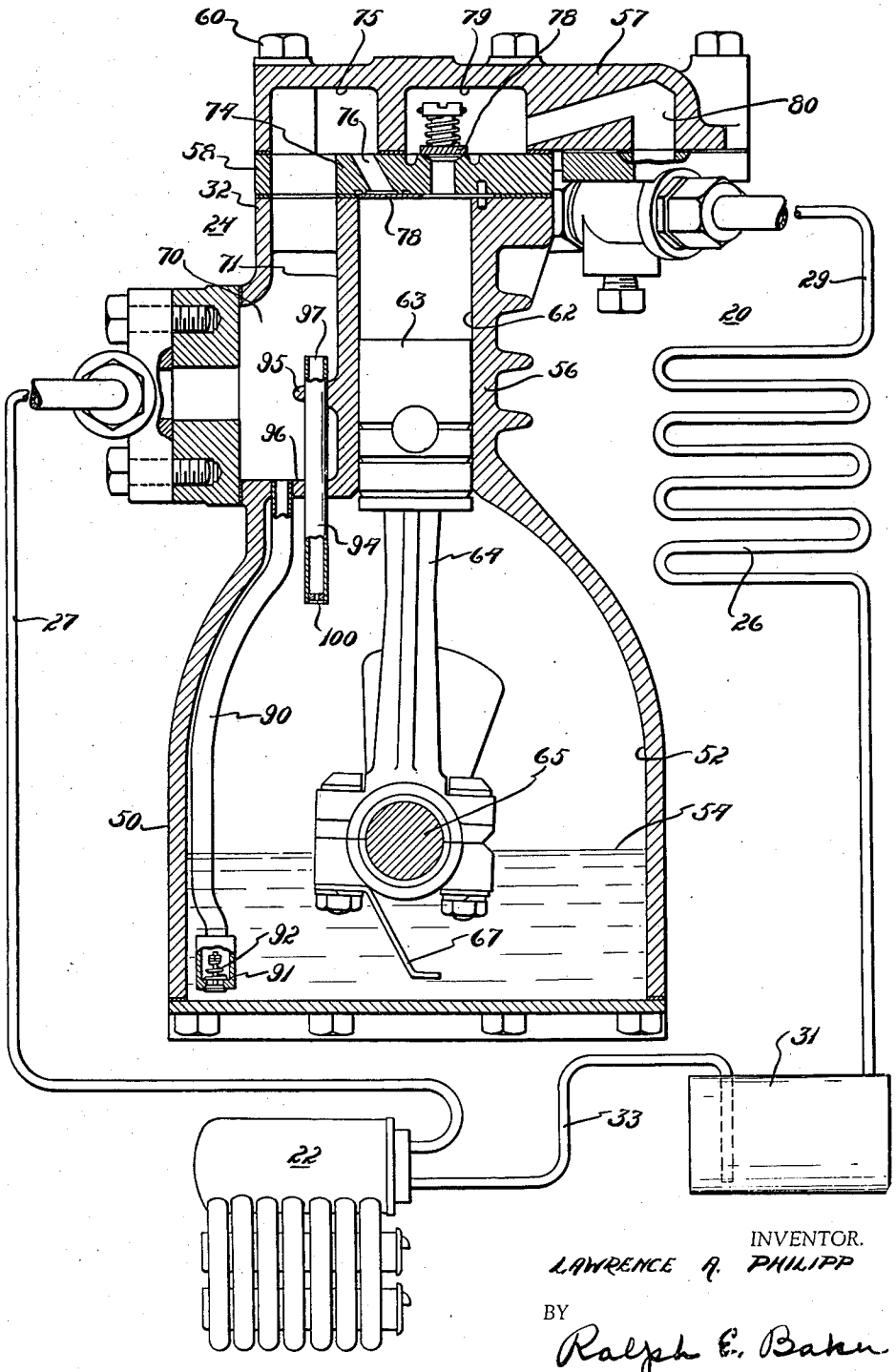
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REFRIGERATING APPARATUS

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REFRIGERATING APPARATUS

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This invention relates to refrigerating apparatus and more particularly to refrigerant compressors adapted for use in such apparatus.

