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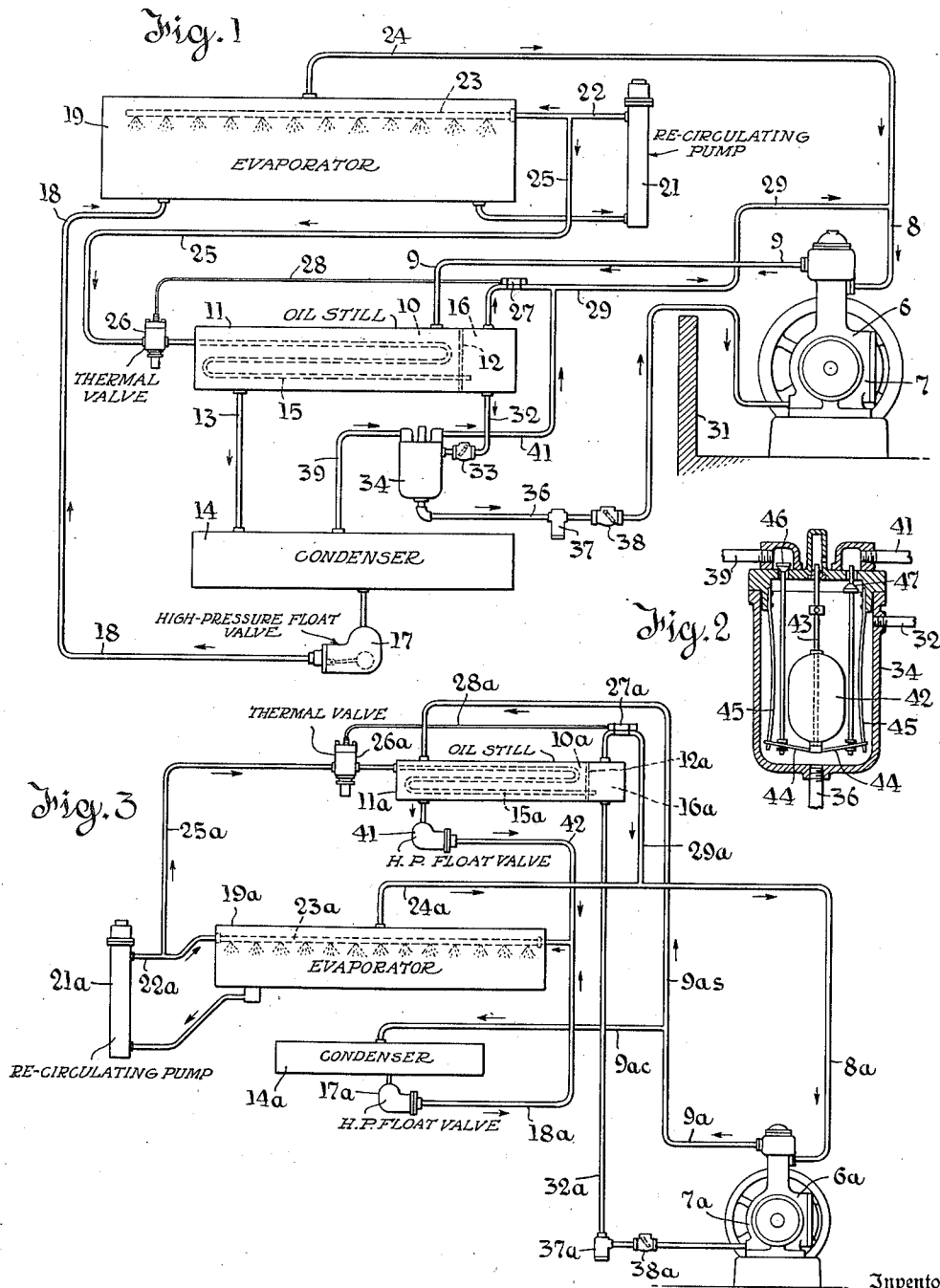
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REFRIGERATION

