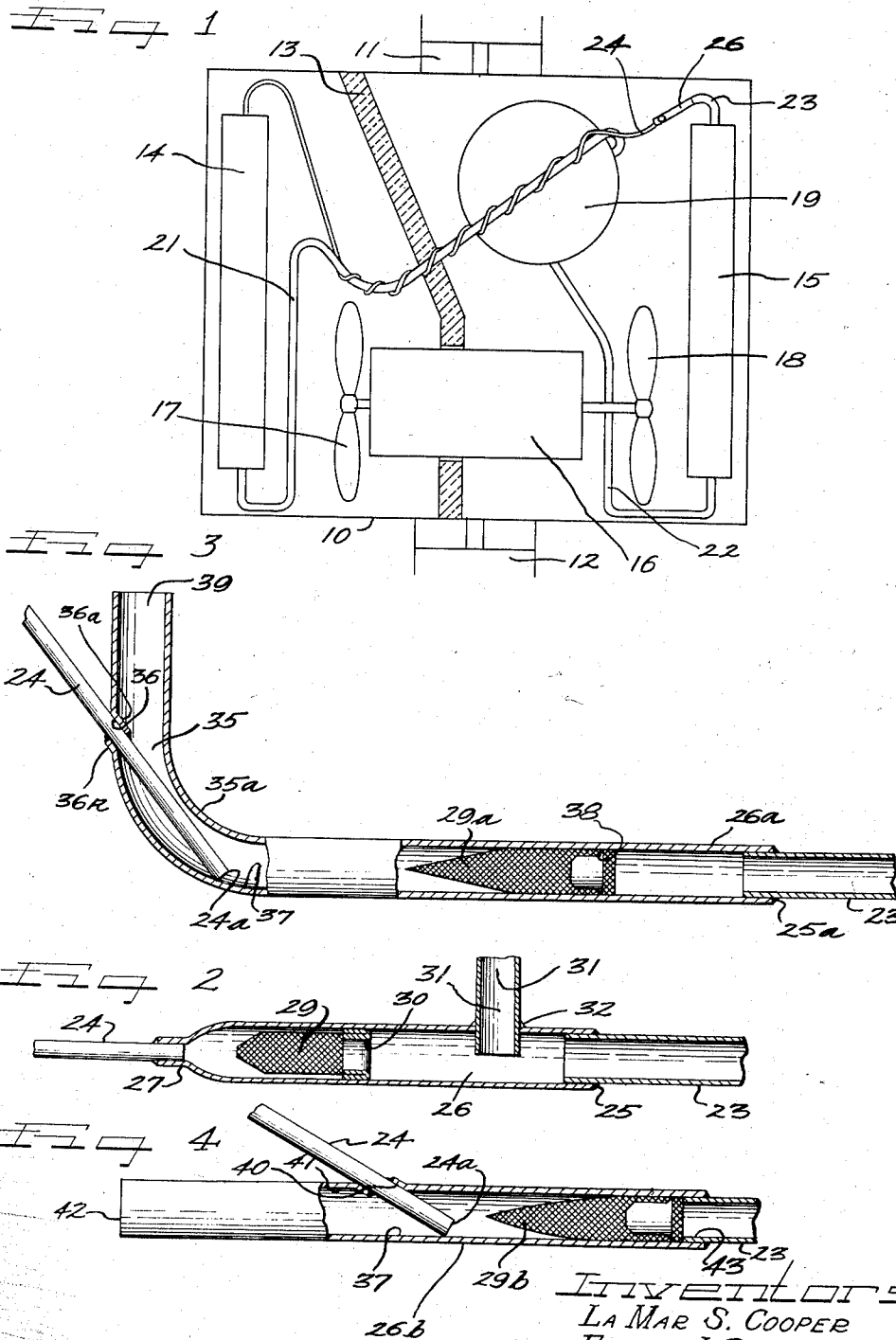


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TUBE AND STRAINER ASSEMBLY

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TUBE AND STRAINER ASSEMBLY

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In the refrigeration, food freezer and air conditioning fields utilizing a refrigerant system having a condenser, an evaporator, and a refrigerant compressor, it is a common practice to connect the discharge end of the condenser to the refrigerant inlet of the evaporator by means of a capillary tube. This capillary tube comprises a length of very small diameter tubing and is constructed to permit the restricted passage of liquid refrigerant from the bottom of the condenser to the evaporator at a relatively slow rate of speed. This restriction maintains the pressure from the compressor in the condenser and also acts as a throttling valve at its entrance into the evaporator, at which latter position the liquid from the capillary tube is expanded as a result of heat absorbed from the space to be cooled.

In the prior art, it has been common practice in the refrigeration field to provide a combined connecting assembly and evacuating connection at the junction between the capillary tube and condenser. This assembly was constructed in the form of a T, one leg of which was connected to the condenser discharge outlet, another leg of which was connected to the capillary tube, and the third leg of which was utilized in evacuating the refrigeration system and was subsequently pinched off. This combined connector also carried a small strainer immediately ahead of the capillary tube entrance in order to prevent any small particles from becoming lodged in the opening of the capillary tube. The strainer was necessary since the extremely small diameter of the capillary tube would cause a flow blockage in the event that small particles became lodged therein.

In the prior art constructions, several disadvantages are manifest. For example, the T construction requires a large number of welds or brazes, each of which increases the danger of refrigerant leakage. In the second place, the coupling of the very small diameter capillary tube to one leg of the T in an end-to-end relationship provides a connection in which the opening to the capillary tube lies substantially above the bottom level of the liquid refrigerant, thereby leaving a permanent pool of stagnant refrigerant below the opening of the capillary tube. In the third place, assembly of the T connector assembly of the prior art is difficult since it is difficult to ascertain, during assembly, the exact length of the capillary tube which has been inserted within the condenser tubing. Thus difficulty has sometimes been encountered from positioning the capillary tube against the strainer such that the strainer interfered with its efficient operation or, on the other hand, from positioning the end of the capillary tube too near the end of the connector, thereby causing a blockage by weld material.

