This invention relates generally to refrigeration apparatus and more particularly to a multiple temperature refrigeration system.

Recently developed refrigerated cabinets are generally provided with a fast freezing compartment and a food storage compartment. The fast freezing compartment is adaptable for the storage of frozen food and ice cream and other articles which are to be maintained at low temperatures. It has been found that the fast freezing compartment should be maintained at approximately 10° F. In order to retain the articles therein in the frozen state. The food storage compartment should be maintained at approximately 32° F. so that the food articles stored therein will be properly preserved. These two compartments may be cooled by separate evaporators and in such case, it is necessary to operate the evaporators at different temperatures in order to cool the compartments to the desired temperature.

Accordingly, it is an object of the present invention to provide a refrigeration system having separate evaporators which will be maintained at different operating temperatures.

Another object of the invention is to provide a refrigeration system which is charged with two refrigerants having different boiling points.

Another object of the invention is to provide the refrigeration system with means for separating the refrigerants after they have been liquefied.

Another object of the invention is to provide means for metering one of the refrigerants into the first evaporators and metering the other refrigerant into the second evaporator.

Another object of the invention is to connect the two evaporators to a common suction line whereby the pressure within the evaporators will be equal so that the two refrigerants will evaporate at different temperatures.

Another object of the invention is to provide a refrigeration system which is adaptable for cooling two separate compartments of a refrigerated cabinet to different temperatures.

Another object of the invention is to provide an evaporator system which operates efficiently to cool a refrigerated cabinet.

The invention itself, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment, when read in conjunction with the accompanying drawings, in which:

Fig. 1 is a diagrammatic view of a refrigeration system embodying the invention.

Fig. 2 is a sectional view of the separator taken along line 2—2 of Fig. 1.

Referring now to the drawings for a detailed description of the invention, a refrigerator cabinet 10 is shown in section in Fig. 1. As illustrated, the cabinet 10 comprises the evaporator 11 having an inner shell 12 spaced therein with insulating material 13 disposed therebetween whereby the heat leakage between the two shells will be reduced substantially the space enclosed by the inner liner 12 is divided by an insulating partition 14 into a low temperature compartment 15 and into a food storage compartment 16. The cabinet 10 as illustrated is arranged and constructed as a domestic type refrigerator, but it is to be understood that the cabinet could be constructed in other forms, since the present invention is directed to the refrigeration system and not to the refrigerated cabinet.

The refrigeration system is diagrammatically illustrated in the drawings, and as seen in Fig. 1, comprises two heat exchange units, the evaporators 17 and 18. The evaporator 17 is positioned within the freezing compartment 15 and is illustrated in the form of a coil or conduit which is bent into a series of runs or turns. The evaporator 18 is illustrated in the same form as the evaporator 17 and is positioned within the lower compartment 16. The evaporators 17 and 18 are preferably secured in heat exchange relation to the walls of the inner liner 12 so that the walls of the compartments 15 and 16 will be cooled thereby. The outlet end 19 of the evaporator 17 connects to an accumulator 20 and a suction tube 21 connects the outlet of the accumulator 20 to the inlet 22 of a motor-compressor unit 23. A second accumulator 24 is connected to the suction tube 21 by conduit 25 and the outlet end 26 of the evaporator 18 connects into this accumulator.

The motor-compressor unit 23 may comprise an electric motor and piston type compressor hermetically sealed within an outer casing in the manner common to the art. The outlet 27 of the unit 23 is connected by conduit 28 to a condenser 29 which is preferably arranged so that cooling air will circulate thereover. A second condenser 30 is connected to the condenser 29 by a separator 31 which comprises an inner tube 32 and a cylindrically shaped outer casing 33. The inner tube 32 extends through the central portion of the outer casing 33 with the ends thereof connected to the condensers 29 and 30.
horizontally disposed straight portion 34 of the tube 32 which is located within the casing 33 is provided with a series of apertures or vertically extending holes 35 by which the lowermost portion thereof as seen in Fig. 2. The holes 35 will permit any liquid flowing through the tube 32 to drain into the casing 33 as will be explained hereinafter. The casing 33 is provided with an opening therethrough in which one end of a conduit 36 is secured. The other end of the conduit 36 is connected to a filter element 37 and the outlet of the filter 37 is joined to a restrictor or capillary tube 38 which extends upwardly and is provided with several turns 39 whereby a tube of considerable length may be fashioned into a compact coil. The upper end of the capillary tube 38 is joined to the inlet end 40 of the evaporator 18. The inlet of a second filter 41 is joined to the outlet of the condenser 36 by a short conduit 42, and the outlet of filter 41 is connected to the inlet 43 of evaporator 17 by a second capillary or restrictor tube 44 having several turns 45 fashioned into a compact coil.

The construction of the invention having been described, the operation of the invention will now be explained. As previously mentioned, the two compartments 15 and 16 are to be maintained at different temperatures. Compartment 15 should be maintained at approximately 10º F. so that ice cubes may be frozen therein and frozen foods may be stored therein. The compartment 16 is normally used for the preservation of food articles and should be maintained at approximately 37º F. To properly cool these compartments, it is necessary to operate the evaporators 17 and 18 at different temperatures.

