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HIGH SIDE DEFROST AND HEAD PRESSURE CONTROLS
FOR REFRIGERATION SYSTEMS
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Sheet 1 of 2

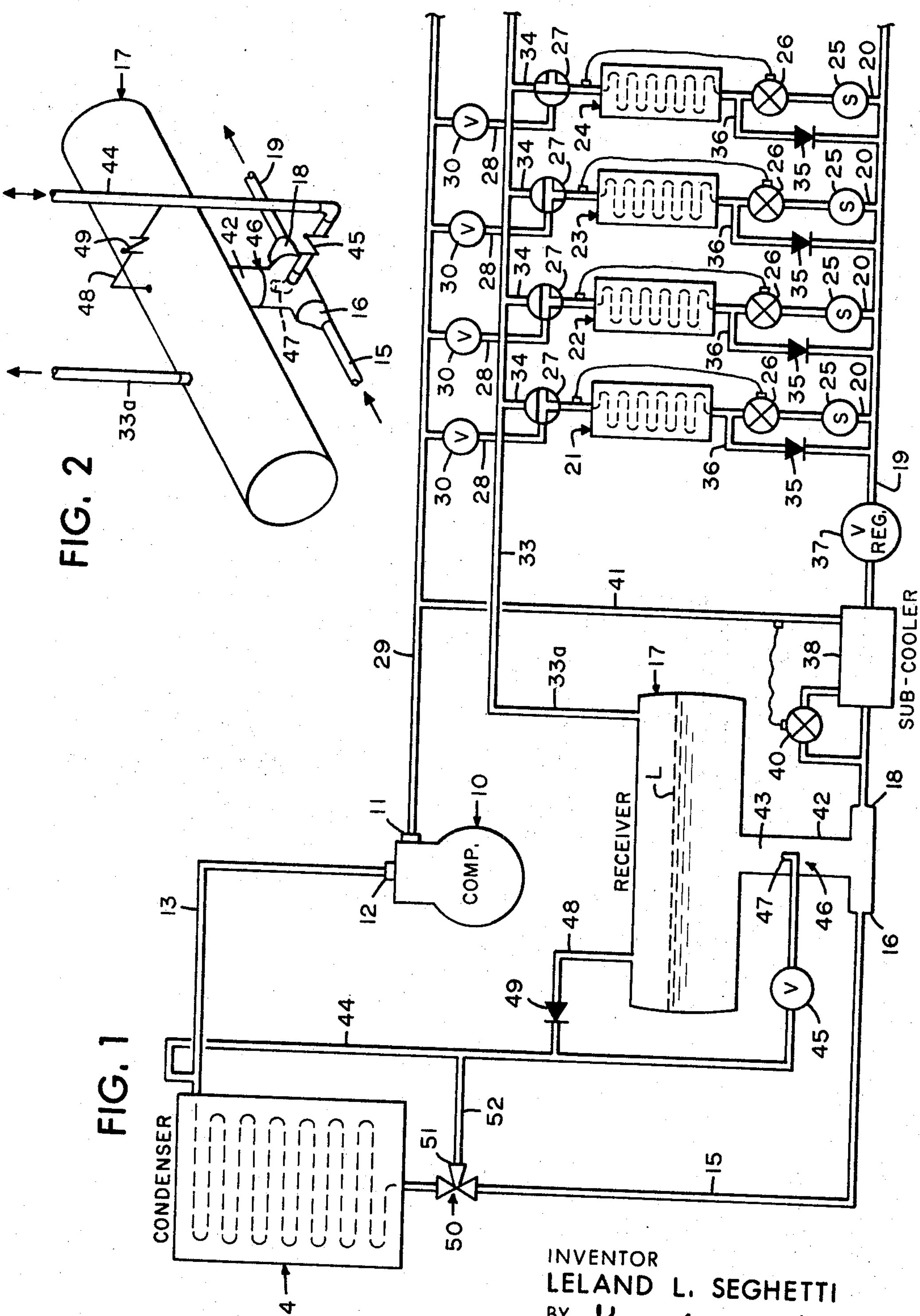

FIG. 1

FIG. 2

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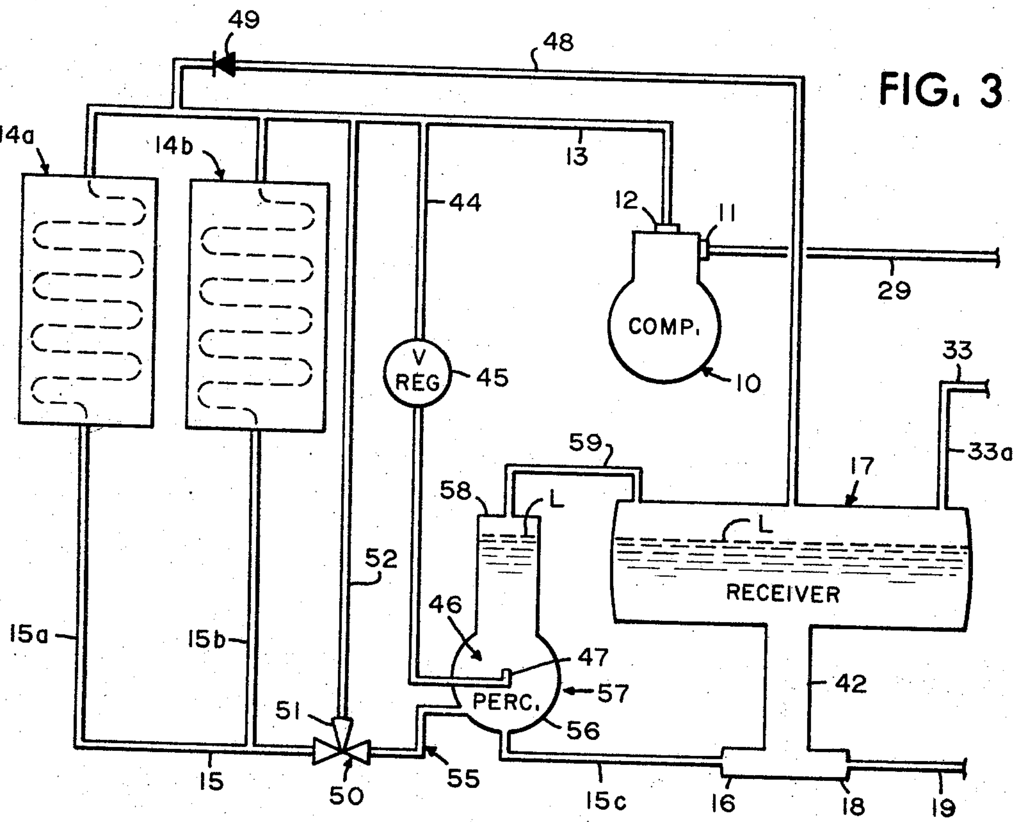

FIG. 3

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HIGH SIDE DEFROST AND HEAD PRESSURE CONTROLS FOR REFRIGERATION SYSTEMS

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ABSTRACT OF THE DISCLOSURE

A hot gas percolation device in a liquid refrigerant supply providing a constant source of saturated gas for defrosting evaporators in a refrigeration system, and pressure valves controlling condenser flooding, hot gas percolation, receiver equalizing and liquid line refrigerant flow to balance the high side of the refrigeration system.

Background of the invention

The invention relates to improvements in defrosting refrigeration system evaporators and in high side pressure controls for such systems.

In the past, closed refrigeration systems of the heavy multiplexing type having a single compressor and of the compounded type having two or more compressors have been used in commercial installations, such as supermarkets, for operating a large number of refrigerated fixtures. Hot gas defrosting is effective in such installations due to the large amount or "superabundance" of heat produced by the refrigerated fixtures in excess of the heat load required for defrosting one or more selected fixture evaporator coils during the continued refrigeration of the remaining fixtures. However, highly superheated hot gas diverted directly from the compressor discharge to the selected evaporator coils for defrosting has resulted in several adverse conditions including (1) the rapid thermal expansion of components such as refrigerant lines causing breakage and leaks and (2) the excessive defrost temperatures to which the evaporator coils are subjected produce fog or steam that is frequently visual in the refrigerated fixture. It has been proposed that the objectionable or adverse effects of "hot gas" defrosting can be obviated by the use of desuperheated or "saturated gas," but prior to the present invention the means for producing saturated gas have not been effective or the supply of saturated gas has been so limited that efficient defrosting could not be accomplished.

