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EVAPORATOR FOR REFRIGERATING MACHINES

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Fig. 2.

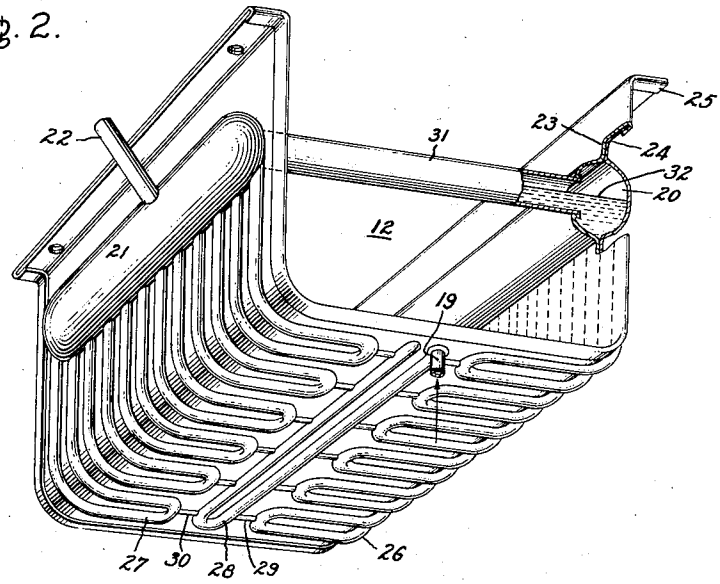
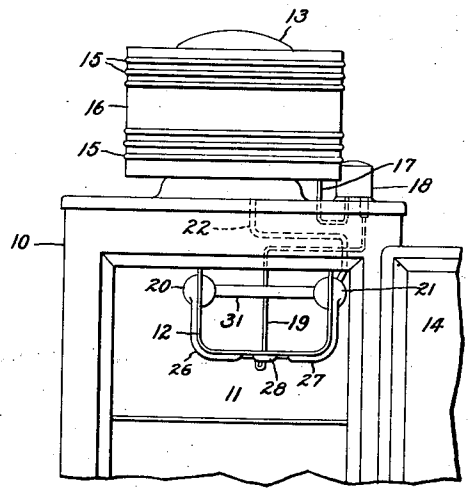


Fig. 1.



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EVAPORATOR FOR REFRIGERATING MACHINES

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21 Claims. (Cl. 62—126)

My invention relates to evaporators for refrigerating machines.

An object of my invention is to provide an improved evaporator of simple and rugged construction and having a highly efficient arrangement for circulating liquid refrigerant therein.

Another object of my invention is to provide a flooded evaporator for refrigerating machines having an arrangement for producing circulation of refrigerant to assist the natural thermally induced circulation in the evaporator in either direction thereof.

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 now to Fig. 1, I have shown a household refrigerating machine provided with a cabinet 10 having a food compartment 11 which is cooled by an evaporator 12 arranged therein and supplied with refrigerant from a motor and compressor unit contained in a casing 13 mounted on the top of the cabinet 10. A door 14 is provided to close the compartment 11 when the refrigerator is being used. During the operation of the refrigerating machine shown, gaseous refrigerant is compressed within the casing 10 and flows into a conduit 15 formed in a shell 16 and comprising a condenser. The gaseous refrigerant is air cooled by natural draft and liquefied in the condenser and flows through a connection 17 to a receiver or float valve chamber 18. The liquid flows in regulated quantities from the chamber 18 through a conduit 19 to the evaporator 12. The absorption of heat from the chamber 11 vaporizes the liquid refrigerant within the evaporator and the vapor collects in headers 20 and 21, and is withdrawn through conduit 22 by operation of the compressor, and returned to the casing 13. The motor and compressor within the casing 13 are operated intermittently under the control of a thermostat in accordance with the temperature of the evaporator so as to maintain the desired temperature in the cabinet. Liquid refrigerant is supplied to the evaporator by operation of the float valve at 18 during operation of the motor and compressor. When the evaporator is sufficiently cooled the operation of the motor and compressor is stopped, and the supply of liquid refrigerant ceases. The liquid within the evaporator continues to evaporate and absorb heat from the chamber 11 until the temperature of the evaporator rises to a predetermined value when the motor is again started. This cycle is continuous and maintains the evaporator within a predetermined range of temperature.

