Jan. 18, 1927. 1,614,676

A. J. KERCHER

REFRIGERATING APPARATUS

Original Filed Feb. 4. 1922 2 Sheets-Sheet 1

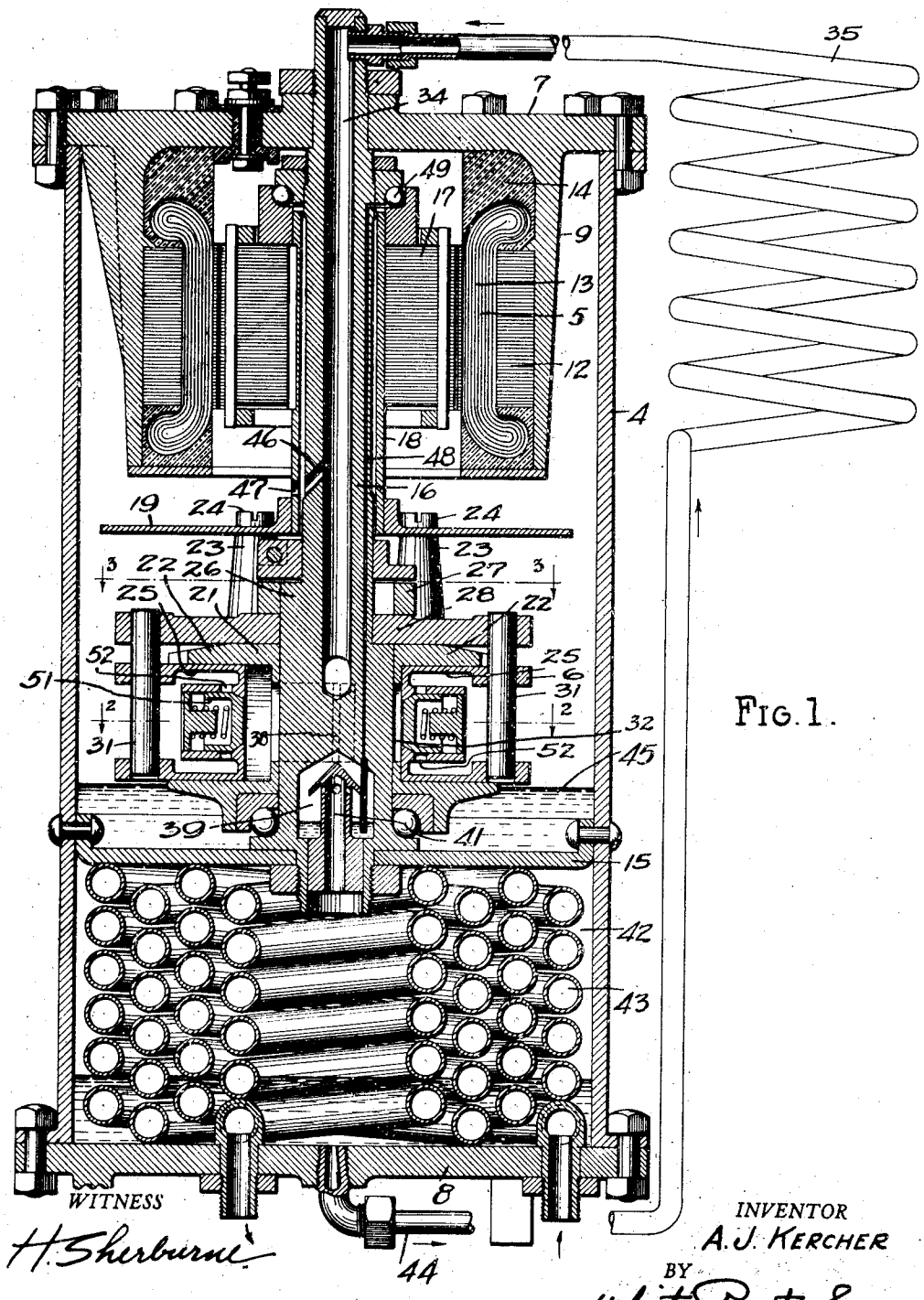


FIG. 1.

