

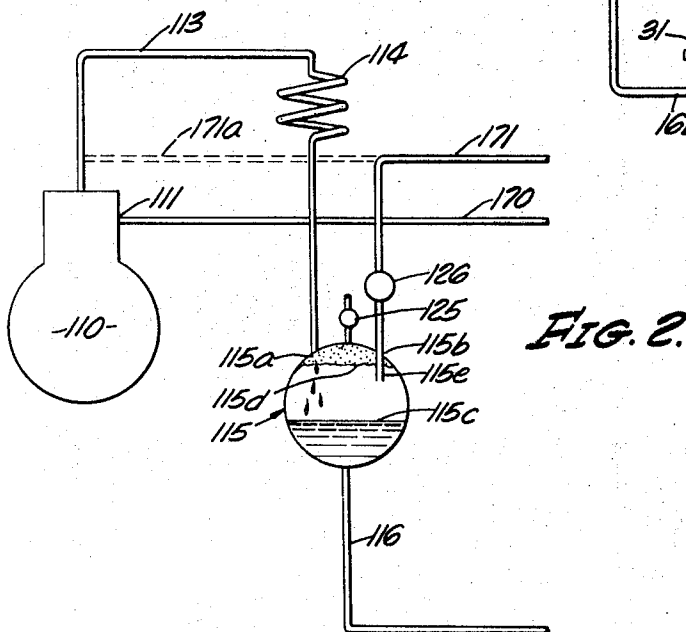
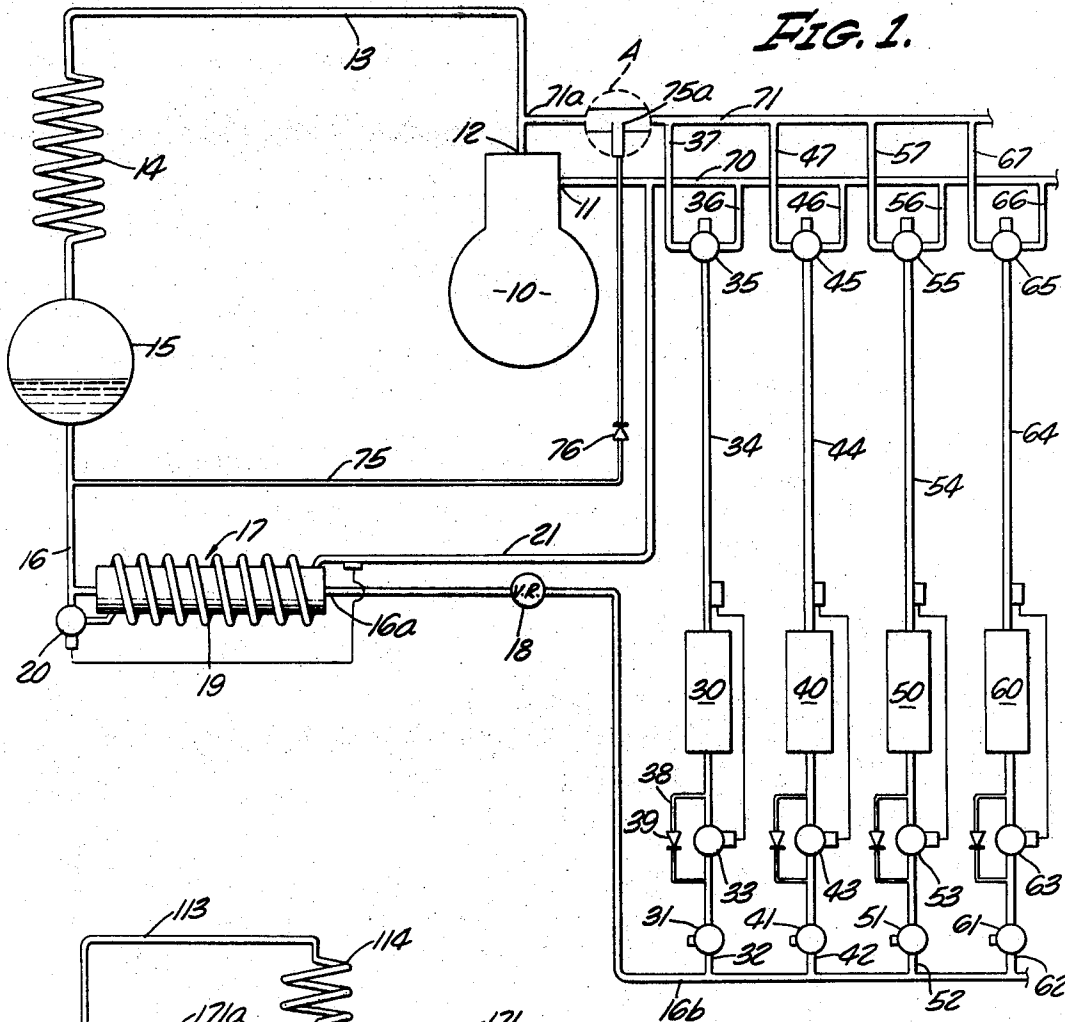
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# LATENT HEAT REFRIGERATION DEFROSTING SYSTEM

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**LATENT HEAT REFRIGERATION  
DEFROSTING SYSTEM**Lester K. Quick, 600 Howard St.,  
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This invention relates to a closed cycle refrigeration system and more particularly, is directed to an arrangement for defrosting the refrigeration system evaporators employing the latent heat of saturated compressed gaseous refrigerant.

