

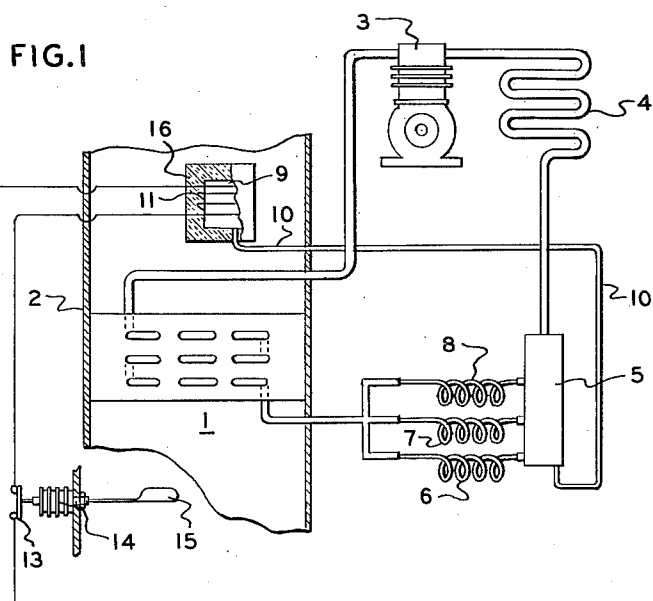
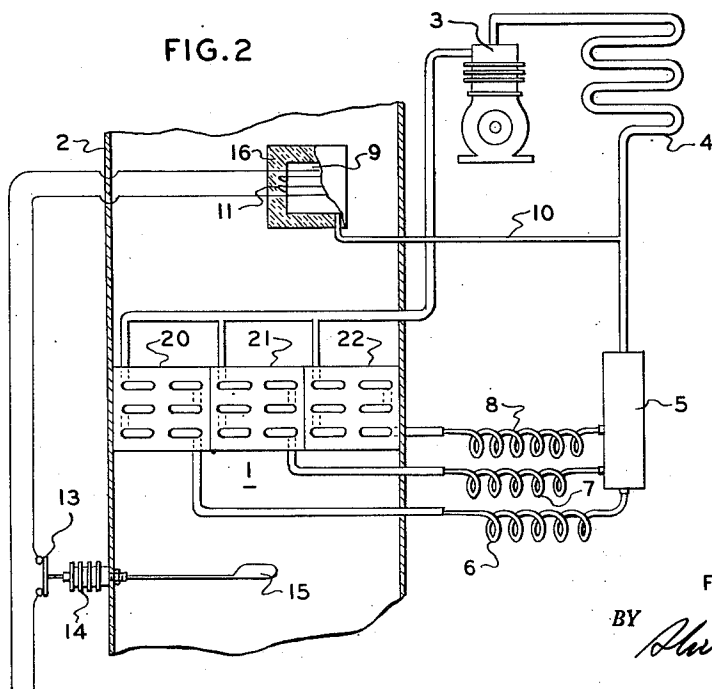
Oct. 1, 1957

