April 5, 1949. G. K. MARSHALL 2,466,460

REFRIGERATING SYSTEM

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Fig. 1.

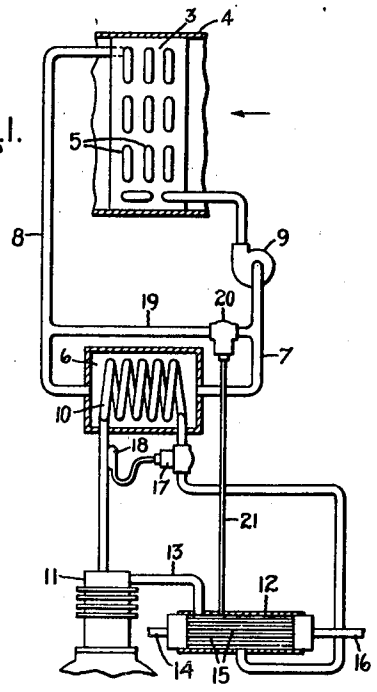
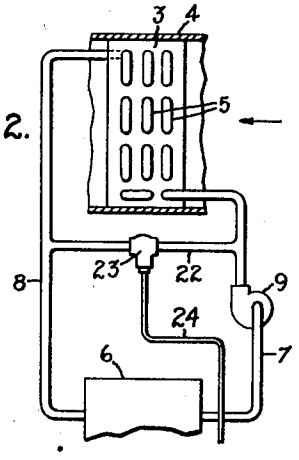


Fig. 2.



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REFRIGERATING SYSTEM

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5 Claims. (Cl. 62—3)

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This invention relates to refrigerating systems and particularly to such systems including motor driven compressor units and employing secondary refrigerant circuits.

It is an object of this invention to provide a refrigerating system including a condenser and an evaporator and a secondary fluid circuit for transferring heat to the evaporator, together with an improved control arrangement for maintaining substantially constant the load on the compressor.

Further objects and advantages of this invention will become apparent as the following description proceeds, and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of this invention reference may be had to the accompanying drawing in which Fig. 1 is a diagrammatic view of an air conditioning system including a refrigerating machine embodying the invention, and Fig. 2 is a diagrammatic view illustrating a modification of the invention.

Referring now to the drawing, the system illustrated in Fig. 1 comprises a heat transfer unit or cooling coil 3 arranged in a duct 4 to cool air circulating therethrough. The heat tranfer unit preferably comprises a plurality of turns or runs of tubing 5 provided with suitable heat transfer fins in the air path. Refrigerant for the unit 3 is supplied from a heat exchange unit 6 which is connected to the unit 3 by discharge and return conduits 7 and 8 respectively. The heat transfer liquid, such as brine, is circulated through the units 3 and 6 by operation of a pump 9 driven by a suitable motor (not shown). The heat transfer liquid in the tank 6 is cooled by an evaporator coil 10 connected in the closed refrigerant circuit of a refrigerating machine including a compressor 11 and a condenser 12. The compressor 11 is driven in the usual manner by a suitable motor (not shown). Hot compressed refrigerant is delivered to the condenser through a discharge connection 13 and is cooled in the condenser by the circulation of cooling water from an inlet 14 through tubes 15 in the condenser and out through a discharge connection 16. The liquid refrigerant is supplied to the evaporator 10 under control of a thermostatic expansion valve 17 having its control bulb or element connected to be responsive to the temperature of the vaporized refrigerant withdrawn from the evaporator as indicated at 18. The thermostatic expansion valve operates in a manner well known in the art to control the admission of refrigerant to the evaporator and maintain a predetermined substantially constant value of superheat of the vaporized refrigerant withdrawn from the evaporator.

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In many refrigerating systems it is desirable that the driving motor and compressor be operated at a substantially constant load regardless of variations of the load on the system. By this type of control it is possible to employ motors operating at rated capacity throughout the operation of the system so that the motor is operated at a high coefficient of performance as compared with refrigerating systems in which an over-sized motor is employed in order to carry peak demands, such over-sized motor being underloaded throughout long periods of operation of the system. In the system illustrated in Fig. 1 a conduit 19 is connected between the conduit 7 and the return conduit 8 to by-pass a portion of the liquid around the heat exchange unit 6. Thus this portion of the liquid after picking up heat in the unit 3 returns to the unit 3 through the pump 9 without being cooled in the unit 6. The flow of liquid through the by-pass 19 is controlled by a valve 20 in accordance with the pressure within the condenser 12 which is communicated to the valve control through a pressure tube 21. By controlling the valve 20 so that more liquid is by-passed as the pressure rises it is possible to maintain substantially constant the load on the compressor so that heat is not supplied to the heat exchange unit 6 in excess of that which can be handled by the compressor at the predetermined load.