It is also known in the prior art that the operation of multiplexed or compounded refrigeration systems is affected by various climatic conditions and that during winter operation, the maintenance of proper pressures in the high side of the system is one of the principal problems in the design and engineering thereof. Various well-known control arrangements are available for maintaining the desired condensing pressures during extreme ambient conditions, but the existing controls are applicable only to specific system arrangements or have other deficiencies which excludes their adaptation from use in a refrigeration system of the present type having saturated gas defrosting of the fixture evaporators.

Summary

The invention is embodied in a refrigeration system having means for providing a continuous supply of saturated gas for defrosting evaporators, and having high side control means for maintaining a balanced pressure relationship of the compressor head pressure or condensing pressure with the liquid supply and saturated gas sources and with the liquid refrigerant header connected with several evaporator coil branch lines in the system.

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An object of the present invention is to provide hot gas injector means for producing a constant supply of saturated gas at a predetermined pressure higher than the refrigerant pressure in the liquid header.

Another object is to provide means for controlling both the compressor head pressure and the liquid line pressure regardless of ambient or load conditions whereby optimum operation is achieved.

Another object is to provide means for maintaining the compressor head pressure or condensing pressure in single and multiple condensing unit arrangemets above a predetermined minimum under various ambient conditions and to balance the high side pressure relationship in the receiver and liquid lines to assure optimum system performance during normal refrigeration and saturated gas defrosting.

These and still other objects and advantages of the present invention will become more apparent hereinafter.

Brief description of the drawings

For illustration and disclosure purposes the invention is embodied in the parts and in the combinations and arrangements of parts hereinafter described. In the accompanying drawings forming a part of the specification and wherein like numerals refer to like parts:

FIG. 1 is a diagrammatic illustration of a typical refrigeration system embodying one form of the invention,

FIG. 2 is a perspective view showing the receiver and refrigerant line connections thereto of the FIG. 1 embodiment, and

FIG. 3 is a diagrammatic illustration showing the high side of a refrigeration system embodying another form of the invention.

Description of the preferred embodiments

For purposes of disclosure, a closed refrigeration system embodying the invention has been illustrated and will be described as a heavy multiplexing system of the type which might be installed in a supermarket for operating a plurality of separate fixtures, such as refrigerated storage and display cases, but it will be understood and readily apparent to those skilled in the art that such a system can be adapted to other commercial or industrial installations. The terms "high side" and "low side" are used herein in a conventional refrigeration sense to mean the portions of the system from the compressor discharge to the evaporator expansion valves and from the expansion valves to the compressor suction, respectively.

Referring to FIG. 1, the refrigeration system shown is in part conventional and includes a compressor **10** having a suction or low pressure side **11** operating at a predetermined suction pressure and having a discharge or high pressure side **12** with a discharge conduit **13** through which hot compressed gaseous refrigerant is discharged to a condenser **14**. The refrigerant is reduced to its condensing temperature and pressure in the condenser **14** which is connected by a conduit **15** to the inlet **16** of a surge-type receiver **17** forming a liquid refrigerant source for operating the system. The outlet **18** of the receiver **17** is connected to a liquid header **19** for conducting liquid refrigerant to branch liquid lines or conduits **20** leading to evaporator coils **21**, **22**, **23** and **24** associated with the different refrigerated fixtures (not shown). Although only four evaporator coils are shown in FIG. 1, it will be apparent that numerous other evaporators can be connected into the refrigeration system. The branch liquid line **20** of each evaporator **21**, **22**, **23** and **24** is provided with a solenoid valve **25**, and expansion valves **26** are provided for metering refrigerant into the evaporators in a conventional manner. The outlets of the evaporators are connected to three-way valves **27** and, under normal refrigerating operation, are connected through these valves and branch suction lines or conduits **28** to a suction header **29** connected to the suction side **11** of the compressor **10** and through which vaporous refrigerant from the evaporators is returned to the compressor **10** to complete the basic refrigeration cycle. Evaporator pressure regulator (EPR) valves **30** are shown interposed in the branch suction lines **28** for illustrating that the suction pressure on the evaporator coils **21, 22, 23** and **24** can be adjusted so that the respective refrigerated fixtures can operate at different temperatures within the range established by the predetermined suction pressure of the compressor **10**.

