

Oct. 31, 1944.

A. A. McCORMACK
REFRIGERATING APPARATUS

2,361,855

Filed May 28, 1941

3 Sheets-Sheet 1

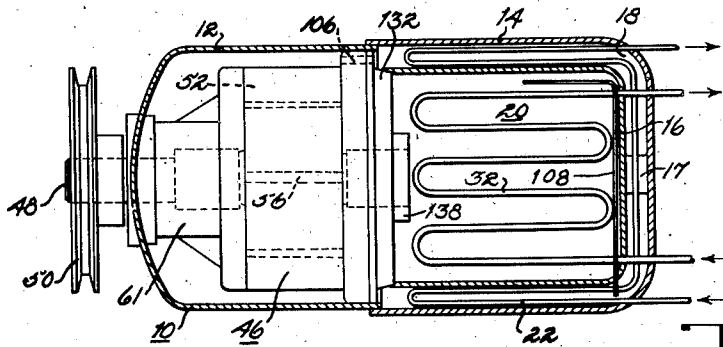
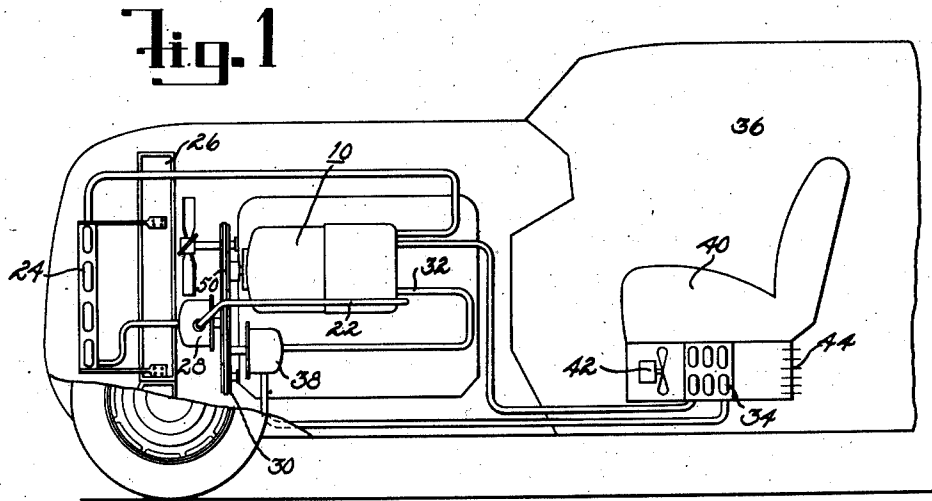


