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G. G. COYNE

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REFRIGERATION SYSTEM FOR AIR CONDITIONING UNITS

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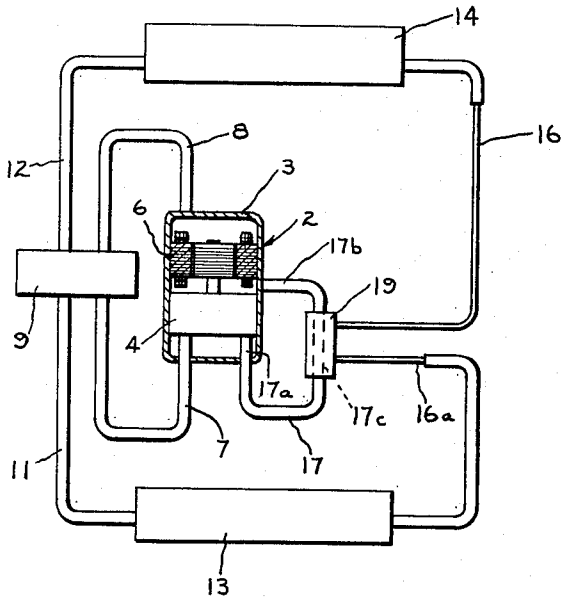


FIG. 1

FIG. 2

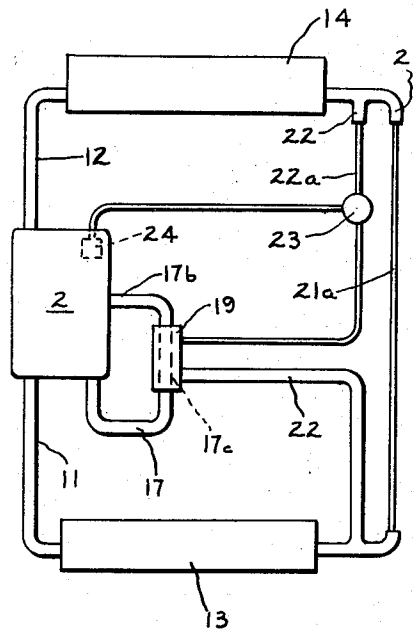
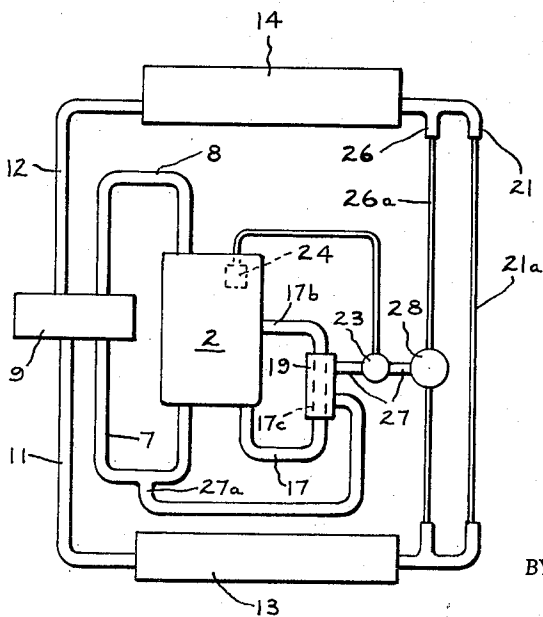


FIG. 3

INVENTOR
GERARD G. COYNE

BY

Gerard G. Coyne

HIS ATTORNEY

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REFRIGERATION SYSTEM FOR AIR CONDITION- ING UNITS

Gerard G. Coyne, Louisville, Ky., assignor to General Electric Company, a corporation of New York

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The present invention relates to a refrigeration system for air conditioning units and more particularly to a refrigeration system utilizing a compressor of the type commonly known as a "high side case" in which the high pressure discharge gases issuing from the compressor are passed into the compressor case for cooling the motor.

It is common practice in refrigeration systems using a high side compressor or a "high side case" to provide a superheat removal coil or a length of heat exchange tubing into which the high pressure discharge gas is directed from the compressor and cooled prior to being passed back into the case for cooling the motor. The coil is generally designed with respect to size and length so that, under normal operating conditions, it cools the high pressure refrigerant gas to a temperature just above its condensing temperature. The dense gas is sufficiently cool to extract heat from the compressor motor thereby maintaining the temperature of the compressor motor within safe operating limits during most operating conditions. However, because the amount of cooling within the superheat removal coil is approximately the same under most conditions of operation, there is a likelihood of overheating the motor when the outdoor temperature rises and the cooling load of the enclosure becomes very high. That is, under high load conditions when the heat output of the motor is at a maximum and the suction and head or discharge pressures are also higher resulting in correspondingly higher discharge temperatures, the cooling in the superheat removal coil is not sufficient to maintain the temperature of the compressor motor within the safe operating limits.

