Oct. 4, 1949. L. A. PHILIPP 2,483,842

TWO-TEMPERATURE REFRIGERATION SYSTEM
USING TWO REFRIGERANTS

Filed Jan. 2, 1948 2 Sheets-Sheet 1

Fig. 1

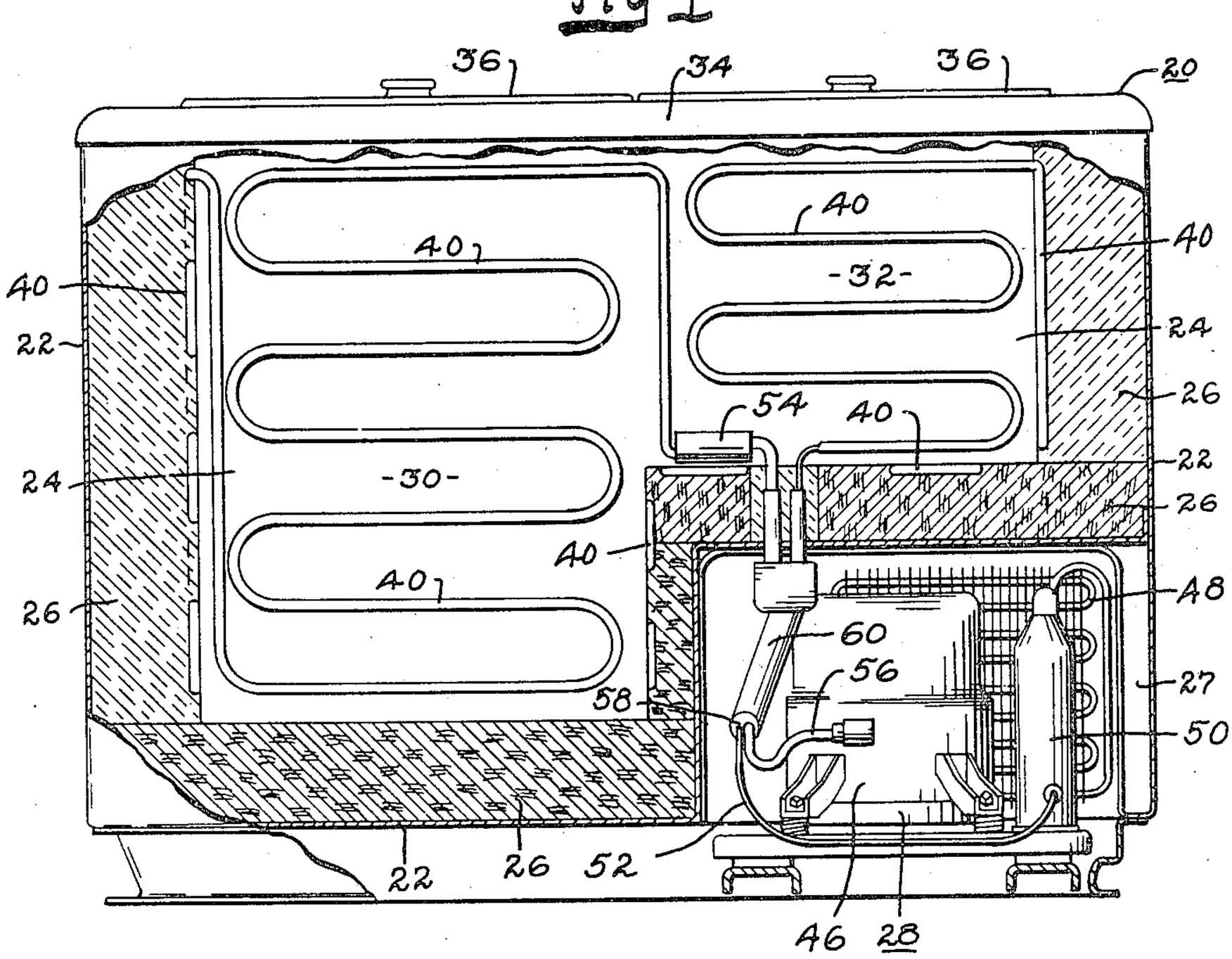

Fig. 4

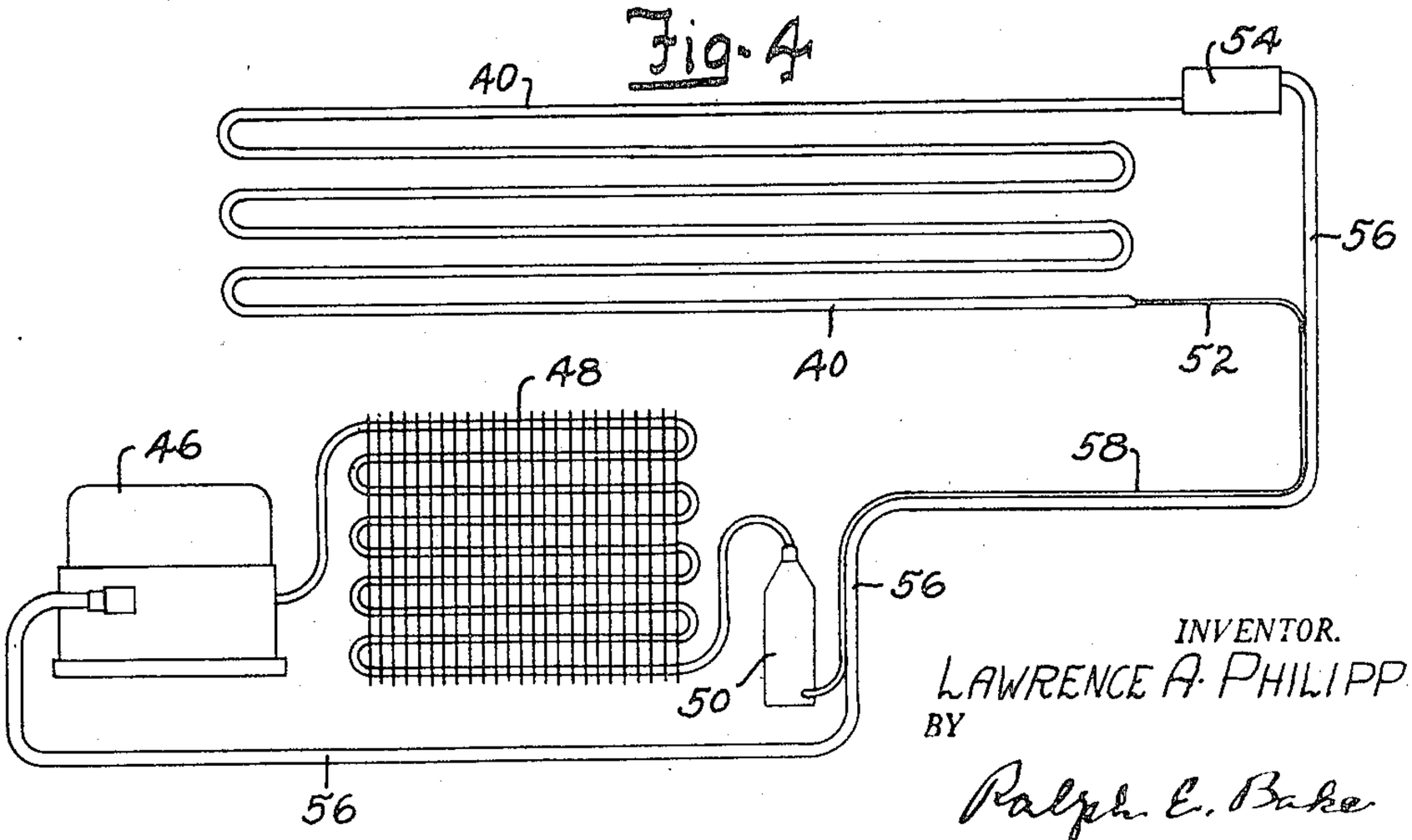

