June 2, 1936. C. H. STEENSTRUP 2,042,558

EVAPORATOR

Filed Aug. 28, 1935

Fig. 2.

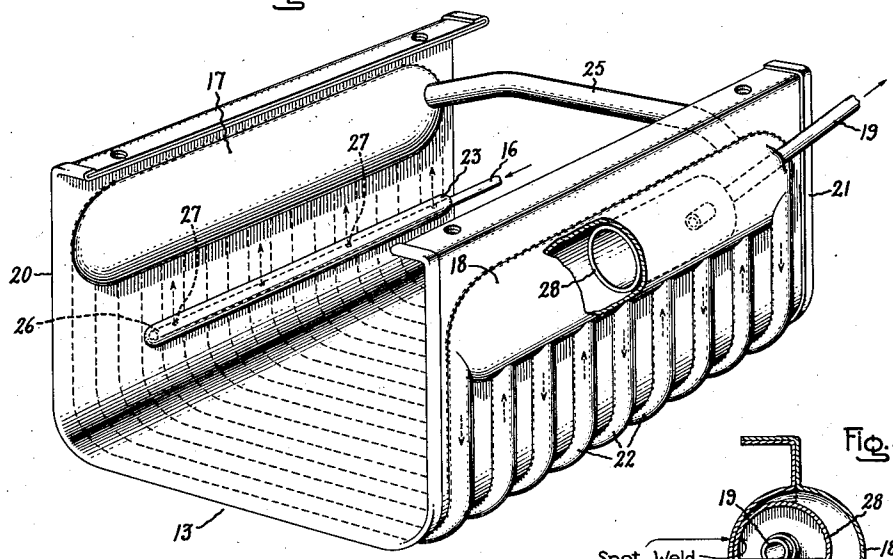


Fig. 4.

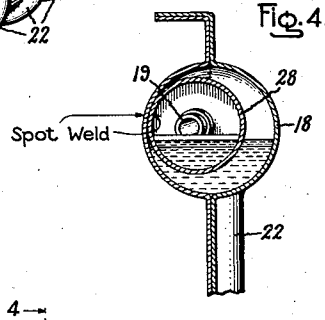


Fig. 1.

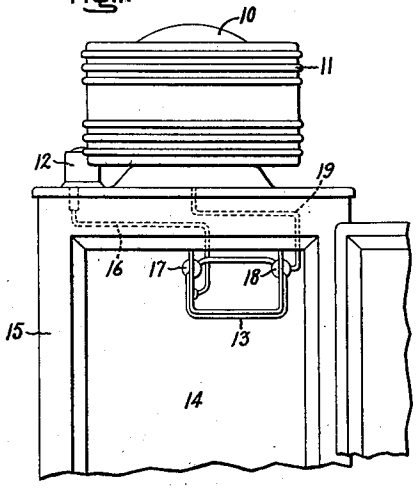
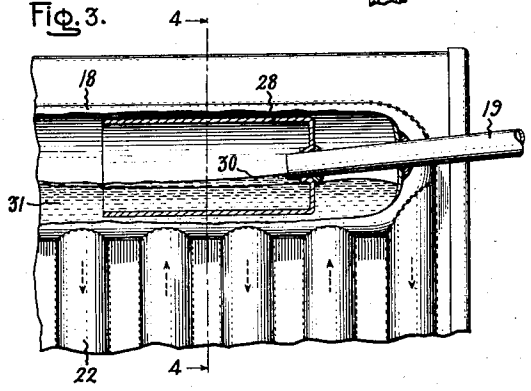


Fig. 3.



Inventor:
CARL H. STEENSTRUP
by Harry E. Dunham
His Attorney.

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2,042,558

EVAPORATOR

Carl H. Steenstrup, Niskayuna, N. Y., assignor to General Electric Company, a corporation of New York

Application August 28, 1935, Serial No. 38,204

6 Claims. (Cl. 62—126)

My invention relates to flooded evaporators for refrigerating machines of the type employing a liquefiable refrigerant and a liquid lubricant.