Also, as a corollary to the above condition, under low load conditions, when the suction pressure drops considerably and the discharge gas leaves the compressor at a much lower temperature, there is sometimes too much cooling in the superheat removal coil and the temperature of the gas in the superheat removal coil is reduced to the point where it condenses and liquid refrigerant is introduced into the case. This decreases the efficiency of the system and causes an excessive amount of oil from within the case to become entrained in the refrigerant. Large quantities of oil are then carried by the refrigerant through the remaining portions of the system where the oil coats the tubing and impairs the heat transfer efficiency of the tubing.

The superheat removal coil is sometimes arranged as part of the heat exchanger exposed to the outdoors in order to take advantage of the air flow over this heat exchanger for cooling the high pressure discharge gas prior to passing it back into the case. This arrangement is, however, inefficient when used in those types of refrigerating systems which are reversible and used for providing heat during the winter as well as cooling during the summer. In a reversible cycle refrigerating system during the heat cycle, the indoor coil is used as a condenser to discharge heat into air from the en-

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sure while the outdoor coil is used as an evaporator. Thus, when the superheat removal coil is located in or adjacent the outdoor coil, its heat is discharged to the outdoors rather than to the inside where it is needed during the winter or heating season.

It is an object of the present invention to provide for an air conditioner, a refrigeration system including a "high side case," and having an improved superheat removal arrangement which supplies a variable amount of cooling to the high pressure gas used to cool the motor according to the cooling requirements of the case.

It is another object of the present invention to provide for an air conditioner of the type adapted to both heat and cool an enclosure, an improved reversible refrigeration system having a "high side case" and adapted to operate at high efficiencies while operating on either cycle.

It is a more specific object of the present invention to provide an improved superheat removal arrangement in a refrigeration system using a "high side case" which arrangement does not rely on the flow of an air stream thereover for removal of the heat.

Further objects and advantages of the invention will become apparent as the following description proceeds 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 accordance with the present invention, there is provided an air conditioning unit having a refrigeration system using a "high side case." A superheat removal means is connected to the compressor to receive discharge gas therefrom and to direct the discharge gas back into the case. In order to cool the gas flowing through the superheat removal means, the present invention provides a refrigerant expansion means connected between the condenser and the evaporator which is also arranged in heat exchange relationship with the superheat removal means for removing heat from the gas flowing therethrough. As a further aspect of the present invention, it is contemplated that, in order to provide variable cooling of the superheat removal coil, at least two conduits be provided between the condenser and the evaporator, one merely for expanding refrigerant from condenser pressure to evaporator pressure and the other having a variable flow restricting means for controlling the flow of liquid refrigerant therethrough and being arranged in heat exchange relationship with the superheat removal means for cooling the gas flowing therethrough. By making the adjustment of the variable flow restricting means in the second conduit responsive to temperatures within the compressor case, the flow of refrigerant through the second conduit and hence its cooling effect on the superheat removal means is made variable according to the temperatures within the case.

For a better understanding of the invention reference may be had to the accompanying drawing in which:

Fig. 1 is a schematic illustration of a reversible refrigeration system embodying the invention in its simplest form;

Fig. 2 is a schematic view, of a non-reversible type refrigeration system incorporating an arrangement for controlling the amount of cooling of the high pressure gas according to the temperature conditions within the case; and

Fig. 3 is a schematic illustration of a modified arrangement of the invention as applied to a reversible type refrigeration system.

Referring now to Fig. 1, there is shown a reversible cycle refrigeration system for use in an air conditioner of the type adapted to both heat and cool air from an

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enclosure. For compressing and pumping refrigerant through the system there is provided a motor-compressor unit 2 including a hermetically sealed casing 3 which houses the compressor 4 and its drive motor 6 and which is suitable for containing the high pressure refrigerant gas. A suction line 7 connects directly with the suction inlet of the compressor for carrying low pressure refrigerant gas to the compressor. A discharge line 8 is connected to the case for carrying the high pressure gas into the remaining portions of the system. The discharge and suction lines are both connected to a reversing valve 9. Also connected to the reversing valve 9 are a pair of conduits 11 and 12 which lead respectively to indoor and outdoor heat exchangers or coils 13 and 14. In an air conditioning unit of this type, the indoor coil 13 is arranged for heating or cooling air from the enclosure, while the outdoor coil 14 is arranged for either rejecting heat to or extracting heat from the outside atmosphere.

