Dec. 6, 1938. R. F. PEO 2,139,459

OIL SEPARATOR FOR EVAPORATORS

Filed Nov. 16, 1935

Fig. 1.

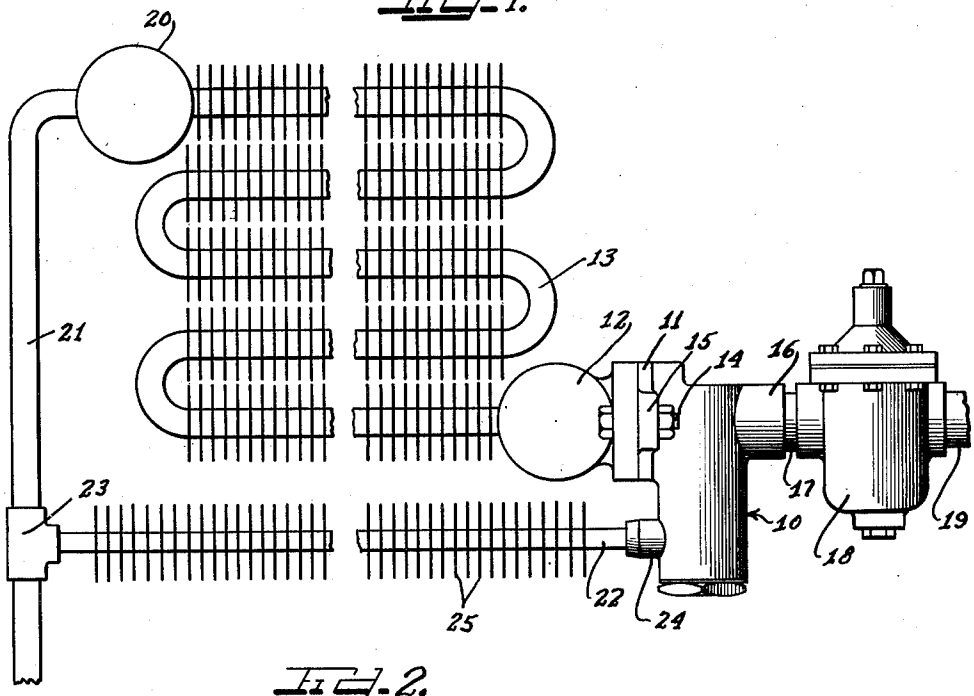


Fig. 2.

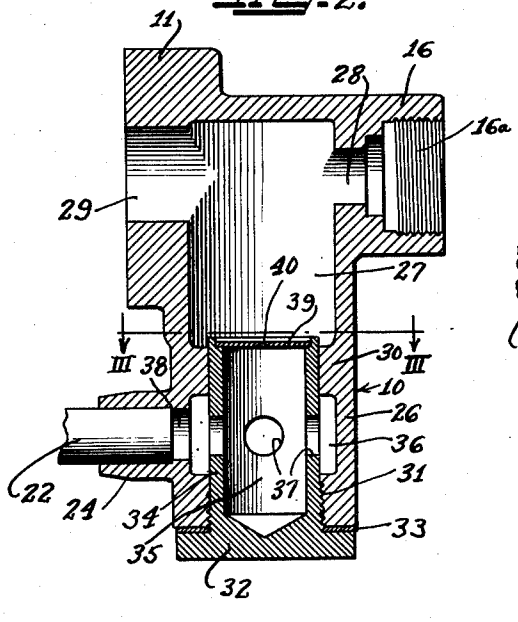
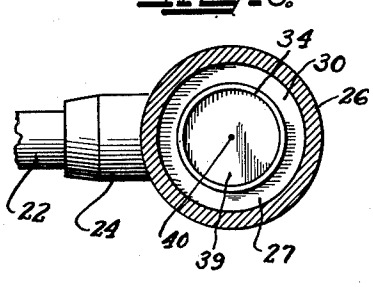


Fig. 3.



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OIL SEPARATOR FOR EVAPORATORS

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4 Claims. (Cl. 62—115)

This invention relates to mechanism for separating high boiling materials, such as oils, from relatively low boiling materials, such as refrigerants.

More specifically, this invention relates to a device for separating oil from refrigerants expanded into an evaporator unit of the dry type and returning the oil to the compressor together with the spent refrigerant.

In mechanical refrigerating systems, it has long been recognized that the refrigerant carries away lubricating oil from the compressor unit and eventually causes a scarcity of lubricant for the bearings of this unit which, in time, will cause the bearings to wear out or become unduly heated by friction. Various means have been heretofore proposed for removing the oil from the refrigerant, but such means have required special changes in the elements comprising the refrigerating system.

