

Aug. 2, 1932.

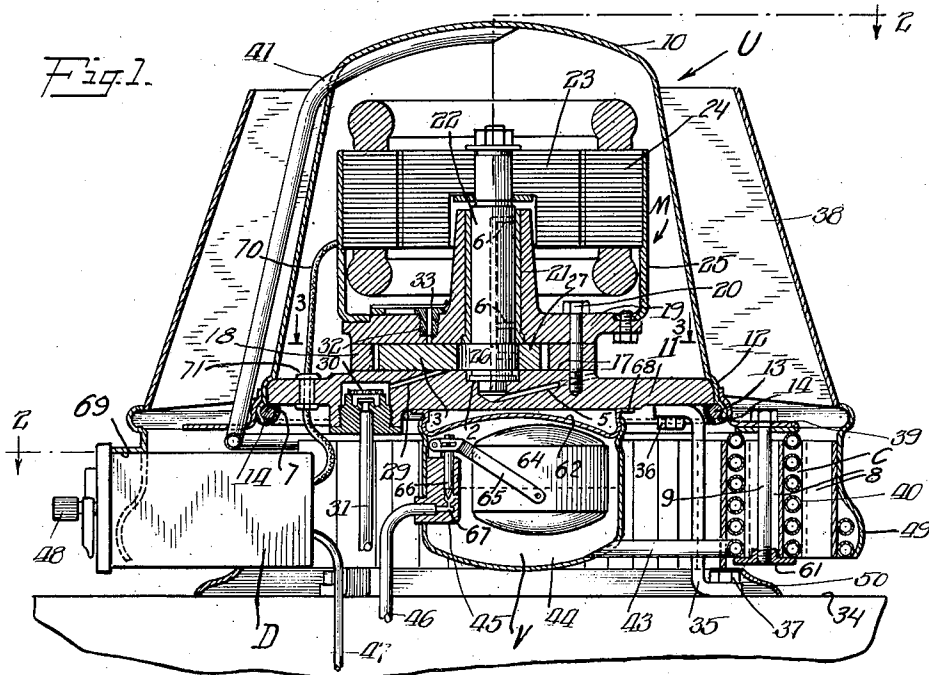
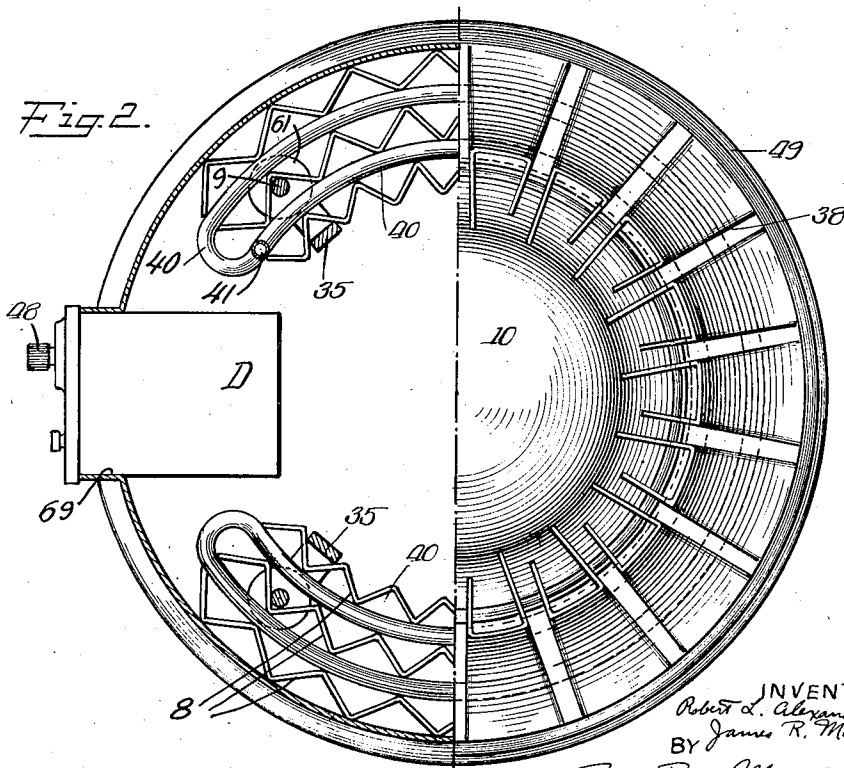
R. L. ALEXANDER ET AL

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REFRIGERATION UNIT

Filed Feb. 26, 1930

4 Sheets-Sheet 1



INVENTORS
Robert L. Alexander and
James R. McCullum
BY
Perrin, Davis, Maurin & Edmonds
ATTORNEYS

Aug. 2, 1932.

R. L. ALEXANDER ET AL

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4 Sheets-Sheet 2

Fig. 3.

