Sept. 15, 1931. A. LENNING 1,823,456

REFRIGERATION

Filed June 10, 1929

Fig. 1.

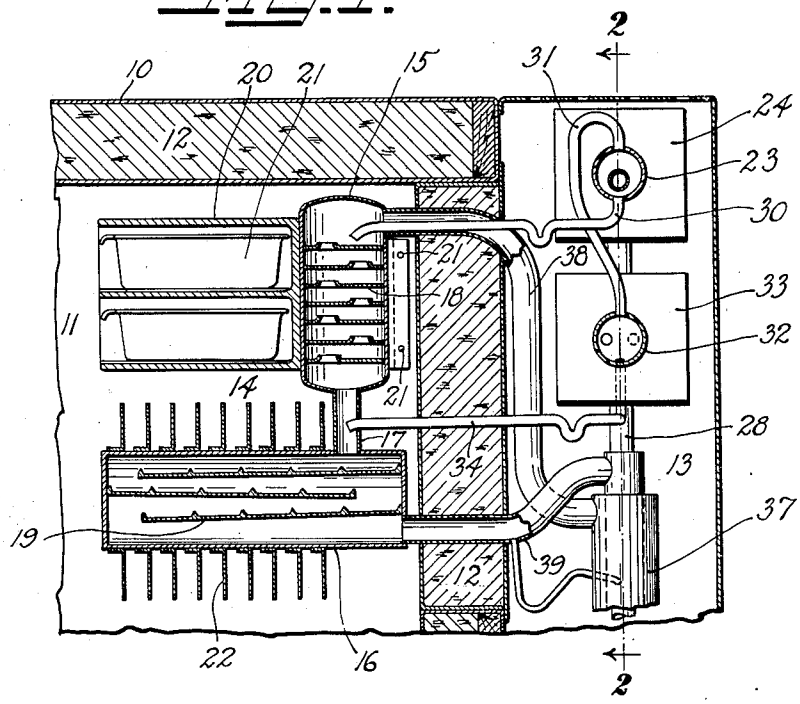


Fig. 2.

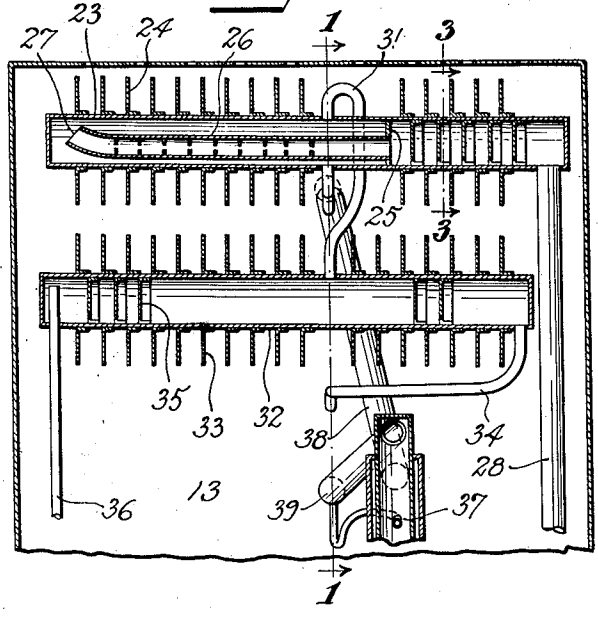
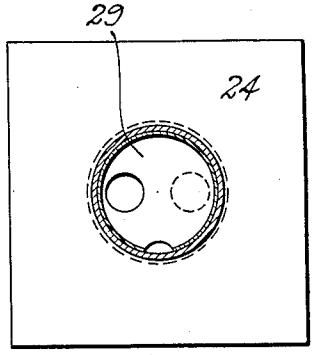


Fig. 3.



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UNITED STATES PATENT OFFICE

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REFRIGERATION

Application filed June 10, 1929. Serial No. 369,721.

My invention relates to refrigerating apparatus and more particularly to the relation of refrigerating apparatus to a household cabinet wherein the cooling medium is a current of air. Still more particularly my invention relates to the above indicated type of refrigerators wherein the air current for cooling is a natural draft current, that is, not employing an electrically driven fan or the like.

Still further my invention relates to apparati wherein it is necessary to have the condenser situated above the evaporator in order to obtain gravity flow of liquid refrigerant from the condenser to the evaporator. This is particularly true of apparati of the equalized pressure type. It is advisable to have the evaporator or refrigerating apparatus in the upper part of the food space of the refrigerator cabinet. If the evaporator is in the uppermost part of the food space and if there is gravity flow of refrigerant in the evaporator, the condenser must be placed higher than the upper part of the food space. This means that the condenser may project above the top of the refrigerator cabinet to an appreciable extent. Pursuant to the present invention the condenser need not project above the top of the refrigerator cabinet proper or at least need not extend any considerable distance above the top of the refrigerator cabinet proper. To accomplish this object I provide upper and lower condenser members thereby distributing the condenser surface vertically and connect the different condenser members to different points of the evaporator arranged as will herein be described.

