Oct. 4, 1949. S. M. SCHWELLER 2,483,439

REFRIGERATING APPARATUS

Filed May 28, 1947

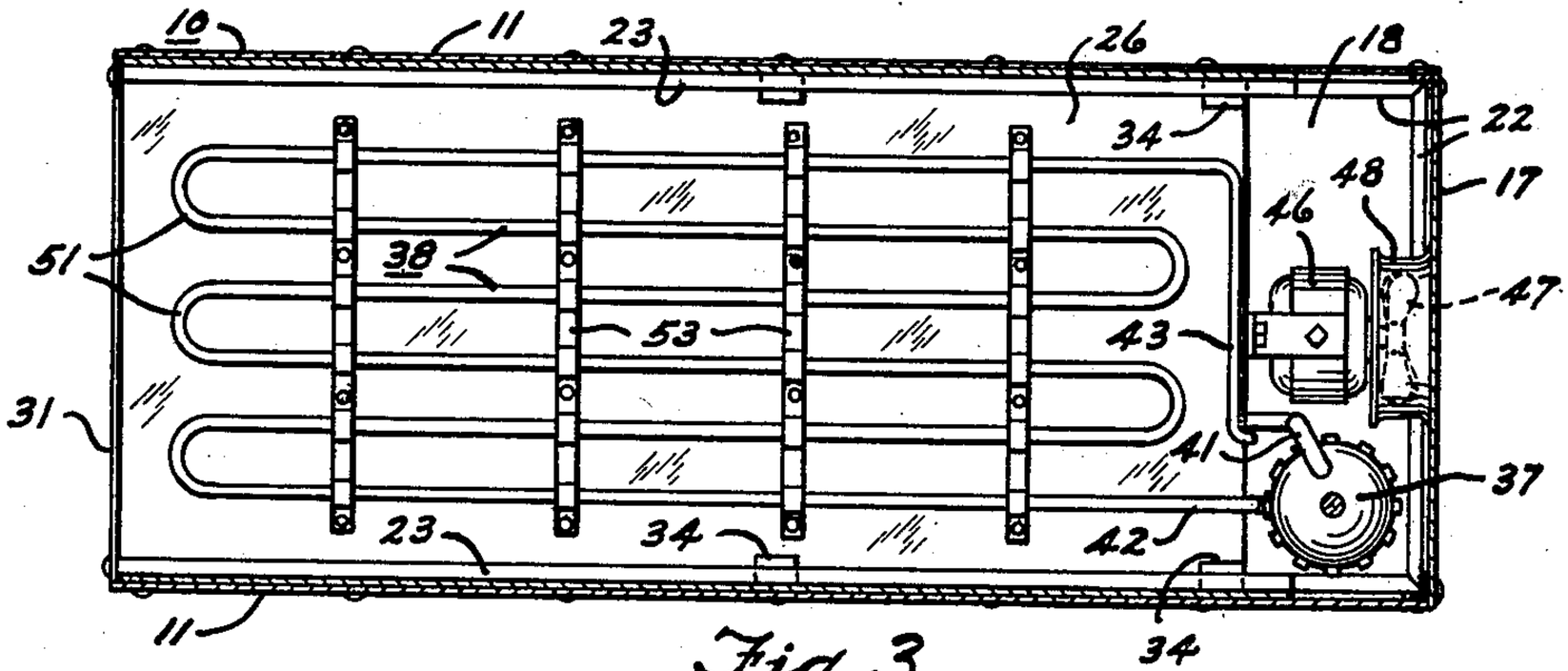

Fig. 3

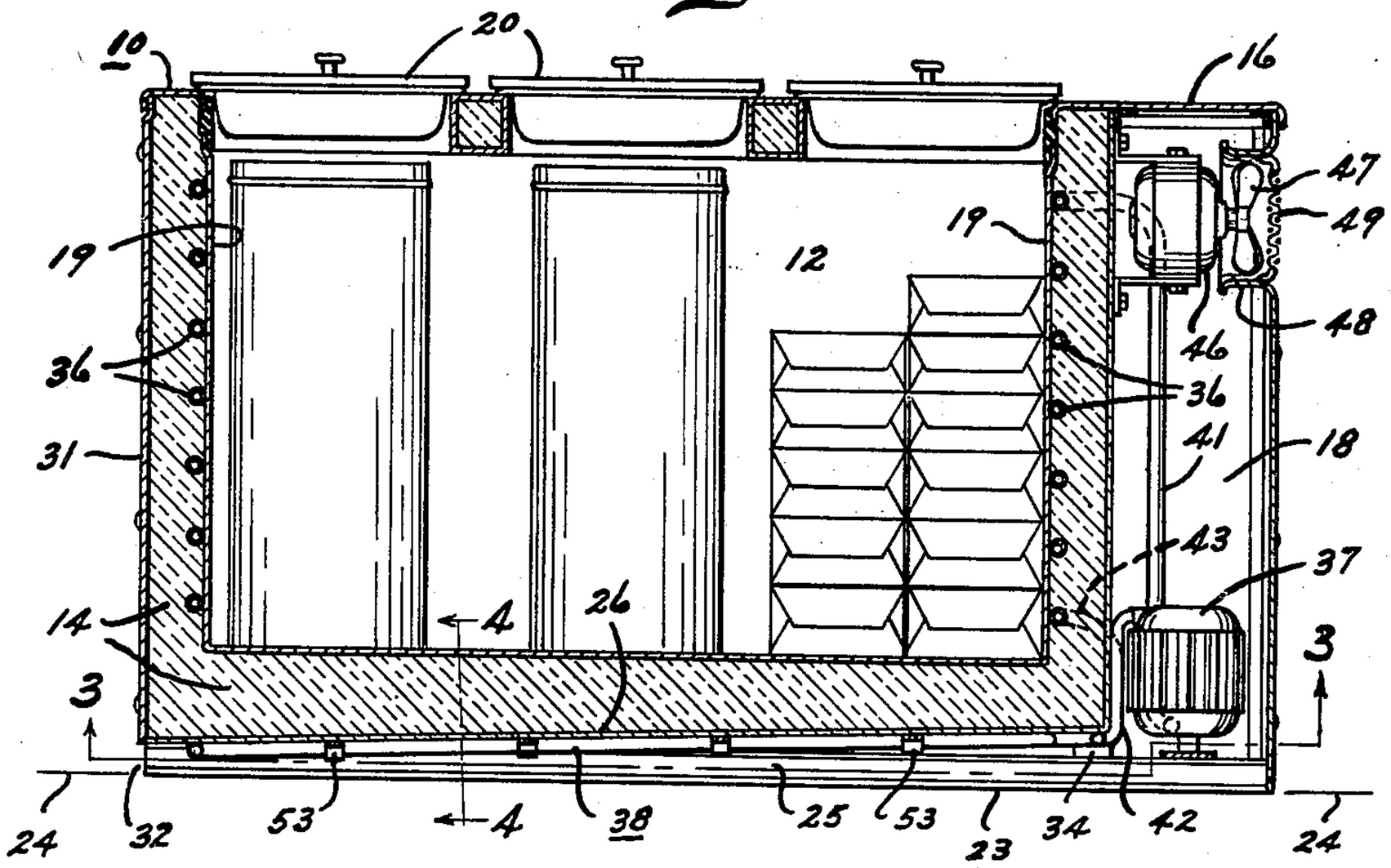

Fig. 2

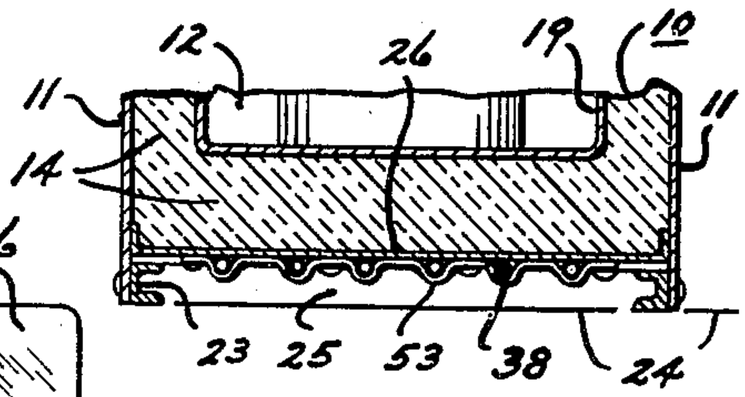

Fig. 4

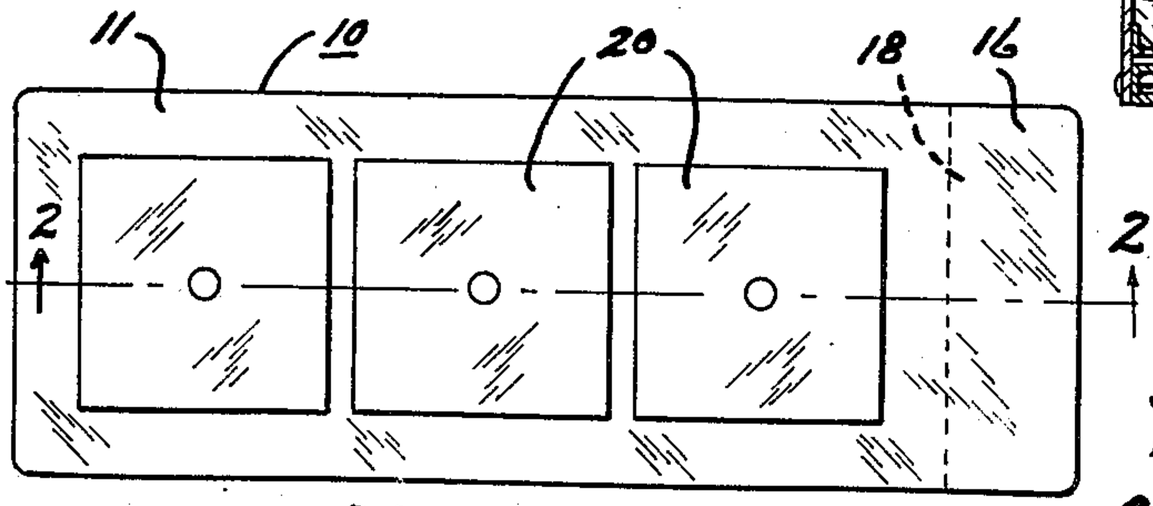

Fig. 1

INVENTOR.
SYLVESTER M. SCHWELLER.
BY

Spencer, Hardman & Fehr.
HIS ATTORNEYS.

Patented Oct. 4, 1949

2,483,439

UNITED STATES PATENT OFFICE

2,483,439

REFRIGERATING APPARATUS

Sylvester M. Schweller, Dayton, Ohio, assignor to General Motors Corporation, Dayton, Ohio, a corporation of Delaware

Application May 28, 1947, Serial No. 751,038

10 Claims. (Cl. 62—116)

1

My invention relates to refrigerating apparatus and particularly to a refrigerated food storage cabinet having a refrigerating system associated therewith employing an air-cooled condenser.

An object of my invention is to provide an improved air cooling arrangement for the condenser of a refrigerating system associated with a refrigerator cabinet.