Filed May 10, 1939

2 Sheets-Sheet 1



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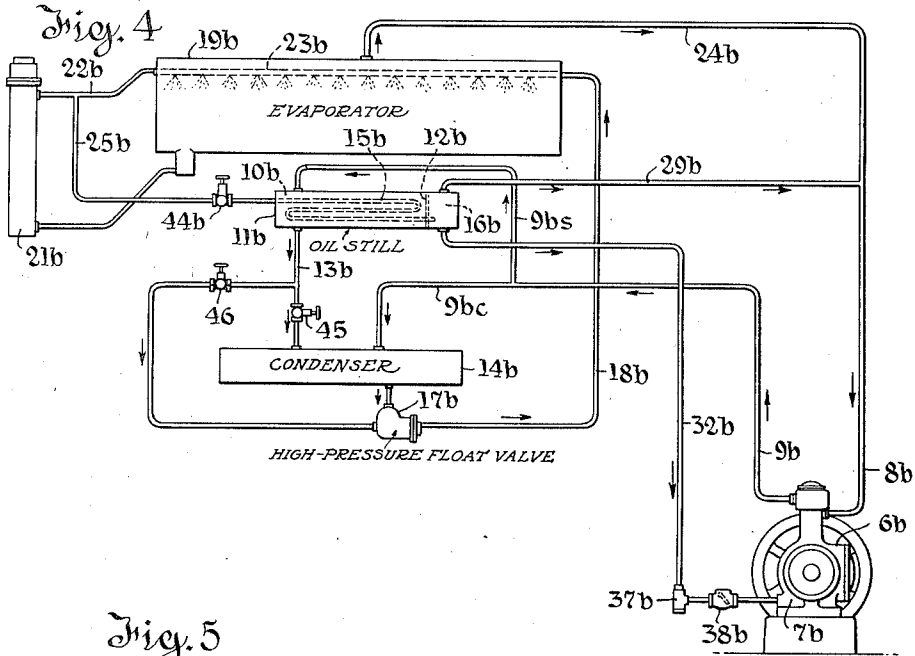
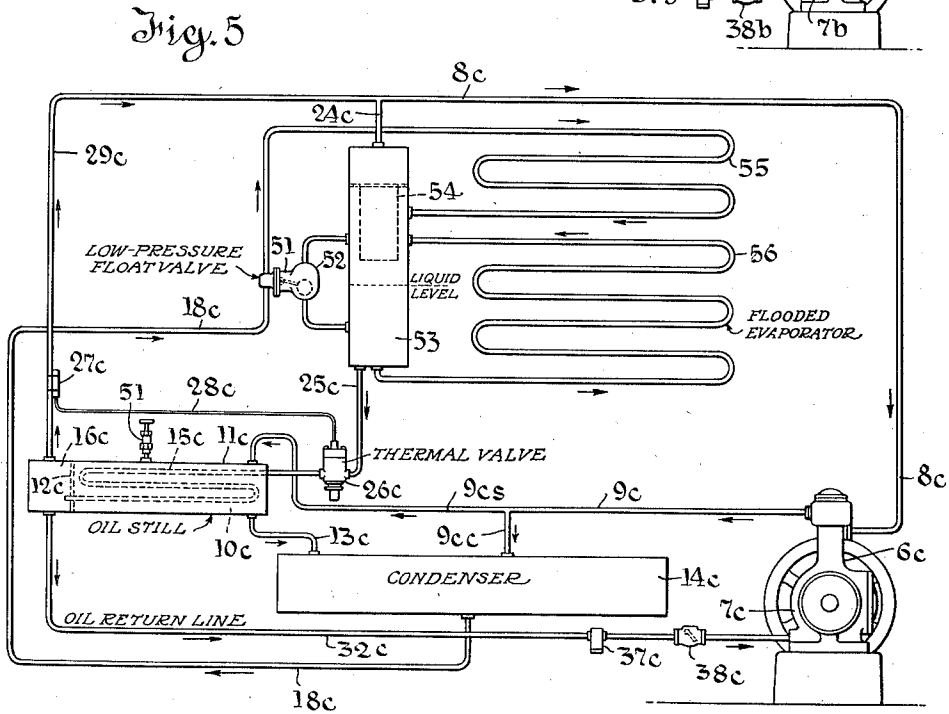
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UNITED STATES PATENT OFFICE

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REFRIGERATION

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12 Claims. (Cl. 62—115)

This invention relates to refrigeration and particularly to a system for returning oil from the evaporator, or any other point in the circuit where oil tends to accumulate, to the compressor.

