Feb. 18, 1941. W. A. SPOFFORD 2,232,568

COOLING UNIT

Filed Feb. 27, 1940

Fig. 1.

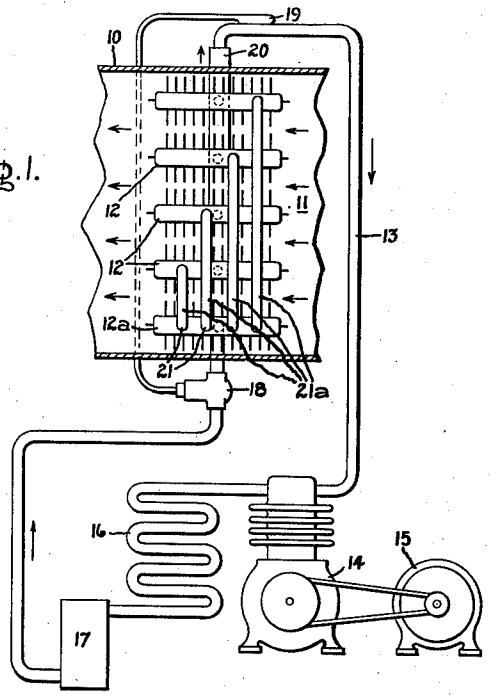
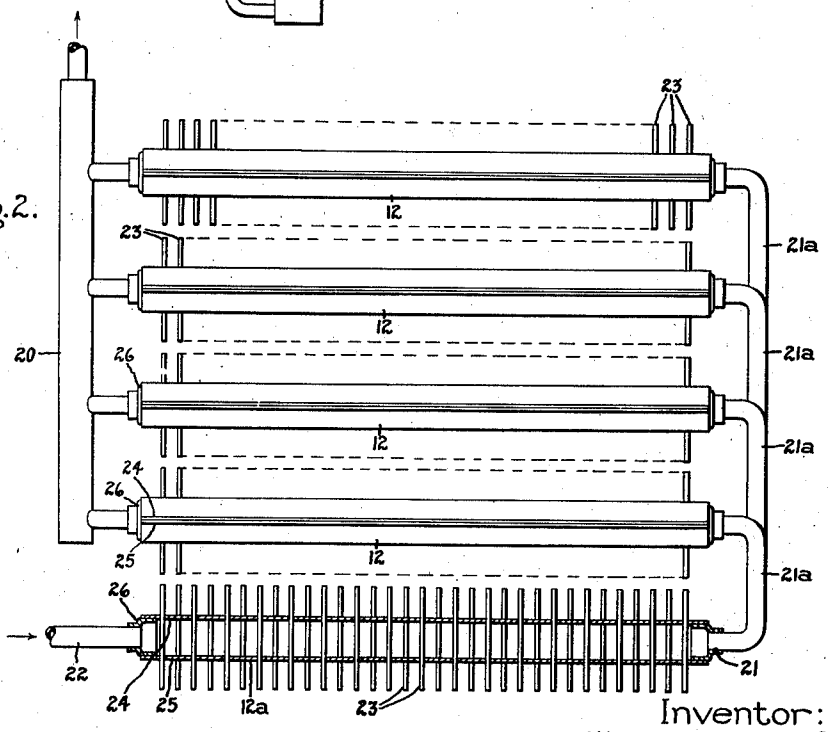


Fig. 2.



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COOLING UNIT

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Application February 27, 1940, Serial No. 321,031

4 Claims. (Cl. 62—126)

My invention relates to cooling units, and particularly to cooling units having a plurality of evaporating elements or conduits supplied from a single source of refrigerant, and is an improvement over the invention disclosed and claimed in a copending application of Rollin H. Norris, Serial No. 321,029, filed Feb. 27, 1940, and assigned to the same assignee as the present invention.