Fig. 2

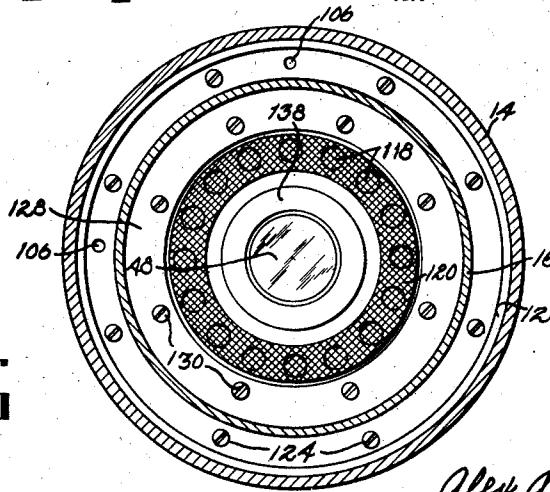


Fig. 5

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3 Sheets-Sheet 2

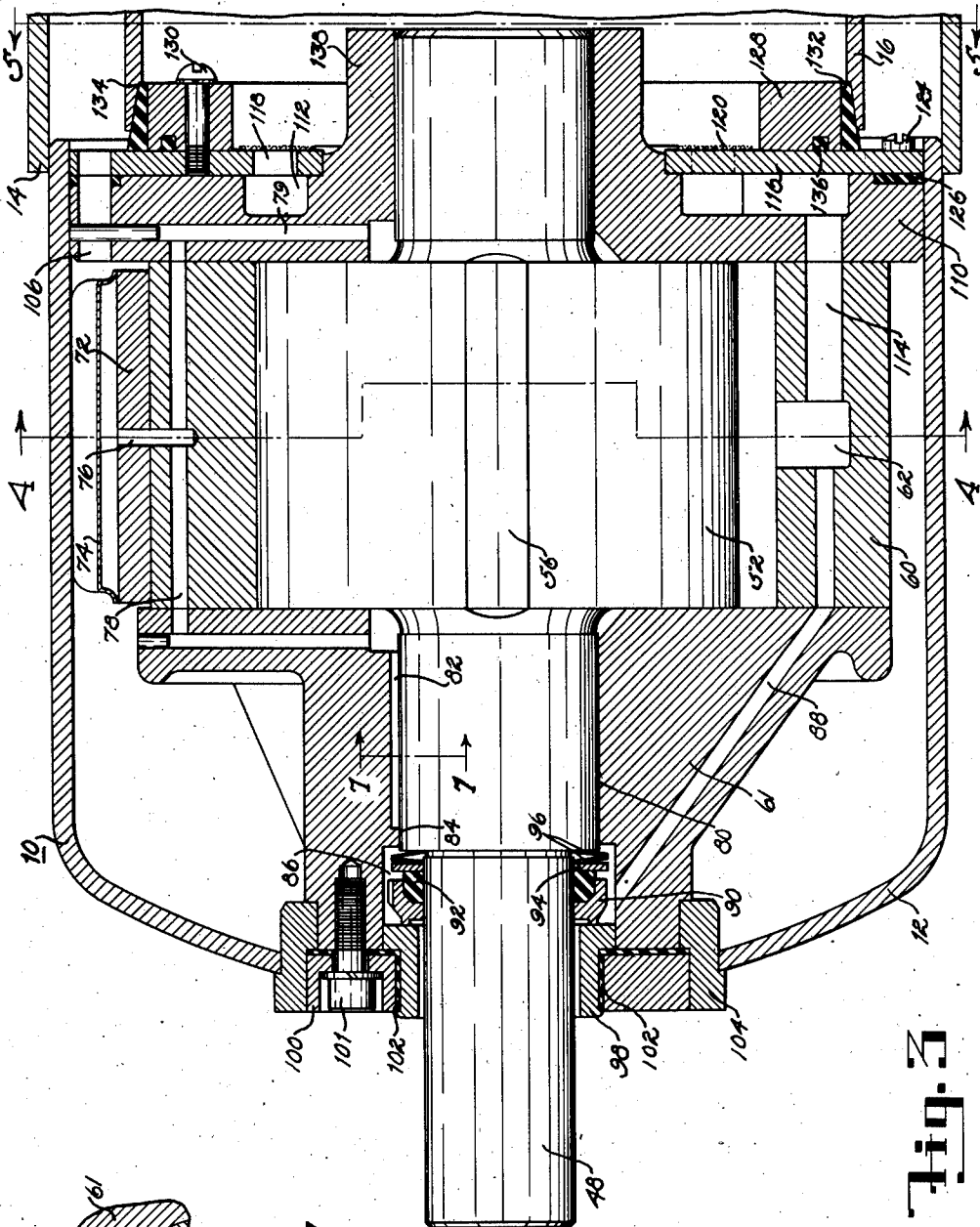
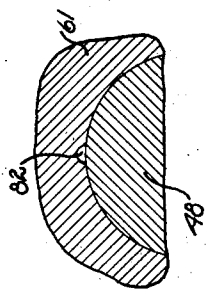


