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REFRIGERATION SYSTEM CONNECTOR APPARATUS

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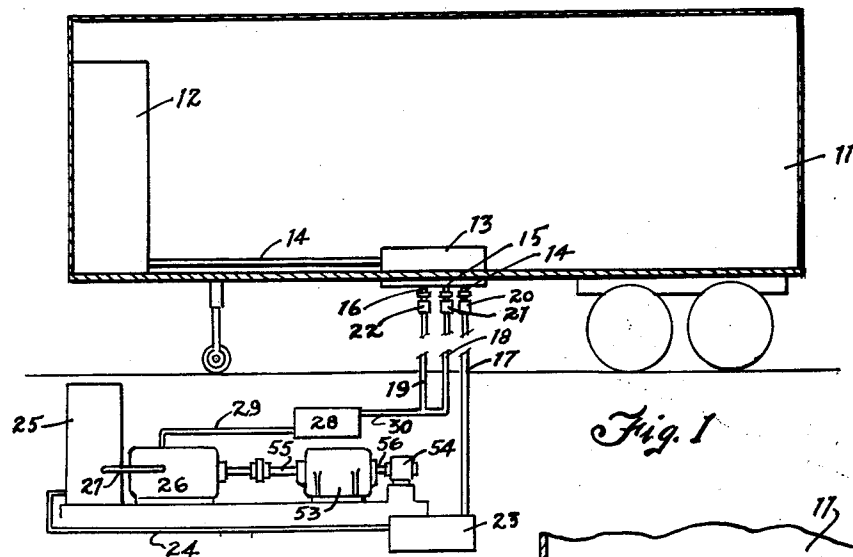


Fig. 1

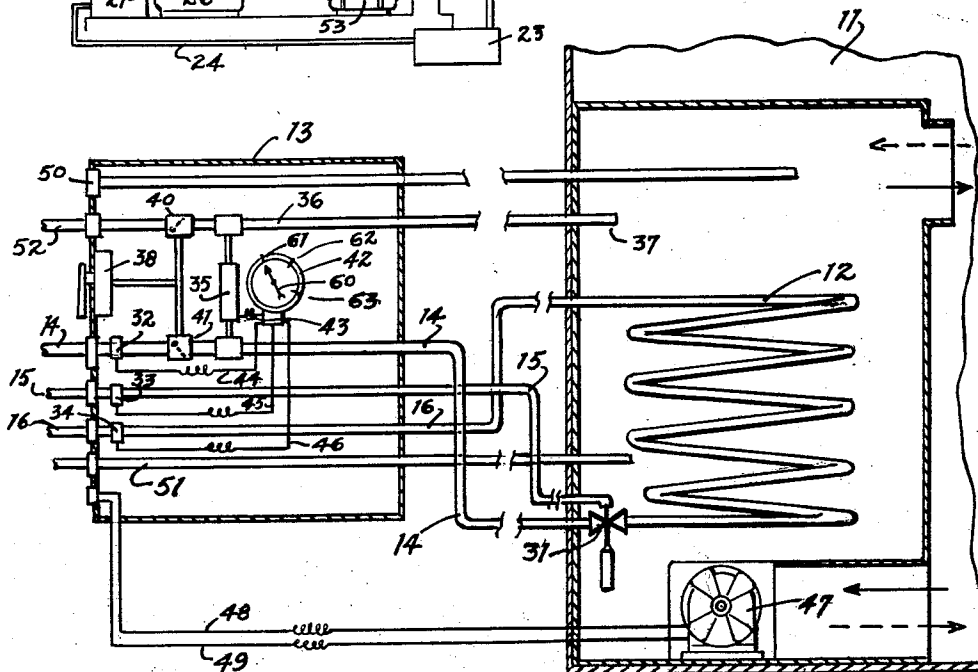


Fig. 2

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**REFRIGERATION SYSTEM CONNECTOR APPARATUS**

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This invention relates to a connector unit utilized in a refrigeration system. The invention is particularly applicable to the method of refrigeration of merchandise carriers set forth in my co-pending application Serial No. 121,580, filed July 3, 1961.

In the general method of refrigeration set forth in the co-pending application means must be provided to permit economic disconnection of the compressor and condenser elements of the closed mechanical refrigeration system employed from the evaporator element thereof. Since closed refrigeration systems normally employ a refrigerant material which is either expensive or difficult to conveniently replace, it is economically required to provide means which will permit the disconnection of the compressor and condenser elements of the mechanical refrigeration systems without the loss of the refrigerant normally contained within the system. It is further preferable to withdraw all of the refrigerant away from the evaporator unit so that when the compressor and condenser elements are reconnected to the evaporator element, there will be no residual refrigerant within the evaporator which would cause erratic performance of the system.

