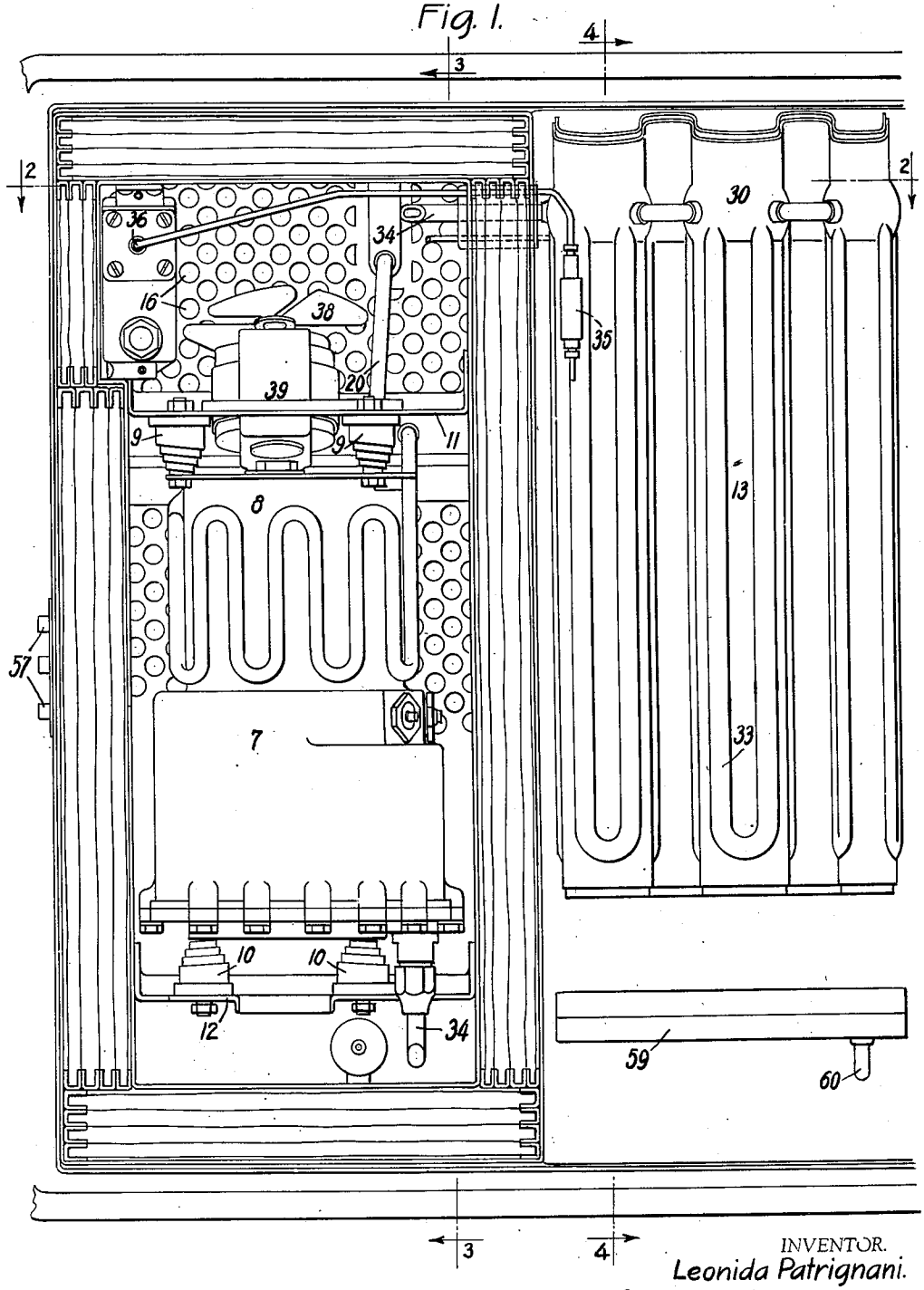
May 7, 1940. L. PATRIGNANI 2,199,413

REFRIGERATING UNIT

Filed July 25, 1936 4 Sheets-Sheet 1

Fig. 1.



