Dec. 5, 1939. F. D. GOWANS 2,182,664

REFRIGERANT DISTRIBUTOR FOR COOLING UNITS

Filed Dec. 17, 1936

Fig. 1.

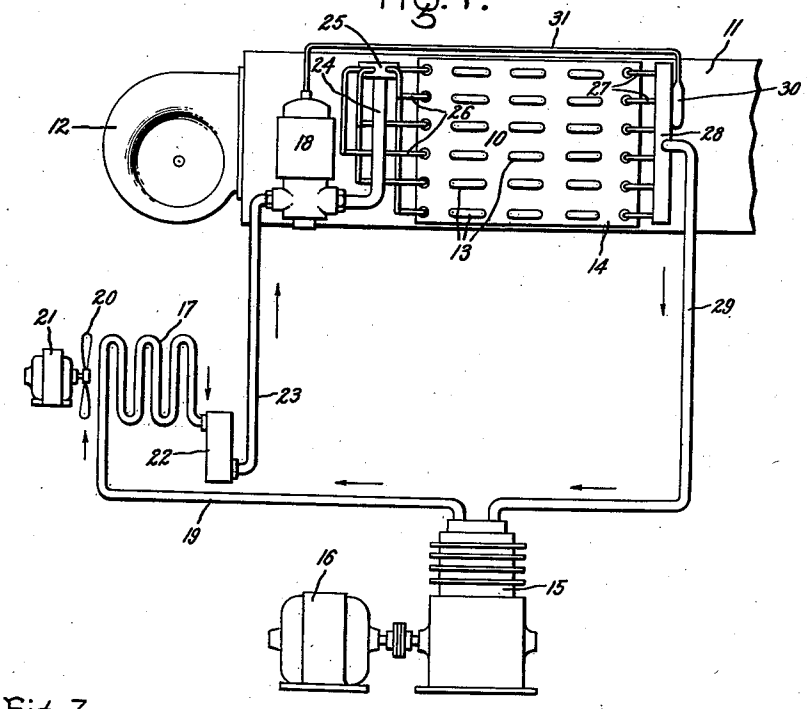


Fig. 3.

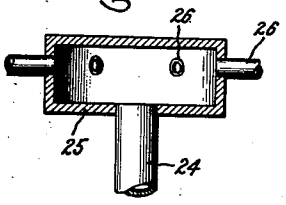


Fig. 4.

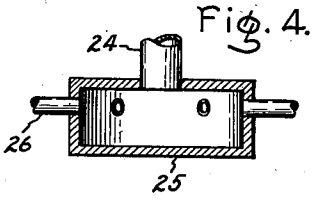
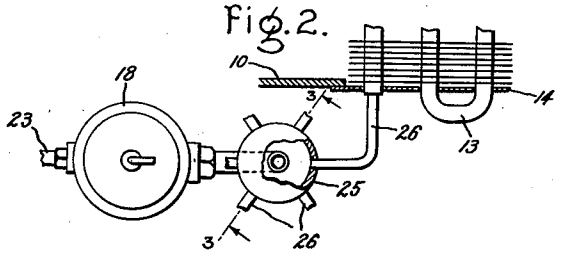


Fig. 2.



Inventor:
Floyd D. Gowans
by Harry E. Dunham
His Attorney

Patented Dec. 5, 1939 2,182,664

UNITED STATES PATENT OFFICE

2,182,664

REFRIGERANT DISTRIBUTOR FOR COOLING UNITS

Floyd D. Gowans, Wesleyville, Pa., assignor to General Electric Company, a corporation of New York

Application December 17, 1936, Serial No. 116,393

3 Claims. (Cl. 62—127)

My invention relates to cooling units of the type having a plurality of evaporator elements supplied with refrigerant from a single expansion valve, and particularly to refrigerant distributing arrangements for such units.