In refrigerating systems of the compression type which include a low side, such as a cooling element, and a high side, such as a refrigerant compressor and condenser, it is usual to provide a body of lubricating fluid, for instance, within a reservoir provided within a casing which houses the compressor for lubricating moving parts of the compressor. During operation of the compressor it has been found that some of the lubricant is pumped to other parts of the system where it is not needed and where it is likely to affect the efficiency of the system. This lubricant is usually returned to the lubricant reservoir along with the vaporized refrigerant by the action of the compressor by entrainement and/or by gravity. One form of special oil returning evaporator which may be used is as disclosed in Patent No. 1,719,024 issued July 2, 1924, to John R. Replogle. Such systems are usually intermittently operated and during the off phase of the refrigerating cycle the pressure in the low side builds up. In systems of this type, which are provided with a refrigerant which is miscible with the lubricant, it has been found by experience that when the lubricant is placed in the low pressure side of the system, any sudden reduction of the pressure on the body of the lubricant will cause considerable foaming to take place. In such systems, which are in open communication with the low side of the system to provide for the return of the lubricating fluid to the reservoir, it has been found that a large part of the lubricant which forms a portion of the foam is drawn into the compressor whence it is discharged into other parts of the system. Under these conditions, an abnormal amount of lubricant is being pumped to other parts of the system and the return thereof, as aforesaid, is less than the amount so pumped to other parts of the system. Accordingly, the compressor would soon be without lubricant and the efficiency of the system would be decreased.

By my invention, I obviate the above difficulties by providing an arrangement which prevents the sudden reduction of pressure on the body of the lubricant.

Another object of my invention is to provide for the return of the lubricant from the cooling element through a passage which is arranged to prevent the return flow of fluid therethrough, and also to arrange for reducing the pressure of the refrigerant vapor on the body of lubricant gradually by withdrawing the vapor through a restricted orifice or valve.

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

In the drawing:

The figure in the drawing is a diagrammatic representation of a refrigerating system embodying features of my invention and showing an enlarged full sized view in cross section of the compressor.

Referring to the drawing, numeral 20 designates a condensing element and the numeral 22 designates a cooling element or evaporator of the flooded type, in which a substantially constant level of liquid refrigerant is maintained by means of a float valve mechanism (not shown). The condensing element comprises in general a compressor 24 which may be operated by any suitable means, such, for example, as an electric motor (not shown), and a condenser 26. Evaporated refrigerant is withdrawn from the evaporator through a vapor conduit 27. The evaporated refrigerant thus withdrawn is compressed by the compressor, as is hereinafter more fully described. The compressed refrigerant is discharged into a conduit 29 through which it passes to the condenser 26 wherein it is condensed and from which it passes to a liquid refrigerant receiver 31. Liquid refrigerant is supplied to the evaporator from the receiver through a liquid supply conduit 33.

The compressor 24 comprises in general an outer casing 50, which includes a crank case portion 52 adapted to contain a quantity of lubricating oil, the level of which I have indicated at 54, and a cylinder block portion 56. The compressor also includes a head portion 57 and a valve plate 58 clamped between the head portion and the cylinder block by screws 60. Within the cylinder block there is provided a compression chamber 62 in which is disposed for reciprocation a piston 63 which, in turn, is connected to a pitman 64 actuated by an eccentric portion 65 of the compressor shaft. The compressor shaft is journaled in suitable bearings (not shown) carried by casing 50. During the operation of the compressor the pitman 64, eccentric 65 and an oil thrower 67, which is secured to the pitman, are adapted to dip into the body of the lubricating oil 54 and throw oil for lubricating various moving parts of the compressor.

Surrounding a portion of the cylinder block is

an intake chamber 70 formed by a portion of the outer wall of the cylinder block, designated 71, and a laterally extending wall 72 which is joined to the cylinder block wall. This intake chamber 70 is in communication with the vapor conduit 27. The evaporated refrigerant which is withdrawn through the vapor conduit 27 from the evaporator 22 passes through the intake chamber 70 and opening 74 provided in the valve plate 58, and into a recessed chamber 75 provided in the head portion 57, whence it passes through a second opening 76 provided in valve plate 57, and into the compression chamber 62 under the control of a suction check valve 78. The refrigerant is compressed within the chamber 62 whence it is discharged therefrom through a discharge valve 78 into a recessed chamber 79 provided in the head portion, and a passage 80 which is also provided in the head portion and which is in communication with the conduit 29 which leads to the condenser.