In a conventional closed cycle refrigeration system, the refrigerant is compressed and condensed to provide a liquid refrigerant which is then evaporated to accomplish the desired cooling and this evaporated refrigerant is then recompressed to complete the cycle. As is well known, the condensing stage involves the dissipation of the heat absorbed during the evaporation stage. While this heat is usually dissipated as a waste byproduct of the refrigeration cycle, there are many conventional uses for this heat source including defrosting the evaporators of the system. In the somewhat conventional hot gas defrosting systems, the gaseous refrigerant is periodically taken from the compressor output and introduced into the evaporator coil to melt the accumulated frost.

Hot gas defrosting has been found particularly effective in installations employing a multiplicity of evaporators operated by a single or a few compounded compressors such as is presently being employed in supermarkets. The multiplicity of the evaporators in the various refrigerated cases produces a super-abundance of heat which may be diverted as hot gas to a limited number of the evaporator coils to rapidly and effectively defrost such coils as is disclosed in my Patent No. 3,151,470, Hot Gas Defrosting System. However certain adverse side affects have been experienced by reason of the super-abundance of heat in the extremely elevated temperature condition. As is well known to those skilled in the art, the temperature of the hot gaseous refrigerant leaving the output of the compressor will vary somewhat depending on the particular type of refrigerant employed, atmospheric conditions, the desired head pressure on the condenser, etc., but generally this temperature will be in the range of about 200° F. to 225° F. Of course, the evaporator coil to be defrosted is below 32°, and substantially therebelow in some instances, when the hot gaseous refrigerant from the compressor is introduced for accomplishing the defrosting. The sudden and extreme temperature change can produce detrimental affects on various components of the system, including causing rapid thermal expansion of the components. This thermal expansion is particularly detrimental in installations such as supermarkets where the tubing from the compressor to the evaporator coil of the refrigerated fixture may be 200 or more feet long. The repeated expansion and contraction of this tubing and the evaporator coils themselves can cause breakage or leaks which result in expensive repairs and loss of refrigerant.

Another adverse side affect of this super-abundance of heat and the extremely elevated temperature of the hot compressed defrosting refrigerant is that the frost is not merely melted but rather a portion is turned to fog or steam rising from the evaporator coils. This fog is a visually objectionable condition in a refrigerated display case. Moreover, the fog is deposited on the now-colder products contained in the refrigerated fixture in the form of frost which reduces the visual appeal of the product.

Accordingly, it is a principal object of this invention to provide a novel defrosting arrangement for refrigera-

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tion systems wherein compressed gaseous refrigerant at substantially the saturated temperature for that refrigerant is passed through the evaporator coils to accomplish the defrosting by reason of the latent heat given off during the change of phase from gaseous to liquid refrigerant.

Another object of this invention is to provide a hot gas refrigeration defrosting system wherein the superheat is removed from the gaseous refrigerant before introducing the refrigerant into the evaporator coil to accomplish the defrosting.

Still another object of this invention is to provide a novel form of closed cycle refrigeration system and defrosting arrangement wherein a central compressor means serves to supply a multiplicity of evaporators and one or a few of such evaporators may be selectively isolated for defrosting by passing through that evaporator saturated gaseous refrigerant at substantially the pressure of the output of the compressor.

A further object of this invention is to provide a novel form of hot gas defrosting system for a closed cycle refrigeration system wherein liquid refrigerant is introduced into the defrosting refrigerant before passing through the evaporator coils in order to desuperheat the hot compressed gaseous refrigerant.

Another object of this invention is to provide a novel form of hot gas defrosting arrangement for closed cycle refrigeration systems wherein the compressed gaseous refrigerant is cooled to its saturated temperature of more than 32° F. but substantially less than the normal temperature of the output of the compressor for supplying such gaseous refrigerant to the refrigeration system evaporators and defrosting such evaporators by reason of the latent heat of condensation of such refrigerant.

Other and more detailed objects and advantages of this invention will appear from the following description and the accompanying drawings, wherein:

FIGURE 1 is a diagrammatic illustration of one form of the refrigeration defrosting system of this invention.