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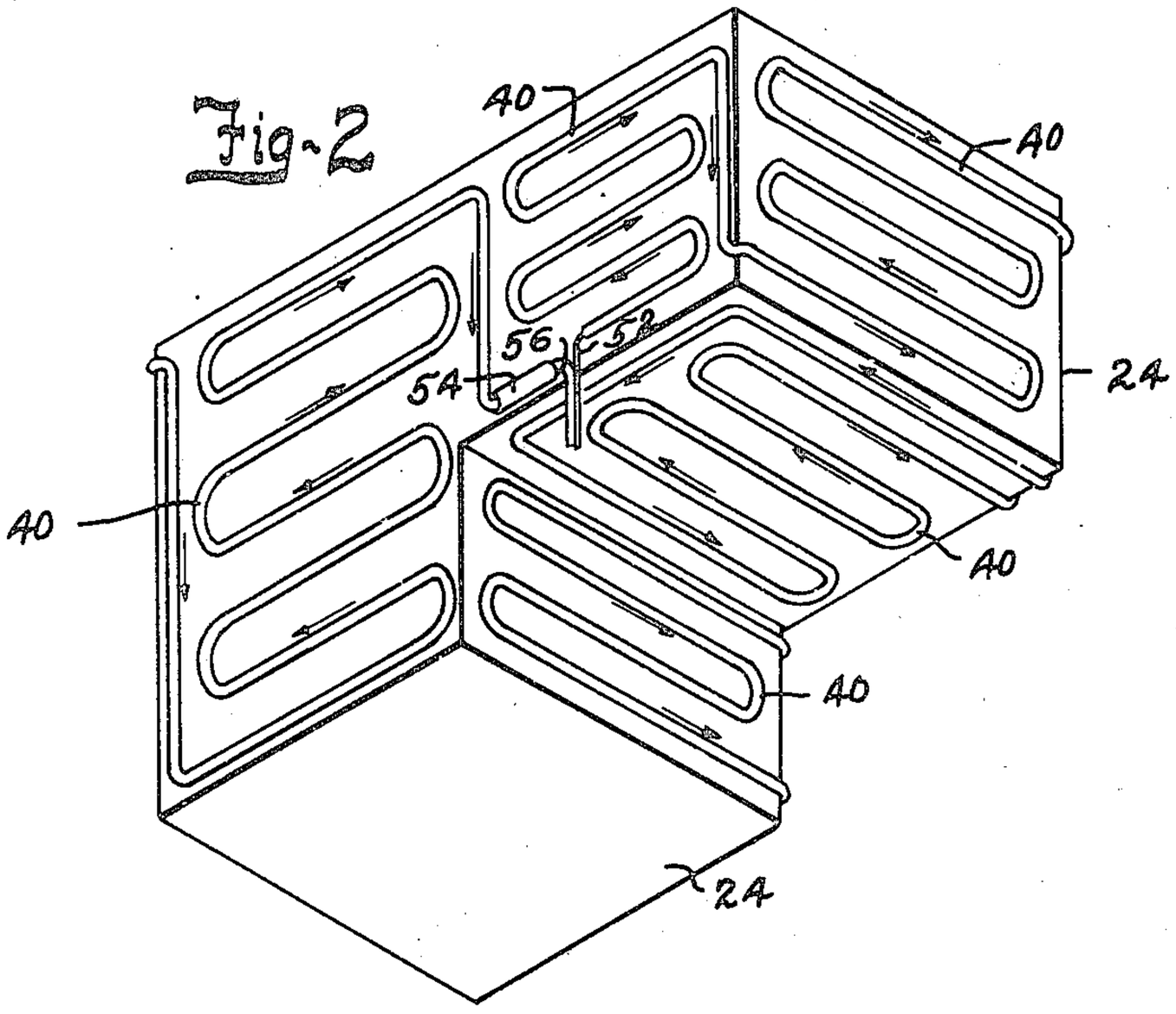
Fig. 2