The refrigeration system operates in a conventional manner in that each fixture evaporator absorbs heat from the fixture or its product load thereby heating and vaporizing the refrigerant and resulting in the formation of frost or ice on the evaporator coils. The number of evaporators in the refrigeration system produce a cumulative latent heat load of the refrigerant gas returned to the compressor, and this heat load is in excess of the amount of heat required to defrost one or more of the evaporators **21, 22, 23** and **24** and is sometimes called a "superabundance" of heat.

A main gas defrost header **33** is provided for conducting gaseous refrigerant selectively to the evaporator coils and is connected through branch defrost lines or conduits **34** to the three-way valves **27**, the three-way valve for the evaporator **24** being shown in defrost position. In a conventional "hot gas" defrost arrangement, the gas header **33** would be connected to the compressor discharge conduit **13** so that this source of highly superheated hot compressed gaseous refrigerant would be used for selectively defrosting the evaporators **21, 22, 23** or **24**. However, a feature of the present invention is to use so-called "saturated gas" for defrosting purposes; that is, the sensible and latent heat of gaseous refrigerant at its normal or desuperheated saturation temperature as will be described more fully hereinafter. Accordingly, the gas defrost header **33** is connected by conduit **33*a*** to the top of the receiver **17** so that gaseous refrigerant will flow through the header **33**, the branch line **34** and the three-way valve **27** into the evaporator coil **24** (or another selected evaporator isolated from the normal refrigeration cycle by actuating the three-way valve **27** and solenoid valve **25**) for heating the coil to remove the frost or ice accumulation and thereby condensing the refrigerant to a liquid as in a conventional condenser. A unidirectional by-pass or check valve **35** is provided in a by-pass line **36** connecting the inlet of the evaporators to the liquid header **19** in by-pass relation with the expansion valve **26**.

In accordance with the teachings of Blake Patent No. 3,150,498 granted on Sept. 29, 1964, the embodiment disclosed in FIG. 1 provides for the return of the liquid refrigerant resulting from the defrost of each evaporator coil into the liquid header **19** through the by-pass line **36** and check valve **35** so that such refrigerant is immediately available for use in the normal operation of the refrigerating evaporators. It is necessary to maintain a pressure differential between the defrost gas header **33** and the liquid header **19** to provide an incentive for the rapid flow of refrigerant through the defrosting evaporator **24** back into the high side of the refrigeration system. Therefore, a pressure reducing or regulating valve **35** is positioned in the liquid header **19** upstream of the branch liquid supply lines **20**, and the liquid header **19** is also provided with a sub-cooler **38** for preventing flash gas from occurring as a result of the reduction of liquid line pressure through the pressure regulator valve **37**. The sub-cooler **38** has an evaporator coil (not shown) surrounding the liquid header **19** with the coil having an expansion valve **40** and the outlet of the coil being connected by a branch suction line **41** to the suction header **29**.

Still referring to the disclosure of the Blake Patent No. 3,150,498, the desirable pressure differential between the gas defrost header **33** and the liquid header **19** is in the range of 10 to 20 p.s.i.g. and preferably about 15 p.s.i.g. The Blake patent also discloses a range of operating head pressures and other means for regulating the defrost arrangement, and reference may be had to said patent for a more complete description of a conventional closed refrigeration system of the compound compressor type in which the present invention may be used. It will be understood that the system as thus far described herein and as described in the Blake patent form examples conventional refrigeration systems in which the present invention is applicable.