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REFRIGERATING UNIT

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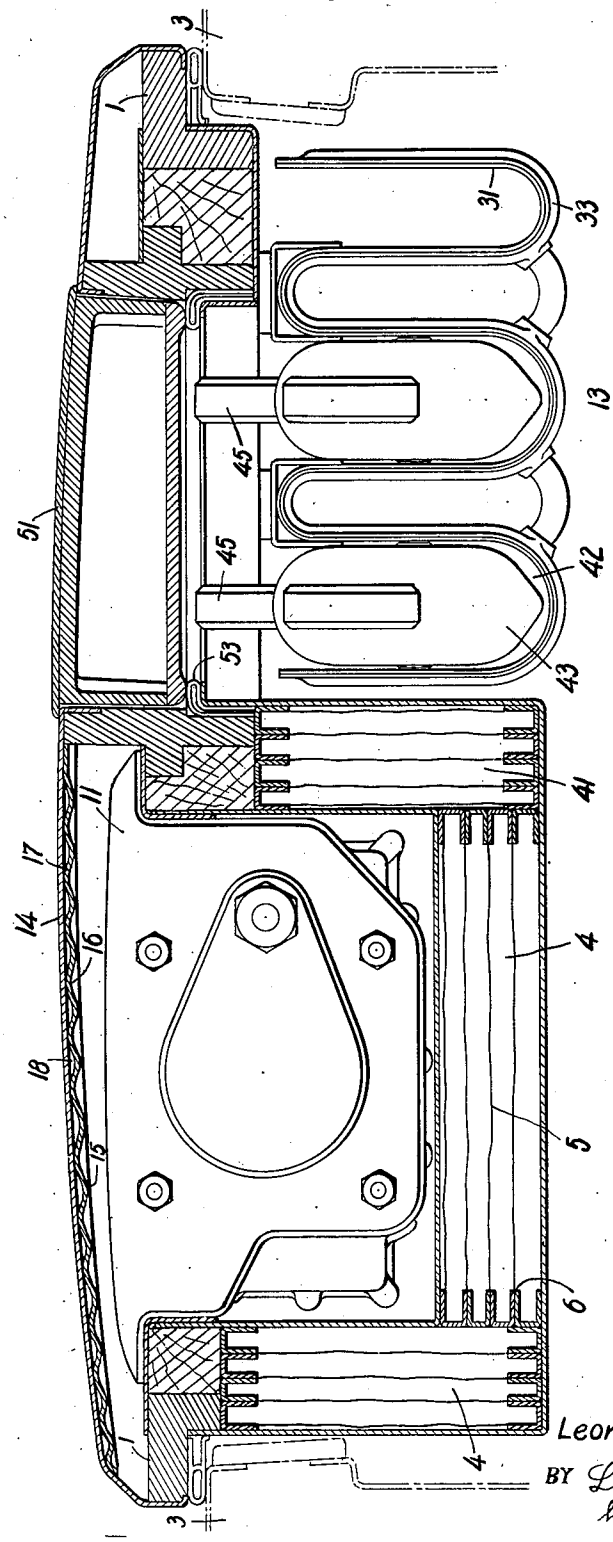

Fig. 2.

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Fig. 3.

