June 4, 1963 S. H. MORSE 3,091,945

REFRIGERATION SYSTEMS

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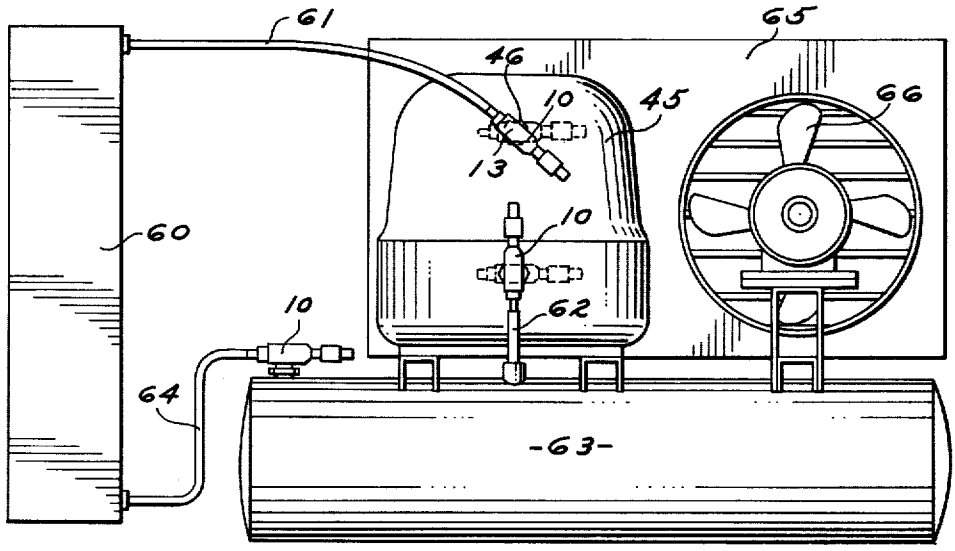


FIG. 1

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FIG. 2

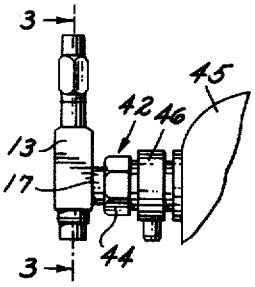


FIG. 4

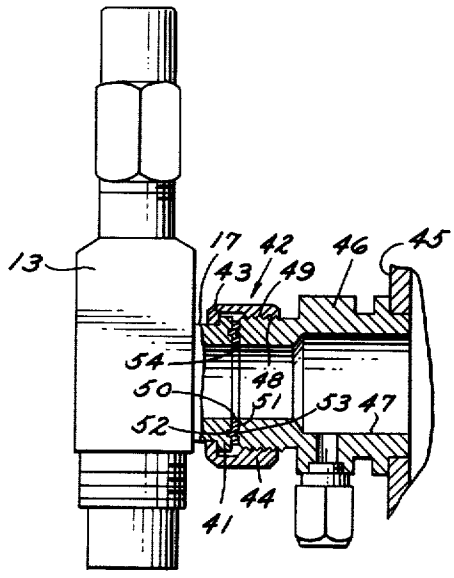


FIG. 3

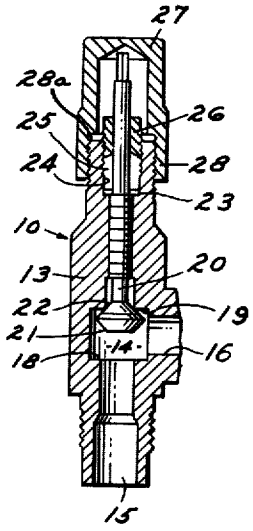
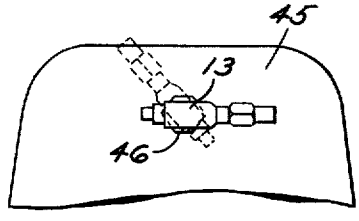