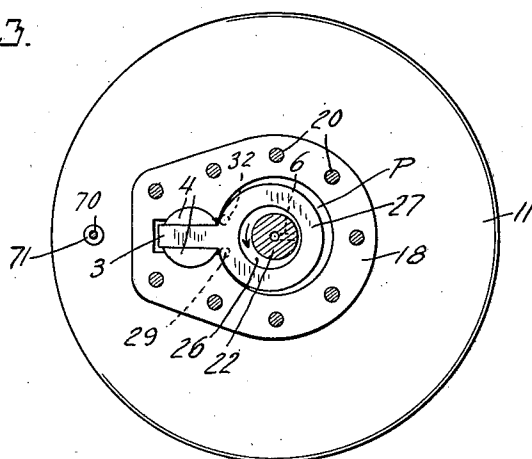


Fig. 4.

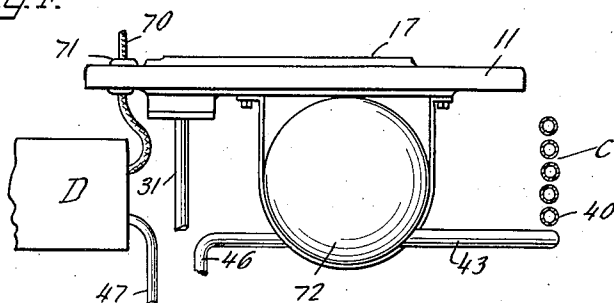
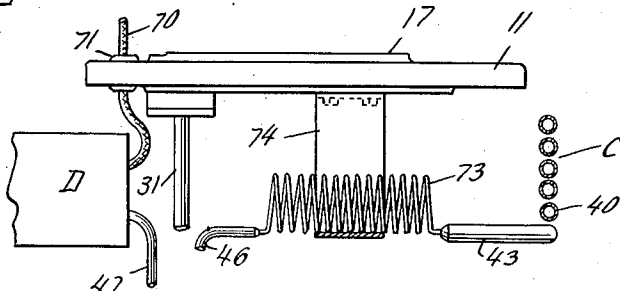


Fig. 5.



INVENTORS
Robert L. Alexander and
James R. McCullum
BY
Pennie, Davis, Marvin & Edwards
ATTORNEYS

Aug. 2, 1932.

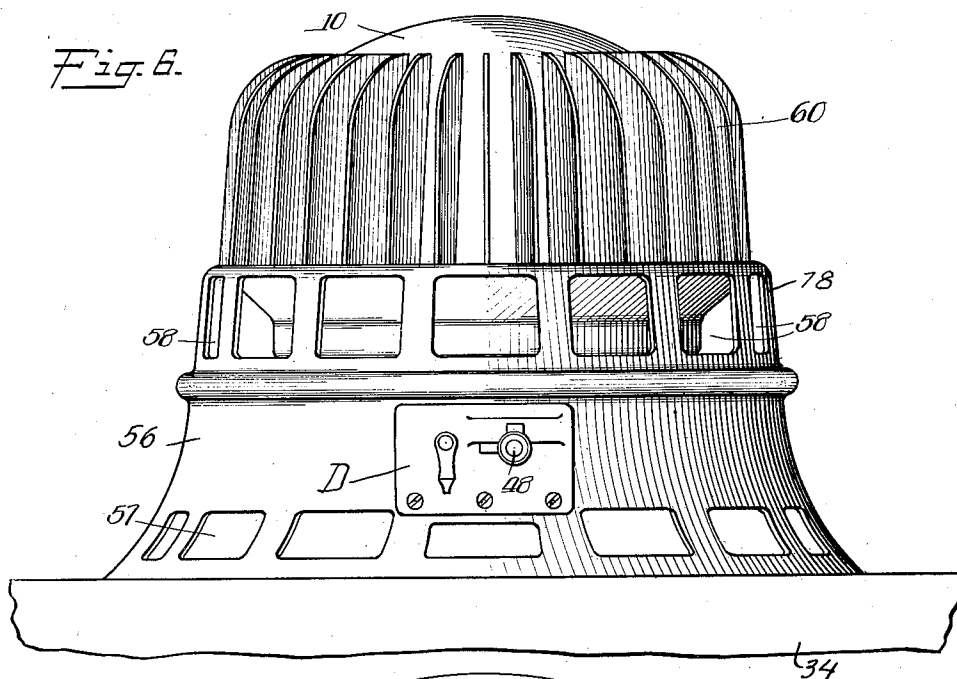
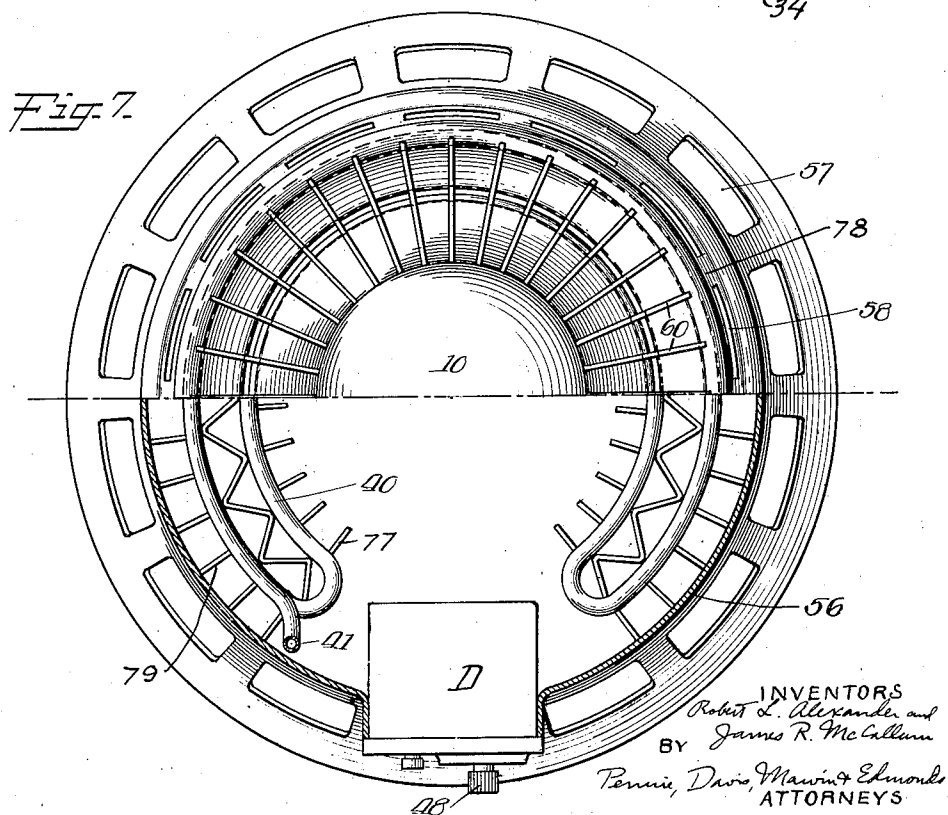
R. L. ALEXANDER ET AL

