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REFRIGERATING APPARATUS

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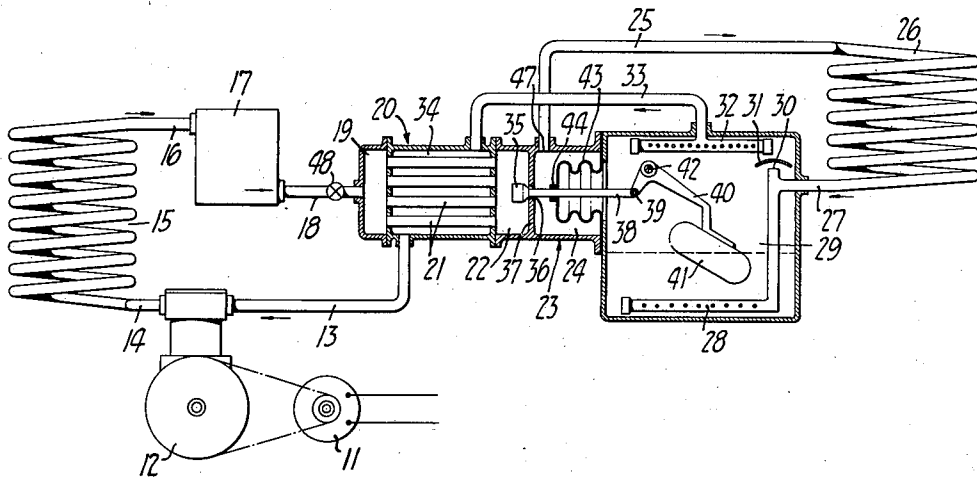
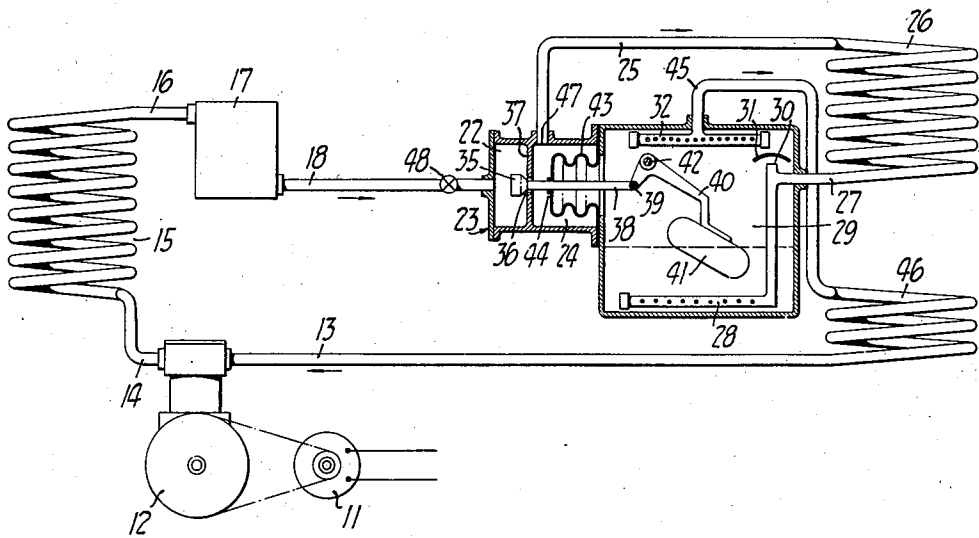


FIG_1_

FIG. 2.



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REFRIGERATING APPARATUS

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5 Claims. (Cl. 62-126)

My invention relates to refrigerating systems of the kind including a compressor, a condenser and an evaporator.

It is an object of my invention to provide means for controlling the supply of refrigerant to the evaporator.

A particular object of my invention is to provide a float actuated expansion valve for controlling the flow of refrigerant to the evaporator and responsive to an average condition of the refrigerant leaving the evaporator.

A further object of my invention is to provide an expansion valve arranged to be responsive to excess differential pressure across the evaporator.

A still further object of my invention is to provide combination precooling and superheating means for the refrigerant as it enters and leaves the evaporator respectively.

Still further objects and advantages of my invention will be apparent during the course of the following description.

Referring to the drawing:

Figure 1 is a diagrammatic view representing a refrigerating system arranged in accordance with one form of my invention; and

Figure 2 is a diagrammatic view representing a refrigerating system in accordance with an alternate form of my invention.

