

Sept. 26, 1939.

W. K. BODY ET AL

2,174,233

SEALED MOTOR COMPRESSOR UNIT

Filed Sept. 1, 1937

3 Sheets-Sheet 1

FIG. 1.

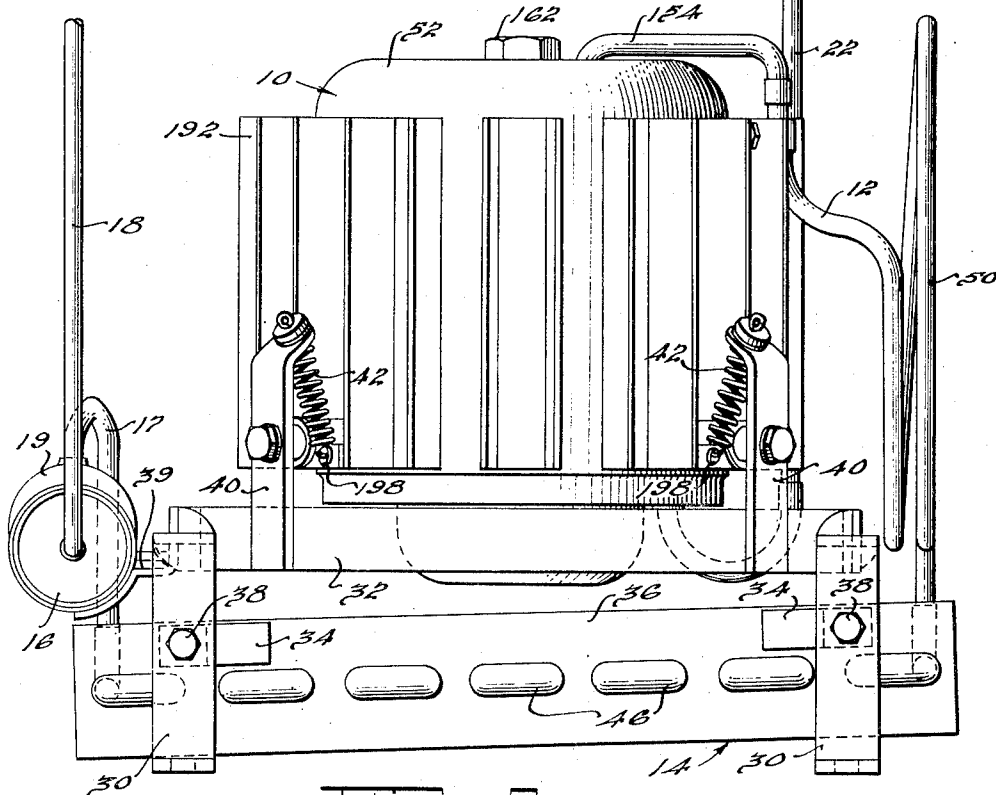
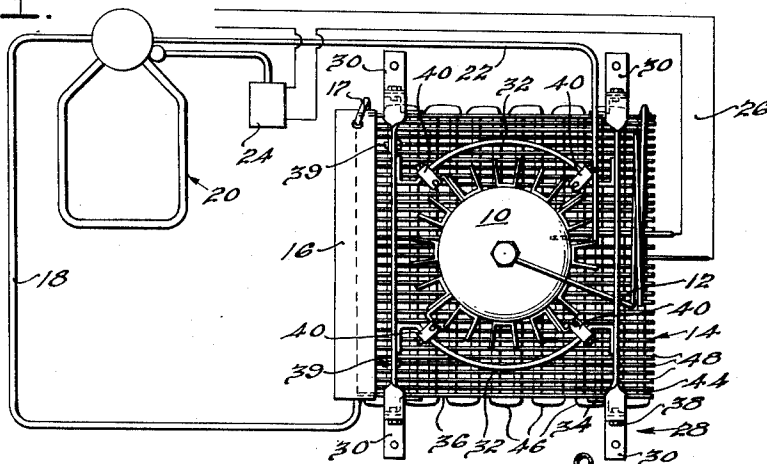


FIG. 2.

INVENTORS.
 William H. Body,
 BY Samuel E. Bickle.
 ATTORNEY

Sept. 26, 1939.

