Dec. 8, 1931. C. E. L. LIPMAN 1,835,569

REFRIGERATING SYSTEM

Filed April 28, 1930

Fig 1.

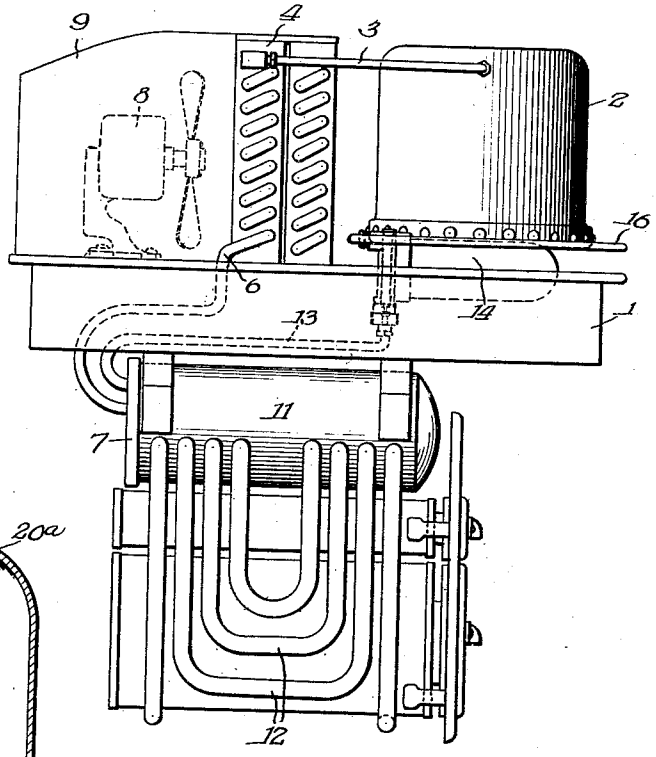


Fig 3

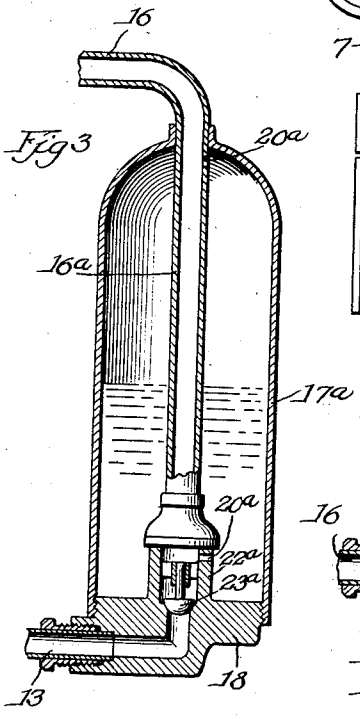
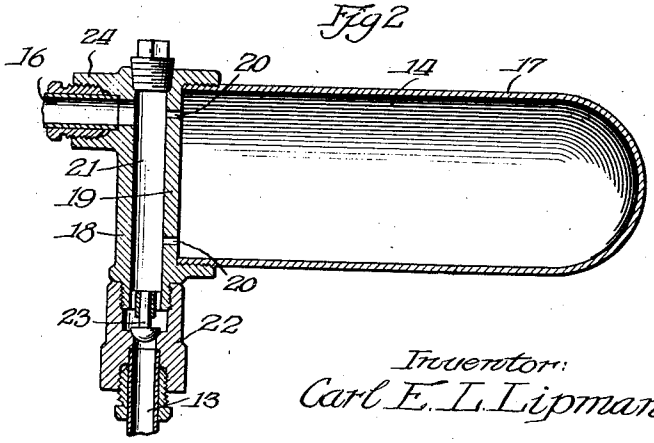


Fig 2



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UNITED STATES PATENT OFFICE

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REFRIGERATING SYSTEM

Application filed April 28, 1930. Serial No. 447,874.

This invention relates to refrigeration systems of the compressor condenser evaporator type and is an improvement upon such a refrigeration system as is shown in my copending application Serial No. 224,571.

In this type of system, as is stated in my copending application, there are several desirable conditions precedent to the successful operation of these systems. It is advisable to substantially equalize the pressures upon the high and low sides when the compressor is stopped in order that the resistance to starting the compressor again will not put too great a load on the compressor. It is also desirable to prevent the compressed refrigerant from passing to the low side before it has been cooled in the condenser otherwise it will warm up the expansion of evaporating element and result in a considerable loss of efficiency. It is also desirable, if not necessary, to return any oil which may pass over into the low side back to the compressor and to prevent the compressor from drawing in slugs of either liquid refrigerant or lubricant as to do so puts an undue load and strain upon the machine. It is therefore preferable to have the suction side of the condenser always in communication with vapors instead of liquids and to return any liquids such as lubricant back to the compressor in small increments rather than solid slugs.

