

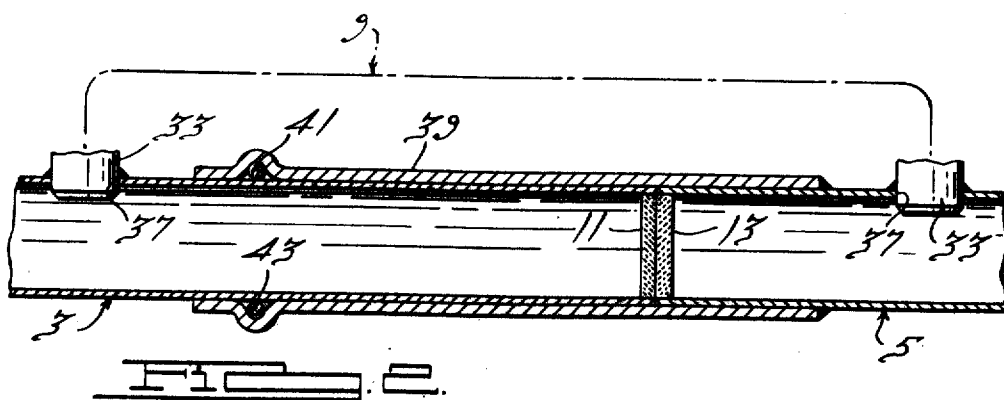
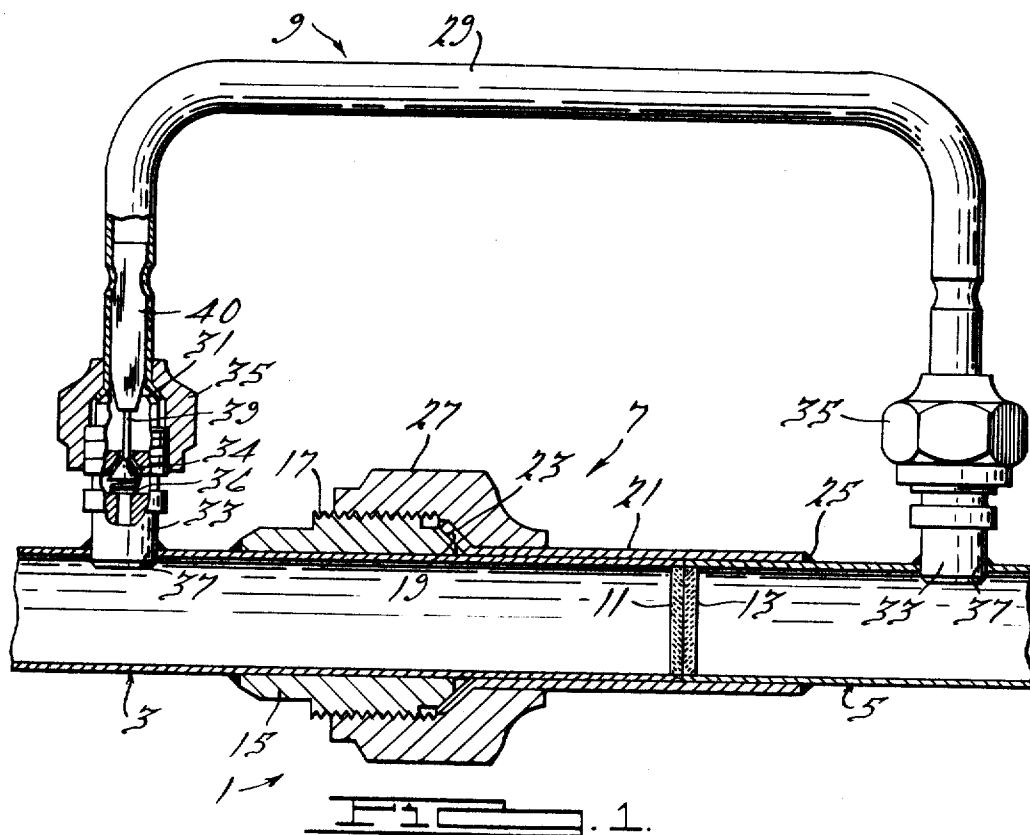
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R. L. BRUGLER ET AL