The reversing valve 9 is selectively reversible to direct discharge gas through either one of the lines 11 and 12 while receiving low pressure gas from the other line, thereby making the system reversible for either heating or cooling an enclosure. Thus, if it is desired to set the system on the heating cycle, the compressor discharge gas flowing through discharge line 8 is connected by means of the reversing valve 9 to the line 11 which carries the hot discharge gas to the indoor coil 13. This coil then acts as a condenser to give up its heat to the enclosure air. If it is desired to set the system for cooling the enclosure, the suction line 7 is connected to the indoor coil 13 through the line 11, which then acts as an evaporator, while the discharge gas is carried to the outdoor coil 14 by the line 12.

Included in the system for the purpose of expanding the refrigerant from condensing pressure to evaporator pressure is a refrigerant expansion means or capillary tube 16. This tube operates as an expansion means during both the cooling and heating cycles and maintains a predetermined pressure differential between the evaporator and the condenser regardless of the direction of refrigerant flow.

As previously stated, the motor-compressor unit 2 of the present invention is a "high side case" in which the high pressure discharge gas is directed into the motor casing 3 for cooling the compressor motor 6 prior to passing into the remaining portions of the system. The high pressure discharge gas is cooled after it leaves the compressor by first passing it through a superheat removal means. In the present invention the superheat removal means comprises a short coil 17 of tubing, one end 17a of which communicates with the discharge opening of the compressor 4 and receives the high pressure gas therefrom. The other end 17b of the coil 17 connects with the casing 3 and discharges the cooled refrigerant back into the case 3 where it flows upwardly to cool the motor 6 before flowing out of the case 3 through the discharge line 8. The coil 17 contains a section 17c which is arranged in heat transfer relationship with the partially expanded refrigerant flowing through the refrigerant expansion means or capillary tube 16.

In the drawings, for simplicity of description, the capillary 16 is shown discharging the partially expanded refrigerant into a superheat removal volume 19 through which the coil 17 passes in heat transfer relationship with the cooled refrigerant. Although this is the preferred arrangement, it is to be understood that it need not take on quite the configuration shown in the drawings. Obviously, the coil 17 and the capillary 16 could themselves be in close engagement or wrapped around each other for a predetermined length and cooling of the gas flowing through coil 17 would result. Or the high pressure gas from the coil 17 could discharge into a small heat exchanger or volume, similar to the superheat re-

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moval volume 19 shown in the drawings, with the capillary 16 wrapped in heat exchange relationship around the heat exchange volume to cool its contents. Obviously, many other different arrangements could be provided but the main objective set forth in this specification is that at least a portion of the superheat removal means 17 be arranged in heat exchange relationship with the cold, partially expanded refrigerant flowing between the heat exchangers through the refrigerant expansion means.

The amount of the superheat removal means or coil 17c in contact with the capillary or cold, partially expanded refrigerant depends upon the amount of cooling desired for the high pressure gas flowing through the coil 17. Under normal conditions of operation, it is desirable that the high pressure gas be cooled to a temperature just above its condensing temperature. In order to accomplish this cooling with the least possible length of section 17c of superheat removal coil 17, it is preferable to place the section 17c in heat exchange relationship with refrigerant which has become very cold. That is, as is shown in the illustrated embodiments of the invention, the section 17c is placed into contact with the capillary 16 or partially expanded refrigerant at some point on the capillary approaching the end 16a connecting with the indoor heat exchanger 13. In this manner, during the cooling cycle when the greatest amount of cooling is required, the section 17c is in heat exchange relationship with expanded refrigerant or with a portion of the capillary 16 adjacent the indoor heat exchanger 13 in which the refrigerant has expanded nearly to evaporator pressure and is consequently very cold. This position of section 17c with respect to the capillary is very desirable for the reverse cycle or heating operation when little or no cooling is required for the high pressure gas flowing through the coil 17, since the section 17c is, of course, still in heat exchange relationship with that portion of the capillary adjacent the indoor heat exchanger, and is not cooled to any great extent because the refrigerant, which is then flowing in the reverse direction, expands very little up to that point in the capillary. It is contemplated in the preferred arrangement of the invention, that the section 17c be placed at least $\frac{2}{3}$ of the length of the capillary 16 from its connecting point with the outdoor heat exchanger 14. However, the section 17c can obviously be located along the capillary 16 at any of an infinite number of positions to provide an infinitely variable amount of discharge gas cooling, because different portions of the capillary are at different temperatures.