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4 Sheets-Sheet 3



INVENTORS
Robert L. Alexander and
James R. McCallum
BY
Perrine, Davis, Manning & Edmunds
ATTORNEYS

Aug. 2, 1932.

R. L. ALEXANDER ET AL

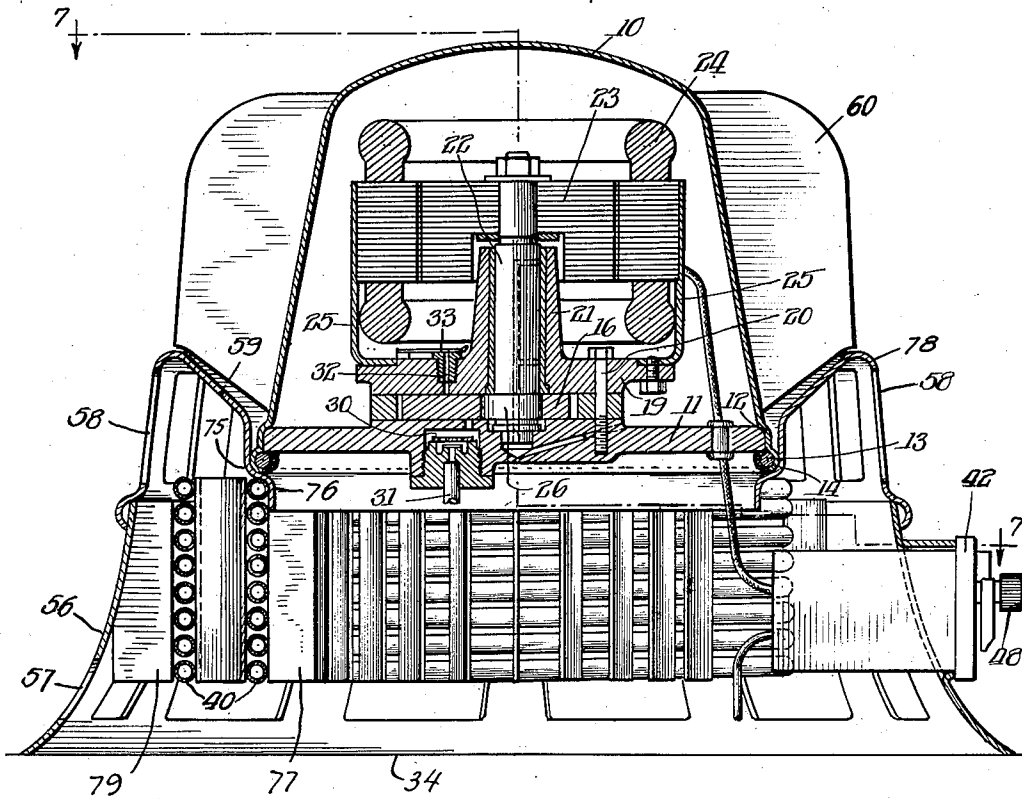
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4 Sheets-Sheet 4

Fig. 8.