Referring more particularly to Fig. 1 of the drawing, the numeral 11 denotes a motor driving a compressor 12 which draws refrigerant from the suction pipe 13 to compress and deliver it through the pipe 14 to the condenser 15. Thence the refrigerant passes through the pipe 16 to the receiver 17 and through pipe 18 and valve 48 to the entrance chamber 19 of the heat exchanger 20. Thence it passes through the heat exchanger tubes 21 to the valve inlet chamber 22. When valve 23 is open, the refrigerant can pass into the valve outlet chamber 24 and through the pipe 25 to the evaporator 26 and thence through the pipe 27 and the perforated member 28 into the float chamber 29. Some of the refrigerant may also pass through the aperture 30, partly covered by the spray deflecting hood 31. From the float chamber 29, the refrigerant may now pass through the perforated discharge member 32, the pipe 33, the heat exchanger chamber 34 and the pipe 13 back to the compressor. The valve 23 comprises a valve member 35 cooperable with the valve port 36 formed in the partition 37 separating the inlet and outlet chambers. The valve stem 38 is connected by the pin 39 to the bell crank lever 40 attached to the float member 41 and having a fixed pivotal support 42. The flex-

ible bellows 43 is sealed to the float chamber 29 at one end and has a rigid head 44 at the other which carries the valve stem 38.

In the modified form of my invention shown in Fig. 2, the heat exchanger 20 of Fig. 1 is omitted and the refrigerant passes from the float chamber 29 through the discharge member 32 and the pipe 45 to the superheater 46 which may be subjected to ambient temperatures.

The heat exchanger 20, shown in Fig. 1, is adapted to perform a double function—that of precooling the liquid refrigerant entering it from the receiver 17 and also that of superheating the gaseous refrigerant returned through it to the compressor.

The valve 23 performs the function of the expansion valve commonly used in refrigerating systems of the type described and is so constructed as to produce a considerable pressure drop between the receiver and the evaporator. The evaporator coil 26 is of the so-called "dry" type as distinguished from the "flooded" type employed in some systems.

In normal operation, the refrigerant leaves the evaporator 26 as a saturated gas which may vary in condition from wet to superheated. This normally saturated gas, in passing through the float chamber 29, deposits therein some of the liquid with which it is charged. In time, the rise of liquid accumulating in the float chamber operates the float to close the valve 23. The refrigerant now being drawn from the evaporator becomes drier and this relatively dry gas, in passing through the float chamber, takes up some of the liquid therefrom and the liquid level in the float chamber accordingly drops, causing the float to reopen the valve. In normal operation the float chamber is partly filled with liquid at all times.

With heat absorption by the evaporator, the refrigerant drawn from it into the float chamber will be relatively dry, so that the liquid level remains such as to maintain the float in position to hold the valve open. When the heat absorption becomes less, the corresponding wet discharge into the float chamber acts to raise the float and close the valve.

With relatively wet refrigerant being drawn into the float chamber, most of it passes downward to enter through the member 28. With drier refrigerant, some of it may pass upward to enter the chamber through the aperture 30 which may be so restricted as to effect the desired flow proportion through the two float chamber inlet means.

The valve 23 may also function independently of its float control. In an installation where other evaporators are employed, connected in parallel with the one shown, and operated by the same compressor and condenser, it might at times be desirable to stop the refrigerant flow to the evaporator 26 while refrigerant continues to be drawn from it, as by closing a valve 48. On reopening of valve 48, the liquid refrigerant tends to rush into the exhausted evaporator 26 and, if unchecked, might be drawn into the compressor in a partly liquid condition, which would result in a dangerous "liquid hammer." However, the first rush of refrigerant into the valve outlet chamber 24 produces a pressure on the bellows 43 to close the valve 23. As the pressure in the chamber 24 is reduced by flow of refrigerant through the outlet aperture 47 into the evaporator 26, the valve 23 again opens, admitting more refrigerant into chamber 24. If the pressure in the evaporator 26 and the float chamber 29 is still very low with respect to the pressure in the chamber 24, i. e., across the bellows 43, the valve 23 will again close until this differential is reduced. The opening and closing of the valve 23 may continue until the high pressure differential across the bellows 43 is finally reduced to a point at which the valve 23 is controlled only by the float 41. This effect may be accentuated by restricting the valve outlet aperture 47 to dimensions that will permit normal maximum refrigerant flow therethrough but will aid in building up the differential pressure across the evaporator and the valve bellows, under conditions as described above.