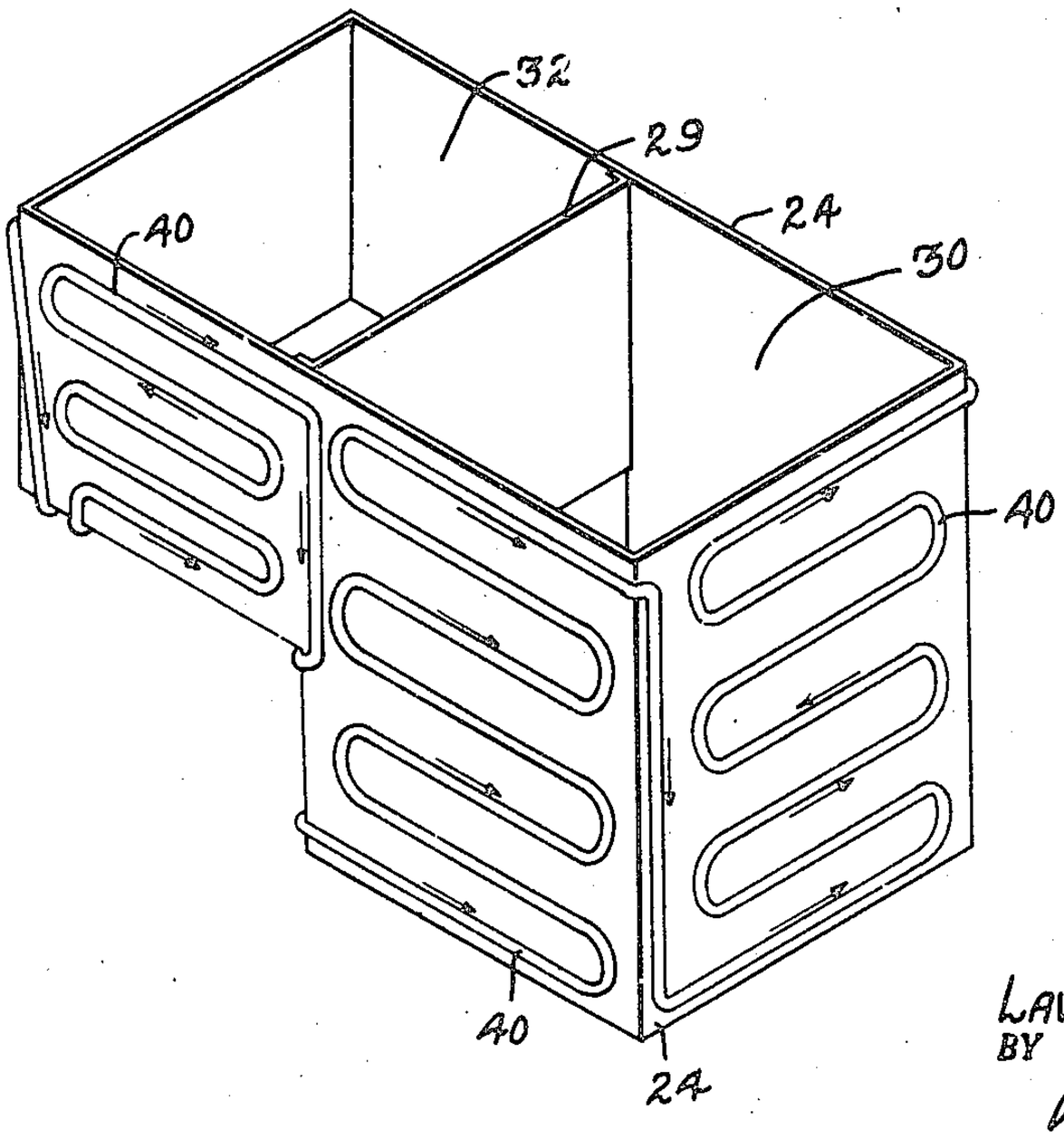


Fig. 3

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TWO-TEMPERATURE REFRIGERATION SYSTEM USING TWO REFRIGERANTS

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5 Claims. (Cl. 62—116)

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This invention relates to refrigerating apparatus and more particularly to such apparatus as is designed to operate at low temperatures.

In storing and preserving confections, such as ice cream, in a frozen condition it has been found that package ice cream including chocolate covered types require a lower temperature than dip ice creams to be maintained in proper frozen condition and accordingly it is both desirable and economical to maintain different temperatures in the refrigerator which stores such confections.

It is an object of the present invention to provide an improved arrangement for maintaining confections in their frozen condition by utilizing a single refrigerant evaporator to refrigerate two compartments and proportion the evaporator so that it has greater refrigerated surface per square inch about the walls of one compartment than the other and to circulate refrigerant through said evaporator by introducing same into said evaporator where it will pass about walls of the compartment which has the greater refrigerated surface about the walls thereof and to utilize as a refrigerant a mixture of refrigerants of different boiling points so that the portion of the evaporator which is the first to receive refrigerant will be the colder portion.

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

In the drawings:

Fig. 1 is a vertical sectional view of a refrigerator embodying features of my invention;

Fig. 2 is an isometric view of a refrigerator cooling element;

Fig. 3 is another isometric view of the cooling element; and

Fig. 4 is a diagrammatical view of the refrigerating system of the refrigerator.

