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REFRIGERANT DISTRIBUTING MEANS

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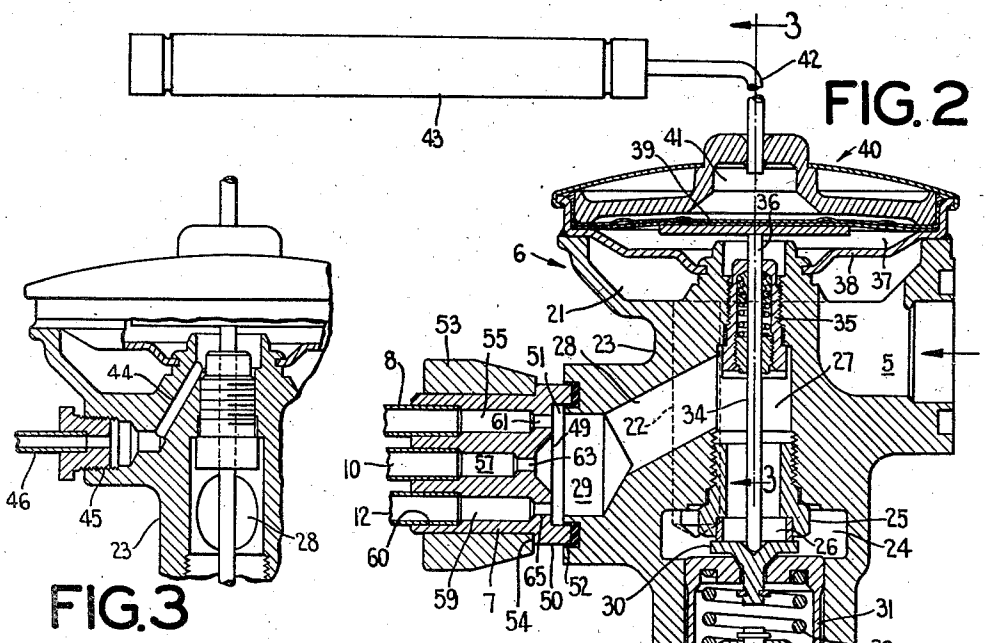


FIG. 2

FIG. 3

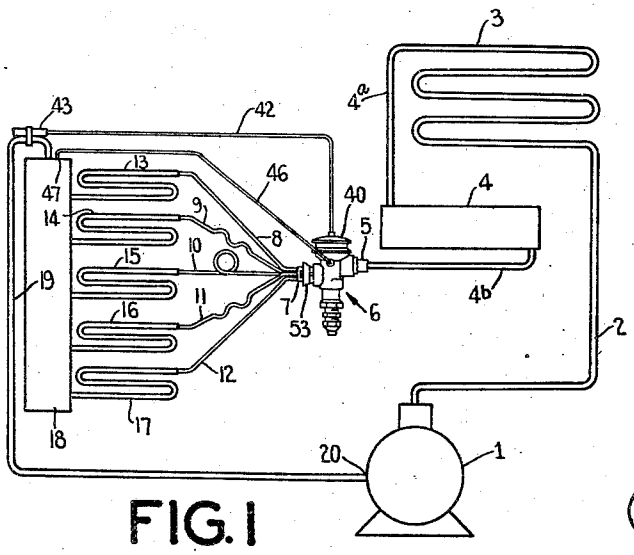


FIG. 1

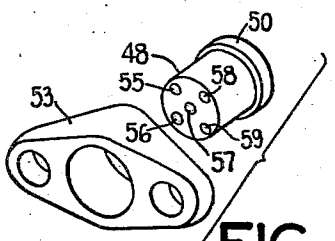


FIG. 4

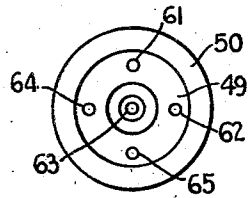


FIG. 5

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REFRIGERANT DISTRIBUTING MEANS

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Application November 15, 1943, Serial No. 510,328

1 Claim. (Cl. 138—37)

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This application relates to new and useful improvements in refrigerating apparatus, and more particularly to means for supplying or distributing a refrigerant medium to a plurality of evaporators.