INVENTORS
Robert L. Alexander and
James R. McCallum
BY
Perrine, Davis, Marvin & Edmonds
ATTORNEYS

UNITED STATES PATENT OFFICE

ROBERT L. ALEXANDER AND JAMES R. McCALLUM, OF CLINTON, IOWA, ASSIGNORS TO
THE CLIMAX ENGINEERING COMPANY, OF CLINTON, IOWA, A CORPORATION OF
DELAWARE

REFRIGERATION UNIT

Application filed February 26, 1930. Serial No. 431,524.

This invention relates to refrigerating systems and more particularly concerns an improved compression and condensing unit of refrigerating systems of the compression type.

Small electric refrigerating systems of the compression type are extensively used to cool household refrigerator cabinets, water coolers and the like. Compression refrigeration systems of this type include as essential elements thereof, a compressor, driving means for the compressor, a condenser, an expansion device, an evaporator and suitable control means for effecting the starting and stopping of the motor and the regulation of the degree of refrigeration produced. Of the elements named, the evaporator is enclosed within a refrigerator cabinet or other space to be cooled, whereas the remaining devices are usually mounted at convenient points outside of the cabinet, and may be located on the top or below the bottom thereof. When exposed to view, as when mounted on top of a refrigerator cabinet, it is desirable that the operating elements of this system present a neat and pleasing appearance.

The present invention contemplates the provision of a unitary and extremely compact construction incorporating the motor, compressor, condenser, expansion device and control means of a compression refrigeration system, and certain subcombinations of these elements. The invention further contemplates a unitary construction embodying some or all of the above elements in which the compression apparatus and the condenser are suitably associated for proper operation and in which the manually operable elements of the control means are readily accessible to the operator. The invention further contemplates the provision of a unitary structure of the type described which is pleasing in appearance in that the unsightly elements thereof are enclosed or hidden from view.

A further object of the invention resides in the provision of improved means for hermetically sealing the motor and compressor of the unit within a casing, whereby the leak-

age of refrigerant from the system is prevented.

Various other specific objects, advantages and characteristic features of the invention will be pointed out or will become apparent as the description thereof progresses.

In general, the improved unit of our invention includes a compression casing enclosing a motor and a compressor and an air cooled condenser mounted below this casing and beneath the heat radiating projections on the casing. The condenser is preferably of substantially crescent shape, the plan thereof generally resembling an annulus having a gap therein, and the control means of the system is conveniently mounted in the gap in the condenser structure. The expansion means or receiver of the system may be mounted beneath the compression casing and within the confines of the condenser and in this manner, the overall height of the unit is not increased by either the control means or the expansion or receiving means incorporated therewith. The compression casing is hermetically sealed by our improved means as hereinafter described.

The invention will be best understood by reference to the accompanying drawings, in which;

Figure 1 is a sectional elevation of a unitary construction embodying the present invention;

Fig. 2 is a plan view, partly in section, taken along the line 2—2 of Fig. 1 and viewed in the direction of the arrows;

Fig. 3 is a sectional view taken along the line 3—3 of Fig. 1 and viewed in the direction of the arrows;

Fig. 4 is a sectional view of the lower portion of the construction shown in Fig. 1, including a modified type of refrigerant receiving means;

Fig. 5 is a view similar to Fig. 4, showing a modified form of expansion means mounted within the condenser;

Fig. 6 is an elevation of a modified form of the construction of the present invention;

Fig. 7 is a plan view, partly in section, taken along the line 7—7 of Fig. 8; and

Fig. 8 is a sectional elevation of the construction shown in Fig. 6.

Referring to the drawings, and more particularly to Figs. 1, 2 and 3, the disclosed embodiment of our invention comprises generally, a unitary structure including a compression unit U, a condenser C, an expansion device V and a control device D. The compression unit includes a base plate 11 on which are supported a compressor P and a motor M in superimposed relation. The construction of the motor and compressor, and the mounting thereof within the compression casing, forms no part of the present invention.

In order that a complete disclosure may be given, the motor and compressor construction will be briefly described.