The novel connecting assembly of the present invention completely eliminates all the above mentioned disadvantages known in the prior art constructions, and in so doing, has provided a substantially more inexpensive, yet far superior capillary-to-condenser connector and strainer assembly.

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It is, therefore, an object of the present invention to provide a novel connector and evacuator assembly for use in refrigerant systems.

Another object of the present invention is to provide an oblique angle connector into which a small diameter tube is connected to a large diameter tube through an oblique aperture in the side of the latter and in which the wall of the latter acts as an automatic positioning indicator during assembly.

Still another object of the present invention is to provide a novel combined conduit connector and strainer assembly wherein the strainer is incapable of interfering with proper operation of the liquid flow through the connected conduits.

A further object of the present invention is to provide a novel method of connecting a pair of dissimilarly sized conduits for fluid flow therebetween.

Another object of the present invention is to provide a simplified strainer assembly for cooperation in a conduit connector and strainer combination.

A feature of the present invention is the provision of an L bend in one of the connected conduits, through which the second conduit is angularly positioned in a permanent, hermetically sealed relationship.

Still other and further objects and features of the present invention will at once become apparent to those skilled in the art from a consideration of the attached drawings in which two preferred embodiments of the present invention are shown by way of illustration only.

On the drawings:

Figure 1 is a diagrammatic plan view of a conventional air conditioning unit and illustrating the relationship of the present invention therewith;

Figure 2 is an illustration of a conventional conduit and strainer assembly;

Figure 3 is one embodiment of the improved apparatus of the present invention; and

Figure 4 is a second, modified form, of the novel connector and strainer assembly constructed according to the present invention.

