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DEHYDRATION OF REFRIGERATION SYSTEMS

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FIG. 1.

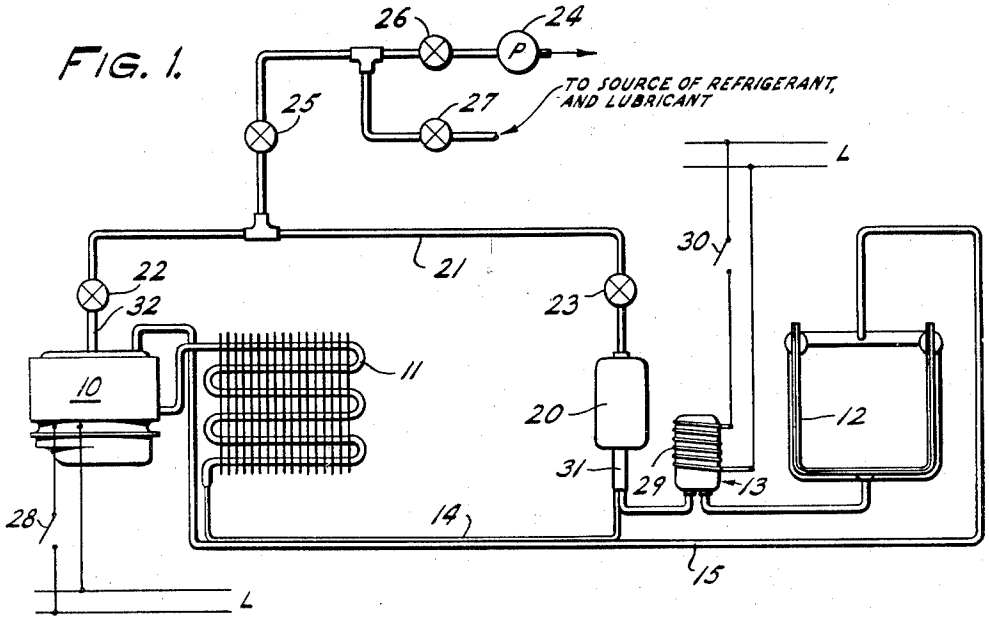
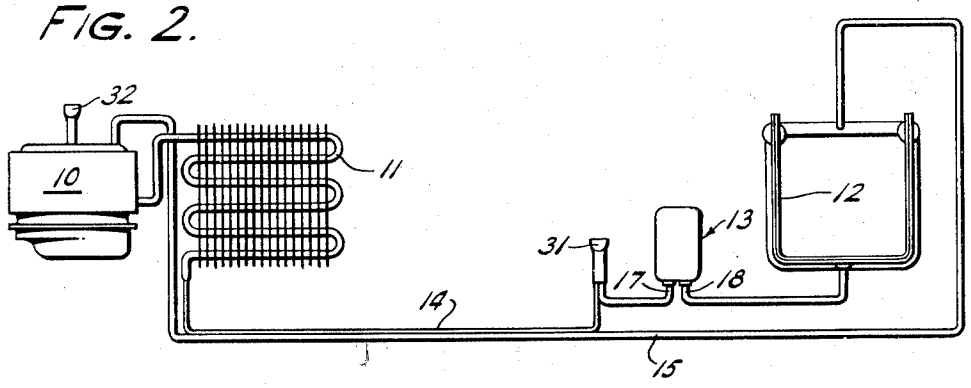


FIG. 2.



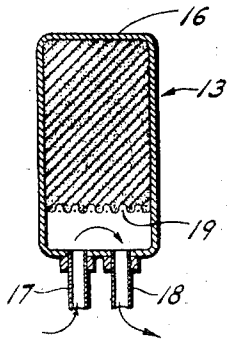


FIG. 3.

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DEHYDRATION OF REFRIGERATION SYSTEMS

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3 Claims. (Cl. 62—115)

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The invention hereinafter described and claimed relates to refrigeration and, more particularly, is concerned with a novel method of and apparatus for dehydrating refrigeration systems. The concepts of the invention have especial applicability to that dehydrating operation which is commonly effected just after the system is charged with refrigerant and lubricant.