FIGURE 2 is a fragmentary diagrammatic illustration of another form of the refrigeration defrosting system of this invention with some of the similar components that are shown in FIGURE 1 omitted for brevity.

The refrigeration system with which the defrosting arrangement of this invention is employed includes the normal closed refrigeration cycle wherein a gaseous refrigerant such as ammonia, refrigerant 12, refrigerant 22, refrigerant 502 or any other convenient refrigerant gas is compressed to an elevated pressure and temperature, condensed to a liquid at the elevated pressure, and expanded and evaporated to a gas at a reduced pressure for accomplishing the refrigeration and thereby being adapted for recompressing to complete the cycle. Various refrigeration systems may differ in certain details but it will readily appear to those skilled in the art that the subject invention is equally applicable to any refrigeration system which is capable of being adapted to hot gas defrosting of the evaporator or evaporators of that system. This invention will be described with respect to a particular refrigeration system for emphasizing the advantages of the invention but without limiting the uses of the invention.

Referring more particularly to FIGURE 1, the normal closed refrigeration cycle includes the compressor 10 having an intake 11 and an output 12 with the output connected through a conduit 13 to the condenser 14 and thence to a receiver 15 where the high pressure, liquid refrigerant is temporarily stored for use in the evaporators. The liquid refrigerant passes from receiver 15 through a conduit 16 to a conventional sub-cooler, generally designated 17, which normally would be used

with a system of this type but is not necessarily essential to the subject invention. The liquid refrigerant conduit 16 passes through the sub-cooler 17 and emerges at 16a. A pressure reducing valve 18 is connected in conduit 16 downstream of the sub-cooler 17 and such valve also is not necessarily essential to this invention but normally would be employed in the system as shown. The pressure reducing valve 18 may assume a variety of forms for accomplishing the basic function of maintaining a lower pressure downstream of the valve than exists upstream of the valve whether such pressure be maintained constant or at merely a differential pressure relative to the upstream pressure. It will be apparent to those skilled in the art that the sub-cooler 17 serves the function in this arrangement of lowering the liquid refrigerant temperature whereby evaporation and "flash gas" does not occur as the liquid passes through reducing valve 18. Sub-cooler 17 simply includes an evaporator coil 19 encircling the liquid refrigerant conduit 16 with an expansion valve 20 to admit refrigerant to coil 19 and maintain the proper low temperature of conduit 16. The outlet of coil 19 is connected through conduit 21 to the intake 11 of the compressor.

The liquid refrigerant conduit 16 includes a liquid header portion 16b having a multiplicity of branch conduits (four shown here) leading to the evaporators of the system. In FIGURE 1, four evaporators 30, 40, 50 and 60 are illustrated as being in parallel in the refrigeration system but it is to be understood that more or fewer evaporators may be employed without departing from this invention and in fact, in a supermarket installation there may be 20 or more such evaporators similarly connected in the system. A control valve 31, 41, 51 and 61 is mounted in each of the branch conduits 32, 42, 52 and 62, respectively, leading from the liquid header 16b. The control valves 31, 41, 51 and 61 are thermostatically controlled by the temperature of the refrigerated fixture within which the associated evaporator coil 30, 40, 50 and 60, respectively, is positioned for controlling the supply of refrigerant to that evaporator coil as necessary to maintain the desired temperature within the associated fixture. Any convenient means may be employed for accomplishing this control and specifically, solenoid valves with electrical thermostatic control means have been found to be satisfactory for use as the control valves 31, 41, 51 and 61. Moreover, this permits electrical overriding of the operation of these valves by a central control system as needed during the defrosting cycles hereinafter described. Downstream of the control valves, the branch conduits 32, 42, 52 and 62 are connected through conventional expansion valves 33, 43, 53 and 63, respectively, to the associated evaporator coils 30, 40, 50 and 60, respectively. The expansion valves 33, 43, 53 and 63 are controlled in the conventional manner by sensing means on the outlets of the associated evaporator coils for properly controlling the expansion of refrigerant into the evaporator coils. The control valves and expansion valves are conventional components employed in systems of this type and any other conventional means may be substituted therefore without departing from this invention.

The outlets of the evaporators 30, 40, 50 and 60 are connected through conduits 34, 44, 54, and 64, respectively, to three-way valves 35, 45, 55, and 65, respectively. In normal refrigeration operation the three-way valves 35, 45, 55 and 65 connect the conduits 34, 44, 54 and 64, respectively, to suction conduits 36, 46, 56 and 66, respectively, which are in turn connected to a common suction header 70. Suction header 70 is connected to the intake 11 of the compressor 10 to complete the closed refrigeration cycle by returning the expanded evaporated gaseous refrigerant from the evaporator coils to the compressor for recompressing. The conduits 34, 44, 54 and 64 are shown as being of substantial length for emphasis since this is the normal arrange-

ment in, for example, a supermarket where the evaporators and the associated refrigerated fixtures are in a public area, whereas the three-way valves, suction header and compressor are all positioned within a compressor room normally at the back of the supermarket. Thus it is conduits 34, 44, 54 and 64 which may be 200 feet long or more.

