W. A. RICHTER & E. S. H. BAARS.

REFRIGERATING APPARATUS.

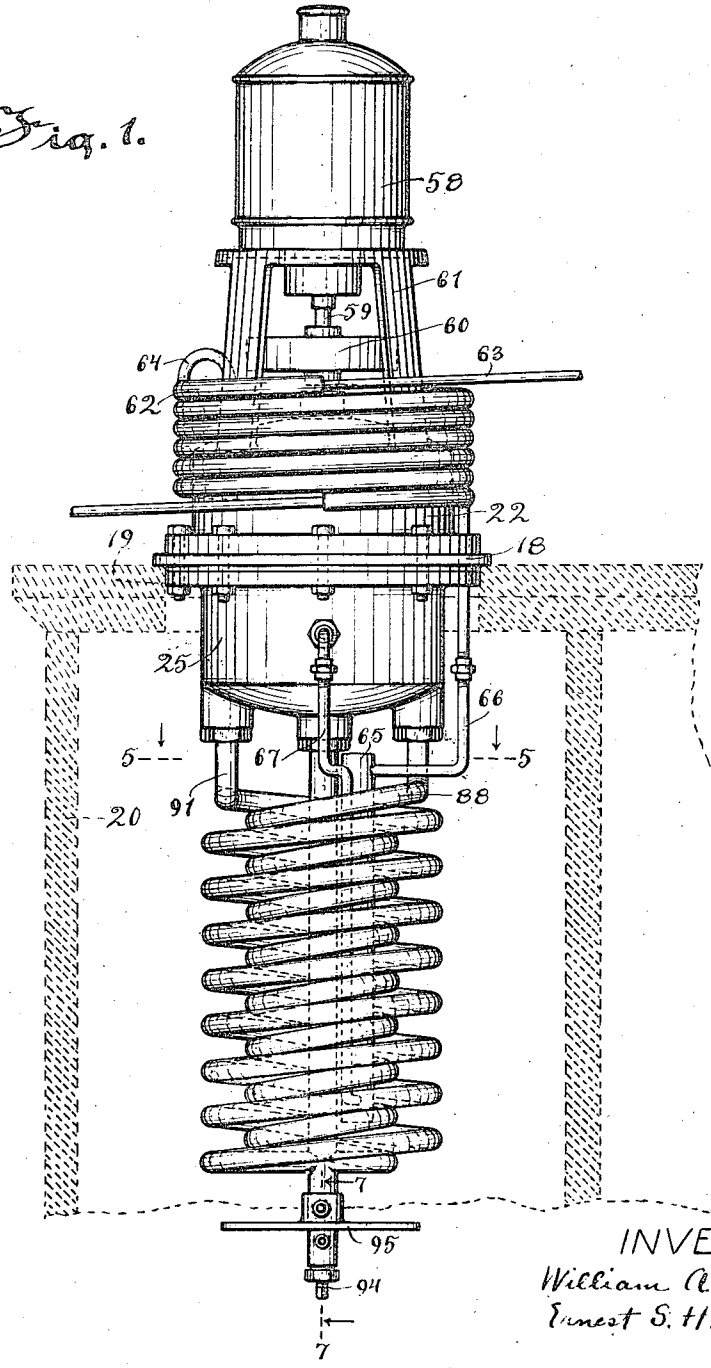
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1,256,730.

Patented Feb. 19, 1918.

4 SHEETS—SHEET 1.

Fig. 1.