Fig. 3



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3 Sheets-Sheet 3

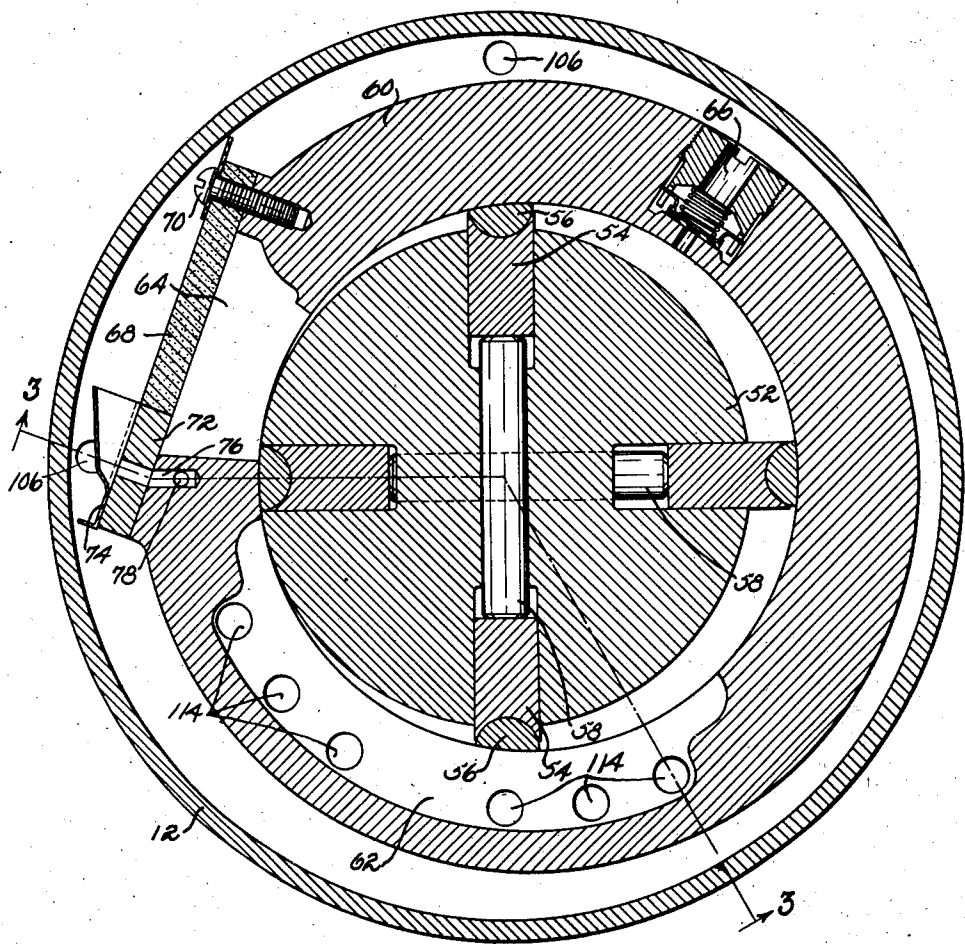


Fig. 4

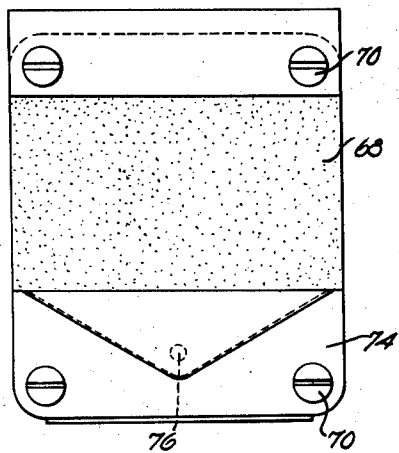


Fig. 6

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UNITED STATES PATENT OFFICE

2,361,855

REFRIGERATING APPARATUS

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Application May 28, 1941, Serial No. 395,647

17 Claims. (Cl. 62-115)

This invention relates to refrigerating apparatus and more particularly to improvements in the construction and method and assembling a completely enclosed refrigeration system.

One object of this invention is to provide a small refrigeration unit in which the compressor, condenser and the evaporator are all mounted within a single casing.

Another object of this invention is to provide an improved oiling arrangement for use in a refrigeration system in which the compressor casing is too small to serve as an oil reservoir.

Another object of this invention is to provide a small compact compressor unit which may be operated at very high speeds and also at very low speeds.

Another object of this invention is to provide an improved shaft seal suitable for use in a compressor operated at varying speeds.

Still another object is to provide a shaft seal cooling arrangement in which the refrigerating capacity of the refrigerant entrained by the lubricant may be used to the fullest advantage in cooling the shaft seal.

Still another object of this invention is to provide an improved means for controlling the return of refrigerant from the evaporator to the compressor in a system in which the compressor is driven at widely varying speeds without any regard for refrigeration requirements.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 diagrammatically shows my invention as applied to a conventional passenger automobile;

Fig. 2 is a sectional view partly diagrammatic showing the general arrangement of the compressor, the evaporator and the condenser;

Fig. 3 is an enlarged sectional view of the compressor taken on the line 3-3 of Fig. 4;

Fig. 4 is a sectional view of the compressor taken on the line 4-4 of Fig. 3;

Fig. 5 is a sectional view taken on the line 5-5 of Fig. 3;

Fig. 6 is an elevational view of the oil separating unit; and

Fig. 7 is a fragmentary sectional view taken on line 7-7 of Fig. 3.

Inasmuch as the ordinary garage is not equipped with refrigeration testing and refrigeration repair equipment and inasmuch as the average garage mechanic is not prepared to service refrigeration equipment, it is desirable to provide a completely sealed refrigeration unit in which no refrigerant lines are exposed for use in conditioning the air for private automobiles.

As shown in Fig. 1, I have provided a refrigeration unit 10 which is adapted to be mounted directly within the engine compartment of a conventional automobile. The unit 10 comprises a casing having a first section 12 which encloses a motor-compressor unit and a second section 14 welded thereto which encloses the refrigerant evaporator and the refrigerant condenser. An inner casing 16 separates the condensing chamber 18 from the evaporator chamber 20. A water coil 22 is provided within the condensing chamber 18 and is adapted to be connected in series with the water cooling coil 24 mounted in front of the main engine radiator 26. A water pump 28 which is adapted to be driven from the fan belt 30 circulates the water between the water coil 22 and the heat dissipating radiator 24. A water chilling coil 32 is mounted directly within the refrigerant evaporating chamber 20 and is connected in series with the water coil 34 which is arranged in thermal exchange relationship with the air to be cooled for the passenger compartment 36 of the automobile. A water pump 38, which is also adapted to be driven by means of the fan belt 30 circulates water through the coils 32 and 34.