As with the normal hot gas defrosting arrangement of this type of system, a hot gas header 71 is connected to the outlet conduit 13 from the compressor 10 as at 71a and branch conduits 37, 47, 57 and 67 are connected from the hot gas header 71 to the aforescribed three-way control valves 35, 45, 55 and 65, respectively. One or more of the evaporator coils may be defrosted at one time and it is preferred that by pre-arrangement only a small proportion of the total number of evaporator coils be defrosted at one time whereby the superabundance of heat being produced by the remaining evaporator coils operating under normal refrigeration conditions will be completely adequate for accomplishing the rapid defrosting of the selected evaporator coils. Thus for example, assuming it is desired to defrost evaporator coil 30 in the described system of FIGURE 1, the other evaporators 40, 50 and 60 remain on normal refrigeration operation as described while three-way valve 35 is actuated to close off suction branch conduit 36 from conduit 34 and connect hot gas branch conduit 37 to conduit 34. Also, the thermostatic control of the associated control valve 31 is overridden and the control valve 31 is closed to prevent the admission of liquid refrigerant to the evaporator coil during the defrosting cycle thereby isolating the evaporator from the normal refrigeration. Although this operation of the valves 35 and 31 could be performed manually, it is preferred for the overall automation of the system that the operation of three-way valves 35, 45, 55 and 65 and the solenoid valves 31, 41, 51 and 61 be controlled by a central timing clock system. In this manner the defrosting of a particular coil may be repeated periodically for the proper period of time as has been shown by experience.

In the conventional hot gas defrosting system of this type, the hot compressed gaseous refrigerant from the compressor 10 passes through header 71 to branch conduit 37 and thence through conduit 34 to and through the evaporator coil 30 for defrosting the coil. The defrosting refrigerant then passes through a by-pass conduit 38 around the expansion valve 33 for protection of the expansion valve. By-pass conduit 38 includes a check valve 39 for preventing by-pass of liquid refrigerant around the expansion valve 33 during the normal refrigeration cycle. The defrosting refrigerant then either by-passes around the control valve 31 to the liquid header 16b by an arrangement (not shown) similar to the by-pass conduit 38 and check valve 39 or by reason of the particular construction of the solenoid valve 31 which permits reverse flow of refrigerant therethrough even when the valve is closed. This reverse flow through the solenoid valve is possible by its spring loaded plunger construction and the operation of the system in this regard is more fully disclosed in my co-pending application Ser. No. 249,175 filed Jan. 3, 1963 for Hot Gas Refrigeration Defrosting System. For purposes of this disclosure it is sufficient to state that in this type of arrangement the defrosting refrigerant leaving the evaporator coil is in a liquid phase and when the pressure exceeds the pressure of the liquid refrigerant in header 16b the defrosting refrigerant will flow into header 16b where it joins the normal supply of liquid refrigerant proceeding to the remaining evaporators for use in the normal refrigerating cycle. Since the defrosting refrigerant is taken directly from the high pressure or output side of the compressor and passes through only the connecting conduits and the single evaporator coil before reaching the liquid header 16b, the pressure of such defrosting refrigerant is always in excess of the normal liquid refrigerant supplied to header 16b, since such liquid

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refrigerant must pass from the compressor output through the condenser 14 which entails an appreciable pressure drop. However, for the overall positive operation of the system, it is preferred that the pressure reducing valve 18 be employed whereby a substantial pressure differential always exists between the derosting refrigerant leaving an evaporator coil after accomplishing defrosting and the normal liquid refrigerant supply in liquid header 16b.

