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CHARGED REFRIGERATION SYSTEM

Filed March 25, 1957

FIG. 1

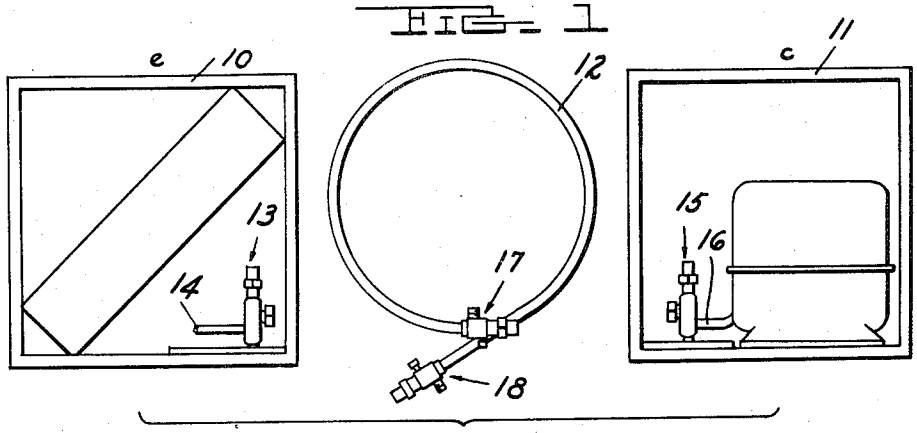
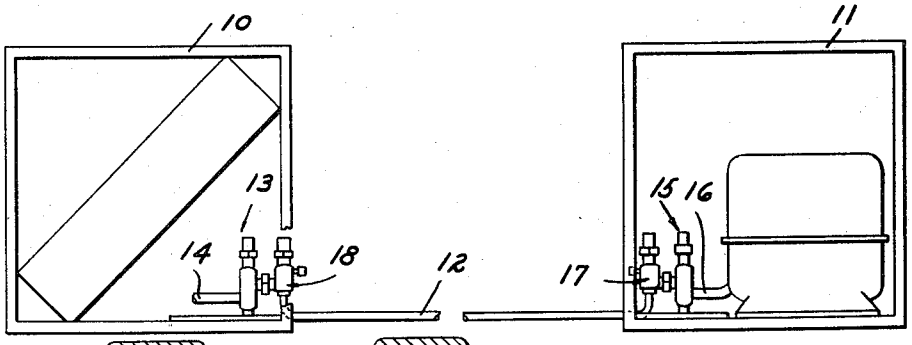


FIG. 2



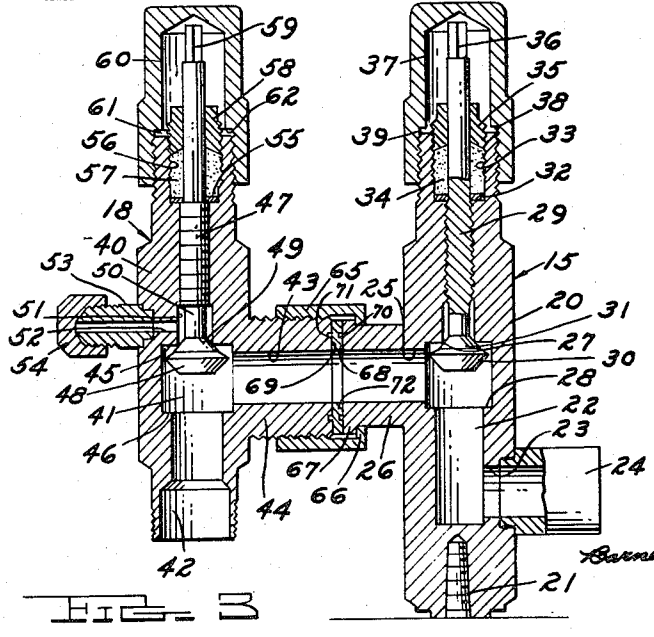


FIG. 3

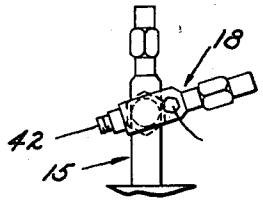


FIG. 4

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CHARGED REFRIGERATION SYSTEM

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This invention relates to refrigeration systems and particularly to charged refrigeration systems wherein the components of the system are processed and charged with refrigerant at the factory.