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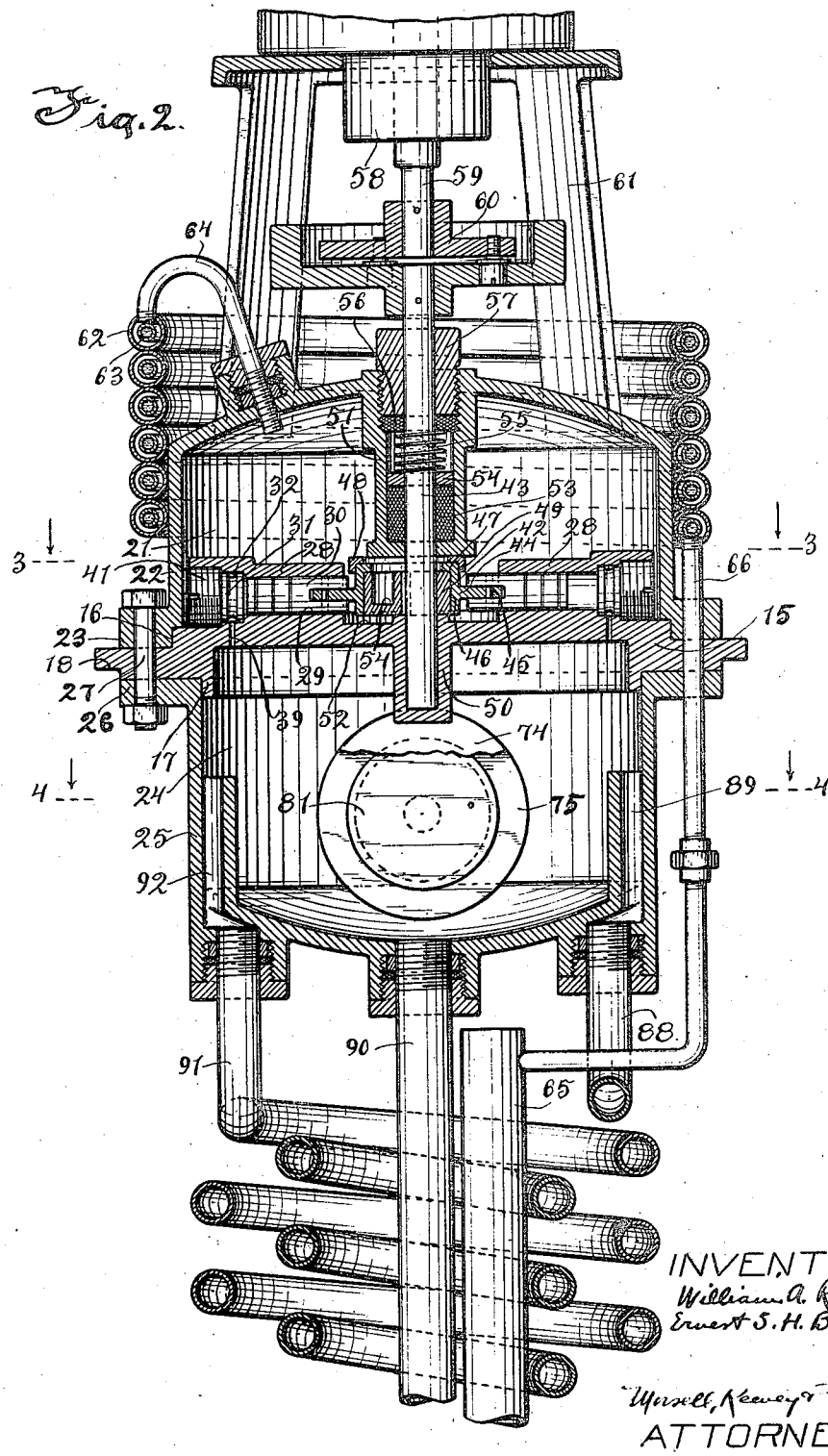
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4 SHEETS—SHEET 2.

Fig. 2.



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4 SHEETS—SHEET 3.

Fig. 3.

