Feb. 24, 1942. L. W. ATCHISON 2,274,394

REFRIGERATING MACHINE

Filed April 24, 1940

Fig. 1.

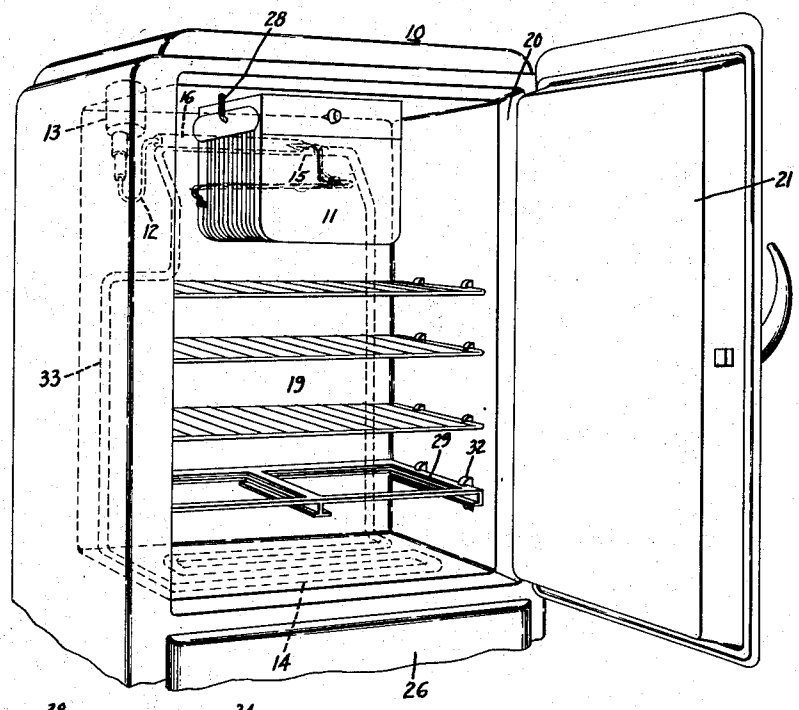
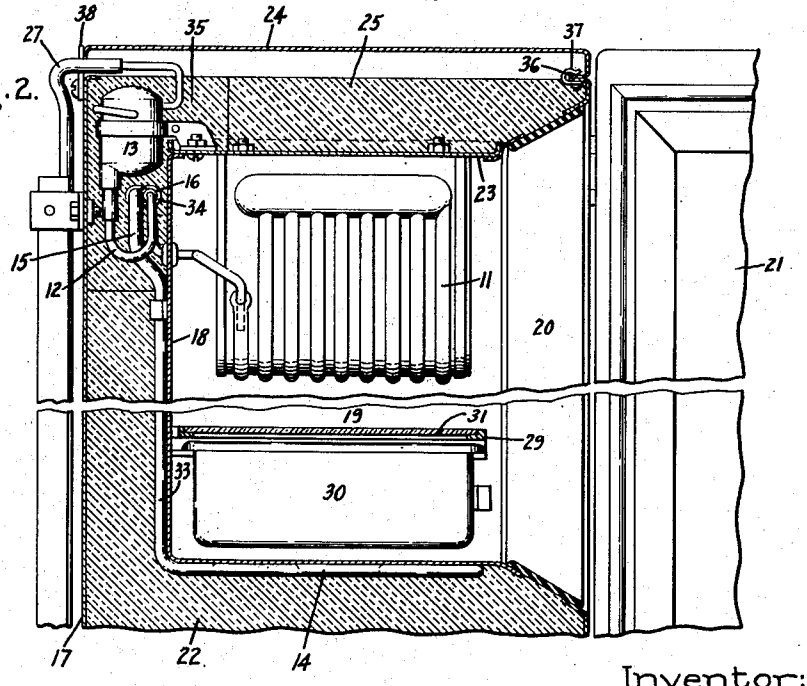


Fig. 2.



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REFRIGERATING MACHINE

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3 Claims. (Cl. 62—116)

This invention relates to refrigerating machines and more particularly to refrigerating machines of the primary-secondary type.

It is an object of my invention to provide a refrigerating machine of the primary-secondary type having an improved arrangement for the exchange of heat between the primary and secondary systems.

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 fragmentary perspective view of a domestic refrigerator embodying the particulars of my invention, and Fig. 2 is a side elevational, sectional view of the refrigerator shown in Fig. 1.

