Nov. 10, 1936. L. W. ATCHISON 2,060,653

REFRIGERATOR EVAPORATOR

Filed Jan. 22, 1935

Fig. 1.

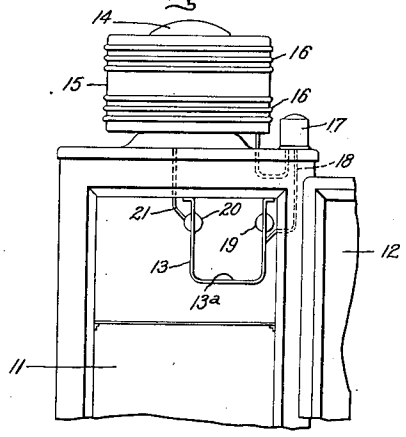
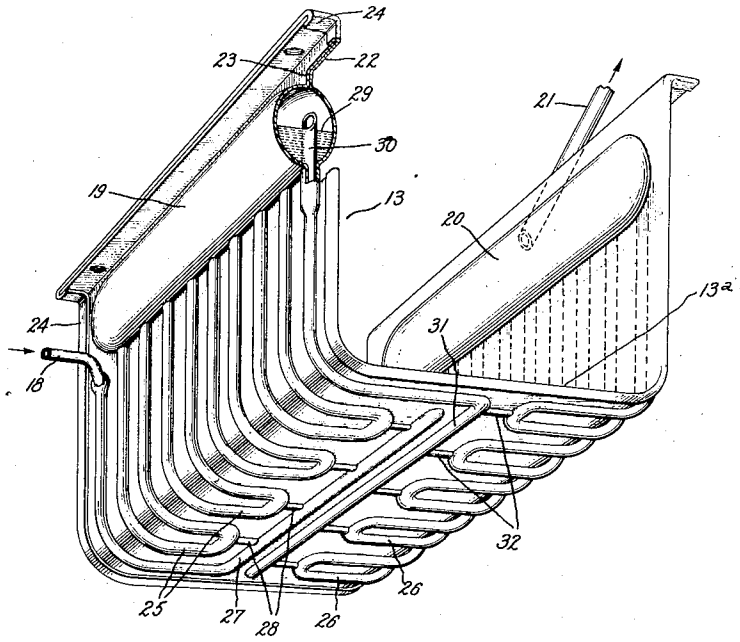


Fig. 2.



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REFRIGERATOR EVAPORATOR

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Application January 22, 1935, Serial No. 2,917

9 Claims. (Cl. 62—126)

My invention relates to evaporators for refrigerating machines.

It is an object of my invention to provide a flooded evaporator for refrigerating machines which affords an efficient circulation of liquid refrigerant and removal of the vaporized refrigerant and which does not require a pressure equalizing connection between any portions of the evaporator above the level of liquid refrigerant therein.

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 shows a household refrigerator provided with an evaporator embodying my invention, and Fig. 2 is an enlarged perspective view partly in section of the evaporator shown in Fig. 1.

Referring to the drawing, in Fig. 1 I have shown a household refrigerator comprising a cabinet 10 having a food compartment 11 to be cooled, and a door 12 for closing the compartment. The compartment 11 is cooled by an evaporator 13 arranged in the upper portion thereof and supplied with refrigerant from a refrigerating machine comprising a closed casing 14 in which is arranged a motor and a compressor, a natural draft air cooled condenser 15 having a conduit 16 and a receiver or float valve chamber 17. During operation of the motor and compressor within the casing 14 refrigerant is compressed and discharged into the conduit 16 of the condenser 15 where it is cooled and liquefied and then flows to the float valve chamber 17. When a predetermined amount of liquid refrigerant has collected in the float valve chamber 17, a float arranged therein rises and admits refrigerant through a conduit 18 to the evaporator 13. The evaporator is arranged to cool the compartment 11 and also to support freezing trays or other vessels and to freeze water desserts or the like placed therein. The liquid refrigerant is vaporized by the absorption of heat from the chamber 11 and from freezing trays supported on the evaporator and the vapor collects in headers 19 and 20, is withdrawn from the header 20 through a conduit 21 and returns to the casing 14. This cycle of operation continues as long as the motor within the casing 14 is operating. The temperature within the compartment 11 may be thermostatically regulated in the usual manner by controlling the operation of the motor which drives the compressor.

In order to provide a minimum amount of obstruction within the evaporator and the refrigerator cabinet, it is desirable that the space within the evaporator between the headers 19 and 20 be free from refrigerant conduits and the like. In accordance with my invention I provide a construction which accomplishes this purpose by arranging the two headers of the evaporator with separate groups of depending refrigerant circulating conduits, and by arranging a connection between one of the headers and the set of conduits connected to the other header so that both liquid and gaseous refrigerant collecting in the first header will be injected into the group of tubes connected to the second header.

