METHOD AND APPARATUS FOR DEFROSTING A REFRIGERATION SYSTEM

Filed Feb. 27, 1956
METHOD AND APPARATUS FOR DEFROSTING A REFRIGERATION SYSTEM

Fred J. Hosken, 1015 Fillmore St., and Edward J. Hosken, 1150 S. Glencoe, Denver, Colo.
Filed Feb. 27, 1956, Ser. No. 567,852
8 Claims. (CI. 62—81)

2,960,840

This invention relates to a method and apparatus for hot gas defrosting of multiple evaporator refrigeration systems.

The principal object of the present invention is to provide a method and apparatus for hot gas defrosting of a multiple evaporator refrigeration system which recycles the condensed hot gas that has been used for defrosting into another evaporator coil to perform useful refrigeration, thus eliminating the pump-down period necessary to dispose of the hot gas condensate and/or eliminating the need for a re-evaporator.

In the prior art hot gas defrosting systems, the condensed refrigerant which was used to defrost the evaporator coils had to be taken from the system and re-evaporated for further use. The instant system, on the other hand, utilizes the cold, condensed refrigerant which has been condensed from hot gas while defrosting one of the evaporator coils to accomplish useful refrigeration in another evaporator coil of a multiple system.

Additional objects of the hot gas defrosting method and apparatus of the present invention are to provide a system which is simple to operate, one which requires less equipment and a system which is more efficient and less expensive to operate than the conventional hot gas defrosting methods.

Other objects will be in part apparent and in part pointed out specifically hereinafter in connection with the description of the drawing which follows and in which:

The single figure of the drawing is a diagrammatic representation of the hot gas defrosting apparatus for multiple evaporator refrigeration systems of the present invention.

The refrigeration system, as shown in the accompanying diagram, includes two refrigerating units which have been designated 10a and 10b, respectively. It is to be understood, however, that the hot gas defrosting system of the present invention is not intended to be restricted to a two unit system as it is likewise adaptable to installations having more than two refrigerating units. Each of the refrigerating units contains an evaporator 12a and 12b, respectively, which form a part of a refrigeration system. The refrigeration system includes a compressor 14 having the discharge end thereof connected to a condenser 16 by a pipe 18. The outlet of the condenser is connected to a liquid receiver 20 by pipe 22, and the liquid receiver is in turn connected to evaporators 12a and 12b by pipes 24, 26a, 26b, 28a and 28b. The outlets of the evaporators are connected to the suction side of the compressor by pipes 30a, 30b and 32.

Pipe 26a, which is the liquid line leading from the receiver to the evaporator 12a, is shown provided with a solenoid valve 34a for temperature control, although this valve may be eliminated from the system without effecting operation of the hot gas defrosting cycle; and, a restricting means 36a of the conventional type which maintains a predetermined degree of floating.

Refrigerating unit 10b is provided with an identical set of valves, controls and tubes similarly designated 34b and 36b. Outlet pipes 30c and 30b from the evaporators are provided with solenoid valves 44a and 44b, respectively. Pipes 28a and 28b form connections between pipe 18 leading from the compressor to the condenser and the inlet ends of evaporators 12a and 12b. Pipes 28a and 28b contain solenoid valves 46a and 46b, respectively, to control the flow of hot refrigerant gas from the condenser and compressor into the evaporators.

The inlet ends of evaporators 12a and 12b are interconnected by pipes 48a and 48b which contain means for restricting the flow of condensed refrigerant therebetween which will be designated hereinafter as a restrictor 50. Any means for restricting the flow of condensed refrigerant between the evaporators can be used, such as a capillary tube, a hand expansion valve, an automatic expansion valve, an orifice of predetermined size or an adjustable orifice.

During normal operation of the refrigerating system solenoid valves 46a and 46b are closed, while all other valves in the system remain open. None of the refrigerant will pass through restrictor 50 as both refrigeration units lie in an open balanced system. The conventional refrigerating cycle need not be described as it is the one commonly used in multiple evaporator systems.

Now in regard to the defrosting cycle, assume that evaporator coil 12a has been selected to be defrosted. Solenoid valve 34a, if used, is closed to stop the flow of refrigerant from the liquid receiver into refrigeration unit 12a and solenoid valve 46a is opened to admit the hot gas refrigerant through pipe 28a into the inlet end of evaporator coil 12a. If evaporator 12a is of the conventional dry-feed type, solenoid valve 44a on the outlet pipe of the evaporator may be closed along with valve 34a, if used, at the same time valve 46a is opened. In any instance, valve 44a is closed to prevent the hot gas from leaving the outlet end of the evaporator. Evaporator 12a is now isolated from evaporator 12b except for pipe 48 containing restrictor 50. The hot gas is admitted to the evaporator under pressure which creates a pressure differential tending to force the condensate formed from the hot gas from pipe 48a into pipe 48b through the restrictor. A small quantity of hot gas may leak through the restrictor before entering the evaporator. However, the gas will quickly condense to a liquid and thereafter the restrictor will pass only liquid. The hot gas in the evaporator defrosts the coil, coils and condenses, whereupon the condensate flows by gravity counter-current through the incoming hot gas and flows out the inlet end of the evaporator into pipe 48a. Accordingly, the condensate will return by gravity to the inlet end of the evaporator 12a at which point the condit 48a may be joined to the underside thereof so as to lead the condensate by gravity flow to the inlet side of the restrictor 50. As mentioned, the restrictor will not permit more than a small quantity of gas to leak through, since gravity will induce a steady stream of liquid to build up and flow through the restrictor 50. Restrictor 50 meters the condensate into line 48b, due to the pressure differential between the evaporator coils and the cold condensate performs useful refrigeration as it flows through evaporator coil 12b. Evaporator 12b may be defrosted in like manner with the condensate from the hot gas being used to accomplish useful refrigeration in coil 12a.

