Nov. 26, 1940. J. L. FLETCHER 2,222,707

REFRIGERATING APPARATUS

Filed Nov. 30, 1938

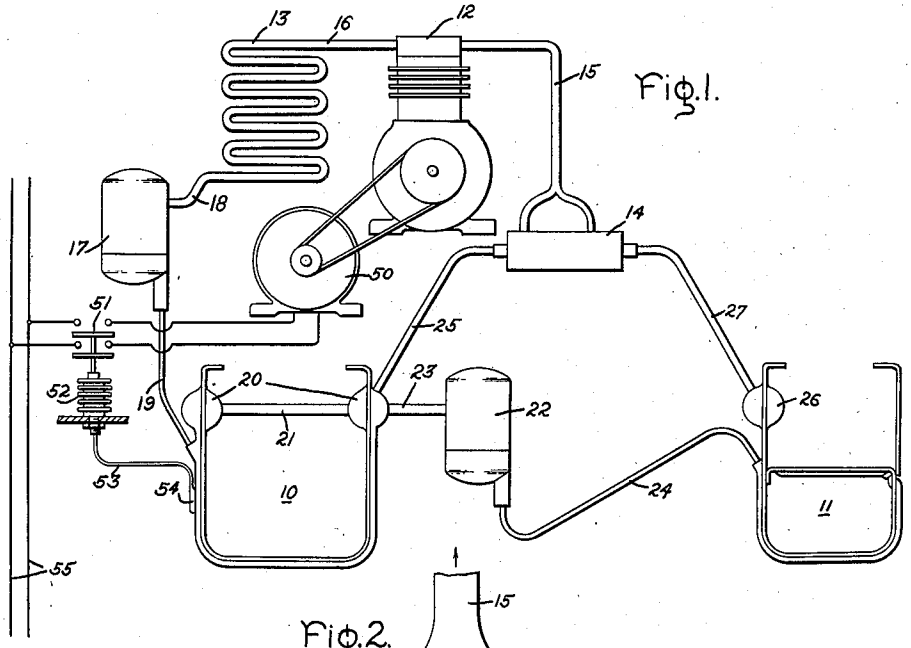


Fig. 1.

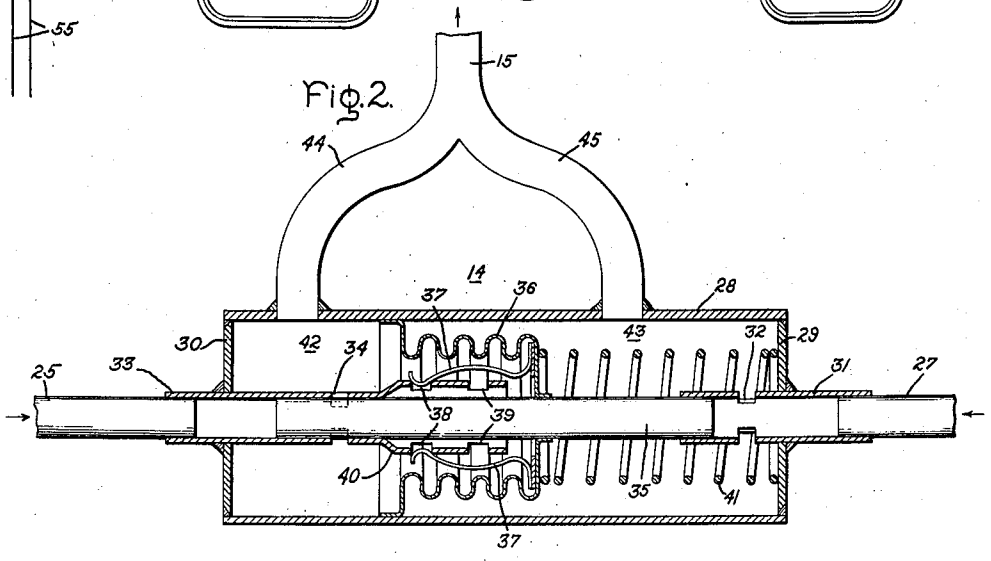


Fig. 2.

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Patented Nov. 26, 1940

2,222,707

UNITED STATES PATENT OFFICE

2,222,707

REFRIGERATING APPARATUS

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Application November 30, 1938, Serial No. 243,156

9 Claims. (Cl. 62—3)

This invention relates to refrigerating systems and more particularly to refrigerating systems including a plurality of evaporators operable at different temperatures.