In accordance with my invention I have provided a refrigerator 10 having a primary system including an evaporator 11 and a conduit 12 for conveying refrigerant from a suitable flow controlling means, such as a float chamber 13, or a capillary tube, to the evaporator or cooling element 11 according to load requirements. Any suitable control may be employed. I have also provided a secondary refrigerant system comprising a cooling portion 14 and a condensing portion 15. The condensing portion 15 and a section 16 of the conduit 12, which may be enlarged, if desired, as shown, are disposed in heat exchange relationship. In order to provide a neat appearance, the secondary system and the heat exchange portion of the primary system are preferably located in the insulation space between the outer case 17 and the inner liner 18 of the cabinet. The arrangement briefly described above is advantageous in that the transfer of heat between the secondary system and the section 16 of the primary system immediately preceding the entry of the refrigerant to the evaporator 11 increases the amount of vaporized refrigerant supplied to the evaporator and accordingly provides a greater injector capacity for the primary system. In addition, since refrigerant is furnished through the flow controlling means to the evaporator 11 only according to load requirements, the secondary system functions proportionally to the load because heat is exchanged only when the refrigerator load requires cooling by the primary evaporator.

Describing my invention in greater detail, I have provided a refrigerator including a thermally insulated cabinet 10 having a compartment 19 for the storage of food. An access opening 20 in the front wall thereof is arranged to be closed by a thermally insulated door 21 suitably hinged to the front of the cabinet 10. The side and bottom walls of the cabinet comprise an outer case 17 and an inner lining 18 with suitable thermal insulation 22 disposed therebetween in order to minimize heat transfer into the interior of the cabinet. The top wall of the cabinet comprises a top liner 23 and a cover 24 and substantially the entire space therebetween is filled with suitable insulating material 25.

The primary evaporator 11 is connected in the refrigerant circuit of a refrigerating machine including a motor compressor unit arranged in the machinery compartment within the cabinet 10 below the compartment 19. Access to the machinery compartment may be had by removing a panel 26. The motor compressor unit has been omitted from the drawing for purposes of clarity. Refrigerant is supplied to the evaporator 11 through a liquid line 27 and a flow controlling means, such as a float chamber 13 and a conduit 12. Vaporized refrigerant is returned to the motor compressor unit through a suction line 28, a portion of which is shown in Fig. 1. During the operation of the primary system, the air in the upper portion of the compartment 19 is cooled by the cooling element or evaporator 11 and circulated downwardly, the warm air in the lower portion of the cabinet rising to take its place and the circulating air absorbing heat from the articles within the cabinet.

In a household refrigerator, it is frequently desirable to place closed containers therein for maintaining a relatively high humidity in order to prevent the dehydration of certain foods, such as vegetables. Frequently such receptacles are placed adjacent the bottom wall of the food storage compartment. As shown in the drawing, I have provided a frame 29 suitably supported from the walls of the compartment 19, the frame being provided with flanges or trackways for slidably supporting food storage receptacles 30. The frame 29 is arranged to support covers 31 for the receptacles. In the drawing I have illustrated the use of glass cover members in order to permit the user of the refrigerator to inspect the interior of the receptacles without withdrawing the same. The frame 29 is preferably spaced from the liner 18, as by supporting brackets 32, in order to permit circulation about the receptacles 30. It will be obvious, however, that only

a limited circulation of air will take place around the receptacles or containers 30 and there is therefore less cooling capacity available to absorb heat entering the food compartment through the bottom wall thereof. It is therefore desirable to provide some arrangement for lowering the temperature of the lower portion of the liner 18. I have found that the additional cooling required may be obtained effectively by providing a container partially filled with a liquid vaporizable at the temperatures prevailing in the lower portion of the compartment 19 and including a liquid vaporizing portion 14 secured in good heat exchange relation with the bottom wall of the liner 18, and a second portion for condensing the vapor arranged in good heat exchange with the primary system. While I have shown a particular disposition of the cooling portion, it will be understood that the cooling portion of the secondary system may be disposed wherever supplemental cooling is desired.