For purposes of illustration, the water coil 34 has been shown as mounted beneath the front seat 40. A fan 42 is provided for circulating air to be conditioned in thermal exchange with the cooling coil 34. The conditioned air is discharged through the grill 44.

The compressor 46 is of the four vane rotary type and includes a drive shaft 48 on which is mounted a pulley 50 which also is adapted to be driven by means of the fan belt 30. The compressor comprises a four vane rotor element 52 which is formed integrally with the main shaft 48. Vanes 54, which are of conventional construction are carried by the rotor 52 as shown. Each vane includes a shoe element 56 of conventional construction. Pins 58 maintain the vanes 54 in proper position with respect to the walls of the main cylinder 60. The shaft 48 is journaled in the compressor end walls 61 and 110. The cylinder 60 is recessed as at 62 so as to provide an intake port for the compressor. A second recess 64 provided in the cylinder walls 60 serves as an outlet port for the compressor. A pressure relief valve 66, of conventional construction, is provided as shown in Fig. 4, so as to relieve the pressure within the compression chamber in the event that the pressure therein exceeds the high side pressure within the refrigerant system. Inasmuch as it is not practical to provide a large housing for the compressor, very little space is available for any reserve supply of lubricant. It is important, therefore, to provide some means for lubricating the com-

pressor bearings without depending upon the accumulation of lubricant within the compressor compartment. This is especially true in a system in which the compressor is required to operate at extremely high speeds for prolonged periods since under such conditions the lubricant is carried along with the high velocity gas flowing through the compressor. As best shown in Fig. 4, I have provided a lubricant entraining means comprising a porous sintered metal plate 68 which is secured to the outer wall of the cylinder 60 by means of cap screws 70. All of the compressed refrigerant together with the lubricant discharged from the compressor is required to pass through the porous sintered metal plate 68. The lower portion 72 of the plate 68 is treated such as by dipping in solder so as to close the pores thereof. The porous portion of the sintered metal plate 68 serves to agglomerate the droplets of lubricant suspended in the refrigerant vapor. The agglomerated lubricant exudes from the outer surface of the plate 68 and trickles into the lubricant catching element 74. A lubricant feed passage 76 is provided for supplying the lubricant separated out from the refrigerant directly back to the compressor bearings in a manner to be explained more fully hereinafter.

As shown in Fig. 3, the lubricant feed passage 76 communicates with branch lubricant passages 78 and 79. The passage 78 conveys lubricant to the main bearing surface 80. A passage 82 is provided in the main bearing surface 80 for distributing the high pressure lubricant along substantially the full length of the bearing surface 80. The passage 82 terminates at a point 84 which is close to the shaft seal cavity 86. A passage 88 is provided between the shaft seal cavity 86 and the compressor inlet port 62 whereby the shaft seal cavity 86 is maintained at a low pressure substantially equal to the pressure within the evaporator. Inasmuch as the lubricant supplied to the passage 82 is at a pressure substantially equal to the high side pressure and inasmuch as the lubricant normally has an appreciable quantity of refrigerant entrained therein, it is apparent the restriction provided by the bearing 80 between the end of the passage 82 and the shaft seal cavity 86 serves the same function as a fixed restrictor provided between the high pressure refrigerant in the condenser and the low pressure refrigerant in the evaporator. Thus the refrigerant contained by the lubricant which escapes into the shaft seal chamber 86 vaporizes and cools the shaft seal mechanism.

As shown in Fig. 3, the shaft seal mechanism comprises a rotating sealing ring 90 carried by the shaft 48. A neoprene gasket 92 provided between the ring 90 and the washer 94 prevents the escape of lubricant and refrigerant between the shaft 48 and the ring 90. The washer 94 is held in place by means of a pair of spring washers 96. These washers are of the type commonly known as Belleville washers and are especially suitable for use in a shaft seal in that they require very little space along the length of the shaft and have superior spring pressure characteristics. The amount of resistance to movement offered by spring washers of this type varies very little throughout the major portion of the range throughout which the washers may be compressed. Inasmuch as the end play in a compressor of this type is not very great, the spring washers are not required to be deformed

beyond the range within which they offer a substantially constant spring pressure. The rotating sealing ring 90 cooperates with the stationary sealing ring 98 which is carried by the compressor end wall casting 61. The sealing ring 98 is held in place by means of a washer element 100 which in turn is held in place by means of one or more cap screws 101. A neoprene gasket 102 serves to resiliently support the sealing ring 98 so as to allow the ring 98 to adjust itself to the rotatable ring 90. A fitting 104 which may be brazed or otherwise secured to the casing section 12, is provided which makes it possible to remove the cap screws 101 and the shaft seal mechanism without much difficulty. The gasket 102 also provides a refrigerant and lubricant tight joint between the fitting 104 and the washer 100.