During the operation of the refrigerating machine it is desirable to provide a continuous circulation of liquid refrigerant in the evaporator in order to obtain the highest possible rate of heat absorption. The liquid refrigerant supplied to the evaporator may be utilized to produce a circulation of refrigerant in the evaporator while the liquid is being supplied thereto. When liquid is not being supplied thereto a circulation of refrigerant will be produced by slight temperature differences, and it is desirable that when the refrigerant supplied to the evaporator is utilized to induce a circulation of refrigerant therein, this circulation will be in the same direction as that which is thermally induced.

In accordance with my invention I construct the evaporator 12 with a header or headers and a plurality of depending refrigerant circulating passages or tubes and provide a manifold for supplying refrigerant to the evaporator and arranged to inject refrigerant into the passages in a manner which produces a circulation assisting the natural thermal circulation of the liquid refrigerant in the evaporator in either direction thereof.

Referring to Figure 2, the evaporator 12 comprises inner and outer metal sheets 23 and 24 respectively secured together about their edges, the sheet 23 being bent over the edge of the sheet 24 as indicated at 25. The headers 20 and 21 are formed by indentations in the sheets near the opposite ends thereof, the sheets being bent in a U-shaped form with the headers at the upper ends of the U. Depending from the headers 20 and 21 respectively are a plurality of separate U-shaped refrigerant passages or conduits 26 and 27 respectively. These U-shaped passages are formed by providing corrugations or indentations in the outer sheet 24 of the evaporator, partly in the sides and partly in the bottom of the evaporator. The lower portions of the passages are available for cooling the bottom of the evaporator, and freezing trays or similar articles which may be supported thereon. The passages 26 are connected as a group with both ends of each

passage opening into the header 20 below the level of liquid refrigerant therein and connected in substantially longitudinal alinement along said header with the ends of the other passages 26. The passages 27 are connected to the header 21 in a similar manner. Liquid refrigerant will circulate from one end of each of the passages 26 and 27 to the other end thereof, the direction being determined by thermal conditions in each particular passage. In order to utilize the liquid refrigerant supplied to the evaporator to induce a circulation of refrigerant in the direction of the natural thermal circulation in each of the passages in either direction, I provide a U-shaped manifold 28 in the bottom of the evaporator between the ends of the tubes 26 and 27 and communicating with the lower ends of the U-shaped passages 26 and 27 through ducts 29 and 30, respectively. The refrigerant from the manifold 28 is injected directly into the passages 26 and 27 transversely of the flow therein and will flow in the same direction as the refrigerant circulating in the passages. The direction of flow is determined by the natural thermal circulation therein, for any bubbles of gaseous refrigerant entering the passages through the ducts 29 and 30 will be carried by the circulation in the direction thereof and when rising will assist the circulation. It is thus evident that regardless of the direction of the thermally induced circulation in the passages, the injection of refrigerant into these passages from the manifold 28 will assist the thermally induced circulation. In order to maintain the same level of liquid in the headers 20 and 21 and to provide a passage for liquid and gaseous refrigerant between the headers, I provide a horizontal conduit 31 connecting the headers and arranged so that the normal level of liquid refrigerant indicated at 32 lies within the conduit. Gaseous refrigerant is withdrawn from the evaporator through the conduit 22 connected to the header 21.

During the idle periods when the compressor of the refrigerating machine is not operating refrigerant will circulate in the depending U-shaped passages in directions determined by the thermally induced currents in each passage. When the motor and compressor unit is started liquid refrigerant will be injected into the passages 26 and 27 through ducts 29 and 30 respectively. Some of the liquid will vaporize and the liquid and vapor will induce a circulation assisting the natural thermal circulation in each of the passages. The rapid circulation produced by this injection of refrigerant will make possible a higher rate of heat absorption, thus ice trays or articles of food placed on the evaporator or within the refrigerator will be cooled rapidly.