F. O. URBAN
REFRIGERATION SYSTEM

2,807,940

Filed March 17, 1954

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG. 3

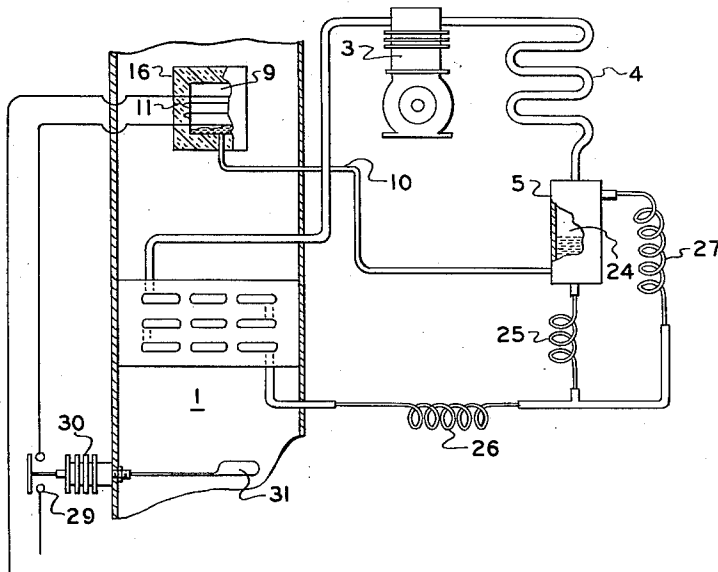
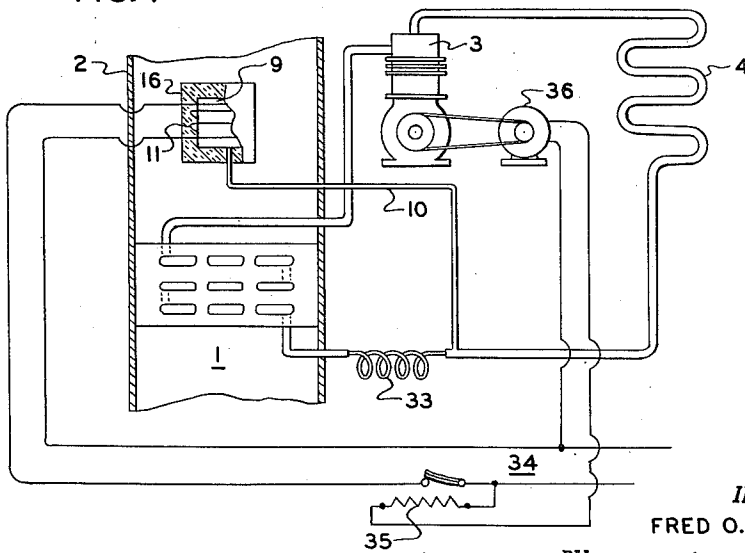


FIG. 4



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2,807,940

REFRIGERATION SYSTEM

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8 Claims. (Cl. 62—3)

The present invention relates to refrigerating systems and particularly to systems including refrigerant expansion devices of the fixed restrictor type.

Mechanical refrigeration systems of the compression type commonly comprise a condensing unit including a motor driven compressor, an air or liquid cooled condenser for liquefying the compressed refrigerant and an evaporating unit in which the refrigerant is caused to evaporate at a lower pressure thereby producing a cooling effect. In order to control the flow of refrigerant from the high pressure side of the system which includes the condensing unit to the low pressure or evaporator side of the unit, some form of expansion valve or device is required. Because of the hazards of refrigerant leakage and mechanical failure which are associated with valves and other moving control devices, it has been found desirable in many cases to employ a capillary tube or other fixed restrictor between the high and low pressure sides of the refrigerant circuit. However, such fixed expansion devices and refrigerating machines equipped with such devices must be designed specifically for the range of temperatures and pressures within which they are expected to be operated. Since the flow of refrigerant through a particular capillary tube or other fixed restrictor is dependent primarily on the temperature and pressure of the refrigerant entering the restrictor and to only a minor extent upon the pressure within the evaporator, the refrigerant flow rate is practically insensitive to evaporator pressure and consequently insensitive to evaporator load. However, as changes in conditions surrounding the evaporator occur, the evaporator load varies and should be accompanied by corresponding changes in refrigerant flow rate so that the evaporator is always supplied with refrigerant at a rate in accordance with its load requirements. Thus, in a system incorporating a fixed restrictor, the refrigerant flow rate will be in balance with the evaporator load only at certain combinations of operating conditions, and at other conditions the performance of the system will be inefficient or unsatisfactory. It is therefore desirable to provide refrigerating systems employing capillary tubes or other fixed restrictors with a means for controlling the refrigerant flow so that such systems will be capable of operating satisfactorily over a wide range of requirements for the system.

It is known that the rate of flow of a refrigerant through a restrictor of fixed type will depend upon the condition of the refrigerant, i. e. whether it is a liquid, a gas, or a mixture of the two, and it has previously been proposed to use various means for heating the restrictor to control the flow of refrigerant therethrough. One of the drawbacks of systems where heat is applied directly to the capillary tube to control the operation of the system is that a substantial amount of heat is required.

As the amount of refrigerant placed in a refrigerating system or circuit incorporating a fixed restrictor critically determines the practical range of operation of the system, it is also possible to control the operation of the system

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including a fixed restrictor by controlling the effective amount of refrigerant in the system.

