June 21, 1938. O. S. McGUFFEY 2,121,253

HEAT EXCHANGER AND ACCUMULATOR

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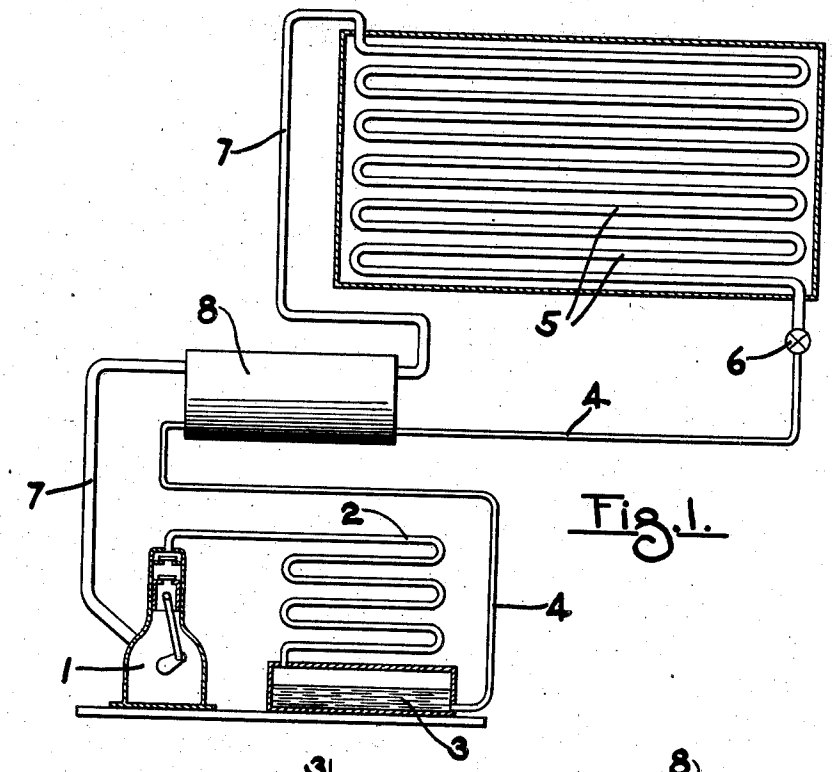


Fig. 1.

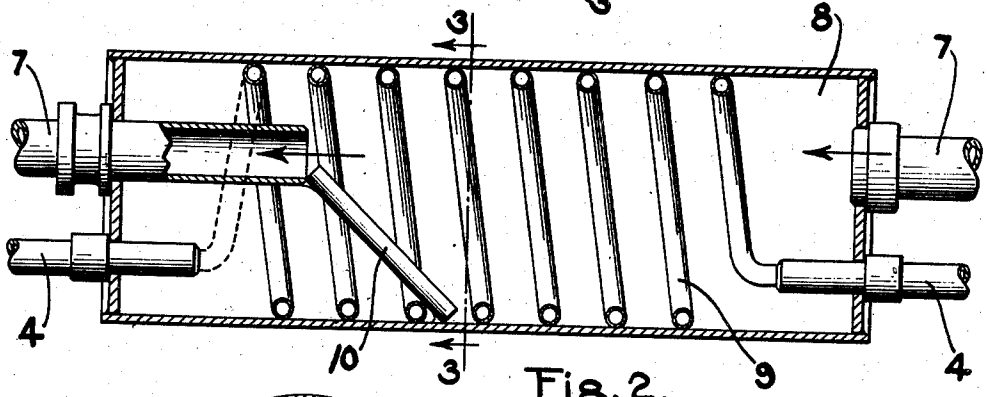


Fig. 2.

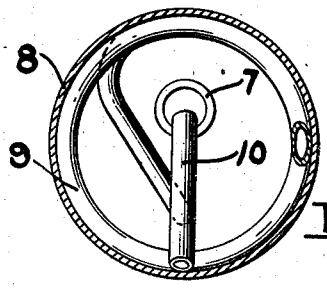


Fig. 3.

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HEAT EXCHANGER AND ACCUMULATOR

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4 Claims. (Cl. 62—115)

This invention relates to a heat exchanger and accumulator for refrigerating systems and more particularly for such refrigerating systems which evaporate a fluid refrigerant to absorb heat and then compress said refrigerant so that it may be again evaporated.

In such refrigerating systems the refrigerant, such as methyl chloride or dichloro-fluoromethane, is combined with oil which is used for lubrication and the refrigerant and oil are mutually soluble and pass together through the system to a large extent.

It is customary to operate the refrigerator intermittently and during the idle period there is a tendency for the evaporator of the system to fill with refrigerant, combined with oil, in liquid condition. Upon resuming operation a considerable part of this refrigerant will pass from the evaporator in liquid form combined with oil into the base or crankcase of the compressor where boiling occurs because of reduction of pressure and increased heat. This boiling usually results in foaming of the oil which foam passes into the compressor where it is compressed to a solid volume of oil greater than the clearance in the compressor and it must be forced rapidly through the discharge valves in a violent manner resulting in damage to the mechanism.

The object of this invention is to overcome difficulties experienced by such performance which it accomplishes by inserting in the return conduit or line between the evaporator and the compressor an accumulating and evaporating chamber which is warmed by a coil of tube through which the heated compressed liquid refrigerant passes and the returning refrigerant is deposited within this chamber where the unevaporated portions are evaporated, the evaporation being aided by heat from the coil therein, and the refrigerant which passes from the chamber to the compressor is entirely in gaseous form.