Although the above-described arrangement permits the use of a relatively short superheat removal coil and eliminates the necessity of placing the superheat removal coil in the air stream flowing over one or the other of the heat exchangers, this arrangement is still subject to overheating or overcooling since the amount of cooling experienced in the superheat removal means is substantially the same during operation of the system in a single direction regardless of the heat load conditions placed on the system. Referring now to Figure 2, there is shown a modified arrangement of the invention which makes possible a variable amount of cooling in the superheat removal means according to temperature conditions within the casing. This arrangement is shown in Figure 2 on a non-reversible type refrigeration system but could, upon proper design of the components, be utilized on a reversible type system for accomplishing both heating and cooling of an enclosure. Components identical to those of Fig. 1 are indicated by the same reference numerals in Fig. 2.

In addition to the regular high side case 2 and the heat exchangers 13 and 14, which in this arrangement are always operated so that the heat exchanger 13 is the evaporator and the heat exchanger 14 is the condenser, the system includes first and second conduits connected

in parallel between the heat exchangers 13 and 14. The first conduit 21 contains a fixed restriction or capillary 21a and merely expands the refrigerant from condenser pressure to evaporator pressure. The second conduit 22 includes a fixed restriction 22a or capillary and a variable restricting valve 23 for controlling the amount of refrigerant flowing through the second conduit. The second conduit contains a portion 19 thereof in heat exchange relationship with the section 17c of the superheat removal conduit 17 which is provided, as in Fig. 1, for cooling the high pressure discharge gases from the compressor. The cooling portion 19 disposed in contact or in heat exchange relationship with the superheat removal means is located at the end of the fixed restriction 22a. That is the cooling portion 19 is arranged so that the restriction, comprising the valve 23 and the capillary 22a, is entirely upstream therefrom with little or no restriction between the cooling portion 19 and the indoor heat exchanger 13. The conduit 22 operates in the same manner as capillary 16 of Fig. 1 to cool the gas flowing through the superheat removal conduit 17. Obviously, it is not necessary to include both the fixed restriction 22a and the variable restricting valve 23 in the conduit 22 in order to obtain variable flow through this conduit as this result can be accomplished with a suitable variable restriction valve 23 alone. However, in the arrangement illustrated which uses a fixed restriction or capillary tube 22a to provide a part of the expansion means, the valve 23 need not be varied over such wide range. The variable valve is operated or adjusted by a temperature responsive means 24 in the case to vary or control, according to temperatures within the case, the amount of refrigerant flowing through the conduit 22 and, thereby, the amount of cooling performed by the refrigerant flowing in heat exchange relationship with the superheat removal conduit 17. Thus, there is provided in conduit 22 a variable flow control means for varying the refrigerant flow through the conduit 22 according to the temperature within the case. The variable restricting valve 23 and its associated temperature sensing means or element 24 may comprise any of the many types of variable flow restricting devices which are well known in the art, such as a needle valve and a fluid pressure operated bellows, and a detailed description thereof is not believed necessary except to state that the valve 23 is adjusted to increase or restrict the flow of refrigerant through the conduit 22, or more specifically, through the capillary 22a by the temperature sensing element 24 according to temperature changes in the casing. Thus, if the cooling load of unit becomes high and the temperature within the casing rises, the amount of refrigerant flowing through capillary 22a is increased to increase the amount of cooling experienced in the superheat removal conduit 17. This, of course, causes greater cooling within the case to maintain the temperature of the compressor motor within safe operating limits. Conversely, when the cooling load of the unit is decreased and the temperature within the case falls, the amount of refrigerant flowing through the capillary 22a is greatly reduced or stopped completely. The discharge gas, which may be at a lower pressure and temperature under these conditions, is passed through the superheat removal coil 17 with very little or no cooling and is not condensed in the superheat removal coil 17. The discharge gas, therefore, always remains in a vaporous state until it enters the condenser 14 thereby maintaining the operating efficiency of the system at a high level.

