The present invention relates to a refrigerating system composed of dissimilar metals and is more particularly concerned with a system of the type used in household refrigerators in which the low pressure side of the system including the evaporator is composed of aluminum while the high pressure side including the capillary flow restrictor is composed of copper.

One of the problems in refrigerating systems composed of dissimilar metals such as aluminum and copper involves the joints necessary to join the different parts of the system. For example, when a copper-aluminum joint is provided in the colder part of the system for example adjacent the evaporator structure and is exposed to the atmosphere, condensation on the joint results in an electrolytic action which over a period of time causes the joint to deteriorate to such extent that a leak may develop in the system. Various attempts have been made to remedy this situation as for example by using an aluminum capillary that can be joined to the aluminum evaporator by an aluminum-to-aluminum joint but for various reasons including the fact that it is rather difficult to manufacture a small bore aluminum tube of uniform diameter suitable for capillary or restrictor use, the industry has generally found it necessary to employ a copper capillary and to protect the resultant copper-aluminum joint by coating or the like.

The present invention has as its principal object the provision of a refrigerating system composed of aluminum and copper, which system is free of any exposed copper-aluminum joints on the low pressure or colder side of the system.

Further objects and advantages of the present invention will become apparent from the following description, when taken in connection with the accompanying drawing and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

In carrying out the objects of the present invention, there is provided a refrigerating system comprising an aluminum evaporator having tubular inlet and outlet connections, and an aluminum suction line and a copper capillary for connecting the evaporator to a condensing unit. In order to provide a system which is free of any exposed copper-aluminum joints at the colder or low pressure sides of the system, most of the copper capillary is enclosed in the suction conduit and in order to provide the necessary circuit connections, the aluminum suction line or conduit comprises a main aluminum tube having a reduced end portion extending into the inlet end of the evaporator and an aluminum side arm extending from the main tube adjacent the reduced end portion and connected by a fused joint to the outlet of the evaporator. The evaporator end of the main aluminum tube is joined by a fused aluminum joint to the inlet end of the evaporator at a point between the reduced end portion and the side arm, preferably at the shoulder between these two points or portions of the main tube, and the copper capillary connecting the outlet end of the condensing unit to the inlet end of the evaporator extends from a point adjacent the condensing unit through the suction line and beyond the reduced end portion of the suction main tube. This reduced end portion is swaged or otherwise brought into close mechanical engagement with the capillary tube. By this arrangement, those copper and aluminum surfaces which are in contact adjacent the evaporator end of the system are enclosed within the tubular inlet to the evaporator and hence are completely protected from the atmosphere.

For a better understanding of the invention reference may be made to the accompanying drawing in which:

Fig. 1 is a schematic diagram of a refrigerating system incorporating the present invention;

Fig. 2 is an enlarged view, partly in section, of a portion of the refrigerating system of Fig. 1 illustrating the joint between the capillary and the inlet to the aluminum evaporator;

Fig. 3 is an enlarged view of certain connections at the condensing end of the system; and

Fig. 4 is a view along line 4-4 of Fig. 3.

With reference to Fig. 1 of the drawing there is shown a refrigeration system including a compressor 1 and a condenser 2, forming the condensing unit for a refrigerating system, and an evaporator 3 which is connected in closed series connection with the condensing unit to form a hermetic refrigerating system of the type generally employed in household refrigerators. In this system condensed refrigerant from the condenser 2 is conveyed by a copper capillary 4 to the inlet 5 of the evaporator while gaseous refrigerant is withdrawn from the outlet end 6 of the evaporator through a suction line or conduit generally indicated by the numeral 7. The suction line, which is composed of aluminum includes a main line 12 and a side arm 8 for connection with the evaporator outlet 6. The condensing unit end of the suction line is connected to the compressor inlet 9 through a copper-aluminum connector 10.

In order to provide a system free of copper-aluminum joints near or adjacent to the evaporator, the capillary 4 is disposed within the suction line 7 and preferably is introduced into the line adjacent the point where the copper end of the connector 10 is connected to the steel inlet tube 9 to the compressor. From this point it extends upwardly through the suction line where it is in heat exchange relationship with the gaseous refrigerant returning to the compressor and is connected to the evaporator in a manner which is more clearly apparent from a consideration of Fig. 2.