It has been found advantageous, particularly in the manufacture of high side refrigeration systems of the hermetically sealed type, to connect an auxiliary removable drier in the system and then to operate the compressor in such manner as to draw the refrigerant through said auxiliary drier, from whence it is returned to the compressor and recirculated through the system. Such dehydrating has frequently been resorted to as a drying operation additional to the electrical heating of the motor windings and, as will be understood by those skilled in the art to which the present invention appertains, the auxiliary drier is disconnected from the system after a predetermined period of operation and the refrigeration system is then ready to be released for use in the field.

It has also been found advantageous to include a drier as a permanent part of the refrigeration system. However, operation of the compressor during the aforesaid dehydrating cycle has been found to result in accumulation of a portion of the moisture in the permanent drier and resultant reduction in the effectiveness and capacity of said drier during subsequent normal operation. For this reason, the permanent drier has at times been omitted from the system and this omission has, in turn, resulted in service difficulties during the useful life of a refrigerating machine incorporating such system.

With the foregoing in mind, it is a primary object of the present invention to provide a method of and apparatus for effecting dehydration of refrigeration systems in such a way that the advantages of the auxiliary, removable drier are realized, while yet retaining the permanent drier as a highly effective part of the system.

To the foregoing general ends, the invention contemplates inactivation—during the dehydration cycle—of the desiccant present in the permanent drier, after which said permanent drier is again rendered active upon conclusion of said cycle. Although the invention, in its broader aspect, is not limited to the use of any particular desiccant, a feature of the present invention—when certain desiccants are employed—resides in the concept of applying heat

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to the permanent drier, substantially to reduce the effectiveness thereof during the time when the auxiliary drier is in operation.

The manner in which the foregoing and other objects and constructional features of the invention are realized, may best be understood from a consideration of the following detailed description, taken in the light of the accompanying drawing, in which there is illustrated a preferred embodiment of my invention.

In the drawing:

Figure 1 is a diagrammatic representation of a refrigeration system having an auxiliary drier coupled thereto, and including apparatus for inactivating the permanent drier during a dehydration cycle;

Figure 2 is a diagrammatic illustration showing the refrigeration system of Figure 1, after the auxiliary drier and associated apparatus have been removed therefrom; and

Figure 3 is a cross-sectional illustration of a permanent drier of a type preferably utilized in the practice of the invention.

Now making more detailed reference to the drawing, and particularly to Figure 2 thereof, there is illustrated, by way of example, a refrigeration system of the closed or sealed type and including a combined motor-compressor 10 of a type in which the motor windings are exposed within a hermetically sealed shell, a condenser 11, an evaporator 12, and a permanent drier 13, the aforesaid components being connected in series flow circuit by conduit means including an elongated restricted connection 14 and a suction line 15, all in accordance with common practice. Since the invention does not reside in the components of such a refrigerating system, per se, and since such components are well known in this art, detailed description thereof is not necessary herein. However, the system preferably, although not necessarily, includes a drier of the type comprising a closed housing 16 (see Figure 3) having in the lower portion thereof a conduit 17 in communication with the capillary tube 14, and a conduit 18 leading to the evaporator 12. The desiccant, which preferably comprises a silica gel, substantially fills housing 16, being held above the level of the aforesaid conduits 17 and 18 as by means of the screen shown at 19. A desiccant of this type may be rendered inactive by the application of heat and may, subsequently, again be rendered active by the removal of the heat. It will be understood that the inactivation may be less than complete, and still be useful for the

purposes of this invention. Other known desiccants have such properties, among which may be mentioned activated alumina. As above indicated, the preferred practice of the invention involves the application of heat to effect the inactivation of the desiccant contained within the permanent drier, but, as will be recognized, it is in accord with the broader concept of my invention to utilize desiccants of other types, together with such means as may be required to render said desiccants inactive during the dehydrating cycle.

Turning now to Figure 1, a system of the aforesaid type is shown in association with auxiliary dehydrating apparatus which, essentially, comprises an auxiliary drier 20. For the purposes of this invention, the auxiliary drier may include a desiccant of any desired type, although a silica gel is preferred.