The evaporator embodying my invention is of simple construction, is easily manufactured and provides a highly efficient arrangement for circulating refrigerant.

While I have shown and described my invention in connection with a household refrigerating machine, other applications will readily be apparent 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 a depending U-shaped refrigerant circulating passage, means communicating with the lower portion of said U-shaped passage for injecting liquid refrigerant into said U-shaped passage and for assisting the thermally induced circulation of refrigerant in said passage in either direction of said thermally induced circulation, and means for withdrawing gaseous refrigerant from said header.

2. A flooded evaporator for refrigerating machines comprising a header and a depending U-shaped refrigerant circulating passage, means communicating with the mid-portion of said U-shaped passage for injecting liquid refrigerant into said U-shaped passage and for assisting the thermally induced circulation of refrigerant in said passage in either direction of said thermally induced circulation, and means for withdrawing gaseous refrigerant from said header.

3. A flooded evaporator for refrigerating machines comprising a header and a plurality of depending U-shaped refrigerant circulating passages, means communicating with the lower portion of each of said U-shaped passages for injecting liquid refrigerant into said U-shaped passages and for assisting the thermally induced circulation of refrigerant in said U-shaped passages in either direction of said thermally induced circulation, and means for withdrawing gaseous refrigerant from said header.

4. A flooded evaporator for refrigerating machines comprising a header and a plurality of separate depending U-shaped refrigerant circulating passages, means communicating with the lower portion of each of said U-shaped passages for injecting liquid refrigerant into said U-shaped passages and for assisting the thermally induced circulation of refrigerant in said U-shaped passages in either direction of said thermally induced circulation, and means for withdrawing gaseous refrigerant from said header.

5. A flooded evaporator for refrigerating machines comprising a header and a plurality of separate depending U-shaped refrigerant circulating passages, both of the ends of each of said passages communicating with said header and all of the ends of said passages being substantially in longitudinal alinement along said header, means communicating with the lower portion of each of said U-shaped passages for injecting liquid refrigerant into said U-shaped passages, and means for withdrawing gaseous refrigerant from said header.

6. A flooded evaporator for refrigerating machines comprising a header and a plurality of depending U-shaped refrigerant circulating passages, both of the ends of each of said passages communicating with said header and all of the ends of said passages being substantially in longitudinal alinement along said header, means communicating with the lower portion of each of said U-shaped passages for injecting liquid refrigerant into said U-shaped passages and for inducing a circulation of refrigerant through said passages, and means for withdrawing refrigerant from said header.

7. A flooded evaporator for refrigerating machines comprising a header and a plurality of separate depending U-shaped refrigerant circulating passages, both of the ends of each of said passages communicating with said header and all of the ends of said passages being substantially in longitudinal alinement along said header, means communicating with the lower portion of each of said U-shaped passages for injecting liquid refrigerant into said U-shaped passages and for inducing a circulation of refrigerant

through said passages, and means for withdrawing refrigerant from said header.

8. A flooded evaporator for refrigerating machines comprising a header and a plurality of depending U-shaped refrigerant circulating passages, both of the ends of each of said U-shaped passages communicating with said header and all of the ends of said U-shaped passages being substantially in longitudinal alinement along said header, said evaporator having a portion arranged to support freezing trays or the like in heat exchange relation with refrigerant in said passages, means communicating with the mid-portion of each of said U-shaped passages for injecting liquid refrigerant into said U-shaped passages and for inducing a circulation of refrigerant through said passages, and means for withdrawing gaseous refrigerant from said header.