While I have described my invention in its preferred embodiments, I wish it to be understood that modifications may be made and that no limitation on the invention is intended than is imposed by the scope of the appended claims.

I claim as my invention:

1. In a refrigerating system comprising a compressor, a condenser and an evaporator, the combination therewith of means forming a float chamber connected to the outlet of said evaporator, means connecting the upper area of said float chamber with said compressor, a refrigerant control valve having an outlet chamber and connected between the outlet of said condenser and the inlet of said evaporator, a valve member for said valve, means connecting said outlet chamber and said float chamber, a partition in said last-named means and separating said chambers, said partition being movable in response to difference of pressure in said chambers, a float in said float chamber and connected to said partition to move the same, and means connecting said partition and said valve member for closing said valve by movement of said partition by said float on predetermined rise of liquid in said float chamber, said last-named means being so arranged as to close said valve when said partition is moved by pressure in said outlet chamber abnormally high with respect to the pressure in said evaporator and said float chamber and when said float is normally in position to hold said valve member in open position.

2. In a refrigerating system comprising a compressor, a condenser and an evaporator, the combination therewith of means forming a float chamber connected to the outlet of said evaporator, means connecting the upper area of said float chamber with said compressor, a refrigerant control valve having an outlet chamber and connected between the outlet of said condenser and

the inlet of said evaporator, means connecting said outlet chamber and said float chamber, a partition in said last-named means and sealingly separating said chambers, said partition being movable in response to difference of pressure in said chambers, a valve member for said valve and operatively connected to said partition and movable toward open position in a direction opposed to the normal flow of refrigerant in the system, and a float in said float chamber and connected to said partition to move the same in a direction to close said valve upon rise of liquid in said float chamber, said partition being movable to close said valve irrespective of the condition of said float by pressure in said outlet chamber abnormally high with respect to the pressure in said evaporator and in said float chamber.

3. In a refrigerating system comprising a compressor, a condenser and an evaporator, the combination therewith of means forming a float chamber connected to the outlet of said evaporator, means connecting the upper area of said float chamber with said compressor, a refrigerant control valve having an outlet chamber and connected between the outlet of said condenser and the inlet of said evaporator, means connecting said outlet chamber and said float chamber, a partition in said last-named means and sealingly separating said chambers, said partition being movable in response to difference of pressure in said chambers, a valve member for said valve, a float in said float chamber, and means operatively connecting said valve member and said float and extending through said partition and sealingly secured thereto, said last-named means being movable by said float in a direction to close said valve upon rise of liquid in said float chamber, and said partition being movable to close said valve irrespective of the condition of said float by pressure in said outlet chamber abnormally high with respect to the pressure in said evaporator and in said float chamber.

4. In a refrigerating system comprising a compressor, a condenser and an evaporator, the combination therewith of means forming a float chamber connected to the outlet of said evaporator, means connecting the upper area of said float chamber with said compressor, a refrigerant control valve having an outlet chamber and connected between the outlet of said condenser and the inlet of said evaporator, means connecting said outlet chamber and said float chamber, a partition in said last-named means and sealingly separating said chambers, said partition being movable in response to difference of pressure in said chambers, a valve member for said valve and movable toward open position in a direction opposed to the normal flow of refrigerant in the system, a float in said float chamber, and means operatively connecting said valve member and said float and extending through said partition and sealingly secured thereto, said last-named means being movable by said float in a direction to close said valve upon rise of liquid in said float chamber, and said partition being movable to close said valve irrespective of the condition of said float by pressure in said outlet chamber abnormally high with respect to the pressure in said evaporator and in said float chamber.

5. In a refrigerating system comprising a compressor, a condenser and an evaporator, the combination therewith of means forming a float chamber connected to the outlet of said evaporator, means connecting the upper area of said float chamber with said compressor, a refrigerant

ant control valve having an outlet chamber and connected between the outlet of said condenser and the inlet of said evaporator, means connecting said outlet chamber and said float chamber, a partition in said last-named means and sealingly separating said chambers, said partition being movable in response to difference of pressure in said chambers, a valve member for said valve and having a stem extending through said partition and into said float chamber, said valve stem

being sealingly secured to said partition, and a float in said float chamber and connected to said valve stem to move the same in a direction to close said valve upon rise of liquid in said float chamber, said partition being movable to close said valve irrespective of the condition of said float by pressure in said outlet chamber abnormally high with respect to the pressure in said evaporator and in said float chamber.

WILLIAM A. RAY. 10