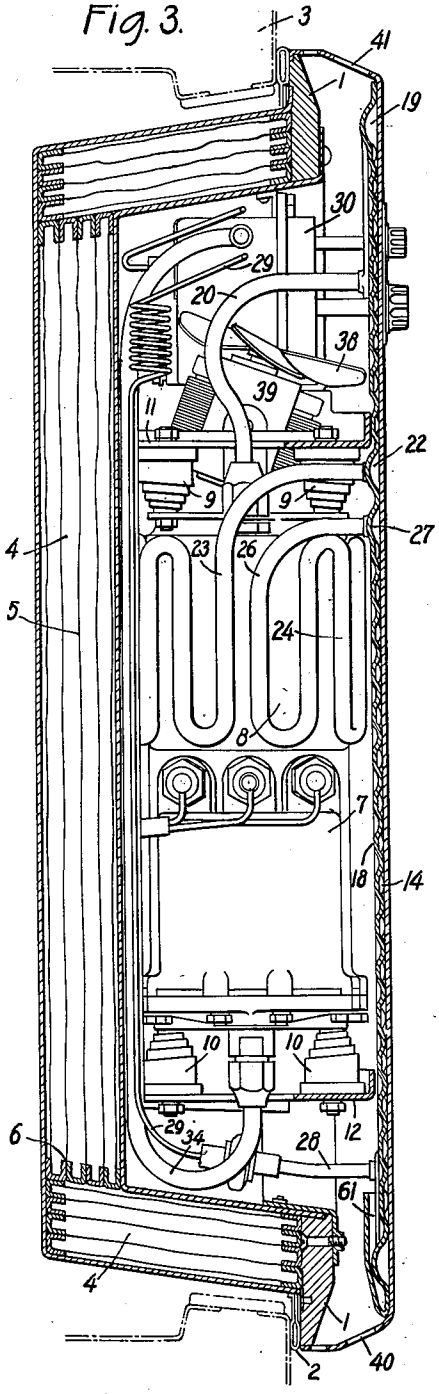
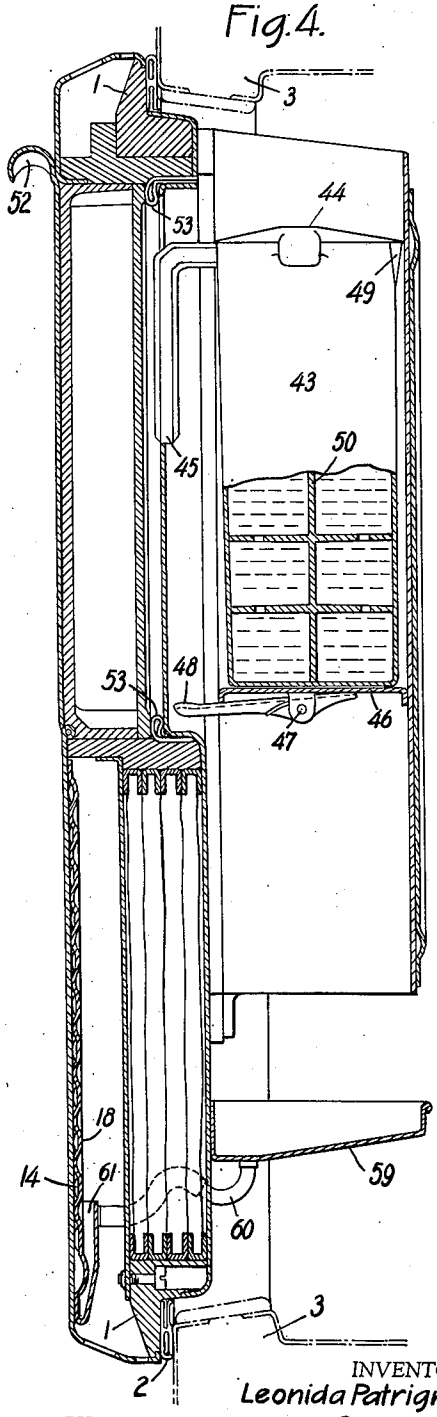


Fig. 4.



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Filed July 25, 1936 4 Sheets-Sheet 4

Fig. 5.