Another object of my invention is to provide an improved arrangement of a condenser of a refrigerating system, with respect to an air flue provided in a refrigerator cabinet housing system whereby, upon failure of a fan normally employed for circulating air over the condenser and other heat dissipating elements of the system, such arrangement will serve as a means to induce a thermo-syphon circulation of air over the condenser so that the refrigerating system may continue to operate to produce refrigeration.

A further object of my invention is to provide an improved cooling arrangement of a condenser of a refrigerating system associated with a horizontally elongated substantially rectangular shaped refrigerator cabinet, such as an ice cream or a frozen food storage cabinet.

In carrying out the foregoing objects it is a still further and more specific object of my invention to provide an air flue or tunnel beneath a horizontally elongated refrigerator cabinet and to dispose the condenser of the refrigerating system associated with the cabinet within the flue and in intimate thermal contact with an inclined bottom metal wall of the cabinet, forming the top wall of the flue, whereby this wall will serve as a secondary heat dissipating surface for 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 top plan view of an ice cream or frozen food storage refrigerator cabinet having my invention embodied therein;

Fig. 2 is an enlarged vertical sectional view of the refrigerator cabinet taken on the line 2—2 of Fig. 1, showing an air flue beneath the cabinet;

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 2, and shows the condenser coil secured to the bottom wall of the refrigerator cabinet; and

Fig. 4 is a fragmentary vertical sectional view taken on the line 4—4 of Fig. 2 showing the width of the air flue as compared to the length thereof disclosed in Fig. 2.