The instant invention provides a relatively inexpensive apparatus for allowing disconnection of the compressor and condenser elements of a closed refrigeration system which are normally charged with a refrigerant from the evaporator element thereof without substantial loss of the refrigerant.

The apparatus comprises first valve means between the condenser and evaporator which remains closed until substantially all of the refrigerant has been evacuated from the evaporator. Second valve means are further provided between the compressor and evaporator which are closed after substantially all of the refrigerant has been evacuated from the evaporator. After closing of the second valve means the compressor and condenser may be disconnected from the evaporator.

The compressor is operated at a higher than normal rate prior to disconnection from the evaporator until the temperature of the refrigerated container is reduced by at least 4° F.

In the apparatus utilized to carry out the method of this invention, first valve means between the condenser and evaporator, second valve means between the compressor and the evaporator, and means for sequentially closing the first and second valve means are provided.

Where it is desired to improve the operation of the system automatic timing means (preferably electrical) are utilized to sequentially close the first and second valve means. Also, in the preferred modification of this invention, automatic air circulation means are provided which are reversed after the first and second valve means are closed.

The form of the invention illustrated also shows selector means which permit alternative use of either a closed mechanical systems or a cold liquid of normally gaseous material (such as liquid nitrogen).

Water inlet means are also provided to control the moisture within the refrigerated container.

The invention will be further described by reference to the accompanying drawings.

FIG. 1 is a diagrammatic view of a refrigerated container having the connector device of this invention se-

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cured thereto. In order to clarify the illustration, the compressor, condenser and driving means are placed below the container, although in the preferred form, these units are mounted upon the container.

FIG. 2 is a diagrammatic view of the connector element of this invention and associated structure.

Referring now to the specific embodiment of this instant invention shown in the drawings, the refrigerated container 11 bears an evaporator unit 12 therewithin, which in turn is connected to a connector element 13. The element 13 has conduits 14, 15 and 16 thereupon. Conduits 14, 15 and 16 are in turn connected to conduits 17, 18 and 19 by means of snap pressure resistant connecting units 20, 21 and 22. Connector units 20 and 22 are of conventional type and are not per se covered in this invention. An example of suitable connectors are the conventional quick coupler sets manufactured by Traintor Mfg. Co., Inc., of Lansing, Mich.

Conduit 17 is connected to receiving tank 23 which is in turn connected to conduit 24 which is connected to condenser 25. Condenser 25 is connected to compressor 26 by conduit 27.

Compressor 26 is connected to second receiving tank 28 by conduit 29. Second receiving tank 28 is connected to conduit 30, which, in turn, is connected to conduits 18 and 19. Evaporator 12 is connected at one end thereof to conduit 14 and is connected at its opposite end to conduit 15 which in turn is connected to compressor 26 through conduits 18 and 30.

An expansion valve 31 is disposed within conduit 14 and serves to automatically control the admission of liquid refrigerant into evaporator 12. Conduit 15 is a "bleeder line" connected to compressor 26 which serves to cool compressor 26 so that it does not get excessively hot in operation.

A valve 32 (preferably electrically controlled) is disposed within conduit 14 and an additional valve 33 is disposed within conduit 15; a third valve 34 is disposed within conduit 16.

An electrically controlled temperature control means 35 (preferably solenoid operated valve controlled by a compound bar thermostat) is also disposed within conduit 14 and simultaneously controls an additional conduit 36 which opens directly into refrigerated container 11 at 37.

A selector 38 alternately controls valves 40 and 41 which are disposed with conduits 36 and 14 respectively. When valve 40 is open valve 41 is closed and vice versa. A timing device 42 (preferably electrical and controlled by clockwork) is electrically connected to valve 35 by wire 43, to valve 32 by wire 44, to valve 33 by wire 45, and to valve 34 by wire 46. Timing device 42 is also connected to fan 47 through a wire connection (not shown) which, in turn, is operatively connected to wires 48 and 49. It is noted that with respect to timing device 42, only one wire is shown since the other wire necessary to actuate the mechanism is a conventional ground wire.

Hygrometer 50 is also provided to determine the humidity within the container. A water inlet 51, which is open at 52, is operatively connected to the container in order to permit proper humidity to be maintained within the system.