As shown on the drawings:

While the conduit connector and strainer assembly of the present invention may, of course, be utilized in many types of refrigeration and air conditioning apparatus it is, for convenience sake, illustrated in connection with a window type air conditioning unit of conventional arrangement. As may be observed from Figure 1, the air conditioning apparatus housing 10 is mounted within the window 11 of a room or another enclosure wall 12. A partition 13 is provided between an evaporator 14 and a condenser 15 to provide evaporator and condenser compartments, respectively. A fan motor 16 is supported by the partition 13 and drives the fan blades 17 and 18 to circulate outside air over the condenser 15 and room air over the evaporator 14.

The refrigerant system of the above described, conventional, air conditioning apparatus is made up of a refrigerant gas compressor 19 positioned in the condenser compartment and connecting conduits between the compressor and the evaporator 14 and condenser 15. The conduit connections comprise an evaporator return conduit 21 leading to the low pressure side of the compressor 19, a high pressure condenser inlet conduit 22 which delivers the compressed refrigerant gas to the condenser 15, a condenser discharge conduit 23 positioned at the bottom of the condenser and which delivers condensed refrigerant under relatively high pressure, and a capillary tube 24 which connects the condenser discharge conduit 23 to the evaporator 14.

In the operation of the apparatus, refrigerant gas at low pressure is returned from the evaporator 14 by the conduit 21 to the compressor 19 wherein it is compressed

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to a higher pressure and discharged to the condenser 15 through the conduit 22. The gas is condensed in the condenser 15 by discharging heat to the outside atmosphere and the liquefied refrigerant flows to the outlet conduit 23 under the relatively high compressor pressure. The capillary tube 24 restricts the flow of the liquid refrigerant under pressure to the evaporator and acts as a throttling valve.

The above conventional apparatus is almost universally manufactured from a plurality of separately constructed units. Thus, for example, the condenser 15 and the evaporator 14 are usually substantially identical pieces of equipment which are manufactured by specialists in heat transfer apparatus. Likewise, the compressor 19 is also ordinarily manufactured by the companies specializing in the production of such pumping equipment. In view of this commercial production technique, it is almost universally found that a short lead, or outlet 23 is provided at the discharge end of the condenser, and assembly of the various conduit components thereto is required of the air conditioning manufacturer.

In prior art structures, the conduit 23 was brazed to a connector conduit 26, as shown in Figure 2 at 25. The capillary tube 24 was then connected in end-to-end relationship with the connector 26 by flattening the connector 26 about the capillary tube 24 and brazing the two together as at 27. A strainer sieve 29 was also positioned within the connector conduit 26 and maintained therein by means of a crimped-over collar 30. The outer surface of the collar 30 was manufactured to be a snug fit with the inside diameter of the connecting conduit 26 and the screen and collar assembly was maintained in its correct position solely through friction between the collar 30 and the conduit 26.

In order to evacuate the refrigerant conduit system during initial assembly of the air conditioning unit, a T connection 31 was provided. This T 31 was brazed or hard soldered at one end, as at 32, to the connector 26 and was crimped and hermetically sealed at its other end as the final step in assembly of the air conditioning unit.

The above described connecting apparatus has been used throughout the industry for a number of years and the T connector comprising the conduit 26 and the T 31, with the strainer 29 in position therein has been sold as a separate item by equipment manufacturers.

In place of the above discussed prior art T connector assembly, the present invention contemplates an improved unit which does away with the evacuator connection 31 without eliminating its function. This elimination removes the need for one relatively large weld and also provides other advantages which will be more fully discussed below.

In the first modification of the improved construction, a connector tube 26a is provided having an L bend 35 at one end thereof. The discharge conduit 23 is brazed at 25a to the connector 26a in the manner substantially the same as shown in Figure 2, but a completely dissimilar connection is provided between the capillary tube 24 and the connector 26a. This may be seen from Figure 3, wherein the tube 24 is inserted in a punched aperture 36 in the wall of the portion 35. In assembly, the tube 24 is inserted in the aperture 36 until the end 24a abuts against the inner wall 37 of the connector 26a. The opening 36 is then sealed by brazing in the manner well known in the art, providing a rigid, hermetic seal.

