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REFRIGERATION SYSTEM, INCLUDING CAPILLARY TUBE

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Fig. 1.

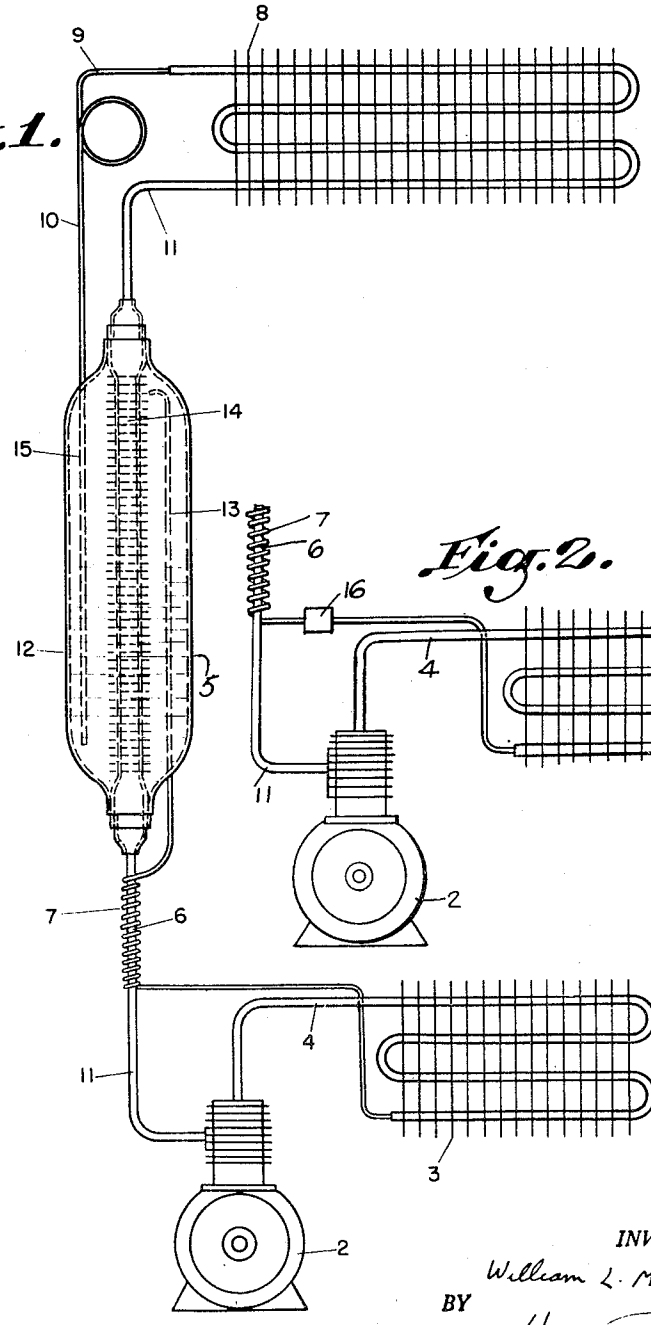


Fig. 2.

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REFRIGERATION SYSTEM, INCLUDING CAPILLARY TUBE

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6 Claims. (Cl. 62—8)

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This invention relates to refrigeration systems and more particularly to a refrigeration system including a capillary tube for regulating the flow of refrigerant into the evaporator.

An object of the invention is to provide a refrigeration system in which the flow of refrigerant into the evaporator is controlled by the difference in pressure between evaporator pressure and saturated pressure corresponding to the temperature of the last pass of the evaporator.

A further object is to provide a self-balancing refrigeration system including a capillary tube for regulating the volume of refrigerant supplied to the evaporator.

A still further object is to provide a refrigeration system including a restriction disposed in the liquid line and a receiver disposed in the system between the condenser and the evaporator, the pressure in the receiver being responsive to suction temperature of the evaporator and varying proportionately in response to variation in suction temperature, the receiver pressure being imposed against one side of said restriction whereby less refrigerant is supplied to the evaporator as the load imposed upon the evaporator decreases and a greater quantity of refrigerant is supplied to the evaporator as the load imposed thereon increases.