5 It is well known that in the operation of refrigerating systems a certain amount of oil leaves the compressor with the compressed refrigerant (which is then in the vapor stage), passes to the condenser in which the refrigerant is cooled and liquefied and thence passes with the liquid refrigerant to the evaporator. The oil tends to accumulate in the evaporator as a result of the evaporation of the refrigerant from the mixture of oil and refrigerant.

10 Such accumulation is objectionable, for several reasons. It causes foaming in the evaporator with consequent wet compression. With certain refrigerants ("Freon" for example) it raises the boiling point with consequent adverse effect on the heat exchange. Accumulating of oil in the evaporator is attended by depletion of the oil charge normally in the compressor.

15 Lubricating oils are miscible or soluble in some degree in practically all known refrigerants. This is true even as to ammonia unless the oil ammonia mixture be substantially quiescent. The problem of separation is peculiarly difficult, however, in connection with certain refrigerants now in extensive use, notably that sold under the trade name of "Freon", because of miscibility of oil in all proportions in such refrigerant. Temperature, pressure and viscosity of the oil are modifying factors in the characteristics of the mixture, but the problem of separation is substantial.

20 Continuous distilling processes have been proposed in which the heat for operating the still is derived from warm liquid leaving the condenser. However, such schemes are not practicable because whenever the condenser water temperature is low, the temperature of the liquid refrigerant leaving the condenser is too low for an effective distilling operation. None so far proposed is believed to be operative under practical service conditions, for this and other reasons.

25 Batch distilling schemes, in which the heat for distilling is derived from hot gas flowing from the compressor to the condenser have been proposed and are workable in certain cases, but are not satisfactory with many refrigerants, notably Freon, for the reason that although the oil is miscible with or soluble in the refrigerant, the oil and refrigerant have a tendency to separate under certain conditions when the mixture is warmed.

In such case the refrigerant settles to the bottom and the oil floats on top. As a result of this effect, the batch still occasionally functions to return to the compressor a considerable quantity of refrigerant in the liquid phase. This causes foaming in the crank case and is highly objectionable since it impairs lubrication. Hence such systems are impracticable for direct and automatic return of oil to the crank case.

5 The present invention offers a continuous and automatic distilling equipment, in which the heat for distilling is preferably derived from hot compressor discharge gas. However the heat is provided, the still includes a separating chamber with one connection for returning oil directly to the crank case of the compressor and another connection for returning refrigerant in the vapor phase directly to the suction line of the compressor. The still draws oil-refrigerant mixture from the evaporator at a rate so limited that all refrigerant is evaporated. A superheat responsive, flow controlling valve similar to an automatic expansion valve is the best means known to ensure such a flow rate. Means can be interposed between the separating chamber and the crank case to return the oil to the crank case when the compressor is remote from or above the level of the still or both.

10 A system of the type in which hot compressor discharge gas is used for heating, penalizes the overall efficiency of the refrigerating circuit in a slight degree, but the penalty does not exceed 1% so that the markedly better separation secured justifies the use of the system.

15 A number of different embodiments will be disclosed indicating the versatility of the inventive concept. For example, it can be used with a spray type evaporator in which the refrigerant is circulated by a pump and showered over the heat transfer surfaces. It can be arranged to return the oil to the compressor over a wall or even when the compressor is located at an elevation higher than that of the still. It can be arranged to work when the still must be located at an elevation higher than the condenser or higher than both the evaporator and the condenser. It can also be arranged to operate with flooded evaporators not having a circulating pump.

20 While it is impossible to illustrate all the possible variants that can be worked out, the various embodiments hereinafter described will illustrate the principles involved, and will readily suggest to those skilled in the art, the con-

trolling factors as to each phase of the problem.

Basically, however, the invention involves a continuous distilling apparatus arranged to derive heat from hot gas leaving the compressor, and in which the parts are so coordinated with the refrigeration circuit that refrigerant is substantially completely removed from the oil and returned to the compressor suction line and the oil thus freed of refrigerant is automatically and substantially continuously returned to the compressor crank case.