It is an object of the present invention to provide a refrigerating system including means for varying the amount of refrigerant fed through an expansion device of the fixed restrictor type in accordance with the load demands on the system.

It is another object of the invention to provide refrigerating apparatus having an expansion device of the fixed restrictor type and including new and improved means for controlling the effective amount of refrigerant in said system.

Further objects and advantages of the invention will become apparent from the following description thereof and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

In carrying out the objects of the present invention there is provided a compressor, a condenser and an evaporator connected in series to provide a normal refrigerant circuit. At least one capillary tube or other fixed restrictor is provided in the circuit between the condenser and the evaporator to control the flow of liquid refrigerant from the high pressure side of the circuit to the low pressure side thereof. A liquid refrigerant dead end storage chamber is arranged outside the normal refrigerant circuit in restricted communication with said circuit, specifically the high pressure side of the circuit through a single restricted conduit. Interchange of liquid refrigerant between the refrigerant circuit and the chamber is obtained through this restricted communication and effective control of the operation of the refrigerating system is obtained by storing liquid refrigerant in the storage chamber out of the path of flow of the refrigerant in the normal refrigerating circuit. For maximum efficiency the storage chamber is located in a position where the ambient temperature is substantially less than the condenser temperature. Preferably the storage chamber is positioned adjacent the evaporator and is cooled thereby. In order to effect a discharge of refrigerant from the storage chamber into the main refrigerating circuit and thereby to control the operating characteristics of the circuit, means are provided for heating the storage chamber above the condensing temperature of the refrigerant at the pressures existing in the high pressure side of the circuit so that the liquid refrigerant stored in the chamber is discharged back into the refrigeration circuit. The energization of the heating means in accordance with a predetermined condition of operation of the system is employed to control the effective capacity of the system.

In accordance with one modification of the invention the normal refrigerant circuit also includes a refrigerant receiver which may or may not be part of the condenser and which is connected to the evaporator by means of a plurality of fixed restrictors having their inlets arranged at different elevations in the receiver. The interchange of liquid refrigerant between the refrigerant circuit and the storage chamber results in a change in the number of restrictors passing liquid refrigerant from the receiver to the evaporator and thereby changes the effective refrigerating capacity of the system.

For a better understanding of the invention, reference may be had to the accompanying drawing in which Fig. 1 is a diagrammatic representation of a refrigerating system embodying the present invention in its application to an air conditioning system;

Figs. 2 and 3 represent other embodiments of the invention in which the heating means is also controlled by the incoming air in an air conditioning system; and

Fig. 4 is a further modification of the invention in which the energization of the heating means is controlled by

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system overload conditions as evidenced by increased motor current.

Referring now to the drawings, the refrigeration system shown in Fig. 1 comprises an evaporator 1 arranged in air duct 2 for cooling the air passing through the duct. Vaporized refrigerant withdrawn from the evaporator by the operation of the compressor 3 is compressed by the compressor and the hot compressed refrigerant is cooled and liquefied in the condenser 4. During normal operation the condensed refrigerant is then stored in the liquid receiver 5 from which it is returned to the evaporator 1 under the control of the plurality of capillary tubes or other fixed restrictors 6, 7 and 8.

Each of the plurality of the restrictors or capillary tubes 6, 7 and 8 is connected to the refrigerant receiver 5 at different elevations. In the modification illustrated the capillary tube 6 is connected near the bottom of the receiver, the capillary tube 7 at a point intermediate the top and the bottom of the receiver and the capillary 8 adjacent the top of the receiver. It is well known that the evaporator can be operated in any desired percentage of its maximum capacity by varying the amount of refrigerant fed thereto. By controlling the height of the liquid refrigerant within the receiver 5 and hence the number of capillary tubes passing liquid refrigerant it is thus possible to control the effective capacity of the evaporator 1.