Referring particularly to FIGS. 1 and 2, the receiver **17** forming the high side liquid refrigerant source has a large T-connection base with a vertical column **42** forming a gas separating or percolation chamber **43** and also having the inlet and outlet legs or ducts **16** and **18** connected to the conduits **15** and **19**, respectively. The surge receiver, according to the present invention, stores a large supply of liquid refrigerant, the normal liquid level being shown by a broken line L and the minimum liquid level being above the vertical column or percolation chamber **43**.

As previously mentioned, one feature of this invention is to utilize saturated gas for defrosting the evaporator coils, and in order to maintain a continuous supply of saturated gas in the receiver **17** (and form a by-pass for winter control as will be described), the compressor discharge conduit **13** is connected by a conduit **44** through a check or pressure regulating valve **45** to a gas percolation injector **46** connected to the vertical column and having an upturned L-shaped gas discharge line **47** substantially centrally located in the percolation chamber **43**. It will be noted that the conduit **44** is shown connected to the compressor discharge conduit **13** above the condenser **14** and, therefore, this conduit also is adapted to function as a gas equalizing line between the condenser **14** and the upper portion of the receiver acting through a vacuum breaker or equalizer line **48** and one-way check valve **49** which prevents the flow of superheated gas from the compressor **10** into the top of the receiver **17**.

It will be understood that in the design, engineering, sizing and location of refrigeration system components and the climatic or environmental conditions under which the system operates will have a direct affect upon the pressure relationships and the efficient operation of the system. Accordingly, there could be a substantial drop between the compressor head pressure and the condensing pressure, but it is assumed that the system is designed so that such pressure drop is negligible and reference to compressor head pressures will also mean the condensing pressures since it is the latter pressure that is critical. Therefore, another feature of this invention is to provide a refrigerant condensing pressure control for controlling liquid refrigerant flooding within the condenser **14** to maintain a minimum compressor head or condensing pressure particularly during winter conditions, in order to maintain a balance in the pressure relationship of the compressor head pressure with the receiver **17** to provide the desired pressure of saturated gas for defrost and liquid header pressure downstream of the regulating valve **37**. A normally open modulating control valve **50** is interposed in the condenser discharge conduit **15** having a pilot inlet **51** for controlling the modulating operation of the valve **50** through an external control line **52** connected to the compressor discharge line **13** (for disclosure purposes, being shown connected to the conduit **44**). In short, as disclosed, the control valve **50** is directly responsive to the compressor head pressure acting through control line **52** and the pilot unit **51** and modulates or throttles the flow of refrigerant from the condenser **14** into the conduit **15** in response to a drop in compressor head pressure below a predetermined value.

FIG. 3 discloses another form of the invention in which refrigerant condensing pressure control means is applicable to multiple or parallel condenser units **14***a* and **14***b* with the modulating control valve **50** being interposed in the conduit **15** downsteam of both condensers. In this embodiment, an inverted condensed liquid drain trap **55** is provided to form a liquid seal between the branch drain lines **15***a* and **15***b* of the condensers **14***a* and **14***b*. The liquid seal formed in the drain trap **55** permits independent operation of the condenser units **14***a* and **14***b* since the operating pressure dorp will differ from one condenser to another when in parallel operation.

The conduit **15** is shown connected through the drain trap **55** to the side of the lower tank portion **56** of a gas separating and percolation device **57** and a conduit **15***c* connects the bottom of the tank portion **56** to the inlet **16** of the receiver **17**. In the precise arrangement shown in FIG. 3, the trap **55** and lower tank portion **56** of the device **57** both perform the function of forming a liquid seal and, therefore, the drain trap could be eliminated. However, in a typical installation in which the condensers **14***a* and **14***b* may be mounted on a roof and the percolation device **56** and receiver **17** may be mounted in a lower room, the drain trap **55** is an important separate feature. In such an installation, the upper portion of the trap **55** should be vented by a vertical leg to a vent line connected to the upper portion of the receiver **17** as through the equalizer line **48**.

