

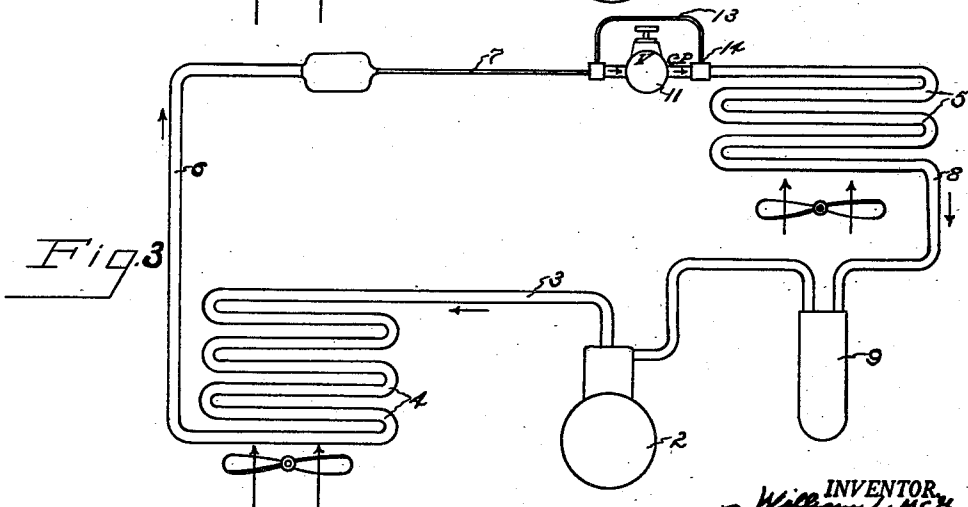
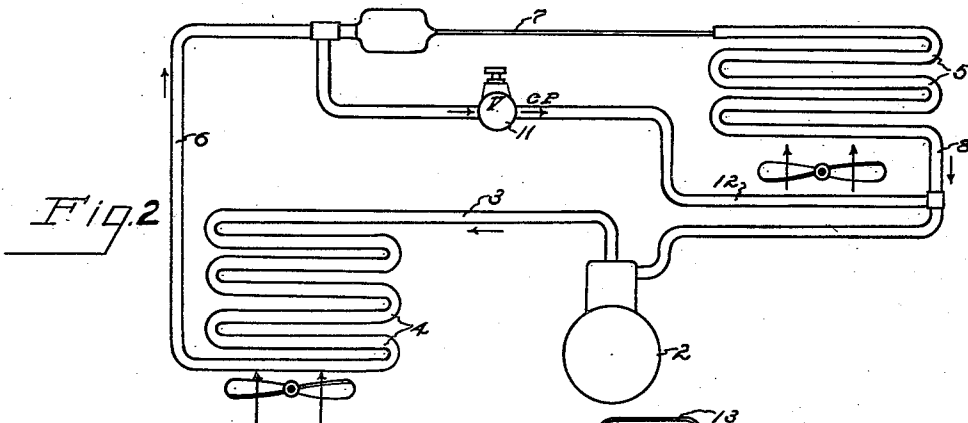
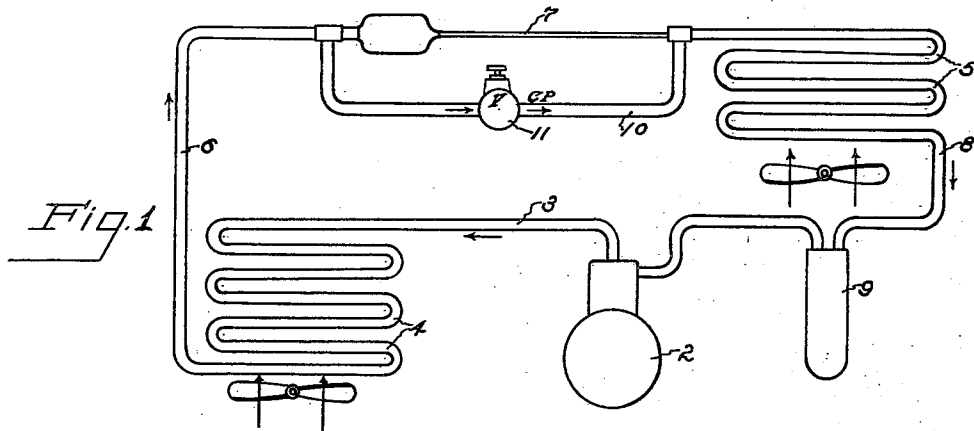
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CONTROL MEANS FOR REFRIGERATION SYSTEMS