The aperture 36 is preferably formed by punching or piercing, rather than by angle drilling since no material is removed from the wall of the connector conduit 26a. The excess material 36a left around the aperture 36 thus forms angularly directed support flanges 36a for the capillary tube 24. It has been found that when the tube 24 is brazed to connector 26a at the aperture 36, the flanged nature of the aperture provides an unusually strong connection which will not break loose even when subjected to severe vibration.

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A strainer 29a is positioned in the connector 26a for preventing small particles from entering the end 24a of the capillary tube 24. The strainer 29a is different from that utilized in the prior art in that it comprises a separate strainer 29a which is maintained firmly against the inner surface 37 of the connector 26a by means of an inside collar 38, rather than the combined inside and outside collar 30, described above. Due to the fact that the capillary tube 24 rests within the connector 26a at an oblique angle and terminates immediately adjacent the bottom wall thereof, it is substantially impossible for the strainer sieve 29a to come in contact with the end of the capillary tube 24. Thus, it is possible to utilize a simplified, outwardly flared ferrule, or inside collar, 38 for maintaining the strainer 29a in position within the connector 26a.

After installation of the above described connector, the vertically positioned upstanding L portion 35 is closed off at 39 by crimping and brazing or otherwise welding.

It may thus be seen that the T connector 31 has been entirely eliminated, along with its undesirable large area braze 32. The evacuating function performed by it is, however, retained through the expediency of providing the vertically upturned L 35 in the connector conduit 26a. By eliminating the T connector 31 and the weld 32, the danger of leakage is greatly reduced and the expense of the unit, likewise, greatly diminished. Further, by providing the aperture 36 in the side wall of the conduit 26a, rather than in the end thereof as shown in Figure 2, a very small weld area is required. In the end-to-end attachment, as shown in Figure 2 and as used in the prior art, the entire end of the connector conduit 26 must be crimped and welded shut, whereas, in the arrangement shown in Figure 3 only a very small area around the capillary tube 24 need be welded.

Due to the fact that in the preferred form the hole 36 is pierced, rather than drilled, flanges 36a are upset from the material and provide a further rigidification not found in prior art structures. Also, in the arrangement shown in Figure 3, the positioning of the capillary tube 24 at an acute angle and adjacent or against the bend portion 35a of the conduit connector 26a, adds to the general rigidity of the structure, thereby rendering failures at the brazed joint 36 negligible.

It will also, of course, be seen that the end 24a of the capillary tube 24 automatically provides a positioning device whereby the proper amount of insertion of the capillary tube 24 through the aperture 36 is readily accomplished. In assembly, the tube 24 is merely inserted to its maximum depth which is readily determined by its point of abutment with the inside tube wall 37. In practice, the tube end 24a is cut off at right angles to the bore thus providing an automatic positioning of the aperture of the capillary tube a slight distance away from the bottom wall 37. This arrangement positively assures that the capillary tube 24 will not be blocked off during assembly.

As mentioned above, the positioning of the tube end 24a adjacent the bottom surface 37 of the connector 26a, renders it substantially impossible for the strainer screen 29a to inadvertently block off the tube 24. Thus, slight movements of the screen 29a within the connector conduit 26a can in no way affect the operation of the capillary connection. This is a valuable improvement over the prior art structures wherein the screen and the end of the capillary tube 24 were directly in line with each other.

A modified form of the present invention is shown in Figure 4, wherein the connector conduit 26b is provided. In this case, the capillary tube 24 is inserted angularly through a pierced or angle-drilled aperture 40 in the top surface 41 of the connector 26b. Thus, as in the case of the embodiment of Figure 3, the end 24a of the capillary tube abuts against the bottom surface 37 of the connector 26b and is thereby automatically positioned within the connector. The end 42 of the connector 26b is then utilized as the evacuator outlet and is closed off by pinching and

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brazing as the final step during assembly of the refrigerant system.