The gas separating and percolation device **57** is arranged vertically in lateral disposition to the receiver **17** and the upper portion **58** of the device **57** is connected by a conduit **59** to the top of the receiver. Accordingly, the liquid level L in the receiver **17** is also maintained in the separate gas separating and perculation device **57**, and the percolation injector **47** is positioned in the percolation device below the minimum liquid level, as perviously disclosed in connection with the FIG. 1 embodiment.

During normal refrigeration operation, and depending upon the engineering design and climatic conditions as previously indicated as well as the specific refrigerant employed in the system, the compressor head pressure can vary substantially, such as between 140 p.s.i.g. and 200 p.s.i.g. Similarly, the refrigerant temperature at the compressor discharge **12** will be in the range of 200° F. to 225° F. or above, but much of this high temperature is attributable to superheat. Accordingly, reference will be had to condensing temperatures and pressures of refrigerant R–22 for disclosing a typical operation of a refrigeration system embodying the present invention.

Assuming that the pressure regulating valve **37** is set to provide a constant downstream pressure of 160 p.s.i.g., as disclosed in the Blake patent, and that a pressure differential of 15 p.s.i.g. across the defrosting evaporator **24** is desirable, then the pressure in the gas defrost header **33** and in the receiver **17** must be maintained at about 175 p.s.i.g. Accordingly, the condensing pressure or compressor head pressure should normally operate at about 180 p.s.i.g. and, at this condensing pressure, the condensing or saturation temperature of R–22 will be about 94.3° F. and at this temperature the superheat and latent heat of condensation will be dissipated so that the condensed liquid refrigerant discharged from the condenser **14** and stored in the receiver **17** will be substantially at the saturation temperature (94.3° F.) and pressure (180 p.s.i.g.). Of course, if a pressure drop to 175 p.s.i.g. occurs across the condenser or in the receiver **17** then the saturation temperature of the liquid will be 92.7° F. for R–22. Such pressure drops and variations in compressor head pressure or condensing pressure are normal and to be expected in most refrigeration systems. It will be understood that there will normally be a balanced condition in the receiver **17** and that gaseous refrigerant at saturation temperature and pressure will always be present due to variations in the supply and demand of liquid refrigerant. In normal refrigeration of the fixtures, the evaporators **21, 22, 23** and **24** create the variable demand for liquid refrigerant from the receiver **17**, and the normal refrigeration cycle will be understood to all skilled in the art.

During the defrosting of a selected evaporator, saturated gas from the receiver **17** flows through the gas header **33** and evaporator coil **24** into the liquid header **19**, as previously described. The normal supply of saturated gas present in the receiver at any time is inadequate to accomplish a complete defrost of the evaporator and, as soon as the saturated gas begins to flow out through the gas header **33**, the pressure in the receiver **17** begins to drop causing liquid refrigerant to boil and provide additional gas at saturated temperature for the pressure at which it is formed. However, this additional saturated gas supply is still inadequate for defrosting partially due to the volumetric flow rate of the saturated gas from the receiver. Furthermore, the rapid pressure drop in the receiver **17** will lower the liquid header pressure delivering liquid to the still refrigerating evaporator coils **21, 22** and **23** and, in general, causes an inbalance in the system operation.

According to the present invention, the valve **45** in the conduit **44** connected to the compressor discharge line **13** is set to open at about 1 p.s.i.g. to 5 p.s.i.g. pressure differential so that during defrost superheated gaseous refrigerant is metered through the gas percolation injector **47** into the liquid refrigerant supply thereby maintaining the receiver pressure substantially at the condensing pressure and effecting a rapid heat exchange between the gaseous and liquid refrigerant in the receiver **17** to provide a constant supply of desuperheated or saturated gas at the pressure maintained by the valve **45** from the compressor **10**.