At the present time some refrigeration units such as condensing units are processed and charged at the factory by dehydrating and purging the units and charging them with refrigerant. Other units of refrigeration systems such as the evaporator and connecting tubing are not processed or charged. When the customer receives the units, it is necessary to process and charge the units and tube which have not been so treated at the factory. According to the recommended procedure, this processing and charging comprises evacuating the component unit and tubing, sweeping with refrigerant, evacuating a second time, sweeping with refrigerant a second time, evacuating a third time, and then finally charging the units and tubing with refrigerant. The valves connecting the securely processed and charged unit may then be opened to place the system in operation.

This procedure results in additional cost due to the extra labor and the wastage of refrigerant especially where the units of the system are spaced substantial distances from one another. The procedure must be performed by a skilled mechanic and is hazardous especially if toxic refrigerant is used. If not performed properly, the life of the component units of the refrigeration system is substantially reduced due to the moisture that might be left in the system.

It is an object of this invention to provide a refrigeration system wherein each component of the system is charged with refrigerant or vacuumized and sealed at the factory and may be connected into a system without any purging or charging and with a minimum of skill required to make the connection.

It is a further object of this invention to provide novel means for making a disconnectable joint between such previously sealed units.

It is a further object of this invention to provide such novel means which do not incorporate any synthetic materials.

In the drawings:

Fig. 1 is a partially diagrammatic showing of several components prior to being connected together in a refrigeration system.

Fig. 2 is a partially diagrammatic showing of several components connected into a refrigeration system.

Fig. 3 is a vertical sectional view on an enlarged scale of the disconnectable joint between the components.

Fig. 4 is a side elevational view of the disconnectable joint showing the parts in a different position.

Referring to Fig. 1 the components of a refrigeration system include evaporator unit **10**, condenser and compressor unit **11** and tubing **12**. Evaporator unit **10** is processed or purged and charged with refrigerant at the factory and the inlet and outlet of the unit are provided with a valve **13** connected to an inlet or outlet conduit, only one of the valves being shown in Fig. 1. Valve **13** is connected to inlet or outlet line **14**. Valve **13** may be opened or closed as presently described, but when unit **10** is shipped from the factory, valve **13** is closed to maintain evaporator unit **10** in a charged and sealed condition.

The condenser and compressor unit **11** is also charged and sealed at the factory and the inlet and outlet thereof are provided with valves **15**, only one of the valves being shown in Fig. 1 as connected to an inlet or outlet conduit **16**. Valve **15** is closed when the condenser unit **11** is shipped from the factory.

Tubing **12** is also purged and charged with refrigerant at the factory, the ends being provided with valves **17**, **18** which are closed to maintain the tubing **12** in charged and sealed condition.

Units **10** and **11** and tubing **12** are shipped in charged and sealed condition to the customer. When received by the customer the units are connected to each other, valve **17** being connected to valve **13** and valve **18** being connected to valve **15** by the structure presently described. The valves are then opened as shown in Fig. 2 providing communication between the units without any need for purging and charging of the units.

Tubing **12** connects the outlet of unit **10** to the inlet of unit **11**. It should be understood that another length of tubing with associated valves is provided between the inlet of unit **10** and the outlet of unit **11**. Moreover, dependent upon the capacity of the units, several lengths of tubing may be used between the inlets of one unit and the outlets of the other unit with a corresponding increase in the number of associated valves which are used.

Valves **13** and **15** on the evaporator unit **10** and condenser unit **11**, respectively, are identical in construction and valves **17** and **18** on the ends of tubing **12** are identical in construction. In order to avoid repetition, only valves **15** and **18** will be described in detail.