By virtue of the small space required by the shaft seal mechanism, the distance from the main bearing 80 to the end of the shaft 48 is so small that it is not necessary to provide an external bearing for the compressor operating shaft 48.

One or more passages such as the passage 106, shown in Fig. 2, allows the compressed gas to flow from the compressor casing 12 into the condensing chamber 18 in which the compressed gas condenses when coming in contact with the water coil 22. The condensed refrigerant collects in the lower portion of the condensing chamber 18 and is supplied therefrom into the evaporator chamber 20 through the capillary tube 108 which serves as a fixed restrictor. The liquid refrigerant thus flowing into the evaporator chamber 20 evaporates therein and serves to refrigerate the water flowing through the water coil 22. Inasmuch as the speed of the automobile engine and therefore the speed of the compressor bears no relationship to the refrigerant requirements, it will frequently happen that the refrigeration system has excess capacity and that a large amount of liquid refrigerant will accumulate within the evaporator chamber 20. The speed of the compressor may be so great at times that it becomes necessary to allow a portion of the liquid refrigerant in the evaporator chamber 20 to enter the inlet of the compressor so as to cool the compressor and supply the necessary lubrication to the compressor. Accordingly, the end plate 110 of the compressor is provided with a circular recess 112 which communicates with the suction port 62 of the compressor through a plurality of passages 114 (see Figs. 3 and 4). Plate member 116 is secured to the compressor end plate 110 by means of the bolts 124 and is provided with a plurality of apertures 118 through which refrigerant in the evaporator chamber 20 may return to the compressor inlet 62. A screen 120 is provided for filtering the refrigerant returning to the compressor and for partially restricting the flow of liquid refrigerant through the apertures 118. The screen 120, being a fine mesh screen, affords considerable restriction to the flow of liquid refrigerant therethrough.

The arrangement of the apertures 118 is such that under certain conditions, the level of liquid refrigerant within the evaporator chamber 20 will be below the lowermost aperture 118.

A gasket 126 of neoprene or some similar material which is relatively unaffected by the lubricant or the refrigerant, is clamped between the ring 116 and the compressor end plate 110. The gasket 126 provides a refrigerant tight seal between the refrigerant in the casing section 12

and the refrigerant in the condenser chamber 18. By virtue of this arrangement, it is not necessary to weld or otherwise fasten the compressor end plate 110 on the ring 116 to the outer casing 12. The advantage of this construction is that relative movement between the compressor end plate 110 and the casing 12 is permitted. Such an arrangement has considerable merit in that it allows for unequal expansion and contraction of the various parts due to the changes in the temperatures. The inner casing section 16 is spaced from the outer casing 14 by the block 17 (see Fig. 2) which is hydrogen brazed or otherwise secured to the casing sections 14 and 16. An adapter ring 128 secured to the plate 116 by means of cap screws 130 carries a neoprene gasket 132 which has a tapered outer surface adapted to engage the inner end of the casing 16 which is also tapered as at 134 so as to insure a tight seal. A neoprene sealing ring 136 is provided between the plate 116 and the ring 128.

The compressor end plate 110 is provided with a shaft bearing extension 138. The one end of the bearing 138 is exposed to the low pressure refrigerant within the refrigerant chamber 20 whereby the high pressure lubricant supplied to the bearing through the passage 79 will find its way along the full length of the bearing 138. The average pressure exerted by the low pressure refrigerant against the inner end of the shaft 48 approximately equals the pressure exerted by the spring washers 96 and the atmosphere against the other end of the shaft.

The refrigeration system is charged with a sufficient quantity of miscible lubricant so as to provide adequate lubrication when the compressor operates at its lowest speed. At low compressor speeds the lubricant will more completely separate out from the refrigerant and will overflow into the compressor housing 12. This is a distinct advantage in that at these low speeds it is important to keep the evaporator reasonably free of lubricant so as to make fullest use of the evaporator. Thus, in hot weather, when it is important to have greatest evaporator efficiency when the compressor is required to operate at slow speeds, the evaporator will be relatively free of lubricant.