WITNESS

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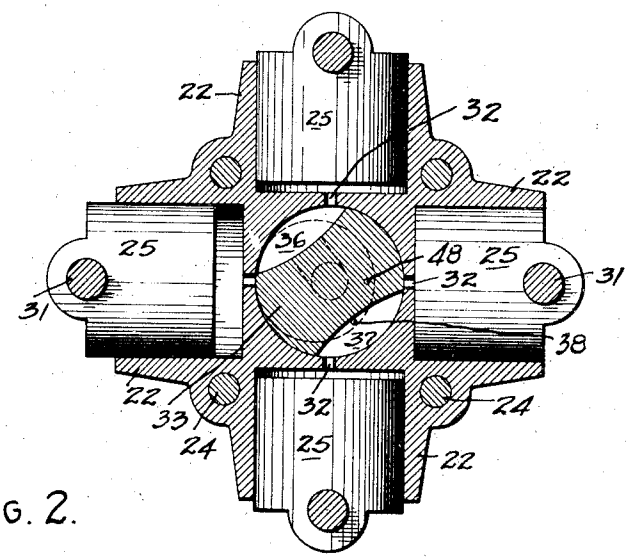
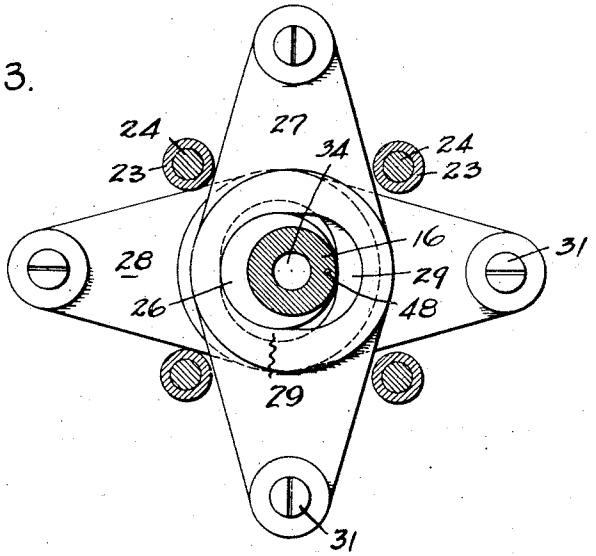


FIG. 2.

FIG. 3.



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UNITED STATES PATENT OFFICE.

ARTHUR J. KERCHER, OF BERKELEY, CALIFORNIA.

REFRIGERATING APPARATUS.

Application filed February 4, 1922, Serial No. 534,167. Renewed March 2, 1926.

The invention relates to small self-contained refrigerating units for domestic and similar use.

An object of the invention is to provide a complete refrigerating apparatus sealed in a casing, so that all stuffing boxes and packing glands are eliminated and the danger of leakage of the refrigerant fluid reduced to a minimum.

Another object of the invention is to provide a refrigerating apparatus in which the driving motor is enclosed in the sealed casing with the refrigerant fluid compressor.

A further object of the invention is to provide a simple, compact, self-contained refrigerating apparatus of low cost of manufacture and operation.

The invention possesses other advantageous features, some of which, with the foregoing, will be set forth at length in the following description where I shall outline in full, that form of the invention which I have selected for illustration in the drawings accompanying and forming part of the present specification. In said drawings I have shown one form of refrigerating apparatus embodying my invention, but it is to be understood that I do not limit myself to such form, since the invention, as set forth in said claims, may be embodied in a plurality of forms.

Referring to said drawings:—

Fig. 1 is a vertical section of the refrigerating apparatus of my invention.

Fig. 2 is a cross section taken on the line 2—2, Fig. 1.

Fig. 3 is a cross section taken on the line 3—3, Fig. 1.

The apparatus shown in the drawings comprises a closed, sealed casing 4 in which the motor 5, the compressor 6 and the compressed refrigerant fluid cooling chamber are enclosed. The casing 4 is closed at the top by the top plate 7 which forms a fluid tight joint with the casing and at the bottom by the bottom plate 8, which forms a similar joint. Mounted on the underside of the top plate 7 by a suitable flange 9, is the stator 12 of the driving motor. The windings 13 of the stator are embedded in an annulus 14 of material, such as bakelite, which will be unaffected by the gaseous or liquid refrigerant fluid.

