March 26, 1935. W. W. WATT 1,995,527

REFRIGERATING APPARATUS

Original Filed May 23, 1930 2 Sheets-Sheet 1

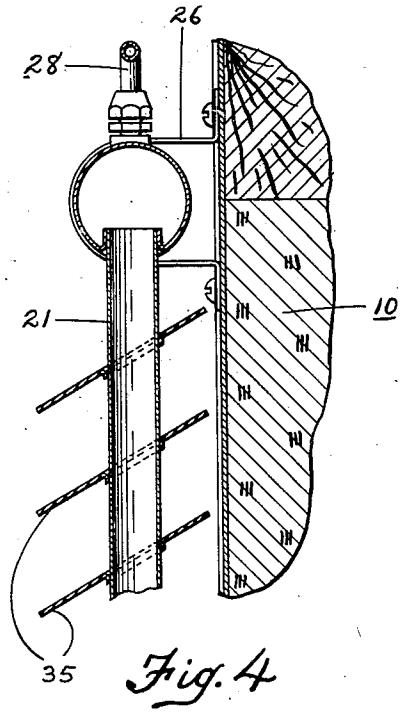


Fig. 4

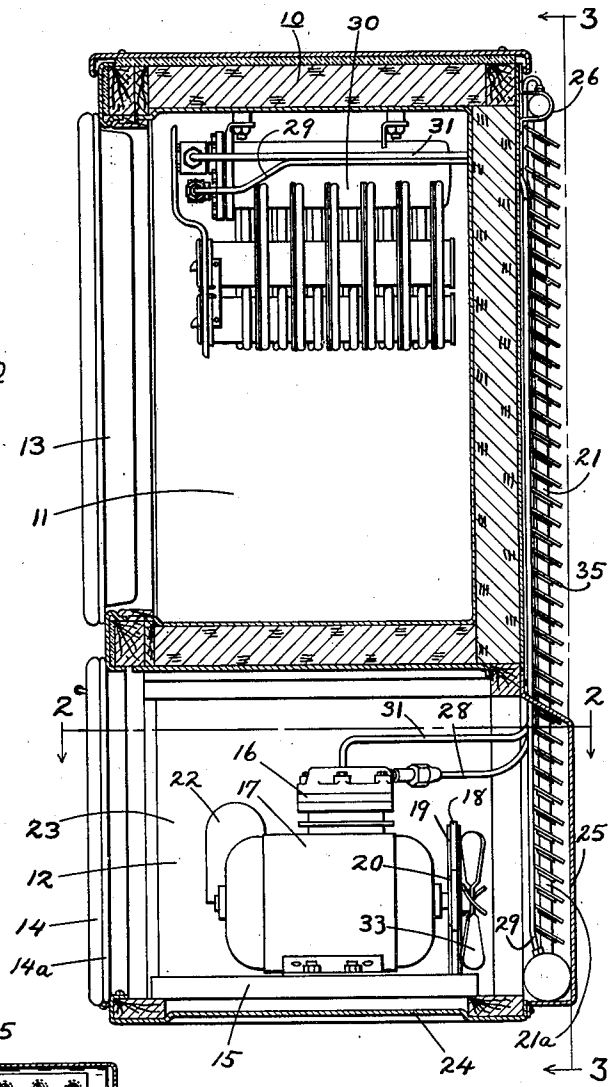


Fig. 1

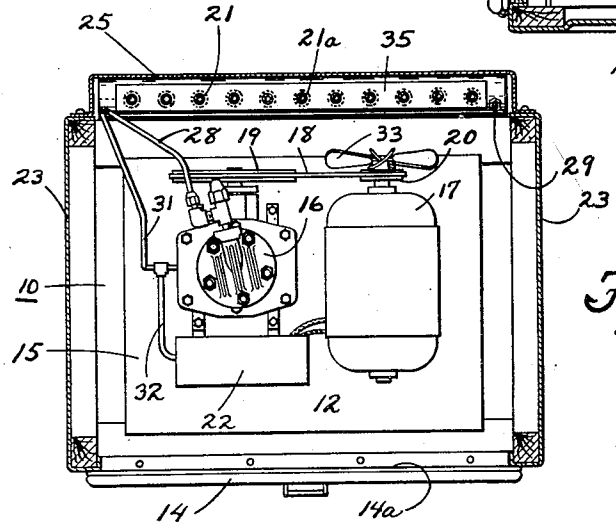


