June 2, 1942. H. A. PHILLIPS 2,285,123

OIL SEPARATOR AND METHOD OF USE

Filed Oct. 10, 1939

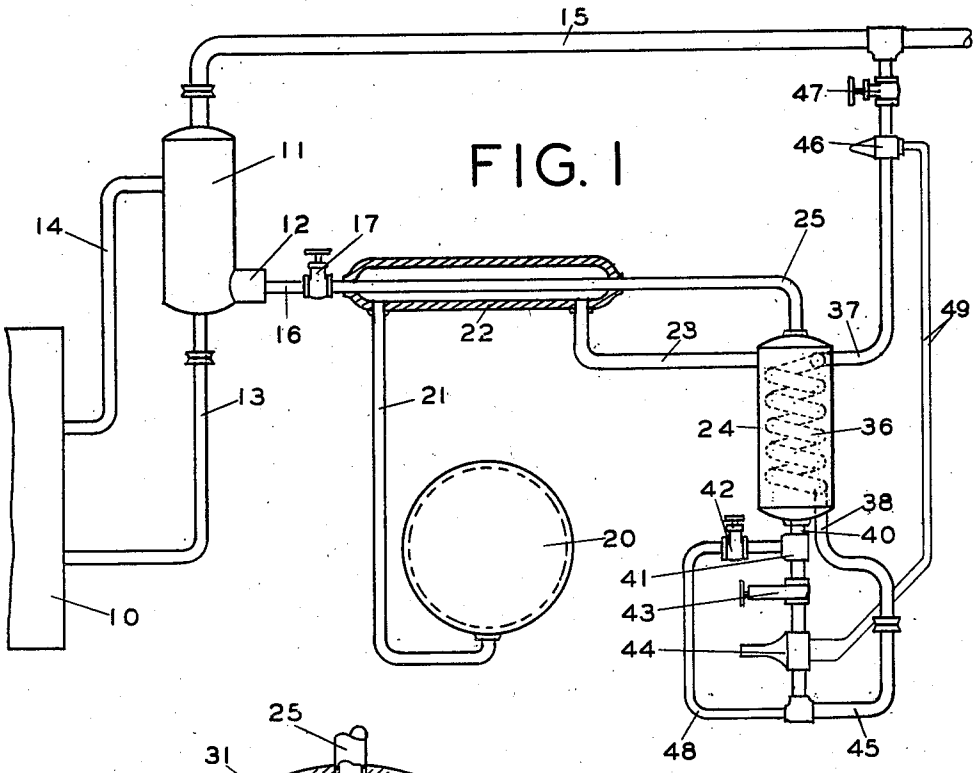


FIG. 1

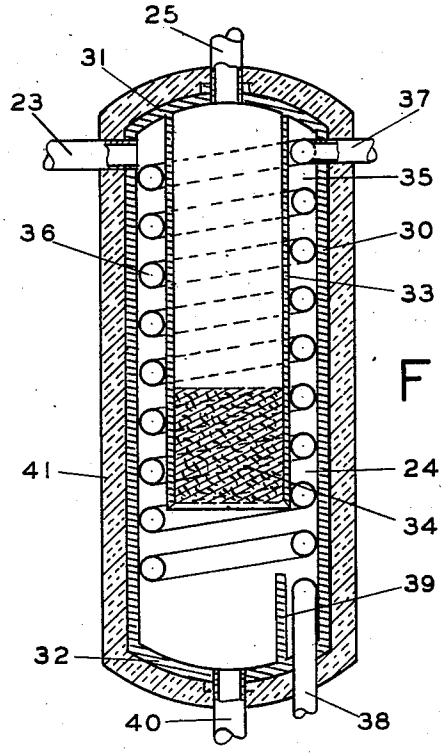


FIG. 2

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Patented June 2, 1942 2,285,123

UNITED STATES PATENT OFFICE

2,285,123

OIL SEPARATOR AND METHOD OF USE

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Application October 10, 1939, Serial No. 298,755

3 Claims. (Cl. 62—115)

This invention relates to an oil separator and method of using same in connection with refrigeration apparatus.

In various types of mechanical refrigeration, lubricating oil becomes mixed with the refrigerating medium used, and it is most important and desirable that as much as possible of this oil be prevented from reaching the apparatus in which the work of refrigeration is carried on.