The base plate 11 is provided with a central raised machined surface 17 which forms the lower end plate of the compressor P. A thrust bearing opening 2 is formed in this surface and a compressor cylinder wall member 18 is mounted directly on its surface about the opening 2. An upper end plate 19 is mounted on the wall member 18 and these elements are clamped together and to the surface 17 of the base plate 11 by suitable means such as the machine screws 20. The upper end plate 19 is provided with an integral upwardly extending journal bearing 21, and a vertical shaft 22 is carried by this bearing and the thrust bearing 2 in the base plate 11. An annular piston 27 having an integral blade portion 3 is mounted within the cylinder wall member 18, and the circular central opening of this piston rotatably engages an eccentric 26 fixed to the shaft 22. The blade 3 of the piston 27 is mounted for reciprocatory and oscillatory movement between a pair of rocker blocks 4 carried in openings in the cylinder wall member 18 as shown in Fig. 3.

The intake of the compressor P comprises a duct 29 in the base plate 11, this duct being connected to the suction pipe 31 through a check valve 30 of suitable construction. The outlet for the compressor comprises a duct 32 through the upper end plate 19, a spring check valve 33 being disposed over the upper end of this duct. Inlet duct 29 and the outlet duct 32 of the compressor terminate respectively on opposite sides of the piston blade 3 within the compressor cylinder, as indicated in Fig. 3. It will be apparent that as the eccentric 26 is rotated by the shaft 22 in the direction indicated by the arrow, refrigerant will be drawn from the intake duct 29, forced around and compressed in the cylinder by the piston 27 and discharged into the compression casing through the outlet duct 32 and the check valve 33.

The rotor 23 of the motor M is fixed to the shaft 22 above the bearing 21, and the stator 24 of this motor is mounted in operative re-

lation to the rotor by means of brackets or supports 25 fixed to or formed integrally with the upper end plate 19 of the compressor P.

Suitable ducts 5 and 6 are respectively provided in the base plate 11 and the shaft 22 to serve oil to the moving parts of the mechanism.

The motor M and compressor P are tightly sealed within a casing formed by the dome or casing shell 10 and the base plate 11. According to the present invention, a depression 12 is formed in the inner surface of the dome near its lower edge, and the outer edge of the base plate 11 is fitted snugly within this depression as shown. The plate 11 is locked within the depression 12 by means of a ring 13 of heavy spring wire which resiliently expands into an annular groove or recess 14 at the lower edge of the dome 10. After being assembled in the manner described, the joint between the base plate 11 and the dome 10 may be sealed by tinning, soldering or welding, as shown at 7, to insure a tight fit between these parts.

The dome or casing shell 10 is preferably provided with heat radiating projections of any desired type, and in the disclosed embodiment, a plurality of outwardly extending fins 38 are employed for this purpose. The particular form of fins disclosed forms no part of the present invention.

The compression unit U is mounted in spaced relation to the supporting surface 34 on which the apparatus is disposed, and in the disclosed embodiment, a plurality of legs 35 are provided for this purpose. The upper ends of the legs 35 are preferably secured to the lower surface of the base plate 11 by suitable means such as machine screws or bolts 36, and the lower ends of these legs may be fixed to the surface 34 by bolts 37 if desired.

The outlet of the compression unit U comprises a pipe 41 which is sealed through an opening in the dome 10 and terminates at approximately the highest point in the dome. The outlet pipe 41 extends to a point below the base plate 11 and there terminates in a condenser pipe 40. The condenser is continuous and is formed in a series of vertically aligned, arcuate concentric loops having a gap between the ends thereof as best shown in Fig. 2. Heat radiating means such as the reversely bent metal strips 8 are preferably disposed between the concentric portions of the condenser pipe 40 and on the outer and inner surfaces thereof as shown in Fig. 2, the strips 8 being preferably tinned or welded to the pipe 40 to insure an efficient heat conductive joint between these elements. The condenser structure is suspended below the base plate 11 and beneath the dome fins 38 by suitable means such as the bolts 9 carried by the supporting brackets 39 which

are welded or otherwise suitably secured to the lower edge of the dome 10 as shown. Suitable discs 61 may be threaded to the lower ends of the bolts 9 to clamp the condenser structure to the brackets 39.

The outlet pipe 43 of the condenser 40 is connected to an expansion device V, which in the embodiment of Fig. 1 comprises a float valve. The float valve is of known and usual construction and comprises generally a casing 44 having a top closure 62 sealed thereto and a valve housing 45 fixed to the inner wall thereof. A float 64 is carried by an arm 65 pivoted to the valve housing 45, and a needle valve 66 cooperating, with a valve seat in the housing 45, is connected to the arm 65. The valve passage 67 through the housing 45 communicates with an outlet pipe 46, and the condenser outlet pipe 43 is sealed to an opening in the casing 44 in any suitable manner. The float valve structure is preferably located beneath the base plate 11 of the compression unit U and within the confines of the condenser structure C. In the disclosed embodiment, a flange 68 on the top closure 62 of the float valve is suitably secured to the lower surface of the base plate 11. It will be readily apparent that when a predetermined quantity of liquid refrigerant has collected within the float valve casing 44, the float 64 will rise to a point at which the needle valve 66 is opened and liquid refrigerant is permitted to pass through the passage 67 and the outlet pipe 46 to the evaporator of the system, not shown. When the liquid level within the float valve chamber 44 falls to the inlet opening of the valve passage 67, the float 64 drops to a point at which the needle valve 66 closes, and the flow of gaseous refrigerant to the evaporator is thereby prevented.

