively high pressure. The compressed gas is conveyed through a conduit 29 to a condenser 31 wherein it is cooled and condensed. Cooling of the condenser is effected in any suitable manner, such as, for example, by means of a motor driven fan 32.

Condensed refrigerant is conveyed from the condenser 31 through a suitable expansion device, shown by way of example as an elongated tube 33 of the so-called capillary type. The tube 33 discharges the expanded refrigerant into an inlet conduit 34 that communicates with the evaporator 19. The expanded, condenser refrigerant discharged from the tube 33 enters an inlet portion 35 of the conduit 34, which portion 35 is disposed exteriorly of the refrigeranted zone 16 and preferably, intermediate the plates 22 and 23. It will be understood that the conduit 34 and its portion 35 define a part of the low pressure side of the system which includes the evaporator 19.

It will be apparent from the foregoing description that the refrigerating apparatus which I have disclosed operates on the well-known compressor-condenser-expander cycle.

Operation of the motor 27 and compressor 26 is thermostatically controlled by means of a thermostat, generally indicated at 36 and including an expansible bellows 37, a pivoted arm 38 actuated thereby and an adjustable spring 39 disposed in opposition to the bellows.

A switch 41 for controlling operation of the motor 27 is actuated by the movable arm 38, preferably through a snap-acting mechanism 42. As is well understood, the switch 41 is closed and opened, respectively, when predetermined high and low pressures, as determined by the bias of the spring 39, obtain in the bellows 37. A manually actuated handle 40 is provided for varying the bias of the spring 39 and, therefore, the pressures and temperatures of the gas in the bellows 37 at which the switch 41 is opened and closed. A conduit 43 is connected to the bellows 37 and defines therewith a closed chamber for a volatile fluid, the pressure of which is a function of the temperature obtaining in the coldest portion of the conduit 43.

In accordance with my invention, a portion 44 of the conduit 43 is disposed in heat transfer relation with the air in the chamber 16 and a second portion, indicated at 45, is disposed in heat transfer relation with the atmosphere exteriorly of the cabinet 10. Preferably the conduit portion 45 is disposed within the opening 24 adjacent the plate 23 where its temperature is affected by the temperature of the ambient atmosphere exteriorly of the cabinet 10. It will be apparent that the flow of heat from the ambient atmosphere through the plate 23 to the conduit portion 45 increases and decreases with respective increases and decreases in the temperature of the ambient atmosphere.

The conduit portions 44 and 45 define relatively small reservoirs for the liquefied portion of the fluid contained in the conduit 43. The

charge of fluid in the conduit 43 and bellows 37 is such, that at the lowest expected temperature of any part of the conduit 43, the amount of condensed fluid present therein is less than the capacity of either reservoir 44 or 45. It will be understood that, in a system charged in this manner, the fluid condenses in the portion thereof of lowest temperature and the pressure of the fluid in the system is a function of the temperature of the liquefied portion of the fluid. For example, if the reservoir 44 is the lowest temperature portion of the conduit 43, the fluid condenses therein and its temperature determines the pressure in the bellows 37. Accordingly, the thermostatic switch 41 is controlled in accordance with the temperature of the reservoir 44 and, therefore, the temperature of the air in the chamber 16. As described hereinafter, the temperature of the reservoir 45 may be depressed to a value below the temperature of the reservoir 44. Accordingly, the fluid condenses in the reservoir 45 so that the pressure in the conduit 43 and bellows 37 is depressed to a value corresponding to the temperature of the reservoir 45. Condensed fluid in the reservoir 44 therefore vaporizes at the lower pressure and condenses in the reservoir 45. At this time, the operation of the thermostat switch 41 is responsive to the temperature of the reservoir 45.