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COUPLING APPARATUS

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INVENTORS
Richard L. Brugler
Robert L. Kiefer
 BY
Harnum, Talburt & Baldwin
 ATTORNEYS

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3,493,002

COUPLING APPARATUS

Richard L. Brugler and Robert L. Kiefer, Trotwood, Ohio, assignors to Chrysler Corporation, Highland Park, Mich., a corporation of Delaware

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9 Claims

ABSTRACT OF THE DISCLOSURE

Coupling arrangement for refrigerant system including two lines precharged with refrigerant, fusible plugs in the ends of the lines, coupling halves connecting the lines together and clamping a sleeve over the joint formed by the end-to-end lines, and an equalizer line extending between the lines around the plugs, the equalizer line having valves adapted to open to place the lines in communication with one another, the plugs being adapted to melt upon the application of heat thereto.

BACKGROUND OF THE INVENTION

This invention relates to refrigerating systems, and more particularly to apparatus for coupling together two refrigerant lines which are precharged with refrigerant.

In many refrigerating systems, such as central household air conditioning systems which employ an evaporator unit inside the house and a condenser-compressor unit outside the house, the evaporator unit and the condenser-compressor unit are separately precharged at the factory. This procedure prevents moisture and air from entering the refrigerant system and also prevents the need for charging the system with refrigerant in the field. As will be understood charging a system with refrigerant in the field requires considerable skill and equipment. Accordingly, as set forth above, the evaporator and condenser-compressor units are precharged at the factory.

The units are connected together at the installation site with lengths of interconnecting tubing which are also precharged with refrigerant. The condenser-compressor unit usually is charged with a portion of the total refrigerant required, while the evaporator unit and the lengths of tubing are normally provided with the remaining portion of the charge for the refrigerant system. It is necessary to provide shut off means on the individual units and lengths of tubing to retain the refrigerant therein. At present most of the companies manufacturing refrigerant systems use quick-connect couplings attached to the refrigerant lines emerging from the evaporator and condenser-compressor units and the precharged lengths of tubing. Each end of a line or tubing normally has one-half of a coupling thereon and the two halves are adapted to be coupled together. The couplings are so constructed that refrigerant is prevented from escaping beyond the coupling until two mating halves are joined together. These couplings are relatively expensive, cause refrigerant pressure drops due to the restrictions provided thereby, and present problems during the field assembly operation. Furthermore, the general trend towards larger refrigeration systems requires larger refrigerant lines, and consequently, larger and more expensive quick-connect couplings.

Attempts have been made to eliminate the need for such expensive couplings by providing fusible or frangible plugs in the ends of the lines and tubing. When the line and tubing were joined together the plugs were broken or melted to place the two conduits in communication. However, the refrigerant charges in the two lines were at different pressures, and when the plugs were disintegrated, the higher pressure refrigerant would blow the fragments

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or particles of the plugs into the system, thereby contaminating it and possibly causing harm to the components thereof. Screens or other barriers have been proposed, but such barriers or screens might not stop the particles due to the high velocity thereof. If the particles were stopped by the barrier, they formed restrictions in the lines which reduced the refrigerant flow. Moreover, the screens or barriers acted as traps for unharmed foreign matter such as minute oil particles for example, flowing in the refrigerant system, and consequently the lines were further restricted. In any event, prior attempts at elimination of quick-connect couplings on refrigerant systems have not been successful, and to the best of applicant's knowledge, none have been commercially utilized.

SUMMARY OF THE INVENTION

Briefly, coupling apparatus of this invention comprises first and second conduit sections, fusible plugs in the sections, means joining the sections together with the plugs being adjacent one another, and a removable equalizer line extending from one section to the other for permitting the pressures in the sections to equalize.

One of the primary objects of this invention is to provide a coupling for connecting two refrigerant carrying components of a refrigeration system together with minimal loss of refrigerant from the components.

