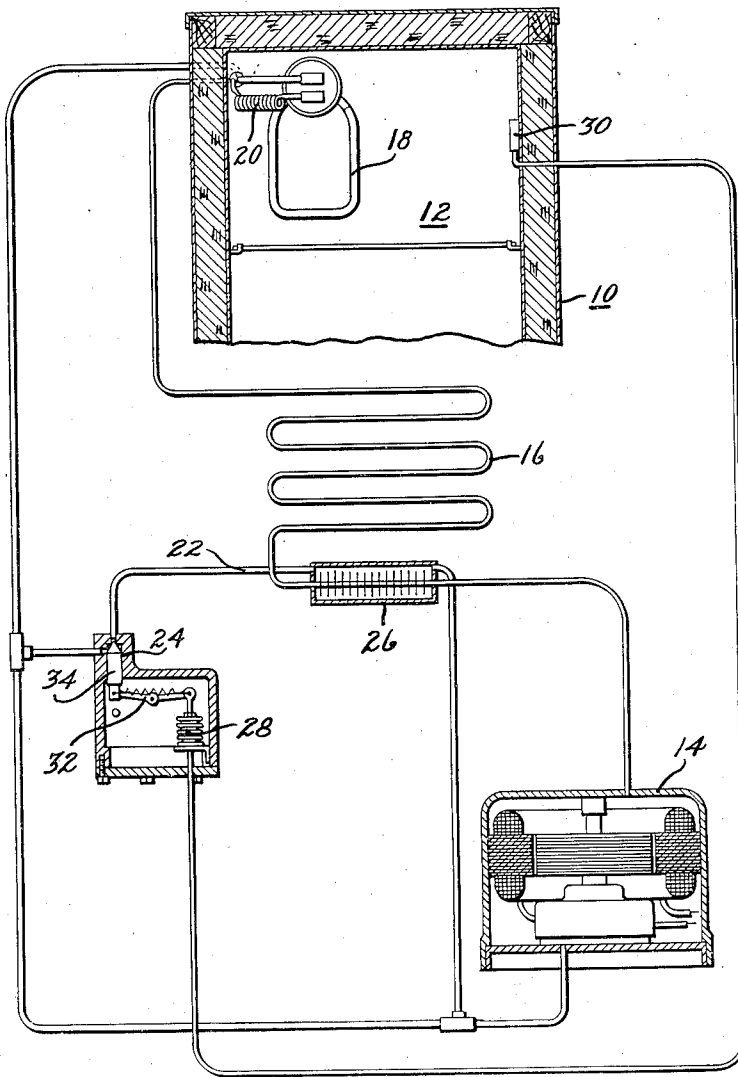


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REFRIGERATING APPARATUS

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REFRIGERATING APPARATUS

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This invention relates to refrigerating apparatus and more particularly to a novel system and control therefor for automatically varying the refrigeration output of the apparatus.

Heretofore, in the construction of refrigerators, particularly those comprising a cabinet having a food storage compartment and which are intended principally for household use, in meeting the problem of varying the refrigeration output of the machine to provide substantially constant food preserving temperatures in the cabinet, it has been customary to provide an automatic switch for stopping and starting the refrigerant liquefying unit as by controlling the motor which drives the compressor and to thus operate the apparatus intermittently. With such a method of control, the system, while it is operating produces refrigeration at a substantially constant rate and the variation in average amount of refrigerant produced over a given period results in variations in the lengths of the period during which the machine operates or is idle. A refrigerating apparatus of this character has certain disadvantages, among them being high first cost and frequent service difficulties, together with certain difficulties arising from the continued stopping and starting of the refrigerant liquefying unit, particularly with liquefying units of the compression type.

It is an object, therefore, of the present invention to provide a refrigerating apparatus which is readily adapted to extremely low cost production and in which the difficulties inherent in an intermittently operated refrigerator are avoided.

It is a further object of the invention to provide a refrigerating apparatus in which automatic control of the output of the apparatus is attained while the refrigerant liquefying unit is constantly running.

