

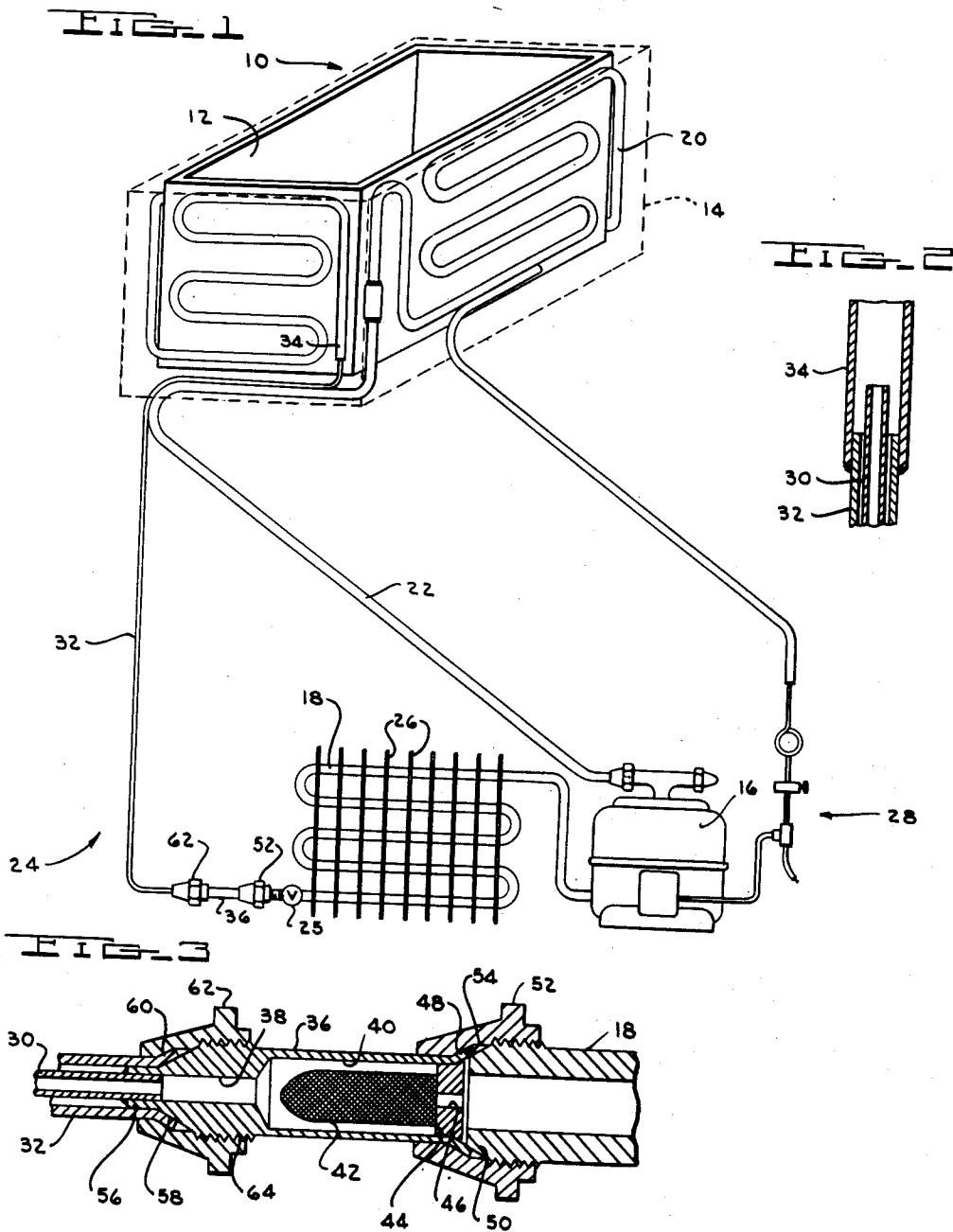
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CAPILLARY TUBE ASSEMBLY FOR REFRIGERATORS

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CAPILLARY TUBE ASSEMBLY FOR REFRIGERATORS

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This invention relates to capillary tube assemblies for refrigerating apparatus and has particular reference to such an assembly wherein the capillary tube may be removed from the refrigerating apparatus and a new tube replaced in the event that the capillary tube becomes clogged or damaged while in use.