In the embodiment illustrated, I provide a closed conduit 33 which may be secured in good heat exchange relation with the liner 18, as by soldering, for example. The conduit is provided with a plurality of turns to form a cooling portion 14 secured to the bottom wall of the liner 18. The container or conduit 33 is partially filled with a vaporizable liquid refrigerant, not shown, so that the turns of the portion 14 are maintained flooded therewith. During the operation of the refrigerating machine, liquid in the cooling portion will be vaporized and the vapor will rise through the upright portions of the conduit 33 and circulate through the condensing portion 15 where it will be cooled by the heat exchange with the section 16 of the primary system and will be liquefied, the liquid returning to the lower portion of the conduit. Thus heat is carried away from the vapor passing from the lower portion of the conduit and the cooled liquid returning tends to supplement the cooling of the lower portion of the liner. As thus described the condensation of refrigerant takes place in the condensing portion 15 of the secondary system only when the portion 16 of the primary system contains refrigerant. Normally, this means that refrigeration is had in the secondary system only when liquid refrigerant is being supplied from the float chamber 13 to the primary evaporator 11, and the refrigerating cycle of the secondary evaporator 14 is substantially the same as that of the primary evaporator 11. In other words, the secondary system supplements the primary system. It should be noted, however, that when the float mechanism in the float chamber 13 closes the passage 12 to the primary evaporator, liquid refrigerant will remain in the loop portion immediately below the float chamber and liquid refrigerant will be trapped in the enlarged portion 16 of the primary system. These sources of liquid refrigerant will continue to exert a cooling effect on the condensing portion 15 of the secondary system for a substantial interval of time following the shutdown of the compressor utilized to circulate refrigerant in the primary system. Moreover, the enlarged portion 16 of the primary system traps a certain amount of liquid refrigerant which is utilized for condensing purposes during the off-cycle of the primary system. It will be obvious that if it is desired to provide a refrigerating effect in the secondary system at all times it will be a simple matter to make the enlarged portion 16 sufficiently large to trap a sufficiently large amount of liquid refrigerant to provide a cooling effect throughout the "off" period of the refrigerant circulating means.

In order to maintain the portions 15 and 16 of the secondary and primary systems, respectively, in good heat exchange relationship, I have provided spring clips 34. To further facilitate good heat transfer between primary and secondary, a material of high thermal conductivity such as a plastic material having particles of a heat conductive material dispersed throughout may be applied to the portions 15 and 16.

In assembling a cabinet embodying my invention, I first arrange the outer casing 17 and the inner lining 18 in their proper places with the insulating material 22 therebetween and the conduit 33 secured to the outside of the lining 18. The refrigerating machine is assembled separately, the evaporator 11 being suitably secured to the top liner 23. The evaporator is then lowered through the upper end of the cabinet and the top liner 23 suitably secured to the inner lining 18. The portions 15 and 16 are then suitably joined together in intimate thermal association as by applying the spring clips 34, following which any thermally conductive material is applied and loose insulation 35 is packed around the upper end of conduit 33 and the float chamber 13. The cover 24 is then applied, the inturned flange 36 of the cover engaging a spring clip 37 and the rear end of the cover being suitably secured to the outer liner 17 as by means of a member 38 suitably secured to the cover and the outer case.

While I have illustrated the heat exchange portions of the primary and secondary systems in the insulation space between the walls of the cabinet, it will be understood that the heat exchange may take place at any point between the flow controlling means 13 and the evaporator 11.

While I have described an embodiment of my invention in connection with a household refrigerator, 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 accompanying 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 refrigerator comprising a cabinet having a food storage compartment, a primary refrigerating system including a cooling element located in one region of said compartment, a secondary refrigerating system comprising a cooling portion constructed and arranged for cooling another region of said compartment and a condensing portion, means for conducting refrigerant to said cooling element, said condensing portion and said conducting means being arranged in heat exchange relationship.

2. A refrigerator comprising a cabinet including inner and outer walls having an insulation space therebetween and defining a food storage compartment, a primary refrigerating system including a cooling element located in one region of said compartment, a secondary refrigerating system comprising a cooling portion constructed and arranged for cooling another region of said compartment and a condensing portion, means for conducting refrigerant to said cooling element, said condensing portion and said conducting means being arranged in heat exchange re-

lationship, said last mentioned means being located in said insulation space.

3. A refrigerator comprising a cabinet having a food storage compartment, a primary refrigerating system including a cooling element located in one region of said compartment, a conduit for conveying refrigerant to said element, flow controlling means in said conduit, a secondary refrigerating system comprising a cooling portion constructed and arranged for cooling another region of said compartment and a condensing portion, said condensing portion and the portion of said conduit between said element and said flow controlling means being arranged in heat exchange relationship.

LEONARD W. ATCHISON.