This is a definite advance over batch methods, all of which, so far as applicant is aware, involve either manual periodic controls or cyclic controls incident to the starting and stopping of the compressor. Unlike batch systems a system according to the present invention becomes operative to return oil, and only oil, to the crank case as soon as the compressor starts into operation. The system remains continuously in operation while the compressor runs. Hence the system is effective without regard to load, shut-downs or other factors which affect, if they do not control, the functioning of prior systems.

In the drawings:

Figure 1 is a diagrammatic view of a refrigerating circuit embodying my invention and showing an evaporator of the type in which the refrigerant is recirculated by a pump, the still being shown below the evaporator and above the condenser, and the oil return being provided with a trap which is needed only in cases where the oil must be returned over a wall or to the crank case of a compressor located at a higher elevation.

Figure 2 is a sectional detail view of the trap used in Figure 1.

Figure 3 shows a modified arrangement in which the oil still is above both the evaporator and the condenser. Since the still is located at a level higher than the crank case of the compressor no trap is required.

Figure 4 shows a further modification in which the oil still is located approximately as in Figure 1 with reference to the evaporator and the condenser, but being above the compressor crank case, no oil trap is required. In this view the use of a manually adjustable flow control valve on the still circuit is indicated.

Figure 5 is a view of a further modification, showing the use of a different type of evaporator not requiring the use of a circulating pump. The location of the still is similar to that in Figure 4.

Embodiment of Figures 1 and 2

The compressor is indicated at 6 and has a crank case 7 designed to serve as an oil sump. The suction line 8 leads to the side of the cylinder, and according to the construction commonly used, the piston is of the trunk type with inlet valves carried in the piston.

In some compressors of this type, the suction space below the head of the piston is in free open communication with the crank case. In other types they are isolated to the extent that the piston has a closed skirt and an oil scraping ring on such skirt somewhat restricts communication. Even in the latter case the crank case pressure approximates suction pressure in the system at all times. Consequently, with reference to Figure 1 and all other embodiments in the present case, it may be assumed that the crank case is at or substantially at suction pressure.

The discharge line 9 from the compressor

enters chamber 10 in the shell 11 of the oil still to the left of a partition indicated at 12. The line 13 leaves the chamber 10 and is in free communication with the condenser 14 which may here be assumed to be of the water cooled type, although the specific type of condenser is not controlling. The invention has particular importance where a water cooled condenser is used, for the reason above explained.

Extending through the chamber 10 is a heat exchange coil 15 here indicated as a simple zig-zag coil without fins, but persons skilled in the art will understand that this showing is diagrammatic and that the coil may assume any form necessary or desirable to give an adequate heat exchange surface between the hot gas flowing from 9 to 13 through chamber 10 and a mixture of refrigerant and oil flowing from left to right through the coil 15. The coil 15 discharges into the oil separation chamber 16 within shell 11 to the right of partition 12.

Before going further into the details of the still circuit, the remainder of the main refrigeration circuit will be traced.

From the bottom of the condenser 14, liquid passes through a high side float valve 17 and thence through a liquid line 18 to the evaporator 19. The heat exchange surface in the evaporator may take any form and no attempt to illustrate it is made. A recirculating pump 21 draws liquid refrigerant from the bottom of the evaporator 19 and delivers it through a connection 22 to the spray pipe 23 within the evaporator 19.

It will readily be understood by those skilled in the art that the liquid refrigerant discharged through the spray pipe 23 will flow over heat transfer surfaces such as tubes located in the evaporator but not shown, and will evaporate under suction pressure in the system because the top of the evaporator is connected by the suction line 24 with the intake 8 of the compressor 6. The latent heat of vaporization is derived from the heat transfer surfaces.

It is obvious that with a refrigerating circuit such as that above described, oil leaving the compressor through the line 9 and entrained by hot gas will pass through the shell 11 and connection 15 to the condenser. The refrigerant will be liquefied in the condenser and will there mix with or dissolve the oil, so that an intimate mixture of refrigerant with a small percentage of oil will pass to the evaporator 19.

In the evaporator only the refrigerant evaporates, and substantially all the oil remains, thus creating an inherent tendency for the oil concentration in the evaporator to rise steadily as the system operates. To hold this concentration within reasonable limits and to maintain an adequate quantity of oil in the crank case 7, a portion of the refrigerant delivered by the pump 21 through the connection 22 is diverted to a branch line 25 and thence fed through the flow control valve 26 to the coil 15 in the oil still.