Referring to Fig. 3, valve **15** comprises a body **20** which has a length several times its cross-sectional dimensions. Body **20** includes a threaded vertical opening **21** in the base thereof providing a means by which the body may be supported on a bolt extending upwardly from the base of condenser unit **11**. Valve body **20** is provided with a vertically extending chamber **22**. A passageway **23** extends from the lower end of chamber **22** laterally through the side of the body **20** to the exterior thereof.

A short tubular fitment **24** is fitted into body **20** and a seal is formed between fitment **24** and body **20** by brazing or other suitable means. Fitment **24** provides communication to passageway **23** and chamber **22**. Conduit **16** of condenser unit **11** is connected to fitment **24** in a suitable manner, preferably by brazing (Fig. 1). Valve body **20** is also provided with a passageway **25** extending laterally from the upper end of chamber **22** and providing communication between chamber **22** and the exterior of the body. A laterally extending projection **26** surrounds passageway **25**.

The walls of chamber **22** include shoulders **27**, **28** which form sealing surfaces for a valve member **29** which is threaded in the upper end of valve body **20**. Rotation of valve member **29** causes the valve member to move upwardly and downwardly relative to the valve body **20**. The lower end of valve member **29** is formed with a frusto-conical sealing surface **30** adapted to contact shoulder **28**. Valve member **29** also has a frusto-conical sealing surface **31** above sealing surface **30** and adapted to contact shoulder **27**.

To prevent the escape of refrigerant through the threaded connection of valve member **29** to valve body **20** a copper washer **32** is provided in a depression **33** in the upper end of valve body **20** and packing material **34**

is positioned over the washer 32. A nut 35, preferably of brass, surrounds the upper end of valve member 29 and is threaded into cavity 33.

The uppermost end 36 of valve member 29 is provided with a non-circular shape to facilitate its being grasped by pliers or other suitable tools so that the valve member 29 may be easily rotated. A cap 37 is threaded onto the exterior of the upper end of valve body 20 to protect the upper end of valve member 29. To further insure a seal, a metal washer 38, preferably copper, is inserted on the upper end of valve body 20 and abuts a shoulder 39 on cap 37.

Valve 18 is similar in construction to valve 15 and comprises a valve body 40 which has a length several times its cross-sectional dimensions. Valve body 40 includes a longitudinally extending chamber 41 which communicates with a passageway 42 extending longitudinally of valve body 40 and providing communication to the exterior of the valve body. A passageway 43 extends laterally from the upper end of chamber 41 to the exterior of the valve body, and a projection 44 surrounds the passageway 43.

The walls of chamber 41 are formed with the shoulders 45, 46 which provide sealing surfaces for a valve member 47 threaded in the upper end of valve body 40 and rotatable relative thereto, thereby moving upwardly and downwardly relative to the valve body, as shown in Fig. 3. The lower end of valve member 47 is provided with an inverted frusto-conical sealing surface 48 which is adapted to engage shoulder 46 and a frusto-conical sealing surface 49 above surface 48 which is adapted to contact shoulder 45. The portion 50 of valve member 47 above surface 49 is of lesser cross-sectional dimensions than cavity 51 which communicates with chamber 41. Valve body 40 includes a port 52 extending laterally from cavity 51. A tubular fitment 53 communicates with cavity 51 and provides a means for checking the pressure in cavity 51 by replacement of a pressure gage on the fitment. In addition, fitment 53 provides a means for purging the system as may be required during the maintenance thereof. A cap 54 is threaded on the exterior of the fitment 53 to seal the fitment.

In order to prevent the escape of refrigerant upwardly through valve member 47 a copper gasket 55 is provided in cavity 56 in the upper end of valve body 40 and packing materials 57 are positioned above gasket 55. A nut 58 preferably of copper is threaded into the interior of the cavity 56. The upper end 59 of valve member 47 is formed with a non-circular configuration to facilitate its being grasped by pliers or other suitable tools in order to rotate the valve member. A cap 60 is threaded on the exterior of the upper end of valve body 40 to protect the upper end of the valve member. An annular washer 61, preferably of copper, is inserted between cap 60 and the upper end of valve body 40 and abuts shoulder 62 in cap 60 to further assist in providing a seal.