As thus far described, the refrigeration and defrosting systems are somewhat conventional in at least in the most recent supermarket installations. However, substantial difficulty has been encountered in these installations due to the extreme temperatures imposed on such components as the three-way valves 35, 45, 55 and 65, the long run-out conduits 34, 44, 54 and 64 and the evaporator coils themselves, as well as the aforescribed undesirable steam and frost caused by defrosting at these extremely elevated temperatures. Means are provided by this invention for accomplishing this hot gas defrosting at substantially lower temperatures and, as shown in FIGURE 1 of the drawings, these means may include a liquid refrigerant feeder line 75 connected from the liquid conduit 16 below the receiver 15 to the hot gas header 71. A check valve 76 is provided in line 75 for preventing reverse flow through line 75 of hot compressed gas when no defrosting cycle is being performed. The connection between suction header 71 and line 75 is enlarged for visual clarity in the area encircled by dashed lines A, although no physical enlargement of these conduits need occur at this point. The end 75a of line 75 extends into header 71 to create a dynamic suction on line 75 as gas passes through header 71 in the nature of a venturi affect and in fact any conventional form of venturi or aspirator arrangement may be employed. This is necessary by reason of the aforescribed condition that exists whereby the liquid refrigerant in conduit 16 even immediately below receiver 15 is at a lower pressure than the output of compressor 10 whereby refrigerant would not normally flow from conduit 16 to header 71 through line 75 without this venturi-suction arrangement. When an evaporator is being defrosted as previously described, the hot gaseous refrigerant flows from the compressor through header 71 to one of the branch conduits 37, 47, 57, or 67 and thence to the evaporator. This dynamic flow of gaseous refrigerant passed end 75a of line 75 will cause liquid refrigerant to be drawn through line 75 into this gaseous refrigerant at a rate controlled by the design of the system for accomplishing the herein-after described function. The gaseous refrigerant discharged by compressor 10 is highly superheated and normally will be in a temperature range of approximately 200° F. to 225° F. The pressure of the gas discharged from the compressor will depend on the particular refrigerant employed but the saturated or condensing temperature of that particular refrigerant at that pressure will normally be in the vicinity of 80° F. to 85° F. For example with refrigerant, 22, the compressor discharge pressure will be approximately 150 p.s.i. and the temperature will be approximately 200° F. to 225° F. but the saturated temperature of refrigerant 22 at 150 p.s.i. is 82° F. Thus if the superheat is removed from the compressed refrigerant without condensing such refrigerant the temperature may be reduced to approximately 82° or slightly thereabove. This is accomplished in the arrangement of FIGURE 1 by the introduction of liquid refrigerant through line 75 in the aforescribed manner. This saturated or nearly saturated gaseous refrigerant at 82° F. passes through the hot gas header 71 and the appropriate branch conduit, such as conduit 37 and thence through conduit 34 to the evaporator 30. In passing through the evaporator coil the saturated gaseous refrigerant is condensed thereby giving off the latent heat of evaporation to warm the evaporator coil and melt the frost. At this pressure the change of phase temperature is approximately 82° F. which is completely adequate for accomplishing the defrost since a super-abundance of heat by way of the latent heat is avail-

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able for the defrosting. In fact in the described situation the actual quantity of heat units such as measured in British thermal units which are supplied to the evaporator coil is equal to that which would be supplied by supplying the hot gaseous refrigerant directly from the compressor. This is due to the fact that the reduction in temperature of the gas is caused by the addition of a quantity or mass of liquid through line 75 which is increased in temperature thereby producing a greater quantity or mass of gaseous refrigerant at a lower temperature but having substantially the same quantity of British thermal units. In other words a larger mass of refrigerant having a lower B.t.u. per unit weight is provided which substantially equals the smaller mass having the larger B.t.u. per unit weight at 200° F. or more. The reduction in volume of the gas by reason of this lower temperature further enhances the defrosting by more readily permitting the passage of the defrosting gaseous refrigerant to the evaporator coil. Since the gaseous refrigerant supplied through the various components including valves 35, 45, 55 and 65 and the lengthy conduits 34, 44, 54, and 64 is now at approximately 82° F., the possibility of damaging these components by reason of the extreme change in temperature is greatly reduced and, in fact, experience shows that damage is virtually eliminated. Moreover, since the evaporator coil is heated to a maximum of 82° F. during defrosting, the ice and frost merely melts and runs off as water rather than producing an objectionable amount of fog or steam in the refrigerated cabinet as had previously occurred.

Referring to the modified form of the system of this invention shown in FIGURE 2, the compressor 110 corresponds in function and operation to the aforescribed compressor 10. The outlet of the compressor is connected through conduit 113 to the condenser 114 both respectively corresponding to the aforescribed conduit 13 and condenser 14. The condensed refrigerant passes from condenser 114 to the receiver 115 and, as is conventional, is introduced near the top of the receiver such as 115a. The liquid refrigerant is supplied through conduit 116 to the various evaporators (not shown) of the system in a manner similar or identical to that described with respect to conduit 16, relative to the system of FIGURE 1. The evaporated refrigerant returns through a suction header 170 to the intake 111 of compressor 110 in the same manner as described with respect to suction header 70 in the system of FIGURE 1. The difference in the system of FIGURE 2 versus that of FIGURE 1 resides in the connection of hot gas header 171 directly to the top of the receiver at 115b rather than to conduit 113 as shown by the dashed lines 171a. A manually controlled valve 126 may be provided in header 171 for conventional maintenance purposes but valve 126 is normally in the open condition both during normal refrigeration operation of the system and defrosting operation. A refrigerant received in a system of this type is a form of accumulator for continually containing an ample supply of liquid refrigerant for the system and permitting variations in the "supply" received from the compressor and condenser versus the "demands" imposed by the evaporators. Thus a liquid refrigerant level 115c will be present, although not at a constant level, in the receiver 115 with a gaseous phase of refrigerant thereabove at all times. This gaseous phase of refrigerant is naturally saturated rather than being superheated since the presence of any superheated gaseous refrigerant would immediately cause evaporation of some of the liquid refrigerant to reduce the superheat and re-establish the saturated condition for the particular pressure within the receiver. As is well known, non-condensable gases such as air may be present or intrude into a refrigeration system of this type and will normally tend to accumulate in the receiver. Since these non-condensable gases are lighter than the gaseous refrigerant they will collect in the uppermost portion of receiver 115 and a rather unprecise or pseudo separation level 115d will exist between the noncondensable gases and the