As stated previously, the arrangement of Fig. 2 may be made reversible merely by using a reversing valve of the type illustrated in Fig. 1 to reverse the refrigerant flow through the system and by properly designing the heat exchangers to provide satisfactory operation in both directions. This arrangement would place a certain amount of liquid refrigerant into that portion of the conduit 22 below the valve 23, as seen in Fig. 2, during opera-

tion of the system in the reversed direction and would cause some limited cooling in the superheat removal coil 17. Also, if the compressor was running hot for some reason or other, it would cause large quantities of liquid refrigerant to flow through both conduits 21 and 22. In such a case, during the heating cycle, there is the probability that the amount of liquid refrigerant directed into the heat exchanger 14, which would then be operating as an evaporator, would be too much to be evaporated completely in this heat exchanger and a flooding over of the evaporator would result. This, of course, would make the evaporator run at a higher temperature than is desirable and would reduce the temperature differential between this unit and the outdoor air. The result would be a lower rate of heat transfer between the outdoor air and this unit, and would thereby reduce the overall efficiency of the system for supplying heat at the other heat exchanger 13, which would then be operating as a condenser.

The above-mentioned deficiencies may be corrected in a reversible system by modifying the invention as shown in Fig. 3, which shows an arrangement designed to enhance the limited cooling of the superheat removal means as well as to eliminate the probability of flooding over of the outdoor heat exchanger during the heating cycle. Those components of the system of Fig. 3 which are identical to the components of the systems in Figs. 1 and 2 are indicated by the same reference numerals. In the system of Fig. 3, there are provided first and second conduits 21 and 26, respectively, connected in parallel between the heat exchangers 13 and 14. The conduit 21 contains a fixed restriction or capillary 21a which is used merely for expanding liquid refrigerant from condenser pressure to evaporator pressure during operation of the system in either direction to heat or cool an enclosure. The second conduit 26, which in the illustrated embodiment includes a second capillary 26a, directs liquid refrigerant flowing from either direction into a third conduit 27. In order to cool the superheat removal coil 17, the third conduit or tube 27 is arranged in heat exchange relationship with section 17c of this coil and operates in the same manner as capillary 16, as was previously explained with respect to Fig. 1, for cooling the high pressure discharge gas from the compressor which flows through coil 17. A check valve 28, forces the liquid refrigerant flowing in either direction within the capillary 26a to be diverted into the third conduit 27 and, thereby, into heat exchange relationship with the superheat removal means.

Means are provided in the third conduit 27 for controlling or varying the flow of refrigerant through the third conduit according to the temperature within the casing. As in the system of Fig. 2, this flow restricting means comprises a restricting valve 23 and its associated temperature sensitive energizing means 24. The restricting valve 23 is disposed in the conduit 27 between the check valve 28 and the point of engagement of the conduit 27 and the superheat removal means. In this modification of the invention, the conduit arranged in cooling relationship with the superheat removal means, discharges into the suction line 7 or to the suction side of the compressor. Thus, as shown in Fig. 3, the conduit 27 connects at 27a with the suction line 7 and discharges the refrigerant gas into the suction line 7. The heat removal section 17c and heat exchange portion 19 should be sized so that when valve 23 and restriction 26a are providing the maximum flow rate, the refrigerant in the heat exchange portion 19 will be completely evaporated. This will prevent any liquid refrigerant from entering the suction side of the compressor and "slugging" the compressor.

During operation of the system shown in Fig. 3 on the cooling cycle, liquid refrigerant flows from the outdoor coil 14 through the conduit 26 and capillary 26a where refrigerant is then diverted by the check valve 28 into the third conduit 27. If the casing temperature is high, the restricting valve 23 permits the refrigerant to flow

through the conduit 27 to remove heat from the discharge gas flowing through the superheat removal conduit. When the temperature in the casing falls, the temperature sensing means 24 adjusts the restricting valve 23 to reduce or stop the flow of refrigerant through the conduit 27. This reduces the cooling of the high pressure discharge gas experienced in the superheat removal conduit 17 and assures that the gas will remain in vaporous form. When the unit is operated on the reverse cycle to provide heat for an enclosure, liquid refrigerant then flows from the indoor coil 13 through the capillary 26a where it is again diverted by the check valve 28 into the conduit 27. If the temperature within the casing is within safe operating limits, which will normally be the case during operation of the system on the heating cycle, the restricting valve 23 will prevent the refrigerant from flowing any further through the third conduit 27. However, as during operation on the cooling cycle, if some cooling of the high pressure discharge gas is required, the temperature sensing element 24 will cause the restricting valve 23 to open thereby permitting refrigerant to flow through the portions of the capillary in heat exchange relationship with the superheat removal coil 17.