Disposed axially of the casing 4 and tightly secured to the top plate 7 and the imperforate pan 15, is a fixed shaft or axle 16 about which the motor rotor 17 and the compressor rotor revolve. Journalled on the axle 16 is a sleeve 18 to which the motor rotor 17 is secured, and secured to the sleeve at its lower end is a horizontal circular splash plate or partition 19, which partially divides the casing into a motor chamber and a compressor chamber. Journalled on the axle 16 below the splash plate is a compressor cylinder member 21, having, in the present instance, four radially disposed cylinders 22. The cylinder member 21 is provided on its upper surface, at the junction of the cylinders, with four bosses 23, into which screws 24, passing through the splash plate 19 extend, for securing the cylinder member to the splash plate.

Disposed in the cylinders are pistons 25 which are arranged to be reciprocated by the rotation of the cylinder member. Above the cylinder member, the axle 16 is provided with a circular eccentric portion 26 which is engaged by the piston operating bars 27 and 28, the bars being provided with elongated openings 29, so that rotation of the cylinder member causes the bars to reciprocate. The bars are arranged at right angles to each other and each bar is connected at its ends to two diametrically opposed pistons. The bars and pistons are shown provided with alined apertures through which the pins or bolts 31 extend.

Each cylinder 22 is provided in its base with a narrow elongated vertically disposed port 32 opening into the cylindrical chamber within the cylinder member. At that portion which is engaged by the cylinder member, the axle is cut away on opposite sides, to form a valve plug 33, for controlling the flow of refrigerant fluid to and from the cylinders. The axle 16 is provided with a bore 34 which forms an inlet conduit for the refrigerant fluid, the bore being connected at its upper end with one side of the expansion coil 35 and communicating at its lower end with one valve chamber 36. The opposite valve chamber 37 is provided with an outlet conduit 38 opening into the chamber 39 formed in the lower end of the axle. The compressed refrigerant fluid passes from the chamber 39, through the perforated hooded stand pipe 41 into the cooling chamber 42 formed between the pan 15 and the bottom plate 8. Disposed in the cooling

chamber is a cooling coil 43 through which water or other cooling liquid is circulated, to cool the compressed refrigerant fluid. The cooled fluid passes from the chamber 42 to the expansion coil through the conduit 44.

The compressor chamber is partially filled with oil 45, which, upon operation of the apparatus, is sufficiently agitated and splashed to thoroughly lubricate the compressor. The splash plate prevents the projection of oil into the motor chamber, except as a vapor, and means are provided for introducing this vapor and any gaseous refrigerant leakage, into the compressor inlet conduit, thus maintaining the pressure within the casing at substantially intake pressure. For this purpose the axle is provided with a conduit 46 extending through the wall thereof and the sleeve 18 is provided with an adjacent aperture 47. Vapor or gas in the motor chamber thus passes into the compressor suction conduit. It is important in order to maintain high operating efficiency to exclude all extraneous fluids from the refrigerating pipes. In my apparatus because of the rapid rotary motion of the cylinder member and pistons, centrifugal force will maintain the lubricant separate from the refrigerant fluid and thus prevent intermingling of the lubricant with the fluid being discharged. Oil which may pass through the compressor is trapped in the chamber 39, whence it is forced by the pressure existing in the chamber, through a conduit 48 in the axle, to the upper rotor bearing 49.

To prevent damage to the compressor, due to the entry of liquid into the cylinders or due to the production of an excessive pressure therein, each piston is provided in its head with a spring loaded valve 51, which, on being depressed, opens ports 52 in the valve barrel to relieve the pressure.

Any suitable refrigerant fluid such as sulfur dioxide, ethyl chloride or methyl chloride may be employed. On account of the fact that no moving or running joints are formed with the casing shell, the danger of leakage of the refrigerant fluid is reduced to a minimum. The sealed casing also prohibits the entrance of moisture into the interior of the casing, so that the refrigerant fluid may be maintained anhydrous, a feature which is essential with some refrigerant fluids, which, when combined with water, form reagents that are deleterious to the materials of which the apparatus is constructed.

I claim:—

1. A refrigerating apparatus, comprising a closed casing, a partition wall dividing the casing into a suction chamber and a pressure chamber, a compressor in said casing and a driving motor therefor disposed in the suction chamber.

2. A refrigerating apparatus comprising a closed casing, a stationary hollow axle extending into said casing, a refrigerant fluid compressor and a driving motor therefor mounted on said axle and sealed within said casing.

3. A refrigerating apparatus comprising a closed casing, a stationary hollow axle extending into said casing and forming a refrigerant fluid conduit, a refrigerant fluid compressor rotatably mounted on said axle and communicating with said conduit and a driving motor in the casing connected to said compressor.