During the operation of refrigerating machines which employ refrigerants such as sulphur-dioxide and a liquid lubricant, such as a refined mineral oil, there is a tendency for the oil to be carried through the system and into the evaporator. The lubricant may be separated from the refrigerant by gravity, but because of the boiling and agitation of the liquid refrigerant this separation cannot be accomplished readily in the header unless a quiet zone of liquid is provided. It is, therefore, necessary to provide some arrangement for separating and collecting the lubricant in the evaporator and for returning it to the compressor for use in lubricating the working parts of the mechanism in order not to deplete the supply of lubricant available for lubricating the working parts of the mechanism.

Accordingly, it is an object of my invention to provide a flooded evaporator for refrigerating machines of the type employing a liquefiable refrigerant and a liquid lubricant having an improved arrangement for facilitating the removal of lubricant from the evaporator.

Further objects and advantages of my invention will become apparent as the following description proceeds and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of my invention reference may be had to the accompanying drawing, in which Fig. 1 is a front elevation view of a household refrigerating machine provided with an evaporator embodying my invention; Fig. 2 is an enlarged perspective view partly in section of the evaporator of the refrigerating machine shown in Fig. 1; Fig. 3 is an enlarged fragmentary view partly in section of a portion of the evaporator shown in Fig. 2; and Fig. 4 is a sectional view of the evaporator on the line 4—4 of Fig. 3.

Referring now to the drawing, in Fig. 1 I have shown a refrigerating machine comprising a casing 10 containing a motor and a compressor, an air-cooled condenser 11, a receiver or float valve chamber 12, and an evaporator 13 arranged to cool a compartment 14 of a household refrigerator cabinet 15. During the operation of the refrigerating machine shown gaseous refrigerant is compressed by operation of the compressor of the casing 10 and is discharged into the condenser 11 where it is cooled by absorption of heat from the surrounding air and is liquefied. The liquid refrigerant flows from the condenser 11 into the receiver 12, and when a predetermined amount of liquid has collected in the receiver a float therein rises and liquid refrigerant is admitted through a liquid line 16 to the evaporator 13. The liquid refrigerant within the evaporator 13 is vaporized by the absorption of heat from the compartment 14 and the vaporized refrigerant separates from the liquid in headers 17 and 18 of the evaporator and is withdrawn therefrom through a suction conduit 19 and is returned to the compressor. This cycle of operation continues as long as the compressor within the casing 10 is operating. The compressor is controlled thermostatically in the usual manner in response to the temperature of the evaporator or of the air within the compartment 14.

In order to lubricate the compressor a quantity of liquid lubricant such as mineral oil is provided in the bottom of the casing 10. This lubricant is supplied to the working parts of the motor and compressor by operation of a suitable pump driven by the compressor motor. As a result of the distribution of oil to the working parts of the compressor some of the oil in the form of a mist flows with the compressed refrigerant into the condenser and thence to the evaporator 13. The oil and liquid refrigerant in the evaporator are intimately mixed, but tend to separate by gravity the oil floating on top of the refrigerant. The separation is, however, hindered by the agitation of the liquid due to the boiling of the refrigerant and is therefore inefficient. In order to prevent depletion of the supply of oil for lubricating the working mechanism it is necessary to separate efficiently the oil and liquid refrigerant and to return to the casing 10 the oil collected on the surface of the liquid refrigerant in the evaporator 13.

In accordance with my invention, I provide a baffle within one of the headers of the evaporator so arranged as to provide an elongated chamber within the evaporator partially below the level of liquid to maintain a quiet zone of liquid within the header, so that the lubricant and liquid refrigerant can readily separate by gravity, and I connect the suction conduit to communicate with the chamber in order to withdraw lubricant collected on the surface of the liquid refrigerant within the baffle. I also construct the evaporator so that the circulating paths thereof provide a relatively quiet zone of liquid refrigerant near the open end of the baffle.