One object of the invention is to provide means to distribute the refrigerating medium in equal quantities from a single condensing unit.

Another object is to provide a novel distributing device.

Another object is to feed refrigerant medium equally to the multiple evaporator passes of an evaporator unit having a common suction header, irrespective of change in load on the unit.

The invention consists in the improved construction and combination of parts to be more fully described hereinafter and the novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawing, to be taken as a part of this specification, there is fully and clearly illustrated a preferred embodiment of the invention, in which drawing—

Figure 1 is a diagrammatic view of a refrigerating apparatus having the distributing means of this invention;

Fig. 2 is a view in vertical central section through the thermostatic expansion valve and part of the distributing means of the apparatus of Fig. 1;

Fig. 3 is a detail view partly in section on the line 3—3 of Fig. 2;

Fig. 4 is an exploded view in perspective of the distributing member and a cooperable clamping means, and

Fig. 5 is a detail view of the inlet end of the distributor member.

Referring to the drawing by characters of reference, 1 designates a refrigerant compressor which may be driven by an electric motor, for example, which may be controlled in the usual manner by suction pressure or space temperature. The compressor 1 feeds the compressed volatile refrigerant medium through a high pressure supply pipe or conduit 2 to a condenser 3 which has its outlet connected to a receiver or liquid refrigerant supply tank 4 by a liquid line or conduit 4a. From the bottom of the tank 4, a liquid line or conduit 4b leads to the inlet 5 of a thermostatic expansion valve 6. The outlet port or conduit of the valve 6 feeds the distributing member 7 which is connected by a plurality of feeder tubes, here shown as five in number and designated 8, 9, 10, 11 and 12, which are of substantially equal length and of the same bore or internal diameter. These feeder tubes are connected respectively to a plurality of evaporators of equal heat exchange surface, designated 13, 14, 15, 16 and 17, which are preferably the separate evaporator passes of an evaporator unit and are connected at their outlet or suction ends into a common suction header 18. A refrigerant suction or return line or conduit 19 is connected into the upper end of the header 18 and leads to the suction side of the compressor 1, as at 20.

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The refrigerant liquid inlet 5 of the valve 6, see Fig. 2, opens into a heat exchange annular chamber 21 connected through one or more passageways 22 in the valve body 23 to the valve member inlet chamber 24. An annular valve seat member 25 provides a valve port 26 which separates the chamber 24 from the outlet chamber 27, which is connected to the exterior of the valve body by an outlet conduit 28 at the valve outlet port 29. In the inlet chamber 24, and cooperable with the seat 25 to control flow through the port 26, there is a valve member 30 which is normally urged toward its seat by a spring follower member 31 guided in the body 23 and backed by a helical coil compression spring 32. The valve member 30 is universally supported in the guide member 31, and the force with which it is urged towards its seat by the spring 32 is adjustable by the spring adjustment screw 33. The movement of the valve member 30 toward and from its seat member 25 is controlled by a thrust member or rod 34, having one end engaging the valve member and extending through the outlet chamber 27 and a refrigerant flow sealing means, generally designated 35. The other end portion, designated 36, of the rod 34 extends into a refrigerant back pressure chamber 37 which is separated and sealed from the refrigerant inlet chamber 21 by a partition 38. The rod end portion 36 abuts a resilient metal diaphragm or pressure responsive member 39 which forms one wall of the chamber 37 and is hermetically sealed at its periphery as by solder or the like to the partition 38. The diaphragm 39 also forms the operating or pressure responsive wall of a thermostatic power element, generally designated 40, having a pressure chamber 41 connected by a capillary tube 42 to a temperature responsive or feeler member 43. The power element 40 is of the gas charged type having a predetermined liquid charge, which in quantity could all condense into the chamber 41, and therefore the refrigerant inlet chamber 21 is provided in order to maintain the chamber 41 at a temperature above that of the bulb 43, so that the bulb 43 will, at all times, be the control point for

the thermostatic power element 40. The bulb 43 is clamped in intimate heat exchange relation with the suction conduit 19 adjacent its outlet from the header 18, as indicated in Fig. 1, so that the evaporator unit will be supplied with the proper quantity of refrigerant medium, as is well understood in the art. The refrigerant pressure chamber 37 is connected, see Fig. 3, to the exterior of the body 23 by an equalizer connection or passageway 44, which has its outer end screw-threaded, as at 45, to receive an external equalizer line or conduit 46, which is connected into the upper end of the header 18, as at 47.