This invention relates to a refrigeration system which comprises in combination a compressor, a condenser, and an evaporator disposed in a closed circuit, a receiver disposed in the circuit, the pressure in said receiver being responsive to suction temperature of the evaporator and varying proportionately in response to variation in suction temperature, and means limiting flow of refrigerant to the evaporator, receiver pressure being imposed against said means whereby less refrigerant is supplied to the evaporator as the load imposed upon the evaporator decreases and a greater quantity of refrigerant is supplied to the evaporator as the load imposed thereon increases.

The attached drawing illustrates a preferred embodiment of my invention, in which

Figure 1 is a diagrammatic view of a refrigeration system illustrating the present invention; and

Figure 2 is a fragmentary, diagrammatic view illustrating a modification of my invention.

Referring to the drawing, there is shown a refrigeration system including a compressor 2 connected to a condenser 3 by line 4. Condenser 3 is connected to receiver 5 by line 6 hereinafter described. A restriction 7, such as a capillary tube or orifice, is disposed in line 6. Receiver 5 is connected to evaporator 8 by line 9. A similar restriction 10 is disposed in line 9. Suction line 11 connects evaporator 8 with compressor 2. Suction line 11 passes through receiver 5 as hereinafter described and is also disposed in heat exchange relation with capillary tube 7.

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Receiver 5 is composed of a casing 12 adapted to retain a desired quantity of refrigerant therein. A continuation 13 of line 6 extends within casing 12 and is adapted to discharge refrigerant in heat exchange relation with that portion 14 of suction line 11 passing through accumulator 5. The discharge of the refrigerant in heat exchange relation with portion 14 serves to condense the minor quantity of flash gas formed by the expansion of refrigerant through the restriction. A continuation 15 of line 9 extends from a point adjacent the bottom of casing 12. The pressure in casing 12 forces liquid refrigerant through line 9 to the evaporator.

The pressure in receiver 5 is determined by the suction temperature of evaporator 8 and varies proportionately in response to variation in suction temperature. Restriction 10 limits the flow of refrigerant to evaporator 8. Receiver pressure is imposed against one side of restriction 10. With an increase in receiver pressure in response to an increase in load imposed upon the refrigeration system, a greater quantity of refrigerant is forced through restriction 10 into evaporator 8. With a decrease in load imposed upon the refrigeration system, the suction temperature of evaporator 8 decreases thus decreasing the pressure maintained in the receiver. A decrease in receiver pressure decreases the pressure imposed against on side of restriction 10 permitting a decreased quantity of refrigerant to be supplied to evaporator 8.

As described above, the flow of liquid refrigerant into the evaporator 8 is controlled by the difference in pressure between evaporator pressure and saturated pressure corresponding to the temperature of the last pass of the evaporator. Since both liquid an gaseous refrigerant are present in the receiver, pressure therein is determined by the suction temperature of the evaporator. Thus, as the load imposed upon the refrigeration system decreases, the suction temperature is decreased, thereby reducing the pressure in casing 12 and causing less refrigerant to flow into the evaporator. This is in effect a self-balancing operation since, if wet liquid reaches portion 14 of suction line 11, the pressure on both sides of restriction 10 is equalized and flow

of refrigerant to the evaporator will be discontinued.

If desired, restriction 7 of the system illustrated in Figure 1 may be supplemented or replaced by an impulse trap 16 as shown in Figure 2 which reacts to the density of the fluid handled and effectively prevents passage of gas while permitting the flow of refrigerant. If desired, of course, restriction 7 may be supplemented or replaced by float valves for the same purpose.

The self-balancing system provided by the present invention may be used if desired in large refrigeration systems, as well as in small refrigeration systems. If desired a number of connections through restrictions may be made to the receiver and connected to various coils of an evaporator. Since the temperature and pressure of liquid in the receiver are very close to the temperature and pressure in the evaporator, only a very minor quantity of flash gas will be produced, thereby simplifying the distribution of liquid refrigerant to a plurality of separate coils of an evaporator.

The present invention provides a ready and simple means for regulating the flow of liquid refrigerant to the evaporator of a refrigeration system. The invention provides a refrigeration system permitting a reduction in cost by the use of capillary tubes while providing regulation of the refrigerant flow as satisfactorily as could be obtained by thermal expansion valves. The system so provided is self-balancing since a decrease in load decreases receiver pressure and consequently decreases the quantity of liquid passing into the evaporator. Likewise an increase in load increases receiver pressure and serves to increase the quantity of liquid refrigerant supplied to the evaporator.