The refrigeration system illustrated is charged with a mixture of two refrigerants having different boiling points. While various types of refrigerants may be used to provide this mixture, by way of example, two refrigerants are used, one being dichlorodifluoromethane, commonly called (P-12), and the other being sulphur dioxide, commonly designated (SO2). The (SO2) has a lower vapor pressure than the (P-12) and will condense at a higher temperature. After being compressed by the motor-compressor unit 23, the mixture of refrigerant gases is conveyed by conduit 28 to the condenser 29. As the gaseous mixture progresses through the condenser 29, it will be cooled to a lower temperature by the cooling air circulating thereover. The condensed (SO2) will condense at a higher temperature than the (P-12), it will be liquefied in condenser 29 whereas the (P-12) will still be in the gaseous state after its journey through the condenser. As the mixture of (SO2) liquid and (P-12) gas passes through the straight portion 34 of the tube 32, the (SO2) liquid will collect in the lower portion of the tube 32 and drain through the holes 35 into the casing 33. The (P-12) gas will be passed through the upper portion of the tube 32 into condenser 36 where it will be cooled and condensed by cooling air circulating over the outer surfaces of the condenser.

From the casing 33, the liquefied (SO2) is conveyed by conduit 36 through filter 37 where any foreign matter will be removed by passage through capillary tube 38 into the evaporator 18. Assuming that the motor-compressor 23 is operating with an inlet pressure of 0.2 lb./sq. in. gage, the (SO2) will vaporize at a temperature of 34º F. within the evaporator 18. This will maintain the temperature of compartment 16 at the desired temperature of 37º F. The liquefied (P-12) will be conveyed from condenser 29 through filter 41 where foreign matters will be removed by passage through capillary tube 44 into the evaporator 17. Since the evaporators 17 and 18 are connected to the inlet of the cooler unit 23 by a common suction tube 21, they will both be subjected to the same 0.2 lb./sq. in. gage pressure. The (P-12) vapor will then pass through the accumulator 28 into the suction tube 21 and be mixed with the (SO2) vapor which is conveyed from the evaporator 18 through the accumulator 24 into the suction tube 21. The accumulators 20 and 24 will prevent liquid refrigerant from being drawn into the suction tube 21. The refrigerants with 1 first and 2nd may be pulled through the suction tube 21 by the motor-compressor unit 23 and be recompressed thereby after which they will be recirculated through the refrigeration system.

From the foregoing it is readily seen that a refrigeration system is provided which will operate to maintain separate compartments of a refrigerated cabinet at different temperatures. Automatic means for controlling the operation of the motor-compressor unit 23 in response to the temperature within the cabinet 18 may be provided if desired. The filters 37 and 41 and the accumulators 20 and 24 may be selected from the many types readily available on the present market. As will be apparent to those skilled in the art, the refrigeration system illustrated and described is simple in structure and efficient in operation. As compared with the two-temperature refrigeration systems common in the art, the present invention provides a system comprising a minimum number of parts. The system is illustrated diagrammatically but it is to be understood that it could be compactly arranged and positioned within a small machinery compartment provided within the cabinet 10.

Although only a preferred form of the invention has been illustrated, and the invention is not limited to the form described in detail, it is 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.

What is claimed is:

1. In a refrigeration system, a pair of evaporators connected in parallel to the inlet of a compressor, a first condenser and a second condenser connected in series to the outlet of said compressor, said system being characterized by a first refrigerant and a second refrigerant which has a lower boiling point than said first refrigerant, means for separating said first refrigerant from said second refrigerant after it has been liquefied by said first condenser, means for metering said liquefied first refrigerant into one of said evaporators, and means for metering said second refrigerant into said other evaporator after it has been liquefied by said second condenser.

2. In a refrigeration system, a first evaporator and a therethrough, then metered by capillary tube 32 into the evaporator 18. Assuming that the motor-compressor 23 is operating with an inlet pressure of 0.2 lb./sq. in. gage, the (SO2) will vaporize at a temperature of 34º F. within the evaporator 18. This will maintain the temperature of compartment 16 at the high-
er boiling point being liquefied by said first condenser and then collected by said separator, means for metering the liquefied refrigerant from said separator into said first evaporator, and means for metering said other refrigerant into said second evaporator after it has been liquefied by said second condenser.

3. In a refrigeration system, a first evaporator and a second evaporator connected in parallel to the outlet of a compressor, a first condenser and a second condenser connected in series to the outlet of said compressor, said system being charged with two refrigerants having different boiling points, the outlet of said first condenser being connected to the inlet of said second condenser by a tube having apertures through the lower portion thereof, an outer casing surrounding said tube, the refrigerant having the higher boiling point being liquefied by said first condenser and then drained through said apertures into said casing, means for metering the liquefied refrigerant from said casing into said first evaporator, and means for metering said other refrigerant into said second evaporator after it has been liquefied by said second condenser.

4. In a refrigeration system, a pair of evaporators connected in parallel to the inlet of a compressor, liquefying means connected to the outlet of said compressor, said system being charged with two refrigerants having different boiling points, means for conveying said refrigerants through a separator after they have been cooled to a temperature between the boiling points of said refrigerants by said liquefying means, the refrigerant having the higher boiling point being collected by said separator, means for conveying the refrigerant collected by said separator to one of said evaporators, and means for conveying said other refrigerant from said separator through said liquefying means so that it is fully liquefied, then conveying it into the other of said evaporators.

5. In a refrigeration system, a first evaporator and a second evaporator connected in parallel to the inlet of a compressing means, liquefying means connected to the outlet of said compressing means, said system being charged with a first refrigerant and a second refrigerant which has a lower boiling point than said first refrigerant, means for conveying the refrigerants through a separator after said first refrigerant has been liquefied by said liquefying means but before said second refrigerant has been liquefied, means for conveying said first refrigerant from said separator through said liquefying means so that it is fully liquefied, then metering it into the other of said evaporators.

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