It is an object of my invention to provide simple, efficient and reliable apparatus to control the operation of refrigerating systems of the above-mentioned type.

It is a further object of my invention to provide improved apparatus for controlling the operation of refrigerating systems of the above type according to the pressures existing in said systems.

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

For a better understanding of my invention reference may be had to the accompanying drawing in which Fig. 1 illustrates schematically a system embodying the principles of my invention; and Fig. 2 is a side elevation, partly in section, of a valve for use in the system illustrated in Fig. 1.

In the system disclosed by Fig. 1, I have shown a high temperature evaporator 10 and a low temperature evaporator 11 having a compressor 12 and condenser 13 common thereto. In a refrigerating system including high and low temperature evaporators with a common compressor and condenser it is necessary to provide means to connect the evaporators to the compressor in such a manner as to maintain a pressure differential between the evaporators. For this purpose, I provide a differential valve 14 which connects selectively either evaporator 10 or evaporator 11 to the suction line 15 according to the difference of pressures in evaporators 10 and 11.

Referring to Figs. 1 and 2 in greater detail, refrigerant vapor is compressed in compressor 12 and discharged into condenser 13 by way of conduit 16. Liquified refrigerant flows from condenser 13 into float valve 17 by way of a conduit 18. Evaporator 10 is supplied with refrigerant from float valve 17 by way of conduit 19.

Evaporators 10 and 11 may be of any desired form although I have illustrated my invention in connection with two flooded type evaporators. The evaporators 10 and 11 may be operated at any two desired temperatures. For example, one may be maintained below the freezing temperature in order to freeze ice, frozen desserts, etc., and also to maintain articles in a frozen state while the other evaporator may be used for the preservation of foods. I have illustrated evaporator 10 as having two headers 20 connected by a conduit 21. Liquid refrigerant is supplied to low temperature evaporator 11 from headers 20 by means of a float valve 22 and conduits 23 and 24. It will be obvious that liquid refrigerant will pass into float valve 22 only when the liquid refrigerant level in headers 20 is sufficiently high to overflow through conduit 23. Valve 14 communicates with header 20 of evaporator 10 above the liquid level therein by means of an inlet conduit 25. Valve 14 communicates with header 26 of low temperature evaporator 11 above the liquid level therein by means of a second inlet conduit 27. Valve 14, as will be described later, connects either conduit 25 or conduit 27 to suction line 15 in order that the vaporized refrigerant in header 20 or 26, respectively, may be drawn into compressor 12.

As shown in Fig. 2, valve 14 comprises a casing or chamber 28 having end walls 29 and 30. Chamber 28 may be incorporated in the casing of compressor 12 or separate therefrom as illustrated. An inlet tube 31 extends through end wall 29 into the interior of casing 28 through a suitable opening and is secured to end wall 29 in any desirable manner, as by welding, thereby providing for the reception of vaporized refrigerant drawn from header 26 of evaporator 11 through conduit 27. Tube 31 is provided with one or more ports 32 intermediate the inner end of tube 31 and the end wall 29. In a similar manner I have provided a second inlet tube 33 extending through the opposite end wall 30 for receiving vaporized refrigerant from header 20 through conduit 25. Tube 33 is provided with one or more ports 34 arranged similarly to ports 32.

In order to provide communication between the interior of casing 28 and one of the evaporators I provide a piston or plunger 35 which is arranged to reciprocate in tubes 31 and 33. Plunger 35 is dimensioned so that one set of ports is closed while the other set of ports is uncovered so that the associated inlet conduit is put into communication with the interior of casing 28 and also dimensioned so that during a portion of time plunger 35 is moving from one selective position to another, both ports 32 and 34 will be closed. For example, as indicated in Fig. 2, ports 32 will be closed before ports 34 are uncovered, assuming that plunger 35 is moved to the right. Thus, as the plunger 35 moves from one selective position to another selective position, at some prede-

termined point of its travel all communication with evaporators 10 and 11 and suction line 15 is cut off.

In order to obtain a snap action of the valve 14 I have provided a bellows 36 and spring arms 37. One end of bellows 36 is suitably secured to the inner wall of casing 28 while the other end is suitably secured to piston 35 intermediate its ends. One end of the arms 37 which are preferably of resilient material is connected to the last-mentioned end of bellows 36. The other end of arms 37 is suitably shaped to rest within recess 38 or recess 39 provided in an extension 40 of the second inlet tube 33. The operation of this device will be described later. The positions of recesses 38 and 39 serve to determine the amount of travel of piston 35.