Oil has a number of detrimental effects in the evaporators, among which are the forming of insulating films on the evaporator surfaces, the interference with the proper ebullition and vaporizing of the refrigerant and the tendency to damp the motion of evaporator float controls.

Undue amounts of oil in an evaporator frequently requires a shut down and blowing off of the evaporator to remove such oil deposits.

The viscosity of oil is greatly increased by the cold evaporator temperatures and thus the evaporator itself tends to act as an oil trap, and may require frequent cleaning to maintain efficiency.

Oil separators of various types have been utilized in refrigeration systems. The methods of operation usually require constant attention and if any oil is in the system, such methods do not protect the plant evaporator from being fouled with same.

The present apparatus and method has as its principal object the by-passing of the oil around the evaporator so that refrigerant, from which oil has been separated, is supplied to the evaporator and thus the degree of oil fouling is materially reduced.

An important object of the invention is the continual return of the separated oil to the main suction line of the plant so that automatic continuous protection may be afforded to the evaporator.

A further object of the invention is the utilizing of a temperature drop to assist in the separation of oil from the refrigerant.

A further object of the invention is the utilization of mechanical means to assist in the separation of oil from the refrigerant.

A further object of the invention is the optional provision of a heat exchanger to effect a reduction in temperature of the mixture prior to the oil separation.

A further object of the invention is to provide means operating a thermo controlled valve to automatically maintain the desired temperature in the separator.

To these and other ends the characteristic features and advantages of my improvement will more fully appear in the following description and the accompanying drawing in illustration thereof.

In the drawing Fig. 1 is a diagrammatic elevation of the apparatus used to carry out the invention and shows a heat exchanger in section.

Fig. 2 is a cross section to an enlarged scale of one form of oil separator drum to be used in connection with the invention.

In the drawing like reference numerals represent like parts. Referring to Fig. 1, reference numeral 10 represents an evaporator which may be of any well known construction. A surge drum 11 is shown as provided with a float control feed valve 12. Pipes 13 and 14 connect the evaporator with the surge drum 11. Pipe 15 conveys vaporized refrigerant from the surge drum 11 and is connected to the main suction line of the refrigeration plant. Liquid refrigerant is fed through pipe 16 to the float valve 12, in accordance with the load demands of the evaporator 10.

A hand valve 17 serves to shut off the supply of refrigerant to the evaporator 10. The plant liquid receiver or reservoir for liquid refrigerant is shown at 20, and 21 is a plant liquid line supplying liquid refrigerant to the evaporator 10 from the receiver 20.

An optional heat exchanger is shown at 22 and liquid from the receiver 20 passes through the pipe 21, the heat exchanger 22 and the pipe 23 into the oil separator 24.

All of the liquid refrigerant required for operation of the evaporator 10, passes through the pipe 23 into the oil separator drum 24, and out of the drum 24 through the pipe 25, thence through the heat exchanger 22, the pipe 16, float valve 12 and surge drum 11. After vaporization in the evaporator 10, the refrigerant passes through the suction line 15 and after being again reduced to liquid by the usual plant apparatus flows back to the receiver 20 to complete its cycle of operation in the well known manner.

Referring to Fig. 2, the oil separator drum 24 comprises the metal shell 30 of cylindrical shape having a head 31 and a bottom 32 to complete the walls of the drum. Attached to the head 31 and extending downwardly within the shell 30 is the internal casing 33. The casing 33 makes a tight joint at its upper end with the head 31 and is open to the interior of the shell 30 at its lower end. As an optianal variation the lower end of the casing 33 may be filled with steel wool or equivalent material as shown at 34.

The casing 33 is centrally positioned within the shell 30 and the annular space 35 between the two provides room for the cooling coil 36 which is wound snugly around the casing 33 and fits snugly within the shell 30. The upper end of the coil 36 is connected with the exit pipe 37 and the lower end of the coil 36 is connected with the inlet pipe 38. Mounted on the bottom 32 is a shield 39 which functions to reduce turbulence within the separator drum which might be engendered by the whirling motion of the fluid descending in the drum 24. The bottom of the drum 24 is provided with an exit pipe 40 through which the separated liquid passes from the drum 24.