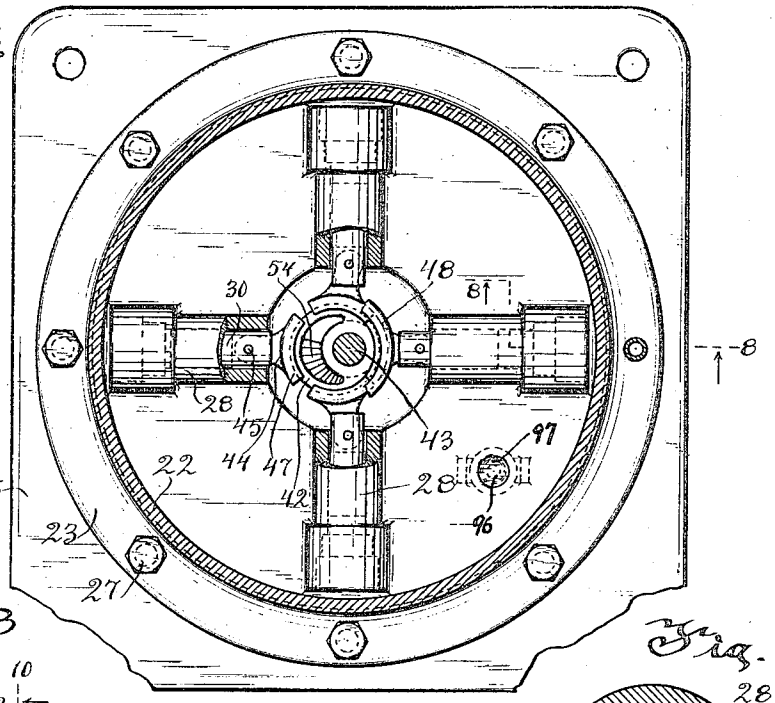


Fig. 8

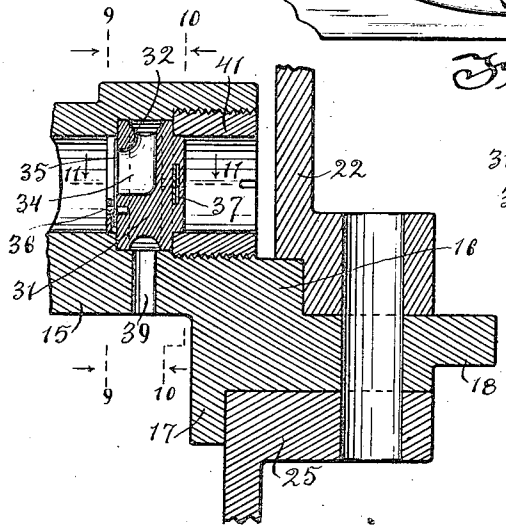


Fig. 11.

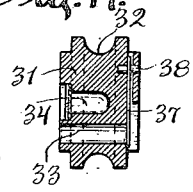


Fig. 9

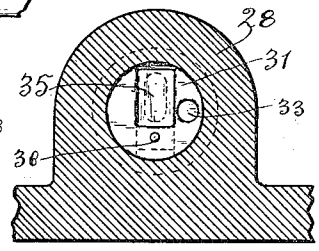
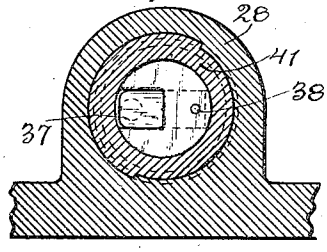


Fig. 10.



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4 SHEETS—SHEET 4.

Fig. 4.

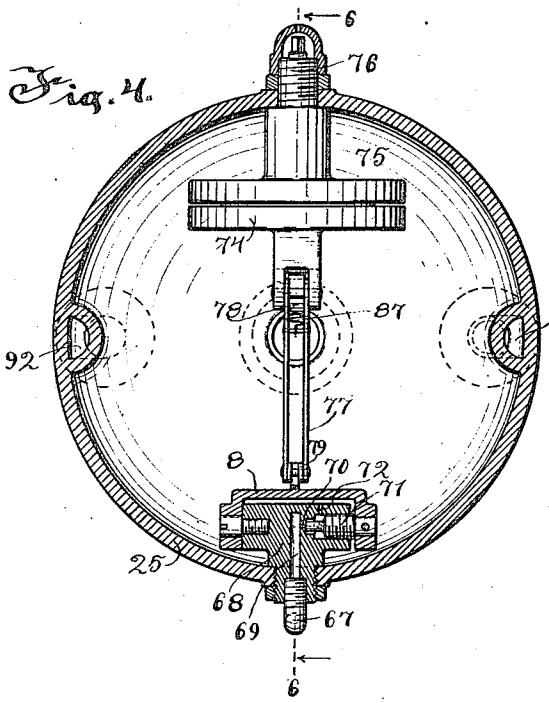


Fig. 5.

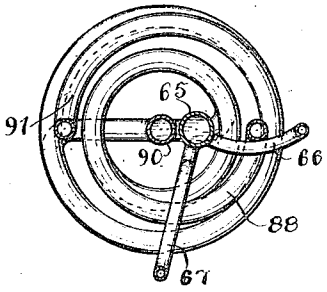


Fig. 6.