Another object of this invention is to provide a coupling of the type described which allows two components having refrigerant therein to be connected together with minimal ingress of air into the system during the coupling operation.

A further object of this invention is to provide a coupling of the class described which prevents contaminants from being blown into the refrigerant system by the higher pressure refrigerant during the coupling operation.

Still another object of this invention is to provide a coupling such as described which prevents the escape of refrigerant from the refrigerant components prior to the coupling operation, and also improves the seal between the refrigerant components after the coupling operation to prevent loss of refrigerant.

A further object of this invention is to provide a coupling of the type described which is economical in construction and effectively non-restrictive in operation.

Other objects and advantages of this invention will become apparent as the description progresses.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings, in which two of several different embodiments are shown,

FIG. 1 is a side elevation of one embodiment of this invention, certain parts being broken away and shown in section for clarity; and

FIG. 2 is a fragmentary side elevation view of a second embodiment of this invention, certain parts being broken away and shown in section for clarity.

Like parts are represented by corresponding reference characters throughout the several views of the drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, coupling apparatus of this invention is generally shown at 1 in FIG. 1. Basically, the coupling apparatus includes two tubes or conduits 3 and 5, sealing and securing means 7 and an equalizer 9.

Tube or conduit 3 is adapted to be connected to one of the air conditioning units, such as the condenser-compressor unit, or the evaporator coil, or coil blower unit, for example, which is precharged with refrigerant, while conduit 5 may be a length of tubing precharged with refrigerant. The sealing and securing means 7 includes

a disc or plug 11 and 13 of fusible material, such as solder for example, located substantially flush with the outer end of the tubes 3 and 5. As will be seen, the ends of the tubes and the discs are adapted to be placed in face-to-face contact with one another. The discs 11 and 13 completely seal the ends of the respective tubes and prevent leakage of refrigerant therefrom. The refrigerants in the tubes 3 and 5 are normally under different pressures. This pressure difference exists because the precharged units may be subjected to different temperatures during installation. For example, the evaporator coil could be in a basement where the temperature is 70° F., the refrigerant pressure being 122.5 p.s.i., for example, while the condenser unit could be out in the sun at a temperature of 100° F., thus creating a refrigerant pressure therein of 198 p.s.i. Similarly, if the units are installed in cold weather, the refrigerant pressure in the condenser unit located outside the house would be lower than the refrigerant pressure in the evaporator located inside the house.

The sealing and securing means also includes a collar or flare coupling half 15 secured as by brazing, for example, to tube 3. Coupling half 15 is provided with threads 17 and a tapered end portion 19. A sleeve 21 having a flared end portion 23 surrounds and extends beyond the end portion of tube 5. The sleeve 21 is attached to tube 5 as indicated at 25 by brazing, for example. A threaded coupling half 27, adapted to be threaded onto coupling half 15 and is slidably received on sleeve 21.

Equalizer 9 comprises a tube 29 having flared ends 31 connected to tubes 3 and 5 by valves 33 and flare nuts 35 adapted to be threaded on valves 33 extending through openings 37 in tubes 3 and 5. Valves 33 are secured, by brazing, for example to the tubes and are similar to ordinary tire valves, i.e., they include a valve member, such as indicated at 34, for example, biased by a spring 36, for example, toward a closed position to prevent the escape of refrigerant from the tubes. A stem 39 extends upwardly from the valve members 34 and when such stem is depressed by a spade member 40 in tube 29, the valve member is moved off its seat and places the interior of the equalizer tube in communication with the interior of the respective tubes 3 or 5. The stem 39 will be depressed by the spade 40 when the flare nut is tightened down on the valve.

