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SEPARATOR FOR INTERMINGLED FLUIDS

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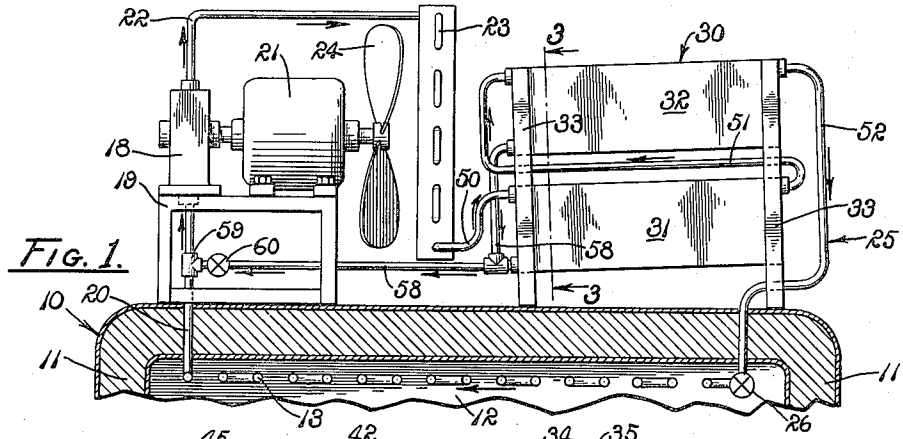


FIG. 1.

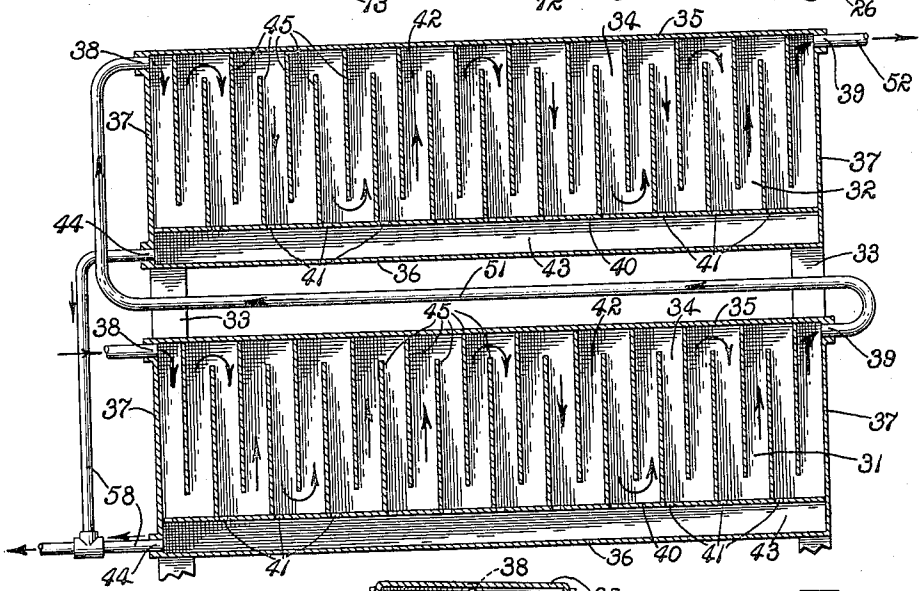


FIG. 2.

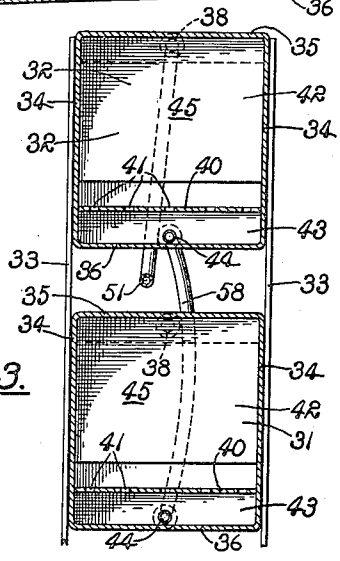


FIG. 3.

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SEPARATOR FOR INTERMINGLED FLUIDS

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2 Claims. (Cl. 62—117.75)

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The present invention relates generally to separators for intermingled fluids and more particularly to the segregation in compressor systems of compressor lubricants from compressed gases or liquids.