The nature and advantages of the invention will be apparent from a consideration of the following description taken in conjunction with the accompanying drawings showing a preferred form of apparatus embodying the invention, which drawings constitute a part of this specification.

Of the drawing illustrations:

Fig. 1 is a vertical cross-sectional view of refrigerating apparatus embodying the invention;

Fig. 2 is a section taken on the line 2—2 of Fig. 1; and

Fig. 3 is a section taken on the line 3—3 of Fig. 2 on an enlarged scale.

In the drawings, reference character 10 designates generally a refrigerator. The refrigerator comprises a food space 11 surrounded by insulation 12 and an apparatus compartment 13 to one side of the insulated food space. The apparatus compartment 13 may extend across the full width of the back of the cabinet as shown in Fig. 2. Suitable walls enclose this compartment.

Situated in the upper part of the food space 11 is an evaporator generally designated by reference character 14. Evaporator 14 comprises a vertical cylindrical shell 15, a horizontal cylindrical shell 16 and a connecting tube 17. Inside shell 15 are disks 18 provided with apertures through the same and adapted to spread out liquid refrigerant supplied to the upper part of shell 15. In shell 16 are trays 19 which slope slightly as indicated and are provided with ridges forming pools of liquid as the liquid flows downwardly from tray to tray.

Clamped around shell 15 is a casting member 20 secured to the shell by bolts or the like 21. Casting member 20 is a box-like member for containing ice trays 21 in which ice is frozen. Surrounding shell 16 is a series of fins 22 which are in close contact therewith and which act as heat transfer members between shell 16 and the food space, giving a large surface for air contact.

In the upper part of compartment 13 is an upper condenser member 23 comprising a substantially horizontally disposed tube surrounded by fins 24. Within condenser 23 is a partition 25. A tube 26 is fixed in this partition and extends to the left as shown and upwardly at the end thereof. The end 27 is open. A vapor supply pipe 28 is connected to the right-hand end as shown of condenser member 23. The portion of the condenser member to the right of partition 25 contains disks 29 of the type shown in Fig. 3 having apertures in adjacent disks staggered and having the bottom parts cut away to provide a passageway for liquid. Con-

denser member 23 slopes downwardly somewhat to the right, as shown. To the left of partition 5 and connected to the bottom of member 23 is a conduit 30 which is connected to the inner part of shell 15 and opens above the uppermost disk 18 therein. This conduit conducts liquid refrigerant into shell 15. A vapor tube 31 is connected to the upper part of condenser member 23 to the left of partition 25 and is connected to the central portion of a lower condenser member 32. The lower condenser member is also inclined slight downwardly to the right, as shown. Member 32 also comprises surrounding fins 33. At the lower right-hand end of member 32 is a conduit 34 which is connected into tube 17 and which supplies liquid refrigerant to shell 16. Apertured disks 35 are provided in member 32. At the left-hand end as shown is a vent pipe 36 for carrying away gas from condenser member 32.

A heat exchanger is designated at 37. This comprises outer and inner pipes. The outer pipe is connected to a conduit 38 which conveys an inert gas to the upper part of shell 15. The inert gas passing through the evaporator leaves through conduit 39 and passes through the inner pipe of the gas heat exchanger 37. The gas heat exchanger is connected with the absorber.

Vapor of refrigerant passes upwardly through conduit 28 from a generator. The generator and absorber and other parts not herein described may be of the type shown in Patent No. 1,609,334 granted December 7th, 1926, to Baltzar Carl von Platen and Carl Georg Munters. The refrigerant may, for example, be ammonia. The ammonia enters the upper condenser member. In its passage through the part of this member to the right of partition 5 and in its passage through conduit 26, vapor of absorption liquid is condensed out and flows back toward the generator. Substantially pure ammonia passes out of opening 27 and into the left-hand portion of condenser member 23, where it is condensed. The condensate collects in the bottom part of member 23 and assists in cooling the tube 26 to separate out the entrained vapor of absorption liquid. The liquid refrigerant flows through conduit 30 and into shell 15. The ammonia vapor does not all condense in the upper condenser member but some flows through conduit 31 and into condenser member 32. Here the remainder is condensed and flows through conduit 34 into shell 16.

In the evaporator shells the ammonia meets the inert gas entering from conduit 38. The inert gas may, for example, be hydrogen. The ammonia diffuses into the hydrogen and produces refrigeration. The refrigeration for producing ice is produced in shell 15. The refrigeration for cooling the food space is produced in shell 16. The liquid refrigerant cascades downwardly over the perforated trays and diffuses into the inert gas. A gas mixture is formed of ammonia vapor and hydrogen which leaves through conduit 39 and passes to the absorber where absorption liquid dissolves the ammonia leaving the inert gas which is returned to the evaporator. The circulation may be due to differences of specific gravity of the fluids in the system.