As shown, the reservoir portion 45 of the tube 43 is also disposed in heat transfer relation with the inlet conduit portion 35 so that the temperature of the reservoir 45 is determined conjointly by the temperatures of the ambient atmosphere and the inlet conduit portion 35. Preferably, an adjustable fin 46 connects the inlet conduit portion 35 and the reservoir 45 and defines a path for the flow of heat therebetween. As best shown in Fig. 2, the fin 46 is defined by sections 47 and 48 connected, respectively, to the reservoir 45 and the conduit portion 35 and secured together by a bolt 49. One of the sections 48 is slotted as shown at 51 to receive the bolt 49 so that the sections 47 and 48 may be adjusted relative to each other whereby the length of the fin 46 may be varied. Accordingly, the rate of heat transfer between the reservoir 45 and the inlet conduit 35 is adjusted so that the cooling effect of the conduit 35 upon the reservoir portion 45 is varied. It will be understood that the fin 46 is permanently adjusted during testing of the apparatus to provide proper compensation and need not be adjusted in service.

The conduit 34 which defines a portion of the low side of the system is of relatively small mass and has low heat storage capacity. During operation of the compressor 26, the temperature of the conduit 34 is depressed to a relatively low value. Heat is abstracted at this time from the fin 46 and reservoir portion 45 of the control tube 43, the rate of heat transfer being determined by the adjustment of the fin 46, so that the temperature of the reservoir 45 is depressed to a value below the temperature of the reservoir 44. Accordingly, the temperature of the reservoir 45 determines the pressure in the conduit 43 and bellows 37 so that operation of the compressor 26 is terminated in response to a predetermined low temperature of the reservoir 45, which temperature is affected conjointly by the temperatures of the ambient atmosphere and the conduit portion 35.

During inactive periods of the compressor 26, flow of condensed refrigerant is substantially stopped. As the conduit portion 35 is disposed exteriorly of the refrigerated chamber 16 in a relatively warm region, its temperature increases more rapidly than the temperature of the evaporator 19. Accordingly, the temperature of the reservoir 45 rises above the temperature of the reservoir 44, whereupon the latter assumes control. As described heretofore, the pressure in the bellows 37 at this time is a function of the temperature of the reservoir 44 and, therefore, the compressor 26 is started in response to a predetermined temperature of the reservoir 44. It will be apparent from the foregoing description that the compressor is started in response to the temperature of the air in the chamber 16 and is stopped in response, conjointly, to the temperatures of the conduit portion 35 and the ambient atmosphere exteriorly of the chamber 16.

The refrigerating apparatus described heretofore will maintain the temperature of the air in the chamber 16 at substantially constant maximum and minimum values irrespective of changes in the ambient atmosphere exterior of the chamber and the different rates of heat leakage into the chamber, which accompany changes in ambient temperature. The mean temperature of the evaporator 19, however, fluctuates with ambient temperature changes. The mean temperature of the evaporator 19 is relatively low during periods when the ambient temperature is high and, conversely, the mean evaporator temperature is relatively high when the ambient temperature is low. The curves shown in Fig. 3 indicate the temperatures of the reservoirs 44 and 45, the liquid line 35 and the evaporator 19 throughout a cycle of operation with an ambient temperature of 65° F. The corresponding curves in Fig. 4 show the temperatures of these elements during a cycle of operation when the ambient temperature is 110° F. Further reference to these curves will be made hereinafter under the description of operation which follows.

Operation

As shown in the drawings, the thermostatic switch 41 is open so that the compressor 26 is inactive. As described heretofore, the temperature of the reservoir 45 is higher than the temperature of the reservoir 44 so that the thermostatic switch 41 is under control of the reservoir 44. When the temperature of the air in the chamber 16 and, therefore, the temperature of the reservoir 44, rises to a predetermined value of, for example, 41° F., the thermostatic switch 41 is closed for initiating operation of the compressor 26. Vaporization of refrigerant in the evaporator 19 is initiated for abstracting heat from the air in the chamber 16. It will be assumed that the temperature of the ambient atmosphere is at the relatively low value of, for example, 65° F. so that the rate of heat leakage into the chamber 16 through the cabinet structure is at a relatively low value. The temperature curve for the reservoir 44 is shown at A, Fig. 3. At the time of starting the compressor, the temperature of the reservoir 45 is approximately 46½° F. as shown by curve B. The temperature of the portion 35 of the liquid line 34 is approximately 43½° F. as shown by the curve C. As shown by Curve D, the temperature of the evaporator at this time is 34° F. During operation of the compressor, the temperature of the reservoir 45 is rapidly depressed by the cold inlet conduit 34—35 to a value below the temperature of the