While any type of flow control valve may be used, I prefer to use a flow control valve of the thermal control type, in which the pressure in the thermostatic bulb 27 communicated to a diaphragm in valve 26 by way of the tube 28 acts in a valve opening direction and opposes pressure on the discharge side of the valve 26 acting in a valve closing direction. The control is such that refrigerant leaving the chamber 16 and passing to the suction connection 8 by way of the branch suction line 29 is always slightly superheated. This amounts to saying that the valve 25

26 automatically regulates the flow through coil 15 to a rate such that all the refrigerant passing valve 26 will be evaporated. It must be completely evaporated if slight superheating of the vapor occurs. Such valves are similar to expansion valves of known commercial forms and are well known. Any preferred form capable of ensuring complete evaporation may be used. Thus the coil 15 discharges vaporized refrigerant and also oil which is substantially free of refrigerant into chamber 16. The vaporized refrigerant flows to the compressor by way of the branch suction connection 29.

Since the chamber 16 is at suction pressure and since the crank case 7 is at suction pressure, it would be practicable to feed the oil from the chamber 16 to the crank case 7 by simple gravity flow as proposed in other modifications herein illustrated, if the bottom of the still 11 were above the oil level in the crank case 7, but Figure 1 is designed to show the solution of a more difficult problem in which the location of the compressor is relatively high and remote and communication must be made over a wall or partition 31. Such conditions are encountered in commercial installations.

Thus in Figure 1 the oil discharge connection 32 which leaves from the chamber 16 cannot lead directly to the crank case 7. Instead it leads through a check valve 33 to a float trap 34. From the bottom of this float trap the return line 36 leads to crank case 7 through a strainer 37 and a check valve 38.

The construction of the trap is shown on an enlarged scale in Figure 2. A connection 39 leads from the top of condenser 14 and is consequently subject to the discharge pressure of the compressor (that is, subject to "high side" pressure). This connection leads to the top of the trap 34. Another connection 41 leads from the top of the trap 34 to the branch suction line 29. The purpose of these two connections is to subject the interior of the trap 34 alternatively to high side and to low side pressures.

A float 42 in the trap is guided for vertical movement by a stem 43. A toggle mechanism, comprising two toggle levers 44 hinged together and sustained at their remote ends by the leaf springs 45 which tend to approach each other and are forced outward by the toggle levers 44, forms a quick throw mechanism by means of which the float 42 closes the valves 46 and 47 selectively.

The normal condition is with the float down, at which time the valve 46 seats downward and prevents the entrance of high side pressure through the connection 39. At such time the valve 47 is open and the interior of the trap 34 is at suction pressure. Thus oil may enter freely through the pipe 32 and check valve 33.

When the oil accumulates to a sufficient depth, it will cause the float 42 to rise. When the toggle shifts it will open the valve 46 and close the valve 47. This cuts off the connection to the "low" side of the system by way of line 29 and subjects the interior of the trap to "high" side pressure. It follows that the oil in the trap is displaced by flow through the pipe 36 and enters the crank case 7 which is at low side pressure. Consequent descent of the float 42 causes the toggle to shift and thus close valve 46 and reopen valve 47 before the entire charge of oil leaves the trap. Thus the high side and the low side are never freely connected with each other, but the pres-

sure differential is availed of to transfer the oil to the crank case.

This is simply a commercial trap chosen for illustrative purposes. Equivalent devices (not all of which are traps) are known and may be substituted.

Embodiment of Figure 3

The construction shown in Figure 3 is essentially similar to that shown in Figure 1, and similar parts are numbered similarly with a distinguishing letter *a*. The differences can readily be explained.

The still here shown is located above the evaporator and above the compressor. Its indicated position above the condenser is not essential. Instead of using the high pressure line 13 from the still to the condenser and passing all the hot gas through the still, the line 9a branches, and one branch 9ac leads to the condenser and the other branch 9as leads to the still. Thus only part of the hot gas is used in the still and is there condensed. This condensed refrigerant flows through a high side float valve 41 and a line 42 directly to the evaporator. Obviously the still can be located at any height which will give proper flow to the compressor crank case.