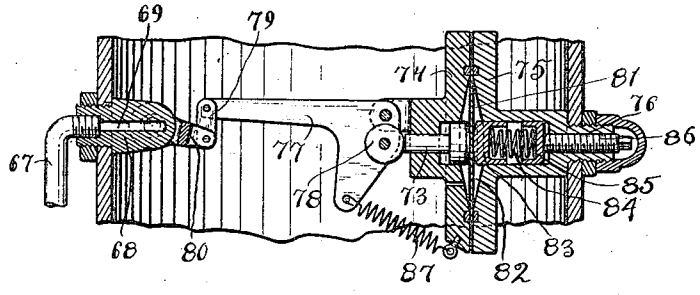
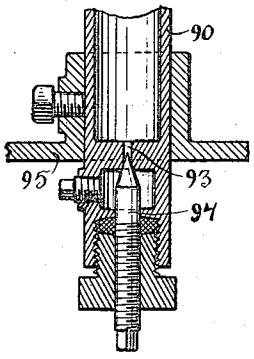


Fig. 7.



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REFRIGERATING APPARATUS.

1,256,730. Specification of Letters Patent. Patented Feb. 19, 1918.

Application filed December 29, 1916. Serial No. 139,519.

To all whom it may concern:

Be it known that we, WILLIAM A. RICHTER and ERNEST S. H. BAARS, citizens of the United States, and residents of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Refrigerating Apparatus, of which the following is a description, reference being had to the accompanying drawings, which are a part of this specification.

The invention relates to refrigerating apparatus.

The invention is more particularly designed to provide a refrigerating unit for domestic use and one which may be readily installed in an ordinary ice-box, though it may be used for other purposes.

The invention is further designed to provide a refrigerating apparatus which is mounted on the top of an ordinary ice-box, a hole being cut in the top of the ice-receiving compartment of the ice-box to allow the cooling coils to be disposed within said compartment.

A further feature of the invention is the construction and arrangement of the parts of the device to form a simple, compact and efficient apparatus.

The invention further consists in the several features hereinafter set forth and more particularly pointed out by claims at the conclusion hereof.

In the drawings:

Figure 1 is an elevational view of the device showing it applied to an ice-box;

Fig. 2 is a vertical sectional view through the device, parts being broken away;

Fig. 3 is a section on the line 3—3 of Fig. 2;

Fig. 4 is a section on the line 4—4 of Fig. 2;

Fig. 5 is a section on the line 5—5 of Fig. 1;

Fig. 6 is a section on the line 6—6 of Fig. 4;

Fig. 7 is a section on the line 7—7 of Fig. 1;

Fig. 8 is a section on the line 8—8 of Fig. 3;

Fig. 9 is a section on the line 9—9 of Fig. 8;

Fig. 10 is a section taken on the line 10—10 of Fig. 8;

Fig. 11 is a section taken on the line 11—11 of Fig. 8.

In general the device comprises a support, a gas chamber, a compressor located therein, means for driving the compressor, a condenser, a receiver, an expansion chamber, cooling or evaporative coils, and valves and connections between the parts of the device to circulate the refrigerant therethrough, any suitable refrigerant being used, as for instance methyl chlorid.

The support for the device consists of a square metal base plate 15 having an upper cylindrical boss 16, a lower cylindrical boss 17, and side flanges 18. As shown in Fig. 1 an opening 19 is made in the top of the ice-box 20 and the flanges 18 resting on the top of the box serve to mount the device thereon.

A gas chamber 21 is formed by the cylindrical upper hood or casing 22, the flange portion 23 of which rests upon the boss 16 of the plate 15.

The expansion chamber 24 is formed by a cylindrical lower hood or casing 25, the flange portion 26 of which is seated adjacent the boss 17 and both the upper and lower casings are secured to the plate 15 by bolts 27.

The compressor is of very compact construction and consists of a plurality of cylinders 28 formed integral with the plate 15 and having bores 29 extending radially from the center of the plate, pistons 30 slidably mounted within the bore of said cylinders, inlet and outlet valves, and means for operating the pistons, Figs. 2 and 3.