The capillary tube assembly constructed according to the principles of my invention permits the replacement of a clogged or damaged capillary tube without the necessity of brazing or soldering operations in the field. According to present constructions, when a capillary tube of a conventional refrigerating apparatus becomes clogged or damaged, considerable difficulty is encountered in repairing or replacing the damaged tube, and it is therefore an object of this invention to overcome the above-mentioned difficulties encountered in servicing an installed refrigerating unit.

It is another object of my invention to provide a capillary tube assembly which is simple in construction and easy to install in a refrigerating apparatus.

A further object of the invention is to provide a capillary tube assembly in which the capillary tube is completely enclosed throughout its length by an outer tube so as to reduce to a minimum the possibility of puncturing or damaging the capillary tube and so as to eliminate the necessity of soldering or brazing the capillary tube to the suction line when installing a new capillary tube.

A further object of my invention is to provide a capillary tube assembly in which the capillary tube is disposed within an outer tube arranged in heat exchange relation with a substantial portion of the suction line of the refrigerating apparatus.

Other and further objects of the invention will be apparent from the following description and claims and may be understood by reference to the accompanying drawings, of which there is one sheet, which by way of illustration show a preferred embodiment of the invention and what I now consider to be the best mode in which I have contemplated applying the principles of my invention. Other embodiments of the invention may be used without departing from the scope of the present invention as set forth in the appended claims.

In the drawings:

Fig. 1 is a somewhat diagrammatic elevational view of a refrigerating apparatus employing a capillary tube assembly constructed according to the principles of my invention;

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Fig. 2 is an enlarged fragmentary sectional view showing the connection between the capillary tube and the inlet of the evaporator; and

Fig. 3 is an enlarged fragmentary sectional view showing the detachable connection between the capillary tube and the outlet from the condenser.

Referring more particularly to the drawings, the numeral 10 designates a cabinet or compartment to be refrigerated and which for purposes of illustration may comprise an inner lining 12 and insulating material 14 surrounding the liner 12. The refrigerating apparatus disclosed is of a conventional type and includes a motor and compressor unit 16, a condenser 18, and an evaporator 20 which comprises serpentine coils surrounding the compartment to be refrigerated. A suction line 22 is arranged between the evaporator 20 and the compressor 16 for conducting gasified refrigerant from the evaporator to the compressor, and a capillary tube assembly indicated generally at 24 is provided for conducting liquefied refrigerant from the condenser to the evaporator. A valve indicated at 25 is provided in the line between the condenser 18 and the capillary tube assembly 24 for shutting off the flow of refrigerant from the condenser into the capillary when necessary.

In a refrigerating apparatus of the type disclosed the compressor 16 pumps the gasified refrigerant through the suction line 22 into the compressor which compresses the gas and discharges the same into the serpentine coils of the condenser 18. The refrigerant gas is discharged from the compressor at a high pressure and consequently at a relatively high temperature. The high temperature gas loses its heat to the air while passing through the condenser 18 by means of the heat radiating fins 26. The result of the withdrawal of heat from the gas by means of the condenser is that the gas is thereby converted into liquid refrigerant. The liquid refrigerant then passes through the capillary tube assembly 24 and into the evaporator 20. The liquid refrigerant is subjected to a considerably reduced pressure in the evaporator 20 due to the suction created by the compressor 16. As a result, the refrigerant will evaporate at greatly reduced pressure and temperature, and heat is absorbed from the compartment 10 by the refrigerant. As soon as the temperature of the compartment 10 is reduced to a predetermined point, suitable temperature responsive controls indicated generally at 28 will function to break the motor circuit and stop the compressor. After the refrigerant in the evaporator has

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ceased to absorb heat from the compartment 10, the temperature of the compartment will rise until a predetermined temperature is reached, at which time the controls 28 will close the motor circuit and start the compressor so as to begin the refrigerating cycle again.