At high compressor speeds, the lubricant will tend to collect in the evaporator so as to reduce the evaporator efficiency. Under this condition an increased amount of oil will be carried along with the refrigerant vapor to the compressor. This not only provides the increased amount of lubrication required but also serves to reduce the cooling capacity of the system. The reduced capacity is caused by the fact that the lubricant returning to the compressor will have a considerable quantity of unevaporated refrigerant entrained therein which reevaporates upon entering the compressor. The greater the compressor speed the greater will be the velocity of the gas whereby a greater amount of lubricant and unevaporated refrigerant will be swept along with the gas returning to the compressor.

The arrangement of the evaporator with respect to the condenser serves to compensate for the changes in the compressor speed. The presence of liquid refrigerant in the evaporator at high compressor speeds and consequently high head pressures, helps to condense the refrigerant in the condenser and thereby reduce the head pressure.

While the form of embodiment of the invention

as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

5 What is claimed is as follows:

1. Air conditioning apparatus comprising in combination; a casing; a compressor within said casing having an inlet port and an outlet port; a compressor operating shaft having one end projecting through one wall of said casing; means carried by said projecting end of said shaft for rotating said shaft; means forming a shaft seal cavity adjacent said shaft; shaft seal means within said cavity cooperating with said casing and said shaft for preventing the escape of lubricant along said shaft; a porous sintered metal oil separating element adjacent the outlet of said compressor; means cooperating with said porous element for collecting the lubricant separated out thereby; means for supplying lubricant from said lubricant collecting means to said shaft seal cavity; means providing a passage between said shaft seal cavity and the inlet to said compressor, a wall member within said casing through which the other end of said compressor operating shaft projects; means cooperating with said wall member forming an evaporator chamber adjacent said other end of said shaft; means for condensing the refrigerant compressed by said compressor; means for supplying condensed refrigerant at a reduced pressure to said evaporator chamber; and means for circulating an air cooling medium in thermal exchange with the refrigerant in said evaporator chamber and in thermal exchange with air to be conditioned.

2. Air conditioning apparatus comprising in combination; a casing; a compressor within said casing having an inlet port and an outlet port; a compressor operating shaft having one end projecting through one wall of said casing; means carried by said projecting end of said shaft for rotating said shaft; means forming a shaft seal cavity adjacent said shaft; shaft seal means within said cavity cooperating with said casing and said shaft for preventing the escape of lubricant along said shaft; said shaft seal means comprising a stationary sealing ring resiliently supported by said casing, a rotatable sealing ring resiliently mounted on said shaft, and resilient washer means biasing said sealing rings into engagement; a porous sintered metal oil separating element adjacent the outlet of said compressor; means cooperating with said porous element for collecting the lubricant separated out thereby; means for supplying lubricant from said lubricant collecting means to said shaft seal cavity; and means providing a passage between said shaft seal cavity and the inlet to said compressor; a wall member within said casing through which the other end of said compressor operating shaft projects; means cooperating with said wall member forming an evaporator chamber adjacent said other end of said shaft; means for condensing the refrigerant compressed by said compressor; and means for supplying condensed refrigerant at a reduced pressure to said evaporator chamber.

3. Air conditioning apparatus comprising in combination; a casing; a compressor within said casing having an inlet port and an outlet port; a compressor operating shaft having one end projecting through one wall of said casing; means carried by said projecting end of said shaft for rotating said shaft; means forming a shaft seal cavity adjacent said shaft; shaft seal means with-

in said cavity cooperating with said casing and said shaft for preventing the escape of lubricant along said shaft; a porous sintered metal oil separating element adjacent the outlet of said compressor; means cooperating with said porous element for collecting the lubricant separated out thereby; means for supplying lubricant from said lubricant collecting means to said shaft seal cavity; means providing a passage between said shaft seal cavity and the inlet to said compressor, a wall member within said casing through which the other end of said compressor operating shaft projects; means cooperating with said wall member forming an evaporator chamber adjacent said other end of said shaft; means for condensing the refrigerant compressed by said compressor; means for supplying condensed refrigerant at a reduced pressure to said evaporator chamber; and means for circulating an air cooling medium in thermal exchange with the refrigerant in said evaporator chamber and in thermal exchange with air to be conditioned; said means for condensing the refrigerant comprising a closed heat transfer system having a heat absorbing element arranged in thermal exchange with the refrigerant to be condensed and having a heat dissipating element arranged in thermal exchange with the outside air.

4. In combination, a casing, a wall member within said casing, a compressor, a compressor operating shaft, bearing means for said shaft provided in said casing and said wall, means cooperating with said wall forming an evaporator chamber, means for collecting lubricant discharged from said compressor along with the compressed refrigerant, means for feeding said lubricant to said bearing means, means for returning the lubricant supplied to the one end of said shaft to the inlet of said compressor, and means for draining the lubricant supplied to the other end of said shaft into said evaporator chamber.

