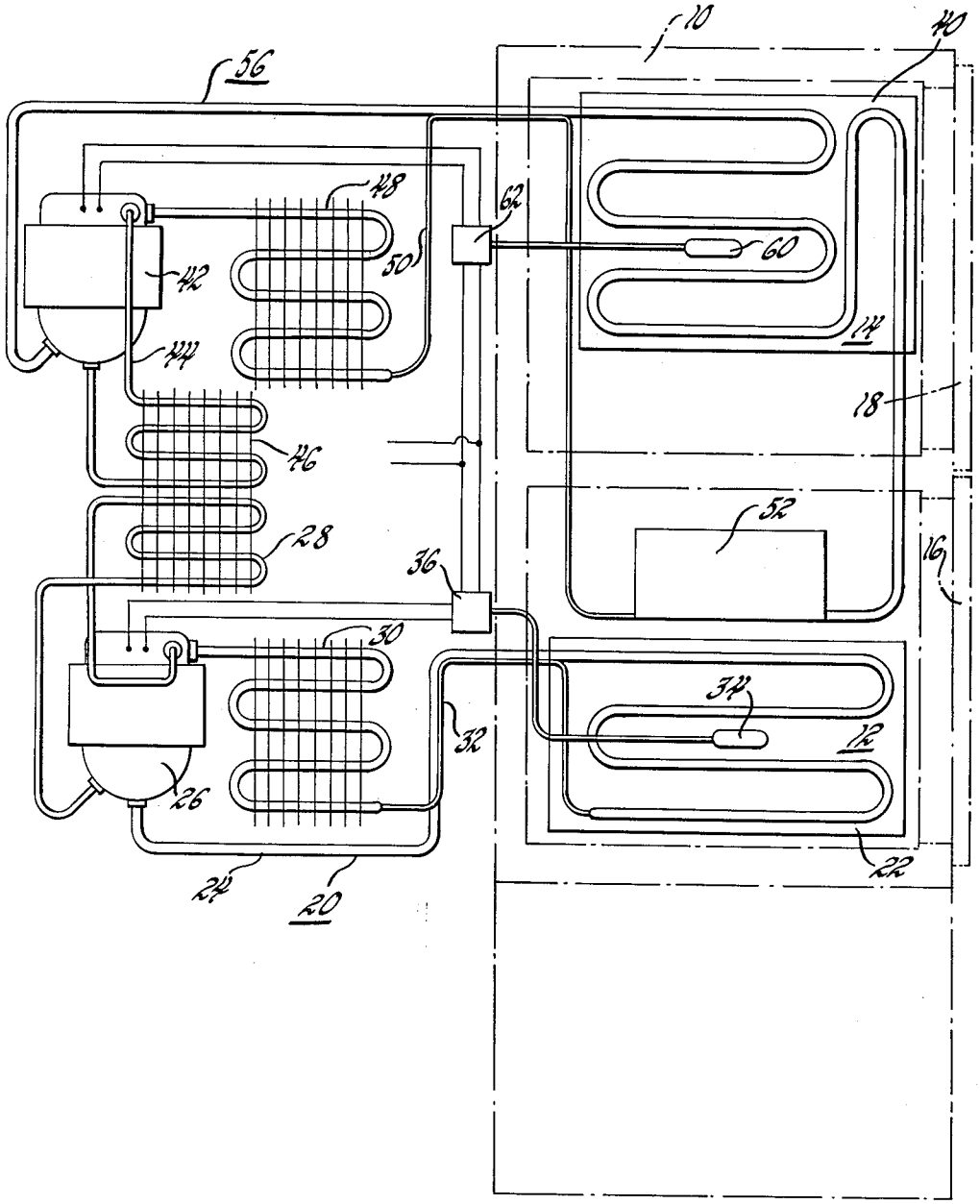
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TWO-TEMPERATURE REFRIGERATING APPARATUS

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TWO-TEMPERATURE REFRIGERATING APPARATUS

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This invention relates to refrigerating apparatus and more particularly to a combination refrigerator and freezer.

It is an object of this invention to provide a combination refrigerator and freezer in which a first refrigeration system cools the low temperature freezer compartment and a second refrigeration system cools the higher temperature unfrozen food storage compartment.