During usual winter conditions with much colder ambient conditions, the condenser temperature and pressure can drop appreciably so that the liquid discharged from the condenser **14** is sub-cooled. Furthermore, under such winter conditions, the head pressure of the compressor **14** may drop appreciably below the desirable or necessary pressure required for proper operation of the system. In order to maintain compressor head pressure above a minimum of about 175 p.s.i.g., the modulating valve **50** is throttled in response to the head pressure pilot control **51** therefor to restrict the flow of refrigerant from the condenser **14** and result in condenser flooding thereby reducing condenser capacity and tending to maintain the compressor head pressure at or above this predetermined minimum. Sub-cooled liquid from the condenser **14** may by-pass the surge receiver **17** through the inlet and outlet legs **16** and **18** into the liquid header **19** for supplying the evaporators, which will refrigerate more efficiently with sub-cooled liquid and create a smaller demand from the receiver **17**.

For winter operation, the conduit **44** and control check valve **45** provides a by-pass flow of superheated gaseous refrigerant from the compressor conduit **13** into the percolation chamber **43** of the receiver, thereby maintaining the pressure in the receiver at approximately 1 to 5 p.s.i.g. below the compressor head pressure. This flow of gaseous refrigerant directly from the compressor discharge **13** by percolation through the liquid refrigerant supply in the receiver **17** effects a heat exchange in which the superheat of the gaseous refrigerant is transferred to the liquid refrigerant and a quantity of the liquid is boiled off or vaporized thereby maintaining a constant supply of saturated gas at the normal saturation temperature/pressure of the refrigerant, such gas being available for defrost purposes.

From the foregoing it will be apparent that a balanced condition can be maintained for year-round operation of the refrigeration system, this balanced condition maintaining the compressor head pressure above about 175 p.s.i.g. by controlling the modulating valve **50** to throttle refrigerant flow from the condenser **14** when the head pressure drops below 175 p.s.i.g., the head pressure of the compressor also being essentially maintained in the receiver **17** (with only a 1 to 5 p.s.i.g. drop) and thereby maintaining the refrigerant pressure in the liquid line **19** above the pressure setting of the pressure regulating valve **37** so that the liquid line pressure downstream of this valve is constantly at 160 p.s.i.g. Furthermore, the minimum receiver pressure of about 170 to 175 p.s.i.g. is the effective pressure under which saturated gas is conducted through the gas defrost header **33** and within the desired 10 to 20 p.s.i. pressure differential across the defrosting evaporator for establishing rapid refrigerant flow through the evaporator into the liquid header **19**.

It will be apparent that the receiver **17** forms a primary source of liquid refrigerant and a saturated gas supply for normal refrigeration and defrosting of the evaporators **21**, **22**, **23** and **24**. In the FIG. 3 embodiment the gas separation and percolation device **57** forms a secondary liquid source, but is the primary source of saturated gas. The check valve **49** is set to open at a negligible pressure of about 0.25 p.s.i.g. under unusual climatic conditions such as when a roof-mounted condenser **14** is employed and the warm environment of the receiver **17** in an operating room causes the pressure in the receiver to exceed the condensing pressure. However, the primary function of the check valve **49** is to prevent gas flow directly from the compressor **10** into the top of the receiver **17**.

In addition to winter conditions, it will also be apparent that the condensing capacity may have to be reduced by throttling the modulating valve **50** sometimes during normal operation of the refrigeration system such as when the compressor **10** is a multicylinder unit having unloader or capacity control means and the suction load from the evaporators is reduced to cause unloading of one or more compressor cylinders.

The foregoing description ise given only by way of illustration and example, and the invention is only to be limited by the scope of the claims which follow.

What I claim is:

1. In a closed refrigeration system including compressor means having discharge and suction sides, condenser means, receiver means forming liquid refrigerant and saturated gas sources, and a plurality of evaporator means connected in parallel by a liquid header to said liquid refrigerant source in said receiver means and connected in parallel by a suction header to the compressor suction side, and means for selectively isolating said evaporator means and diverting saturated gas from said receiver means to said selected evaporator means for defrosting same, the improvement comprising first means for controlling the capacity of said condenser means to maintain the compressor head pressure at a predetermined minimum, second means for connecting said compressor discharge side through said liquid refrigerant source in said receiver means in by-pass relation with said condenser means for maintaining a predetermined pressure in said receiver means acting on said liquid refrigerant and saturated gas sources therein and providing a constant supply of saturated gas for defrosting said evaporator means, and third means for regulating the pressure in said liquid header to create a predetermined pressure differential relative to the pressure in said receiver means.