The float valve 41 ensures that the refrigerant is in the liquid phase before it leaves the still. The liquid line 18a from the condenser meets the line 42 and they both enter the end of the spray pipe 23a remote from the pump 21a. This is illustrated as a possible alternative way of supplying liquid refrigerant to the evaporator 19a, but the refrigerant could enter the evaporator just as well in the manner shown in Figure 1.

Figure 3 shows how the still can be located above all other components in the system, making it relatively simple to secure gravity flow of oil back to the compressor however this be located. Oil flow to the crank case occurs through the line 32a, strainer 37a and check valve 38a.

Embodiment of Figure 4

The embodiment shown in Figure 4 has aspects of similarity to both Figures 1 and 2. The corresponding parts are similarly numbered, using the distinguishing letter *b*.

The discharge 9b branches, one branch 9bc passing to the condenser and the other branch 9bs passing to the oil still, but the discharge gas passing through the oil still enters the condenser through a connection 13b, so that in one feature it resembles Figure 1 and in the other Figure 2.

Instead of an automatic flow control valve such as 26 or 26a, use is made of a manually adjusted flow control valve 44 which, however, must be set for a proper flow rate. The purpose of illustrating a manual valve in Figure 4 is to indicate the possibility of its use here, and also in the structure of any of the figures, to control the rate of flow through the transfer coil. The return of oil through the line 32b is by gravity as in Figure 2. The trap arrangement of Figure 1 obviously could be inserted in case of need.

In order to indicate the fact that the line 13b might enter the condenser 14b either directly or through the float chamber of float valve 17b, two stop valves 45 and 46 are indicated. The valve 45 controls a direct connection to the condenser. The valve 46 controls a connection to the chamber of float 17b. The connections are functionally the same. Only one of the valves 45, 46 would be open at a time, and in a com-

mercial installation one or the other connection would be made and the other omitted. The purpose is to indicate on Figure 4 that either type of connection may be used.

Embodiment of Figure 5

Figure 5 differs from the other figures chiefly in the form of the evaporator and is included to make clear the fact that the invention is not limited to use with an evaporator having pump circulation and sprays.

The general arrangement resembles Figure 4 in that the evaporator is above the still and the still is above the condenser, the oil being returned to the crank case by gravity. A trap can be used when the location of the compressor requires. Parts similar to those in other figures will be given the same reference numeral with the distinguishing letter c.

It will be observed that the high pressure line 9c branches, one branch 9cc going to the condenser and the other branch 9cs to the still.

With this explanation, the similarity of the parts numbered 6c to 18c will be readily apparent. The parts 24c to 38c are also essentially similar in form and arrangement to those already described. However, the evaporator parts which are numbered 19 to 23 in Figure 1 are replaced by others, which will now be described.

The liquid line 18c leads to the valve element 51 of a low side float valve whose float chamber is indicated at 52 and is piped to a receiver suction trap 53. This receiver suction trap takes the form of a vertical cylinder with a cylindrical baffle 54 in its upper portion. Above this baffle the suction connection 24c leads from the interior of the trap to the suction 8c of the compressor.

Thus the float in the chamber 54 corresponds to the liquid level in the receiver suction trap 53 and controls flow of refrigerant directly from the liquid line 18c to a coil 55 in which the refrigerant is partly evaporated, the lower end of the coil discharging into the trap 53 opposite the baffle 54. Thus the float valve operates to maintain a constant liquid level in the trap and the entering liquid is partly evaporated in an entrance coil 55.

Leading from the bottom of the trap 53 is a flooded evaporator coil 56 which is shown as a simple zig-zag coil and which re-enters the trap above the liquid level and opposite the baffle 54.

As is well understood, active evaporation of refrigerant in the coil 56 will produce rapid circulation in that coil. The effect of such evaporation is to increase the concentration of oil in the liquid in the drum 53. Part of this flows off through the connection 25c under the control of the automatic flow control valve 26c. The control is at such a rate that the refrigerant is substantially completely evaporated in passing through the coil 15c, so that the refrigerant returns to the suction line 24c from chamber 16c by way of line 29c and oil flows by gravity back to the crank case 7c, as clearly indicated in the drawings.

A purge valve 51 is indicated in shell 11.

In this device, as in all others illustrated, a trap structure such as shown in Figure 2 can be inserted as indicated in Figure 1, whenever necessary to deliver the oil to the crank case against reasonable gravity or pressure head.