Referring to the drawing, for illustrating my invention, I have shown in Fig. 1 thereof a refrigerating apparatus of the type commonly referred to as an ice cream or frozen food storage refrigerator. These types of refrigerators are rectangular in shape, horizontally elongated, and

2

of substantially table height. The refrigerator disclosed in Fig. 1 comprises a cabinet generally represented by the reference character 10 and having metal walls 11 forming or enclosing a food storage compartment 12 surrounded by suitable insulating material 14 (see Fig. 2). The outer cabinet walls 11 extend horizontally beyond the insulated food storage compartment 12, as at 16, to form or provide, with one end wall 17 of cabinet 10, a machine compartment 18 disposed in substantially the same horizontal plane as the food compartment 12 and extending across the one end of the cabinet. Food compartment 12 has a metal liner 19 and is provided with suitable access openings normally closed by doors 20. Cabinet end wall 17 may be removably attached to cabinet 10 so as to provide access to the interior of the machine compartment 18. In order to increase the structural strength of cabinet 10 a plurality of angle iron members 22 may be employed where necessary. The angle iron members 22 may be supported from or attached to channel iron members or the like 23, extending horizontally along the bottom of cabinet 10 at each side thereof. These channel iron members 23 together with the cabinet walls 11, the food compartment bottom wall 17, and the floor upon which the cabinet rests, indicated by the reference character 24, provide means which forms an air flue or tunnel 25 beneath the bottom metal wall 26 of compartment 12, for a purpose to be presently described. The vertical end wall 31 of cabinet 10 opposed to the wall 17 thereof is cut off at the compartment bottom wall 26, so as to provide the tunnel 25 with an opening or open end 32 for the ingress of air, as will be more fully explained hereinafter. The exterior metal bottom wall 26 of compartment 12 is preferably, although not necessarily, inclined upwardly from the air inlet opening 32 of tunnel 25 toward the machine compartment 18. Suitable blocks 34 may be inserted between the inclined wall 26 of compartment 12 to support the compartment from the channel iron members 23 located on each side of the cabinet. End wall 17 of compartment 18 extends down to the floor level 24 and over the ends of the channel members 23 to close the flue 25 at this point. It will be seen that the flue 25 is of great length as compared to its cross-sectional area and that the inclined top wall thereof, formed by the exterior metal bottom wall 26 of compartment 12, serves to make the flue of increased cross-sectional area in a direction toward its air outlet end.

A refrigerating system associated with the refrigerator 10 includes an evaporator 36 secured to the exterior surface of the metal liner 19 of food storage compartment 12, for cooling the interior thereof, a combined motor-compressor unit 37, mounted within the machine compartment 18 in any suitable or desirable manner, and a con-

denser 38, all connected by suitable conduits in closed circuit relationship. The compressor of the motor-compressor unit 37 withdraws evaporated or gaseous refrigerant from the evaporator 36, through conduit 41, compresses the refrigerant and forwards the compressed refrigerant, through conduit 42, into the condenser 38. Refrigerant cooled and condensed in the condenser 38 flows, through the liquid refrigerant conduit 43, under the control of a suitable expansion valve or restrictor (not shown) into the evaporator coil 36 where it is again evaporated to remove heat from the food storage compartment 12. Any suitable or conventional thermostatic switch (not shown) may be employed for starting and stopping the motor of the motor-compressor unit 37. A motor 46, having a fan 47 mounted on its shaft, is mounted in any suitable manner within machine compartment 18 and is preferably electrically connected in series with the motor-compressor unit 37, so as to be started in operation or stopped simultaneously with starting and stopping of unit 37 under the control of the thermostatic switch. The fan 47 is located within a shroud or the like 48 formed integral with or attached to the cabinet end wall 17. A protective grille or screen 49 may be mounted in the air outlet opening formed in the top portion of cabinet end wall 17.

The condenser 38 preferably comprises a plurality of loops 51 of conduit extending along and being secured in metal-to-metal contact with the metal bottom wall 26 of the food compartment 12 by suitable metal straps 53. The long flat condenser coil 38 formed by the conduit loops 51 extends over or traverses a substantial area of the food compartment exterior bottom wall 26 and this metallic wall serves as a heat radiating surface, or forms a secondary fin or heat dissipating portion for the condenser 38 to augment its transference of heat to the atmosphere. In fact the entire outer metal wall surface of cabinet 10 augments dissipation of heat from condenser 38 due to these wall surfaces being in contact with the bottom metal wall 26. The metal straps 53 may be bolted or otherwise suitably secured to wall 26.