The components of the coupling are assembled in the factory in the following relationship. The tube 3 is connected to one of the units, such as the condenser-compressor unit. One valve 33 and the coupling half 15 are attached to the tube 3. Obviously, the disc or plug 11 must also be sealingly secured to the outer end of tube 3. The tube 5, which may be a precharged line, is provided with fusible plug 13 and valve 33 at the end thereof which will be attached to the line 3. It will be understood that the other end of tube 5 could likewise be provided with a valve 33 and a plug 13 to facilitate connection of such other end to another length of precharged tubing or to a tube connected to the other air conditioning unit. The sleeve 21 and coupling half 27 are also assembled on the end of tube 5. Equalizer tube 29 is not attached to either valve 31, but many form part of the installation kit accompanying the air conditioning system shipped from the factory. It will be understood that varying lengths of precharged tubing 5 are conventionally sold separately to air conditioning installation firms so that the latter have a supply of such tubing in stock.

The tubes 3 and 5 may be coupled in the field in the following manner:

The ends of the tubes are placed in end-to-end abutting relationship with sleeve 21 sliding over the end of tube 3 until flare 23 is adjacent taper 19 on coupling half 15. With the tubes in this position plugs 11 and 13 are in face-to-face abutting relationship. The coupling half 27 may be tightened on coupling half 15 to secure the tubes together.

Before the discs or plugs 11 and 13 are melted, the equalizer line 29 must first be installed so the pressures on opposite sides of the two discs will equalize and prevent blowing the melted particles of the discs into the system. Equalizer line 29 is connected by first threading loosely threading the flare nuts 35 onto the respective valves 33 so that the stems 39 are not depressed by the ends of the spades 40. Then one of the nuts 35 is tightened down on the respective valve 33, thereby causing the adjacent end of tube 29 to engage stem 39 and open the valve. Refrigerant escapes from the tube 3 or 5 now in communication with tube 29 and forces the air in tube 29 out the other end of the latter. It only takes a moment to expel the air from tube 29 and the other flare nut 29 may next be tightened on the respective valve 33. This action places the equalizer tube 29 in communication with the other tube 3 or 5 and the pressures in tubes 3 and 5 then quickly equalize.

The area around the plugs or discs 11 and 13 is next heated to melt the latter. This heating may be accomplished in any of various ways. For example, a specially designed electrical heating coil unit could be placed around sleeve 21. The unit could be powered by the electricity in the house in which the air conditioning system is being installed and a timer could be preset to turn off after a predetermined period of time during which the solder would melt. Another method of heating would simply be to apply a blow torch, a tool usually carried by installation crews, for a predetermined period of time to the sleeves 21 in the area of discs or plugs 11 and 13. It is also contemplated that a paint band could be applied around sleeve 21, the paint being of a type which would change colors when the metal is heated to a predetermined temperature, which temperature would be known to be sufficiently high to insure that the fusible plugs had melted. This would provide a visual indication to the installer that the plugs had melted.

It has been found the fusible plugs, upon melting, spread fairly evenly around the tube joint and form a curved surface around and bonds to the inside of the tubes 3 and 5 due to surface tension of the molten material. This not only reduces the restrictiveness of the fusible material when it hardens, but also increases the effectiveness and strength of the seal between the tubes 3 and 5.

It will be understood that after the tubes 3 and 5 are connected similar couplings would be effected on the remaining connectable lines of the system to complete the installation thereof. Naturally, the remaining connectable lines would have the ends thereof fitted with the same hardware as described above.

The utilization of equalizer 9 is extremely important to the successfulness of the coupling apparatus. Not only do the valves 33 permit substantially all of the air in tube 29 to be expelled prior to complete connection of the tube so that no air is introduced into the system, but more importantly, the pressures in the tubes 3 and 5 can be equalized and thus prevent particles of the plugs 11 and 13 from being blown into the system when the plugs are melted. After the tubes 3 and 5 have been joined, the pressures equalized, and the solder plugs melted, the tube 29 may, if desired, be removed. Upon removal of tube 29, valves 33 automatically close to prevent the escape of refrigerant.