9. A flooded evaporator for refrigerating machines comprising a header and a plurality of separate depending U-shaped refrigerant circulating passages, both of the ends of each of said U-shaped passages communicating with said header and all of the ends of said U-shaped passages being substantially in longitudinal alinement along said header, said evaporator having a portion arranged to support freezing trays or the like in heat exchange relation with refrigerant in said passages, means communicating with the mid-portion of each of said U-shaped passages for injecting liquid refrigerant into said U-shaped passages and for inducing a circulation of refrigerant through said passages, and means for withdrawing gaseous refrigerant from said header.

10. A flooded evaporator for refrigerating machines comprising a header and a plurality of separate depending U-shaped refrigerant circulating passages, both of the ends of each of said U-shaped passages communicating with said header and all of the ends of said U-shaped passages being substantially in longitudinal alinement along said header, said evaporator having a portion arranged to support freezing trays or the like in heat exchange relation with refrigerant in said passages, means including a plurality of ducts, one communicating with the mid-portion of each of said U-shaped passages for admitting liquid refrigerant to said evaporator and for inducing a circulation of refrigerant through said passages, and means for withdrawing gaseous refrigerant from said header.

11. A flooded evaporator for refrigerating machines comprising two headers, a plurality of depending U-shaped refrigerant circulating passages arranged in two groups, all of the U-shaped passages of one of said groups communicating with one of said headers and being arranged substantially in longitudinal alinement along said header, all of the passages of the other of said groups communicating with the other of said headers and being arranged substantially in longitudinal alinement along the other of said headers, means including a U-shaped manifold communicating with the mid-portion of each of said passages for admitting liquid refrigerant to said evaporator and for inducing a circulation of liquid refrigerant through said passages, and means for withdrawing gaseous refrigerant from said headers.

12. A flooded evaporator for refrigerating machines comprising two headers, a plurality of separate depending U-shaped refrigerant circulating passages arranged in two groups, all of the U-shaped passages of one of said groups communicating with one of said headers and being arranged substantially in longitudinal alinement along said header, all of the passages of the other of said groups communicating with the other of said headers and being arranged substantially in longitudinal alinement along the other of said headers, means communicating with the mid-portion of each of said passages for admitting liquid refrigerant to said evaporator and for inducing a circulation of liquid refrigerant through said passages, and means for withdrawing gaseous refrigerant from said header.

13. A flooded evaporator for refrigerating machines comprising two headers, a plurality of separate depending U-shaped refrigerant circulating passages arranged in two groups, all of the U-shaped passages of one of said groups communicating with one of said headers and being arranged substantially in longitudinal alinement along said header, all of the passages of the other of said groups communicating with the other of said headers and being arranged substantially in longitudinal alinement along the other of said headers, means including a U-shaped manifold communicating with the mid-portion of each of said passages for admitting liquid refrigerant to said evaporator and for inducing a circulation of liquid refrigerant through said passages, and means for withdrawing gaseous refrigerant from said headers.

14. A flooded evaporator for refrigerating machines comprising two headers, a plurality of depending U-shaped refrigerant circulating passages arranged in two groups, all of the U-shaped passages of one of said groups communicating with one of said headers and being arranged substantially in longitudinal alinement along said header, all of the passages of the other of said groups communicating with the other of said headers and being arranged substantially in longitudinal alinement along the other of said headers, means including a plurality of ducts, one communicating with the mid-portion of each of said passages for admitting liquid refrigerant to said evaporator and for inducing a circulation of liquid refrigerant through said passages, and means for withdrawing gaseous refrigerant from said headers.

15. A flooded evaporator for refrigerating machines comprising two headers, a plurality of separate depending U-shaped refrigerant circulating passages arranged in two groups, all of the U-shaped passages of one of said groups communicating with one of said headers and being arranged substantially in longitudinal alinement along said header, all of the passages of the other of said groups communicating with the other of said headers and being arranged substantially in longitudinal alinement along the other of said headers, means communicating with the mid-portion of each of said passages for admitting liquid refrigerant to said evaporator and for inducing a circulation of liquid refrigerant through said passages, means including a connection between said headers for maintaining a common liquid level therein, and means for withdrawing gaseous refrigerant from said header.