By the present invention there has been provided for an air conditioning unit having a refrigeration system using a "high side" case, or a high side compressor-motor unit, a cooling arrangement for the case requiring no coils in heat exchange relationship with the air streams flowing through the unit and which, when applied to reversible type refrigeration systems, eliminates heat losses which normally result when the superheat removal coil is placed in the outdoor air stream. Furthermore, slight modifications of the present invention permits variation of the amount of cooling of the high pressure gas used to cool the high side case according to the temperatures within the case.

While in accordance with the patent statutes there has been shown what at present is considered to be the preferred embodiments of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention and it is, therefore, the aim of the appended claims to cover all such changes and modifications as fall within the true 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 refrigeration system for an air conditioning unit comprising a motor-compressor unit and a pair of heat exchangers connected in refrigerant flow relationship, expansion means connected between said heat exchangers for expanding refrigerant from condenser pressure to evaporator pressure, a hermetically sealed casing housing said motor-compressor unit and adapted to contain high pressure refrigerant gas, and superheat removal means communicating with the discharge outlet of said compressor for receiving high pressure refrigerant gas therefrom, said superheat removal means having an outlet connecting with said casing for discharging cooled gas into said hermetic casing for cooling said motor, said superheat removal means and said expansion means being arranged in heat transfer relationship so that said expansion means cools said high pressure gas in said superheat removal means prior to discharge of said gas into said casing.

2. A refrigeration system for an air conditioning unit comprising a motor-compressor unit, a condenser and an evaporator connected in refrigerant flow relationship, a capillary expansion tube connected between said condenser and said evaporator for expanding refrigerant from condenser pressure to evaporator pressure, a hermetically sealed casing housing said motor-compressor unit and adapted to contain high pressure refrigerant gas, and superheat removal means communicating with the discharge outlet of said compressor for receiving high

pressure refrigerant gas therefrom, said superheat removal means having an outlet connecting with said casing for discharging cooled gas into said hermetic casing for cooling said motor, said superheat removal means being arranged in heat exchange relationship with a portion of said capillary tube for cooling said high pressure discharge gas from said compressor prior to discharge of said gas into said casing, said portion of said capillary in heat exchange relationship with said superheat removal means being disposed less than one-third of the length of said capillary away from its connecting point with said evaporator.

3. A refrigeration system for an air conditioning unit comprising a motor-compressor unit, a condenser, and an evaporator connected in refrigerant flow relationship, a capillary expansion tube connected between said condenser and said evaporator for expanding refrigerant from condenser pressure to evaporator pressure, a hermetically sealed casing housing said motor-compressor unit and adapted to contain high pressure refrigerant gas, and superheat removal means communicating with the discharge outlet of said compressor for receiving high pressure refrigerant gas therefrom, said superheat removal means having an outlet connecting with said casing for discharging cooled gas into said hermetic casing for cooling said motor, said superheat removal means being in heat transfer relationship with said capillary expansion tube in the low pressure portion thereof prior to its connecting point with said evaporator so that the coldest portion of said capillary expansion tube is in heat exchange relationship with said superheat removal means for cooling the gas flowing through said superheat removal means prior to discharge of said gas into said casing.

4. A refrigeration system for an air conditioning unit adapted for heating and cooling an enclosure comprising a motor-compressor unit and a pair of heat exchangers connected in reversible refrigerant flow relationship, a capillary expansion means connected between said heat exchangers for expanding refrigerant from condenser pressure to evaporator pressure, means for reversing the flow of refrigerant through said system thereby to operate each of said heat exchangers interchangeably as a condenser or as an evaporator, said motor-compressor unit being mounted in a hermetically sealed casing for containing a high pressure refrigerant gas, and superheat removal means communicating with the discharge outlet of said compressor for receiving high pressure refrigerant gas therefrom, said superheat removal means having an outlet connecting with said casing for discharging cooled gas into said hermetic casing for cooling said motor, said superheat removal means and said capillary expansion means being arranged in heat transfer relationship so that said capillary expansion means cools said high pressure gas in said superheat removal means prior to discharge of said gas into said casing.