Means for regulating the height of the liquid refrigerant in receiver 5 is provided in the form of a closed or dead end storage chamber 9 which is outside the normal refrigerant circuit and which is in communication with the circuit through a restricted tube or duct 10 connected to the bottom of the storage chamber 9 and to the high pressure side of the refrigerating circuit between the compressor and the restrictor tubes. The storage chamber 9 is located in the path of the air leaving the evaporator 1 and is therefore cooled to temperatures approaching those of the evaporator at which temperatures liquid refrigerant is withdrawn from the high pressure side of the system and stored in the storage chamber. An electric heater 11 in heating relationship with the chamber 9 provides means for discharging refrigerant into the circuit and hence to control the quantity fed to the evaporator. The heater 11 is energized from a suitable source of electric current by closing switch 13 which switch is operated by a bellows 14 actuated in accordance with a pressure within a thermal bulb 15 positioned in the duct 2 in the path of the incoming air flowing to the evaporator 1. During normal operation the switch 13 is closed and the heater 11 energized so that the temperature of the storage chamber 9 is above the condensing temperature of the refrigerant. The storage chamber is then empty of liquid and all of the inlets to the restrictor tubes 6, 7 and 8 are submerged in liquid refrigerant so that the evaporator is fully refrigerated. When the temperature of the evaporator inlet air falls indicating that only partial evaporator capacity is required, the opening of switch 13 which is under control of the bulb or feeler 15 deenergizes the heater 11 so that the temperature of the storage chamber 9 falls below the condensing temperature of the refrigerant and will be completely filled with the refrigerant. This withdrawal of the refrigerant from the normal refrigerant circuit exposes one or more of the restrictor tube entrances in the storage chamber 9 to refrigerant vapor so that liquid refrigerant is fed to the evaporator only through the remaining restrictor tubes thereby decreasing the effective evaporator capacity.

The minimum amount of heat required is that which will maintain the temperature of the storage chamber 9 slightly above the condensing temperature of the refrigerant. This amount of heat can be further reduced by applying insulation 16 around the tank 9 and the heater 11. The thickness of the insulation will be dependent upon the design requirements. The chamber 9 should preferably be insulated sufficiently to hold the heating requirements of the heater 11 to a minimum but should

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not be so great that the control means has a high time constant, i. e. a slow response to the cooling effect of the evaporator air.

The heat required for the control of the present system is substantially less than that ordinarily required for the control of flow through capillary tubes of a closed refrigerating system where the heat is applied directly to the capillary tube or other restrictor. Whereas a suitable system employing direct heat on the capillary tube may require several hundred watts per ton of refrigeration, the requirements of the system of the present invention can be reduced to approximately ten to twenty watts per ton of refrigerating capacity.

The system may be applied to either an air cooled or water cooled condenser. In the case of an air cooled condenser it is not necessary that the auxiliary liquid receiver 5 be used. The condenser itself may act as a liquid receiver with one capillary tube coming off the bottom tube of the condenser, a second capillary off the next higher tube, and so forth. In the case of a water-cooled condenser the use of an auxiliary liquid receiver can be avoided by designing the condenser so that it also performs the functions of liquid receiver.

The modification of the invention illustrated in Fig. 2 is similar to that of Fig. 1 and corresponding parts have been designated by the same numerals. In the operation of the system of Fig. 1 the evaporator is the single circuit type fed by two or more restrictor tubes so proportioned that the evaporator is fed the proper amount of refrigerant for normal refrigerating capacity only when the entrances of all of the restrictor tubes are below the level of the liquid in the receiver. In the modification shown in Fig. 2 the evaporator consists of two or more circuits and has there been illustrated as consisting of three circuits or sections 20, 21 and 22. Each of these three sections is fed by a separate restrictor tube so proportioned that with its entrance or inlet below the liquid level in the receiver 5, the evaporator circuit to which it is connected is fed the proper amount of refrigerant. The size of the storage tank or chamber 9, the refrigerant receiver 5 and the locations of the restrictor tube inlets in the storage chamber 9 are so proportioned and positioned that when the chamber 9 is empty of refrigerant all of the restrictor tube entrances are submerged in liquid refrigerant and all three of the evaporator sections 20, 21 and 22 are operating. When the liquid level of refrigerant in the receiver 5 is lowered by deenergization of the heater 11 through the operation of the control sensing means operating switch 13 a predetermined number of the restrictor tube entrances is above the liquid level in the receiver 5 and hence the corresponding evaporator sections starved.