5. In a refrigerating system having a compressor adapted to be operated at widely varying speeds irrespective of refrigeration requirements, a casing, means for dividing said casing into a plurality of compartments, refrigerant compressing mechanism within one of said compartments having an inlet port and outlet port, a compressor operating shaft projecting through said casing, a shaft seal for said shaft, means enclosing said shaft seal, lubricant separating means adjacent said outlet port, means for supplying lubricant from said separating means to said shaft seal enclosing means, means for returning lubricant from said shaft seal enclosing means to the inlet of said compressor, means for condensing refrigerant within one of said compartments, means for evaporating refrigerant in another of said compartments, means for supplying refrigerant condensed in said one compartment to said evaporator compartment at a reduced pressure, means for conveying refrigerant from said evaporator compartment to said inlet port, and means for conveying compressed refrigerant from said outlet port to said condenser compartment.

6. In combination, a casing, a compressor within said casing including a compressor operating shaft and bearing means for said shaft, means forming a condensing chamber within said casing, means forming an evaporator chamber within said casing, refrigerant and lubricant flow connections between said compressor, said condensing chamber and said evaporator chamber, said refrigerant and lubricant flow connections

comprising a plurality of openings leading from said evaporator chamber to the inlet of said compressor, and means cooperating with said openings restricting the flow of liquid refrigerant and lubricant through said openings.

7. In combination, a casing, a compressor within said casing including a compressor operating shaft and bearing means for said shaft, means forming a condensing chamber within said casing, means forming an evaporator chamber within said casing, refrigerant and lubricant flow connections between said compressor, said condensing chamber and said evaporator chamber, said refrigerant and lubricant flow connections comprising a plurality of openings leading from said evaporator chamber to the inlet of said compressor, means cooperating with said openings restricting the flow of liquid refrigerant and lubricant through said openings, said refrigerant and lubricant connections also including a passage from the outlet of said compressor to the condenser, means within said last named passage for separating lubricant from the refrigerant, and means for supplying said lubricant to said bearing means.

8. Air conditioning apparatus for use in an automobile comprising in combination; a casing; a compressor within said casing having an inlet port and an outlet port; a compressor operating shaft having one end projecting through one wall of said casing; means carried by said projecting end of said shaft for rotating said shaft; means forming a shaft seal cavity adjacent said shaft; shaft seal means within said cavity cooperating with said casing and said shaft for preventing the escape of lubricant along said shaft; a porous sintered metal oil separating element adjacent the outlet of said compressor; means cooperating with said porous element for collecting the lubricant separated out thereby; means for supplying lubricant from said lubricant collecting means to said shaft seal cavity; means providing a passage between said shaft seal cavity and the inlet to said compressor, a wall member within said casing through which the other end of said compressor operating shaft projects; and means cooperating with the said wall member forming a low pressure refrigerant chamber adjacent said other end of said shaft whereby said other end is cooled by the evaporating refrigerant.

9. Air conditioning apparatus for use in an automobile comprising in combination; a casing; a compressor within said casing having an inlet port and an outlet port; a compressor operating shaft having one end projecting through one wall of said casing; means carried by said projecting end of said shaft for rotating said shaft; means forming a shaft seal cavity adjacent said shaft; shaft seal means within said cavity cooperating with said casing and said shaft for preventing the escape of lubricant along said shaft; a porous sintered metal oil separating element adjacent the outlet of said compressor; means cooperating with said porous element for collecting the lubricant separated out thereby; means for supplying lubricant from said lubricant collecting means to said shaft seal cavity; means providing a passage between said shaft seal cavity and the inlet to said compressor whereby refrigerant entrained by the lubricant evaporates to cool said shaft and shaft seal means, a wall member within said casing through which the other end of said compressor operating shaft projects; means cooperating with said wall member form-

ing a low pressure chamber adjacent said other end of said shaft; and means for supplying refrigerant and lubricant at a reduced pressure to said chamber.

10. In combination, a casing, a wall member within said casing, a compressor, a compressor operating shaft, bearing means for said shaft provided in said casing and said wall, means cooperating with said wall forming a low pressure chamber in which oil may collect, means for collecting lubricant discharged from said compressor along with the compressed refrigerant, means for feeding said lubricant to said bearing means, means for returning the lubricant supplied to the one end of said shaft to the inlet of said compressor, and means for draining the lubricant supplied to the other end of said shaft into said chamber.