5. A refrigeration system for an air conditioning unit adapted for heating and cooling an enclosure comprising a motor-compressor unit and a pair of heat exchangers connected in reversible refrigerant flow relationship, one of said heat exchangers being disposed in heat exchange relationship with indoor air and the other heat exchanger being disposed in heat exchange relationship with outdoor air, a capillary expansion means connected between said heat exchangers for expanding refrigerant from condenser pressure to evaporator pressure, means for reversing the flow of refrigerant through said system thereby to operate each of said heat exchangers interchangeably as a condenser or as an evaporator, said motor-compressor unit being mounted in a hermetically sealed casing for containing a high pressure refrigerant gas, and superheat removal means communicating with the discharge outlet of said compressor for receiving high pressure refrigerant therefrom, said superheat removal means having an outlet connecting with said casing for discharg-

ing cooled gas into said hermetic casing for cooling said motor, said superheat removal means being arranged in heat exchange relationship with a portion of said capillary tube for cooling said high pressure discharge gas from said compressor prior to discharge of said gas into said casing, said portion of said capillary in heat exchange relationship with said superheat removal means being disposed less than one-third of the length of said capillary away from its connecting point with said heat exchanger exposed to indoor air.

6. A refrigeration system for an air conditioning unit adapted for heating and cooling an enclosure comprising a motor-compressor unit and a pair of heat exchangers connected in reversible refrigerant flow relationship, first and second refrigerant carrying conduits connected in parallel between said heat exchangers, said first conduit containing a fixed restriction therein for expanding refrigerant from condenser pressure to evaporator pressure, means for reversing the flow of refrigerant through said system thereby to operate each of said heat exchangers interchangeable as a condenser or as an evaporator, a hermetically sealed casing housing said motor-compressor unit and adapted to contain high pressure refrigerant gas, superheat removal means communicating with the discharge outlet of said compressor for receiving high pressure refrigerant gas therefrom, said superheat removal means having an outlet connecting with said casing for discharging a cooled gas into said hermetic casing for cooling said motor, said second conduit being arranged in heat transfer relationship with said superheat removal means so that said second conduit cools said high pressure gas in said superheat removal means prior to discharge of said gas into said casing, variable flow restricting means in said second conduit responsive to temperatures within said casing for varying the quantity of liquid refrigerant flowing through said second conduit tube, said means adapted to adjust the flow of refrigerant through said second conduit tube as the temperature within said casing increases and for decreasing the flow of refrigerant through said second conduit as the temperature within said casing decreases so that the cooling of high pressure gas in said superheat removal means is increased or decreased according to the temperature within said casing.

7. A refrigeration system for an air conditioning unit adapted for heating and cooling an enclosure comprising a motor-compressor unit and a pair of heat exchangers connected in reversible refrigerant flow relationship, first and second refrigerant carrying conduits connected in parallel between said heat exchangers, said first conduit containing a capillary expansion means for expanding refrigerant from condenser pressure to evaporator pressure, means for reversing the flow of refrigerant through said system thereby to operate each of said heat exchangers interchangeable as a condenser or as an evaporator, a hermetically sealed casing housing said motor-compressor unit and adapted to contain high pressure refrigerant gas, a superheat removal conduit communicating with the discharge outlet of said compressor for receiving high pressure refrigerant gas therefrom, said superheat removal conduit having an outlet connecting with said casing for discharging cooled gas into said hermetic casing for cooling said motor, said second conduit being arranged in heat transfer relationship with said superheat removal means so that said second conduit cools said high pressure gas in said superheat removal conduit prior to discharge of said gas into said casing, variable flow restricting means in said second conduit for controlling the flow of liquid refrigerant therethrough, and temperature responsive means within said casing adapted to adjust said variable flow restricting means for increasing the flow of refrigerant through said second conduit as the temperature within said casing increases and for decreasing the flow of refrigerant through said second conduit as the temperature within said cas-

ing decreases so that the cooling of said high pressure gas in said superheat removal means is increased or decreased according to the temperature within said casing.

8. A refrigeration system for an air conditioning unit comprising a motor-compressor unit and a pair of heat exchangers connected in refrigerant flow relationship, a first conduit connected between said heat exchangers and containing a first capillary expansion tube for expanding refrigerant from condenser pressure to evaporator pressure, a hermetically sealed casing housing said motor-compressor unit and adapted to contain high pressure refrigerant gas, a superheat removal conduit communicating with the discharge outlet of said compressor for receiving high pressure refrigerant gas therefrom, said superheat removal conduit having an outlet connecting with said casing for discharging cooled gas into said hermetic casing for cooling said motor, a second conduit connected between said condenser and said evaporator, said second conduit including a second capillary tube arranged in heat transfer relationship with said superheat removal conduit so that said second capillary tube cools said high pressure gas in said superheat removal conduit prior to discharge of said gas into said casing, variable flow restricting means in said second capillary tube for controlling the flow of liquid refrigerant flowing therethrough, and means responsive to temperatures within said casing for adjusting said variable flow restricting means so that the flow of refrigerant through said second capillary tube is increased as the temperature within said casing increases and the flow of refrigerant through said second capillary tube is decreased as the temperature within said casing decreases so that the removal of heat from said high pressure gas flowing through said superheat removal means is increased or decreased according to the temperature within said casing.