A skirt or shroud 49 is preferably disposed about the condenser structure C, and as shown, extends from the bottom of the lowest coil of the condenser pipe 40 to the lower outer edges of the dome fins 38. The shroud 49 may be tinned or welded to the outer condenser fin strip 8 or to the edges of the dome fins 38 or to both these elements. An opening 69 is provided in the skirt 49 at a point opposite the gap between the ends of the condenser coil 40 and the control device D of the system is suitably fixed in this opening and extends between the spaced ends of the condenser structure C as clearly shown in Fig. 2. The device D preferably includes manually operable means for adjusting the cabinet temperature, and as shown, manual control knobs 48 are provided on the exposed panel of the device D for operating the switching and temperature adjusting means of the device. The specific construction of the control device employed forms no part of the present invention and since devices of this type are known in the art, the detailed

construction thereof will not be described herein. For the purpose of the present invention, it is sufficient to state that the device D includes suitable controlled contact operating means, connected by a duct 47 or other means, to a temperature responsive element within the refrigerator cabinet, and is further provided with manually adjustable means for varying the temperatures at which the contacts are operated to start and stop the motor M. The device D further includes manually operable means for actuating the switch to start and stop the system, and may incorporate automatic cut-out means effective to open the motor energizing circuit in the event of an overload on the motor. The control device D may be connected to the motor circuit by suitable conductors 70 passing through sealed openings 71 in the base plate 11 of the compression unit U.

A base ring 50 may be disposed below the condenser C to conceal the lower ends of the supporting legs 35 of the device and thereby improve the appearance thereof.

As explained above, the present invention contemplates the use of any suitable expansion or refrigerant receiving means in conjunction with the condenser, and according to one embodiment of the invention, such means are mounted beneath the base plate of the compression casing and within the confines of the condenser. Thus, in Fig. 4, we have shown a portion of a unit similar to that disclosed in Figs. 1 and 2 wherein a receiver 72 is suitably supported on the lower surface of the base plate 11 within the condenser structure C in place of the float valve shown in the unit of Fig. 1. The receiver may comprise a sealed container of cylindrical or other suitable shape, and the outlet pipe 43 of the condenser C as well as the pipe 46 leading to the evaporator are suitably sealed to openings in this container. When a receiver of this type is employed, it is preferably included in the high pressure side of the system to receive and collect refrigerant from the condenser, and an expansion valve or other suitable pressure-reducing device is provided at any point between the receiver 72 and the evaporator. Since the expansion device forms no part of the present invention except when mounted with the unitary compression and condensing mechanism, no expansion device has been shown in the modification of Fig. 4.

A modified form of expansion device, mounted in accordance with one embodiment of our invention, is shown in Fig. 5. This device comprises a suitable length of tubing 73 of extremely small bore, generally designated in the art as a capillary tube. The extended and restricted passage through the capillary tube 73 offers a considerable resistance to the flow of refrigerant therethrough, and thus the tube acts as a pressure-reducing

or expansion device. As shown in Fig. 5, the capillary tube 73 is supported from the base plate 11 of the compression unit U and within the confines of the condenser C by suitable means such as the bracket 74, and is connected between the condenser outlet pipe 43 and the evaporator pipe 46.

It should be understood that one embodiment of the invention includes the use of any suitable expansion or refrigerant receiving means or combinations of these elements mounted beneath the compression unit and within the confines of the condenser, and that the invention is not limited to the particular expansion and receiving means shown herein.

It is to be understood that the arrangement and relative disposition of the parts of our refrigeration system is an important feature of the invention and accordingly, the exact means of mounting or attaching the parts may be varied according to convenience. Thus, although in the present disclosure, the expansion or refrigerant receiving means are shown supported on the bottom of the base plate 11 of the compression unit U, which plate also serves as the mounting for the compressor P and the motor M, these elements may be attached to and supported by other parts of the structure. For example, the expansion or receiving means may be supported from the legs 35 or by means of any structure which will suitably connect the parts as a unitary construction and yet maintain the compact disposition thereof disclosed.

A modified form of the refrigeration unit of the present invention has been shown in Figs. 6, 7 and 8. The internal construction of the compression unit U in this modification is substantially identical with that of the compression unit described above in connection with the modification of Fig. 1, and accordingly, this construction will not be separately described. The reference characters employed to designate the parts of the compression unit U in the modification of Figs. 6, 7 and 8 correspond to the reference characters designating like parts in the unit of Fig. 1.