In the embodiment shown in Figure 4, it is thus apparent that no bends whatever are required in the connecting conduit 26b unless, for convenience sake, it is desired that a horizontal bend be provided to permit easier access to the apparatus during the evacuation process. It is contemplated, however, that the connector 26b be constructed of straight tubing and, in this respect, it is therefore possible to eliminate the braze 43 entirely by merely extending the connection 23 from the condenser 15. This latter extension could also, of course, be utilized in connection with the embodiment in Figure 3, except that the provision of the L bend 35 makes it desirable that the connector 26a be constructed of a separate piece in order to facilitate its manufacture.

It will be noticed that the connector conduit 26b of the modification shown in Figure 4 may be reversed and connected to the conduit 23 at the opposite end, if desired. In that case, of course, the strainer screen 29b would be positioned on the left-hand side of the aperture 40, rather than the right-hand side. In either case, interference with the operation of the capillary tube 24 by the strainer is impossible.

It will thus be seen that we have provided a greatly simplified tube connector and strainer assembly which has substantially reduced the manufacturing costs, while at the same time, providing all of the functions heretofore performed by prior art structures. Further, assembly procedure is simplified due to the fact that the capillary tube automatically locates itself in its proper position and also due to the fact that the strainer assembly can never move to a position of interference with the end of the capillary tube. Also, the elimination of the extra brazed connection 32 has rendered the structure less expensive and has increased the strength of the assembled unit by eliminating a major source of leakage.

It will be understood, of course, that modifications and variations may be made in the above disclosed structure without departing from the scope of the novel concepts of the present invention.

We claim as our invention:

1. In a refrigeration system, a condenser and an evaporator, and means connecting the discharge of said condenser to the inlet of said evaporator, said means comprising a capillary tube and a connector conduit, said connector comprising a length of bendable tubing having one end secured to said condenser discharge and having its other end sealed upon evacuation of the refrigerant system, said capillary tube being inserted at an acute angle relative to said connector tubing through a side wall thereof and into abutting contact with the inside wall surface of said connector tubing, said capillary tube having an open end and an end surface cut at an angle to the axis of the capillary tube different from said acute angle whereby said open end is not blocked upon said abutting contact.

2. In a refrigeration system, a condenser and an evaporator, and means connecting the discharge of said condenser to the inlet of said evaporator, said means comprising a capillary tube and a connector conduit, said connector conduit comprising a bendable tube

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having one end secured to said condenser discharge and having its other end sealed upon evacuation of the refrigerant system, said capillary tube being inserted at an acute angle relative to said connector tubing through a side wall thereof and extending into abutment with the inner wall of said connector conduit on the side opposite its point of entry through said side wall.

3. A strainer and connector assembly comprising a first large diameter tube having a substantially conical strainer positioned therein intermediate its ends and maintained in said position by an outwardly expanded retainer collar positioned entirely within said strainer, a second small diameter capillary tube connected with said first large diameter tube, said connection comprising a flanged aperture in a side wall of said first tube at a portion intermediate its ends and having its peripheral wall flanges inclined at an acute angle to its axis and in contact with the capillary tube to maintain said second tube in an acute angle position relative to said first tube such that the opening of said second tube is positioned adjacent the bottom inside surface of said first tube adjacent said strainer but out of alignment with the adjacent end thereof.

4. A connector assembly for use in refrigerant systems, comprising a large diameter tubular L, one leg of said L being positioned horizontally and the other leg of said L being positioned in a substantially upright position, an aperture in the side wall of said upright leg at a point adjacent the periphery of the bend between the legs of said L and having its peripheral edge flanged, and a small diameter capillary tube permanently secured in said aperture to the flanges thereof at an acute angle to said upright leg, said capillary tube extending through said aperture across the bight of said L and into abutting contact with the inside wall of the horizontal leg of said L at a point on the outer peripheral edge of the bend.

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