Referring now to Fig. 2, evaporator 13 is of U-shaped form having legs 20 and 21 providing

side walls of a freezing compartment and having the headers 17 and 18 respectively formed in the upper portions thereof, a plurality of conduits or passages 22 are provided in the walls of the evaporator and connect the headers, each of the passages communicating at one end with the header 17 and at the other end with the header 18. A manifold 23 is formed in the wall 20 near the lower portion thereof and connects a plurality of the passages 22. A vapor conduit 25 connecting the headers 17 and 18 above the level of liquid refrigerant therein is provided to equalize the pressures in the headers and to remove gaseous refrigerant from the header 17. The liquid line 16 enters the manifold 23 and terminates in a tube 26 closed at the end and provided with orifices 27 connecting alternate ones of the passages 22 and arranged to inject refrigerant upwardly into those passages. During the operation of the refrigerating machine liquid refrigerant enters the tube 26 and flows upwardly in the alternate passages as indicated by dotted arrows. During the normal operation of the refrigerating machine the headers 17 and 18 are maintained partially filled with liquid refrigerant. The refrigerant entering the passages from the orifices 27 induces a circulation in alternate passages from the header 18 to the header 17, liquid refrigerant then returns from the header 17 to the header 18 through the remaining passages and thereby a continuous circulation of liquid refrigerant is maintained.

This evaporator construction wherein a circulation of refrigerant is produced by injection of the refrigerant supply into a portion only of the total number of refrigerant passages is not my invention but is the invention of Leonard W. Atchison and is described and claimed in his co-pending application Serial No. 750,977 filed November 1, 1934 and assigned to the General Electric Company assignee of this present application. I do not therefore herein claim anything claimed in the said Atchison application which is to be regarded as prior art with respect to this present application, my invention relating to an improved arrangement for separating and removing lubricant from the header of an evaporator.

The continuous circulation of refrigerant and the absorption of heat from the compartment 14 produces a violent bubbling or boiling action in the headers 17 and 18 and it is necessary to provide some arrangement for keeping the liquid refrigerant from splashing into the suction line 19. Furthermore, the violent agitation of the liquid makes it difficult for the lubricant and liquid refrigerant to separate by gravity and for the lubricant to collect in such a manner that it may be removed from the evaporator without also removing liquid refrigerant In order to provide a quiet zone of liquid within the header 18 for the gravity separation of lubricant and liquid refrigerant I secure a substantially cylindrical baffle 28 within the header and arrange the suction line 19 in communication with the interior thereof. The arrangement of this baffle is clearly shown in Figs. 3 and 4. One end 29 of the baffle is closed, and it is to this end that the suction line 19 is connected in communication with the interior of the baffle, the baffle being supported within the header by the suction line and by the side wall of the header to which the baffle is secured by spot welding or in some other suitable manner. The other end of the baffle 28 is open, and since the baffle is arranged horizontally within the header and is partially below the level of liquid refrigerant, a quantity of liquid refrigerant will cover the lower portion of the interior of the baffle. A quantity of liquid lubricant 30 separates by gravity from the liquid refrigerant and collects on the surface of the liquid refrigerant as indicated at 31, and due to the violent agitation of the liquid in the header 18 there is a tendency for the oil to accumulate in a greater quantity on the quiet surface near the closed end 29 of the baffle 28. The suction line 19 communicates with the header 18 within the baffle 28 near the closed end thereof, and during operation of the compressor the oil which collects on the surface of the liquid refrigerant is drawn into the suction line and returned to the compressor. The open end of the baffle is preferably arranged above one of the passages 22 in which there is a downward flow of liquid refrigerant from the header 18 since the liquid above the downward passage will be more quiet than that above the passages in which refrigerant is flowing upwardly into the header 18. This position of the open end further aids the maintenance of the quiet zone of liquid within the baffle.