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CONTROL MEANS FOR REFRIGERATION SYSTEMS

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This invention relates to a refrigeration system, and more particularly to a refrigeration system including a capillary tube and means for preventing freezing of the evaporator coil under conditions of light load or low exterior temperature.

It is known that if a capillary tube is employed in a system which possesses a low design evaporator temperature, under conditions of light loading or low exterior temperature or both the evaporator pressure will drop causing the coil to freeze. The use of an automatic expansion valve in such a system in place of a capillary tube prevents freezing of the coil. The use of an automatic expansion valve, however, creates a serious problem of unbalance or lack of capacity at or near full load since it is impossible to adjust the valve to control exactly the balance point between the compressor and the evaporator. Occasionally protection against freezing of the coil is obtained by using a suction pressure regulator. Such a regulator is expensive and creates a residual pressure drop in the suction line.

The chief object of the present invention is to provide a refrigeration system including a capillary tube in which freezing of the coil is eliminated under conditions of light load or low outside temperature or both.

An object of the present invention is to provide a refrigeration system including a capillary tube or other fixed restriction so designed that when evaporator pressure drops to a predetermined point, liquid refrigerant may be by-passed about the fixed restriction and collect in the accumulator of the system, thereby in effect removing some portion of liquid refrigerant from the system to reduce the capacity of the compressor and to increase the evaporator pressure.

A further object is to provide a refrigeration system including a by-pass about a fixed restriction and a normally closed control member in the by-pass which is responsive to a pressure corresponding to evaporator temperature so that upon a predetermined change in evaporator temperature the valve will open to permit liquid refrigerant to collect in the accumulator. Other objects of our invention will be readily perceived from the following description.

This invention relates to a refrigeration system which comprises in combination a compressor, a condenser, a fixed restriction an evaporator and an accumulator disposed in such order in a refrigerant circuit and pressure responsive means responsive to a predetermined change in pressure in the circuit corresponding to a predetermined change in evaporator temperature to per-

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mit liquid refrigerant to collect in the accumulator.

The attached drawing illustrates a preferred embodiment of our invention in which

Figure 1 is a diagrammatic view of a refrigeration system embodying the present invention; and Figures 2 and 3 are diagrammatic views of modifications of the present invention.

Referring to the attached drawing, there is shown a refrigeration system including a compressor 2 connected by line 3 to a condenser 4. Evaporator 5 is connected to condenser 4 by liquid line 6. A capillary tube 7 or other fixed restriction is placed in liquid line 6 and serves to meter the quantity of refrigerant passing to evaporator 5. Suction line 8 connects evaporator 5 with compressor 2. An accumulator 9 is placed in suction line 8 and serves to prevent liquid refrigerant flooding the compressor.

Referring to Figure 1, there is shown a by-pass line 10 connecting liquid line 6 with the inlet to evaporator 5. It will be noted by-pass 10 permits liquid refrigerant from line 6 to pass to evaporator 5 without passage through capillary 7. A normally closed pressure responsive valve 11 is placed in line 10. Valve 11 is normally set at a pressure corresponding to a predetermined refrigerant temperature; for example, 28° F.