gaseous refrigerant. A purging connection and valve 125 is conventionally provided on top of the receiver and is periodically opened to purge or exhaust all of the non-condensable from the receiver to atmosphere. Since these non-condensable gases would not condense in the evaporators but rather would tend to fill an evaporator during defrost thereby defeating the defrosting operation, it is preferred that an extension conduit 115e connected to header 171 extend into receiver 115 to point below the uppermost portion of the receiver, such as below the non-condensable gas separation level 115d, and yet well above the liquid level 115c whereby substantially only gaseous refrigerant enters header 171. Thus this intermediate upper portion of the receiver forms a continuous source of saturated gaseous refrigerant at a high pressure and this refrigerant is used in the same manner as described with respect to FIGURE 1 for periodically defrosting selected evaporator coils but without requiring the addition of liquid refrigerant to create the saturated condition as was needed in the arrangement of FIGURE 1. By taking the gaseous refrigerant from the receiver 115 for defrosting, any tendency for the condenser 114 to fill with liquid during defrosting cycles, as might occur in the system of FIGURE 1, is eliminated. Since the source of hot gaseous refrigerant for defrosting is downstream of the condenser 114, the pressure will be slightly lower and therefore it may be necessary to employ a pressure reducing valve similar to valve 18 for reintroducing the defrosting refrigerant into the liquid header or to employ some other method for reintroducing the defrosting refrigerant into the normal refrigeration cycle such as disclosed in my Patent No. 3,151,470 or my pending application Hot Gas Refrigeration Defrosting System, Ser. No. 252,436 or Reevaporator System for Hot Gas Refrigeration Defrosting System, Ser. No. 259,189 or Desuperheater for Refrigeration System, Ser. No. 281,408 or the like.

Thus it may be seen that by this invention there is provided a refrigeration defrosting system whereby the latent heat of condensation is employed as the source of defrosting heat without impairing the rapidity and effectiveness of the defrosting cycle but in fact improving the defrosting while eliminating adverse side affects previously experienced with using hot gas directly from the compressor output for accomplishing the defrost. Having fully described my invention, it is to be understood that I do not wish to be limited to the particular embodiments disclosed in the drawings or the details set forth herein, but rather my invention is of the full scope of the appended claims.

I claim:

1. A defrosting arrangement for a closed cycle refrigeration system employing a centrally located refrigerant compressor and condenser and remotely located evaporator means, comprising, means for providing only a portion of the total hot compressed gaseous refrigerant output from the compressor at substantially the temperature of saturated gaseous refrigerant during continuing operation of the compressor, said saturation temperature being above 32° F., conduit means of substantial length for conducting that saturated gaseous refrigerant to said evaporator means to accomplish defrosting of said evaporator means by transferring the latent heat of the refrigerant to the evaporator means upon change of phase of the refrigerant to a liquid, and means for thereafter returning that refrigerant to the normal closed refrigeration cycle.

2. A defrosting arrangement for a closed cycle refrigeration system employing a centrally located refrigerant compressor and condenser and remotely located evaporator means, comprising, centrally located means for providing a supply of compressed gaseous refrigerant at a pressure substantially equal to the compressor output pressure and at substantially the saturated temperature of that gaseous refrigerant during continuing operation of the

compressor, said saturation temperature being above 32° F., and conduit means of substantial length for conducting that saturated gaseous refrigerant to said evaporator means to accomplish defrosting of said evaporator means by transferring the latent refrigerant heat to the evaporator means upon change of phase of the refrigerant to a liquid.

3. A defrosting arrangement for a closed cycle refrigeration system employing a centrally located refrigerant compressor and condenser and plural remotely located evaporator means, comprising, centrally located means for cooling the hot compressed gaseous refrigerant output from the compressor to substantially the saturation temperature of that gaseous refrigerant during continuing operation of the compressor, said saturation temperature being above 32° F., and means for selectively terminating the normal refrigeration of at least one of said evaporator means, and conduit means of substantial length for conducting that saturated gaseous refrigerant to that said evaporator means for accomplishing the defrosting thereof by transferring the latent heat to the evaporator means upon change of phase of the refrigerant to a liquid.