Preferably systems of the type herein disclosed are intermittently operated for maintaining predetermined temperatures within evaporator 22 and the operation of the compressor is usually controlled in response to changes in pressures within the conduit 27, which is in communication with the refrigerant vapor space of the evaporator 22. Since the evaporator 22 is of the flooded type, the pressure of evaporated refrigerant in the evaporator will bear a direct relation to the temperature in the evaporator. Any suitable pressure responsive control mechanism may be provided for connecting and disconnecting the motor which drives the compressor to and from the electric power mains.

During operation of the compressor, some of the lubricating oil contained in the crank case portion 52 of compressor 24 is carried to other parts of the system, due to the pumping of oil by the compressor 24. When this occurs, the level of lubricating oil within the crank case portion 52 gradually diminishes and the lubricating oil which is pumped to other parts of the system, for example, to the evaporator 22, has a tendency to affect the efficiency of the system. Under these conditions, it is necessary to return the oil from the evaporator to the reservoir provided in the crank case of the compressor. This oil is returned as aforesaid through conduit 27 and any oil entrained with the vapor will be separated therefrom when coming in contact with the walls of the chamber 70, and also due to the greatly reduced gas velocity upon entering said chamber from the relatively small interior diameter conduit 27. This separated oil flows to the bottom of chamber 70.

In the above described system, I prefer to use a refrigerant which is miscible with the body of oil, which refrigerant may be, for example, CCl_2F_2. In systems of such type in which it is desired to use a refrigerant which is miscible with the body of the lubricating oil, it has been found, as previously stated herein, that any sudden reduction of pressure on the body of lubricant will cause considerable foaming. This is due to the fact that the oil absorbs a portion of the refrigerant in the crank case, the amount depending upon the pressure therein and the length of time that the compressor is not in operation. Consequently, a sudden reduction of pressure on the oil results in a large amount of foaming as the refrigerant which is absorbed in the oil tends to separate itself therefrom. Thus it is desirable to reduce the refrigerant vapor pressure on the body of the lubricating oil gradually so as to prevent foaming within the crank case 52. As previously stated, this pressure on the body of lubricant is the result of pressure which builds up in the low pressure side of the system during the off phase of the refrigerant cycle of the system. By low pressure side of the system is meant the evaporator 22 and the low pressure portion of the compressor, which includes the crank case 52 in which the body of lubricating oil is stored. By high pressure of the system is meant between the discharge valve 78 of the compressor and up to and including the point where the liquid refrigerant enters the evaporator 22. The building up of pressures in the low pressure side of the system during off phase causes the pressure to build up in the crank case 52 of the body of lubricating oil 54, for the reason, that it is necessary to establish communication between the suction chamber 70 and the crank case portion 52 in order to return the oil which has previously been pumped to other parts of the system to its reservoir. In view of the fact that the refrigerant is miscible with the oil, a portion of the refrigerant vapor becomes absorbed in the oil which is returned to the crank case 52. In order to provide for returning the oil to the crank case portion 52 from suction chamber 70, I have provided a conduit 90, which is in open communication on its upper end with bottom wall of the suction chamber 70, and at its discharge, or lower end 91, I have provided a valve mechanism 92 which permits the flow of oil into the reservoir but prevents the return of any fluid through the conduit 90. By this arrangement I may provide a valve of sufficient size to return the oil to the crank case 52 without the possibility of clogging.

In order to withdraw the refrigerant vapor which accumulates within the crank case portion 52, I have provided a conduit 94 which is carried by a laterally extending wall portion 95 of cylinder block 56 and a horizontal wall portion 96 of the casing 50. The upper end 97 of conduit 94 is in open communication with the suction chamber 70 and is disposed sufficiently high enough in the chamber so that it would be unlikely to receive oil returning through the vapor conduit 27 into the suction chamber 70. On the lower end of the conduit 94, which projects downwardly within the crank case portion 52, there is provided a valve or restricted orifice 100. This restricted orifice is provided for limiting the amount of refrigerant vapor which is withdrawn from the crank case portion into the compression chamber by the action of the piston 63. Thus, this restricted orifice serves to provide a means for gradually reducing the pressure within the crank case portion 52. The restricted orifice 100 also limits the amount of refrigerant vapor entering into the crank case during the off phase of the system. Consequently, the pumping of oil by the compressor to other parts of the system is reduced to a negligible amount since the possibility of foaming within the crank case portion 52 occuring in response to sudden reduction of pressures therein is substantially or entirely obviated by such an arrangement.