With particular reference to Fig. 2 it will be seen that the main portion 12 of the suction line 7 includes a portion 13 that extends beyond the side arm 8 connected to the evaporator outlet 6 and at least this portion of the suction conduit is of a larger diameter than the evaporator inlet 5. The capillary tube 4 terminates in this portion of the main tube 12 has its end 14 terminating within the evaporator inlet 5 and portion 13 of the main aluminum tube has a reduced end portion 16 which is in close mechanical engagement with the capillary tube, this mechanical engagement being obtained for example by swaging the end of the main tube 12 into mechanical contact with the capillary tube 4. By this arrangement, the reduced end portion 16 is joined to the portion 13 of the aluminum tubing 12 by a shoulder portion 17, and making an aluminum-to-aluminum joint between the main tube 12 and the evaporator inlet 5 by bringing the shoulder portion 17 into contact with the open end of the inlet 5 and thereafter making a fused joint 18 between the shoulder portion 17 of the suction conduit and the evaporator inlet 5. Preferably, for this purpose the internal diameter of the inlet 5 is of
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about the same dimension as the exterior or outer diameter of the reduced end portion 16 of the main aluminum tube 12. Also by this arrangement, during the formation of the interior surface of the main aluminum tube 12. However, it may be noted here that since the evaporator inlet 5 and outlet 6 communicating through the side arm 8 with the interior of the main aluminum tube 12 are at substantially the same pressure, the joint or seal between the capillary and the main aluminum tube 12 at this point need not be completely pressure tight. In other words a close mechanical fit is sufficient to prevent any substantial flow of refrigerant between the capillary 4 and the reduced section 16.

While the invention is not restricted thereto, the connections between the aluminum suction line 7 and the condensing unit are preferably obtained through an aluminum-copper connector in which the copper portion is originally flared and thereafter pressed to the configuration shown in Figs. 3 and 4 whereby the copper portion 10 has a generally V configuration with the two legs of the V joined by a web 21. One leg 22 is connected as by brazing to the inlet 9 of the compressor while the capillary 4 passes into the suction line through the other leg 23, the space between the suction line 4 and the open end of the leg 23 being closed by a suitable brazing or soldering operation as indicated. The aluminum end of the connector is brazed to the aluminum tube 12.

From the above description of the present invention, it will be seen that there has been provided a refrigerating system in which the only connection between dissimilar metals exposed to the atmosphere is that forming part of the aluminum-copper connector 10 which is positioned close to the condensing unit or in other words at a point where moisture from the atmosphere will not condense on the copper aluminum joint to any substantial extent or at least to the extent which will cause corrosion and failure of the joint. At the evaporator end of the system the only point at which copper and aluminum are in contact is completely enclosed within the tubular inlet 5 to the evaporator where the contact is exposed on all sides only to the refrigerant contained in the system and is completely protected from the ambient atmosphere. In other words, the only joint at the colder end of the system are aluminum-to-aluminum and are obtained by any of the well known fusing methods employed for making such joints.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. Refrigerant flow control means for use in a refrigerating system to connect an aluminum evaporator having tubular inlet and outlet ends to a condensing unit; said refrigerant flow conduit means comprising a capillary tube for conducting refrigerant from said condensing unit to said evaporator and an aluminum suction conduit for connecting evaporator and said condensing unit, said suction conduit comprising a main aluminum tube having a reduced end portion adapted to extend into the inlet end of said evaporator and an aluminum side arm extending from said main tube for connection to the outlet end of said evaporator, said copper capillary extending through said main tube and having an outlet end extending through said reduced end portion for insertion into the evaporator inlet end, said reduced end portion being in close mechanical engagement with said capillary tube.

2. For use in a refrigerating system comprising an aluminum evaporator having tubular inlet and outlet ends and a condensing unit; a refrigerant flow conduit means for connecting said evaporator to said condensing unit comprising a copper capillary tube for conducting liquid refrigerant from said condensing unit to said evaporator and an aluminum suction conduit for connecting evaporator and said condensing unit; said suction conduit comprising a main aluminum tube of a larger diameter than said evaporator inlet and having reduced end portion forming a shoulder adjacent said end portion, said reduced end portion being adapted to be inserted into the inlet of said evaporator with said shoulder contacting the end of said evaporator inlet for connection thereto by a fused joint, and an aluminum side arm extending from said main tube adjacent said reduced end portion for connection by a fused joint to the outlet end of said evaporator, said copper capillary extending from a point adjacent said condensing unit through said main aluminum tube with the outlet end thereof extending through said reduced end portion for insertion into said evaporator inlet, said reduced end portion being formed into mechanical engagement with said capillary tube.

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