reservoir 44 so that the reservoir 45 becomes the controlling point of the thermostat 36. Operation of the compressor is terminated when the temperature of the reservoir is depressed to 29° F. as shown by the curve B at which time the temperature of the evaporator 19 is 7½° F. As the rate of heat leakage into the chamber 16 is relatively low with an ambient temperature of 65° F., the heating of the reservoir 45 thereby is low and the temperature of the reservoir is rapidly depressed whereby the compressor is operated for a relatively short time of approximately 2 minutes as shown by the curve. During operation of the compressor it will be apparent from curve A that the temperature of the air in the chamber 16 is depressed to a value of approximately 39° F. so that the average temperature of the air between cut-on and cut-off periods is approximately 40° F.

During inactive periods of the compressor, the temperature of all of the elements recited in the foregoing description increases as shown by the curves A, B, C, and D. Heating of the reservoir 45 by the ambient atmosphere is effected at this time and its temperature increases to a value higher than the temperature of the reservoir 44 at the fifteen-minute period as indicated on the chart of Fig. 3. Accordingly, at this time, the control point of the thermostat 36 is transferred to the reservoir 44. Operation of the compressor is again initiated when the temperature of the air in the chamber 16 and therefore the temperature of the reservoir 44 increases to a value of 41° F. as shown by the curve A, this operation being effected at approximately the forty-six minute position on the chart. The complete cycle of operation has now been described for an ambient temperature of 65° F.

The operation of the apparatus under high ambient temperature conditions is similar to that described. The temperatures of the reservoirs 44, 45, the evaporator 19, and the liquid line portion 35 are indicated by the curve A', B', C' and D' of Fig. 4. It will be understood that, as shown by the curve A', operation of the compressor is started when the temperature of the air in the chamber 16 rises to a value of 41° F.

As the ambient temperature is relatively high, the flow of heat to the fin 46 is high so that the temperature of the reservoir 45 is 61° F. at this time. With a 110° F. ambient temperature, the temperature in the evaporator 19 is approximately 19° F. at starting. The temperature of the inlet conduit portion 35 is 51° F. at starting and is quickly depressed, as shown by the curve C'. Accordingly, heat is abstracted from the reservoir 45 at a high rate and, after approximately two minutes of operation, its temperature is depressed below the temperature of the reservoir 44. Operation of the compressor continues until the temperature of the reservoir 45 is depressed to the cut-off temperature of 29° F. at which time the compressor is stopped as described heretofore. The period of operation of the compressor is approximately seven minutes with a 110° ambient temperature compared with approximately two minutes with a 65° F. ambient temperature.

At the time of stopping the compressor, the temperature of the evaporator is approximately —1° F. as shown by the curve D', due, of course, to the relatively long period of operation. During inactive periods of the compressor, the temperature of the reservoir 45 increases rapidly, due to the relatively high ambient temperature, so that control is transferred to the reservoir 45 approximately two minutes after the compressor is stopped. As the heat load is high, the temperatures of the evaporator 19 and of the air in the chamber 16 rise rapidly as shown by the curves D' and A', respectively, it being understood that the temperature of the reservoir 44 closely follows the temperature of the air in the chamber 16. Operation of the compressor is again initiated when the temperature of the air in the chamber 16 and of the reservoir 44 increases to a value of 41° F. At the time of starting the compressor, the temperature of the evaporator is 19° F.

It will be apparent from the foregoing description that, when the ambient temperature is at a relatively high value of 110° F., a complete cycle of operation is effected in approximately twenty minutes which is relatively short when contrasted with the 46 minute cycle effected during operation under 65° F. ambient temperature conditions. It will also be noted that under both high and low ambient temperatures, the air temperature is maintained between 39° F. and 41° F. whereby an average cabinet temperature of 40° F. is effected. The different rates of heat leakage into the chamber 16 are compensated for by the different mean evaporator temperatures as clearly shown in charts of Fig. 3 and Fig. 4.