It is therefore an object of this invention to provide a refrigerating apparatus of the above character in which the pressure in the high side is dropped considerably when the compressor is stopped without allowing the compressed refrigerant to enter the low side and warm up the expansion element and which provides for the return of the lubricant in the refrigerant lines to the compressor in such a manner that the compressor is not unduly loaded or strained.

In accordance with this invention a receptacle for the refrigerant and lubricant is provided and means are provided for inspirating or injecting the liquid lubricant into the suction line for return to the compressor in such quantities that the return of the lubricant is positive yet not detrimental to the system.

Other and further objects and advantages of this invention will be apparent as the same becomes better understood from an examination of the specification and claims in connection with the accompanying drawings wherein:

Fig. 1 is a side elevation of a refrigerating system embodying the features of this invention.

Fig. 2 is a longitudinal section through the lubricant receptacle and return means, and

Fig. 3 is a vertical section through the center of a modified form of lubricant receptacle and return means.

Referring to the drawings and more particularly to Fig. 1, there is shown a refrigerating system of the general type heretofore mentioned and particularly suitable for household refrigeration embodying a removable unit. The high pressure side of the unit is secured to the top of an insulating mount 1 and the low pressure side or evaporator is secured to the lower side of the removable insulating support.

The high pressure side of the apparatus which is insulated from the low pressure side by the support 1 comprises a motor compressor 2 adapted to deliver compressed refrigerant through pipe 3 to a condenser 4, condenser 4 being connected by pipe 6 to the low pressure side or evaporating unit 7. The entire high pressure side may be cooled by an electric fan 8 mounted with a duct or housing 9.

The low side comprises the evaporator 7 which may be of any suitable type or construction to provide for cooling ice trays (not shown) and for cooling the refrigeration compartment (not shown). The evaporating unit illustrated is of the float chamber and float valve type comprising a float chamber 11 supplying a series of coils 12 adapted to receive refrigerant which has been cooled and liquefied in the condenser and expand the same to produce the desired cooling effect. The refrigerant after it has expanded in the evaporating element 7 and has done its work

is withdrawn through a pipe 13 to a lubricant receptacle and check valve or unloading device indicated generally by 14. The other side of the unloader 14 is connected by conduit 16 to the suction side of the motor compressor 2.

The lubricant receptacle and valve comprising the unloading device consists of a cylinder or open ended receptacle 17 of sufficient capacity to contain enough refrigerant and lubricant to permit substantial balancing of the pressures of the low and high sides when the compressor is stopped. The open end of the receptacle 17 is closed by a header 18 threaded thereto. The sealing wall 19 of the header is provided with two restricted passages 20 one adjacent the bottom of cylinder 17 and one adjacent the top thereof. To the lower end of the header is secured a check valve housing 22 having a check valve 23 therein normally arranged to prevent flow out of cylinder 17 through chamber 21. To the inlet of the check valve housing 22 is secured the pipe 13 leading to the evaporating unit. The upper end of header 18 is provided with an outlet 24 to which is connected the suction line 16.

In operation the compressor will create a suction in conduit 16 and thus attempt to withdraw gas from the unloader 14 and evaporator 7, compress the same and deliver the compressed refrigerant to the condenser where it is cooled and liquefied. The cool liquid refrigerant is delivered to the evaporating element and after it has produced the necessary cooling effect is withdrawn by the compressor thus completing the cycle.

Whenever the compressor is stopped the high pressure of the refrigerant in the compressor will drop by reason of the refrigerant slipping back through the compressor to the unloading receptacle 17 and the pressure will become equalized on both sides of the compressor at a considerably lowered pressure. The receptacle 17 is of sufficient capacity to allow enough refrigerant and accompanying lubricant to slip back in this manner to cause a considerable drop in pressure in the condenser and to receive lubricant along with the refrigerant. The unloader is preferably positioned at the lowest point in the suction side of the system in order that oil will flow by gravity into the receptacle.

The presence of the check valve 23 in the line 13 between the evaporator and the receptacle 17 prevents the refrigerant and lubricant from leaking back past the receptacle 17 into the evaporating element. The warm refrigerant from the high side cannot therefore enter the evaporating unit and raise the temperature thereof and thus reduce the efficiency of the system.

When the compressor is again started the pressure in the condenser having been dropped considerably does not present too great a resistance to the starting of the compressor motor and since a quantity of gas is contained in the receptacle 17 at substantially the same pressure as is in the condenser the pressure in the condenser may be built up gradually. In withdrawing gas from the receiver 17 any liquid lubricant collected in the receptacle will be withdrawn therefrom by an inspirating or injecting action through the apertures 20 particularly the lower aperture 20. Should the lift be too great, check valve 23 will raise and permit the withdrawal of vapor from the evaporator through pipe 11. The lubricant will therefore be drawn into the suction line in small increments and returned to the compressor.