Conventional mechanical refrigerators which employ a compressor, condenser, and evaporator in a closed circuit filled with refrigerant invariably are supplied with a quantity of liquid lubricant for the compressor. Ordinarily this lubricant or oil circulates through the entire circuit. The presence of oil in the refrigerant during its evaporation for refrigeration purposes substantially reduces the refrigerating efficiency of the system and leads to the formation of objectionable sludge. Various systems and devices have been devised in attempts temporarily to remove the oil from the refrigerant while it passes through the evaporator in order to increase efficiency of operation. Prior to the present invention such efforts have met with at best only partial success.

Rotary compressors are recognized as being definitely more efficient than reciprocating compressors. Usually the less efficient reciprocating compressors are used for the reason that rotary compressors require a considerably larger quantity of lubricant for lubricating and compressor sealing purposes. This greater quantity of lubricant definitely impairs refrigerating efficiency while present in the evaporator of a refrigerating system. If this lubricant were removed from the refrigerant while the refrigerant passes through the evaporator, the more efficient rotary compressors would be almost universally employed with definitely improved refrigerating efficiency over the use of reciprocating compressors.

It is an object of the present invention to provide an improved separator in refrigeration systems for removing liquid lubricant from the refrigerant while the refrigerant passes through the evaporator.

Another object is to provide a separator that segregates substantially all of the oil from the refrigerant of refrigeration systems during a phase of operation thereof.

Another object is to provide a separator that separates lubricant sufficiently from refrigerating lubricant that the more efficient rotary compressors may be used in refrigerating systems rather than the less efficient reciprocating compressors heretofore employed.

Another object is to permit the use of increased quantities of lubricants in refrigeration systems

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while minimizing the objectionable effects heretofore considered inescapable in the use of such lubricants.

Another object is to provide means whereby the refrigerant in a mechanical refrigerator is substantially devoid of oil while it passes through the evaporator of the system so that increased efficiency of operation obtains.

A still further object is to provide a separator of the character described that is simple and economical to manufacture, easy to install in a refrigerating system, and efficient in operation.

Other objects and advantages will become apparent in the subsequent description in the specification.

Referring to the drawing:

Fig. 1 is a side elevation of a refrigerating system employing a separator embodying the principles of the present invention mounted on a refrigerator cabinet, shown fragmentarily in vertical section.

Fig. 2 is a vertical longitudinal section through the separator.

Fig. 3 is a vertical transverse section through the separator, as viewed from line 3—3 in Fig. 1.

Referring in greater detail to the drawing:

The separator of the present invention is illustrated in connection with a refrigeration system which is shown in Fig. 1 in conjunction with a cabinet 10, shown fragmentarily in section having insulated walls 11 enclosing a freezing or cooling compartment 12. The compartment encloses evaporator coils 13 in which refrigerant of the refrigerator system evaporates absorbing heat from the interior of the compartment thereby cooling the compartment and its contents.

The refrigeration system also includes a compressor 18 whereby the refrigerant of the system is pressurized. The compressor is of the rotary type with which type the present invention is more advantageously adapted to be employed than with reciprocating compressors. The compressor is mounted in an elevated position on a stand 19 supported on the refrigerator cabinet with a low-pressured pipe 20 interconnecting the outlet end of the evaporator coil with the inlet of the compressor. The compressor 18 is motivated by a motor 21 which is also mounted on the stand 19 and has driven connection with the compressor. A high pressure duct 22 leads from the outlet of the compressor to an inlet of a vertically positioned condenser coil 23. The condenser coil is preferably located transversely and symmetrically of the axis of the motor and a fan 24 is attached to the motor shaft which

forces air through the condenser coil for cooling the refrigerant therein when the motor is in operation. The foregoing parts of the refrigeration system are of substantially conventional heat-exchange form and usually are employed with a high pressure conduit 25 leading from an outlet of the condenser coil through an expansion valve 26 to the inlet of the evaporator coil 13.

In mechanical refrigerators of the character described, a fluid lubricant, not shown, is enclosed in the closed circuit of the system and a quantity of oil circulated with the refrigerant for lubricating the compressor as the oil passes therethrough during compression of the refrigerant. The present invention provides means for separating or removing substantially all of the lubricating oil from the refrigerant before the refrigerant passes into the evaporator so that evaporator coil contains a maximum quantity of undiluted compressed refrigerant and may transfer heat from the interior of the refrigerator cabinet unhampered by the presence of lubricating oil therein.