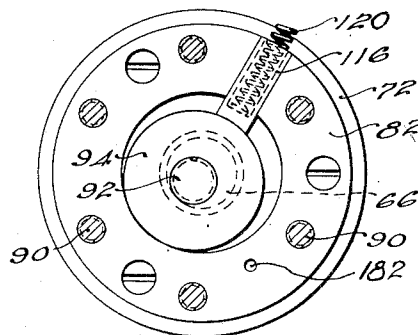
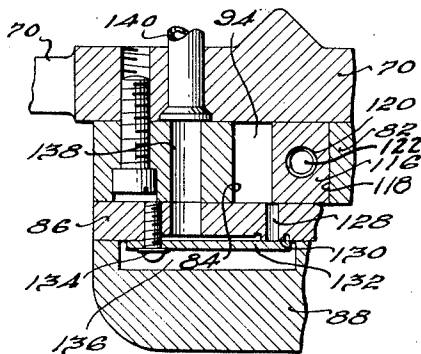
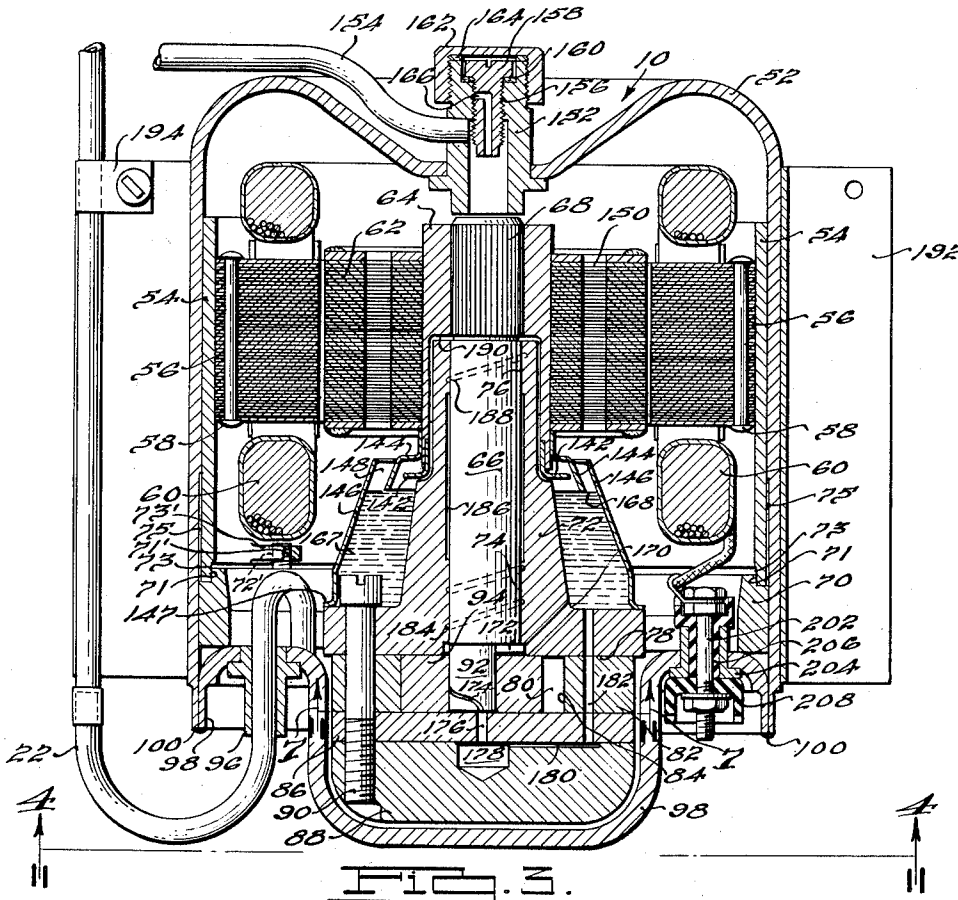
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INVENTORS
William H. Body,
BY Samuel E. Bickle,

ATTORNEY

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SEALED MOTOR COMPRESSOR UNIT