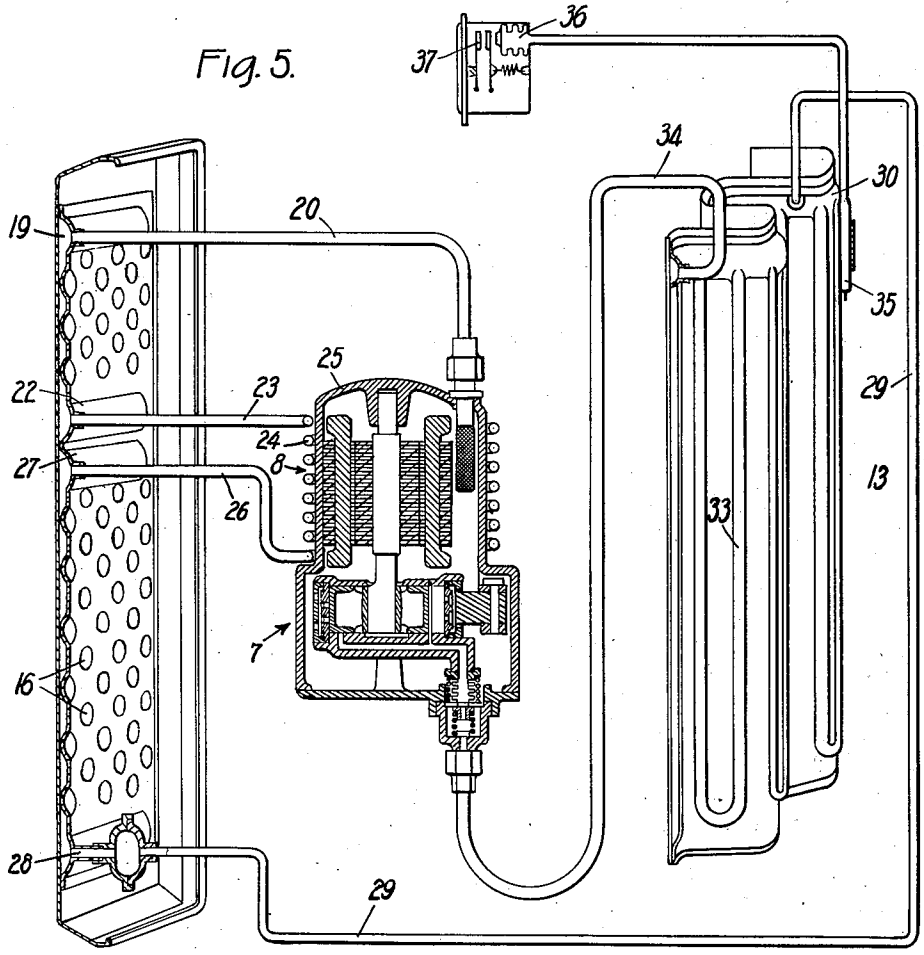
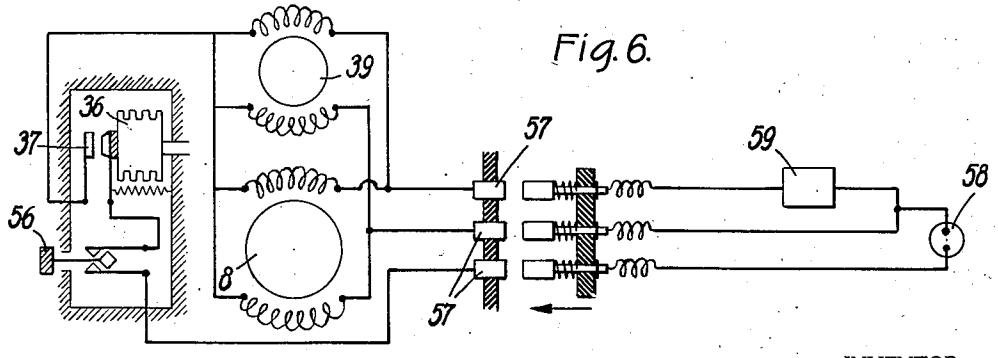


Fig. 6.