4. A refrigerating apparatus comprising a closed casing, a partition wall dividing said casing into two chambers, a hollow stationary axle extending into one of said chambers and a compressor and motor therefor mounted on said axle and disposed in said chamber.

5. A refrigerating apparatus comprising a closed casing containing a quantity of liquid lubricant, a stationary axle depending into said casing, a refrigerant fluid compressor rotatably mounted on said axle and adapted, when in rotation, to splash said lubricant, a motor arranged in said casing above the compressor and connected to said compressor and a splash plate interposed between the compressor and the motor.

6. A refrigerating apparatus comprising a closed casing, a stationary refrigerant fluid inlet conduit extending into said casing, a compressor in said casing connected to said conduit and a motor for driving the compressor arranged in said casing, said conduit being provided with a port opening into the chamber enclosed by the casing.

7. A refrigerating apparatus comprising a closed casing, a stationary hollow axle forming a refrigerant fluid inlet conduit extending into said casing, a refrigerant fluid compressor mounted for rotation on and with respect to said axle, said axle being formed to provide a valve for controlling the flow of refrigerant fluid to and from said compressor and a motor, surrounding said axle and connected to said compressor.

8. In a refrigerating apparatus, a casing, a top plate on said casing, a motor stator mounted on said top plate, a stationary axle extending through said top plate, a motor rotor rotatably mounted on said axle, a compressor rotatably mounted on said axle and means connecting the compressor and the rotor.

9. In a refrigerating apparatus, a casing, a top plate on said casing, a motor stator mounted on said top plate, a stationary axle extending through said top plate, a motor rotor rotatably mounted on said axle, a compressor cylinder block rotatably mounted on said axle, means connecting the cylinder block and the rotor, pistons in said cylinders

and means actuated by rotation of the cylinder block for reciprocating said pistons.

10. In a refrigerating system, a refrigerant fluid compressor comprising a stationary member, an external member adapted to rapidly rotate about said stationary member, and means for immersing at least a portion of said movable member in a bath of oil, the rotation of said member serving to both compress fluid and to prevent mixing of oil with the refrigerant fluid being discharged.

11. In a refrigerating system, a refrigerant fluid compressor comprising a vertical stationary member having intake and outlet passageways for refrigerant fluid, a member rotatably journaled upon said vertical member, reciprocating pistons cooperating with said member and rotatable therewith, a casing enclosing said members, and an oil bath in said casing immersing at least a part of said rotatable member whereby rotation of the same will separate oil from the refrigerant by centrifugal action.

12. A refrigerating apparatus comprising a closed casing, a stationary shaft disposed in said casing, and means surrounding said shaft and rotatable relative thereto for compressing a refrigerant liquid, said shaft having a fluid intake passage in one end thereof and a fluid outlet passage in the other end thereof.

13. A refrigerating apparatus comprising a closed casing, a motor mounted in the casing, a reciprocating pump mounted below said motor, said pump including a stationary shaft secured to the casing and having inlet and outlet passages communicating with the exterior of the casing, and a direct drive connection between said motor and pump.

14. In a refrigerating apparatus, a closed casing, a fluid compressor mounted within said casing, said compressor having inlet and outlet passages communicating with the exterior of the casing, and a port establishing communication between the intake passageway and the interior of the casing whereby the exterior of the pump will not be subjected to a pressure in excess of the intake pressure.

15. In a refrigerating apparatus, a closed casing, a fluid compressor mounted within said casing, said compressor having inlet and outlet passages communicating with the exterior of the casing, a pressure operated valve associated with the pump and adapted to permit compressed fluid to escape into the interior of the casing when the outlet fluid pressure reaches a given maximum, and a port communicating between the intake and the interior of the casing whereby fluid which may escape from said valve is returned to the pump.

16. A fluid pump comprising a shaft, a relatively rotatable member surrounding said shaft and having opposed cylinders, opposed pistons operatively disposed in said cylinders, a rigid bar interconnecting said pistons, and means for reciprocating said bar upon relative rotation between said shaft and member.

17. In a refrigerating apparatus, a casing having a removable head, a pump mounted within said casing, a motor disposed within the casing and adapted to drive said pump, said motor including a rotor and a stator, and means for securing said stator to said removable head.

In testimony whereof, I have hereunto set my hand.

ARTHUR J. KERCHER.