A disconnectable joint is provided between valve 15 and valve 18 by means which includes an internally threaded collar 65 mounted on projection 26 of valve 15. Collar 65 has an inwardly extending peripheral flange 66 which abuts a shoulder formed by an annular rib 67 on the exterior of projection 26. The shoulder formed by annular rib 67 limits the movement of collar 65 outwardly relative to valve 15. Collar 65 is threaded onto threads on the exterior of projection 44 of valve 18. The ends of projections 26 and 44 are provided with annular sealing surfaces 68, 69, respectively, which lie in planes at right angles to the axis of projections 26 and 24.

Projection 26 includes an annular rib 70 which projects axially from surface 68. Surface 69 of projection 44 has a complementary groove 71 therein. An annular washer 72 of malleable metal, preferably copper, is inserted between the surfaces 68, 69 and when collar 65 is threaded on projection 44 the metal of washer 72 is deformed by annular rib 70 and annular groove 71 to provide a gas-tight connection between valves 15 and 18.

In use when condenser unit 11 is sealed at the factory, valve member 29 of valve 15 is moved downwardly to bring surface 30 into sealing contact with the shoulder 28, thereby cutting off or closing the valve. Similarly, valve 18 of the charged tubing 12 has valve member 47 moved downwardly to bring surface 48 into sealing contact with shoulder 46, preventing the escape of refrigerant from the tube. Similarly valve 13 on evaporator unit 10 and valve 17 on the other end of tubing 12 are closed. When the customer receives the condenser unit 11 and charged tubing 12 and wishes to connect the unit and tubing, malleable washer 72 is inserted between sealing surfaces 68, 69 and collar 65 is threaded onto projection 44. Collar 65 is turned until a finger-tight connection is obtained. Valves 15 and 18 and valve members 29 and 47 may then be opened slightly by rotating valve members 29 and 47 to permit a small amount of refrigerant to flow through passageways 25 and 43 through the threaded connection and purge the very small amount of air from these passageways. Collar 65 is then tightened, causing the annular rib 70 and groove 71 to deform or cold flow the malleable material of washer 72 and provide a seal between the valves 15 and 18. Valve members 29 and 47 are then rotated to fully open the valves. Valve members 29 and 47 may be moved to bring sealing surfaces 31 and 49 into contact with shoulders 27 and 45, respectively, to insure that no refrigerant will escape by moving upwardly through the valve body (Fig. 3).

As shown in Fig. 4, the disconnectable joint between valves 15 and 18 permits the valves to be secured to one another with the valve bodies 20 and 40 forming any desired angle with each other. This permits the position of valve body 40 to be changed in order that the tubing 12, extending from the end of the body and communicating with passage 42, to extend at any desired angle away from the valve 15. This is of particular importance in installations where the units are in such close proximity to other units or the parts of the units are so arranged that the tubing can only be extended in one particular direction away from the unit.

It can thus be seen that I have provided a refrigeration system wherein each component including the tubing may be purged, charged and sealed at the factory and may be connected by the customer without requiring any processing or purging and charging in the field. The units may be positioned at substantial distances from one another. In addition, I have provided a disconnectable joint between each unit and tubing which provides a gas-tight seal without the use of synthetic materials. The joint is such that the angular position of one valve relative to another may be changed without affecting the joint in order that the tubing will extend away from the unit in the desired direction as necessitated by the construction of the unit or the surroundings.

It should be understood that the valves, after the initial installation, perform the function of shut-off valves in case it is necessary to isolate a unit or a length of tubing in order to perform maintenance thereon.

It should be understood that the invention is also applicable to systems wherein some of the refrigeration units are purged of air, vacuumized and sealed. By this arrangement, all of the refrigerant can be placed in one unit while the other unit and the lengths of tubing are purged, vacuumized and sealed. The expression "charged and sealed" when used herein is intended to cover such units or tubing which are vacuumized and sealed.