The charts shown in Figs. 3 and 4 are plotted from test data of a refrigerating machine constructed generally along the lines of the apparatus shown in Figs. 1 and 2. It will be apparent that the temperatures and duration of the cycle will vary with different machines. The temperatures of the various elements set forth are for a single position of the adjusting handle 40 and will vary, of course, for other positions thereof, it being understood that the mean temperature of the air in the zone 16 is varied as the handle 40 is moved to its different positions.

I have shown the thermostat reservoir 45 and fin 46 connected to the evaporator conduit portion 35 within the insulation intermediate the inner and outer plates 22 and 23. In this position the temperature of the reservoir 45 is readily affected by ambient temperature changes although not directly subjected to the ambient atmosphere. Accordingly, condensation of moisture from the room atmosphere is not effected by the fin 46 and conduit portion 35 during the periods when their temperatures are below the dew point temperatures of the ambient atmosphere. It will be understood, however, that this showing is by way of example and that these elements may be disposed otherwise in accordance with my invention.

Furthermore, forms of thermostats other than the specific form disclosed may be employed in accordance with the invention; it being understood that any suitable thermostatic mechanism is applicable that responds to refrigerated air temperature for initiating operation of the apparatus and which is responsive, conjointly, to refrigerant temperature and temperature of the ambient atmosphere for terminating operation of the apparatus.

I have shown the control tube reservoir portion 45 connected to the inlet conduit of the evaporator but it will be understood that other portions of the low pressure side of the system of small mass may be connected thereto. It will be understood that, while I have shown a refrigerating system having a device of the so-called capillary type for the expansion of refrigerant, my invention is not so limited and may be applied

to apparatus employing other types of expansion devices.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited but is susceptible of various changes and modifications without departing from the spirit thereof and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as set forth in the appended claims.

What I claim is:

1. In refrigerating apparatus, the combination of means defining a zone to be refrigerated, evaporating means for abstracting heat from the media in said zone and including a portion of low heat storage capacity disposed exteriorly of the zone, means for translating refrigerant through the evaporating means, and thermostatic means responsive to the temperature of said media for initiating operation of the translating means and responsive primarily to the temperature of said portion of the evaporating means of low heat storage capacity for terminating operation of the same.

2. In refrigerating apparatus, the combination of a cabinet embodying a zone to be refrigerated, an evaporator for abstracting heat from the air in said zone, refrigerant condensing means, means for conveying condensed refrigerant from the condensing means to the evaporator and including a portion of the evaporator of relatively small mass disposed exteriorly of the zone, thermostatic means responsive to the temperature of the refrigerated media in said zone for initiating operation of the refrigerant condensing means and responsive primarily to the temperature of said evaporator portion for terminating operation thereof.

3. In refrigerating apparatus, the combination of means defining a zone to be refrigerated, an evaporator for abstracting heat from the media in said zone, means for circulating refrigerant through the evaporator and including a conduit for conveying liquid refrigerant to the evaporator, said conduit extending exteriorly of the zone being refrigerated, and means responsive to the temperature of said media for initiating operation of the refrigerant circulating means and responsive primarily to the temperature of a portion of the conduit exteriorly of the refrigerating zone for terminating operation of the same.

4. In refrigerating apparatus, the combination of an insulated cabinet defining a zone to be refrigerated, cooling means for abstracting heat from the air in the zone, means for translating refrigerant to the cooling means and including a conduit having a portion disposed exteriorly of said zone, thermostatic means responsive primarily to the temperature of the air in the zone for starting operation of the refrigerant translating means and responsive conjointly to the temperatures of the atmosphere exterior of the zone and of said conduit portion for terminating operation of the refrigerant translating means.