The inlet and outlet valves for each of the compressor cylinders are both mounted on a cylindrical valve member 31 having a circumferential groove 32, a discharge outlet 33 connecting the interior of the cylinder with the gas chamber, a right angled inlet 34 connecting the upper part of the interior of the cylinder with the groove 32, Figs. 2, and 8 to 11. A spring plate inlet valve 35 is mounted in a recess in the member 31 and secured to said member by a pin 36. A spring plate outlet valve 37 is mounted in a recess in the member 31 and secured to said member by a pin 38. Ducts 39 in the plate 15 connect the expansion chamber with the grooves 32 so that the gas may be drawn from the expansion chamber into the compressors. Each member 31 is seated in the bore of the cylinder and held against a shoulder thereof by a hollow screw

plug 41 having threaded engagement with the outer end of the cylinder. By leading the suction admission through the gas tight passageways to the top or near the top of the compressors the suction openings will be above the level of the oil used in lubricating the parts of the compressor and consequently the seeping or leaking of oil into the expansion chamber is prevented.

The means for operating the pistons consists of an eccentric 42 mounted on a vertically disposed revoluble shaft 43, arc-shaped flanged pitmen 44 each pivotally connected to its respective piston by a pin 45 and having its other arc-shaped end 46 abutting against the periphery of the eccentric 42 and having its flanged portions 47 resting upon the top of said eccentric, said pitmen being operatively connected to said eccentric by an annular ring 48 having a peripheral flange 49 which engages over the pitmen.

The lower end of the shaft 43 has an end thrust bearing 50 formed in the plate 15 and is further mounted in a bearing box 51 formed integral with the casing 22. It is very important to have the running parts of the device properly oiled and at the same time to keep the oil from mixing with the refrigerant and to this end the plate 15 is provided with an annular recess 52, the eccentric 42 with an inclined arcuate slot 54 forming a scoop to move the oil from the recess 52 up over the ring and pitmen and the shaft 43 also has a special housing in the casing 22. This housing consists of the box 51, previously mentioned, provided with a self-adjusting stuffing box consisting of a packing 53, a washer 54 held against said packing by a spring 55 surrounding said shaft which also acts against a packing 56 and a bearing plug 57. This housing for the shaft is designed to keep it lubricated but to prevent lubrication passing through the box 51 and the gas from passing out of the gas chamber. It will be noted that the ring 48 is held against endwise movement with respect to the shaft bearing box 51 and the eccentric 42.

The means for driving the compressor comprises a vertically disposed electric motor 58 having its shaft 59 directly connected through a flexible coupling 60 to the shaft 43, the motor being mounted on a stand 61 formed integral with the top casing 22. While we prefer the vertical disposition and direct connection of the motor with the vertical compressor shaft 43 it will be understood that a motor of the horizontal type might be used and suitably connected to the shaft 43 through gearing or otherwise. The construction shown however is preferable because of its simplicity and compactness.

The condenser consists of a refrigerant carrying coil 62 surrounding the hood 22 and within which is disposed a cooling coil 63. The upper end of the coil 62 is connected to the gas chamber 21 by a conduit 64 and the lower end of the coil is connected to the receiver 65 of ordinary construction by a conduit or pipe 66. The cooling coil 63 is connected up to any suitable supply of cooling water as to the water from the mains leading into the dwelling or building in which the device is installed and during the operation of the compressor the water is continuously circulated therethrough from the bottom to the upper part of said coil 63. By this arrangement the gas or liquid refrigerant leaving the condenser is brought into contact with that part of the cooling coil through which the coldest water is flowing to obtain the most efficient operation and require a minimum of power to perform the required work of refrigeration.

The receiver 65 is connected to the expansion chamber 24 by a pipe 67 and the flow of refrigerant into the expansion chamber is controlled by an expansion valve.

The expansion valve may be of any suitable construction and the one herein shown is of the pressure controlled type. It consists of a valve member 68 having a bore 69 therein communicating with the pipe 67 and a passage 70 leading from said bore, small at its point of connection with said bore and enlarged to receive in threaded engagement the movable threaded valve stem 71 whose end is adapted to seat against member 68 at the constricted parts of the passage 70 to shut off the passage of refrigerant, the stem 71 being rotated to open and close the valve and on the opening of the valve the refrigerant passes into the expansion chamber 24 through a small passage 72 communicating with the passage 70. The means for moving the stem 71 comprises a slidable plunger 73, connections between said plunger and said stem and pressure controlled means for operating the plunger. The plunger 73 is slidably mounted in a disk 74 which is connected in abutting relation to a disk 75 having an extension 76 secured to the lower casing 25.