In Fig. 3 there is illustrated another modification of the invention which is similar to that shown in Figs. 1 and 2 and corresponding parts have again been designated by the same numerals. In the operation of the system of Fig. 3 the charge of refrigerant is such that when the heater is deenergized the refrigerant level within the receiver 5 is at about the half full mark as indicated by numeral 24, and when the heater is energized the refrigerant level is above the entrance to restrictor 27. The refrigerant is fed from the receiver 5 to the evaporator 1 through restrictors 25 and 27 which are connected in parallel and thence through restrictor 26. The restrictors are so proportioned that under these conditions the evaporator is normally refrigerated. In general, restrictors 25 and 27 will be so proportioned that under normal conditions the flow through restrictor 27 will be several times that through restrictor 25, and restrictor 26 will be so proportioned that the major portion of the pressure drop between the liquid receiver and the evaporator occurs across restrictor 26. When the liquid level in receiver 5 is lowered by deenergization of heater 11 the entrance to restrictor 27 is exposed to gaseous refrigerant and liquid refrigerant can flow to the evaporator only through restrictors 25 and 26 in series. A substantial

pressure drop then exists across restrictor 25, thus inducing a substantial flow of gaseous refrigerant through restrictor 27. This gaseous refrigerant mixing with the liquid flowing through restrictor 25 at the entrance to restrictor 26 substantially increases the effective flow resistance of restrictor 26, thus starving evaporator 1 and reducing the refrigerating capacity of the system. The magnitude of reduction of refrigerating capacity is determined by the design proportions of the restrictors 25, 26 and 27, and by the volume of tank 9.

In the systems as described heretofore, heat is applied to the storage chamber 9 when full capacity is desired and is removed when reduced capacity operation is desired, and hence may be termed indirect acting. In these systems capacity reduction is accompanied by a lowering of the compressor suction pressure inasmuch as the capacity reduction is effected by a reduction in evaporator capacity without reduction of inherent compressor capacity. In certain systems, such as those employing hermetic type compressors, and more particularly hermetic type compressors so designed that they will withstand a substantial amount of liquid refrigerant mixed with the suction gas, either of the systems may be made to function on a direct-acting principle, i. e. heat is applied to the storage chamber 9 when reduced capacity is desired and removed when full capacity operation is desired. In this case capacity reduction is associated with an increase in suction pressure as the effective capacity of the compressor is reduced without reducing the inherent capacity of the evaporator. In general, this alternate method of causing capacity reduction will be less desirable than the indirect-acting method, as its operating economy, or coefficient of performance, will usually be lower than that of the indirect method. However, it has the advantage, particularly in systems operating at low refrigerant temperatures, that the higher refrigerant temperature in the evaporator reduces the chances of accumulating undesirable quantities of frost on the evaporator in air cooling systems.

The modification illustrated by Fig. 3 is particularly adapted to the direct-acting method, which will be explained in connection therewith. In this case the charge of refrigerant is such that, as before, when the heater 11 is deenergized the refrigerant level within the receiver 5 is at about the half full mark as indicated by numeral 24. The refrigerant is fed from the receiver 5 to the evaporator 1 through fixed restrictors 25 and 26 which are connected in series. A third fixed restrictor connected to the upper portion of the receiver 5 is in parallel with the restrictor 25 and in series connection with restrictor 26. With the restrictor 27 exposed to gaseous refrigerant only the relative restrictions of the restrictors 25 and 27 are such with restrictor 27 carrying gas and the restrictor 25 carrying liquid refrigerant, the weight flow of gas is about one percent, or thereabouts, of the weight flow of liquid. In this case the restrictor 26 is so proportioned that under these conditions the evaporator is normally refrigerated.

To effect a decrease in the capacity of the evaporator, heater 11 is energized by the closing of switch 29, controlled by bellows 30 and the bulb or feeler 31. The energization of the heater 11 causes the refrigerant stored in the storage chamber 9 to be discharged into the normal refrigeration circuit or more specifically into the receiver 5 with the result that the liquid level of the refrigerant in the receiver 5 is raised and the restrictor 27 is exposed to liquid refrigerant. The flow resistance of the restrictor system to liquid is much less than to gas. Hence, when both restrictors 25 and 27 are carrying liquid, the overall restriction between the receiver 5 and evaporator 1 is substantially reduced and the flow of refrigerant to the evaporator is greatly increased. This causes the liquid in evaporator 1 to flood through to the compressor 3 thereby effectively reducing the compressor capacity by imposing a thermal short circuit on it, and consequently reducing

the overall capacity of the system, with an associated increase in suction pressure.