In order to obtain and preserve the necessary difference of pressures between the evaporators 10 and 11 I have provided a spring 41 between bellows 36 and end wall 29 tending to bias the plunger 35 toward the left as viewed in Fig. 2. Arm 37 and extension 40 cooperate with spring 41 to provide the pressure differential as will be apparent when the operation of the valve 14 is described.

Inasmuch as bellows 36 divides valve 14 into two compartments 42 and 43, respectively, I have provided suction line 15 with branches 44 and 45 communicating with compartments 42 and 43 respectively, through suitable openings in casing 28 and secured to casing 28 in any suitable fashion as by welding.

The operation of valve 14 in the system illustrated in Fig. 1 will now be described. If it be assumed that the pressure in low temperature evaporator 11 plus the force biasing the plunger toward the left, as viewed in Fig. 2, is greater than the pressure in high temperature evaporator 10, the plunger 35 will be as shown in Fig. 2. In this position, vaporized refrigerant will pass from header 26 of low temperature evaporator 11 through conduit 27 into inlet chamber or tube 31 from whence the vaporized refrigerant will pass through ports 32 into compartment 43 and finally through branch conduit 45 into suction line 15. The connection between evaporator 10 and suction line 15 is, of course, closed by means of plunger 35. When the pressure relations in evaporators 10 and 11 respectively, change to such a degree that the pressure exerted on the left hand end of plunger 35 becomes greater than the bias force and pressure in the low temperature evaporator 11, plunger 35 will be urged toward the right. Inspection of Fig. 2 will show that this movement will be prevented as long as arms 37 rest in recesses 38 but it will be clear that when the pressure urging plunger 35 toward the right is sufficiently great, arms 37 will be forced out of the recesses 38 whereupon plunger 35 will move toward the right until arms 37 fall into recesses 39. It will now be clear that the arrangement of arm 37 and recesses 38 gives a snap action such that when the pressure differential is large enough to pull arms 37 out of the recesses 38 the plunger 35 will immediately jump to its alternative position, thereby closing ports 32 and uncovering ports 34. In this position, conduit 25 and therefore evaporator 10 will be put into communication with suction line 15 through inlet chamber or tube 33, ports 34, chamber 42 and branch conduit 44.

From what has already been said, it will be clear that the differential between the pressures in evaporators 10 and 11 will depend upon the tensions of spring 41 and resilient arms 37 as well as the size of recesses 38 and 39. The size of the recesses affects the differential because the deeper the recess or the further arm 37 is permitted to drop into the extension 40 the more pressure will be required to lift arms 37 out of the recesses.

While my invention is described in connection with a particular device, modifications will be apparent to those skilled in the art.

I have provided a temperature control for the above described system. As illustrated in Fig. 1, operation of compressor 12 and its driving motor 50 from a suitable source of power supply 55 is controlled by means of a switch 51 actuated by a bellows 52. Bellows 52 is connected through a conduit 53 with thermostatic bulb 54 which is arranged in good heat exchange relationship with high temperature evaporator 10. Whenever the temperature of evaporator 10 exceeds the value for which the control bellows 52 is adjusted, the thermostatic fluid in bulb 54 will expand into conduit 53 and bellows 52 causing the latter to elongate and operate switch 51, thereby energizing motor 50 from electric supply lines 55 to operate compressor 12. When the temperature of evaporator 10 is sufficiently lowered, the pressure in bellows 52 will decrease, permitting contraction of bellows 52 and opening of switch 51 to halt operation of motor 50 and compressor 12.

While I have shown a particular embodiment of my invention in connection with a compression machine, I do not desire my invention to be limited to the particular construction shown and described and I intend in the appended claims to cover all modifications within 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. In a refrigerating system, a plurality of evaporators adapted to operate at different temperatures, means for withdrawing vaporized refrigerant from said evaporators, and a single pressure responsive means associated with said evaporators, said means being directly responsive to the difference of pressures between said evaporators for selectively connecting one of said evaporators to said withdrawing means.

2. In a refrigerating system, a plurality of evaporators adapted to operate at different temperatures, means for withdrawing vaporized refrigerant from said evaporators and a single pressure responsive means associated with said evaporators, said means being directly responsive to the difference of pressures between said evaporators for selectively providing communication between one of said evaporators and said withdrawing means, said pressure responsive means being arranged for cutting off communication between said plurality of evaporators at a predetermined point during the movement of said means from one selective position to another selective position.