The compression unit U shown in Figs. 6, 7 and 8 is supported by an annular base ring 56 preferably formed of sheet metal which may comprise an integral portion of the associated refrigerator cabinet. An annular baffle ring 78 is suitably fixed to the base ring 56 adjacent the upper edge thereof as shown, and serves to support the compression unit U centrally above the base ring 56. The upper edge of the baffle ring 78 is bent inwardly and downwardly to form an outwardly and upwardly flared baffle portion 59 and a circular supporting portion 75 depending from the baffle portion, as shown in Fig. 8. The lower edge of the dome 10 of the compression

unit U rests within the supporting portion 75 of the baffle ring 78 and may be welded, tinned or otherwise secured thereto. The lower edge 76 of the supporting portion 75 preferably extends inwardly beneath the base plate of the unit U and downwardly therefrom, and the arcuate condenser structure C may be attached to this edge by tinning or welding the upper inner coils of the condenser pipe 40 and the upper edges of the inner condenser fins 77 thereto. The outer edges of the outer condenser fins 79 may be suitably secured to the inner surface of the base ring 56, and the condenser structure is so mounted that a space is provided between the lower surface thereof and the surface 34 on which the apparatus is mounted to permit the flow of cooling air to the condenser.

A plurality of openings 57 are provided in the base ring 56 near the lower edge thereof to permit the passage of air to the space below the condenser C. A similar set of openings 58 is provided through the outer vertical wall of the baffle ring 78 above the upper end of the condenser coil 40, as shown. The dome 10 of the unit is provided with a plurality of radially extending cooling fins 60, which fins are preferably tapered at their lower ends to fit within the baffle portion 59 of the ring 78.

The condenser structure C of the assembly of Figs. 6, 7 and 8 is of the same shape as that described above in connection with Figs. 1 and 2, and the control device D of the unit is mounted in an opening 80 in the base ring 56 and extends between the spaced ends of the condenser structure C as shown in Fig. 7.

If desired, suitable expansion or refrigerant receiving means may be mounted within the condenser structure C and beneath the compression unit U of the modification of Figs. 6, 7 and 8, but since the present invention, in its broader aspects, includes the disclosed compact relationship of the compression unit, the condenser and the control device, with the expansion or receiving means omitted, such means have not been shown in this modification.

During the operation of the modified construction shown in Figs. 6, 7 and 8, cooling air is induced by the heat of the condenser through the openings 57 and this air passes upwardly over the condenser structure and is deflected outwardly through the openings 58 and away from the dome 10 by the flared baffle portion 59 of the ring 78. The compression unit U is cooled by direct radiation to the atmosphere and by convection air currents flowing over the fins 60 on the dome 10.

It will be readily apparent that the unitary construction of the present invention presents many advantageous features. The location of the condenser below the sealed compression unit and beneath the cooling fins thereof permits the effective circulation of

cooling air by convection to maintain these elements at the required temperatures during operation. The use of a crescent shape condenser with the control device disposed between the spaced ends thereof provides a structure in which the manually operable controls are so located that they are readily accessible to the operator, and in which the control device is associated with the compression and condensing mechanism without any increase in the overall height or bulk of the structure. When an expansion device or refrigerant receiver is included in the structure, the disposition of this element within the confines of the condenser and beneath the compression unit provides a neat and compact assembly in which all of the unsightly parts are hidden from view. The assembled structure is pleasing in appearance, which is an important consideration particularly when the unit is mounted on the top of a refrigerator cabinet or in some other exposed location. The assembly may be shipped as a unit and may be quickly and easily included in a refrigeration system by simply making the proper evaporator connections and connecting the power supply leads to an electric supply circuit.

Although the present invention has been described in connection with certain specific modifications, it should be understood that the invention is not limited to the exact constructions or arrangements disclosed. For example, various expansion or receiving means other than those described may be employed, the condenser fin and shroud structure as well as the mounting means for the condenser and the compression unit may be modified, the expansion or receiving means may be omitted from the construction and various other changes may be made without departing from the scope of the invention as defined by the appended claims.

We claim:

1. A refrigerating apparatus comprising in combination, a sealed compression unit including a compressor and a driving motor therefor enclosed within a casing, means for supporting said casing with the lower end thereof in spaced relation to and above a surface, a condenser connected to receive compressed refrigerant from said compressor, means for receiving refrigerant from said condenser, a control device for said motor and means for mechanically connecting said condenser, said receiving means and said control device to said unit below the lower end of said casing.