5. In refrigerating apparatus, the combination of an insulated cabinet for defining a zone to be refrigerated, an evaporator for abstracting heat from the air in said zone, refrigerant condensing means disposed exteriorly of the zone, means for conveying liquid refrigerant from the condensing means to the evaporator and including a conduit of relatively low heat storage capacity and defining a portion of the evaporator, said conduit having a portion thereof disposed exteriorly of the refrigerated zone so that its temperature is affected by the temperature of the ambient atmosphere, and thermostatic means for initiating operation of the refrigerant condensing means in response to the temperature of the air being cooled and for terminating operation of the same in response to the temperature of said conduit portion.

6. In refrigerating apparatus, the combination of means defining a zone to be refrigerated, an evaporator for abstracting heat from said zone, means for condensing refrigerant vaporized in the evaporator, an expansion device for reducing the pressure of the condensed refrigerant, said evaporator having a portion of relatively small mass disposed exteriorly of the zone for receiving the condensed refrigerant from the expansion device, and thermostatic means for initiating operation of the condensing means in response to the temperature of the media cooled by the evaporator and for terminating operation thereof conjointly in response to the temperatures of said evaporator portion of small mass and of the atmosphere exteriorly of said zone.

7. In refrigerating apparatus, the combination of a cabinet having an inner shell for defining a zone to be cooled and an outer shell spaced from the inner shell, an evaporator for abstracting heat from said zone, means disposed exteriorly of said zone for condensing refrigerant vaporized in said evaporator, means for conveying condensed refrigerant from the condensing means to the evaporator and including a conduit of relatively small mass disposed at least in part between said shells, and thermostatic means for controlling the operation of the refrigerant condensing means and including a gas filled member having a first portion thereof disposed in the media in said zone and a second portion disposed in heat transfer relation with the conduit and intermediate said shells.

8. The combination as claimed in claim 7 including a fin interposed between said conduit and the second portion of the gas filled member.

9. In refrigerating apparatus, the combination of means defining a zone to be cooled, an evaporator for abstracting heat from said zone, means for translating refrigerant through the evaporator and including a conduit connected to the evaporator, said conduit having a portion thereof extending exteriorly of the zone being cooled and in heat transfer relation with the atmosphere exterior of the zone, said conduit portion being depressed in temperature during operation of the translating means to a value below the temperature of the media being cooled in said zone and, during inactive periods of the translating means, said conduit portion being heated by the atmosphere exterior of the zone to a temperature in excess of the temperature of the media in the zone, and means for controlling the operation of the translating means and including a gas filled thermostatic member having respective portions thereof disposed in heat transfer relation with the media being cooled and with said conduit portion.

10. In refrigerating apparatus, the combination of means defining a zone to be refrigerated, cooling means for abstracting heat from the media in said zone, said cooling means including a portion of relatively small mass extending exteriorly of said zone, means for circulating refrigerant through said cooling means, and thermostatic means for initiating operation of the circulating means in response primarily to the temperature of the media being refrigerated and for terminating operation of the circulating means in response

primarily to the temperature of said portion of the cooling means.

11. In refrigerating apparatus, the combination of a cabinet enclosing a zone to be refrigerated, a cooling device having a main portion for abstracting heat from the media in said zone, and also including a portion of relatively small mass disposed in spaced relation with respect to the main portion of the cooling device, means for translating refrigerant to both portions of the cooling device, means for imparting heat to said portion of the cooling device of small mass at rates bearing a predetermined relation to the temperature of the atmosphere exteriorly of said zone, and thermostatic means for controlling operation of the refrigerant translating means and having a heat responsive element disposed in heat transfer relation with the media being refrigerated and with said portion of the cooling device of small mass, said thermostatic means being so constructed and arranged that operation of the refrigerant translating means is initiated primarily in response to a predetermined temperature of said media being refrigerated and is terminated primarily in response to a predetermined temperature of the portion of the cooling device of small mass.