From the foregoing description of the apparatus and method for accomplishing hot gas defrosting of multiple evaporator refrigeration systems it will be appreciated that various modifications may be made without departing from the fundamental principles of the invention.

Therefore, it is to be understood that the scope of the invention is not to be limited in any manner except in accordance with the appended claims.
We claim:

1. A defrosting apparatus for use with a plurality of evaporators in a refrigeration system including a source of refrigerant connected to supply either hot gas or cold refrigerant to each of the evaporators of the system comprising means for isolating a selected evaporator in the system from the supply of cold refrigerant for defrosting, means for introducing the hot gaseous refrigerant under pressure into each isolated evaporator for defrosting same, and means for transferring the cold, condensed refrigerant that has been used for defrosting the selected evaporator to the source and to the exclusion of the gaseous refrigerant through each of the evaporators not being defrosted in order to accomplish useful refrigeration.

2. A method for defrosting a refrigeration system of the type including at least two evaporators and a source of refrigerant connected to supply either hot gas or cold refrigerant to at least one of the evaporators of the system comprising the steps of shutting off the supply of cold refrigerant to the inlet end of the evaporator selected for defrosting, shutting off the outlet end of said evaporator, introducing hot gaseous refrigerant under pressure into the inlet end of said evaporator to accomplish defrosting thereof, allowing said hot gaseous refrigerant to become cool and condensed in said evaporator and flow counter-currently back to the inlet end thereof, and transferring the condensed refrigerant to the inlet end of another evaporator in the system to accomplish refrigeration thereof.

3. A closed circuit refrigeration system comprising in combination: a compressor, a condenser, a receiver and an evaporator unit connected in a series circuit containing, the evaporator unit including at least two evaporators connected in parallel to receive cold refrigerant from the receiver at the inlet ends thereof and discharge hot gas to the compressor from the outlet ends, the inlet ends of each evaporator being connected independently to the compressor to receive hot gas directly therefrom, and cold means interconnecting the inlet ends of each evaporator including means for restricting the flow of condensed refrigerant therebetween to receive the condensed refrigerant from the evaporator being defrosted to the exclusion of the hot gas, each evaporator being positioned to establish counter flow of the condensed refrigerant in relation to the flow of the hot gas through the inlet ends, means for selectively and independently connecting each evaporator to the compressor to receive hot gas therefrom or the receiver to receive cold refrigerant, and means for controlling the flow of hot gas from the outlet end of each evaporator.

4. A device in accordance with claim 3 in which the means for selectively connecting each evaporator with the receiver or the compressor comprises a valve between the compressor and each evaporator, and a valve between the receiver and each evaporator.

5. A device in accordance with claim 4 in which a second valve is provided between the receiver and each evaporator, said second valve being connected in series with the first mentioned valve therebetween.

6. In an evaporator system wherein there is provided a source of refrigerant to supply either hot gas or cold refrigerant to a pair of evaporators of the system, the combination therewith comprising means to admit the hot gas to each of said evaporators for defrosting, means for selectively closing the outlet end of each evaporator as it is being defrosted, conduit means interconnecting said evaporators to the liquid condensate under gravity flow from the evaporator being defrosted for flow into said other evaporator in the form of cold refrigerant, said evaporators being connected to provide for successively defrosting each of said evaporators while simultaneously passing the condensate from said evaporator into the other evaporator for refrigeration purposes.

7. A method for successively defrosting each of a pair of evaporators connected in parallel in a refrigeration system, the system including a source of refrigerant connected to selectively supply either hot gas or cold refrigerant to each of said evaporators, comprising the steps of isolating one of the evaporators from the supply of cold refrigerant, heating the isolated evaporator with hot gaseous refrigerant to accomplish defrosting thereof, and transferring the condensed refrigerant from the isolated evaporator under gravity flow to the other evaporator to the exclusion of the gaseous refrigerant for refrigeration thereof in a first cycle of operation, then in a second cycle isolating the other evaporator, defrosting it as in the first cycle with the hot gaseous refrigerant, and followed by transferring the condensed refrigerant to the evaporator previously isolated to establish the reversible and simultaneous defrosting and refrigeration of the evaporators during each cycle.

8. A defrosting apparatus for use with at least one evaporator in a refrigeration system including a source of refrigerant connected to supply either hot gas or cold refrigerant to each of said evaporators comprising the steps of isolating one of the evaporators from the supply of cold refrigerant, heating the isolated evaporator with hot gaseous refrigerant to accomplish defrosting thereof, and transferring the condensed refrigerant from the isolated evaporator under gravity flow to the other evaporator to the exclusion of the gaseous refrigerant for refrigeration thereof in a first cycle of operation, then in a second cycle isolating the other evaporator, defrosting it as in the first cycle with the hot gaseous refrigerant, and followed by transferring the condensed refrigerant to the evaporator previously isolated to establish the reversible and simultaneous defrosting and refrigeration of the evaporators during each cycle.

References Cited in the file of this patent

UNITED STATES PATENTS

1,601,445 Hilger Sept. 28, 1926
1,718,312 Shipley June 25, 1929
2,141,715 Hilger Dec. 7, 1938
2,145,773 Muffly Jan. 31, 1939
2,195,781 Newton Apr. 2, 1940
2,200,424 Kubaugh May 14, 1940
2,349,367 Muffly May 23, 1944
2,381,651 Dickens Aug. 7, 1944
2,433,574 Newton Dec. 30, 1947
2,585,748 De Silvestro Feb. 12, 1952
2,700,280 Heuser Jan. 25, 1955
2,749,721 Trepaud June 12, 1956