In air conditioning systems and in other applications of refrigerating machines, it frequently becomes necessary to supply a plurality of evaporating tubes or elements from a single source of refrigerant. The refrigerant is supplied under control of an expansion valve and enters the evaporator as a mixture of liquid and gaseous refrigerant. When a plurality of evaporating elements are arranged in a single air stream, it has been found necessary to provide some arrangement for assuring substantially uniform distribution of both liquid and gaseous refrigerant to the several evaporating elements so that all the elements will carry substantially equal loads. Accordingly, it is an object of my invention to provide a cooling unit having a plurality of evaporating elements and an improved arrangement for facilitating the uniform distribution of both liquid and gaseous refrigerant to the several elements.

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 diagrammatically a refrigerating machine for an air conditioning system having a cooling unit embodying my invention; and Fig. 2 is an enlarged side elevation view partly in section of the cooling unit shown in Fig. 1.

The refrigerating system shown in the drawing comprises essentially a motor driven compressor, a condenser for liquefying the refrigerant, and a cooling unit arranged in a stream of fluid or other medium to be cooled, the flow of refrigerant to the cooling unit being controlled by a single expansion valve. The cooling unit itself comprises a plurality of evaporator elements one of which is provided with internal baffles and is arranged as a distributor for facilitating the even distribution of liquid and gaseous refrigerant to the remaining elements.

Referring now to the drawing, in Fig. 1 I have shown a duct or casing 10 of an air conditioning system provided with a cooling unit 11 having a plurality of refrigerant evaporating elements 12 arranged in the path of the air stream, the lowermost of the elements being designated 12*a*. Vaporized refrigerant is withdrawn from the cooling unit 11 through a suction line 13 by operation of a compressor 14 driven by a motor 15. The withdrawn refrigerant is compressed and discharged by the compressor into a condenser 16 where it is cooled and liquefied, the liquid refrigerant collecting in a receiver 17. From the receiver 17 the liquid refrigerant is returned to the cooling unit 11 under control of a thermostatic expansion valve 18 having a thermal element or feeler bulb 19 secured in heat exchange relation with the suction line 13 adjacent the discharge end of the cooling unit 11. The liquid refrigerant within the cooling unit 11 is evaporated in the several elements 12 and 12*a* by the absorption of heat from the air passing through the duct 10 to be cooled. The vaporized refrigerant collects in a discharge or suction manifold 20 from which it enters the suction line 13.

The lowermost element 12*a* is arranged to perform the function of a distributor for assuring the uniform distribution of a uniform mixture of liquid and gaseous refrigerant to the evaporating elements 12. In order to accomplish this purpose, the lowermost element is provided with a plurality of outlets 21 at one end thereof and preferably equally spaced and in horizontal alignment and which are connected to the inlets of the evaporating elements 12 by conduits 21*a*. A mixture of liquid and gaseous refrigerant flowing from the expansion valve 18 is admitted to the evaporating element 12*a* through an inlet connection 22 remote from the several outlets 21. A portion of the liquid refrigerant in the mixture flowing through the lowermost evaporating element is vaporized by the absorption of heat from the air flowing over the external surfaces of the element, and since the inlets and outlets of the evaporator are spaced apart the length of the evaporator, the velocity effects due to the discharge of refrigerant from the connection 22 are minimized at the outlets and both the liquid and gaseous components of the mixture tend to be distributed evenly to the several outlets. This even distribution of liquid and gaseous refrigerant is further facilitated by a plurality of internal baffles or heat transfer elements 23 arranged in the path of the refrigerant

between the inlet and outlets of the evaporating element 12a. The heat transfer elements 23 have been illustrated as a plurality of wires or pins penetrating the sheets of metal constituting the walls of the evaporating elements 12 and 12a and provide both external and internal heat transfer fins or extended surfaces. A heat transfer element of this type is described and claimed in a copending application of William Dalton and Rollin H. Norris, Serial No. 292,440, filed August 29, 1939, and assigned to the same assignee as the present application, I do not, therefore, claim herein anything described or claimed in the aforesaid Dalton and Norris application. The outlets of the evaporating elements 12 other than the lowermost evaporating elements 12a, are all connected to the suction manifold 20, and these remaining elements are, therefore, connected in parallel between the element 12a and the suction manifold. Since substantially equal quantities of liquid and gaseous refrigerant are supplied to the several evaporating elements 12 through the conduits 21a, the loads carried by these elements are substantially equal. Furthermore, the load carried by each of the evaporating elements 12 is not materially different from that of the lowermost element 12a, since the velocities of the refrigerant gas in the several elements 12 and in the element 12a are of the same order of magnitude.