Referring to the drawings by characters of reference, the numeral 20 designates generally a cabinet of the type suitable for the storing and preserving of confections such as ice creams and other foods to be frozen. The cabinet 20 may comprise a sheet metal casing 22 and a sheet metal liner 24. Suitable heat insulation 26 is preferably provided between the casing 22 and the liner to decrease heat leakage into the cabinet. At one end of the cabinet 20, the casing 22 and the liner 24 have their corresponding bottom walls offset upwardly providing a machinery compartment 27 within the cabinet outer casing to receive a refrigerant condensing element, designated generally by the numeral 28.

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Extending upwardly from the cabinet offset wall between the ends of the cabinet is a partition 29 which divides the interior of the cabinet formed by the liner into a relatively large deep storage compartment 30 and a relatively small, shallow storage compartment 32. In the top wall of the cabinet, as at 34, access openings to the storage compartments 30 and 32 are preferably closed by removable closure members 36. In the present refrigerator the compartments 30 and 32 are cooled to different temperatures. Compartment 30 may be cooled to a low temperature suitable for preserving foods like ice cream of the dip type whereas compartment 32 may be cooled to a lower temperature for storing chocolate covered ice creams and other package ice creams which require lower temperatures than dip ice cream.

In accordance with my invention I provide a single refrigerant evaporator 40 for the refrigerator and arrange this evaporator to absorb heat from both of the cabinet compartments 30, 32 in a manner such that the compartments are cooled to different low temperatures. As shown, the evaporator 40 is preferably in the form of a coil or conduit and is preferably arranged in sinuous form along the side, ends and offset wall of the cabinet liner 24 to absorb heat from walls of the liner. Preferably, the evaporator coil 40 is attached to the exterior surface of the liner 24 out of the way of foods to be stored in the compartments. Any well known suitable cement may be used to secure the evaporator coil 40 to the liner 24 in good heat transfer relationship therewith.

In the machinery compartment 27, the refrigerant condensing element 28 comprises, in general, a motor-compressor unit 46 and a refrigerant condenser 48. A refrigerant receiver 50 may be provided and also may be located in the machinery compartment 26. Liquid refrigerant is supplied from the condenser 48 to the refrigerant receiver 50, whence the refrigerant is delivered by a capillary or flow controlling tube 52 to the inlet end of the evaporator 40. As is well known, the capillary tube 52 serves to supply proper amounts of the refrigerant to the evaporator to obtain desired temperatures. From a refrigerant accumulator 54 at the outlet end of the evaporator 40, gaseous refrigerant is returned to the motor-compressor unit 46 through a return conduit 56. A portion of the capillary tube, as at 58, is preferably arranged in good heat absorbing relationship with a portion of the return cor-

duit **56** so as to cool the refrigerant en route to the evaporator **40** for increased refrigerating efficiency. As shown in Fig. 1, the portion of the capillary tube **52** which is in heat transfer relationship with the return conduit **56** preferably extends through or is surrounded by an insulating casing **60**. This casing may be made of rubber or of any other suitable heat insulating material. From the insulating casing **60**, the capillary tube **52** and the return line **56** extend through the offset, cabinet bottom wall which separates the machinery compartment **26** from the food storage compartments **30, 32**.

In order to maintain different low temperatures in the compartments **30** and **32** with the single evaporator **40** without use of mechanical or other control devices, I provide a mixture of two miscible refrigerants having different boiling points. While various types of refrigerants may be used to provide this mixture I combine two refrigerants, one of which is dichlorodifluoromethane (CCl_2F_2) commonly called (F-12) and the other is monochlorodiflouromethane ($CHClF_2$) commonly called (F-22). These two refrigerants have different boiling points with (CCl_2F_2) having a lower boiling point than ($CHClF_2$). The proportions of these refrigerants by weight are approximately 40% (CCl_2F_2) to approximately 60% of ($CHClF_2$). The refrigerant flow through the evaporator **40** is in the direction of the arrows shown in Figs. 2 and 3. As will be noted in Figs. 2 and 3 the parallel straight runs of the evaporator **40** are closer together about the side walls of the liner portion forming compartment **32** than about the side walls of the liner part which forms the compartment **30**. Also the liner part which forms the bottom walls of compartment **32** has a portion of the evaporator **40** attached thereto. Accordingly the walls of compartment **32** have the greater refrigerated surface per square inch of liner surface.