2. The refrigeration system according to claim **1**, in which said second means includes normally closed valve means adapted to open upon a pressure drop of about 1 to 5 p.s.i.g. in said receiver means relative to said compressor head pressure, and a hot gas injector positioned in said liquid refrigerant source below the minimum level thereof whereby during defrosting of a selected evaporator coil and the depletion of saturated gas from said source in said receiver means with a consequent pressure drop said second means is actuated to maintain the receiver means pressure and provide said constant supply of saturated gas for defrost.

3. In a refrigeration system comprising a compressor having suction and discharge sides, a condenser, first means forming a liquid refrigeration source and a saturated gas source, and a plurality of evaporators connected in parallel between said liquid refrigerant source and said compressor suction side in a normal refrigeration cycle, said evaporators returning vaporous refrigerant having a superabundant latent heat load in excess of the heat load required to defrost any of said evaporators, means for selectively isolating said evaporators from said normal refrigeration cycle and connecting said selected evaporator to said saturated gas source for defrosting, and other means for returning liquid refrigerant resulting from said defrosting of said selected evaporator into said refrigeration system, the improvement comprising second means for connecting said compressor discharge side into said liquid refrigerant source below the minimum liquid level thereof for maintaining the high side pressure in said first means and providing a constant supply of saturated gas for defrosting said evaporators.

4. The refrigeration system according to claim **3**, in which said first means comprises a surge receiver having a vertical base column, and said second means comprises a gas injector positioned in said base column and being connected through a valve-controlled conduit to said compressor discharge.

5. The refrigeration system according to claim **4**, in which said valve-controlled conduit includes normally closed valve means adapted to open upon a predetermined pressure drop in said surge receiver.

6. The refrigeration system according to claim **4**, in which the top of said surge receiver is vented to the top of said condenser means through one-way valve means.

7. The refrigeration system according to claim **4** in which said first means comprises a receiver means, and said second means comprises a gas separating and percolation device laterally disposed from said receiver means and forming a secondary liquid refrigerant source, said device having a lower tank portion connected between said condenser means and receiver means and an upper portion vented to the top of said receiver means, and a gas injector positioned in said device below the minimum liquid level therein and being connected through a valve-controlled conduit to said compressor discharge.

8. The refrigeration system according to claim **7**, including means for equalizing the condensing pressure to the saturated gas pressure in the top of said receiver means, said last mentioned means having one-way valve means preventing the flow of hot gaseous refrigerant from said compressor and condenser means into said saturated gas source.

9. In a refrigeration system having a compressor with discharge and suction sides, condenser means connected to said compressor discharge side, receiver means connected to said condenser means and providing a liquid refrigerant source, a liquid header connected to said receiver means, and a plurality of evaporator means normally connected to said liquid header for receiving liquid refrigerant from said receiver means and returning gaseous refrigerant to said compressor suction side, the improvement comprising modulating valve means between said condenser and receiver means, said modulating valve means having a pilot control externally connected between said compressor discharge and said condenser means and being directly responsive to compressor head pressure.

10. The refrigeration system according to claim **9**, in which said condenser means comprises multiple condenser units having parallel inlet branch lines connected in parallel flow to said compressor means and having outlet branch lines connected in parallel flow by conduit means to said receiver means, and means forming a liquid seal across said branch lines.

11. The refrigeration system according to claim **10**, in which said outlet branch lines are connected by a substantially horizontal section of said conduit means, and said last mentioned means comprises an inverted drain trap extending vertically above said horizontal section and being vented to the top of said receiver means.

12. The refrigeration system according to claim **10**, in which said outlet branch lines are connected by a substantially horizontal section of said conduit means, and said means forming a liquid seal comprises a liquid refrigerant tank portion of a gas separating and percolating device, said horizontal section being connected into said tank portion below the minimum liquid level therein, and the upper portion of said device being vented to the top of said receiver means.

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U.S. Cl. X.R.

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