All of the evaporating elements 12 and 12a have been illustrated as of identical construction, each comprising thin, flat plates 24 and 25 bent to provide the two halves of the thin flat conduit and provided with flanges welded or otherwise suitably sealed together about their edges, the ends of the conduit being closed by suitable end plates or connections 26 inserted between the plates 24 and 25 at their ends and welded or otherwise suitably secured thereto and to the inlet and outlet connections of the cooling unit.

From the foregoing, it will readily be apparent that I have provided a cooling unit having an arrangement for facilitating the even distribution of both liquid and gaseous refrigerant to a plurality of evaporating elements which is of simple and rugged construction, and which avoids the necessity of providing a distributing header or similar device externally of the cooling unit. Furthermore, the distributing element is built into the unit and it is connected in a manner similar to that of the evaporating elements.

While I have described my invention in connection with a cooling unit for an air conditioning system, other applications will readily be apparent to those skilled in the art. I do not, therefore, desire my invention to be limited to the particular construction illustrated and described, and I intend in the accompanying 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. A cooling unit for a refrigerating system comprising a plurality of heat exchange elements, one of said elements having an inlet and a plurality of outlets remote from said inlet, each of the remaining ones of said elements having an inlet and an outlet, an outlet for said cooling unit communicating with the outlets of said remaining elements, means including said plurality of outlets of said one element for connecting a plurality of said remaining elements in parallel between said one element and said outlet of said unit to supply said remaining elements with refrigerant from said one element, and baffle means in said one element in the path of flow of refrigerant between the inlet thereof and said plurality of outlets for producing substantially uniform flow of a mixture of liquid and gaseous refrigerant from said one element through all of said plurality of outlets.

2. A cooling unit for a refrigerating system comprising a plurality of heat exchange elements, one of said elements having a thin flat passage therein and having an inlet at one end and a plurality of outlets at the other end of said passage, each of the remaining ones of said elements having an inlet and an outlet, an outlet for said cooling unit communicating with the outlets of said remaining elements, means connecting said plurality of outlets of said one element to respective ones of the inlets of a plurality of said remaining elements for conducting to said remaining elements refrigerant from said one element, and means including a plurality of heat conducting fins arranged within said passage of said one element for facilitating the uniform distribution of both liquid and gaseous refrigerant through all of said outlets of said one element.

3. A cooling unit for a refrigerating system comprising a plurality of heat exchange elements arranged for the flow thereover of a medium to be cooled, each of said elements comprising a conduit thin and flat in the direction of flow thereover of the medium to be cooled and having a plurality of heat transfer members extending therethrough and providing extended heat exchange surfaces both internally and externally of the conduit, one of said elements having an inlet and a plurality of outlets remote from said inlet, each of the remaining ones of said elements having an inlet and an outlet, an outlet for said cooling unit for receiving refrigerant from said remaining elements, means connecting said plurality of outlets of said one element to respective ones of the inlets of a plurality of said remaining elements to conduct to said remaining elements refrigerant from said one element, the portions of said heat transfer members within said one element facilitating the even distribution of both liquid and gaseous refrigerant to all of the outlets of said one element.

4. A cooling unit for a refrigerating system comprising a plurality of heat exchange elements, one of said elements being thin and flat and lying substantially in a horizontal plane, said one element having formed therein a thin flat passage with an inlet at one end and a plurality of horizontally aligned outlets at the other end thereof, each of the remaining ones of said elements having an inlet and an outlet, an outlet for said cooling unit communicating with the outlets of said remaining elements, means connecting said plurality of outlets of said one element to respective ones of the inlets of a plurality of said remaining elements for conducting to said remaining elements refrigerant from said one element, and means including a plurality of heat conducting fins arranged within said passage of said one element for facilitating the uniform distribution of both liquid and gaseous refrigerant through all of said outlets of said one element.

WARREN A. SPOFFORD.