The refrigerating system illustrated in Fig. 2 is similar to that of Fig. 1 and corresponding parts have been designated by the same numerals. In the system of Fig. 2 a by-pass 22 is provided between the conduits 7 and 8 on the discharge side of the pump 9 so that the liquid refrigerant is by-passed around the unit 3 instead of around the unit 6. Thus liquid cooled by operation of the evaporator 10 in the unit 6 is returned to the unit without picking up heat by circulation through the unit 3. The flow of fluid through the by-pass 22 is controlled by a valve 23 of the same type as the valve 20 and connected to the condenser 12 through a pressure tube 24 in the same manner as the tube 21 is connected to the condenser in Fig. 1.

During the operation of both systems the by-pass control maintains the load on the compressors substantially constant regardless of condition changes, such as variations in the temperature of the ambient air, and the motor which

drives the compressor is operated at a high coefficient of performance. It is readily apparent that this system provides a simple and effective control for maintaining a predetermined load on the compressor.

While I have illustrated and described a particular embodiment of my invention, modifications thereof will occur to those skilled in the art. I desire it to be understood, therefore, that my invention is not to be limited to the particular arrangement disclosed, and I intend in the appended claims to cover all modifications which do not depart from the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A refrigerating system comprising a compressor and a condenser and an evaporator connected in a closed refrigerant circuit, means for circulating a cooling fluid over said condenser, a first heat transfer unit, means including a second heat transfer unit arranged in heat exchange relationship with said evaporator for circulating a heat transfer liquid over said evaporator and through said first unit in series, means providing a by-pass for circulating a portion of said liquid around one of said units, and means responsive to an operating condition of said condenser for controlling the flow of liquid through said by-pass to maintain substantially constant the load on said compressor.

2. A refrigerating system comprising a compressor and a condenser and an evaporator connected in a closed refrigerant circuit, means for circulating a cooling fluid over said condenser, a first heat transfer unit, means including a second heat transfer unit arranged in heat exchange relationship with said evaporator for circulating a heat transfer liquid over said evaporator and through said first unit in series, means providing a by-pass for circulating a portion of said liquid around one of said units, and means responsive to the pressure of the refrigerant in said condenser for controlling the flow of liquid through said by-pass to maintain substantially constant the load on said compressor.

3. A refrigerating system comprising a compressor and a condenser and an evaporator connected in a closed refrigerant circuit, means for circulating a cooling fluid over said condenser, a first heat transfer unit, means including a second heat transfer unit arranged in heat exchange relationship with said evaporator and a pump for circulating a heat transfer liquid over said evaporator and through said first unit in series, means providing a by-pass around said second heat transfer unit for returning a portion of said liquid directly to said first unit, and means responsive to an operating condition of said condenser for controlling the flow of liquid through said by-pass to maintain substantially constant the load on said compressor.

4. A refrigerating system comprising a compressor and a condenser and an evaporator connected in a closed refrigerant circuit, means for circulating a cooling fluid over said condenser, a first heat transfer unit, means including a second heat transfer unit arranged in heat exchange relationship with said evaporator and a pump for circulating a heat transfer liquid over said evaporator and through said first unit in series, means providing a by-pass around said first unit for circulating a portion of the liquid cooled by said evaporator directly back to said second unit, and means responsive to an operating condition of said condenser for controlling the flow of liquid through said by-pass to maintain substantially constant the load on said compressor.

5. A refrigerating system comprising a compressor and a condenser and an evaporator connected in a closed refrigerant circuit, means including a thermostatic valve connected between said condenser and said evaporator to control the flow of liquid refrigerant to said evaporator for maintaining a predetermined substantially constant value of superheat of the vaporized refrigerant withdrawn from said evaporator, means for circulating a cooling fluid over said condenser, a first heat transfer unit, means including a second heat transfer unit arranged in heat exchange relationship with said evaporator for circulating a heat transfer liquid over said evaporator and through said first unit in series, means providing a by-pass for circulating a portion of said liquid around one of said units, and means responsive to an operating condition of said condenser for controlling the flow of liquid through said by-pass to maintain substantially constant the load on said compressor.

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No references cited.