Fig. 2

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March 26, 1935. W. W. WATT 1,995,527

REFRIGERATING APPARATUS

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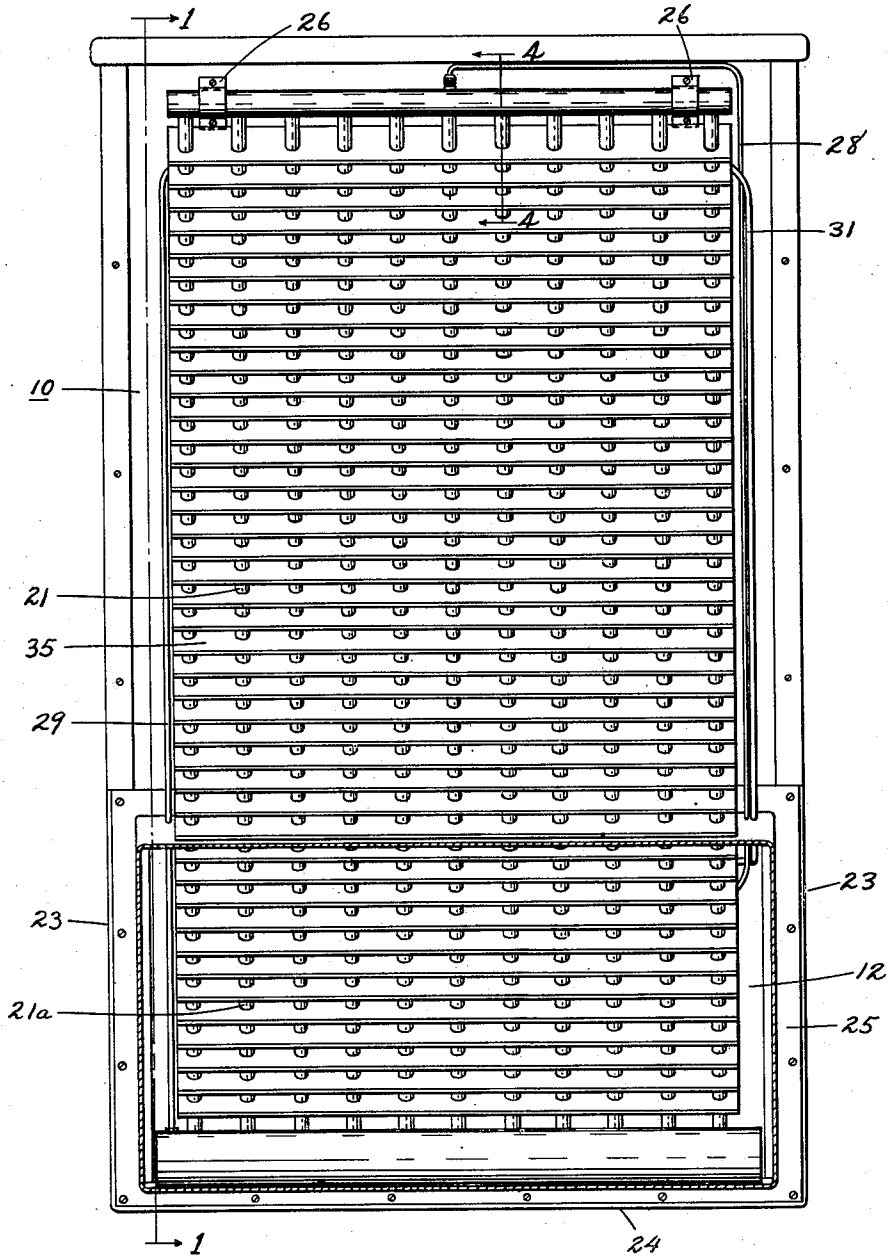