Compartment 13 is open at the top or has a perforated top member. Air passes upwardly through compartment 13, which is in reality an air flue. The air cools the condenser members and thus liquefies the refrigerant.

It will be obvious that if all the refrigerant were conducted to the upper part of shell 15, the condensers arranged as shown would have to be moved up by a considerable amount as a result of which the condenser would project an appreciable distance above the top of the refrigerator cabinet proper. This is undesirable from a point of view of space and appearance. If the condensers were placed side by side, twice as wide a flue would be necessary. By arranging the condenser and connecting it to the evaporator as shown, I am enabled to use a narrow air flue or apparatus compartment and at the same time keep the condenser down in position and place the evaporator up near the top of the food space.

While I have shown and described the preferred embodiment of the invention it will be obvious that variations of structure will fall within the spirit and scope of the invention.

Having thus described my invention, what I claim is:

1. Refrigerating apparatus comprising an evaporator, said evaporator comprising an ice producing section, a food space cooling section below said ice producing section, an upper condenser member, a lower condenser member, means for conducting liquid refrigerant from the upper condenser member to the ice producing section and means for conducting liquid refrigerant from the lower condenser member to the food space cooling section.

2. Refrigerating apparatus comprising walls enclosing a food space, walls forming an apparatus compartment and air flue to one side of said food space, an evaporator in said food space situated near the top thereof, said evaporator comprising an ice producing section and a food space cooling section below the ice producing section, an upper condenser member in said air flue, a lower condenser member below the upper condenser member in said air flue, fins surrounding the condenser members, means for conducting liquid refrigerant from the upper condenser member to the ice producing section of the evap-

orator and means for conducting liquid refrigerant from the lower condenser member to the food space cooling section of the evaporator.

3. Refrigerating apparatus comprising an evaporator made up of a plurality of vertically disposed sections one above the other, a condenser made up of a plurality of vertically disposed sections one above the other and means to conduct liquid refrigerant in parallel from the condenser sections to the evaporator sections.

4. Refrigerating apparatus comprising an evaporator, said evaporator comprising a vertically disposed cylindrical shell, means in said shell for distributing liquid, a lower horizontally disposed cylindrical shell, means in said lower shell for distributing liquid, an upper condenser member, a lower condenser member, means for conducting liquid from the upper condenser member to the vertically disposed shell and means for conducting liquid from the lower condenser member to the horizontally disposed shell.

5. Refrigerating apparatus comprising an evaporator, said evaporator comprising a vertically disposed cylindrical shell, means in said shell for distributing liquid, a lower horizontally disposed cylindrical shell, means in said lower shell for distributing liquid, an upper condenser member, a lower condenser member, means for conducting liquid from the upper condenser member to the vertically disposed shell, means for conducting liquid from the lower condenser member to the horizontally disposed shell, and means for circulating an inert gas through both shells.

6. A refrigerator comprising walls enclosing a food space and an air flue, the top wall of the refrigerator being in one plane, an evaporator in said food space having its upper part close to the top of the food space, said evaporator comprising an ice producing section and a food space cooling section below the ice producing section, an upper condenser member in said air flue below said plane, a lower condenser member below the upper condenser member, means for conducting liquid refrigerant from the upper condenser member to the ice producing section of the evaporator and means for conducting liquid refrigerant from the lower condenser member to the food space cooling section of the evaporator.

7. In a refrigerating apparatus, an evaporator, an upper condenser member, a lower condenser member, means for conducting liquid refrigerant from said upper condenser member to said evaporator at an upper part thereof and means for conducting liquid refrigerant from said lower condenser member to a part of said evaporator below said upper part.

8. In a refrigerating apparatus, an evaporator, an upper condenser member, a lower condenser member and means for conducting liquid refrigerant from said upper condenser member and from said lower condenser member in parallel to an upper and a lower point, respectively, in said evaporator.

9. In a refrigerating apparatus, an evaporator, an upper condenser member, a lower condenser member, means for conducting liquid refrigerant from said upper condenser member to said evaporator at an upper part thereof, means for conducting liquid refrigerant from said lower condenser member to a part of said evaporator below said upper part, means for circulating an inert gas through said evaporator and a series of apertured discs disposed in said evaporator.

10. In a refrigerating apparatus, an evaporator, an upper condenser member, a lower condenser member, means for conducting liquid refrigerant from said upper condenser member and from said lower condenser member in parallel to an upper and a lower point, respectively, in said evaporator, means for circulating an inert gas through said evaporator and a series of apertured discs disposed in said evaporator.

In testimony whereof I have affixed my signature.

ALVAR LENNING.