12. In a mechanical refrigerator, the combination of an insulated cabinet, a cooling unit therefor effective to cool the media in said cabinet, a mechanism for supplying refrigerant to said cooling unit, automatic control means for starting the supply of refrigerant from said mechanism to the cooling unit when the temperature of the media rises to a predetermined value and for normally stopping the supply of refrigerant substantially independently of the temperature of the media a substantial time interval after starting, said time interval being determined conjointly by the temperature of the refrigerant in the cooling unit and the temperature of the atmosphere exteriorly of the cabinet.

13. In refrigerating apparatus, the combination of means defining a zone to be refrigerated, evaporating means, at least part of which abstracts heat from the media in said zone and including a portion disposed in heat transfer relationship with the ambient atmosphere, said portion of the evaporating means increasing in temperature more rapidly than the main portion of the evaporator during inactive periods of the refrigerating apparatus, means for translating refrigerant through the evaporating means and thermostatic means responsive to the temperature of the media being cooled for initiating operation of the refrigerant translating means and responsive primarily to the temperature of said portion of the evaporator which is disposed in heat transfer relationship with the ambient atmosphere for terminating operation of the refrigerant translating means.

14. In refrigerating apparatus, the combination of means defining a zone to be refrigerated, evaporating means, at least part of which abstracts heat from the media in said zone and including first and second portions, the latter of which increases more rapidly than the former during inactive periods of the refrigerating apparatus, means for translating refrigerant through the evaporating means and thermostatic means responsive to the temperature of the media in said zone for initiating operation of the refrigerant translating means and responsive primarily to the temperature of said portion of the evaporating means which increases in temperature more rapidly for terminating operation of the refrigerant translating means.

15. In refrigerating apparatus, the combination of means defining a zone to be refrigerated, evaporating means, at least part of which abstracts heat from the media in said zone, intermittently operated means for translating refrigerant to the evaporating means, said evaporating means having first and second portions, said second portion of the evaporating means increasing and decreasing in temperature more rapidly than the first portion during periods when the refrigerant translating means is inactive and active, respectively, a thermostatic regulator for initiating and terminating operation of the refrigerant translating means, said regulator including a gas-filled expansible element having respective heat responsive portions disposed in heat transfer relation with the media being cooled and with said second portion of the evaporating means, the charge of gas in said element being such that at normal operating temperatures the amount of condensed gas in the element is less than the capacity of either of the heat responsive portions, whereby the operation of the thermostatic regulator is in response to the temperature of the coldest of said heat responsive portions, and means for conveying heat from the ambient atmosphere to said second heat responsive element in amounts varying directly with changes of temperature of the ambient atmosphere.

16. In an intermittently operated refrigerating apparatus, the combination of an insulated cabinet, a cooling unit associated therewith, means for supplying refrigerant to said cooling unit, and a control for said supplying means comprising a volatile control liquid in heat conducting relationship primarily with the air in said cabinet at least after said air has been cooled and the refrigerant supply has substantially been terminated, means responsive to an increase in pressure of said control liquid above a predetermined point for starting the flow of refrigerant to said cooling unit, and automatic means for normally stopping said flow of refrigerant a substantial time interval after the starting of said flow and independently of the temperature of the air in said cabinet.

17. In refrigerating apparatus, the combination of an insulated cabinet, a cooling unit associated therewith, means for supplying refrigerant to said cooling unit, and a control for said supplying means comprising a tube having a portion in heat conducting relationship primarily with the air in said cabinet, said portion becoming the coldest portion of said tube after the cabinet has been cooled and after the refrigerant supply from said supplying means has terminated, said tube comprising a second portion in heat exchange relationship with both the cooling unit and the ambient atmosphere of said cabinet, said second portion being cooled to a temperature below that of the first portion by the cooling unit when supplied with refrigerant, said ambient temperature warming said second portion to a temperature above that of the first portion after the supply of refrigerant to the cooling unit has ceased.

RAYMOND E. TOBEY.

CERTIFICATE OF CORRECTION.

Patent No. 2,192,850. March 5, 1940.

RAYMOND E. TOBEY.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 9, for the word "condenser" read condensed; page 5, first column, line 66, claim 14, before "more" insert in temperature; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 9th day of April, A. D. 1940.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.