It is also an object of the invention to provide a refrigerating apparatus in which the liquefying unit runs continuously throughout a substantial range of room temperatures normally encountered and in which substantially constant temperatures are maintained in the food preserving or other compartment to be cooled solely by purposely causing the refrigerating system to operate at reduced efficiencies when its full capacity is not required.

Another object is to provide a refrigerating apparatus of the type employing a fixed restrictor as a liquid refrigerant control device and in which means are provided for reducing temporarily the pressure difference across the fixed

restrictor whereby to reduce the refrigeration output of the apparatus.

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

In the drawing:

Referring now to the drawing, the figure illustrates a diagrammatic view of a refrigerating apparatus embodying the present invention, a portion of the mechanism being shown in cross section.

In the form of the invention illustrated there is provided a refrigerator cabinet generally designated as 10 having a food compartment 12 in which substantially constant temperatures are to be maintained throughout a wide range of room temperatures. For example, in an ordinary household refrigerator, it is desirable to maintain a temperature within the compartment 12 between substantially 42° and 50° F., while room temperatures may run as high as 110° F. and are generally not below 60° F. Associated with the cabinet 10 is a refrigerant liquefying unit comprising a compressor 14, and a condenser 16, both of which may take any of numerous suitable forms in order to maintain a constant supply of liquefied refrigerant for use in the system. Within the compartment 12, there is mounted a refrigerant evaporator 18 for cooling the air within the compartment 12, and which may also be provided with means for freezing water as is well known in the art. Suitable means for controlling the flow of liquid refrigerant from the liquefying unit to the evaporator are provided and may comprise a fixed restrictor or other refrigerant control device 20. The elements so far described are connected in series by suitable refrigerant conduits in the well known manner to provide a closed refrigerant circuit. The elements of the refrigerating system including the refrigerant liquefying unit, the liquid refrigerant control device and the evaporator are preferably so proportioned and coordinated with each other as to provide a maximum refrigeration output not substantially in excess of the heat load requirements of the cabinet under the highest room temperature normally encountered.

In order to provide for a reduction in the output of a refrigerating system under conditions at which its maximum output is not required, means are provided for purposely causing the system to operate at reduced efficiencies. Gen-

erally speaking, this means has for its purpose the reduction of the pressure difference across the fixed restrictor 20, in order to decrease the rate of flow of refrigerant therethrough and consequently to decrease the output of the apparatus. This end is accomplished in the embodiment illustrated by the provision of a bypass 22 providing an alternate path for expanded refrigerant from the evaporator to the inlet of the compressor. Included in the bypass 22 are a thermostatic valve 24 and a heat exchanger 26 surrounding the conduit connecting the discharge of the compressor with the condenser. The valve 24 is operated by a bellows 28 which is responsive to pressure changes in a thermostatic bulb 30 situated in the food compartment 12. A snap acting linkage 32 connects the bellows 28 to the valve plunger 34 of the valve 24.

In operation, whenever the temperature of the food compartment 12 is above the maximum normally desired, the bellows 28 will be in expanded position and the valve 24 will be maintained closed. In this condition, the apparatus operates at its full capacity and produces refrigeration in the conventional manner. Whenever conditions are such that the full output of the apparatus is not required, the temperature of the food compartment 12 will drop sufficiently low to permit the bellows 28 to contract and thus open the valve 34. In this condition, a portion of the expanded refrigerant withdrawn from the evaporator 18 will pass through the bypass 22 and cool the compressed refrigerant discharged from the compressor 14, before this compressed refrigerant enters the condenser 16. This additional cooling effect exerted upon the compressed refrigerant lowers the head pressure within the condenser 16, and consequently reduces the pressure difference across the restrictor 20. Under these conditions, therefore, the rate of feed of liquid refrigerant to the evaporator is reduced. Likewise, the heat given off to the expanded refrigerant in the heat exchanger 26 raises the back pressure in the low side of the system tending further to lower the pressure difference across the restrictor and reflecting in a higher operating temperature at the evaporator.