FIG. 5



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FIG. 6

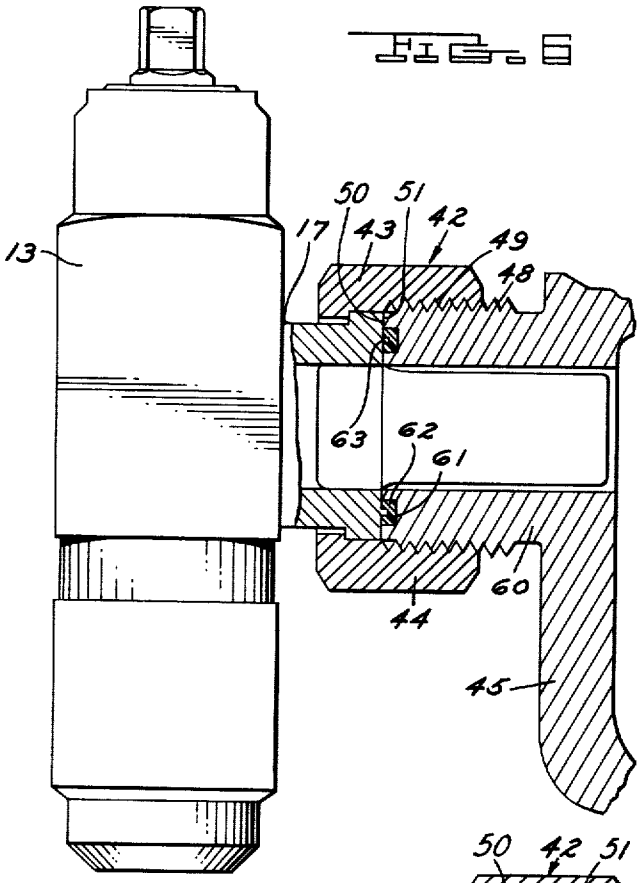
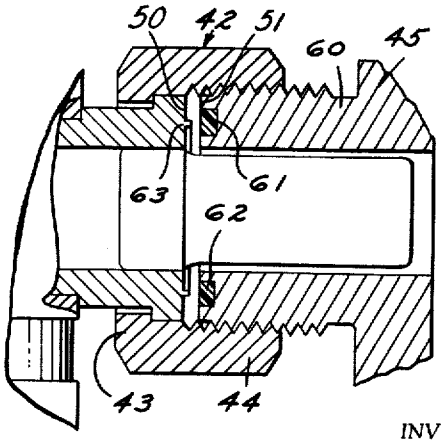


FIG. 7



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REFRIGERATION SYSTEMS

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Original application Aug. 5, 1959, Ser. No. 832,883. Divided and this application May 31, 1962, Ser. No. 199,098

3 Claims. (Cl. 62—299)

This invention relates to refrigeration systems and particularly to the mounting of shut-off valves on refrigeration units.

In refrigeration systems, it is customary to provide shut-off valves at the inlet or suction side and the outlet or pressure side of the component units such as the compressor unit which may be closed when it is desired to isolate the unit for purposes of repair or replacement. These valves may also be used to facilitate charging the unit with refrigerant and sealing the unit at the factory for shipment to the customer.

A conventional type construction comprises the use of a shutoff valve having a body which has a length several times its lateral dimensions. The body includes a chamber, a first passageway extending axially of the body and providing communication between the chamber and the end of the body and a second passageway formed by a projection extending laterally of the body and providing communication between the chamber and the exterior of the body. A valve member is movable axially of the body in the chamber to open and close the valve by control of the communication between the passageways.

In use, the second passageway is connected to a first refrigeration unit. A conduit or tube is connected to the first passageway and leads to another unit of the refrigeration system. The means for connecting the second passageway to a refrigeration unit comprises a pad of substantial thickness fixed on the projection and having a flat surface which is adapted to contact a complementary flat surface on the refrigeration unit. A gasket may be interposed between the surfaces and the pad is drawn toward the refrigeration unit by bolts passing through the pad and threaded into the refrigeration unit.

A major disadvantage of such a construction is that when the shut-off valve is mounted on the refrigeration unit the direction or angle in which the tube connected to the first passageway extends away from the refrigeration unit is fixed and cannot be adjusted. This raises particular problems when limitations in space surrounding the refrigeration unit or the position of the other refrigeration unit to which the tube extends require that the tube extend in a different direction. To overcome this disadvantage, shut-off valves have been manufactured wherein the pad is in different angular positions relative to the valve body. This necessitates keeping a large number of valves of different types in stock. In addition, a manufacturer of a refrigeration unit may install a particular valve which may provide for the tubing from the first passageway to extend in the proper direction for space requirements in the refrigeration unit, nevertheless when the consumer receives the unit he may find that the tubing should extend in another direction in order to make the proper connection to an adjacent refrigeration unit. This necessitates removing one valve and replacing it with another having a pad forming a different angle with the valve body. Such a replacement results in the loss of the refrigerant charge which may have been placed in the refrigeration unit at the factory and necessitates the purging of air from the refrigeration unit. These additional steps are obviously costly and time consuming.