The oil which was combined with the refrigerant is also precipitated and accumulated in the chamber and is drawn off in controlled quantities with the gaseous refrigerant to the compressor in manner and quantity proper for operation of the compressor.

The invention provides various new features of construction and arrangement which produce new results as hereinafter more fully described and particularly pointed out in the claims, reference being had to the accompanying drawing, in which

Fig. 1 is a diagrammatic illustration of a refrigerating system embodying this invention.

Fig. 2 is a longitudinal sectional elevation of the heat exchanger and accumulator, and

Fig. 3 is a vertical cross section of the same on the line 3—3 of Fig. 2.

Like reference numbers refer to like parts in all the figures.

The diagram Fig. 1 illustrates a conventional refrigerating system, excepting that it includes the heat exchanger and accumulator embodying this invention. In this system there is a compressor 1 in which the refrigerant is compressed and forced into a condenser 2 and thence into a liquid receiver 3. A high pressure conduit or line 4 leads from the liquid receiver 3 into the evaporator 5. A valve 6, such as a thermostatically controlled expansion valve, controls the passage of the high pressure liquid refrigerant into the evaporator. The refrigerant returns from the evaporator 5 through a low pressure conduit or line 7 to the compressor 1.

The heat exchanger accumulator comprises a chamber 8 in which is located a heat exchanging coil 9 which is interposed in the high pressure line 4, the high pressure and warmed liquid passing through the coil 9 on its way to the evaporator. The chamber 8 is tightly closed and at comparatively high levels at its respective ends the low pressure return line 7 communicates providing inlet and outlet communications between the chamber 8 and the low pressure return line 7.

A relatively small oil feed tube 10, open at both ends, is located within the chamber, preferably in inclined position, and has its lower end located near the bottom of the chamber and its upper end adjacent the outlet from the chamber and communicating with the return line 7. This tube serves to pass oil in controlled quantities from the chamber into the return line. Oil is elevated in and passes through the tube partially by capillary attraction and partially by suction caused by the rush of gas past its upper end in leaving the chamber.

There is a phenomenon which may be called a "wetting film movement" which occurs to aid the movement of the oil along the tube. This wetting film movement resembles capillarity and results in the movement of liquid on the surface of a body and is greatly aided by the velocity of gas moving past the body. In this case oil will move upwardly both inside and outside the tube and pass from its upper end to the gas stream and it is conceived that a solid rod could be substituted for the tube 10 depending entirely upon capillarity combined with the wetting film movement on the surface of the rod aided by the

gas movement past the rod to pass the oil from the chamber.

Operation

In operation all of the refrigerant and oil which passes through the system will be deposited in the chamber 8. Gassification of the refrigerant and precipitation of the oil occur in this chamber, these being aided by heat from the coil 9. The chamber is preferably of sufficient depth below the outlet therefrom into the return line 7 that it will contain any quantity of unevaporated refrigerant below said outlet which will accumulate in the chamber. Therefore, only gaseous refrigerant will pass from the chamber through the outlet into the return line 7.

Lubricating oil which has precipitated in the chamber will be passed therefrom in controlled quantities through the pipe 10 as heretofore described and will find its way through the return line 7 to the compressor in proper quantity for correct evaporation thereof.

By this invention the unevaporated liquid refrigerant combined with excessive amounts of lubricant is prevented from being returned to the compressor. It insures that only gaseous refrigerant combined with the proper amount of lubricant will enter the compressor and also serves to more evenly distribute the proper amounts of refrigerant and lubricant.

The invention also serves to cool the liquid in the coil 9 which is en route to the evaporator and permits the high pressure refrigerant to do the maximum amount of useful refrigeration in the evaporator.

The device is simple, durable and comparatively inexpensive and by actual use has proven to be of great advantage.

The device is defined in the appended claims and is to be considered comprehensive of all structures coming within their scope.

I claim:

1. The combination with a refrigerating system including an evaporator, a compressor, and a conduit extending between them, of a chamber located remote from the space to be cooled interposed in said conduit and in communication therewith, the communication leading from the chamber to the compressor being through the outlet, said chamber having a portion of considerable capacity located below said outlet, and an element having one end located at said outlet in the path of the flow of gas therethrough and its other end located in the lower part of said chamber, said element acting to convey liquid from said chamber to said outlet by action of capillary attraction and the movement of gas past its body.

2. The elements in combination defined in claim 1, in which said element is a tube open at both its ends and acts to convey liquid through it by suction.

3. The combination with a refrigerating system including an evaporator, a compressor and a conduit extending between them to conduct fluid from the evaporator to the compressor, of a chamber interposed in said conduit, the communication leading from the chamber to the compressor being through the outlet, said chamber having a portion of considerable capacity located below said outlet, an element having one end located at said outlet in the path of the flow of gas therethrough and its other end located in the lower part of said chamber, said element being inclined from the vertical upwardly in the direction of flow of gas and said element acting to convey liquid from said chamber to said outlet by action of capillary attraction and movement of the gas past its body.

4. The elements in combination defined in claim 3, in which said element is a tube open at both ends and acts to convey liquid through it by suction.

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