Fig. 3

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UNITED STATES PATENT OFFICE

1,995,527

REFRIGERATING APPARATUS

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Application May 28, 1930, Serial No. 456,738
Renewed April 10, 1934

20 Claims. (Cl. 62—116)

This invention relates to refrigerating apparatus and particularly to refrigerant liquefying mechanisms.

One of the objects of the invention is to utilize refrigerant contained in the refrigerating system to cool parts of the system which generate heat.

Another object of the invention is to provide a condenser for a refrigerating system arranged so that a portion thereof is in heat receiving relation with parts of the system which generate heat and arranging another portion thereof remote from the heated parts.

Another object of the invention is to provide a compartment for the moving parts of a refrigerating apparatus and to expose to the atmosphere heat dissipating parts which latter parts may be utilized for dissipating heat from the moving parts within the compartment by the use of refrigerant of the system.

In carrying out the foregoing objects it is a more specific object of the invention to provide a novel condenser structure and arrangement thereof, relative to a wall of a refrigerator cabinet, to provide a flue therebetween and to cause efficient air flow over the condenser and into the flue by convection to insure that relatively cool air will circulate over a substantial portion of the condenser.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a vertical section through a refrigerator cabinet constructed in accordance with the present invention;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a rear view of the refrigerator cabinet taken on the line 3—3 of Fig. 1 showing the condenser of the apparatus; and

Fig. 4 is an enlarged view taken on the line 4—4 of Fig. 3 showing a portion of the condenser of the apparatus.

Referring to the drawings, 10 designates a refrigerator cabinet having an insulated food storage compartment 11 and a lower compartment 12. The food compartment 11 is provided with a door 13 to afford access thereto. The lower compartment 12 is closed by a door 14 having a gasket 14*a* secured thereto. A base 15 supported by the lower framework of the cabinet has mounted thereon a compressor 16 and a motor 17 which drives the compressor through a belt 18 and pulley wheels 19 and 20. Connected to the compressor 16 is a condenser 21 which receives compressed refrigerant from the compressor, cools and liquefies the refrigerant which then flows to the lower portion 21*a* thereof. A switch 22 mounted in the compartment 12 controls the operation of the motor and compressor. Since it is the motor, compressor, and switch which make noise in operation, I propose to avoid annoyances by preventing such noises from transmitting from the apparatus itself. This may be accomplished by completely inclosing the moving or noisy parts of the apparatus in the compartment 12 which prevents the transmission of sound from the apparatus to distant points. For the purpose of illustrating my invention I have shown in the drawings compartment 12 as being completely inclosed by the outerside panels 23 of the cabinet, a bottom plate 24, and a back 25 secured to the condenser 21 and also to the rear framework of cabinet 10, together with the door 14 which permits access to the elements in the compartment. The bottom wall of the food storage compartment 11 provides a top wall for the compartment 12. If desired the walls of compartment 12 may be lined with a suitable material, preferably some material which absorbs sound waves and prevents transmission of sound through the walls. The back 25, of compartment 12, and suitable brackets 26 secure the condenser 21 in spaced vertical position on the rear wall of cabinet 10.

Since the motor 17 and compressor 16 both generate heat during operation and since this heat must be removed, I provide means for dissipating to the outside atmosphere heat generated by these elements which otherwise would accumulate in the compartment 12 and render the refrigerant circulating unit less efficient. Since the condenser does not make noise this may be placed outside of the compartment 12 where it is cooled by contact with the atmosphere, which cooling may be enhanced by circulating air over the condenser in any desired manner.