Although only a preferred form of the invention has been illustrated, and that form described in detail, it will be apparent to those skilled in the art that various modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

What is claimed is as follows:

1. A refrigerating apparatus for circulating a volatile refrigerant comprising in combination a casing, a compressor disposed in said casing, said casing being adapted to provide a reservoir for lubricating fluid for lubricating moving elements of the compressor, said refrigerant being miscible with the body of lubricant, a condenser for condensing refrigerant compressed in the compressor, a refrigerant evaporator connected to the condenser, a conduit connected to the evaporator and leading to the suction side of the compressor for conducting evaporated refrigerant from the evaporator to the compressor to be compressed and for conducting lubricating fluid from the evaporator delivered thereto by the action of the compressor to the suction side of the compressor, fluid conduit means for delivering the lubricant from the suction side of the compressor to said reservoir and for preventing the return of lubricant and refrigerant therethrough, means in communication with the suction side of the compressor for restricting the amount of refrigerant vapor entering said reservoir, said vapor being adapted to create a pressure on the body of lubricating fluid, said last named means also serving to permit the reduction of pressure on said oil at a rate below that which would cause the foaming of said oil.

2. A refrigerating system of the type wherein a volatile refrigerant and oil are circulated comprising a high pressure portion and a low pressure portion having a reservoir for oil and a second reservoir containing a quantity of liquid refrigerant, an oil conducting conduit having its inlet end associated with the low pressure portion above the level of liquid refrigerant and its outlet end associated with said reservoir, and a valve below the level of oil in said reservoir for controlling the passage of oil through said conduit.

3. A refrigerating system of the type wherein a volatile refrigerant and oil are circulated comprising a high pressure portion and a low pressure portion, said low pressure portion having a reservoir containing a quantity of oil and a second reservoir containing a quantity of liquid refrigerant, and an oil conducting conduit having its inlet end associated with said low pressure portion above the level of liquid refrigerant and its outlet end associated with said reservoir below the level of oil therein.

4. A refrigerating system of the type wherein a volatile refrigerant and oil are circulated, comprising a high pressure portion, a low pressure portion having a reservoir containing a quantity of oil and a second reservoir containing a quantity of liquid refrigerant, and an oil conducting conduit having its inlet end associated with said system above the level of liquid refrigerant for receiving oil and its outlet end associated with said reservoir below the level of oil therein.

5. A refrigerating system of the type wherein a volatile refrigerant and oil are circulated, comprising a high pressure portion, a low pressure portion having a reservoir containing a quantity of oil and a second reservoir containing a quantity of liquid refrigerant, an oil conducting conduit having its inlet end associated with said system above the level of liquid refrigerant for receiving oil and its outlet end associated with said reservoir below the level of oil therein, and means for controlling the passage of oil through said conduit.

6. A refrigerating system of the type wherein a volatile refrigerant and oil are circulated, comprising a high pressure portion and a low pressure portion having a reservoir containing a quantity of oil, an oil conducting conduit having its inlet end associated with said system for receiving oil and its outlet end associated with said reservoir below the level of oil therein, said refrigerant being miscible in said oil and being adapted to create a pressure thereon whereby a portion of said refrigerant becomes absorbed in the oil, and means for reducing the pressure on said oil at a rate below that which would cause the foaming of said oil by the reduction of pressure thereon.

7. A refrigerating system of the type wherein a volatile refrigerant and oil are circulated, comprising a high pressure portion and a low pressure portion having a reservoir containing a quantity of oil, an oil conducting conduit having its inlet end associated with said system for receiving oil and its outlet end associated with said reservoir below the level of oil therein, said refrigerant being miscible in said oil and being adapted to create a pressure thereon whereby a portion of said refrigerant becomes absorbed in the oil, a valve for controlling the flow of oil through said conduit, and means for reducing the pressure on said oil at a rate below that which would cause the foaming of said oil by the reduction of pressure thereon.

8. A refrigerating system of the type wherein a volatile refrigerant and oil are circulated, comprising a high pressure portion and a low pressure portion having a reservoir containing a quantity of oil, an oil conducting conduit having its inlet end associated with said system for receiving oil and its outlet end associated with said reservoir, said refrigerant being miscible in said oil and being adapted to create a pressure thereon whereby a portion of said refrigerant becomes absorbed in the oil, means for reducing the pressure on said oil at a rate below that which would cause the foaming of said oil by the reduction of pressure thereon, said means including additional conduit means having a restricted orifice, and a valve for controlling the flow of oil through said oil conducting conduit.

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