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Patented May 7, 1940 2,199,413

UNITED STATES PATENT OFFICE

2,199,413

REFRIGERATING UNIT

Leonida Patrignani, Paris, France, assignor, by mesne assignments, to Caladon Corporation, Boston, Mass., a corporation of Delaware

Application July 25, 1936, Serial No. 92,521
In France March 3, 1936

4 Claims. (Cl. 62—116)

The present invention relates to removable and interchangeable wall elements or doors, each of which constitutes a complete refrigerating unit or plant for a cabinet, and the main object of the invention is to provide a novel and advantageous unit of this general character.

According to the invention, this refrigerating unit may be movable or stationary, removable or fixed, interchangeable or not, and it may contain within its confines all apparatus, and substances required to produce refrigeration within a cooling chamber or cabinet. Also the arrangement may be such that the compressed refrigerant is condensed in the outer wall of the unit and the evaporator is in direct contact with air circulated in the interior of the enclosure or cabinet that is to be cooled.

The refrigerating unit, which may be in the form of a door or may be part of the wall of a refrigerator, may have at its outer surface a hollow wall, consisting of two elements, the outer being flat and the inner being provided with pressed out projections, preferably in regular arrangement and attached to the outer element as by point welding. When the two elements have thus been joined, there is obtained a condenser with a large heat-transfer area at each face.

Further objects, features and advantages will appear upon consideration of the following detailed description and the drawings. In the accompanying drawings which illustrate by way of example a preferred form of construction of a door of a household refrigerator, constituting a complete refrigerating unit.

Fig. 1 is an elevational view of the inner side of the door with certain parts omitted to show the interior structure.

Fig. 2 is a transversal section on the line II—II of Fig. 1, drawn to a larger scale;

Figs. 3 and 4 are vertical sections on the lines III—III and IV—IV respectively of Fig. 1; and

Figs. 5 and 6 are diagrams of the cooling system and the electric connections.

The door comprises a frame 1 designed to be applied, with an interposed packing 2, to wall 3 of a refrigerator box, partially shown. This door comprises a heat insulating frame 4 constituted preferably, as may be seen more clearly in Figs. 1–3, by preferably corrugated sheets or plates 5 of any suitable material, such as aluminum or the like, and preferably suitably polished. The said sheets may be held at their edges by elements 6 having, for instance, the form of channels and being suitably insulated, so that the various compartments set off by the plates 5 are properly insulated from each other. The heat-insulation thus formed is very efficient.

Frame 4 defines within the door a compartment receiving the compressor 7 with its motor 8, constituting a block supported by groups of springs 9, 10 on a suitably positioned transverse base 11, 12. The unit or block including the compressor and motor is therefore completely insulated by wall 4 from the interior of the cooling compartment or cabinet.

On the door of the cabinet is mounted an evaporator 13 which is in free communication with the interior of the cooling compartment.

The outer wall or cover plate of the door consists of a plate 14 suitably flat and smooth to which is joined a plate 15 arranged on the inner side of this exterior enclosure and being provided with depressions or recesses 16 of, for instance, circular form or the like (seen best in Fig. 1), joining of the two plates 14 and 15 being effected as by electric welding at each contact point 17 of the two plates. The said electric welding is preferably carried out in a manner such that the outer face of plate 14 retains its completely smooth appearance.

In this way, a unit of great rigidity is obtained which presents between the two plates 14 and 15 a series of fine wavy ducts 18 communicating with each other. The device thus formed by the two plates is used as condenser, the cooling surface of which is formed by the outer plate 14 as well as by the inner plate 15 of the door, thus providing a large cooling surface, while the various connected wavy paths or ducts 18 assure a large flowing surface of the refrigerant so that rapid cooling is secured.

The condenser formed by the various wavy paths 18 communicates at the upper part of the door, through a collector 19 (Fig. 3) with a supply pipe 20 (Fig. 5) leading from the compressor 7. A second and intermediate collector 22 is connected by pipe 23 to a coil or jacket 24 provided at the wall 25 (Fig. 5) of the motor driving the compressor 7, thus providing a cooler for this motor as well as for the compressor driven by said motor.