The level of liquid refrigerant 31 within the headers varies somewhat with ambient air temperature, but is maintained substantially constant by the normal operation of the refrigerating machine under average ambient air temperature conditions. The cylindrical baffle 28 provides a very simple and effective arrangement for facilitating the separation of lubricant from liquid refrigerant and the removal of lubricant from the surface of the liquid refrigerant in the header and at the same time provides a quiet zone of liquid preventing the splashing of liquid refrigerant into the suction line and possible damage to the compressor mechanism.

While I have shown and described a particular embodiment of my invention in connection with an evaporator for a household refrigerating machine, modifications will occur to those skilled in the art. I do not, therefore, desire my invention to be limited to the construction shown and described, and I intend in the appended claims to cover all modifications within the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A flooded evaporator for refrigerating machines of the type employing a liquefiable refrigerant and a liquid lubricant separable by gravity and including a header for separating liquid and gaseous refrigerant, means including a suction conduit entering said header for removing gaseous refrigerant and lubricant therefrom, and means including an elongated vessel in said header communicating at one end with said conduit and open at the other end and having the interior thereof throughout its length partially below the level of and covered by the liquid refrigerant in said header for separating lubricant from the liquid refrigerant in said evaporator.

2. A flooded evaporator for refrigerating machines of the type employing a liquefiable refrigerant and a liquid lubricant separable by gravity and including a header for separating liquid and gaseous refrigerant, means including a suction conduit entering said header for removing gaseous refrigerant and lubricant therefrom, and means including an elongated substantially cylindrical baffle having an open end and arranged horizontally within said header and extending throughout its length partially below the

level of liquid refrigerant in said header for separating lubricant from the liquid refrigerant within said evaporator, said suction conduit communicating with said header within said baffle.

3. A flooded evaporator for refrigerating machines of the type employing a liquefiable refrigerant and a liquid lubricant separable by gravity and including a header for separating liquid and gaseous refrigerant, means including a suction conduit entering said header for removing gaseous refrigerant and lubricant therefrom, a substantially cylindrical baffle closed at one end and open at the other end and arranged horizontally within said header, said baffle extending throughout its length partially below the level of liquid refrigerant in said header, said suction conduit being connected to the closed end of said baffle and communicating with the interior thereof.

4. A flooded evaporator for refrigerating machines of the type employing a liquefiable refrigerant and a liquid lubricant separable by gravity and including a header for separating liquid and gaseous refrigerant, means including a suction conduit entering said header for removing gaseous refrigerant and lubricant therefrom, and means including an open-end elongated substantially cylindrical baffle arranged horizontally within said header and extending throughout its length partially below the level of liquid refrigerant in said header for separating lubricant from the liquid refrigerant within said evaporator, means including said suction conduit for supporting said baffle in said header, said suction conduit communicating with said header within said baffle.

5. A flooded evaporator for refrigerating machines of the type employing a liquefiable refrigerant and a liquid lubricant separable by gravity and including a header for separating liquid and gaseous refrigerant, means including a suction conduit entering said header for removing gaseous refrigerant and lubricant therefrom, and means including an elongated vessel communicating at one end with said conduit and open at the other end and having the interior thereof throughout its length partially below the level of and covered by the liquid refrigerant in said header for separating lubricant from the liquid refrigerant in said evaporator, said suction conduit communicating with said vessel adjacent the level of liquefied refrigerant therein.

6. A flooded evaporator for refrigerating machines of the type employing a liquefiable refrigerant and a liquid lubricant separable by gravity and including a header for separating liquid and gaseous refrigerant, means providing a plurality of depending refrigerant circulating passages communicating with said header below the level of liquid refrigerant therein, means for producing a circulation of liquid refrigerant in an upward direction through some of said passages and in a downward direction through others of said passages, means including a suction conduit entering said header for removing gaseous refrigerant and lubricant therefrom, and means including an elongated vessel closed at one end and open at the other end and communicating at said closed end with said conduit and having said open end partially below the level of liquid refrigerant in said header for separating lubricant from the liquid refrigerant in said evaporator, said open end of said vessel being substantially directly above one of said passages wherein liquid refrigerant is directed downwardly from said header.

CARL H. STEENSTRUP.