Another object of this invention is to so arrange the two systems that it is possible to transfer heat from the one system to the other while defrosting the one system during its "off" cycle.

More particularly it is an object of this invention to place the receiver of the relatively high temperature system in thermal exchange relationship with the evaporator of the relatively low temperature system whereby the receiver may be used to condense vaporized refrigerant leaving the high temperature evaporator during the defrosting of a high temperature evaporator.

Still another object of this invention is to provide each of the refrigerating systems with its own superheat removing coil and to provide common fins for both of the superheat removing coils.

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 drawing:

The sole figure of the drawing schematically shows the construction and arrangement of the refrigeration systems and their relationship to the food storage compartments.

Referring now to the drawing wherein a preferred embodiment of the invention has been illustrated, reference numeral **10** generally designates an insulated refrigerator cabinet having a first relatively low temperature compartment **12** for storing frozen foods and a second relatively high temperature compartment **14** for storing unfrozen foods. For purposes of illustration the freezer compartment **12** has been shown disposed beneath the higher temperature compartment **14** whereas these compartments could be arranged in side-by-side relationship. In the embodiment shown, separate doors **16** and **18** have been provided for the separate compartments whereas a single door could be used for both compartments if desired. The doors **16** and **18** are of the vertically movable type, more fully shown and described in copending application Ser. No. 404,563, filed January 18, 1954, to which reference is hereby made for more complete description of the doors and door actuating mechanism.

Each food storage compartment is preferably provided with its own refrigerating system. Thus a first refrigerating system generally designated by the reference numeral **20** serves to refrigerate the frozen food compartment **12**. This first system comprises an evaporator **22** located in the compartment **12**. The vaporized refrigerant leaves the evaporator **22** through the suction line **24** which

leads to conventional sealed motor compressor unit **26**. The compressed refrigerant leaving the compressor first flows into a superheat removing coil **28** wherein the superheat of the compressed refrigerant and entrained lubricant is removed. The mixture of compressed refrigerant and lubricant is then returned to the motor compressor unit **26** in accordance with standard practice so as to separate the entrained lubricant from the refrigerant before discharging into the condenser **30**. The condensed refrigerant is applied to the evaporator **22** through a fixed restricter **32** which serves to reduce the pressure on the refrigerant and the evaporator **22**. A thermostat **34** which is preferably located in thermal exchange relationship with a portion of the evaporator **22** serves to operate the motor control switch **36** for starting and stopping the operation of the motor compressor unit **26**. The motor control switch is preferably of the type which starts the motor whenever the temperature of the evaporator **22** reaches 12° F. or higher and shuts off the motor at —4° F. The refrigeration system thus far described is intended to represent a conventional refrigeration system of the type used in frozen food storage cabinets.

The refrigerating system for cooling the relatively high temperatures food storage compartment **14** comprises a plate type evaporator **40** which is arranged in thermal exchange relationship with the contents of the compartment **14**. The vaporized refrigerant leaving the evaporator **40** returns to a second motor compressor unit **42** similar to the motor compressor unit **26**. The compressed refrigerant and entrained lubricant is discharged into a superheat removing coil **44** adjacent to the superheat removing coil **38**. Common fin elements **46** are provided for both superheat removing coils with the result that the two coils may be handled and supported as one coil. Another advantage of this construction is that when only one of the motor compressor units is in operation the available fin surface for dissipating the heat is much greater than if the two coils had separate fins. After the superheat has been removed from the mixture of refrigerant and vapor this mixture is returned to the motor compressor housing **42** where the oil separates out in accordance with standard practice and the relatively oil free refrigerant flows to the condenser **48** where the refrigerant liquifies before entering the fixed restrictor **50** which is in thermal exchange relationship with cold suction line throughout a portion of its length. The fixed restrictor then feeds the refrigerant at a reduced pressure into a receiver like receptacle **52** which is located in the frozen food storage compartment **12** so as to be arranged in thermal exchange relationship with the evaporator **22**. Liquid refrigerant leaves the receptacle **52** through a line which then feeds the liquid refrigerant into the evaporator **40** during the "on" cycle of the motor compressor unit **42**. This second refrigerating system, generally designated by the reference numeral **56**, is of the self-defrosting type wherein all of the frost which accumulates during the "on" cycle melts during the "off" cycle. This second refrigerating system **56** is controlled by a thermostat **60** located in thermal exchange relationship with the evaporator **40** and which cooperates with the control switch **62** for the motor compressor unit **42** so as to initiate operation of the motor compressor unit **42** whenever the temperature of the evaporator **40** exceeds 36° and so as to stop operation of the motor compressor unit **42** whenever the temperature of the evaporator **40** falls below —12°. The evaporator **40** is preferably in the form of a plate located adjacent one of the walls of the compartment **14** and is small in size so that when the compressor stops operating the evaporator **40** will quickly warm up due to the relatively warm air in the compartment **14**. As the evaporator **40** warms up the liquid