4. A defrosting arrangement for a closed cycle refrigeration system employing a centrally located refrigerant compressor and condenser and remotely located evaporator means, comprising, a refrigerant having a moderate saturation temperature substantially above 32° F. at the pressure of the compressor output, means for cooling the hot compressed gaseous refrigerant output from the compressor to substantially that saturation temperature of the gaseous refrigerant during continuing operation of the compressor, and conduit means of a substantial length for conducting refrigerant between the central and remote locations during normal refrigeration operation of the evaporator means and for selectively conducting that saturated gaseous refrigerant to said evaporator means to accomplish defrosting of said evaporator means with such refrigerant changing phase to a liquid to give off heat for defrosting.

5. A defrosting arrangement for a closed cycle refrigeration system employing a centrally located refrigerant compressor and condenser and remotely located evaporator means, comprising, means for introducing liquid refrigerant into a portion of the hot compressed gaseous refrigerant output from the compressor to cool that portion to substantially the saturation temperature of that gaseous refrigerant during continuing operation of the compressor, said saturation temperature being above 32° F., and means for selectively conducting that saturated gaseous refrigerant to and through a said evaporator means for the defrosting thereof by transferring the latent heat to the evaporator means upon change of phase of the refrigerant to a liquid and for thereafter returning that refrigerant to the normal closed refrigeration cycle, said means for introducing liquid refrigerant being located near the compressor for causing all of the refrigerant conducted by said conducting means to be in a saturated condition throughout the entire length of said conducting means.

6. A defrosting arrangement for a closed cycle refrigeration system employing a centrally located refrigerant compressor, condenser and receiver and remotely located evaporator means, comprising, means for extracting solely the compressed gaseous refrigerant from the receiver at substantially the saturation temperature of that gaseous refrigerant at the pressure in the receiver during continuing operation of the compressor and without the addition of heat from externally of the closed cycle refrigeration system, conduit means of a substantial length for conducting that saturated gaseous refrigerant from the first said means to said evaporator means to accomplish defrosting of said evaporator means by transferring the latent heat to the evaporator means upon change of phase of the refrigerant to a liquid, and means for thereafter returning that refrigerant to the normal closed refrigeration cycle.

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7. In a refrigeration system with a defrosting arrangement, the combination of: a compressor means, a condenser-receiver means for condensing the compressed refrigerant to a liquid, evaporator means located remote from and connected between said condenser-receiver means and said compressor means to accomplish the desired normal refrigeration by evaporating that liquid refrigerant, means for selectively isolating said evaporator means from that normal refrigerating connection, means for providing at least a portion of said compressed refrigerant in a gaseous phase and at substantially the saturation temperature of that refrigerant during the continuing operation of the compressor and without the addition of heat from externally of the normal refrigeration system and conduit means of a substantial length for conducting that saturated-gaseous refrigerant to a said isolated evaporator means for passing therethrough to defrost said isolated evaporator means.

8. In a refrigeration system with a defrosting arrangement, the combination of: a compressor means, a condenser-receiver means for condensing the compressed refrigerant to a liquid, a multiplicity of evaporator means connected in parallel between said condenser-receiver means and said compressor means to accomplish the desired normal refrigeration by evaporating that liquid refrigerant and returning that gaseous refrigerant to the compressor means as a substantial heat load, means for selectively isolating individual said evaporator means from said normal refrigeration connection, means for providing at least a portion of said compressed refrigerant in a gaseous phase at substantially the saturation temperature of that refrigerant without the addition of heat from externally of the normal refrigeration system, said multiplicity of evaporator means being located at a substantial distance from the compressor means and condenser-receiver means, and conduit means of a substantial length for conducting that saturated-gaseous refrigerant from the said means for providing such refrigerant to a said isolated evaporator means for passing therethrough and heating said isolated evaporator means by reason of the change of phase of said gaseous refrigerant to a liquid for defrosting that isolated evaporator means.

9. In a refrigeration system with a defrosting arrangement, the combination of: a compressor means for compressing a refrigerant to a preselected high pressure, said refrigerant having a saturation temperature above 32° F. for that preselected high pressure, a condenser-receiver means for condensing that compressed refrigerant to a liquid at substantially that preselected high pressure, a multiplicity of evaporator means connected in parallel between said condenser-receiver means and said compressor means to accomplish the desired normal refrigeration by evaporating that liquid refrigerant at a preselected low pressure and returning that gaseous refrigerant to the compressor means as a substantial heat load, means for selectively isolating individual said evaporator means from said normal refrigeration connection, means for causing at least a portion of said compressed refrigerant at said preselected high pressure to be in a gaseous phase and at substantially the saturation temperature of that refrigerant, means for conducting that saturated-gaseous refrigerant to a said isolated evaporator means for passing therethrough and heating said isolated evaporator means by reason of the change of phase of said gaseous refrigerant to a liquid for defrosting that isolated evaporator means, and means for reintroducing that defrosting refrigerant back into the normal refrigeration cycle.