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3 Sheets-Sheet 3

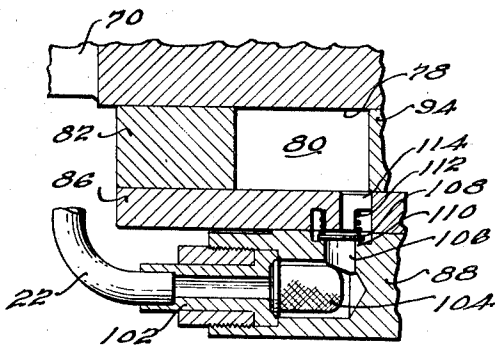
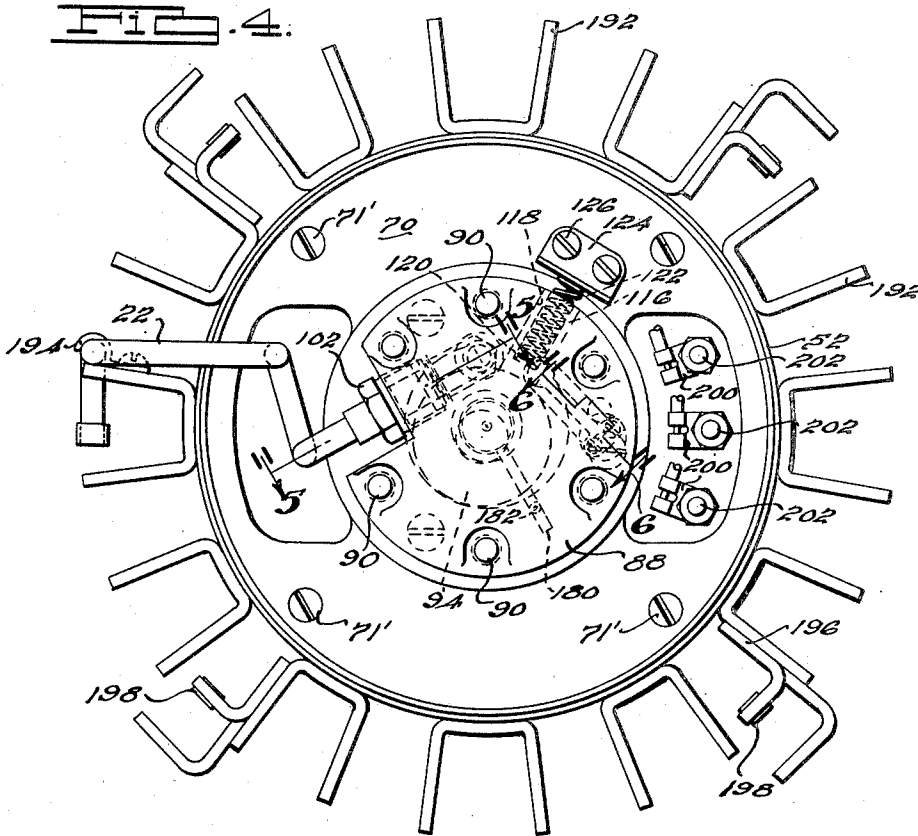


FIG. 5.

INVENTORS.
William H. Body,
Samuel E. Bickle.
BY *W. H. Body* ATTORNEY

UNITED STATES PATENT OFFICE

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SEALED MOTOR COMPRESSOR UNIT

William K. Body, Detroit, and Samuel E. Bickle,
Highland Park, Mich., assignors to Borg-Warner Corporation, a corporation of Illinois

Application September 1, 1937, Serial No. 161,950

6 Claims. (Cl. 62—115)

This invention relates to refrigeration, and particularly to small capacity refrigerating machines of the compression type which are suitable for household use and has for its object to provide apparatus of the character designated which shall operate reliably, quietly and efficiently. It has for a further object the provision of a refrigerating machine which shall be compactly arranged and which shall have its mechanism entirely sealed within a unitary structure to prevent escape of the working fluid.

A further novel feature of the invention resides in the relative arrangement of the compressor and condenser which are so located as to facilitate circulation of air thereabout and hasten the transfer of heat from these two bodies to the atmosphere. With this object in view, the condenser is placed below the motor-compressor unit so as to cause a rising current of air to sweep both of these objects, the air being caused to rise by being heated by these bodies.

As will be recognized, the preferred embodiment of the invention resides in an electric motor and a compressor located within a sealed casing and adapted to be positioned within a refrigerator cabinet with the electric motor positioned above the compressor. The compressor-condenser assembly is supported from a frame which is attached to the frame of the refrigerator cabinet as a unitary structure and is so constructed that it occupies a very small space therein.

Means are also provided for withdrawing oil from a bath in which the compressor operates and circulating such oil to the various parts of the compressor, such oil being ultimately returned to the bath or reservoir.

Still further objects will be observed as the description proceeds and in connection with the appended claims.