A further disadvantage of using the conventional pad type shut-off valve is that in order to provide a tight seal

between the sealing surface on the pad and the complementary surface of the refrigeration unit, a large force is required and it is necessary to have a very thick heavy pad.

It is therefore an object of this invention to provide a refrigeration system wherein the shut-off valve may be positioned in a plurality of angular relationships relative to the refrigeration unit.

It is a further object of this invention to provide such a system wherein there is an improved sealing connection between the valve and the refrigeration unit.

It is a further object of this invention to provide a refrigeration system which utilizes a high unit pressure sealing ring or rib between the shut-off valve and the refrigeration unit so that a seal is provided along a thin annular area as distinguished from a large flat surface area thereby permitting the use of a relatively thin pad or valve contacting surface.

It is a further object of this invention to provide a refrigeration system which has novel sealing means between the shut-off valve and the refrigeration unit, which means can be loosened to permit angular adjustment between the valve and the refrigeration unit without loss of refrigerant.

It is a further object of the invention to provide a refrigeration system wherein novel sealing means is provided between the shut-off valve and the refrigeration unit, the sealing means being such that when it is loosened an effective seal is maintained which prevents leakage of refrigerant and at the same time permits relative angular adjustment between the shut-off valve and the refrigeration unit so that the angular position of the valve relative to the unit may be adjusted without loss of refrigerant.

It is a further object of this invention to provide a refrigeration system which has novel sealing means including a high pressure rib and a plastic ring between the shut-off valve and the refrigeration unit, the sealing means being particularly adapted to provide a finger tight seal and such that when loosened an effective seal is maintained between the valve and the refrigeration unit which prevents leakage of refrigerant and at the same time permits relative angular adjustment between a valve and a refrigeration unit, said seal being such that it maintains the relative angular position of the valve and the refrigeration unit during the final locking of the valve to the refrigeration unit. This application is a divisional application of my co-pending application Serial No. 832,883, filed August 5, 1959, now abandoned, which in turn is a continuation-in-part of my co-pending application Serial No. 648,305, filed March 25, 1957, now abandoned.

In the drawings:

FIG. 1 is a partly diagrammatic elevation of a refrigeration system embodying the invention.

FIG. 2 is a side elevational view of a portion of the apparatus shown in FIG. 1.

FIG. 3 is a sectional view taken along the line 3—3 in FIG. 2.

FIG. 4 is a fragmentary sectional view similar to FIG. 2, on an enlarged scale.

FIG. 5 is an end elevational view of a portion of the apparatus shown in FIG. 1.

FIG. 6 is a fragmentary sectional view of a further modified form of the invention.

FIG. 7 is a fragmentary sectional view of a portion of the invention shown in FIG. 6 showing the parts in a different relative position.

Referring to FIGS. 1, 2 and 3, the refrigeration system includes a plurality of shut-off valves **10** which may be mounted on various components of the system such as compressor **45** in order to provide a means for opening

and closing and thereby controlling communication between the units. Specifically referring to FIG. 1, a pair of off-set valves are mounted on compressor **45** for controlling connections to line **61** extending to evaporator **60** and to line **62** extending to receiver **63**. Similarly, a shut-off valve **10** is provided for controlling flow in line **64** which extends to the evaporator **60**. As shown, the refrigeration system includes the conventional condensor **65** and fan **66**.

As shown in FIG. 3, valve **10** comprises a body **13** which has a length several times its lateral or cross sectional dimensions. Body **13** includes a longitudinally extending chamber **14** which communicates with a passageway **15** extending longitudinally of valve body **13** and providing communication to the exterior of the valve body. A second passageway **16** formed by a projection **17** extends laterally from the end of chamber **14** to the exterior of the valve body. The walls of chamber **14** are formed with shoulders **18**, **19** which provide sealing surfaces for a valve member **20** threaded in the other end of valve body **13** and rotatable relative thereto, thereby moving longitudinally of said valve body.