16. A flooded evaporator for refrigerating machines comprising two headers, a plurality of depending U-shaped refrigerant circulating passages, said passages being arranged in two groups, all of the passages of one of said groups communicating with one of said headers and being arranged substantially in longitudinal alinement

along said header, all of the passages of the other of said groups communicating with the other of said headers and being arranged substantially in longitudinal alinement along the other of said headers, means including a U-shaped manifold and a plurality of ducts, one communicating with the mid-portion of each of said passages for admitting liquid refrigerant to said evaporator and for inducing a circulation of liquid refrigerant through said passages, means including a connection between said headers for maintaining a common liquid level therein, and means for withdrawing gaseous refrigerant from said headers.

17. A flooded evaporator for refrigerating machines comprising inner and outer sheet metal walls provided with indentations forming two headers and a plurality of separate refrigerant circulating passages depending from said headers, said passages comprising a plurality of U-shaped loops arranged in two groups, all of the loops of one of said groups communicating at both ends with one of said headers, all of the loops of the other of said groups communicating at both ends with the other of said headers, means formed between said inner and outer walls for admitting liquid refrigerant to said evaporator, means communicating with each of said U-shaped passages for inducing a circulation of refrigerant in said passages, and means for withdrawing gaseous refrigerant from said headers.

18. A flooded evaporator for refrigerating machines comprising inner and outer sheet metal walls provided with indentations forming two headers and a plurality of refrigerant circulating passages depending from said headers, said passages comprising a plurality of U-shaped loops arranged in two groups, all of the loops of one of said groups communicating at both ends with one of said headers, all of the loops of the other of said groups communicating at both ends with the other of said headers, means including a manifold formed between said inner and outer walls for admitting liquid refrigerant to said evaporator, means including ducts connecting said manifold and each of said U-shaped passages for inducing a circulation of refrigerant in said passages, and means for withdrawing gaseous refrigerant from said headers.

19. A flooded evaporator for refrigerating machines comprising inner and outer sheet metal walls provided with indentations forming two headers and a plurality of separate refrigerant circulating passages depending from said headers, said passages comprising a plurality of U-shaped loops arranged in two groups, all of the loops of one of said groups communicating with one of said headers, all of the loops of the other of said groups communicating at both ends with the other of said headers, means formed between said inner and outer walls for admitting liquid refrigerant to said evaporator, means communicating with each of said U-shaped passages for inducing a circulation of refrigerant in said passages, means including a connection between said headers for maintaining a common liquid level therein, and means for withdrawing gaseous refrigerant from said headers.

20. A flooded evaporator for refrigerating machines comprising inner and outer sheet metal walls provided with indentations forming two headers, and a plurality of depending refrigerant circulating passages, said passages comprising a plurality of U-shaped loops arranged in two groups, all the loops of one of said groups communicating at both ends with one of said headers, all the loops of the other of said groups communicating at both ends with the other of said headers, means including a manifold formed between said inner and outer walls for admitting liquid refrigerant to said evaporator, means including ducts connecting said manifold and each of said U-shaped passages for inducing a circulation of refrigerant in said passages, means including a conduit connecting said headers for maintaining a common level of liquid refrigerant therein, and means for withdrawing gaseous refrigerant from said headers.

21. A flooded evaporator for refrigerating machines comprising inner and outer sheet metal walls provided with indentations forming two headers and a plurality of depending refrigerant circulating passages, said passages comprising a plurality of U-shaped loops arranged in two groups, all the loops of one of said groups communicating at both ends with one of said headers, all the loops of the other of said groups communicating at both ends with the other of said headers, means including a manifold formed between said inner and outer walls for admitting liquid refrigerant to said evaporator, means including ducts connecting said manifold and each of said U-shaped passages for assisting the thermally induced circulation of refrigerant in said passages in either direction thereof, and means for withdrawing gaseous refrigerant from said headers.

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