In accomplishing the dissipation of heat, generated by the elements 16 and 17 within the compartment 12, to the atmosphere I prefer to utilize refrigerant contained in the system. Since refrigerant in the system is cooled and liquefied in condenser 21 and flows to the bottom thereof I locate the bottom portion 21*a* of the condenser in heat receiving relation to the refrigerant circulating unit or inside the closed compartment 12. The manner in which heat is extracted from the compartment 12 and dissipated to the at-

mosphere will be more fully described hereinafter together with an explanation of the operation of the system.

As before stated refrigerant compressed by the compressor 16 is circulated to the condenser 21, through pipe 28, where it is cooled and liquefied and flows to the bottom thereof. A pipe 29 directs this liquefied refrigerant to a cooling unit or evaporator 30 located in the food storage compartment 11. A predetermined quantity of liquid refrigerant is maintained within the cooling unit or evaporator 30 under control of a float valve (not shown) which float valve may be of the type shown in the patent to Osborn, No. 1,556,708, filed October 13, 1925. Refrigerant evaporated in the evaporator 30 returns to the compressor through a gaseous return conduit 31. The switch 22 may be connected with the conduit 31 by pipe 32 (See Fig. 2) and actuated in response to pressures, within the system, to start or stop operations of the motor, or may be actuated by a thermostat responsive to temperatures within the compartment 11. A fan 33 mounted on the shaft of motor 17 circulates air and consequently heat, within the compartment 12, generated by the motor 17 and compressor 16, over the portion 21*a* of condenser 21. Portion 21*a* of condenser 21 contains cool condensed liquid refrigerant which absorbs heat from the compartment 12. The cool liquid refrigerant in portion 21*a* of the condenser upon absorbing heat vaporizes and rises upwardly in the condenser where it dissipates the heat, absorbed from compartment 12, to the atmosphere and is recondensed and again flows to the lower portion of the condenser. Thus as long as heat is applied to the lower portion 21*a* of the condenser liquid refrigerant therein will vaporize and dissipate heat, absorbed from compartment 12, to the atmosphere outside this compartment. It is to be understood that other elements within the compartment 12 may be cooled in the same manner as shown with regard to the motor and compressor and that the condensing portion exterior of the compartment 12 may be readily increased if desired by increasing the volume of the tubes forming the condenser 21 which are connected in parallel circuit relation and by adding more fins 35.

The fins 35 contact with and bridge the vertically extending refrigerant conduits 21 which conduits are disposed substantially in parallel relation with the rear wall of cabinet 10. These fins are spaced from the cabinet wall to form a flue between the condenser and the back wall of the cabinet. Since the refrigerant liquefying and circulating unit is substantially hermetically sealed within the compartment 12 of cabinet 10 and the fan or fans ordinarily connected with such units are likewise sealed within the compartment 12 no means is available to force or blow air over that portion of the condenser extending from the compartment 12 and adapted to dissipate heat to the atmosphere exterior of the compartment 12. This therefore necessitates the condenser to be constructed in such manner as to cause air to flow therethrough or thereover by convection. The fins 35 are therefore disposed horizontally across the vertical conduits 21 and provide a plurality of vertically spaced transverse air spaces or reticulations through the condenser. The horizontally disposed fins are each inclined from their outer extremity upwardly to their inner extremity adjacent the flue to induce air into the flue by convection. Relatively cool air from the room in which the cabinet is located thereby circulates over substantially the entire area of the condenser disposed outside the sealed compartment. It is thus apparent that the novel construction of the condenser and the arrangement of the fins thereon provides a condenser which will be efficiently cooled by convection air which air upon entering the spaces or reticulations between the fins 35 is caused to flow therethrough and upwardly through the flue provided between the condenser and the rear wall of the cabinet.