The end of the valve member **20** adjacent sealing surface **18** is provided with an inverted frusto-conical sealing surface **21** which is adapted to engage shoulder **18** and a frusto-conical sealing surface **22** longitudinally spaced from surface **21** which is adapted to contact shoulder **19**. To prevent the escape of refrigerant through the threaded connection of valve member **20** to valve body **13**, a copper washer **23** is provided in a depression **24** in the end of valve body **13** and packing material **25** is positioned over the washer **23**. A nut **26** preferably of copper surrounds the upper end of valve member **20** and is threaded into the cavity.

The end of valve member **20** which extends to the exterior of valve body **13** is provided with a non-circular shape to facilitate its being grasped by pliers or other suitable tools so that the valve member **20** may be easily rotated. A cap **27** is threaded onto the exterior of the upper end of valve body **13** to protect the upper end of valve member **20**. To further insure a seal, a metal washer **28***a*, preferably of copper, is pressed in cap **27** adjacent the upper end of the valve body **13** and abutting a shoulder **28** on the cap.

As shown in FIG. 4, fitment **17** of the valve is provided with a peripheral flange **41** and a collar **42** is rotatably mounted on the projection. Collar **42** has an inwardly extending flange **43** and a cylindrical body **44** with a hexagonal external configuration extending axially away from the valve body **13**. The axial movement of the collar **42** away from valve body **13** is limited by engagement of flange **43** on collar **42** with flange **41** on projection **17**. Refrigeration unit **45** is provided with a fitment **46** forming a passageway **47** communicating with the inlet or outlet as the case may be of the refrigeration unit. Fitment **46** is mounted on refrigeration unit **45** in fixed sealing relationship thereto in any suitable manner such as by hydrogen brazing. The end of fitment **46** is formed with threads **48** and the inner surface of cylindrical body **44** of collar **42** is formed with complementary threads **49**.

The end of projection **17** is formed with an annular sealing surface **50** extending in a plane generally perpendicular to the axis of projection **17**. The end of fitment **46** is formed with a complementary sealing surface **51**. Sealing surface **50** is formed with an annular groove **52** immediately adjacent but spaced from the opening in projection **46** and sealing surface **51** is formed with a complementary rib **53**. A washer **54** made of malleable material, preferably copper, is interposed between the sealing surfaces **50** and **51**.

When collar **42** is threaded on fitment **46**, flange **43** engages flange **41** on projection **17** and draws the valve toward fitment **46** bringing sealing surfaces **50** and **51** into contact with the surfaces of washer **54**. Further

threading of collar **42** on fitment **46** causes the annular rib **53** on fitment **46** to deform the malleable material of washer **54** into annular groove **52** on projection **17** providing a high unit pressure in the area of the rib **53**. In this manner, a gas-tight seal is insured. The angular position of the valve body **13** relative to the refrigeration unit **45** may be adjusted to accommodate space limitations or to cause the end having the first passageway to extend in a particular direction as desired. The positions through which the body may be moved extend 360°.

In order to adjust the angular position of a valve relative to a refrigeration unit **45** which has been previously charged with refrigerant, the collar **42** is loosened to a position in which leakage of refrigerant is prevented and at the same time angular adjustment of the valve may be made.

A modified form of the invention is shown in FIGS. 6 and 7 wherein identical numbers are used to identify the same parts wherever applicable. As shown in FIGS. 6 and 7, fitment **60** is formed integral with refrigeration unit **45** and the threads **48** are formed on the fitment **60**. Sealing surface **51** is formed with an annular groove **61** immediately adjacent but spaced from the opening therein in which a plastic ring **62** of tetrafluoroethylene (Teflon) or nylon is positioned. Sealing surface **50** on fitment **17** is formed with a complementary rib **63** of lesser width than the Teflon ring **62** immediately adjacent but spaced from the opening therein. When the collar **42** is tightened, the rib **63** presses against the plastic ring **62** and causes it to flow outwardly permitting the surfaces **50**, **51** to engage in a metal to metal contact. In this manner, a high unit pressure seal is provided between the rib **63** and plastic ring **62** and in addition, a metal to metal engagement is provided between the surfaces **50** and **51** which assists in locking the valve body in the selected position.