When the electric circuit is completed to the motor-compressor unit 37 to cause operation of the compressor it is also completed to motor 46 to cause operation of the fan 47. The fan 47 blows air out of the machine compartment 18 through the air outlet opening or screen 49 and creates a suction within the hood or shroud 48. Suction created by the fan 47 causes air to enter the inlet opening or open end 32 of the air flue or tunnel 25. This air flows in a horizontal direction lengthwise of and beneath the cabinet 10, over the food compartment bottom wall 26 and over the condenser 38 secured thereto, so as to cool and condense compressed refrigerant received by the condenser. When the circulating air reaches the machine compartment 18 it flows upwardly therein over the motor-compressor unit 37 and over the fan motor 46 to remove heat from these heat dissipating elements. The air is then forced by the fan outwardly of compartment 18 through the outlet opening or screen 49.

While fan 47 normally induces or circulates air in the manner described I have, by virtue of inclining the bottom wall 26 of the food compartment upwardly from the air flue inlet opening 32, toward the point at which the flue communicates with the machine compartment 18, provided other means for inducing air circulation into and

through the flue 25 over the heat dissipating elements 38 and 37. The inclination of wall 26, together with locating the air outlet adjacent the top of machine compartment 18, creates a natural draft or theremo-syphon circulation of air into and through the flue 25. If for any reason the fan motor 46 becomes inoperative a safety factor is provided, since the present arrangement which induces a thermo-syphon circulation of air through the air flue 25 and over the heat dissipating elements, condenser 38 and motor 37 respectively of the refrigerating system, will cause the flow of sufficient air to permit continued operation of the refrigerating system and prolonged cold storage of contents located in the low temperature food storage compartment. The refrigerating system may not operate at its maximum efficiency so long as motor 46 and fan 47 remain inoperative, but the prolonged more or less inefficient operation of the system is highly desirable until a serviceman can arrive, repair and again place fan 47 in operation. The cost of operating the refrigerating system somewhat less efficiently than normal, due to inoperation of fan 47, is not expensive as compared to having spoilage of all the food stored in the refrigerator, which is usually the case in refrigerating systems equipped with thermostatic controls which stop the system when abnormal heating of elements thereof occurs.

By the arrangement described and illustrated various advantages are offered. The location of the air inlet opening of the flue adjacent the floor level insures that the coldest air in the room, in which the refrigerator cabinet is placed, will enter the flue and circulate over the condenser to thus increase the cooling efficiency of the condenser. By arranging the air outlet opening so that it is adjacent the top of the cabinet paint on the cabinet walls is not discolored or damaged as a result of heat from the condenser. The location of the air outlet in the uppermost portion of a relatively low cabinet of the type disclosed, as distinguished from a vertically elongated household type refrigerator cabinet, more effectively causes the heat of the condenser to induce the thermo-syphon air circulation heretofore described. Another advantage lies in the fact that air circulated over the condenser, parallel to the length of the coils thereof, more effectively cools and condenses refrigerant therein since it flows in a counter direction with respect to the flow of refrigerant in at least portions of the condenser. Also by securing the condenser in intimate thermal contact with the food storage compartment bottom wall this wall dissipates heat to the circulating air throughout the length of the air flue.

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, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. A refrigerating apparatus comprising in combination, a horizontally elongated cabinet having a plurality of walls forming an insulated food storage compartment and a machine compartment at one side of said food compartment in substantially the same horizontal plane therewith, a refrigerating system associated with said cabinet including an evaporator for cooling said food compartment, a refrigerant translating unit within said machine compartment, a condenser, and conduit means connecting said evaporator,

said unit and said condenser in closed circuit relation, means forming an air flue beneath said food compartment and communicating at one end thereof with the lower portion of said machine compartment, said condenser being disposed within said flue, said flue having an air inlet opening at the base portion of said cabinet, said machine compartment having an air outlet opening in an upper wall portion thereof, and the exterior bottom wall of said food storage compartment forming the upper wall portion of said flue and being inclined upwardly in a direction from said flue inlet opening toward the point of communication of the flue with said machine compartment for inducing circulation of air into and out of said openings through said flue and over said condenser.

2. A refrigerating apparatus comprising in combination, a cabinet having a plurality of walls forming an insulated food storage compartment and a machine compartment at one side thereof, a refrigerating system associated with said cabinet including an evaporator for cooling said food compartment, a refrigerant translating unit within said machine compartment, a condenser, and conduit means connecting said evaporator, said unit and said condenser in closed circuit relation, means including the exterior metal bottom wall of said food compartment forming an air flue of great length as compared to its cross-sectional area beneath said food compartment and communicating at one end thereof with the lower portion of said machine compartment, said condenser being disposed within said flue and secured in metal-to-metal contact with said food compartment bottom wall, said flue having an air inlet opening at the base portion of said cabinet, said machine compartment having an air outlet opening in an upper wall portion thereof, and means for inducing circulation of air into and out of said openings through said flue and over said condenser.