In order to provide for the removal of condenser 21 from the apparatus the back 25 is secured to the condenser in the same manner as the fins 35 and is detachably secured to the rear framework of the cabinet 10 by screws or other suitable means. To remove the condenser without disturbing the cooling unit 30 or the elements within compartment 12, the connections of the pipes 28, 29 and 31 are loosened together with the screws which secure the back 25 to the cabinet. The condenser may thus be removed for repair or replacement without disturbing other elements of the apparatus or the pipes connecting such elements. The top portion of the back 25 is preferably slotted at the points where the various pipes 28, 29 and 31 extend from within the compartment 12 to the outside thereof. These slots may be suitably closed as for example by rubber grommets or the like each having a groove which snuggly embraces the opposite sides of the back 25 and each having an opening for receiving the tubes or pipes.

By the use of the present invention the moving parts of a refrigerating apparatus can be installed in a noise-proof housing or compartment and if desirable can be sealed within a compartment and heat dissipated therefrom through the agency of refrigerant of the system.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A refrigerating apparatus comprising in combination, a sealed compartment, a refrigerant circulating unit within said compartment, a heat exchange device including a condenser connected with said unit and exposed to atmosphere outside of said compartment, an evaporator having a connection with said unit and another connection with said condenser, means including a portion of said heat exchange device disposed below the portion exposed to atmosphere outside said compartment for absorbing heat from said compartment and causing the heat to be dissipated to the atmosphere outside of said compartment.

2. A refrigerating apparatus comprising in combination, a sealed compartment, a refrigerant circulating unit within said compartment, a heat exchange device including a condenser connected with said unit and exposed to atmosphere outside of said compartment, an evaporator having a connection with said unit and another connection with said condenser, means including a portion of said heat exchange device disposed below the portion exposed to atmosphere outside said compartment and extending into said compartment for absorbing heat therefrom and causing the heat to be dissipated to the atmosphere outside of said compartment.

3. A refrigerating apparatus comprising in combination, a sealed compartment, a refrigerant circulating unit within said compartment, a heat

exchange device having parts thereof arranged in parallel circuit relation and including a portion disposed in heat receiving relation to said compartment for absorbing heat therefrom, an evaporator having a connection with said unit and another connection with said heat exchange device, said heat exchange device also including another portion exposed to atmosphere outside said compartment and disposed above the first mentioned portion for dissipating the heat absorbed by said first mentioned portion to the atmosphere outside said compartment.

4. A refrigerating apparatus comprising in combination, a sealed compartment, a refrigerant circulating unit within said compartment, a heat exchange device having parts thereof arranged in parallel circuit relation and including a portion disposed within said compartment for absorbing heat therefrom, an evaporator having a connection with said unit and another connection with said heat exchange device, said heat exchange device also including another portion exposed to atmosphere outside said compartment and disposed above said first mentioned portion for dissipating the heat absorbed by said first mentioned portion to the atmosphere outside said compartment.

5. A refrigerating apparatus comprising in combination, a sealed compartment, a refrigerant circulating unit within said compartment, a vertical heat exchange device including a condenser connected with said unit and exposed to atmosphere outside of said compartment, an evaporator having a connection with said unit and another connection with said condenser, means including a portion of said vertical heat exchange device extending into said compartment and disposed above said first mentioned portion for absorbing heat therefrom and causing the heat to be dissipated to the atmosphere outside said compartment.

6. A refrigerating apparatus comprising in combination, a cabinet including a food storage compartment, a sealed compartment, a refrigerant circulating unit within said sealed compartment, a heat exchange device including a condenser connected with said unit and exposed to atmosphere outside said sealed compartment, an evaporator having a connection with said unit and another connection with said condenser, said heat exchange device being vertically mounted on a wall of said cabinet and having a portion thereof disposed below the portion exposed to atmosphere outside said compartment and extending into said sealed compartment for absorbing heat therefrom and causing the heat to be dissipated to the atmosphere outside said sealed compartment.