11. In combination, a casing, a compressor within said casing including a compressor operating shaft and bearing means for said shaft, means forming a high pressure chamber within said casing, means forming a low pressure chamber within said casing, refrigerant and lubricant flow connections between said compressor, said high pressure chamber and said low pressure chamber, said refrigerant and lubricant flow connections comprising a plurality of openings leading from said low pressure chamber to the inlet of said compressor, and means cooperating with said openings restricting the flow of liquid refrigerant and lubricant through said openings.

12. In a refrigerating system, a casing, refrigerant compressing mechanism within said casing having an inlet port and an outlet port, a compressor operating shaft projecting through said casing, a shaft seal for said shaft, means enclosing said shaft seal and forming a shaft seal cooling cavity, a lubricant separating means adjacent said outlet port, means for supplying lubricant from said separating means to said shaft seal cooling cavity, means for connecting said shaft seal cooling cavity to the inlet port of said compressor, means for condensing refrigerant, means for evaporating refrigerant, means for supplying condensed refrigerant to said evaporator at a reduced pressure, means for conveying refrigerant from said evaporator to said inlet port, and means for conveying compressed refrigerant separated from said lubricant to said condenser.

13. In a volatile refrigerant system, an evaporator, a condenser, a compressor, refrigerant flow connections between said evaporator, condenser and compressor, said compressor having a compressor operating shaft and a bearing therefor, a shaft seal for preventing the escape of lubricant and refrigerant from said bearing to the outside atmosphere, means forming a cavity surrounding said shaft seal, means for supplying lubricant containing refrigerant under pressure to said shaft seal cavity comprising a lubricant supply passage having a fixed restriction adjacent the outlet thereof into said shaft seal cavity, and means for maintaining said cavity at a pressure lower than the pressure of the lubricant and refrigerant supplied thereto whereby the refrigerant evaporates and cools said shaft seal.

14. Air conditioning apparatus comprising in combination; a casing; a compressor within said casing having an inlet port and an outlet port; a compressor operating shaft having one end projecting through one wall of said casing; means carried by said projecting end of said shaft for

rotating said shaft; means forming a shaft seal cavity adjacent said shaft; shaft seals means within said cavity cooperating with said casing and said shaft for preventing the escape of lubricant along said shaft; a porous sintered metal oil separating element adjacent the outlet of said compressor; means cooperating with said porous element for collecting the lubricant separated out thereby; means for supplying lubricant from said lubricant collecting means to said shaft seal cavity; means providing a passage between said shaft seal cavity and the inlet to said compressor; means forming an evaporator chamber; means for condensing the refrigerant compressed by said compressor; and means for supplying condensed refrigerant at a reduced pressure to said evaporator chamber.

15. Air conditioning apparatus comprising in combination; a casing; a compressor within said casing having an inlet port and an outlet port; a compressor operating shaft; means for rotating said shaft; means forming a shaft seal cavity adjacent said shaft; shaft seal means within said cavity cooperating with said casing and said shaft for preventing the escape of lubricant along said shaft; said shaft seal means comprising a stationary sealing ring resiliently supported by said casing, a rotatable sealing ring resiliently mounted on said shaft, and resilient washer means biasing said sealing rings into engagement; a porous sintered metal oil separating element adjacent the outlet of said compressor; means cooperating with said porous element for collecting the lubricant separated out thereby; means for supplying lubricant from said lubricant collecting means to said shaft seal cavity; and means providing a passage between said shaft seal cavity and the inlet to said compressor; means forming an evaporator chamber; means for condensing the refrigerant compressed by said compressor; and means for supplying condensed refrigerant at a reduced pressure to said evaporator chamber.

16. In a volatile refrigerant system; an evaporator; a condenser; a compressor; refrigerant flow connections between said evaporator, condenser and compressor; said compressor having a compressor operating shaft and a bearing therefor; means forming a cavity adjacent said shaft; means for supplying lubricant containing refrigerant under pressure to said cavity comprising a lubricant supply passage having a fixed restriction adjacent the outlet thereof into said cavity; and means for maintaining said cavity at a pressure lower than the pressure of the lubricant and refrigerant supplied thereto whereby the refrigerant evaporates so as to produce a cooling effect.

17. In a volatile refrigerant system; an evaporator; a condenser; a refrigerant compressor having an inlet port and an outlet port and having bearing means lubricated by means of lubricant flowing through said compressor; refrigerant flow connections between said evaporator, condenser and compressor; and oil separating means located adjacent the outlet port comprising a porous sintered metal member through which the compressed refrigerant together with any entrained lubricant is required to pass before the compressed refrigerant flows to said condenser; and means for collecting the lubricant thus separated from the refrigerant and for returning the lubricant to said bearing means.

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