The capillary tube 30 is provided for conducting the liquid refrigerant from the condenser to the evaporator, and such capillary tube is provided with a length and a bore of a size sufficient to permit the proper amount of such refrigerant to flow into the evaporator under the normal differences in pressure in the system.

In order to provide a capillary tube which may be easily removed from the refrigerant line of the system and replaced therein, I have provided an outer tube 32 which may be soldered or otherwise secured at one end to the inlet end 34 of the evaporator 20. The capillary tube 30 has a sliding fit within the tube 32. The clearance between the outside diameter of the capillary tube 30 and the inside diameter of the outer tube 32 has been somewhat exaggerated in the drawings for purposes of clarity, and in practice the amount of clearance between the tubes is slight. The evaporator end of the capillary tube 30 may extend slightly beyond the adjacent end of the tube 32 and communicates with the inlet end 34 of the evaporator 20, as shown in Fig. 2.

The other end of the capillary tube 30 is brazed or otherwise secured to one end of a fitting or casing 36 within a passage 38 therein which communicates with the bore of the capillary tube 30. The fitting 36 is provided with an enlarged passage or chamber 40 therein communicating with the passage 38 and in which passage 40 a screen filter 42 is secured. The screen 42 is secured to a ring 44 which is pressed into the opening 40 in the fitting 36 and is provided with an opening 46 so that refrigerant flowing from the condenser into the capillary tube must flow through the filter 42.

The fitting 36 has a flared end 48 which is adapted to abut the outlet end 50 of the condenser 18. A nut 52 surrounds the fitting 36 and is slidable thereon and is threaded on to the threaded end 50 of the condenser and is provided with a tapered recess 54 engageable with the flared end 48 of the fitting 36 so as to detachably connect the fitting 36 to the condenser 18 in pressure tight relation.

The end of the tube 30 is soldered or brazed to a reduced neck portion 56 provided on the end of the fitting 36, which neck portion terminates in a tapered surface 58 against which the flared end 60 of the tube 32 abuts. A nut 62 similar in construction to the nut 52 surrounds the tube 32 and slides thereon and is engageable with threads 64 on the fitting 36 for detachably clamping the flared end 60 of the tube 32 against the tapered surface 58 of the fitting 36 in pressure tight relation.

With the parts arranged as shown in Fig. 3, it will be apparent that the liquefied refrigerant from the condenser will flow through the outlet end 50 of the condenser through the passage 46 and through the screen 42. The screen 42 is provided to prevent any particles of dirt or other foreign matter from entering the capillary tube 30, and effectively prevents clogging of the capillary. The refrigerant flows through the passage 38 into the capillary tube 30 where it is discharged into the inlet end of the evaporator 20. The remainder of the refrigerating cycle is carried out as previously described.

Since the capillary tube 30 is inherently small and susceptible to damage and clogging, it is necessary in such event to replace the capillary. In the present construction the capillary tube 30 is surrounded by the outer tube 32 throughout its entire length, thereby greatly reducing any possibility of puncture or damage to the tube 30. If the tube 30 should become clogged, however, the nuts 52 and 62 may be unthreaded and the fitting 36 may be disconnected from the end of the condenser coil. The capillary tube 30 may then be removed from the assembly by pulling the capillary through the condenser end of the outer tube by means of the fitting 36.

When servicing refrigerating apparatus in the field, it is often difficult to perform brazing or soldering operations properly, and by means of the present construction any need for such operations is eliminated. All that is necessary to do in the event a capillary tube needs repair or replacement is to remove the capillary in the aforesaid manner, and a new capillary tube which has previously been brazed to the end of a fitting 36 may then be inserted into the tube 32 and the nuts 52 and 62 employed to complete assembly of the unit without the need for any repairs being done at the place of installation of the unit.

The capillary tube 30 is of small diameter and is rather flexible so as to enable the tube to be removed from and inserted into the outer tube 32 quite easily. In order to facilitate such operations it might be found desirable to eliminate some of the bends in the tubing shown in Fig. 1, but if fairly large radius bends are used no difficulty will be encountered in this respect.