refrigerant in the evaporator vaporizes and tends to force some of the liquid in the passes of the evaporator **40** to be returned to the receiver **52**. Some of the refrigerant which has been vaporized in the evaporator **40** will return to the receiver **52** in vapor form but due to the cold temperature of the receiver **52** it will recondense in the receiver **52** so as to be immediately available for reevaporation just as soon as the motor compressor unit **42** restarts. Upon starting of the motor compressor unit **42** the liquid refrigerant in the receiver **52** will very quickly be pulled into the evaporator **40** and the upper portion of the receiver **52** will at times contain little or no liquid refrigerant. This is particualrly true toward the end of the "on" cycle of the system **56** when the evaporator **40** will be operating at a lower temperature than that being maintained in the frozen food storage compartment **12**.

By virture of the above described arrangement of parts the two refrigerating systems operate very efficiently and it is not necessary to apply any external heat to the systems for defrosting the evaporator **40**. Furthermore the time required for defrosting the evaporator **40** is made very short due to the fact that the receiver **52** in effect becomes a condenser which helps to accelerate the removal of all liquid refrigerant from the evaporator **40** immediately upon stoppage of the motor compressor unit **42**. Still another advantage of the arrangement shown is that the liquid refrigerant which accumulates in the receptacle **50** during the "off" cycle is refrigerated and is made available for immediate reuse in the evaporator **40**.

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, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. In a refrigerator assembly having a first relatively low temperature frozen food storage chamber and a second relatively high temperature unfrozen food storage chamber, a first refrigeration system including a first evaporator in said first chamber and refrigerant liquefying means for supplying liquid refrigerant to said first evaporator, a second refrigeration system including a second evaporator in said second chamber, a receiver located in thermal exchange relationship with said first evaporator for storing liquid refrigerant for said second evaporator, a second refrigerant liquefying means for supplying liquid refrigerant to said receiver, and means for connecting said second evaporator, receiver and said second liquefying means in refrigerant flow relationship.

2. In a refrigerator assembly having a first relatively low temperature frozen food storage chamber and a second relatively high temperature unfrozen food storage chamber, a first refrigeration system including a first evaporator in said first chamber and refrigerant liquefying means for supplying liquid refrigerant to said first evaporator, a second refrigeration system including a second evaporator in said second chamber, a receiver located in thermal exchange relationship with said first evaporator for storing liquid refrigerant for said second evaporator, a second refrigerant liquefying means for supplying liquid refrigerant to said receiver, and means for connecting said second evaporator, receiver and said second liquefying means in refrigerant flow relationship, first means for controlling the operation of said first refrigerant liquefying means in response to refrigeration requirements in said first compartment, and second means for controlling the operation of said second liquefying means in response to refrigeration requirements in said second compartment.

3. In a refrigerator assembly having a first relatively low temperature frozen food storage chamber and a second relatively high temperature unfrozen food storage chamber, a first refrigeration system including a first evaporator in said first chamber and refrigerant liquefying means for supplying liquid refrigerant to said first evaporator, a second refrigeration system including a second evaporator in said second chamber, a receiver located in thermal exchange relationship with said first evaporator for storing liquid refrigerant for said second evaporator, a second refrigerant liquefying means for supplying liquid refrigerant to said receiver, and means for connecting said second evaporator, receiver and said second liquefying means in refrigerant flow relationship, first means for controlling the operation of said first refrigerant liquefying means in response to refrigeration requirements in said first compartment, and second means for controlling the operation of said second liquefying means in response to refrigeration requirements in said second compartment, said second controlling means comprising a thermostat arranged in thermal exchange relationship with said second evaporator for starting and stopping operation of said second refrigerant liquefying means at predetermined high and low second evaporator temperatures whereby said second evaporator defrosts on each off cycle.