The connections between the plunger 73 and the valve stem consist of a bell crank lever 77 formed of two spaced apart members pivotally connected intermediate its ends to the disk 74 and carrying a roller 78 for engaging the plunger and pivotally connected at its other ends to spaced apart links 79 which in turn are pivotally connected to a yoke 80 carrying the valve stem 71.

The pressure control means for operating the plunger consists of a diaphragm 81 located in a recess 82 between the disks 74 and 75 and contacting on one side with the plunger 73 and on the other with a plunger 83 held against said diaphragm by a spring 84, the pressure of which may be manually

controlled by an adjustable washer 85 and threaded rod 86. With the construction above described when the pressure within the chamber falls below a predetermined value, the diaphragm will move the plunger 73 to operate the linkage previously described to open the expansion valve by turning the valve stem 71 away from its seat and thus admitting liquid to the compartment. When the pressure rises again the diaphragm moves back and a retractile spring 87 connected to the lever 77 and the disk 74 moves the linkage to close the expansion valve. By regulating the pressure of the spring 84 by the adjustable washer 85 and rod 86 the pressure at which the diaphragm is desired to operate may be regulated.

The cooling or evaporative coils consist of a coil 88 communicating at its upper end with a passage 89 communicating with the expansion chamber 24 and at its lower end with a central conduit 90 leading to chamber 24 and a second coil 91 connected at its lower end to the support 90 and communicating therewith and communicating at its upper end with a passage 92 leading to the expansion chamber.

In order that the refrigerant may be removed or replaced in the machine the conduit 90 is provided with an opening 93 having a screw plug valve 94, Fig. 7 and for the purpose of supporting forms for making ice a plate 95 is mounted on the lower end of the support 90.

To prevent any danger of explosion due to an abnormal pressure in the gas chamber 22 owing to the failure of the water supply to the condenser or any other cause, a safety valve 96 of suitable size is inserted in a passage 97 in the plate 15 connecting the gas chamber 22 with the expansion chamber 24.

The operation of the apparatus is familiar to those skilled in the art. On the starting of the motor and the cooling water which may be done in any suitable way, the preferred way being by an automatic thermostatic control the refrigerant gas is pumped by the compressors into the gas chamber and thence passes through the coil 62, cooled by the cooling water 63, thus liquefying the refrigerant which flows by the pipe 66 and the receiver 65 and from thence by the pipe 67 and the expansion valve to the expansion chamber 24 and thence through the pipe 90 and thence upwardly through the coils 88 and 91 absorbing heat while passing through the coils and due to this absorption gasifying again in the expansion chamber and then sucked up by the compressors and returned to the gas chamber to repeat the operation.

From the foregoing it will be noted that we have provided a light, compact and simple refrigerating apparatus which is well adapted for household use as when the expansion valve is once set the device will not need any attention and if any trouble should arise the device may be readily carried away and repaired by workmen familiar with the machine.

We are aware that the specific construction of the device herein shown and described is capable of variation and change and it is to be understood that such constructions as come within the scope of the appended claims are within the spirit of our invention.

What we claim as our invention is:

1. In a refrigerating apparatus, the combination with a support, of a gas chamber mounted above and an expansion chamber below said support, a compressor within the gas chamber and in communication with said gas and expansion chambers, a vertically disposed shaft for driving said compressor, a vertically disposed motor mounted above the gas chamber and connected to drive said compressor shaft, a condenser surrounding the gas chamber and communicating therewith, a vertically disposed conduit communicating with the condenser and said expansion chamber, and vertically disposed cooling coils connected to and communicating with the expansion chamber.

2. In a refrigerating apparatus the combination, with a flanged base plate, of a hood connected to the top thereof forming a gas chamber, a hood connected to the bottom thereof forming an expansion chamber, a compressor within the gas chamber and communicating with both of said chambers, a vertically disposed compressor shaft journaled in the upper hood, a support carried by the upper hood, a motor mounted thereon and connected to drive said compressor shaft, a condenser surrounding the upper hood and communicating therewith, a vertically disposed conduit communicating with said condenser and the expansion chamber, and cooling coils connected to and communicating with and disposed in vertical alinement with said expansion chamber.