Cooling units are frequently constructed with a plurality of separate evaporating elements such as sinuous coils arranged in banks and connected to be supplied with refrigerant through a single expansion device such as a thermostatic expansion valve. When the several evaporating elements are fed from the usual manifold or distributing header there is an uneven distribution of liquid and gaseous refrigerant to the evaporating elements which produces uneven temperatures of the several elements of the cooling unit. For efficient operation of the cooling unit each element should carry the same proportion of the total load. When the distribution of refrigerant is uneven this condition is impossible and, therefore, uneven distribution results in inefficient operation of the cooling unit. The various devices heretofore proposed to provide uniform distribution of refrigerant have not proved entirely satisfactory. Accordingly, it is an object of my invention to provide a simple and rugged device of improved construction for providing uniform distribution of liquid and gaseous refrigerant to a plurality of evaporators of a cooling unit supplied from a single expansion valve.

Another object of my invention is to provide a device for distributing liquid and gaseous refrigerant uniformly to a plurality of evaporators supplied by a single expansion valve and which shall require no additional moving parts.

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 is a diagrammatic view of a cooling unit for an air conditioning system provided with a refrigerant distributing device embodying my invention shown in side elevation; Fig. 2 is an enlarged plan view partly in section of a portion of the distributing device shown in Fig. 1; Fig. 3 is an enlarged sectional view on the line 3—3 of Fig. 2; and Fig. 4 is an enlarged sectional view similar to Fig. 3, showing a modification of my invention.

Referring now to the drawing, in Fig. 1, I have shown a cooling unit 10 arranged to cool air passing through a duct 11 by operation of a fan 12. The cooling unit 10 comprises a plurality of horizontally arranged evaporating elements 13 extending across the duct 11 and mounted in an endplate 14. The evaporating elements 13 are connected in the circuit of a refrigerating machine comprising a compressor 15 driven by a motor 16, a condenser 17, and an expansion valve 18. During the operation of the refrigerating machine gaseous refrigerant is compressed in the compressor 15 and delivered through a connection 19 to the condenser 17 where it is cooled and liquefied, the condenser being cooled by air circulated thereover by a fan 20 driven by a motor 21. The liquid refrigerant flows from the condenser 17 to a liquid receiver 22 and thence through a connection 23 to the inlet of expansion valve 18. The outlet of the expansion valve 18 is connected by a vertically extending tube 24 in communication with an opening in the bottom of an upright cylindrical distributing header 25. Liquid and gaseous refrigerant are distributed uniformly to the elements 13 through a plurality of outlet conduits 26 each connecting a different evaporator element to the header. The liquid refrigerant in the elements 13 is vaporized by the absorption of heat from the air passing through duct 11 and the vaporized refrigerant is discharged through a plurality of connections 27 into a header 28 from which it is withdrawn through a conduit 29 and returned to the compressor 15. The expansion valve 18 is of the well known type provided with a thermostatic bulb 30 filled with volatile liquid and connected through a tube 31 to a bellows in the casing of the valve 18 to control the actuation of the valve 18.

I have found that when the header is made of symmetrical form about a vertical axis and the mixture of liquid and gaseous refrigerant from the expansion valve is admitted to the header near the top or near the bottom thereof, and if the outlet conduits leading to the several evaporators are connected to the header at substantially the same level and at substantially equal distances from the inlet opening communicating with the expansion valve, the mixture of the refrigerant will be evenly distributed to the several outlet conduits. I have also found that it is preferable to locate the inlet opening in the top or bottom of the header so that the vertical axis about which the header is symmetrical passes through the inlet opening. The mixture of liquid and gaseous refrigerant flowing through the distributing header from the inlet thereof to the several outlets may be considered as flowing in a plurality

of paths or streams, each path leading from the inlet to an outlet. The construction described herein makes all the paths alike through which the refrigerant travels in the header so that the same velocity and momentum effect prevails in all the paths. The magnitude of the velocity of refrigerant is, therefore, not of importance to the maintenance of satisfactory operation. Furthermore, by locating all the outlet openings at substantially the same level, the effect of gravity is equalized for all paths of the refrigerant in the header. Furthermore, I have found that the separation of liquid and gaseous refrigerant in the header may be minimized by making the volume of the header sufficiently small. The distribution of the liquid and gaseous refrigerant to all the outlets will also be more uniform if the outlets are equally spaced with respect to one another.