I claim:

1. A valve assembly for providing a disconnectable connection between a refrigerator unit and tubing, each of which contains refrigerant, said assembly comprising a valve adapted to be connected to a unit, a valve adapted to be connected to one end of refrigerant tubing, each said valve including a body having a length several times its cross sectional dimensions, each said body including a

chamber, means on said body accessible from one end of said body and movable axially of said body to provide and cut off communication through said chamber, means forming a passageway in each said body communicating with said chamber whereby communication may be made to a unit or tubing, a projection extending from each said body in a direction at substantially right angles to the longitudinal axis of said body, each said projection having an axially extending passageway, each said projection having an annular sealing surface on the end thereof surrounding said passageway, and means for drawing and holding said annular sealing surfaces together to align said passageways and produce a gas-tight seal between said sealing surfaces, said latter means permitting said valves to be connected with the axis of said valve bodies at any angle whereby the relative position of said valve bodies may be changed to accommodate the surrounding apparatus, said means providing a gas-tight seal including an annular rib on one said sealing surface, a complementary groove in the other said sealing surface, and an annular washer of deformable material interposed between said sealing surfaces.

2. The combination set forth in claim 1 wherein said deformable material comprises copper.

3. The combination set forth in claim 1 wherein said means for drawing and holding said sealing surfaces in contact comprises a collar around one said projection having a radially inwardly extending flange, a shoulder on said one projection abutting said flange and limiting the axial movement of said collar outwardly toward the end of said projection, said collar having a thread formed on the inner surface thereof, the other said projection having a complementary thread formed on the exterior thereof whereby said collar may be rotated to engage said threads causing the flange thereof to abut the shoulder on the one said projection and draw said projection toward the other said projection to bring the sealing surfaces into gas-tight contact.

4. In a refrigeration system, the combination comprising a condenser unit, an evaporator unit, and refrigerant tubing extending between said condenser unit and said evaporator unit to permit said condenser unit to be positioned remotely from said evaporator unit, a valve mounted on each said condenser unit and evaporator unit and including means for closing said valve to cut off the flow of fluid therethrough, each said valve having communication with its respective unit, a valve on each end of said tubing and including means for cutting off the flow of fluid therethrough, means providing a disconnectable gas-tight connection between said valve on said condenser and the valve on one end of said tubing, and means providing a disconnectable gas-tight joint between the valve on said evaporator unit and the valve on the other end of said tubing, whereby said condenser unit,

evaporator unit and tubing may be charged and sealed separately for subsequent assembly and when refrigerant is in said condenser unit, evaporator unit and tubing, one said unit may be disconnected from said tubing by actuating the means for closing the valve on said unit and the valve on the tubing and disconnecting said gas-tight connection between said unit and said valve on said tubing, said means forming a gas-tight joint comprising a projection on each said valve, each said projection having an axially extending passageway, each said projection having an annular sealing surface on the end thereof surrounding said passageway, and means for drawing and holding said annular sealing surfaces together to align said passageways and produce a gas-tight seal between said sealing surfaces, whereby when the valve of said unit and a valve in one end of said tubing have been closed and the gas-tight connection has been disconnected, said unit and said end of said tubing may be reconnected by first actuating said drawing means and holding means to draw said sealing surfaces into initial contact, opening said valves slightly to permit refrigerant to pass through said passageways and between said sealing surfaces to purge said passageways of air, and thereafter further actuating said drawing and holding means to bring said surfaces into gas-tight contact, said means providing a gas-tight joint including an annular rib on one said sealing surface, a complementary groove in the other said sealing surface, and an annular washer of malleable metal interposed between said sealing surfaces, said means for drawing and holding said sealing surfaces in contact comprising a collar around one said projection having a radially inwardly extending flange, a shoulder on said one projection abutting said flange and limiting the axial movement of said collar outwardly toward the end of said projection, said collar having a thread formed on the inner surface thereof, the other said projection having a complementary thread formed on the exterior thereof, whereby said collar may be rotated to engage said threads causing the flange thereof to abut the shoulder on the one said projection and draw said projection toward the other said projection to draw and hold the sealing surfaces into gas-tight contact.

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