Conduit 36 is also open at 52 for the admission if desired of a cold normal gaseous liquid such as liquid nitrogen or the like. Compressor 26 is driven by a motor 53, or if more power is required, by a gasoline engine.

The electrical power required to operate the electrically controlled device is produced by generator 54 which is driven by motor or engine 53. Engine 53 also drives compressor 26 through shaft 55 and generator 54 through shaft 56.

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With the foregoing specific description the operation of this invention will now be explained. When container 11 is being transported utilizing the closed mechanical system set forth in this specification motor 53 drives compressor 26 which in turn causes a conventional refrigerant such as Freon, methyl chloride, carbon dioxide, sulphur dioxide, or the like to circulate through evaporator 12. At this time valve 41 is open and valve 40 is closed with the temperature being controlled by solenoid 35.

As the refrigerated container 11 is moved to a point where the compressor and condenser are to be disconnected prior to the time when another refrigeration mechanism is to be attached, timing device 42 is actuated and the setting means 60 are first brought to position 61. At this point solenoid 35 is automatically set to a lower temperature, at least 4° F. below the temperature normally used. When timing device reaches position 62, valve 32 is closed cutting off the supply of refrigerant to evaporator 12. Compressor 26, on the other hand, is still operated so that the refrigerant contained within evaporator 12 is now deposited into receiving tanks 23 and 28.

When timing device goes to position 63 (being set for the time required to remove all refrigerant from the evaporator 12) valves 33 and 34 are closed and fan 47 is reversed. Compressor 26 is also shut down. The device is now in the position wherein the compressor-condenser-motor unit may now be detached from the refrigerated container by removing conduits 14, 15 and 16 from conduits 17, 18 and 19, by means of coupler units 20, 21 and 22. An indicator light might be placed in the device to indicate the proper time for this detachment.

While the cold temperature produced by actuation of the thermostat will permit the refrigerated container to be held at a lower temperature for a certain length of time it is obvious that sooner or later additional refrigeration power will have to be employed.

If the container stands for a considerable length of time without alternative mechanical refrigerated means being available a longer holding period can be provided by actuating selector 38 and closing valve 41 while opening valve 40. Liquid nitrogen may then be sent through conduit 36 in order to decrease the temperature.

I claim:

1. A closed mechanical refrigeration system utilizing a refrigerant wherein the compressor and condenser units thereof may be disconnected from the evaporator unit without substantial loss of refrigerant or substantial initial rise in the temperature of the refrigerated material comprising a refrigerated container, a normally interconnected mechanically operated compressor condenser and evaporator unit having instantaneous disconnection means therebetween operatively connected with said refrigerated container, water inlet means carried by said refrigerated container, first electrically actuated valve means and thermostat means between the condenser and the evaporator, second electrically actuated valve means be-

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tween the compressor and the evaporator, reversible electrically actuated fan means within said refrigerated container, and electrical timing means first actuating said thermostat means so as to reduce the temperature of the refrigerated container at least 4° F. below its normal level, thence closing said first valve means but continuing to actuate said compressor means until substantially all of the refrigerant has been evacuated from the evaporator unit, thence closing said second valve means and shutting off said compressor means, and thence reversing the direction of rotation of said fan.

2. A refrigeration device normally utilizing a closed mechanical system utilizing a refrigerant and wherein the compressor and condenser units may be disconnected from the evaporator unit without substantial loss of refrigerant or substantial initial rise in the temperature of the refrigerated material, and further providing means for maintaining a low temperature while the mechanical system is inoperative comprising a thermally insulated refrigerated container, a normally interconnected mechanically operated compressor condenser and evaporator unit normally operatively connected with said refrigerated container, water inlet means and cold liquid of normally gaseous material inlet means carried by said refrigerated container, first electrically actuated valve means and thermostat means between the condenser and the evaporator, second electrically actuated valve means between the compressor and the evaporator, reversible electrically actuated fan means within said refrigerated container, selector means permitting alternative use of the closed mechanical system or the cold liquid of normally gaseous material, and electrical timing means operative when the closed mechanical system is being utilized to refrigerate the container, said timing means, when operative, first actuating said thermostat means so as to reduce the temperature of the refrigerated container at least 4° F. below its normal level, thence closing said first valve means but continuing to actuate said compressor means until substantially all of the refrigerant has been evacuated from the operator unit, thence closing said second valve means and shutting off said compressor means, and thence reversing the direction of rotation of said fan.

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