2. A refrigerating apparatus comprising in combination, a sealed compression unit including a compressor and a driving motor therefor enclosed within a casing, means for supporting said casing with the lower end thereof in spaced relation to and above a surface, a condenser connected to receive

compressed refrigerant from said compressor, a control device for said motor and means for mechanically connecting said condenser and said control device to said unit below the lower end of said casing.

3. A refrigerating apparatus comprising in combination, a base plate, a compressor and a driving motor therefor mounted on the upper surface of said base plate, means for supporting said base plate in spaced relation to and above a surface, an annular condenser having a gap therein mounted below said base plate, means for connecting said condenser to receive compressed refrigerant from said compressor and a control device for said motor mounted below said base plate and extending within the gap in said condenser.

4. A refrigerating apparatus comprising in combination, a sealed casing, a compressor and a driving motor therefor in said casing, means for supporting said casing in spaced relation to a surface, an annular condenser having a gap therein mounted between said casing and said surface and a control device for said motor mounted between said casing and said surface and extending into the gap in said condenser.

5. A refrigerating apparatus comprising in combination, a sealed casing, a compressor and a driving motor therefor in said casing, means for supporting said casing in spaced relation to and above a surface, heat radiating projections extending laterally from said casing, an annular condenser having a gap therein mounted below said casing and beneath said heat radiating projections, means for connecting said condenser to receive refrigerant from said compressor and a control device for said motor mounted below said casing in the gap in said condenser.

6. A refrigerating apparatus comprising in combination, a sealed casing, a compressor and a driving motor therefor in said casing, means for supporting said casing in spaced relation to and above a surface, an annular condenser having a gap therein mounted below said casing, means for connecting said condenser to receive fluid from said compressor, a wall member laterally surrounding said condenser and having an opening therein opposite the gap in said condenser and a control device for said motor mounted in the opening in said wall member and extending into the gap in said condenser.

7. A refrigerating apparatus comprising in combination, a sealed casing, a compressor and a driving motor therefor in said casing, means for supporting said casing in spaced relation to and above a surface, an annular condenser mounted below said casing in spaced relation to said surface and surrounding a space beneath said casing, means for connecting said condenser to receive compressed refrigerant from said com-

pressor and expansion means connected to said condenser and mounted in said space beneath said casing and within the confines of said condenser.

8. A refrigerating apparatus comprising in combination, a sealed casing, a compressor and a driving motor therefor in said casing, means for supporting said casing in spaced relation to and above a surface, heat radiating projections on said casing extending laterally therefrom, an annular condenser mounted below said casing and beneath said heat radiating projections and disposed in surrounding relationship to a space beneath said casing, means for connecting said condenser to receive compressed refrigerant from said compressor and a float valve mounted in said space beneath said casing and within the condenser and connected to receive refrigerant from said condenser.

9. A refrigerating apparatus comprising in combination, a sealed casing, a compressor and a driving motor therefor in said casing, means for supporting said casing in spaced relation to and above a surface, an annular condenser having a gap therein mounted below said casing and disposed in surrounding relationship to a space beneath said casing, means for connecting said condenser to receive refrigerant from said compressor, refrigerant receiving means connected to said condenser and mounted in said space beneath said casing and within the confines of said condenser, and a control device for said motor mounted below said casing and extending within the gap in said condenser.

10. A refrigerating apparatus comprising in combination, a sealed casing, a compressor and a driving motor therefor in said casing, means for supporting said casing in spaced relation to and above a surface, a condenser of annular shape having its ends spaced to form a gap therein, means for mounting said condenser below said casing and in surrounding relationship to a space beneath said casing, means for connecting said condenser to receive compressed refrigerant from said compressor, expansion means connected to said condenser and mounted beneath said casing and within the confines of said condenser and a control device for said motor mounted below said casing and extending into the gap between the spaced ends of said condenser.

11. A refrigerating apparatus comprising in combination, a sealed casing, a compressor and a driving motor therefor in said casing, means for supporting said casing in spaced relation to and above a surface, a plurality of heat radiating projections extending laterally from said casing, a condenser of annular shape having its ends spaced to form a gap therein, means for mounting said condenser below said casing beneath said heat

radiating projections, means for connecting said condenser to receive compressed refrigerant from said compressor, expansion means connected to said condenser and mounted beneath said casing and within the confines of said condenser and a control device for said motor mounted below said casing and extending into the gap between the spaced ends of said condenser.

12. A refrigerating apparatus comprising a unitary structure including a sealed casing, a compressor and a driving motor therefor within said casing, an annular base portion for said casing having an opening therein, a condenser of annular shape having its ends spaced to form a gap therein, means for mounting said condenser below said casing and within said base portion with the gap therein opposite said opening and a control device for said motor mounted below said casing between the spaced ends of said condenser and extending through said opening in said base portion.

In testimony whereof we affix our signatures.

ROBERT L. ALEXANDER.
JAMES R. McCALLUM.