9. A refrigeration system for an air conditioning unit adapted for heating and cooling an enclosure comprising a motor-compressor unit and a pair of heat exchangers connected in reversible refrigerant flow relationship, a first conduit including a first capillary expansion tube connected between said heat exchangers for expanding refrigerant from condenser pressure to evaporator pressure, a hermetically sealed casing housing said motor-compressor unit and adapted to contain a high pressure refrigerant gas, a suction line connecting with the suction inlet of said compressor for feeding low pressure refrigerant gas into said compressor, a discharge line leading from said casing for carrying high pressure discharge gas from said casing, a reversing valve connecting with said suction line and said discharge line for reversing the flow of refrigerant through said heat exchangers thereby to operate each of said heat exchangers interchangeably as a condenser or as an evaporator, a superheat removal conduit communicating with the discharge outlet of said compressor for receiving high pressure refrigerant gas therefrom, said superheat removal conduit having an outlet connecting with said casing for discharging cooled gas into said hermetic casing for cooling said motor, means for cooling said superheat removal conduit including a second conduit connected parallel to said first conduit between said condenser and said evaporator, said second conduit also including a second capillary tube therein, a third conduit arranged in heat transfer relationship with said superheat removal conduit and connecting at one end with said suction line to said compressor and at the other end with said second capillary tube, means at the connection of said second capillary and said third conduit for diverting refrigerant flowing from either direction through said second capillary into said third conduit, variable flow restricting means in said third conduit for controlling the flow of liquid refrigerant through said third conduit, and temperature responsive means within said casing adapted to adjust said variable flow restricting means for increasing the flow of refrigerant through said third conduit as the temperature within said casing in-

creases and for decreasing the flow of refrigerant through said third conduit as said temperature within said casing decreases so that cooling of high pressure refrigerant gas in said superheat removal means is increased or decreased according to the temperature within said casing.

10. A refrigeration system for an air conditioning unit adapted for heating and cooling an enclosure comprising a motor-compressor unit and a pair of heat exchangers connected in reversible refrigerant flow relationship, a first conduit including a first capillary expansion tube connected between said heat exchangers for expanding refrigerant from condenser pressure to evaporator pressure, a hermetically sealed casing housing said motor-compressor unit and adapted to contain a high pressure refrigerant gas, a suction line connected with the suction inlet of said compressor for feeding low pressure refrigerant gas into said compressor, a discharge line connecting from said casing for carrying high pressure discharge gas from said casing, a reversing valve connecting with said suction line and said discharge line for reversing the flow of refrigerant through said heat exchangers thereby to operate each of said heat exchangers interchangeably as a condenser or as an evaporator, a superheat removal conduit communicating with the discharge outlet of said compressor for receiving high pressure refrigerant gas therefrom, said superheat removal conduit having an outlet connecting with said casing for discharging cooled gas into said hermetic casing for cooling said motor, a second conduit connected parallel to said first conduit between said heat exchangers, said second conduit including

a second capillary tube adapted to conduct liquid refrigerant in either direction from one or the other of said heat exchangers, a third conduit arranged in heat transfer relationship with said superheat removal conduit and connecting at one end with said suction line to said compressor and at the other end with said second capillary tube, check valve means at the connection of said second capillary and said third conduit for diverting the flow of refrigerant gas in said second capillary into said third conduit, variable flow restricting means in said third conduit between its connection point with said second capillary tube and said superheat removal conduit for controlling the flow of liquid refrigerant through said third conduit, and temperature responsive means within said casing adapted to adjust said variable flow restricting means for increasing the flow of refrigerant through said third conduit as the temperature within said casing increases and for decreasing the flow of refrigerant through said third conduit as said temperature within said casing decreases so that heat removal from said high pressure refrigerant gas in said superheat removal conduit is increased or decreased according to the temperature within said casing.

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