The distributor member 7 is preferably externally cylindrical and has an end wall 49 which closes the valve outlet 29 and which is surrounded by an annular flange 50 which, together with the wall 49, provides a refrigerant chamber 51. The flange 50 extends into an annular recess 52 in the body 23 and surrounding the outlet 29. The flange 50 is clamped into the recess 52 and against packing material therein to seal the joint by a clamping member 53, which is sleeved over the distributor member 7 and urged into clamping engagement with a shoulder 54 thereon by screws or bolts screw-threaded into the body 23. The feeder tubes 8, 9, 10, 11 and 12 are sealed into the outer ends of parallel passageways 55, 56, 57, 58 and 59 respectively, see Fig. 4, which extend longitudinally through the member 7. It will be apparent that five tubes and passageways are shown merely for convenience of exposition, and that any number of tubes and passageways may be employed up to, for example, say sixteen or more, depending upon the number of evaporator passes to be supplied. The outer ends of the passageways 55 to 59 are each of counterbored, enlarged diameter, as at 60 to provide tube receiving sockets, so that the passageways will preferably be of equal flow area to that of their respective feeder tubes which may, for example, be of $\frac{3}{16}$'' internal diameter. The passageways 55 to 59 open through the wall 49 and communicate with the chamber 51 by means of calibrated refrigerant flow restricting ports 61, 62, 63, 64, 65 respectively, see Fig. 5, which may, for example, have a diameter of .067''.

The operation of the refrigerating apparatus and the distributing means is as follows: Assume that the compressor 1 is in operation and that the valve member 30 is throttling the flow of refrigerant medium to the outlet 29 in accordance with the back pressure in chamber 37 and the pressure in chamber 41 corresponding to the temperature of the bulb 43. The distributor member having the above dimensions will be suitable for the system of Fig. 1 when the inlet liquid temperature is

90° F., the suction pressure is 40 pounds per square inch, the minimum head pressure is 110 pounds per square inch, and the total load on the evaporator unit is 45,000 B. t. u. The lengths of the feeder tubes 8 to 12 are all substantially equal to each other and preferably less than 3' long and, therefore, the drops in pressure between the distributor inlet chamber 51 and the inlets to the evaporator passes 13 to 17 will all be equal. The ports 61 to 65 are of such small size that they materially restrict the flow from the outlet conduit 28, thereby to maintain liquid refrigerant medium with a minimum of flash gas in the distributor inlet chamber 51. Since the inlets to the feeder tubes are all of equal flow area, and since the pressure drops to the inlets of the evaporator passes are all equal, each of the evaporator passes 13 to 17 will be supplied with refrigerant medium at equal rates. When the suction pressure in the conduit 19 drops to the desired low point, or the temperature in the space cooled by the evaporator unit becomes sufficiently cold, then the control means (not shown) will function in the usual manner to stop operation of the compressor 1, and the valve member 30 will thereupon move to closed position, as is well understood in the art.

It may be noted that by restricting the areas of the ports 61 to 65 to the minimum permissible area in relation to the maintenance of an operative pressure drop through the valve port 26, that the refrigerant medium may in most cases be maintained at a sufficiently high pressure at the distributor member inlet to insure the feeding of liquid with a minimum of flash gas to the ports 61 to 65, thereby assuring highly efficient distribution.

Having thus described the invention, what is claimed and is desired to be secured by Letters Patent of the United States is:

A refrigerant distributing device comprising a conduit closing member having an unobstructed end wall with a surrounding tubular flange providing a circular inlet chamber, said member having a plurality of passageways therethrough, all of the passageways in said member extending straight from end to end through said member, all of the passageways opening through said end wall into said chamber, all of the passageways in said member communicating with one another through said chamber and all serving to distribute refrigerant admitted to said chamber, each of said passageways having at least three portions of successively increasing diameter with its portion of smallest diameter opening through said wall into said chamber.

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