In Fig. 3 there is illustrated a slightly different form of unloading device in which a vertically arranged receptacle 17*a* is employed. The lower end of the receptacle is sealed by a header 18*a* having a check valve housing 22*a* and check valve 23*a* therein. The header is connected to the evaporating unit as in the former instance by pipe 13. The suction line 16 is brought in through the upper end of the receptacle 17*a* and is extended downwardly through extension 16*a* to the upper end of check valve housing 22*a*. Adjacent the upper end of receptacle 17*a* and within the receptacle 16*a* is provided with a restricted aperture 20*a*. The valve housing is also provided with a similar restricted opening 20*a* immediately above the check valve and below the normal oil level.

It is obvious that the operation of the modified form shown in Fig. 3 is the same as that described in connection with the form illustrated in Figs. 1 and 2.

It is apparent from the foregoing arrangement that there is provided a system particularly well adapted for household use in that it provides for the return of lubricant from the low pressure side to the compressor, reduces the requirements of the motor, and adds to the safety of the system as a whole.

It is obvious that the receptacle here shown as a separate chamber may be made a part of the evaporating unit if it is desired to omit some of the other features of the invention, and that many other changes may be made in the details of construction without departing from the principles of this invention as defined in the claims appended hereto.

I claim:

1. An unloading device for use in a refrigerating system comprising a receptacle adapted to be connected in the suction line for receiving refrigerant and lubricant, means associated with said receptacle for inspirating the liquid contained therein into said suction line and means for preventing return flow through said unloading device.

2. An unloading device for use in a refrigerating system comprising a receptacle adapted to be connected in the suction line for re-

ceiving refrigerant and lubricant, a check valve associated with said receptacle for preventing return flow through said unloading device and means associated with said receptacle for inspirating the liquid contained therein into said suction line.

3. An unloading device for use in a refrigerating system comprising a receptacle adapted to be inserted in the suction line between the evaporator and the compressor, a closure wall for said receptacle, said wall having an aperture therein establishing a restricted communication between said receptacle and said suction line.

4. An unloading device for use in a refrigerating system comprising a receptacle adapted to be inserted in the suction line between the evaporator and the compressor, a closure wall for said receptacle, said wall having an aperture therein establishing a restricted communication between said receptacle and said suction line, and a check valve associated with said receptacle to prevent return flow through said suction line.

5. An unloading device for use in a refrigerating system comprising a receptacle adapted to be connected in the suction line between the evaporator and condenser for receiving refrigerant and lubricant, a check valve in said line for preventing return flow through said line and device, a header for said receptacle having a passage therethrough terminating in connections for said suction line and a port through said header into said receptacle, said port being adjacent the bottom of said receptacle.

6. An unloading device for use in a refrigerating system comprising a receptacle adapted to be connected in the suction line between the evaporator and condenser for receiving refrigerant and lubricant, a header for said receptacle having a passage therethrough terminating in connections for said suction line, a check valve in one of said connections for preventing return flow past said receptacle, and a port through said header into said receptacle, said port being adjacent the bottom of said receptacle.

7. An unloading device for use in a refrigerating system comprising a receptacle adapted to be connected in the suction line of a refrigerating system for receiving refrigerant and lubricant, a check valve in said receptacle for preventing return flow therethrough, a tube extending through said receptacle and including said valve and having openings therethrough adjacent the upper and lower ends of said receptacle, whereby the lubricant in said receptacle will be inspirated from said receptacle into the suction line.

8. In a refrigerating system, a compressor, a condenser, an evaporating device for receiving refrigerant from said condenser, a closed receptacle in said suction line for storing refrigerant and lubricant therein, and means for inspirating lubricant from said receptacle into the refrigerant circuit.

9. In a refrigerating system, a compressor, a condenser and an evaporator connected in a circulatory system, means in said system and associated with the suction side of said compressor for inspirating lubricant from the low side of said system back to said compressor and means for preventing return flow through said first mentioned means.

10. In a refrigerating system, a compressor, a condenser, an evaporating device for receiving refrigerant from said condenser, a receptacle between said evaporator and compressor for storing refrigerant and lubricant therein, means for inspirating lubricant from said receptacle into the refrigerant circuit and means for preventing return flow through said receptacle.

11. In a refrigerating system, a compressor, a condenser, an evaporating device for receiving refrigerant from said condenser, a receptacle between said device and compressor for storing refrigerant and lubricant therein, a check valve in said suction line arranged to prevent reverse flow from said compressor to said evaporator, and means for inspirating lubricant from said receptacle into the refrigerant circuit.

In witness of the foregoing I affix my signature.

CARL E. L. LIPMAN.