LIQUID DISTRIBUTOR FOR REFRIGERATING SYSTEMS

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INVENTOR.

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The present invention relates to a liquid distributor for refrigerating systems. In many refrigerating systems the cooling coil or evaporator of the system consists of a plurality of coils connected together in parallel, and in such arrangement the refrigerant is divided at a distributing head connected with said coils and is passed in parallel paths of flow through these coils. These parallel feeds or paths of flow are advantageous for reducing coil friction. Coil friction is detrimental because it builds up pressure, causing the refrigerant to boil at a higher temperature, thereby reducing the effective capacity of the cooling coil and of the compressor. However, if these coils with parallel paths do not receive the refrigerant evenly part of the coil surface is then not working at maximum efficiency and hence the coil and compressor capacity are reduced.

The primary object of the present invention is to provide an improved distributor which will secure a more even distribution of flow between the parallel coils than can be obtained in any prior distributors now known to me. My improved construction comprises a conical distributing point and a toroidal distributing chamber cooperating therewith, these two structural features producing a very efficient turbulence and rotary flow of the refrigerant which insures its even distribution into the intake ends of the several parallel coils. The distributor receives the refrigerant directly from the expansion valve, at which point approximately 10% to 15% of the refrigerant is composed of gas bubbles. The turbulence and rotary flow referred to above serve to break up these bubbles into small evenly divided gas cells before they enter the ports leading to the parallel cooling coils. My improved construction is such that there can be no direct stream of liquid and no direct stream of bubbles into any one of the ports of the plurality of parallel coils, but instead all of the liquid and all of the bubbles are compelled to first pass through the toroidal flow chamber where the rotary flow is imparted thereto. My improved distributor has a very low pressure drop, is very simple in construction, and is inexpensive to manufacture.

Other objects, features and advantages of the invention will appear from the following detailed description of one preferred embodiment thereof.

In the accompanying drawings illustrating such embodiment:

Figure 1 is a diagrammatic view of a conventional refrigerating system embodying my improved liquid distributor;

Figure 2 is an axial sectional view through the improved distributor;

Figure 3 is a transverse sectional view showing the distributor in plan;

Figure 4 is a flow diagram showing the action of the bubbles; and

Figure 5 is a similar flow diagram showing the turbulence and rotary flow.

Referring first to Figure 1, this shows a conventional refrigerating system comprising a compressor 10, a condenser 11 and an evaporator 12. The compressor 10 is driven by a motor 13, and air for cooling the condenser 11 may be circulated therethrough by a fan 14 which can also be driven by the motor 13. A conduit 15 carries the compressed refrigerant from the compressor 10 to the condenser 11, and the condensed refrigerant is conducted from the condenser or from a liquid receiver connected therewith through conduit 17 leading to the expansion valve 18. The discharge side of this expansion valve is connected through conduit 19 with the inlet opening of my improved distributor 20. Leading from the outlet ports of this distributor 20 are the plurality of parallel coils 21 which make up the cooling surface of the evaporator 12. The outlet ends of the coils 21 discharge into a header 22 which is connected to the inlet side of the compressor 10 by a suction conduit 23. The expansion valve 18 may be of any suitable type, one typical arrangement being to have this valve automatically controlled by a thermostatic control 25 responsive to temperatures at the header 22 or suction conduit 23. It will be understood that this refrigerating system shown in Figure 1 has been illustrated only for the purpose of showing a typical installation of my improved distributor, and that this improved distributor is adaptable to other refrigerating systems than that shown.

Referring now to Figure 2, this improved distributor comprises a cylindrical housing 30 having a reduced lower end 31 and an expanded upper end 32. Preferably, this housing consists of a standard copper reducer. In one conventional size for distributing the flow to two, three or four parallel coils, this reducer can be of the size for receiving 1½" O.D. conduit at its upper end and ½" O.D. conduit at its lower end. Mounted in the enlarged upper end 32 of this reducer housing is a head 33 comprising a cylindrical shank 34, a conically tapered lower point 35, and an annular groove 36 of circular profile located between the cylindrical shank 34 and tapered point 35. This distributor head is provided with a circularly arranged series of holes...
37 extending down into its upper end for receiving the inlet ends of the evaporating coils 31. In the illustrated construction, three of such holes 37 are provided for receiving three of these parallel coils, but it will be understood that the distributor head can also be constructed for supplying a greater or lesser number of these coils. Extending downwardly from the holes 37 are counterbored passageways or ports 38 of smaller diameter, such construction forming a sloping shoulder 39 between each hole 37 and its counterbore 38. The ends of the coils 21 have a snug fit in the holes 37 and about against the shoulders 39. The distributor ports or passageways 38 extend downwardly to intersect or pass through the annular groove 36, the lower ends of these passageways extending into but not through the conical point 35.

Referring now to Figures 4 and 5 illustrating the operation of the distributor, it will be seen that all of the refrigerant, including both liquid and bubbles, passing upwardly into chamber 41 will be acted upon by the conical point 35 before any of this refrigerant can reach any of the passageways 38. The distributor is always installed in a vertical position, or substantially so, so that all bubbles 42 in the flow will tend to travel upwardly to the conical distributing point 35 and will be uniformly acted upon by gravity. These bubbles 42 are broken up into small evenly divided gas cells 43 by the turbulence and rotary flow created along the tapering point 35 and within the toroidal chamber 36. As shown in Figure 5, the sloping surface of the tapering point directs the velocity pressure of the refrigerant outwardly for causing it to impinge at an upward and outward angle against the inner wall of the chamber 41 substantially at the point of juncture with the toroidal groove 36. This means that the refrigerant enters the groove with an upward motion along the outer side of the groove, as a result of which a rotary whirling motion is imparted to the refrigerant within the toroidal area 36 substantially as indicated by the arrows. This circular whirling motion within the toroidal chamber serves to break up the gas bubbles 42 into the relatively smaller gas cells 43. This circular whisking motion and the circumferential rotary flow of the refrigerant in moving laterally toward one of the ports 38 brings about a very even distribution of gas cells throughout the liquid content of the refrigerant. Such circular whisking motion and circumferential flow also causes a uniform distribution of the liquid and gas contents of the refrigerant to each of the three outlet ports 38. Thus, the desired object of maximum uniformity of distribution to the several parallel coils is achieved. It will be noted that this improved distribution is obtained without any objectionable pressure drop occurring within the distributor head. Also, all openings therein are large so that they will not plug or foul with oil. The entire unit is sufficiently small so that it will fit inside a conventional coil casing. The major diameter of the tapering point substantially overlies all portions of the distributing ports 38, so that none of the liquid bubbles can pass directly into these outlet ports.

In the assembly of the device, the head 32 is preferably soldered or brazed in place within the enlarged upper end 37 of the reducer fitting, although it will be understood that it might be threaded or pinned in this fitting if preferred. The ends of the parallel coils 21 are preferably silver soldered in the openings 37, and the shoulders lower ends 39 of these holes insure that the solder will not flow down and restrict the effective diameters of the ports 38.

While I have illustrated and described what I regard to be the preferred embodiment of my invention nevertheless it will be understood that such is merely exemplary and that numerous modifications and rearrangements may be made therein without departing from the essence of the invention.

I claim:

In a liquid distributor for supplying parallel evaporator coils of a refrigerating system, a housing having an inlet opening in its lower end and a plurality of outlet openings in its upper end, a projection on said housing having a downwardly pointing conical deflecting surface against which the refrigerant entering said inlet opening impinges, and said projection forming with said housing an angular distribution passageway above said conical deflecting surface connecting said plurality of outlet openings.

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