7. A refrigerating apparatus comprising in combination, a cabinet including a food storage compartment, a sealed compartment, a refrigerant circulating unit within said sealed compartment, a heat exchange device including a condenser connected with said unit and exposed to atmosphere outside said sealed compartment, an evaporator having a connection with said unit and another connection with said condenser, said heat exchange device being vertically mounted on the rear wall of said cabinet and having a portion thereof disposed below the portion exposed to atmosphere outside said compartment and extending into said sealed compartment for absorbing heat therefrom and causing the heat to be dissipated to the atmosphere outside said sealed compartment.

8. A refrigerating apparatus comprising in combination, a sealed compartment, a compressor and a motor operatively connected thereto disposed within said compartment, a fan on the shaft of said motor, a heat exchange device including a condenser connected with said compressor and exposed to atmosphere outside said compartment, an evaporator having a connection with said unit and another connection with said condenser, means including a portion of said heat exchange device disposed below the portion exposed to atmosphere outside said compartment and extending into said compartment for absorbing heat generated by said motor and compressor and causing the heat to be dissipated to the atmosphere outside said compartment, and said fan adapted to circulate heat generated in said compartment over the portion of said heat exchange device disposed in said compartment to augment absorption of heat by the condenser.

9. A refrigerating apparatus comprising in combination, a cabinet including a food storage compartment, a sealed compartment, a refrigerant circulating unit within said sealed compartment having a fan operatively connected therewith, a heat exchange device including a condenser connected with said unit and exposed to atmosphere outside said sealed compartment, an evaporator having a connection with said unit and another connection with said condenser, said heat exchange device being vertically mounted on a wall of said cabinet and having a portion thereof disposed below the portion exposed to atmosphere outside said compartment and extending into said sealed compartment for absorbing heat generated therein and causing the heat to be dissipated to the atmosphere outside said sealed compartment, and said fan adapted to circulate heat generated in said sealed compartment to cause it to pass over that portion of the heat exchange device disposed therein.

10. A refrigerating apparatus comprising in combination, a cabinet having an exterior wall thereof directed in a generally vertical direction, a condenser adjacent to and extending substantially parallel to said cabinet wall and being spaced therefrom to provide a flue therebetween, said condenser being transversely reticulated throughout a substantial portion of its area, and an air directing boundary of said reticulations being upwardly inclined toward said cabinet wall to induce air into said flue by convection along said reticulations.

11. A refrigerating apparatus comprising in combination, a wall directed in a generally vertical direction, a condenser adjacent to and extending substantially parallel to said wall and being spaced therefrom to provide a flue therebetween, said condenser being transversely reticulated throughout a substantial portion of its area, and an air directing boundary of said reticulations being upwardly inclined toward said wall to induce air into said flue by convection along said reticulations.

12. A refrigerating apparatus comprising in combination, a cabinet having an exterior wall thereof directed in a generally vertical direction, a condenser adjacent to and extending substantially parallel to said cabinet wall and being spaced therefrom to provide a flue therebetween, means forming a plurality of relatively flat surfaces along said condenser, said flat surfaces providing a plurality of vertically spaced transverse air spaces through said condenser, said surfaces

being upwardly inclined toward said cabinet wall to induce air into said flue by convection along said plurality of vertically spaced transverse air spaces.

13. A refrigerating apparatus comprising in combination, a wall directed in a generally vertical direction, a condenser adjacent to and extending substantially parallel to said wall and being spaced therefrom to provide a flue therebetween, means forming a plurality of relatively flat surfaces along said condenser, said flat surfaces providing a plurality of vertically spaced transverse air spaces through said condenser, said surfaces being upwardly inclined toward said wall to induce air into said flue by convection along said plurality of vertically spaced transverse air spaces.