A second embodiment of this invention is illustrated in FIG. 2. This embodiment includes discs or plugs 11 and 13 and equalizer 9 (shown diagrammatically) connected to tubes 3 and 5 in the same manner as the embodiment shown in FIG. 1. A sleeve 39 is secured to tube 5 by brazing, for example, and extends beyond the end of tube 5. Sleeve 39 has an internally located annular recess 41 near its outer end. A solder ring 43 is placed in recess 41. The coupling is assembled by sliding the outer end of sleeve 39 over the outer end of tube 33 until the ends of tubes 3 and 5 and plugs 11 and 13 are adjacent one another. Heat is applied around sleeve 39 in the area

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of solder ring 43 to melt the latter and seal the sleeve 39 to the tube 3. The equalizer 9 is attached and the plugs 11 and 13 are melted in the same manner as in the FIG. 1 embodiment.

It will be seen that the coupling of this invention permits connection of two precharged components of a refrigerant system without substantial loss of refrigerant and without contaminating the system with particles of foreign matter.

In view of the foregoing, it will be seen that the several objects and advantages of this invention are achieved.

I claim:

1. A coupling for refrigeration apparatus comprising first and second conduit sections, fusible plugs in the ends of said sections, each of said sections containing refrigerant, the pressures of the refrigerant in said sections being different when said sections are subjected to different temperature, means joining the sections together with the plugs being adjacent one another, and an equalizer line adapted to place one section in communication with the other for permitting the pressures in said sections to equalize, said plugs, upon the application of heat to said sections around said plugs, melting to place said tubes directly in communication with one another.

2. A coupling for refrigeration apparatus as set forth in claim 1 wherein said means comprises sleeve means on one of said sections and extending over the end of the other section, the outer end of said sleeve means being flared, a first coupling half secured to said other section, and a second coupling half on said sleeve means, said coupling halves being adapted to be connected together over said flared end of said sleeve means.

3. A coupling for refrigeration apparatus as set forth in claim 1 wherein said equalizer line comprises a tube, and valves on opposite ends of said tube, one valve being adapted to place one of said sections in communication with said tube and the other valve being adapted to place the other section in communication with said tube.

4. A coupling for refrigeration apparatus as set forth in claim 1 wherein said means comprises sleeve means on one of said sections and extending over the end of the other section, a solder ring inside and located adjacent the outer end of said sleeve means, said solder ring being adapted, upon the application of heat thereto, to melt and seal said sleeve means to said other section.

5. A coupling for refrigeration apparatus as set forth in claim 3 wherein said means comprises sleeve means on said one section and extending over the end of said other section, the outer end of said sleeve means being flared, a first coupling half secured to said other section, and a second coupling half on said sleeve means, said coupling halves being adapted to be connected together over said flared end of said sleeve means.

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6. A coupling for a refrigeration system comprising first and second tubes each of which is precharged with refrigerant, the pressure of the refrigerant in said tubes being different, fusible plugs in said tubes, said plugs being adapted to melt upon the application of heat thereto, said tubes being located adjacent one another with the outer faces of said plugs being adjacent one another, means securing said tubes together and sealing the joint between said tubes, and an equalizing line connected between said tubes around said plugs, said equalizer line including valve means adapted to place said first tube in communication with said second tube around said plugs to permit equalization of the pressures of the refrigerant in said tubes prior to heating of said plugs.

7. A coupling for a refrigeration system as set forth in claim 6 wherein means securing said tubes in said relationship and sealing the joint between the ends of said tubes comprises sleeve means on said first tube, said sleeve means surrounding the end of said second tube and having a flared end, a first coupling half secured to said second tube, and a second coupling half on said sleeve means, said coupling halves being connected together over said flared end of said sleeve means.

8. A coupling for a refrigeration system as set forth in claim 6 wherein said means comprises sleeve means on one of said tubes and extending over the end of the other tube, a solder ring inside and located adjacent the outer end of said sleeve means, said solder ring being adapted, upon the application of heat thereto, to melt and seal said sleeve means to said other tube.

9. A coupling for a refrigeration system as set forth in claim 7 wherein said equalizer line includes tube means, and said valve means includes a valve at each end of said equalizer tube means, each of said valves being adapted to be opened by the adjacent end of said equalizer tube means, to place the refrigerant tube with which the particular valve is associated in communication with said equalizer tube means.

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WILLIAM F. O'DEA, Primary Examiner

RICHARD GERARD, Assistant Examiner

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