A pipe 26 connects the other end of coil 24 with an intermediate collector 27 forming the head of a second stage of condensation which ends at the lower part of the door in a collector 28 connected by a pipe 29, having a suitable regulator of any desired type, with a reservoir or collector 30 located at the head of the evaporator 13. This evaporator comprises, as may be best seen in Figs. 2 and 5, a sinuous bearing sheet or

plate 31 to which is attached, preferably by electric welding, or the like, a plate 32 provided with depressions 33 which, after the elements 31 and 32 have been joined, constitute channels for the circulation of the refrigerant.

At a suitable point of the evaporator 13, preferably at a point of collector 30 opposite to the connection point of pipe 29, conduit 34 returns to the compressor 7 the vapors produced in said evaporator.

The customary bulb 35 of the thermostat 36 controlling interrupter 37 of the motor of the compressor is mounted on the evaporator, for instance in the position indicated in Fig. 5.

A fan 38 (Figs. 1 and 3) driven by an electric motor 39, functioning preferably in parallel with motor 8 driving the compressor, is provided to assure or intensify the circulation of air produced in the motor compartment by the difference in the level of ports 40 and 41 (Fig. 3), provided respectively in the lower and the upper parts of the corresponding compartment of the door.

The cooling circuit is indicated in Fig. 5 and the lines of different character indicate the path of the refrigerant.

The peculiar form of the evaporator, shown best in Figs. 1 and 2, is utilized for the new arrangement of the ice-producing devices destined to cool beverages. In the recesses, such as 42, formed by the wall or sinuous bearing surface 31, there may be placed receptacles 43, each as shown in Fig. 4, a cover 44 and a handle 45, each of these receptacles being adapted to rest on a support or platform 46 provided with a pivot 47 and carrying a tilting lever 48.

Each of these receptacles 43 has a spout 49 and may receive flexible and deformable separators to divide the interior of receptacle 43 into a certain number of compartments which may or may not be in communication with one another by means of openings in said partition walls of said separator. This elongated shape of the receptacles makes them very convenient for handling liquids.

At the outer side of the receptacle or receptacles, the main door is provided with a wicket or small door in the form of a swinging shutter 51 (Figs. 2 and 4) having a handle 52 for its manipulation and cooperating with packing 53. The said shutter when in open position may serve as a platform to support a receptacle at the time of its insertion or removal.

It will be seen that, to obtain ice blocks or cubes, it is sufficient to introduce in the recesses 42 water-filled receptacles 43 into which the separators 50 have been placed. The insertion and withdrawal may be effected without opening the main door of the cabinet and consequently without any substantial rise in temperature in the cabinet. Furthermore, the removal of the ice cubes contained in each receptacle 43 can be effected with the greatest facility by turning the receptacle upside down and agitating the separator 50 which, by reason of such deformation, permits the cubes to be loosened easily and to fall into any vessel placed to receive them. Each cube may therefore be taken out separately without any need of emptying the entire tray, as is necessary with the usual arrangements.

In addition, the described arrangement with vertical trays for freezing the cubes will permit of utilizing these trays or receptacles for the direct cooling of liquids, beverages or the like, without changing in any way the composition of said liquids, for example by dilution. It is necessary only to place the liquid or other material to be cooled into a receptacle 43, to set the receptacle in the position indicated in Fig. 4, and to obtain direct refrigeration without any admixture of ice and, consequently, water to the material to be cooled.

A tank 59 placed below the evaporator to receive the water of condensation and defrosting communicates through pipe 60 with a receiver 61 placed against the double-walled condenser (Fig. 4) to assure the re-evaporation of the water of condensation and defrosting, such evaporation producing the cooling of the condenser in connection with the air cooling, and removing the necessity of emptying tank 59.