An additional feature of my invention is that the capillary tube assembly provides a means for obtaining a good heat exchange relation between a portion of the capillary tube and a portion of the suction line 22. As shown in Fig. 1, the outer tube 32 is soldered or brazed to a portion of the length of the suction tube 22. Since the tube 30 has a relatively close fit within the outer tube 32, a metal to metal contact between the tubes will be provided, thereby insuring good heat exchange between the tubes. Therefore, when the outer tube 32 is brazed to a considerable portion of the length of the suction line 22, a good heat exchange is obtained between the refrigerant within the capillary 30 and the refrigerant gas within the suction line 22. The purpose of such heat exchange relation is to increase the temperature of the cold refrigerant gas as it flows through the suction line 22 so that it more nearly approximates the temperature obtained within the compressor and condenser, which also prevents or decreases frost back where the suction line emerges from the cabinet. At the same time the temperature of the liquid refrigerant within the capillary 30 will be decreased somewhat by means of the heat exchange relation until it more nearly approximates the evaporating temperature, thereby increasing over-all efficiency of the apparatus.

It should be noted that the outer tube 32 and the suction line 22 are soldered or brazed together within the walls of the cabinet to be refrigerated and for some distance outside of such walls. The usual practice is to solder or braze the capillary tube directly to the suction line within the walls of the refrigerated cabinet, and when it is necessary to replace a capillary tube in such a construction, considerable difficulty is experienced in removing the old capillary and in brazing the new capillary tube to the suction

line at the place of installation. Consequently, I have provided a construction which greatly facilitates replacement of a damaged or clogged capillary tube by eliminating all soldering or brazing operations during such replacement.

It will be apparent that the construction of the fitting 36 and the means for detachably connecting the outer tube 32 to the fitting and for detachably connecting the fitting to the condenser outlet may be varied considerably without departing from the principles of my invention, and the specific structure shown in Figs. 2 and 3 has been selected for purposes of illustration only.

While I have illustrated and described a preferred embodiment of my invention, it is understood that this is capable of modification and I therefore do not wish to be limited to the precise details set forth, but desire to avail myself of such changes and alterations as fall within the purview of the following claims.

I claim:

1. In a refrigerating apparatus having a compressor, a condenser, an evaporator, and conduit means connecting the evaporator, compressor and condenser in the order named, a capillary tube assembly for conducting liquefied refrigerant from said condenser to said evaporator, said capillary tube assembly comprising an outer tube secured to the inlet of said evaporator, a capillary tube disposed entirely within said outer tube and having one end thereof communicating with said evaporator inlet, a fitting secured to the other end of said capillary tube and having a fluid flow passage therethrough communicating with said capillary tube, means for detachably connecting said fitting to the outlet of said condenser, and means for detachably securing said outer tube to said fitting, said capillary tube being arranged in heat exchange relation with a portion of the

conduit means connecting said evaporator and said compressor, said capillary tube being arranged within said outer tube so as to be removable therefrom when said outer tube and said condenser outlet are detached from said fitting.

2. In a refrigerating apparatus including a compressor, a condenser, an evaporator, conduit means connecting the evaporator, compressor, and condenser in the order named, and a compartment to be refrigerated; a capillary tube assembly for conducting liquefied refrigerant from said condenser to said evaporator, said capillary tube assembly comprising an outer tube secured to the inlet of said evaporator, a removable and replaceable capillary tube slidably disposed within said outer tube and having one end thereof communicating with said evaporator inlet, and means for detachably connecting the other end of said capillary tube in fluid flow relation with the outlet of said condenser, whereby said capillary tube may be withdrawn from and inserted into said outer tube when said capillary tube is disconnected from said condenser outlet, a portion of said outer tube and a portion of the conduit means connecting said evaporator and said compressor being secured together in heat exchange relation within a wall of the compartment to be refrigerated.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,073,863	Bird	Mar. 16, 1937
2,279,928	Shoemaker	Apr. 14, 1942
2,339,815	Roth	Jan. 25, 1944
2,489,914	Lindgren	Nov. 29, 1949