The means for separating oil from the compressed refrigerant comprises a separator indicated generally by the reference numeral 30 interposed in the high pressure conduit 25 between the condenser 23 and evaporator 13. This separator comprises a plurality of superimposed chambers, a lower chamber 31 and an upper chamber 32. The chambers are horizontally elongated and are supported, in a tilted attitude with one end of each of the chambers lower than its opposite end, by means of a plurality of straps 33 which interconnect the chambers. The straps have lower ends which rest on the refrigerator cabinet to support the chambers in elevated and inclined positions thereon.

Each of the chambers is conveniently formed from sheet metal and has spaced parallel vertical side walls 34, a slightly inclined top wall 35, a slightly inclined bottom wall 36 in parallel relation to the top wall, and spaced parallel substantially vertical end walls 37. Inlet openings 38 are formed through an upper portion and the end walls 37 at the lower end of each of the chambers 31 and 32. Outlet openings 39 are formed through an upper portion of the end walls 37 at the high ends of each of the chambers 31 and 32.

A sheet metal, false bottom 40, having a plurality of perforations 41 therethrough, extends across each chamber 31 and 32 a short distance above the bottom walls 36 thereof. This false bottom 40 divides each chamber 31 and 32 into an upper separation compartment 42 and a smaller lower drainage compartment 43. Each drainage compartment 43 is provided with a drainage opening 44 through the end wall 37 of its respective chamber at the lower end thereof.

A plurality of rectangular baffles 45 extend transversely across each separation compartment 42 in equal spaced relation longitudinally of their respective separation compartments. The baffles extend from side wall to side wall of their respective separation compartments but alternately terminate short of the top wall 35 and the false bottom 40 of their respective separation compartments 42. This provides for staggered relation of the baffles so that fluid passing therethrough courses in a vertically reciprocal zigzag pattern between the baffles.

It is to be pointed out that the end baffles in each compartment terminate short of the false bottom 40 and presents a transverse impacting surface transversely of each inlet opening of each separation compartment. Fluid enters each separation compartment under pressure and at high velocity is impacted against a transverse baffle which initially tends toward separation of the refrigerant and lubricating oil therein. The conduit 25 leading from the condenser coil 23 to the expansion valve 26 has a portion identified at 50 connected between the condenser coil and the inlet opening 38 of the lower chamber 31, a portion 51 interconnecting the outlet opening 39 of the lower chamber and the inlet opening 38 of the upper chamber 32, and a portion 52 leading from the outlet opening 39 of the upper chamber to the expansion valve 26.

Thus compressed refrigerant passing from the condenser coil to the evaporator coil must pass through the separator 30 and its separation compartments 42 connected in series. The refrigerant and oil contained therein contacts the baffles 45 and the oil adheres thereto while the refrigerant passes therethrough. Oil collecting on the baffles drains therefrom onto the false bottom and gravitates through the perforations into the drainage compartment 43 in each chamber 31 and 32. Oil thus collected drains to the drainage opening 44 of each drainage compartment. An oil drain 58 interconnects the oil drainage opening with a T pipe fitting 59 located in the low-pressure pipe 20. A pressure regulating valve 60 or other suitable means permits the passage of drained oil from the conduit 58 into the low pressure pipe 20 while maintaining the desired pressure on the compressed refrigerant within the chambers 31 and 32 adequate to preclude refrigerant blown back therethrough.

Operation

The operation and utility of the present invention are believed to be apparent from the foregoing description and are briefly summarized at this point. The refrigerant of the refrigerator system carrying with it a quantity of oil for lubricating purposes, is compressed by the compressor, cooled somewhat in the condenser coil to remove the heat of condensation, and is released by the valve 26 to evaporate in the evaporator coil and returned at low pressure to the compressor for further compression and the starting of another cycle.

The separator 30 removes the oil from the refrigerant before it passes into the evaporator coil so that more efficient and effective refrigeration is obtained in the refrigerator cabinet 10. The refrigerant and oil pass from the condenser coil through the conduit portion 50 and therefrom through the inlet opening 38 to the lower end of the lower separation compartment 42. The refrigerant and oil enter the lower separation compartment under relatively high pressure and velocity so that the refrigerant containing the lubricant impinges against the first baffle in the compartment. This has an initial tendency to separate the refrigerant and lubricating oil. As the refrigerant passes in a zigzag pattern between the baffles in the lower separation compartment, oil precipitates from the refrigerant between the baffles and drains downwardly therefrom to the false bottom 40. The oil thereafter drains through the perforations in the false bottom into the drainage compartment 43 therebelow. Separation of the lubricating oil from the compressed refrigerant is aided by the reduced velocity of the refrigerant through the separation

compartment incident to the increased cross sectional area of the path therethrough as compared to that of the conduit 25.