Referring now to Fig. 2, the evaporator 13 comprises inner and outer metal sheets 22 and 23 respectively secured together face to face and bent into U-shaped form, the edges of the sheet 22 being bent around the sheet 23 as indicated at 24. The walls of the evaporator are sealed by welding them around their edges and between the passages formed therein or in any other suitable manner. The cylindrical headers 19 and 20 and the depending refrigerant passages are formed by indentations in the sheets, the headers being arranged in the upper ends of the U. The inner sheet 22 is smooth except for the header indentations therein so that the horizontal portion 13a of the evaporator provides a suitable support for freezing trays or the like. The depending refrigerant circulating passages are arranged in two groups, one group communicating with the header 19 comprising a plurality of separate U-shaped passages or tubes 25, and the other group communicating with the header 20 and comprising a plurality of separate U-shaped passages or tubes 26. Each of the U-shaped passages communicates at both ends with the same header and below the normal level of liquid refrigerant in that header.

In order to supply refrigerant to the evaporator 13, I provide a manifold 27 arranged in the bottom of the evaporator and providing communication between the liquid refrigerant supply conduit 18 and each of the U-shaped passages 25 through ducts 28. The refrigerant flowing from the float chamber 17 through the conduit 18 enters the manifold 27 and flows through ducts 28 into the passages 25. Injection of refrigerant into the passages induces a circulation of refrigerant, which assists the natural thermally in-

duced circulation within the passages from the header into one end of each of the U-shaped passages and then through the passages back to the header, and provides an efficient arrangement for the rapid absorption of heat by the evaporator.

This arrangement whereby the ducts introduce refrigerant into the circulating tubes in order to assist the natural thermally induced circulation regardless of the direction thereof, is not my invention, but is the invention of Delbert F. Newman, and is described and claimed in copending application, Serial No. 3,651, filed January 26, 1935, and assigned to the General Electric Company, assignee of my present invention. I do not, therefore, claim herein anything described or claimed in the said Newman application, which is to be regarded as prior art with respect to the present application, my invention relating to the arrangement of an evaporator having a plurality of headers and which does not require an equalizing connection between the headers.

Liquid refrigerant in the evaporator 13 will collect in the header 19 and normally will be approximately at a level indicated at 29, lubricant ordinarily floating on the surface of the liquid refrigerant. Vaporized refrigerant will collect in the header 19 above the liquid refrigerant therein. In order to remove the vaporized refrigerant and excess liquid refrigerant and lubricant from the header 19, I provide an outlet connection 30 opening into the header 19 at the liquid level 29 therein and communicating with a manifold 31 in the bottom of the evaporator. The manifold 31 communicates with the lower ends of the U-shaped passages 26 through ducts 32, and the liquid and gaseous refrigerant received from the header 19 is injected into the passages 26 from the manifold 31 through these ducts and produces a circulation of refrigerant in the passages 26, which assists the thermally induced circulation therein as in the passages 25. The vaporized refrigerant from the header 19 and the refrigerant vaporized in the passages 26 collects in the header 20 above the level of liquid refrigerant therein and is withdrawn therefrom through the conduit 21. Since the connection 30 and the manifold 31 convey both liquid and gaseous refrigerant with oil from the header 19 and inject this refrigerant with oil into the passages 26, no equalizing connection is required between the headers 19 and 20. Furthermore, as long as refrigerant is being vaporized in the header 19 and the passages 25, refrigerant vapor will be injected into the passages 26 through the ducts 32 and will maintain a rapid circulation of liquid refrigerant in the passages 26. This rapid circulation of refrigerant provides an efficient evaporator which will rapidly absorb heat from the air in the cabinet and articles placed thereon.

During the operation of the refrigerating machine shown in Figs. 1 and 2 refrigerant is collected in the float valve chamber 17, and is admitted periodically to the evaporator 13 and, while being admitted, induces a rapid circulation of refrigerant in the U-shaped passages 25, and refrigerant is also injected into the passages 26 from the header 19 and induces a rapid circulation in the passages 26. During the idle periods of the compressor within the casing 14, and during the intervals when refrigerant is not flowing from the float valve chamber 17 into the evaporator, the refrigerant evaporating within the passages 25 and the header 19 will collect in this header and continue to flow through the connection 30 into the manifold 31 and through the ducts 32 into the passages 26 where it continues the rapid circulation of refrigerant. It will thus be seen that there is a rapid circulation of refrigerant in the passages 26 at all times when heat is being absorbed by the evaporator and is vaporizing refrigerant in the tubes 25 and the header 19. The surface of the evaporator 13 is adequate for cooling the air in the refrigerator cabinet 11, and the contents of freezing trays or the like placed on the surface thereof at 13a.

While I have shown my invention embodied in a particular evaporator for a household refrigerating machine, other modifications will occur to those skilled in the art. I do not, therefore, desire my invention to be limited to the particular 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 comprising a header and means providing two groups of refrigerant circulating passages for containing refrigerant, all of the passages in one of said groups communicating with said header, means injecting liquid refrigerant into a plurality of the passages of said one of said groups of passages for producing a circulation of refrigerant in said one group of passages, means providing communication between said header and the other of said groups of passages for removing liquid and gaseous refrigerant from said header and injecting said removed refrigerant into a plurality of the passages in said other group of passages for producing a circulation of refrigerant in the second of said groups of passages, and means for withdrawing gaseous refrigerant from said second group of passages.