14. A refrigerating apparatus comprising in combination, a vertically disposed wall, a condenser including a plurality of substantially parallel extending conduit portions adjacent to and extending parallel to said wall, a plurality of fins thermally bridging said conduit portions of said condenser and being spaced from said wall to provide a flue between said condenser and said wall, said fins also providing a plurality of vertically spaced transverse air spaces through said condenser, and said fins being upwardly inclined toward said wall to induce air into said flue by convection along said plurality of vertically spaced transverse air spaces.

15. A refrigerating apparatus comprising in combination, a vertically disposed wall, a condenser including a plurality of vertically extending parallel conduit portions adjacent to and disposed parallel to said wall, a plurality of fins thermally contacting substantially all of said conduit portions of said condenser and being disposed horizontally thereacross, said fins being spaced from said wall to provide a flue between said condenser and said wall, said fins providing a plurality of vertically spaced transverse air spaces through said condenser, and said fins being upwardly inclined toward said wall to induce air into said flue by convection along said plurality of vertically transverse air spaces.

16. A refrigerating apparatus comprising in combination, a cabinet including a food storage compartment, a sealed compartment, a refrigerant circulating unit within said sealed compartment, a condenser connected with said unit and exposed to atmosphere outside said sealed compartment, an evaporator disposed in said food storage compartment and having a connection with said unit and another connection with said condenser, said condenser being mounted on a wall of said cabinet and having a portion thereof disposed below the portion exposed to atmosphere outside said compartment, the lower portion of said condenser being in intimate thermal association with the interior of said sealed compartment for absorbing heat therefrom, the upper portion of said condenser being spaced from the wall of said cabinet to form a flue, and an inlet and outlet for said flue to cause circulation of air over said condenser whereby the upper portion thereof dissipates heat absorbed by the lower portion to the atmosphere outside said sealed compartment.

17. A refrigerating apparatus comprising in combination, a compartment substantially closed off from the air outside said apparatus, a refrigerant circulating unit within said compartment, a condenser connected with said unit and exposed to the atmosphere outside of said compartment, an evaporator outside of said compartment having a connection with said unit and another connection with said condenser, means having a portion in thermal exchange relation with said compartment which receives liquid refrigerant from said condenser, evaporates the liquid refrigerant and returns the evaporated refrigerant to the condenser for absorbing heat from said compartment and causing the heat to be dissipated to the atmosphere outside said compartment.

18. A refrigerating apparatus comprising in combination, a compartment substantially closed off from the air outside said apparatus, a refrigerant circulating unit within said compartment, a condenser connected with said unit and exposed to the action of a cooling medium, an evaporator outside of said compartment having a connection with said unit and another connection with said condenser, means having a portion in thermal exchange relation with said compartment which receives liquid refrigerant from said condenser, evaporates the liquid refrigerant and returns the evaporated refrigerant to the condenser for absorbing heat from said compartment and causing the heat to be dissipated to the cooling medium.

19. A refrigerating apparatus comprising in combination, a compartment substantially closed off from the air outside said apparatus, a refrigerant circulating unit within said compartment, a condenser connected with said unit and exposed to the action of a cooling medium outside of said compartment, an evaporator outside of said compartment having a connection with said unit and another connection with said condenser, means having a portion in thermal exchange relation with said compartment which receives liquid refrigerant from said condenser, evaporates the liquid refrigerant and returns the evaporated refrigerant to the condenser for absorbing heat from said compartment and causing the heat to be dissipated to the cooling medium.

20. A refrigerating apparatus comprising in combination, a compartment substantially closed off from the air outside said apparatus, a refrigerant circulating unit within said compartment, a condenser connected with said unit and exposed to the action of a cooling medium, an evaporator outside of said sealed compartment having a connection with said unit and another connection with said condenser, a circulating medium in said compartment other than the refrigerant, means having a portion in thermal exchange relation with said circulating medium which receives liquid refrigerant from said condenser, evaporates the liquid refrigerant and returns the evaporated refrigerant to the condenser for absorbing heat from said compartment and causing the heat to be dissipated to the cooling medium.

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