A large proportion of the lubricating oil is precipitated from the refrigerant as it passes through the lower separation compartment and the refrigerant passes from the lower separation compartment into the upper separation compartment via the interconnecting conduit portion 51. The same process takes place in the upper separation compartment as in the lower separation compartment which further removes lubricating oil from the compressed fluid refrigerant as it passes therethrough. Oil separated from the refrigerant in the upper compartment passes downwardly through the perforations in its false bottom 46 and into the drainage compartment 43 thereof. Oil drained from the refrigerant in both the upper and lower separation compartments flows from the drainage compartments 43 through the oil drainage conduit 56 into the low pressure pipe 29. The compressed refrigerant passes from the outlet opening 39 of the upper separation compartment 42 substantially free of lubricating oil, through the conduit portion 52, and through the expansion valve 26 into the evaporator coil 13 to cool the interior of the refrigerator in an economical and efficient manner.

It is significant to note that the upper separation chambers are connected in series with each other and with the condenser coil 28, expansion valve 26, evaporator coil 13, and compressor 18. It will also be noted that the lower drainage compartments are connected in the refrigeration system in parallel with each other and with the valve 26 and evaporator coil 13 between the condenser coil 23 and the compressor 18.

Although the invention has been herein shown and described in what is conceived to be the most practical and preferred method and embodiment, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices and systems.

Having described our invention what we claim as new and desire to secure by Letters Patent is:

1. In a refrigeration system having a compressor, a condenser, an expansion valve, and an evaporator connected in closed series relation and containing a refrigerant and a lubricant; a separator comprising a horizontally elongated chamber having end walls, side walls, a top wall and an approximately horizontal slightly inclined bottom, the condenser being connected to an end wall of the separator adjacent to the top wall, the expansion valve being connected adjacent to the top wall to the end of the chamber opposite that to which the condenser is connected, a false bottom mounted in the chamber in substantially parallel relation to the bottom, a plurality of rectangular baffles mounted transversely in the chamber in substantially erect parallel relation, there being a baffle adjacent to each end of the chamber and alternate baffles therebetween connected to the top wall and downwardly extended therefrom having lower edges in spaced adjacent relation to the false bottom, and the intermediate baffles being connected to the false bottom and upwardly extended therefrom providing upper edges in spaced adjacent relation to the top wall and with the alternate baffles defining therebetween a vertically reciprocal path through the chamber from the end thereof connected to the condenser to the end connected to the expansion valve, the false bottom having perforations therethrough adjacent to the upwardly extended baffles on the side of the baffles towards which the bottom is inclined; and a pressure regulating valve connected to the chamber of the separator at the lower end of the bottom and below the false bottom and to the compressor in by-pass relation to the expansion valve and evaporator, the pressure regulating valve and the expansion valve being adapted to offer substantial resistance to passage therethrough of lubricant and refrigerant respectively.

2. In a refrigeration system having a compressor providing an intake and an outlet, an expansion valve, and an evaporator connected in closed series relation and containing a refrigerant and a lubricant; a separator comprising a horizontally elongated chamber having end walls, side walls, a top wall and an approximately horizontal slightly inclined bottom, the outlet of the compressor being connected to an end wall of the separator adjacent to the top wall, the expansion valve being connected adjacent to the top wall to the end of the chamber opposite that to which the compressor is connected, a false bottom mounted in the chamber in substantially parallel relation to the bottom, a plurality of rectangular baffles mounted transversely in the chamber in substantially erect parallel relation, there being a baffle adjacent to each end of the chamber and alternate baffles therebetween connected to the top wall and downwardly extended therefrom having lower edges in spaced adjacent relation to the false bottom, and the intermediate baffles being connected to the false bottom and upwardly extended therefrom providing upper edges in spaced adjacent relation to the top wall and with the alternate baffles defining therebetween a vertically reciprocal path through the chamber from the end thereof connected to the compressor to the end connected to the expansion valve, the false bottom having perforations therethrough adjacent to the upwardly extended baffles on the side of the baffles towards which the bottom is inclined; and a pressure regulating valve connected to the chamber of the separator at the lower end of the bottom and below the false bottom and to the intake of the compressor in by-pass relation to the expansion valve and evaporator, the pressure regulating valve and the expansion valve being adapted to offer substantial resistance to passage therethrough of lubricant and refrigerant respectively.

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