2. A flooded evaporator for refrigerating machines comprising two headers and means providing two groups of depending refrigerant circulating passages for containing refrigerant, one of said groups of passages communicating with one of said headers, the other of said groups of passages communicating with the other of said headers, means injecting liquid refrigerant into a plurality of the passages of said one of said groups of passages for producing a circulation of refrigerant in said one group of passages, means providing communication between said one header and said other group of passages for removing liquid and gaseous refrigerant from said one header and injecting said removed refrigerant into a plurality of the passages in said other group of passages for producing a circulation of refrigerant in said other group of passages, and means for withdrawing gaseous refrigerant from said other header.

3. A flooded evaporator for refrigerating machines comprising two headers and means providing two groups of depending refrigerant circulating passages for containing refrigerant, one of said groups of passages communicating with one of said headers and the other of said groups of passages communicating with the other of said headers, means injecting liquid refrigerant into each passage of said one group of passages for supplying refrigerant to said evaporator and for producing a circulation of refrigerant in said one group of passages, means providing communication between said one header and said

other group of passages for removing liquid and gaseous refrigerant from said one header and for producing a circulation of refrigerant in said other group of passages, and means for withdrawing gaseous refrigerant from said other header.

4. A flooded evaporator for refrigerating machines comprising two headers and means providing two groups of depending refrigerant circulating passages for containing refrigerant, one of said groups of passages communicating with one of said headers and the other of said groups of passages communicating with the other of said headers, means including a manifold and a plurality of ducts communicating therewith for supplying liquid refrigerant to said one group of passages and for producing a circulation of refrigerant in said one group of passages, means including a second manifold and a plurality of ducts providing communication between said one header and said other group of passages for removing liquid and gaseous refrigerant from said one header and for producing a circulation of liquid refrigerant in said other group of passages, and means for withdrawing gaseous refrigerant from said other header.

5. A flooded evaporator for refrigerating machines comprising two headers and means providing two groups of U-shaped depending refrigerant circulating passages for containing refrigerant, one of said groups of passages communicating with one of said headers and the other of said groups of passages communicating with the other of said headers, means injecting liquid refrigerant into a plurality of the passages of said one group of passages for producing a circulation of refrigerant in said one group of passages, means providing communication between said one header and said other group of passages for removing liquid and gaseous refrigerant from said one header and injecting said removed refrigerant into a plurality of the passages in said other group of passages for producing a circulation of refrigerant in said other group of passages, and means for withdrawing gaseous refrigerant from said other header.

6. A flooded evaporator for refrigerating machines comprising two headers and means providing two groups of U-shaped depending refrigerant circulating passages for containing refrigerant, one of said groups of passages communicating with one of said headers and the other of said groups of passages communicating with the other of said headers, means including a manifold and a plurality of ducts connecting said manifold and said one group of passages for supplying liquid refrigerant to said one group of passages and for producing a circulation of refrigerant in said one group of passages, means including a second manifold and a plurality of ducts providing communication between said one header and said other group of passages for removing liquid and gaseous refrigerant from said one header and for producing a circulation of refrigerant in said other group of passages, and means for withdrawing gaseous refrigerant from said other header.

7. A flooded evaporator for refrigerating machines comprising two metal sheets secured together and having indentations formed therein providing two headers and two groups of depending refrigerant circulating passages, one of said groups of passages communicating with one of said headers, the other of said groups of passages communicating with the other of said headers, means injecting liquid refrigerant into a plurality of the passages of said one group of passages for producing a circulation of refrigerant in said one group of passages, means providing communication between said one header and said other group of passages for removing liquid and gaseous refrigerant from said one header and injecting said removed refrigerant into a plurality of the passages in said other group of passages for producing a circulation of refrigerant in said other group of passages, and means for withdrawing gaseous refrigerant from said other header.

8. A flooded evaporator for refrigerating machines comprising two metal sheets secured together and having indentations formed therein providing two headers and two groups of depending refrigerant circulating passages, one of said groups of passages communicating with one of said headers and the other of said groups of passages communicating with the other of said headers, means including a manifold and injecting liquid refrigerant into a plurality of the passages of said one group of passages for producing a circulation of refrigerant in said one group of passages, means including a second manifold providing communication between said one header and said other group of passages for removing liquid and gaseous refrigerant from said one header and injecting said removed refrigerant into a plurality of the passages of said other group of passages for producing a circulation of refrigerant in said other group of passages, and means for withdrawing gaseous refrigerant from said other header.

9. A flooded evaporator for refrigerating machines comprising two metal sheets secured together and having indentations formed therein providing two headers and two groups of depending refrigerant circulating passages, one of said groups of passages communicating with one of said headers, the other of said groups of passages communicating with the other of said headers, means including a manifold and ducts connecting said manifold with each of said passages in said one group of passages for supplying refrigerant to said evaporator and for producing a circulation of refrigerant in said one group of passages, means including a second manifold and ducts connecting said second manifold with each of the passages in said other group of passages for removing liquid and gaseous refrigerant from said one header and for producing a circulation of refrigerant in said other group of passages, and means for withdrawing gaseous refrigerant from said other header.

LEONARD W. ATCHISON.