A pair of valves are included in a conduit 21 which interconnects the compressor and the auxiliary drier 20, the valves being shown at 22 and 23. Conduit 21 may be placed in communication with a vacuum pump, diagrammatically represented at 24, or with a suitable source of refrigerant and lubricant (not shown), through the agency of valves shown at 25, 26 and 27.

After the system has been assembled with the auxiliary drier and its associated apparatus, the system or unit is preferably evacuated by opening valves 22, 23, 25 and 26 and placing the vacuum pump 24 in operation. When a satisfactory degree of evacuation has been attained, the unit is charged with refrigerant and lubricant by closing valve 26 and opening valve 27.

Upon completion of the charging operation, the refrigeration system is ready for dehydration. If desired, the dehydration process may be performed conjointly with performance tests.

To effect dehydration, valve 25 is closed, valves 22 and 23 remaining open. Operation of the motor-compressor 10 is then initiated by closing the switch shown at 28, thereby placing the motor across the supply line indicated at L.

Before, or concurrently with, the operation of the motor-compressor, the invention contemplates inactivation of the permanent drier 13. As stated above, the desiccant preferably comprises a silica gel, and such inactivation is effected through the agency of a resistance heating coil 29 which is disposed in heat exchange relation with said permanent drier. Heat is, of course, applied to the permanent drier 13 by closing the switch indicated at 30 and thereby placing the heating coil across the line L. The silica gel is raised to a temperature sufficiently high to render it inactive as a desiccant.

Operation of the motor-compressor is continued for a time period sufficiently long to remove substantially all the moisture contained within the motor windings as well as within other portions of the refrigeration system. The moisture present in the system is absorbed by the refrigerant and released in the auxiliary drier 20, it being understood that all, or substantially all, of the refrigerant bypasses the evaporator and flows through said auxiliary drier 20, returning to the compressor through conduit 21.

Liquid refrigerant continues to collect in the auxiliary drier until the inflow of heat energy into said drier reaches a balance with the rate at which the compressor draws refrigerant therefrom. In effect, the auxiliary drier functions as an evaporator, in that refrigerant is vaporized therein and passes through the conduit 21 to the compressor 10. Moisture-laden refrigerant follows the above-described cyclic path, repetitively, leaving moisture within the permanent drier as it passes through the latter. When the dehydration operation has been completed, the permanent drier is again rendered active by opening the switch 30, thus interrupting the circuit to the heating coil 29. Concurrently with the interruption of the flow of current to the heating coil, the conduit on the inlet side of the permanent drier 20 is pinched-off, as at 31, and the operation of the compressor is continued until all of the refrigerant has been withdrawn from the auxiliary drier 20 and delivered to the refrigeration system including the evaporator 12. When this condition is reached, the conduit leading to the inlet side of the compressor is pinched-off at 32 just below the valve 22, thus disassociating the auxiliary drying apparatus from the refrigeration system.

From the foregoing description, it will be understood that the invention provides a novel method of and apparatus for effecting dehydration of refrigeration systems in such manner that a permanent drier may be retained as a highly effective part of the system. It is significant that the full effectiveness of the drier is maintained, and in this way it is possible to insure that the permanent drier will operate to reduce to an inappreciable quantity the residual moisture which is inevitably present after the so-called final dehydrating operation.

I claim:

1. In combination with a refrigeration system comprising a motor-compressor, condenser, flow-restrictor, drier and evaporator connected in closed circuit; auxiliary drying apparatus attachable in said circuit and through which the gas in said system is adapted to flow and be dehydrated when said apparatus is attached, and means substantially preventing accumulation of moisture in said drier when said auxiliary drying apparatus is attached and operative.

2. A combination as set forth in claim 1, and further characterized in that the mentioned drier includes a desiccant which may be rendered inactive when raised to an elevated temperature, and the said means comprises apparatus effective to apply heat to the said drier during the dehydrating operation.

3. A combination as set forth in claim 2, and in which the mentioned desiccant comprises a silica gel.

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