In the accompanying drawings, in which like reference characters are employed to indicate similar parts, and which are to serve as an example and not to be considered as limiting the invention;

Fig. 1 is a diagrammatic view of the refrigerating system showing somewhat in detail the compressor and the condenser in plan view;

Fig. 2 is an elevational view of the compressor condenser assembly;

Fig. 3 is a vertical sectional view of the motor-compressor;

Fig. 4 is a bottom plan view of the motor-compressor taken on substantially the plane indicated by the line 4—4 of Fig. 3 and looking in the

direction of the arrows, but omitting the bottom cover plate of the compressor casing;

Fig. 5 is a sectional view taken substantially on the plane indicated by the line 5—5 of Fig. 4 looking in the direction of the arrows;

Fig. 6 is a sectional view taken substantially upon the plane indicated by the line 6—6 of Fig. 4 and looking in the direction of the arrows;

Fig. 7 is a sectional view taken substantially upon the plane indicated by the line 7—7 of Fig. 3 and looking in the direction of the arrows.

Referring first to Fig. 1, the refrigerating system will be seen to comprise a motor-compressor unit 10 which serves to compress gaseous refrigerant, said refrigerant being discharged through conduit 12 whence it passes through the convolutions of condenser 14 to become a liquid and into receiver 16 through conduit 17. The liquid refrigerant in receiver 16 is withdrawn through conduit 18 and is discharged into the evaporator 20 (located in space to be cooled) through an expansion valve or some other type of metering device (not shown).

Within the evaporator the refrigerant boils and absorbs heat from the environs of the evaporator and changes from a liquid to a gaseous state. The gaseous refrigerant is returned by conduit 22 to the compressor 10 where the cycle begins anew. A control 24 is provided which is responsive to changes in temperature within the refrigerated compartment and is adapted periodically to close and open the circuit 26 to the compressor motor from the usual domestic electrical supply line.

A structural steel frame 28 made up of strap members 30 and curved cross members 32 secured together is provided for supporting the compressor and condenser. Clips 34 connected to the condenser frame 36 are attached to the strap members 30 by means of bolts 38. Curved cross members 32 support lugs 40 which are slotted at their upper ends to receive a spring 42 for resiliently supporting the motor-compressor 10. The receiver 16 is supported by members 39 secured to the frame 28 and condenser 16.

The condenser 14 comprises a series of parallel tubes 44 connected at their ends by headers 46 and intersected throughout their length by transversely extending fins 48.

Refrigerant being discharged from the compressor 10 enters the condenser 14 after passing through a circular loop 50 in the discharge line. The general flow of refrigerant within the condenser 14 is from right to left as viewed in Figs. 1 and 2 and, in order to provide proper drainage

of all liquid components of the refrigerant within the condenser, the condenser is sloped downwardly to the left as viewed in Fig. 2. The receiver may also be slightly sloped downwardly from its intake end to its outlet end as illustrated at 19 in Fig. 2.

The motor-compressor 10 comprises in general an outer casing 52 which may be of pressed steel. (See Fig. 3.) Press fitted into the interior of casing 52 is a frame element 54 for a stator 56 of an electric motor. Stator 56 may be made up of a plurality of core laminations connected together by rivets or bolts 58 and windings 60 extending thereabout for inducing magnetism in the stator 56. A laminated rotor 62 having a hub 64 is pressed onto the upper portion of a shaft 66 splined at 68 to receive the hub 64.

The spider 70, arranged within the interior of casing 52, may be provided with a circular peripheral portion which abuts the lower edge of stator frame 54. The peripheral portion of spider 70 may be provided with a seat 71 for receiving the lower edge 73 of the stator frame 54. The seat 71 and the lower edge 73 provide complementary interfitting aligning surfaces so that the stator frame 54 and spider 70 may be assembled, prior to the assembly thereof with the casing 52, which makes it possible to test the compressor while the parts are still accessible to an inspector. The spider 70 may be secured to the stator frame 54 by a plurality of bolts 71', the ends of which are threaded into threaded openings 72' formed in lugs 73' carried by the stator frame 54. The casing 52 is relieved at 75 so as to facilitate assembly of spider 70 and stator frame 54 with the casing 52. The central portion of spider 70 extends upwardly at 72 to provide bearings 74 and 76 in which shaft 66 is rotatably mounted. Spider 70 is also provided with a flat downwardly presented surface 78 which forms the upper wall of the cylinder 80 of the compressor. A plate or cylinder block 82, provided with a cylindrical bore 84 concentric with respect to bearings 74 and 76, is arranged below spider 70, and a third plate 86 forms the bottom wall of the cylinder 80. These parts and a valve cover plate 88 are secured together by cap screws 90.