While the control sensing means illustrated in Figs. 1, 2 and 3 is of the bellows-bulb type responsive to the temperature of the air flowing to the evaporator, it is to be understood that the control sensing means may be any suitable thermostat, humidistat or other device arranged in a manner depending upon the purposes of the capacity control. For example the humidistat control sensing means may be employed for reducing the effective capacity of the system when dehumidification of the incoming air rather than substantial cooling thereof is required.

The system may also be controlled in accordance with other operating conditions. For example in the system shown in Fig. 4, the control sensing means is employed to avoid or minimize the hazard of overload of the refrigerating compressor motor. In this modification corresponding parts have again been designated by the same numerals. Liquid refrigerant is fed from the condenser 4 to the evaporator 1 through a restrictor 33 and a tube or duct 10 leading from the storage chamber 9 is connected to the normal refrigerating circuit intermediate the condenser and the restrictor 33. The chamber heater 11 is actuated by a normally closed thermal switch 34 the heater 35 of which is in the power circuit of the compressor motor 36. The heater is so sized that when the motor current approaches the overload condition, the thermal switch is caused to open the heating effect of its heater 35 with the result that the heating element 11 is deenergized and the storage chamber 9 cools to a temperature lower than the condensing temperature. This causes the storage chamber 9 to become filled with refrigerant thus starving the evaporator 1. One method for accomplishing this result is to design the system so that during normal operation there is a definite amount of refrigerant in the condenser resulting in an appreciable amount of liquid subcooling, and to provide a storage tank 9 of such a size that when it is filled with refrigerant there is no excessive refrigerant in the condenser and hence no subcooling of the liquid. With tank 9 filled, the entrance to the restrictor tube 33 will be exposed to gas as well as liquid. The effect therefore is to increase the restrictive value of the restrictor or capillary tube 33 so that it will not pass refrigerant at as high a flow rate as it does during normal operations with subcooling in the condenser. The resultant starving of the evaporator reduces the load on the compressor and hence unloads the compressor motor. Another method is to design the system for little or no subcooling in the condenser during normal operation. As in the previous method, the withdrawal of refrigerant into the storage reservoir will result in increasing the restrictive value of the restrictor by exposing its inlet to proportionately more gas and less liquid. The magnitude of this increase in restrictive value of the restrictor is determined by the volume of the storage reservoir. For example, if the capacity of the storage reservoir is sufficient to hold the entire charge of refrigerant in the system, or less than this by the amount dissolved in the oil in the compressor and the amount required to fill the remainder of the volume of the system with superheated gas, the de-energization of the heater will result in complete loss of refrigerating capacity.

In each of the systems of the present invention it will be noted that the storage chamber 9 is of the dead end type, i. e. it is connected to the normal refrigeration circuit only through a single restricted tube 10 so that its operation is not dependent upon any dynamic equilibrium of the refrigerant within the system. The operation of each of the systems is dependent upon a change in the effective restriction of the fixed restrictors connecting the high pressure side of the system to the evaporator so that the restrictor system is exposed at its inlet to either pure liquid or to a mixture of liquid and gas or to pure gas. While in prior systems the change in the restrictiveness of the capillary tubes have been ob-

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tained by applying heat directly to the fixed restrictor, this result is obtained in accordance with the present invention by varying the charge of refrigerant in the normal refrigerating cycle. The systems are so designed as to act in a completely on or off manner, i. e. the storage chamber 9 is either completely full of refrigerant or it is completely empty. The system thus avoids the complicated and extensive controls which are common to some systems wherein the relation of heat input to heat loss from the reservoir together with various mechanical arrangements requiring a delicate balance are employed to vary the refrigerant charge in the normal refrigerant circuit by small increments. Actually the operation of the present systems between a completely on and a completely off condition, that is with the storage chamber either completely full or empty, greatly simplifies the system without materially affecting the capacity control which can be accomplished thereby. A modulating control can be accomplished for example by a cycling between the two extremes at any desired rate of cycling with the range in the operating capacity of the system and the rate of cycling between the on and off conditions being dependent upon the size and proportions of the storage chamber 9, the differences between the temperature of the condenser 4 and the ambient in which the storage tank 9 is located, the amount of insulation 16 on the storage chamber 9, as well as the quantity of heat supplied to the heater 11. By controlling the cycling program suitably the storage chamber 9 can be operated completely empty, completely full or at any point between these extremes. An alternate method, where modulated control is desired, is to employ step control. The number of steps may be made as great as desired by employing more than one separate storage chamber, a separate chamber being required for each step control.