I have now provided a device for separating oil from refrigerants, which can be readily inserted in the refrigerating system without redesigning any of the elements therein. My device is especially adapted for use with refrigerating systems having evaporators or cooling coils of the expanded refrigerant or dry type. The device will be specifically described in combination with a refrigerating system using a refrigerant which is compressed and condensed into a liquefied form, from which form it is expanded through an expansion valve into the low side of the system for travel, in its expanded gasified form, through the cooling coil.

The device of this invention is preferably mounted for receiving the expanded refrigerant directly from the expansion valve and also communicates directly with the evaporator or cooling coil.

It is therefore an object of this invention to provide an oil separator for refrigerating systems which can be readily interposed in said systems without redesigning the elements thereof.

Another object of this invention is to provide an oil separator for refrigerant evaporators which may be readily attached to such evaporators.

A further object of this invention is to provide a simplified oil separator for refrigerating systems.

Another object of this invention is to provide a device for separating high boiling materials from low boiling materials, which operates automatically in a circulation system for said materials.

Other and further objects of this invention will become apparent from the following detailed description of the annexed sheet of drawings which discloses a preferred embodiment of the device of this invention.

On the drawing:

Figure 1 is a side elevational view of a device according to this invention interposed between the expansion valve and evaporator of a dry or expanded refrigerant type of refrigerating system.

Figure 2 is an enlarged vertical cross-sectional view taken along a longitudinal plane through the central portion of the device.

Figure 3 is a horizontal cross-sectional view taken substantially along the line III—III of Figure 2.

As shown on the drawing:

As shown in Figure 1, the oil separator 10 of this invention is secured at one side 11 thereof to the inlet header 12 of an evaporator or cooling coil 13 by means of bolts 14 extending through ears or flanges 15 on the device 10. The other side of the device has a boss 16 formed at the top thereof for receiving a pipe or tube 17 which communicates with the low side of an expansion valve 18. The high side of the expansion valve 18 receives compressed and condensed refrigerant through a pipe or tube 19.

In refrigerating systems of the dry type using a refrigerant such as methylene chloride (CH_2Cl_2), the liquefied methylene chloride from the compressor and condenser is fed into the expansion valve 18 through the tube 19 and is expanded directly into the oil separator 10 of this invention. The expanded refrigerant then is drawn through the evaporator or cooling coil 13 wherein it absorbs heat from the surrounding atmosphere and performs its refrigerating purpose. After passing through the cooling coil 13, the expanded refrigerant is collected in an outlet header 20 and sucked into the vacuum line 21 back to the vacuum pump or compressor in which it is compressed and forced through a condenser (not shown) wherein it is liquefied. The system shown in Figure 1 is therefore a dry system in which liquefied refrigerant from the condenser is expanded into the cooling coils which are maintained under vacuum or any pressure less than the pressure maintained on the high side of the expansion valve.

Oil separated from the refrigerant in the device 10 of this invention is reinserted into the system in the suction line 21 by a tube 22 which is connected to a T-coupling 23 in the suction line 21 at one end thereof and at the other end

thereof in a nipple 24 formed on the device 10 near the bottom thereof.

The tube 22 is provided with fins 25 adapted to absorb heat from the surrounding atmosphere and vaporize or distill off any remaining liquid refrigerant in the tube 22. It should be understood that when the refrigerant is completely vaporized or gasified the oil can be readily collected therefrom by the pump to lubricate the bearings therein. However, when the refrigerant is in the compressed or liquefied condition, it dissolves or holds the oil so that it cannot be separated therefrom.

As shown in Figures 2 and 3, the oil separator 10 of this invention comprises an elongated cylindrical housing 26 defining an enlarged chamber 27 near the top thereof. The chamber 27 has an inlet opening 28 near the top thereof communicating with the boss 16. As shown, the boss 16 is internally threaded as at 16a for receiving the pipe or tube 17 in threaded relation therein. An enlarged outlet opening 29 for the chamber 27 is disposed at the top of the chamber opposite the inlet opening 28.

An inturned flange or collar 30 is formed intermediate the ends of the housing 26 and a flange or rim 31 is also formed at the bottom of the housing 26. This flange 31 is interiorly threaded, as shown in Figure 2. A plug 32 is threaded into the end 31 of the housing and sealed therein by a gasket 33. The plug 32 has an elongated hollow shank 34 extending into the housing and defining a well or sump 35 therein. The shank 34 is in snug fitting engagement with the inturned collar 30 of the housing but is spaced from the housing walls at points between the collar 30 and the inturned flange 31 to provide an annular chamber 36 bounded by the inturned collars 30 and 31 at the top and bottom thereof and by the outer wall of the shank 34 and the inner wall of the housing 26 at the sides thereof.

A plurality of openings 37 are formed through the walls of the shank 34 so that the annular chamber 36 will communicate with the well or sump 35 in the plug. An outlet 38 is provided for the annular chamber 36 in communication with the tube 22 described above.