All four embodiments above described have in common the idea of continuous distillation of

refrigerant from oil by the use of heat derived from hot gas.

In Figure 1 all the hot gas passes through the still. In the remaining figures only a part of the hot gas passes through the still.

While hot gas from the compressor offers the best source of heat at suitable temperature, because it is in a sense waste heat and because it becomes available automatically upon starting the compressor, other sources of heat at suitable temperature could be used. If such source be substituted, the idea of controlled continuous flow of liquid mixture from evaporator to suction line, while the system operates, ensuring complete evaporation of refrigerant, would still be present.

Means, of which the illustrated trap is typical, may be used to return the oil against adverse pressure conditions. The various arrangements shown indicate that the still may be located in a wide range of positions relatively to the condenser and the evaporator.

Two distinct types of evaporator are illustrated, and the adaptability of the inventive concept of these two types is clearly disclosed. It is similarly applicable to other specifically different types.

While it is impossible to illustrate every conceivable embodiment of the invention, sufficient has been shown to indicate the versatility of the scheme. By a conjoint use of various principles illustrated by the different figures, it is possible to meet almost any condition that may be encountered in practice.

The illustrations of evaporators, heat exchangers, etc., are conventional. Obviously the selection of any type of exchanger having extended surfaces is a matter of mechanical skill so far as the present invention is concerned. Consequently the descriptions given are general and intended to be illustrative and not limiting. The scope of the invention is defined by the claims.

What is claimed is:

1. The method of operating a refrigerating system of the compressor, condenser, evaporator circuit type using a volatile refrigerant and having a compressor lubricating means using a lubricant miscible with such refrigerant, which method comprises passing at least a portion of the hot refrigerant gas compressed by the compressor in heat exchanging relation with oil-refrigerant mixture in which mixture the refrigerant is initially in the liquid phase, said mixture being continuously withdrawn from the evaporator and subjected during such heat exchange to suction pressure of the circuit; limiting the rate of withdrawal of such mixture sufficiently to assure that the refrigerant component thereof evaporates; returning said evaporated refrigerant to the suction of the compressor; and delivering the lubricant thus freed of refrigerant to the lubricating means of the compressor.

2. The method of operating a refrigerating system of the compressor, condenser, evaporator circuit type using a volatile refrigerant and having a compressor lubricating means using a lubricant miscible with such refrigerant, which method comprises passing all of the refrigerant flowing from the compressor to the condenser in heat exchanging relation with oil-refrigerant mixture in which the refrigerant is initially in the liquid phase, said mixture being continuously withdrawn from the evaporator and subjected

during such heat exchange to suction pressure of the circuit; limiting the rate of withdrawal of such mixture sufficiently to assure that the refrigerant component thereof evaporates; returning said evaporated refrigerant to the suction of the compressor; and delivering the lubricant thus freed of refrigerant to the lubricating means of the compressor.

3. A refrigerating circuit containing a volatile refrigerant and comprising, a compressor; a condenser to which the compressor delivers compressed refrigerant; an evaporator connected with the suction of said compressor; flow controlling means for delivering refrigerant from the condenser to the evaporator; lubricating means for said compressor operating substantially at suction pressure in the system; an oil still comprising a separating chamber and a heat exchanger, the latter having two flow paths the first of which delivers to said chamber; connections, one leading from the upper portion of said chamber to the suction of the compressor and another from the lower portion of said chamber to said lubricating means; a flow control valve connected to deliver liquid refrigerant and lubricant from the evaporator at a restricted rate to said first flow path; and means rendered effective upon operation of said compressor for circulating a heating fluid through said second flow path.

4. The combination with the structure defined in claim 3, of a trap interposed in the connection between said chamber and said lubricating means; said trap including automatic valve mechanism for subjecting the trap alternately to suction pressure in the system to cause it to receive lubricant from said chamber and a high side pressure while isolating said trap from said chamber to cause the transfer of lubricant from said trap to said lubricating means.