4. In a refrigerator assembly having a first relatively low temperature frozen food storage chamber and a second relatively high temperature unfrozen food storage chamber, a first refrigeration system including a first evaporator in said first chamber and refrigerant liquefying means for supplying liquid refrigerant to said first evaporator, a second refrigeration system including a second evaporator in said second chamber, a receiver located in thermal exchange relationship with said first evaporator for storing liquid refrigerant for said second evaporator, a second refrigerant liquefying means for supplying liquid refrigerant to said receiver, and means for connecting said second evaporator, receiver and said second liquefying means in refrigerant flow relationship, said receiver having an inlet adjacent its one lower edge and having an outlet adjacent its other lower edge.

5. In a refrigerator assembly having a first relatively low temperatre frozen food storage chamber and a second relatively high temperature unfrozen food storage chamber, a first refrigeration system including a first evaporator in said first chamber and refrigerant liquefying means for supplying liquid refrigerant to said first evaporator, a second refrigeration system including a second evaporator in said second chamber, a receiver located in thermal exchange relationship with said first evaporator for storing liquid refrigerant for said second evaporator, a second refrigerant liquefying means for supplying liquid refrigerant to said receiver, and means for connecting said second evaporator, receiver and said second liquefying means in refrigerant flow relationship, each of said refrigeration systems including a compressor and a superheat removing coil at the outlet of each compressor said superheat removing coils being mounted adjacent one another and having common fins.

6. In combination, means forming a frozen food storage compartment, means forming an unfrozen food storage compartment, a first refrigerating system including a first evaporator for maintaining said first named compartment at below freezing temperatures, a second refrigerating system for refrigerating said unfrozen food storage compartment, said second system comprising a compressor, a condenser, a receiver located in thermal exchange relationship with said first evaporator, a second evaporator in said unfrozen food compartment, and refrigerant flow connections between said compressor, condenser, receiver, and said second evaporator, and control means for operating said second system on a defrosting cycle.

7. In combination, means forming a frozen food storage compartment, means forming an unfrozen food storage compartment, a first refrigerating system including a first evaporator for maintaining said first named compartment at below freezing temperatures, a second re-

frigerating system for refrigerating said unfrozen food storage compartment, said second system comprising a compressor, a condenser, a receiver located in thermal exchange relationship with said first evaporator, a second evaporator in said unfrozen food compartment, and refrigerant flow connections between said compressor, condenser, receiver and said second evaporator, and control means for operating said second system on a defrosting cycle, said receiver and said refrigerant flow connections being arranged so as to prevent gravity flow of refrigerant from said second evaporator to said receiver.

8. In combination, means forming a frozen food storage compartment, means forming an unfrozen food storage compartment, a first refrigerating system including a first evaporator for maintaining said first named compartment at below freezing temperatures, a second refrigerating system for refrigerating said unfrozen food storage compartment, said second system comprising a compressor, a condenser, a receiver located in thermal exchange relationship with said first evaporator, a second evaporator in said unfrozen food compartment, and refrigerant flow connections between said compressor, condenser, receiver, and said second evaporator, and control means for operating said second system on a defrosting cycle, said frozen food storage compartment and said unfrozen food storage compartments being disposed in juxtaposition within an insulated cabinet.

9. In combination, means forming a frozen food storage compartment, means forming an unfrozen food stor age compartment, a first refrigerating system including a first evaporator for maintaining said first named compartment at below freezing temperatures, a second refrigerating system for refrigerating said unfrozen food storage compartment, said second system comprising a compressor, a condenser, a receiver located in thermal exchange relationship with said first evaporator, a second evaporator in said unfrozen food compartment, and refrigerant flow connections between said compressor, condenser, receiver, and said second evaporator, and control means for operating said second system on a defrosting cycle, said frozen food storage compartment and said unfrozen food storage compartments being disposed in juxtaposition within an insulated cabinet having access openings in a vertical wall of said cabinet, and vertically slidable doors for closing said access openings.

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