Shaft 66 is provided on its lower end with an eccentric portion 92, which rotatably receives a roller or rotor 94 which is operatively associated with the top and bottom walls of the cylinder 80 and with the cylindrical wall of bore 84. Eccentric 92 bears upon bottom plate 86 of the cylinder 80 and thereby supports the rotor 94 of the electric motor and the weight of shaft 66.

The clearance provided between the rotor 94 and the top and bottom walls of the cylinder 80 is extremely small, being in the nature of only a few ten thousandths of an inch. A similar clearance exists between the rotor and the cylindrical wall of bore 84. These clearances in operation are spanned by a film of lubricant which serves to prevent leakage of the refrigerant therethrough.

Gaseous refrigerant returning from the evaporator 20 through suction line 22 enters the motor-compressor unit 10 through a gland 96 provided in lower cover member 98, such cover member being fitted into the interior of casing 52 and welded thereto along adjacent flanged edges as at 100. Suction line 22 enters valve plate 88 (Fig. 5) through a fitting 102 provided therein. The gaseous refrigerant is conducted through a strainer 104 and discharged upwardly through

port 106 in plate 88 near the upper surface of which there is provided a check valve 108. Valve 108 is seated at 110 upon valve plate 88 and is pressed by spring 112 into engagement therewith. Refrigerant passing valve 108 is admitted to cylinder 80 through a port 114.

Rotation of eccentric 92 (Fig. 3) causes rotor 94 to be progressively associated with the wall of bore 84. A blade 116 (Figs. 4 and 7) extends into the cylinder through a slot 118 in block 82 and engages the rotor 94 for separating the high and low sides of the compression chamber. Blade 116 is urged in the direction of the rotor 94 by spring 120 seated in a recessed portion 122 of the blade 116 and bearing against a clip 124 secured to the lower surface of spider 70 by screws 126. Refrigerant compressed within cylinder 80 is discharged downwardly through port 128 (Fig. 6) in lower plate 86. Plate 86 has a valve seat 130 formed on its lower surface about port 128 and a flapper valve 132 is operatively engaged therewith. Valve 132 is maintained in seating relation to seat 130 by means of its own resiliency and screw 134.

The compressed refrigerant is discharged into a pocket 136 in valve plate 88 from which point it passes upwardly through a port 138 formed in cylinder forming members 70, 82 and 86. A section of tubing 140 leading from the port 138 in plate 70 discharges the compressed refrigerant into the space defined by shield 146, where it impinges upon baffle ring 142 prior to escaping through the annular aperture 148 and holes in baffle ring 144. Baffle rings 142 and 144 may be secured to the hub 64 of the rotor 62 in any suitable manner while ring 146 is secured as at 147 to the top surface of spider 70 to provide a reservoir 167 for lubricant.

The compressed refrigerant may flow upwardly through holes 150 provided in the rotor 62 and is discharged from the casing 52 through a fitting 152 and discharge line 154. Fitting 152 is tapped at 156 to receive a plug 158 which has sealing engagement with a washer 160. Dust cap 162, having sealing engagement with a washer 164, is provided for covering plug 158. In order to charge the compressor the dust cap 162 may be removed and replaced by a charging fitting (not shown). Plug 158 is then backed out until port 166 is clear of the threaded portion and the device may be charged. After charging, the procedure is reversed and the dust cap 162 returned to its original position.

Lubricant 167 collects within the shield member 146 to about the level indicated by the line 168, the shield member forming a reservoir for such lubricant. The lubricant 167 is subjected to the relatively high pressures existing within the casing 52 and is forced through port 170 to the vicinity of eccentric 92 and rotor 94 where it accumulates in clearance space 172. A spiral groove 174 formed in the eccentric 92 carries lubricant 167 downwardly from clearance space 172 to lubricate the eccentric formal bearing and the thrust bearing between the end of eccentric 92 and plate 86 from which the lubricant is carried through a port 176 formed in the bottom plate 86 to a sump 178 in valve plate 88. As the oil accumulates in this sump, it flows laterally through a slot 180 formed in the upper face of the valve plate 88 to a port 182 through the three cylinder forming members and is returned to the lubricant reservoir.

The lubricant in clearance space 172 is also withdrawn therefrom by means of a spiral groove

184 formed in the bearing 74 and is moved upwardly thereby to clearance space 186 from which point it is carried to the top of bearing 76 by means of a spiral groove 188 formed therein. The lubricant spills over the top of bearing 76 through space 190 and is returned past the baffle plate 142 to the oil reservoir.