5. A refrigerating circuit containing a volatile refrigerant and comprising, a compressor; a condenser to which the compressor delivers compressed refrigerant; an evaporator connected with the suction of said compressor; flow controlling means for delivering refrigerant from the condenser to the evaporator; lubricating means for said compressor operating substantially at suction pressure in the system; an oil still comprising a separating chamber and a heat exchanger, the latter having two flow paths the first of which delivers to said chamber; connections, one leading from the upper portion of said chamber to the suction of the compressor and another from the lower portion of said chamber to said lubricating means; a flow control valve connected to deliver liquid refrigerant and lubricant from the evaporator at a restricted rate to said first flow path; and connections for passing at least a part of the refrigerant delivered by the compressor through said second flow path.

6. The combination with the structure defined in claim 5 and so arranged that said second path is interposed in a by-pass from the discharge of the compressor to the high side of the system without passing through the condenser, of an automatic valve arranged to inhibit the discharge of vaporous refrigerant from said second path to said high side of the system.

7. A refrigerating circuit containing a volatile refrigerant and comprising, a compressor; a condenser to which the compressor delivers compressed refrigerant; an evaporator connected with the suction of said compressor; flow con-

trolling means for delivering liquid refrigerant from the condenser to the evaporator; lubricating means for said compressor operating substantially at suction pressure in the system; an oil still comprising a separating chamber and a heat exchanger, the latter having two flow paths, the first of which delivers to said chamber; connections one leading from the upper portion of said chamber to the suction of the compressor and another from the lower portion of said chamber to said lubricating means; a flow control valve of the superheat control type connected to deliver liquid refrigerant and lubricant from the evaporator to said first flow path and arranged to control the supply in such a way that refrigerant leaving said separating chamber is completely evaporated; and connections for passing at least a part of the refrigerant delivered by the compressor through said second flow path.

8. A refrigerating circuit containing a volatile refrigerant and comprising, a compressor; a condenser to which the compressor delivers compressed refrigerant; an evaporator connected with the suction of said compressor; flow controlling means for delivering refrigerant from the condenser to the evaporator; lubricating means for said compressor operating substantially at suction pressure in the system; an oil still comprising a separating chamber and a heat exchanger, the latter having two flow paths, the first of which delivers to said chamber; connections one leading from the upper portion of said chamber to the suction of the compressor and another from the lower portion of said chamber to said lubricating means; a flow control valve connected to deliver liquid refrigerant and lubricant from the evaporator at a restricted rate to said first flow path; and connections whereby refrigerant compressed by the compressor and flowing to the condenser flows through said second flow path.

9. The combination defined in claim 8, in which all the refrigerant compressed by the compressor flows to the condenser through said second path.

10. The combination defined in claim 8, in which said second path is interposed in a by-pass leading from the discharge of the compressor to the condenser, said by-pass being in parallel with the main connection from the compressor to the condenser.

11. A refrigerating circuit containing a volatile refrigerant and comprising, a compressor; a condenser to which the compressor delivers compressed refrigerant; an evaporator connected with the suction of said compressor; flow controlling means for delivering refrigerant from the condenser to the evaporator; lubricating means for said compressor operating substantially at suction pressure in the system; an oil still comprising a separating chamber and a heat exchanger, the latter having two flow paths, the first of which delivers to said chamber; connections one leading from the upper portion of said chamber to the suction of the compressor and another from the lower portion of said chamber to said lubricating means; a flow control valve of the superheat control type connected to deliver liquid refrigerant and lubricant from the evaporator to said first flow path, said flow control valve being so arranged that refrigerant leaving said separating chamber is evaporated; and connections for passing refrigerant compressed by the compressor and flowing to the condenser through said second flow path.

12. The method of operating a refrigerating system of the compressor, condenser, evaporator circuit type using a volatile refrigerant and having a compressor lubricating means using a lubricant miscible with such refrigerant, which method comprises passing at least a portion of the hot refrigerant gas compressed by the compressor in heat exchanging relation with oil-refrigerant mixture in which mixture the refrigerant is initially in the liquid phase, said mixture being continuously withdrawn from the evaporator and subjected during such heat exchange to

suction pressure of the circuit; varying the rate of withdrawal of such mixture independently of performance of the evaporator to maintain practically the maximum permissible withdrawal rate consistent with substantially complete evaporation of the refrigerant component of the mixture so withdrawn; returning said evaporated refrigerant to the suction of the compressor; and delivering the lubricant thus freed of refrigerant to the lubricating means of the compressor.

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