3. In a refrigerating system having a plurality of evaporators adapted to operate at different temperatures, means including a chamber for withdrawing vaporized refrigerant from said evaporators, means providing communication between said chamber and one of said evaporators, additional means providing communication between said chamber and another of said evaporators, and a single pressure responsive means associated with said evaporators, said means being directly responsive to the difference of pressures between said evaporators for selectively

closing one and opening the other of said communication means or opening said one and closing said other of said communication means.

4. In a refrigerating system, a plurality of evaporators adapted to operate at different temperatures, means including a chamber for withdrawing vaporized refrigerant from said evaporators, means providing communication between said chamber and one of said evaporators, additional means providing communication between said chamber and another of said evaporators, and a single pressure responsive means associated with said evaporators, said means being directly responsive to the difference in pressures between said evaporators for selectively closing one and opening the other of said communication means or opening said one and closing said other of said communication means, said last-mentioned means being arranged to close the open communication means before opening the closed communication means.

5. In a refrigerating system, a plurality of evaporators adapted to operate at different temperatures, means including a chamber for withdrawing vaporized refrigerant from said evaporators, means providing communication between said chamber and one of said evaporators, additional means providing communication between said chamber and another of said evaporators, a single pressure responsive means associated with said evaporators, said means being directly responsive to the difference in pressures between said evaporators for selectively closing one and opening the other of said communication means or opening said one and closing said other of said communication means, said last-mentioned means being arranged to close the open communication means before opening the closed communication means, and means for obtaining snap action of said pressure responsive means.

6. In a refrigerating system having a plurality of evaporators adapted to be operated at different temperatures, means for withdrawing vaporized refrigerant from said evaporators, means directly responsive to the difference of pressures between said evaporators for selectively providing communication between one of said evaporators and said withdrawing means, said pressure responsive means including a chamber, a first inlet conduit communicating between said chamber and one of said evaporators, a second inlet conduit communicating between said chamber and another of said evaporators, each of said conduits communicating with the interior of said casing, and a plunger arranged for selectively closing one or the other of said inlet conduits.

7. In a refrigerating system having two evaporators adapted to be operated at different temperatures, means for withdrawing vaporized refrigerant from said evaporators, means directly responsive to the difference of pressures between said evaporators for selectively providing communication between one of said evaporators and said withdrawing means, said means including a casing, a first inlet conduit communicating between said casing and one of said evaporators and extending into said casing, a second inlet conduit communicating between said casing and the other of said evaporators and extending into said casing, each of said conduits having a port communicating with the interior of said casing, and a plunger arranged to reciprocate in both of said conduits for selectively closing said port in one or the other of said inlet conduits, said plunger being so arranged as to close the open port before opening the closed port.

8. In a refrigerating system having two evaporators adapted to be operated at different temperatures, means including a compressor and a chamber for withdrawing vaporized refrigerant from said evaporators, means directly responsive to the difference of pressure between said evaporators for selectively connecting one or the other of said evaporators to said compressor, means including a first inlet conduit for providing communication with one of said evaporators and said chamber, additional means including a second inlet conduit communicating between the other of said evaporators and said chamber, one of said inlet conduits having a plurality of spaced apart recesses, a piston adapted to reciprocate in both of said inlet conduits, and means including a resilient member having one end thereof associated with said piston for obtaining snap action of said piston, the other end of said member being arranged to rest in one of said recesses.

9. In a refrigerating system having two evaporators adapted to operate at different temperatures, a compressor common to both, valve means directly responsive to the difference of pressures between said evaporators for selectively connecting one or the other of said evaporators to said compressor, a casing, a first inlet conduit communicating with one of said evaporators and extending into said casing, a second inlet conduit communicating with the other of said evaporators and extending into said casing, a suction line communicating between said compressor and said casing, a port in each of said inlet conduits, a piston adapted to reciprocate in both of said inlet conduits for selectively closing one or the other of said ports, a bellows, one end of said bellows being attached to said casing, the other end of said bellows being attached to said piston intermediate the ends thereof, means including a spring arranged to bias said piston in one direction, one of said inlet conduits having two spaced-apart recesses, a resilient member having one end thereof attached to said bellows, the other end of said member being arranged to rest in one or the other of said recesses.

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