Considering the operation of the system, under normal operating conditions, the system operates at design evaporator pressure, valve 11 remaining closed with liquid refrigerant feeding through capillary 7 in a normal manner. Under conditions of light load or low outside temperature or both, the evaporator temperature falls when the evaporator pressure drops to a point corresponding to a decrease in evaporator temperature to 28° F. Valve 11 will tend to move toward an open position, permitting liquid from line 6 to pass into the evaporator 5 without passage through capillary tube 7, and flood through the evaporator 5 into the accumulator 9. The removal of liquid from the condenser 4 through line 6 and by-pass 10 will reduce the amount of sub-cooling and eventually will permit gas to flow through valve 11 and capillary tube 7, both of these conditions effectively reducing the capacity of the compressor and tending to increase the evaporator pressure. This balancing action results in the evaporator pressure being maintained substantially constant at the predetermined level under light load conditions.

In Figure 2 we have shown a modification in which a by-pass line 12 is provided connecting liquid line 6 with suction line 8. Valve 11, of

course, is disposed in line 12. This is not as satisfactory as the system shown in Figure 1 since slight flooding of the compressor may result.

In Figure 3, we have shown a further modification of the present invention in which capillary tube 7 and valve 11 are placed in series in the refrigerant circuit. In this case, a second capillary tube 13 is provided in a by-pass 14 about valve 11. In the system described, under normal conditions of operation, valve 11 remains closed. Upon light load or low outside temperature or both, valve 11 moves toward an open position permitting liquid refrigerant to pass through the evaporator and to collect in the accumulator.

The present invention provides an inexpensive and simple mechanism for controlling a refrigeration system including a capillary tube under conditions of light load or of low outside pressure to prevent freezing of the evaporator coil. The mechanism provided for the purpose is inexpensive and does not deleteriously affect the refrigeration system. It does not create a problem of unbalance or lack of capacity at or above full load and serves to regulate the system under conditions of light load or low outside temperature to prevent freezing of the evaporator.

While we have described a preferred embodiment of our invention it will be understood our invention is not limited thereto since it may be otherwise embodied within the scope of the following claims.

We claim:

1. In a refrigeration system, the combination of a compressor, a condenser, a capillary tube, an evaporator and an accumulator disposed in such order in a refrigerant circuit, and a normally closed pressure responsive valve in the circuit responsive to a predetermined change in pressure corresponding to a predetermined change in evaporator temperature to move toward an open position permitting liquid refrigerant to bypass about at least a portion of the capillary tube.

2. In a refrigeration system, the combination of a compressor, a condenser, a capillary tube, an evaporator, an accumulator, and a normally closed pressure responsive valve placed in the system in parallel with the capillary tube, said valve being responsive to a predetermined change in pressure corresponding to a predetermined change in evaporator temperature to move toward an open position permitting liquid refrigerant to accumulate in the accumulator.

3. In a refrigeration system, the combination of a compressor, a condenser, a capillary tube, an evaporator and an accumulator disposed in such

order in a refrigerant circuit, a by-pass line about at least a portion of the capillary tube, a normally closed pressure responsive valve in said by-pass responsive to a predetermined change in pressure corresponding to a predetermined change in evaporator temperature to move toward an open position permitting liquid refrigerant to accumulate in the accumulator.

4. A refrigeration system according to claim 3 in which the by-pass line connects the liquid line of the system and the inlet of the evaporator.

5. In a refrigeration system, the combination of a compressor, a condenser, a capillary tube and an evaporator disposed in such order in a refrigerant circuit, a by-pass line about at least a portion of the capillary tube, said by-pass line connecting the liquid line and the suction line of the system, a normally closed pressure responsive valve in said by-pass line responsive to a predetermined change in pressure corresponding to a predetermined change in evaporator temperature to move toward an open position permitting liquid refrigerant to pass directly from the liquid line to the suction line without passing through the evaporator during refrigerating operation.

6. In a refrigeration system, the combination of a compressor, a condenser, a fixed restriction, a pressure responsive valve, an evaporator, and an accumulator disposed in such order in a refrigerant circuit, and a capillary tube connected in the circuit in parallel with the pressure responsive valve, said valve being responsive to a predetermined change in pressure corresponding to a predetermined change in evaporator temperature to move toward an open position permitting liquid refrigerant to accumulate in the accumulator.

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