As may be seen in Fig. 6, the fan and the compressor are driven by motors 8 and 39, respectively, the circuit of which is controlled through contact 37 and also a controlled interrupter 62 that is connected with contacts 63 arranged on the door to cooperate with suitable spring contacts 64 so that the motor circuit will be broken when the door of the cabinet is opened. A junction box 65 is cut in the circuit which includes any suitable device 59 for interrupting the auxiliary phase and, if needed the condenser after starting. This result may be obtained in any desired manner, either by heating and interrupting resistances or by any suitable type of circuit interrupter.

It will be seen that due to the described arrangement, an economical and convenient construction of a refrigerating unit is obtained, which unit comprises all elements required for any refrigerator installation, particularly for home or store use.

The fan may be driven by the same motor as the compressor. The unit of the present invention may be utilized to change the cabinet of an ice refrigerator into an electric refrigerator simply by substituting the door of the present invention for the old door.

It should be understood that various changes may be made and that various features may be used without others without departing from the true scope and spirit of the invention.

Having thus described my invention, I claim:

1. A removable and interchangeable wall closure for a cabinet constituting a complete refrigerating element therefor, comprising an outer wall constituting a condenser for compressed refrigerant, said outer wall having therein ducts close to its outer and inner surfaces to facilitate cooling of the refrigerant by heat transfer at both the outer and inner surfaces of said outer wall, a vertically arranged motor-compressor unit and an evaporator arranged side by side across said outer wall at the inner side thereof, said evaporator being in heat exchanging relationship with the interior of the cabinet and thermally insulated at its front, a connection from the motor compressor to the upper part of said condenser, a connection from the lower part of the condenser to the evaporator, a connection from the evaporator to the compressor, and a vertically arranged compartment for said motor-compressor unit thermally insulating the same from the evaporator and the interior of the cabinet and having at its bottom and top intake and discharge openings respectively both connected with the outside air to obtain a flow of air therethrough to aid in cooling the condenser and the motor-compressor unit.

2. A removable and interchangeable wall closure for a cabinet constituting a complete re-

frigerating element therefor, comprising a compressor, a motor for said compressor arranged above the same, a vertically extending compartment containing said motor and compressor and having air intake and discharge openings at the bottom and top and an outer wall constituting a condenser for compressed refrigerant, a duct supplying refrigerant from the compressor to the upper part of the condenser and a motor-cooling device receiving refrigerant from one level of the condenser and discharging it to a lower level of the condenser.

3. A removable and interchangeable wall closure for a cabinet constituting a complete refrigerating element therefor, comprising a compressor, a motor for said compressor arranged above the same, a vertically extending compartment containing said motor and compressor, thermally insulated from the interior of the cabinet and having in communication with the outside air intake and discharge openings at the bottom and top respectively, an outer wall constituting a condenser and receiving compressed refrigerant at its upper part, an evaporator for the condenser refrigerant located at one side of the upper part of said compartment in heat exchanging relation with the interior of the cabinet, thermal insulation means below said evaporator and spaced from the condenser, and a movable thermal insulation member in the condenser to provide access to the interior of the evaporator.

4. A removable and interchangeable wall closure for a cabinet constituting a complete refrigerating element therefor, comprising a compressor, a motor for said compressor arranged above the same, a vertically extending compartment containing said motor and compressor, thermally insulated from the interior of the cabinet and having in communication with the outside air intake and discharge openings at the bottom and top respectively, an outer wall constituting a condenser and receiving compressed refrigerant at its upper part, an evaporator for the condensed refrigerant located at one side of the upper part of said compartment in heat exchanging relation with the interior of the cabinet, thermal insulation means below said evaporator and spaced from the condenser, a movable thermal insulation member in the condenser to provide access to the interior of the evaporator, a collecting pan beneath the evaporator and cooling means for the condenser receiving liquid collected in said pan and utilizing it for such cooling.

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