3. In a refrigerating apparatus, the combination, with a base plate, of a hood connected to the plate to form a gas chamber, a drive shaft journaled in said hood, a plurality of compressor cylinders radially disposed with respect to said shaft, an eccentric mounted on said shaft, pistons slidably mounted in said cylinders, pitmen operatively connected to said pistons and having arc-shaped ends abutting against said eccentric, and a flanged ring for maintaining said pitmen in sliding engagement with said eccentric, an inlet valve for each compressor cylinder, and an outlet valve leading from each cylinder.

4. In a refrigerating apparatus, the combination, with a gas chamber and an ex-

pansion chamber, of a compressor including a compressor cylinder, a member seated within the cylinder and having a peripheral groove therein communicating with the expansion chamber and an inlet duct leading from the upper end of the groove into the compressor cylinder and an outlet duct leading from the compressor cylinder to the gas chamber, and alternately operating valves for opening and closing said inlet and outlet ducts.

5. The combination, with an ice-box having an opening in its top, of a refrigerating apparatus including a base member provided with means for engaging the sides of said opening, a gas chamber supported upon the base member above the ice-box, an expansion chamber carried by the member within the ice-box, a condenser surrounding the gas-chamber, a support extending upwardly from the gas chamber, a motor mounted on said support, a compressor within the gas chamber and operatively connected to both gas and expansion chambers, a compressor drive shaft journaled in the gas chamber and operatively connected to said motor, vertically disposed means for conducting the refrigerant from the condenser to the expansion chamber, and vertically disposed cooling coils depending within the box below said expansion chamber and communicating therewith.

6. In a refrigerating machine, the combination of a base plate and a casing joined together to form a gas chamber, a drive shaft journaled in said casing and base plate, a plurality of compressor cylinders radially disposed with respect to said shaft, said base plate having an annular oil groove therein between said cylinders and said shaft, an eccentric mounted on said shaft and having an inclined arc-shaped slot therein for elevating oil from said groove, pistons slidably mounted in said cylinders and operatively connected to said eccentric, and inlet and outlet valves for each of said compressor cylinders.

7. The combination, with an ice-box having an opening in its top, of a refrigerating apparatus including a base provided with means for supporting the apparatus on said ice-box, a gas chamber supported upon the base member above the ice-box, an expansion chamber carried by the member within the ice-box, a condenser surrounding the gas-chamber, a motor mounted above the gas chamber, a compressor disposed within the gas chamber and communicating therewith and with the expansion chamber, a vertically disposed compressor drive shaft journaled in the gas chamber and operatively connected to said motor, a conduit connecting the condenser with the expansion chamber, an expansion valve in said conduit where it enters the expansion chamber, means for operating said valve, and vertically disposed cooling coils depending within the ice-box below said expansion chamber and communicating therewith.

8. The combination, with an ice-box having an opening in its top, of a refrigerating apparatus including a base provided with means for supporting the apparatus on said ice-box, a gas chamber supported upon the base member above the ice-box, an expansion chamber carried by the member within the ice-box, a condenser surrounding the gas chamber, a motor mounted above the gas chamber, a compressor disposed within the gas chamber and communicating therewith and with the expansion chamber, a vertically disposed compressor drive shaft journaled in the gas chamber and operatively connected to said motor, a conduit connecting the condenser with the expansion chamber including a vertically disposed receiver, an expansion valve in said conduit where it enters the expansion chamber, means for operating said valve, and vertically disposed cooling coils depending within the box below said expansion chamber and communicating therewith.

9. In a refrigerating apparatus, the combination with a support, of a gas chamber mounted above and an expansion chamber mounted below said support, a compressor mounted within the gas chamber and communicating therewith and with the expansion chamber, a vertically disposed shaft for driving said compressor, a motor connected to drive said compressor shaft, a refrigerant carrying coil surrounding the gas chamber and communicating therewith, a cooling coil disposed within the refrigerant coil, a conduit connecting said refrigerant coil with the expansion chamber, and cooling coils disposed below and communicating with said expansion chamber.

10. In a refrigerating apparatus, the combination with a support, of a gas chamber mounted above and an expansion chamber below said support, a compressor within the gas chamber and in communication with said gas and expansion chambers, a vertically disposed shaft for driving said compressor, a motor connected to drive said shaft, a condenser surrounding the gas chamber and communicating therewith, a conduit communicating with the condenser and said expansion chamber, and cooling coils disposed below and communicating with the expansion chamber.

In testimony whereof, we affix our signatures.

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