A metal disk 39 is seated in the end of the shank 34 of the plug 32. This disk 39 can be either spun into the end of the shank 34 or merely pressed therein in tight frictional engagement therewith. This metal disk is provided with a small orifice 40 in the center thereof which is merely large enough to allow the passage of oil therethrough which is collected on the bottom of the chamber 27.

In operation, the device of this invention receives expanded refrigerant having the oil dissolved or carried therein. The vacuum line 21 from the cooling coil or evaporator 13 evacuates the chamber 27 of the device and causes the refrigerant therein to gasify. Since the oil has a considerably higher boiling point, it is not gasified and collects at the bottom of the chamber 27, from which it is drained through the orifice 40 in the metal disk 39 into the well or sump 35. Oil in the well or sump 35 overflows into the annular chamber 36 and is removed from the device 10 through the tube 22 which is connected to the vacuum line 21. Any refrigerant still remaining in the oil is fractionally distilled from the oil as it flows along the tube 22 because of the heat exchanging radiating fins 25 disposed around the tube 22. Since the tube 22 is preferably mounted near the cooling coil 13, any cooling effect of the refrigerant being gasified from the oil is utilized to cool the same atmosphere surrounding the cooling coil 13.

The oil separated from the refrigerant is directed into the vacuum line 21 and returned to the compressor or vacuum pump to lubricate the bearings therein. The oil is readily separated from the gasified refrigerant by gravity.

From the above description, it should be understood that I have provided a simplified device for mounting between the expansion valve and the inlet header of the evaporator in a mechanical refrigerating system which efficiently separates any oil dissolved or occluded in the refrigerant and returns this oil to the vacuum pump or compressor of the refrigerating system. The small orifice 40 prevents a short circuiting of refrigerant around the cooling coil since oil separated from the gasified refrigerant in the chamber 27 covers this small opening and is drained at a slow rate therethrough. The evaporator or cooling coil is preferably mounted above the oil separator, as shown in Figure 1, so that any oil which enters these coils with the refrigerant can drain back into the separator.

I am aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I, therefore, do not purpose limiting the patent granted hereon otherwise than is necessitated by the prior art.

I claim as my invention:

1. An oil separator for refrigerating systems comprising a housing defining an enlarged chamber in the top portion thereof, inlet and outlet openings in comunication with the top of said chamber, a plug having a hollow shank inserted through the bottom of said housing and extending into the chamber therein, means defining a restricted orifice seated in the shank of said plug for providing a restricted passageway from the chamber in the housing to the hollow opening in the plug, an opening in the side wall of said shank, an outlet pipe near the bottom of said housing in communication with the opening in the shank of said plug, and means for sealing said plug in said housing.

2. An oil separator for evaporators comprising a substantially cylindrical housing having an enlarged chamber in the top portion thereof having inlet and outlet openings communicating with said chamber near the top thereof, spaced inturned collars formed in said housing at the bottom thereof and intermediate the ends thereof, a plug having an elongated hollow shank threaded into the collar at the bottom of the housing and in tight fitting engagement with the collar intermediate the ends of the housing, a metal disk seated in the end of said shank having a restricted orifice in the central portion thereof connecting the chamber in the housing with the opening in the hollow shank, said inturned collars, shank and housing wall defining an annular passage around the intermediate portion of said shank, said shank having openings therethrough in communication with said annular passage, and an overflow tube in communication with said annular passage for removing oil from the housing that has passed through the orifice in the end of the shank.

3. In combination with a mechanical refrigeration system having an expansion valve, an evaporator unit and a vacuum line leading from said evaporator unit comprising a housing disposed be-

tween said expansion valve and said evaporator unit in communication therewith, said housing defining an enlarged chamber between the expansion valve and the inlet to the evaporator, said chamber having a restricted orifice at the bottom thereof, said housing also defining a well below said orifice for receiving oil drained therethrough, a drain line communicating with said well and with said vapor line from the evaporator for removing oil from the well and introducing the oil into the vapor line with the expanded refrigerant, and radiating means associated with said drain line for distilling off any refrigerant entrained in the oil draining therethrough.

4. In a mechanical refrigerating system of the dry expanded refrigerant type including an expansion valve, and an evaporator communicating therewith for receiving expanded refrigerant therefrom, the improvement of an oil separator disposed between the expansion valve and the evaporator in communication therewith comprising a housing defining an enlarged chamber for receiving gasified refrigerant and occluded oil from the expansion valve, a sump below said chamber, means at the bottom of the chamber defining a restricted orifice joining the chamber and sump whereby the oil, being heavier than the gasified refrigerant, collects at the bottom of the chamber over the orifice and drains into the sump while the gasified refrigerant being lighter than the oil passes into the evaporator, and means for conveying oil from the sump back to the refrigerating system.

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