In operation the liquid from the plant receiver 20 enters the separator drum 24 through the pipe 23 and flows downwardly within the annular space 35. The helixes of the coil 36 afford a long path for the liquid and also cause a circular or whirling motion of the liquid which assists in separation of oil from the liquid.

As the mixture of liquid refrigerant and oil passes downwardly through the drum 24 the oil is congealed and settles toward the bottom of the drum. The clarified liquid moves upwardly into the casing 33, passing through the steel wool 34, if same is used.

From the casing 33 the liquid passes out of the drum 24, through the pipe 25 and, as shown in Fig. 1, through the heat exchanger 22 in which the cold liquid within the pipe 25 absorbs part of the heat from the warm liquid coming into the heat exchanger through the pipe 21. As shown in Fig. 2 the exterior of the drum 24 is covered with insulation 41.

It will be understood that the oil which passes downwardly in the drum 24 is mixed with refrigerant in liquid form although the percentage of oil is much greater in this mixture than in the mixture entering the separator drum through the pipe 23. The refrigerant in the mixture which exists in the lower portion of the drum 24 is used to refrigerate the drum and to accomplish this the mixture passes from the drum 24 through the exit pipe 40, a T 41, a scale trap 43, a control expansion valve 44 and through the pipe 45 which connects with the inlet pipe 38 for the coil 36. Passing upwardly through the coil 36 the mixture of oil and refrigerant, now under suction pressure, leaves the separator drum 24 through the exit pipe 37, past the thermostatic control 46, the hand valve 47 and finally into the suction line 15, whence it returns to the system.

It will be understood from the operation described that the greater portion of the refrigerant of the total mixture of refrigerant and oil passing through the pipe 21 is separated in the drum 24 and goes into the evaporator 10 in a clarified condition. The balance of the refrigerant, together with the separated oil, by-passes the evaporator and from the oil separator drum, goes directly into the plant suction line.

Valve 44 is controlled by the thermostat control 46 (using an electrical circuit shown diagrammatically at 49) which responds to temperature conditions in the pipe 37, coil 36 and drum 24. Valve 44 acts to modulate the amount of liquid being vaporized through the coil 36. In starting, valve 44 may be kept closed and valve 42 and pipe 48 used to by-pass the valve 44 and manually control the refrigerating effect in the coil 36. When the temperature in the drum 24 is sufficiently reduced, the valve 41 is closed and the valve 44 is used to maintain the temperature in the drum.

Valve 42 may also be used to "blow-off" the drum 24 to the suction line 15, and thus remove accumulated deposits from the drum, the coil 36 and from the steel wool filter mass 34, if same is used.

It will be understood that the coil 36 may be controlled, if preferred, by a customary float valve such as designated at 12 in Fig. 1.

The expansion valve 44 may be self controlled in response to temperature conditions of the liquid leaving the drum 24 through the pipe 40. This will obviate the need for the thermostat 46 and electrical connections 49.

I claim:

1. The method of by-passing oil around an evaporator which comprises the initial passage of liquid refrigerant, containing oil, through a heat exchanger, thereafter chilling and whirling said liquid to clarify a portion thereof; feeding said chilled clarified portion through said heat exchanger and to the said evaporator and thence into the plant suction line and utilizing the remainder of said original liquid refrigerant to accomplish said chilling during its passage with entrained oil to the plant suction line.

2. The method of separating oil from a liquid refrigerant which comprises the steps of simultaneous chilling and whirling of said refrigerant to congeal the oil therein and cause said oil to adhere to the surfaces encountered during its path through the separator apparatus.

3. In a refrigeration system including a liquid refrigerant line and a suction line, apparatus to by-pass oil around a refrigerating evaporator which comprises a heat exchanger; a separator drum provided with a partition member dividing the upper portion of the drum into an annular outer space and an upper interior space; a helical refrigerating coil within said annular space; a pipe for feed of liquid refrigerant, containing oil, through said heat exchanger and into said drum to the said annular space; an exit for clarified liquid refrigerant from said upper interior space through said heat exchanger to provide a liquid feed of refrigerant for said evaporator; and an exit pipe for a mixture of oil and refrigerant from said drum to convey said mixture to said refrigerating coil and thereby cool said coil and drum during its passage therethrough to the said suction line.

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