The lubricant in clearance 172, being subjected to the discharge pressure, also flows outwardly between the small clearances existing between the rotor 94 and the walls of the cylinder to provide the seal previously referred to. Such lubricant as is carried out of the cylinder with the compressed gas is, in the main, removed by contact with the baffles 142, 144 and 146, whence it is returned to the reservoir.

Any lubricant which may happen to find its way outside of ring member 146 is also subjected to the high pressure existing within the casing 52, and accumulating in the bottom of the casing 52, is forced by such pressure through the minute clearances existing between the plate members of the compressor and between the blade 116 and the blade slot and ultimately finds its way back to the reservoir. The oil charge is sufficient to insure overflow of shield member 146 and the maintenance of the oil level above cylinder 82 and the blade slot therein.

The exterior of casing 52 may be provided with radially disposed fins 192 for dissipating heat generated within the casing. A clamp 194 may be provided on such fins for retaining the suction line in place. Clips 196 welded to fins 192 are apertured and bushed as at 198 to receive supporting springs 42 extending from frame members 40.

Leads 200 (Fig. 4) from the motor extend to bolts 202 which pass through cover member 98. Fittings 204 (Fig. 3) serve to receive bolts 202 which function as binding posts, and bushings 206 and washers 208 of insulating material insulate the connections from the casing 52.

It will thus be seen that a highly compact and a readily assembled structure has been provided which by reason of the intimate contact of the main internal portions thereof with the casing will readily dissipate heat generated in the casing to the atmosphere. It will also be noted that the moving parts of the compressor and motor are supported by a single member through which oil is adapted to be circulated and that the compressor will operate with a very small quantity of oil due to the peculiar construction of the oil reservoir.

While the invention has been described in considerable detail, it is to be expressly understood that the description given is for the purpose of illustration only and is not definitive of the limitations of the inventive idea. The right is reserved to make such changes in the details of construction and arrangement of parts as fall within the scope of the appended claims.

We claim:

1. In a refrigerating system, a sealed motor-compressor unit, a frame having resilient connections extending to and supporting said unit, and a condenser rigidly mounted on said frame below said unit, said frame member having legs extending below said condenser and having cross

members for supporting said motor-compressor unit which presents their smallest area to air rising through said condenser and around said motor-compressor unit.

2. In a refrigerating apparatus, a sealed motor-compressor unit, a frame having resilient connections extending to and supporting said unit, and a condenser rigidly mounted on said frame below said unit, said frame comprising horizontal members which define a generally ring-shaped frame of larger diameter than said motor-compressor unit and to which ring-shaped frame said resilient connections are mounted.

3. In a refrigerating system, a sealed motor-compressor unit, a horizontal frame having resilient connections extending to said unit for supporting the unit, a condenser rigidly mounted on said frame below said unit, and a receiver rigidly secured to the frame above the lower end of the condenser, said horizontal frame having leg portions extending below said connections and arcuate cross members supporting said resilient connections in spaced relationship with said motor-compressor unit.

4. In a refrigeration system, a motor and a compressor contained in a sealed casing, a planar condenser located below said casing and positioned at an acute angle with respect to a horizontal plane, the inlet to the condenser being located at the high point thereof and the outlet therefrom being located at the low point thereof, a receiver located over the low point of said condenser, the longitudinal axis of said receiver being sloped downwardly with respect to the horizontal from intake to outlet, and a frame for supporting said motor and compressor unit and said condenser and receiver, said frame comprising cross members with bent-down legs at either end and two arcuate members, said condenser being supported between said bent-down legs by means of clips, and said motor-compressor unit being supported from said arcuate members by means of clips extending above said arcuate members.

5. Refrigerating apparatus including a planar condenser arranged in an inclined plane, a frame carried thereby and including a pair of spaced horizontally arranged strap members, curved cross members carried by said strap members and vertically extending lugs carried by said cross members, a sealed motor compressor unit resiliently carried by said vertical lugs and connected to said condenser for supplying compressed refrigerant to the upper part thereof, a part of said condenser being arranged at a lower elevation than said unit.

6. Refrigerating machinery comprising a motor-compressor unit, a condenser and a receiver, a frame for supporting said receiver, condenser and motor-compressor unit comprising two cross members having bent-down legs at either end thereof, two oppositely curved cross pieces fastened between said cross members, said curved cross pieces carrying vertical lugs slotted at their upper end for receiving spring mounts for said motor-compressor unit, and clips attached to the legs of said cross members for supporting a condenser.

WILLIAM K. BODY.
SAMUEL E. BICKLE.