The arrangement is such that substantially normal finger tightening of the collar **42** is sufficient to prevent leakage of refrigerant and at the same time permit relative angular movement of the valve relative to the refrigeration unit.

In order to adjust the angular position of a valve relative to a refrigeration unit which has been charged, the collar **42** is loosened on fitment **60** until finger tight relationship is obtained of the rib **63** on the plastic ring **62**. In this position, the rib **63** is in contact with plastic ring **62**, but not distorting the ring and an effective seal is provided between the fitments **17** and **60** such as to prevent leakage of refrigerant. At the same time, the plastic ring **62** permits angular adjustment of the valve relative to the fitment without loss of refrigerant. Moreover, the plastic ring serves to hold the valve in its angular adjusted position while the collar **42** is being tightened by the use of tools to lock the valve in its newly adjusted position. Plastic ring **62** returns to its original shape when collar **42** is loosened so that repeated loosening and adjusting of the valve may be made without the need for replacing the ring **62**. Plastic ring **62** is preferably made of Teflon because of its resistance to refrigerants such as Freon, oils and its high temperature resistance which is needed to withstand the temperatures used in dehydrating refrigeration units, which temperatures are on the order of 350° F. Nylon may also be used but is not as desirable because it is harder, requiring a greater finger tight pressure to prevent leakage of refrigerant when the angular adjustment is being made to a previously charged refrigeration unit.

It can thus be seen that one of the most important features of the invention is that a gas tight connection can be maintained by finger tight pressure of the sealing surfaces, because of the high unit pressure seal, to permit the adjustment of the valve relative to the refrigeration unit to any angle desired at the time of installation. Furthermore, when a plastic sealing ring is used, the position

of the valve is more easily maintained in the desired angular relation to the refrigeration unit during the final tightening of the valve in position.

It will also be seen that I have provided a refrigeration system wherein the shut-off valve can be adjusted angularly relative to the refrigeration unit as is required by space limitations or other considerations such as the direction in which the tubing is to be provided. This obviates the need for maintaining an inventory of a large number of different valves. In addition, an improved seal is provided to insure a gas tight connection, thereby preventing the loss of refrigerant. The seal prevents the escape of refrigerant and at the same time permits angular movement of the valve body relative to the refrigeration unit during assembly. Particularly where a plastic ring is used, the valve is retained in its selected angular position during the locking of the valve in position. In addition, I have obtained the unexpected result in that, because of the ability of the plastic ring such as Teflon to return to its original shape, the same ring can be used repeatedly resulting in a lifetime seal, for all practical purposes.

I claim:

1. In a charged refrigeration system comprising a compressor unit having means thereon defining an opening extending outwardly of said unit, said compressor unit being adapted to contain a refrigerant under pressure, a valve including a valve body, a chamber in said body, a projection on said valve body providing communication between said chamber and the exterior of said body, means defining an opening on said compressor unit including an annular sealing surface lying in a plane generally perpendicular to the axis of the opening, said projection having a complementary annular sealing surface lying in a plane generally perpendicular to the axis of the passageway through said projection, an annular rib on one of said annular sealing surfaces closely adjacent but spaced radially from said opening, the radial width of said annular

rib being a relatively narrow part of the radial width of said one annular surface, the other said annular sealing surface being formed with a complementary groove therein having a radial width greater than the width of said rib, a ring of deformable material positioned in and filling said groove radially, and means for drawing and holding said valve against said compressor unit to bring said rib into high unit pressure engagement with the ring providing a gas tight seal by manual finger force and permitting relative angular adjustment of said body relative to said refrigeration unit by manual force without losing refrigerant, said annular rib engaging said ring when the valve is in fixed operating position on said compressor unit and causing said ring to flow so that the annular sealing surfaces are in engagement in the areas surrounding said groove to provide rigidity to said valve, said means being independent of the angular position of said body relative to said refrigeration unit, whereby said body may be angularly positioned relative to said compressor unit in accordance with space limitations and requirements for the direction in which it is desired to have the first passageway extend.

2. The combination set forth in claim 1 wherein said annular rib is on the sealing surface of said projection on said valve body and said groove is on the annular sealing surface of said compressor unit.

3. The combination set forth in claim 2 wherein said ring is made of a plastic material.

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