The foregoing description of this invention has been given in terms of what may be termed normal operation of the system, that is, liquid refrigerant is stored in the receiver 5, or alternatively in the condenser if an auxiliary receiver 5 is not employed. In systems employing fixed restrictors there are certain conditions under which the condenser, or liquid receiver in the high pressure portion of the system, tends to purge itself and the excess liquid finds storage space in the low pressure part of the system. Increase of condenser pressure beyond limits dependent on the system design will result in this tendency to purge liquid from the high pressure storage volumes and cause the evaporator to flood through. Another cause is reduction of evaporator capacity below certain limits dependent on the system design. For example, the air flow over the evaporator may be reduced unduly, or thermostat 15 may set very low so that as the temperature falls the evaporator may flood through before bulb 15 opens contact 13. In the flood through mode of operation one or more of the fixed restrictors receives a mixture of liquid and gas. Removing a portion of the refrigerant from the system by storing it in chamber 9 will increase the percentage of gaseous to liquid refrigerant entering the restrictor, or restrictors, already receiving a mixture. If more than one restrictor is employed in the system, deenergizing the heater on chamber 9 will increase the number of restrictors whose entrances are exposed to gaseous refrigerant or a mixture of liquid and gas, depending on the relative volume of chamber 9. Thus the invention will operate to change capacity as the heater 11 is energized and deenergized, both during normal operation and during flood through operation.

It will be obvious, of course, that the control of the energization of the heating means is not limited to that shown in each modification. Any one of the modifications shown may be controlled by any suitable sensing means responsive to some condition of operation, such as air temperature or motor overload, which condition is to be

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modified or corrected by changing the refrigerating capacity of the system.

While the invention has been illustrated in connection with refrigerating systems for cooling air, other applications will readily be apparent to those skilled in the art. The invention therefore is not to be limited to the particular arrangement shown and described and it is intended to cover by the appended claims all of the modifications which are within the spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A refrigerating system comprising a compressor, condenser, liquid refrigerant receiver, and evaporator in closed series connection to provide a normal refrigerant circuit, a plurality of fixed restrictors in said circuit connecting said receiver with said evaporator, said restrictors being connected to said receiver with their entrances at different elevations, and a liquid refrigerant storage chamber arranged outside the normal refrigerant circuit and having a single communication with said circuit affording passage of liquid refrigerant between said chamber and said circuit and means for controlling the storage of refrigerant in said chamber to vary the number of restrictors passing liquid refrigerant.

2. A refrigerating system comprising a compressor, condenser, liquid refrigerant receiver, and evaporator in closed series connection to provide a normal refrigerant circuit, a plurality of fixed restrictors in said circuit connecting said receiver with said evaporator, one of said restrictors being connected adjacent the bottom of said receiver and the remainder at spaced points above the bottom of said receiver, and a liquid refrigerant storage chamber arranged outside the normal refrigerant circuit and having a communication with the high pressure side of said circuit affording passage of liquid refrigerant between said chamber and said circuit and heating means for controlling the relative amounts of refrigerant in said chamber and in said circuit to effect a change in the level of liquid refrigerant in said receiver and vary the number of restrictors passing liquid refrigerant.

3. A refrigerating system comprising a compressor, condenser, liquid refrigerant receiver, and evaporator in closed series connection to provide a normal refrigerant circuit, a plurality of fixed restrictors in said circuit connecting said receiver with said evaporator, said restrictors being connected to said receiver with their inlets at different elevations, and a liquid refrigerant storage chamber arranged outside the normal refrigerant circuit and having a communication with said circuit affording passage of liquid refrigerant between said chamber and said circuit and means responsive to a change in the condition of the medium cooled by said evaporator for controlling the relative amounts of refrigerant in said chamber and in said circuit to vary the number of restrictors passing liquid refrigerant.