10. In a refrigeration system with a defrosting arrangement, the combination of: a compressor means for compressing a refrigerant to a preselected high pressure, said refrigerant having a saturation temperature above 32° F. for that preselected high pressure, a condenser-receiver means for condensing that compressed refrigerant to a liquid at substantially that preselected high pressure, a

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multiplicity of evaporator means connected in parallel between said condenser-receiver means and said compressor means to accomplish the desired normal refrigeration by evaporating that liquid refrigerant at a preselected low pressure and returning that gaseous refrigerant to the compressor means at a substantial heat load, means for selectively isolating individual said evaporator means from said normal refrigeration connection, means for extracting from said condenser-receiver means a supply of gaseous refrigerant at substantial said preselected high pressure and at substantially the saturation temperature of that refrigerant, means for conducting that saturated-gaseous refrigerant to a said isolated evaporator means for passing therethrough and heating said isolated evaporator means by reason of the change of phase of said gaseous refrigerant to a liquid for defrosting that isolated evaporator means, and means for reintroducing that defrosting refrigerant back into the normal refrigeration cycle.

11. In a refrigeration system with a defrosting arrangement, the combination of: a compressor means for compressing a refrigerant to a preselected high pressure, said refrigerant having a saturation temperature above 32° F. for that preselected high pressure, a condenser-receiver means for condensing that compressed refrigerant to a liquid at substantially that preselected high pressure, a multiplicity of evaporator means connected in parallel between said condenser-receiver means and said compressor means to accomplish the desired normal refrigeration by evaporating that liquid refrigerant at a preselected low pressure and returning that gaseous refrigerant to the compressor means as a substantial heat load, means for selectively isolating individual said evaporator means from said normal refrigeration connection, means for introducing liquid refrigerant into at least a portion of said compressed refrigerant at said preselected high pressure to lower the temperature of the refrigerant to substantially the saturation temperature of that refrigerant without condensing an appreciable portion of such refrigerant, means for conducting that saturated-uncondensed refrigerant to a said isolated evaporator means for passing therethrough and heating said isolated evaporator means by reason of the condensing of said refrigerant to a liquid for defrosting that isolated evaporator means, and means for reintroducing that defrosting refrigerant back into the normal refrigeration cycle.

12. An improvement in a hot gas defrosting system for remotely located evaporator means of a conventional closed cycle refrigeration system comprising, positively cooling at a central location the hot compressed gaseous refrigerant to be used in defrosting to substantially the saturation temperature of the refrigerant gas at that pressure before passing only that saturated gaseous refrigerant to the remote location of the evaporator means to then pass through the evaporator means for heating and defrosting that evaporator means with the refrigerant solely by the change in phase of the refrigerant from gaseous to liquid.

13. In an improved process for hot gas defrosting remotely located evaporator means of a conventional closed cycle refrigeration system, comprising the steps of: providing a centrally located supply of compressed gaseous refrigerant at a high pressure and substantially the saturation temperature of the refrigerant at that pressure conducting only saturated gaseous refrigerant from the supply to the remote location of the evaporator means, and passing that saturated gaseous refrigerant through the evaporator means to be defrosted for heating and defrosting that evaporator means with the refrigerant solely by the change in phase of the refrigerant from gaseous to liquid.

14. A process for defrosting remotely located evaporator means of a conventional closed cycle refrigeration system, comprising the steps of: compressing the refrigerant to the normal high pressure for condensing in the

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closed cycle refrigeration system, positively cooling that compressed refrigerant at a central location to substantially the saturation temperature of the refrigerant gas at the pressure, isolating the evaporator means to be defrosted from the normal refrigeration cycle, conducting only the saturated gaseous refrigerant to the remote location of the isolated evaporator means, passing that saturated gaseous refrigerant through the isolated evaporator means for heating and defrosting that evaporator means with the refrigerant solely by the change in phase of the refrigerant from gaseous to liquid.

15. A process for defrosting remotely located evaporator means of a conventional closed cycle refrigeration system using a refrigerant having a saturation temperature above 32° F. at the condensing pressure of the system, comprising the steps of: compressing the refrigerant to the condensing pressure of that closed cycle refrigeration system, positively cooling at least a portion of that compressed refrigerant at a central location to substantially the saturation temperature of the refrigerant gas at that pressure without condensing the refrigerant, isolating the evaporator means to be defrosted from the

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normal refrigeration cycle, conducting only the saturated gaseous refrigerant to the remote location of the isolated evaporator means, passing that saturated gaseous refrigerant through the isolated evaporator means for heating and defrosting that evaporator means with the refrigerant solely by the change in phase of the refrigerant from gaseous to liquid, and reintroducing that refrigerant used in defrosting back into the normal closed refrigeration cycle.

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