Referring now to Figs. 2 and 3 of the drawing, the distributing header **25** is of upright cylindrical form and hence is symmetrical about a vertical axis; the outlet conduits **26** are equally spaced and enter the header **25** radially thereof. The upper portions of these conduits are substantially at right angles to the vertical portion of the tube **24** entering the bottom wall of the header, and all of the conduits enter the upper portion of the header at substantially the same level and at the same distance from the top of the tube **24** which is flush with the inner bottom wall of the header. The volume of the header is made as small as practicable to assist in preventing any substantial separation of liquid and gaseous refrigerant. During the operation of the cooling unit the mixture of liquid and gaseous refrigerant flowing from the outlet of the expansion valve **18** to the header **25** circulates turbulently in the header and flows uniformly into all of the outlet conduits **26**. All the evaporating elements **13** are thereby supplied with substantially equal amounts of liquid and gaseous refrigerant and operate at substantially the same average temperature, thereby maintaining the cooling unit **10** at substantially the same temperature from the top to the bottom thereof.

In Fig. 4 I have shown a modified arrangement of the header **25** in which the tube **24** enters the header at the top thereof. The operation of this inverted header is the same as that of the header shown in Fig. 3 and it is, therefore, evident that either the top or bottom inlet opening may be utilized depending on the position in which it is desired to mount the expansion valve **18** with respect to the cooling unit.

From the foregoing it is apparent that I have provided an extremely simple and easily constructed arrangement for distributing liquid and gaseous refrigerant uniformly to a plurality of evaporators and which requires no moving parts and is of a rugged construction.

While I have disclosed a particular embodiment of my invention in connection with a cooling unit for an air conditioning system, various modifications will occur to those skilled in the art. I do not, therefore, desire my invention to be limited to the 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 cooling unit including a plurality of evaporators and an expansion valve having an inlet and an outlet for conveying refrigerant to the unit, an arrangement for providing uniform distribution of liquid and gaseous refrigerant to the evaporators comprising an upright cylindrical distributing header having an inlet opening about the central vertical axis thereof, means including a tube having a vertical portion communicating with said header through said inlet opening for conveying refrigerant from the expansion valve to said header, a plurality of outlet conduits entering the side wall of said header and connecting said header and the evaporators, all of said conduits opening into said header at substantially the same level and at substantially the same distance from said inlet opening of said header.

2. In a cooling unit including a plurality of evaporators and an expansion valve having an inlet and an outlet for conveying refrigerant to said unit, an arrangement for providing uniform distribution of liquid and gaseous refrigerant to the evaporators comprising an upright cylindrical distributing header having an inlet opening about the central vertical axis thereof, means including a tube having a vertical portion communicating with said header through said inlet opening for conveying refrigerant from the expansion valve to said header, means including a plurality of outlet conduits secured to said header radially thereof and substantially at right angles to said tube for connecting said header and the evaporators, said conduits being spaced equally and all of said conduits opening into said header at substantially the same level and at substantially the same distance from said inlet opening of said header.

3. In a cooling unit including a plurality of evaporators and an expansion valve having an inlet and an outlet for conveying refrigerant to said unit, an arrangement for providing uniform distribution of liquid and gaseous refrigerant to the evaporators comprising an upright cylindrical distributing header having an inlet opening in the bottom wall thereof, means including a tube having a vertical portion communicating with said header through said opening in the bottom wall thereof for conveying refrigerant from the expansion valve to said header, said tube having its upper end flush with the inner surface of said bottom wall, a plurality of outlet conduits connecting said header and the evaporators, all of said conduits opening into said header at substantially the same level and at substantially the same distance from the upper end of said tube.

FLOYD D. GOWANS.