While I have described and illustrated a preferred embodiment of my invention, it will be understood that my invention is not limited thereto since it may be otherwise embodied within the scope of the following claims.

I claim:

1. In a refrigeration system, the combination of a compressor, a condenser and an evaporator disposed in a closed circuit, a receiver disposed in the circuit, pressure in said receiver being responsive to suction temperature of the evaporator and varying proportionately in response to variation in suction temperature, a restriction disposed in the line connecting the condenser and the receiver metering flow of refrigerant to the receiver, said restriction being disposed in heat exchange relation with the suction line, and a second restriction disposed in the line connecting the receiver and the evaporator limiting flow of refrigerant to the evaporator, receiver pressure being imposed against one side of the second restriction whereby less refrigerant is supplied to the evaporator as the load imposed upon the evaporator decreases and a greater quantity of refrigerant is supplied to the evaporator as the load imposed thereon increases.

2. A system according to claim 1, in which an impulse trap supplements said first restriction, said trap reacting to the density of the fluid supplied to prevent passage of gas while permitting flow of refrigerant.

3. In a refrigeration system, the combination of a compressor, a condenser and an evaporator disposed in a closed circuit, a receiver disposed in the circuit between the condenser and the evaporator, the suction line connecting the evaporator and the compressor being disposed in heat exchange relation with refrigerant in the receiver, a portion of the liquid line connecting the condenser and the receiver being formed as a capillary tube and being disposed in heat exchange relation with the suction line, another portion of the liquid line extending within the receiver adjacent the top thereof, a line connecting the receiver and the evaporator, said connecting line extending from within the receiver adjacent the bottom thereof, the opening in the connecting line being below the liquid level in the receiver, and a second capillary tube in said connecting line, receiver pressure being imposed against said second capillary tube whereby less refrigerant is supplied to the evaporator as the load imposed upon the evaporator decreases and a greater quantity of refrigerant is supplied to the evaporator as the load imposed thereon increases.

4. In a refrigeration system, the combination of a compressor, a condenser and an evaporator disposed in a closed circuit, a receiver disposed in the circuit between the condenser and the evaporator, the suction line connecting the evaporator and the compressor passing through the receiver, the liquid line connecting the receiver and the condenser extending within the receiver and being adapted to permit discharge of liquid refrigerant in heat exchange relation with the suction line passing therethrough, a portion of the liquid line being disposed in heat exchange relation with the suction line, a line connecting the receiver and the evaporator, a restriction in said line, receiver pressure being imposed against one side of said restriction, pressure in said receiver being responsive to suction temperature and varying proportionately in response to variation in suction temperature whereby less refrigerant is supplied to the evaporator as the load imposed upon the evaporator decreases and a greater quantity of refrigerant is supplied to the evaporator as the load imposed thereon increases.

5. In a refrigeration system, the combination of a compressor, a condenser and an evaporator disposed in a closed circuit, a suction line connecting the evaporator with the compressor, a receiver disposed in the circuit, the suction line being placed in heat exchange relation with the receiver, pressure in said receiver being responsive to suction temperature of the evaporator and varying proportionately in response to variation in suction temperature, an impulse trap disposed in the circuit between the condenser and the receiver, a restriction disposed in the line connecting the receiver and the evaporator limiting flow of refrigerant to the evaporator, receiver pressure being imposed against one side of the restriction whereby less refrigerant is supplied to the evaporator as the load imposed upon the evaporator decreases and a greater quantity of refrigerant is supplied to the evaporator as the load imposed therein increases.

6. In a refrigeration system the combination of a compressor, a condenser and an evaporator disposed in a closed circuit, a receiver in said circuit between the condenser and the evaporator, a capillary tube in said circuit between the condenser and the receiver, said capillary tube being disposed in heat exchange relation with the suction line of the system, the suction line of the system passing through the receiver and a second capillary tube disposed in the circuit between the receiver and the evaporator, said second capillary tube having receiver pressure imposed on

one side thereof, a reduction in pressure in said receiver permitting a decrease in refrigerant supplied to the evaporator as the load imposed upon the evaporator decreases and an increase in pressure in said receiver permitting the supply of a greater quantity of refrigerant to the evaporator as the load imposed thereon increases.

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