3. A refrigerating apparatus comprising in combination, a cabinet having a plurality of walls forming an insulated food storage compartment and a machine compartment at one side thereof, a refrigerating system associated with said cabinet including an evaporator for cooling said food compartment, a refrigerant translating unit within said machine compartment, a condenser, and conduit means connecting said evaporator, said unit and said condenser in closed circuit relation, means including the exterior metal bottom walls of said food compartment forming an air flue of great length as compared to its cross-sectional area beneath said food compartment and communicating at one end thereof with the lower portion of said machine compartment, said condenser being disposed within said flue and secured in metal-to-metal contact with said food compartment bottom wall, said flue having an air inlet opening at the base portion of said cabinet, said machine compartment having an air outlet opening in an upper wall portion thereof, and means for inducing circulation of air into and out of said openings through said flue and over said condenser, said last named means including a fan disposed within and located adjacent the air outlet opening of said machine compartment.

4. A refrigerating apparatus comprising in combination, a cabinet having a plurality of walls forming an insulated food storage compartment and a machine compartment at one side thereof, a refrigerating system associated with said cabinet including an evaporator for cooling said food

compartment, a refrigerant translating unit within said machine compartment, a condenser, and conduit means connecting said evaporator, said unit and said condenser in closed circuit relation, means including the exterior metal bottom wall of said food compartment forming an air flue of great length as compared to its cross-sectional area beneath said food compartment and communicating at one end thereof with the lower portion of said machine compartment, said condenser being disposed within said flue and secured in metal-to-metal contact with said food compartment bottom wall whereby at least the food compartment bottom wall of said cabinet provides a heat radiating surface for said condenser, said flue having an air inlet opening at the base portion of said cabinet, said machine compartment having an air outlet opening in an upper wall portion thereof, and said bottom wall of said food compartment being inclined upwardly in a direction from said flue inlet opening toward the point of communication of the flue with said machine compartment for inducing circulation of air into and out of said openings through said flue and over said food compartment bottom wall and the condenser secured thereto.

5. A refrigerating apparatus comprising in combination, a substantially rectangular horizontally elongated cabinet having a plurality of walls forming an insulated food storage compartment and a machine compartment at one end of said food compartment and in the same horizontal plane therewith, a refrigerating system associated with said cabinet including an evaporator for cooling said food compartment, a refrigerant translating unit within said machine compartment, a condenser, and conduit means connecting said evaporator, said unit and said condenser in closed circuit relation, means including the exterior metal bottom wall of said food compartment forming an air flue of great length as compared to its cross-sectional area beneath said food compartment and communicating at one end thereof with the lower portion of said machine compartment, said condenser being disposed within said flue and secured in metal-to-metal contact with said food compartment bottom wall, said flue having an air inlet opening at the base portion of the end of said cabinet opposed to said machine compartment end thereof, said machine compartment having an air outlet opening in a vertical wall portion thereof adjacent the top surface of said cabinet, said flue-forming means being so constructed and arranged as to provide the flue with increased cross-sectional area from its air inlet opening to a point where the flue communicates with said machine compartment, and means in addition to the shape of the flue for circulating air into and out of said openings through said flue over said food compartment bottom wall and the condenser secured thereto and thence over said unit within said machine compartment.

6. A refrigerating apparatus comprising in combination, a substantially rectangular horizontally elongated cabinet having a plurality of walls forming an insulated food storage compartment and a machine compartment at one end of said food compartment and in the same horizontal plane therewith, a refrigerating system associated with said cabinet including an evaporator for cooling said food compartment, a refrigerant translating unit within said machine compartment, a condenser, and conduit means

connecting said evaporator, said unit and said condenser in closed circuit relation, means including the exterior metal bottom wall of said food compartment forming an air flue of great length as compared to its cross-sectional area beneath said food compartment and communicating at one end thereof with the lower portion of said machine compartment, said condenser being disposed within said flue and secured in metal-to-metal contact with said food compartment bottom wall, said flue having an air inlet opening at the base portion of the end of said cabinet opposed to said machine compartment end thereof, said machine compartment having an air outlet opening in a vertical wall portion thereof adjacent the top surface of said cabinet, said flue-forming means being so constructed and arranged as to provide the flue with increased cross-sectional area from its air inlet opening to a point where the flue communicates with said machine compartment for inducing a thermo-syphon circulation of air into and out of said openings through said flue to remove heat from said condenser and said unit.