4. A refrigerating system comprising a compressor, condenser, liquid refrigerant receiver, and evaporator in closed series connection to provide a normal refrigerant circuit, a plurality of fixed restrictors in said circuit connecting said receiver with said evaporator, said restrictors being connected to said receiver with their inlets at different elevations below the normal level of liquid refrigerant in said receiver and a dead end liquid refrigerant storage chamber arranged outside the normal refrigerant circuit and having a communication with said circuit affording passage of liquid refrigerant between said chamber and said circuit, said chamber being disposed in an ambient below the condensing temperature of the refrigerant, means for heating said chamber above the condensing temperature of said refrigerant, and means for controlling the energization of said heating means to effect an interchange of refrigerant between said chamber and said circuit whereby deenergization of said heating means effects a withdrawal of refrigerant from said circuit to said

chamber to expose at least one of said restrictor inlets to refrigerant vapor.

5. A refrigerating system comprising a compressor, condenser, liquid refrigerant receiver, and evaporator in closed series connection to provide a normal refrigerant circuit, a plurality of fixed restrictors in said circuit connecting said receiver with said evaporator, said restrictors being connected to said receiver with their entrances at different elevations, and a liquid refrigerant storage chamber cooled by said evaporator to a temperature below the condensation temperature of the refrigerant, said chamber being arranged outside the normal refrigerant circuit and having a communication with the high pressure side of said circuit affording passage of liquid refrigerant between said chamber and said circuit and means for heating said chamber above the condensing temperature of the refrigerant, deenergization of said heating means effecting a lowering of the level of liquid refrigerant in said receiver to decrease the number of restrictor tubes passing liquid refrigerant.

6. An air conditioning system including a closed refrigerant circuit including a compressor, a condenser, a liquid refrigerant receiver and an evaporator for conditioning a circulating air stream, a plurality of fixed restrictors in said circuit for controlling the flow of refrigerant to said evaporator and having inlets connected to said receiver at different elevations, a dead end liquid refrigerant storage chamber arranged outside the normal refrigerant circuit and having a connection with the high pressure side of said circuit for passage of refrigerant between said chamber and said circuit, said chamber being arranged in the path of conditioned air leaving said evaporator, and maintained thereby at a temperature below the refrigerant condensing temperature, means for heating said chamber above the refrigerant condensing temperature, and control means responsive to a condition of operation of said system for controlling the operation of said heating means.

7. An air conditioning system including a closed refrigerant circuit including a compressor, a condenser, a liquid refrigerant receiver, and an evaporator for conditioning a circulating air stream, first and second fixed

restrictors in series in said circuit for controlling the flow of refrigerant to said evaporator, said first restrictor having its inlet connected to the bottom of said receiver, a third restrictor having its inlet connected adjacent the top of said receiver above the normal level of liquid refrigerant therein, and its outlet to said circuit between the first and second restrictors, a dead end liquid refrigerant storage chamber arranged outside the normal refrigerant circuit and having a single restricted connection with said receiver for passage of refrigerant between said chamber and said receiver, said chamber being arranged in the path of conditioned air leaving said evaporator and maintained thereby at a temperature below the refrigerant condensing temperature, means for heating said chamber above the refrigerant condensing temperature, and control means responsive to a condition of operation of said system for controlling the operation of said heating means.

8. An air conditioning system including a closed refrigerant circuit including a compressor, a condenser, and an evaporator for conditioning a circulating air stream, a fixed restrictor in said circuit for controlling the flow of refrigerant to said evaporator, a dead end liquid refrigerant storage chamber arranged outside the normal refrigerant circuit and having a single connection with the high pressure side of said circuit for passage of refrigerant between said chamber and said circuit, said chamber being arranged in the path of conditioned air leaving said evaporator and maintained thereby at a temperature below the refrigerant condensing temperature, means for heating said chamber above the refrigerant condensing temperature, and means responsive to compressor overload conditions for controlling the operation of said heating means.

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