When the refrigerant is introduced into the evaporator **40** the more volatile refrigerant of lower boiling point will evaporate in that portion of the evaporator **40** adjacent the evaporator inlet or in the portion of the evaporator which principally cools the compartment **32** so as to cool this compartment to the desired temperature. The other, or less volatile refrigerant of higher boiling point, will pass along and evaporate principally in that portion of the evaporator **40** which is associated with compartment **30** and thus will cool this compartment to the desired temperature and at a temperature above that of compartment **32**. Accordingly, I attach the evaporator coil **40** to the liner **24** so that a desired length of the coil starting with the inlet end thereof is arranged to extend continuously along the bottom and three sides or surface portions of the liner which form the compartment **32**. The evaporator coil **40** then extends on the other side of the partition **28** from the compartment **32** and is arranged in heat absorbing relation with the wall portions of the liner forming the relatively higher temperature compartment **30**. Thus, it will be seen that the refrigerant of relatively low boiling point will boil out in the anterior portion of the coil **40** and the refrigerant of relatively high boiling point will boil out in the posterior portion of the coil **40** cooling compartments **30, 32** to different desired temperatures. In other words the temperature at which vaporization of the refrigerant of low boiling point takes place will be lower than the temperature at which vaporization of the refrigerant of higher boiling point takes place as a result of which heat absorption is greater about the compartment **32**.

From the foregoing description it will be noted that I have arranged for the cooling of two refrigerator compartments to different temperatures by a single evaporator using a mixture of refrigerants of different volatility and boiling points. It will be appreciated that by the use of a mixture of two refrigerants of the proper proportion that two storage compartments may be maintained at different temperatures by a single evaporator without need of pressure differential devices or other control elements. It will also be noted that the liner portion which forms the compartment **32** has a greater refrigerated surface per square inch than the portion which forms the compartment **30**. By having a greater refrigerated surface and by evaporating the refrigerant of low boiling point about the liner portion which forms compartment **32** this compartment will be maintained at a lower temperature than compartment **30**.

Although only a preferred form of the invention has been illustrated, and that form described in detail, it will be apparent to those skilled in the art that various modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

I claim:

1. Refrigerating apparatus comprising a cabinet having a liner, a refrigerating system including a refrigerant evaporator and a refrigerant condensing element operatively connected together, said evaporator having an inlet section in heat exchange relation with a first portion of said liner and another section in heat exchange relation with a second portion of said liner, and a mixture of refrigerants of different boiling points in said system with the refrigerant of low boiling point being proportioned with respect to the evaporator section in heat exchange relation to said first portion of said liner to substantially evaporate in its passage through said inlet section.

2. Refrigerating apparatus comprising a cabinet having a liner, a refrigerating system including a refrigerant evaporator and a refrigerant condensing element operatively connected together, said evaporator having an inlet section in heat exchange relation with a first portion of said liner and another section in heat exchange relation with a second portion of said liner, the first portion of said liner having a greater refrigerated area per square inch than said second portion, and a mixture of refrigerants of different boiling points in said system with the refrigerant of low boiling point being proportioned with respect to the evaporator section in heat exchange relation to said first portion of said liner to substantially evaporate in its passage through said inlet section.

3. Refrigerating apparatus comprising a cabinet having a liner, a refrigerating system including a refrigerant evaporator and a refrigerant condensing element operatively connected together, said evaporator having an inlet section in heat exchange relation with a first portion of said liner and another section in heat exchange relation with a second portion of said liner, the first portion of said liner having a greater refrigerated area per square inch than said second portion, and a mixture of refrigerants of different boiling points in said system.

4. Refrigerating apparatus comprising a cabi-

net including sheet metal material forming walls of a relatively large and a relatively small compartment, a refrigerating system including a refrigerant evaporator and a refrigerant condensing element operatively connected together, said evaporator having portions in engagement with walls of said sheet metal material about both compartments with a greater effective heat absorbing surface per square inch of material being placed about said relatively small compartment, and a mixture of refrigerants of different boiling points in said system.

5. Refrigerating apparatus comprising sheet metal material forming walls of a cooling zone, sheet metal material forming walls of a freezing zone, conduit means arranged for conducting refrigerants about walls of said zones, said means having its inlet end in heat absorbing relationship with the material forming walls of said

freezing zone and having greater heat absorbing area per square inch about said freeing zone than about said cooling zone, a refrigerant condensing element operatively connected with said means and a mixture of refrigerants of different boiling points in said element and said means.

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