7. A refrigerating apparatus comprising in combination, a substantially rectangular horizontally elongated cabinet having a plurality of walls forming an insulated food storage compartment and a machine compartment at one end of said food compartment and in the same horizontal plane therewith, a refrigerating system associated with said cabinet including an evaporator for cooling said food compartment, a refrigerant translating unit within said machine compartment, a condenser, and conduit means connecting said evaporator, said unit and said condenser in closed circuit relation, means forming an air flue of great length as compared to its cross-sectional area beneath said food compartment and communicating at one end thereof with the lower portion of said machine compartment, said condenser being disposed within said flue, said flue having an air inlet opening at the base portion of the end of said cabinet opposed to said machine compartment end thereof, said machine compartment having an air outlet opening in a vertical wall portion thereof adjacent the top of said cabinet, said flue-forming means being so constructed and arranged as to provide the flue with increased cross-sectional area from its air inlet opening to a point where the flue communicates with said machine compartment for inducing a thermo-syphon circulation of air into and out of said openings through said flue and over the condenser therein.

8. A refrigerating apparatus comprising in combination, a cabinet, a plurality of insulated walls dividing the interior of said cabinet into a food storage compartment and a machine compartment, a refrigerating system associated with said cabinet including an evaporator for cooling said food compartment, a refrigerant translating device including a first heat dissipating element within said machine compartment and a second heat dissipating element, conduit means connecting said evaporator and said heat dissipating elements of said device in closed circuit relation, the insulated bottom of said food compartment having a metal covering spaced from the lowermost portion of said cabinet and forming the top wall of an air flue beneath said food compartment, said flue communicating at one end with said machine compartment, said flue having an air inlet opening adjacent the base of said cabinet remote from said machine compartment, said

machine compartment having an air outlet opening in one wall thereof, said second heat dissipating element extending along said flue and being secured in intimate thermal contact with the metal top wall thereof, and means for inducing circulation of air into and out of said openings through said flue and over said elements.

9. A refrigerating apparatus comprising in combination, a cabinet, a plurality of insulated walls dividing the interior of said cabinet into a food storage compartment and a machine compartment, a refrigerating system associated with said cabinet including an evaporator for cooling said food compartment, a refrigerant translating device including a first heat dissipating element within said machine compartment and a second heat dissipating element, conduit means connecting said evaporator and said heat dissipating elements of said device in closed circuit relation, the insulated bottom of said food compartment having a metal covering spaced from the lowermost portion of said cabinet and forming the top wall of an air flue beneath said food compartment, said flue communicating at one end with said machine compartment, said flue having an air inlet opening adjacent the base of said cabinet remote from said machine compartment, said machine compartment having an air outlet opening in one wall thereof, said second heat dissipating element extending along said flue and being secured in intimate thermal contact with the metal top wall thereof, and the top wall of said flue being inclined upwardly in a direction from said flue inlet opening toward the point of communication of the flue with said machine compartment for inducing a thermo-siphon circulation of air into and out of said openings through said flue and over said elements.

10. A refrigerating apparatus comprising in combination, a cabinet, a plurality of insulated walls dividing the interior of said cabinet into a food storage compartment and a machine compartment, a refrigerating system associated with said cabinet including an evaporator for cooling said food compartment, a refrigerant translating device including a motor-compressor unit within said machine compartment and a condenser, conduit means connecting said evaporator, said unit and said condenser in closed circuit relation, said condenser including a heat dissipating refrigerant conducting portion and a secondary heat dissipating plate-like portion in intimate thermal contact therewith, said condenser being spaced from the lowermost part of said cabinet and having its plate-like portion covering the insulated bottom wall of said food compartment to provide the top wall of a flue beneath said food compartment, said flue communicating at one end with said machine compartment and having an air inlet opening adjacent the base of said cabinet remote from said machine compartment, said machine compartment having an air outlet opening in a wall thereof, and means for inducing circulation of air into and out of said openings through said flue and over said condenser.

SYLVESTER M. SCHWELLER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,295,113	Jordan et al.	Sept. 8, 1942