Thus, it will be seen that the refrigerant liquefying unit is maintained in continuous operation and that the temperature of the air in compartment 12 is maintained substantially constant notwithstanding the continuous operation of the refrigerant liquefying unit. By this construction, it is possible to provide a refrigerating apparatus wherein the refrigerant liquefying unit runs continuously throughout substantially the entire range of room temperatures normally encountered, although if a thermostatic switch is provided for controlling the motor-compressor 14, its cut-out point may be selected so as to provide intermittent operation of the liquefying unit below any desired room temperature less than maximum.

Thus, the present invention provides a refrigerating apparatus having means for maintaining the temperature of the compartment to be cooled within a predetermined range, while the refrigerating apparatus for the compartment is maintained in continuous operation.

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, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A refrigerating apparatus comprising in combination a cabinet to be cooled, a refrigerating system including a compressor, a condenser, a fixed restrictor, and an evaporator connected in series to form a closed refrigerant circuit, and means for regulating cabinet temperatures including a heat exchanger for exchanging heat between the expanded refrigerant and the warm compressed refrigerant to alter the pressure difference across the restrictor, and means for controlling the amount of heat thus exchanged.

2. A refrigerating apparatus comprising in combination a cabinet to be cooled, a refrigerating system including a compressor, a condenser, a fixed restrictor, and an evaporator connected in series to form a closed refrigerant circuit, and means for regulating cabinet temperatures including a heat exchanger for exchanging heat between the expanded refrigerant and the warm compressed refrigerant to alter the pressure difference across the restrictor, and thermostatic means for controlling the amount of heat thus exchanged.

3. A refrigerating apparatus comprising in combination a cabinet to be cooled, a refrigerating system including a compressor, a condenser, a fixed restrictor, and an evaporator connected in series to form a closed refrigerant circuit, and means for regulating cabinet temperatures including a heat exchanger for exchanging heat between the expanded refrigerant and the warm compressed refrigerant to alter the pressure difference across the restrictor, and means for controlling the amount of heat thus exchanged, said first mentioned means exerting sole control over cabinet temperatures throughout a substantial range of room temperatures.

4. A refrigerating apparatus comprising in combination a cabinet to be cooled, a refrigerating system including a compressor, a condenser, a fixed restrictor, and an evaporator connected in series to form a closed refrigerant circuit, and means for regulating cabinet temperatures including a heat exchanger for exchanging heat between the expanded refrigerant and the warm compressed refrigerant to alter the pressure difference across the restrictor, and thermostatic means for controlling the amount of heat thus exchanged, said first mentioned means exerting sole control over cabinet temperatures throughout a substantial range of room temperatures.

5. A refrigerating apparatus comprising in combination a cabinet to be cooled, a refrigerating system including a compressor, a condenser, a fixed restrictor, and an evaporator connected in series to form a closed refrigerant circuit, and coordinated to provide a refrigerating capacity not substantially in excess of the heat load of the cabinet under the highest room temperature normally encountered, and means for regulating cabinet temperatures including a heat exchanger for exchanging heat between the expanded refrigerant and the warm compressed refrigerant to alter the pressure difference across the restrictor, and means for controlling the amount of heat thus exchanged, said first mentioned means exerting sole control over cabinet temperatures throughout a substantial range of room temperatures.

6. A refrigerating apparatus comprising in combination a cabinet to be cooled, a refrigerating system including a compressor, a condenser, a fixed restrictor, and an evaporator connected in series to form a closed refrigerant circuit, and coordinated to provide a refrigerating capacity not substantially in excess of the heat load of the

cabinet under the highest room temperature normally encountered, and means for regulating cabinet temperatures including a heat exchanger for exchanging heat between the expanded refrigerant and the warm compressed refrigerant to alter the pressure difference across the re-

strictor, and thermostatic means for controlling the amount of heat thus exchanged, said first mentioned means exerting sole control over cabinet temperatures throughout a substantial range of room temperatures.

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