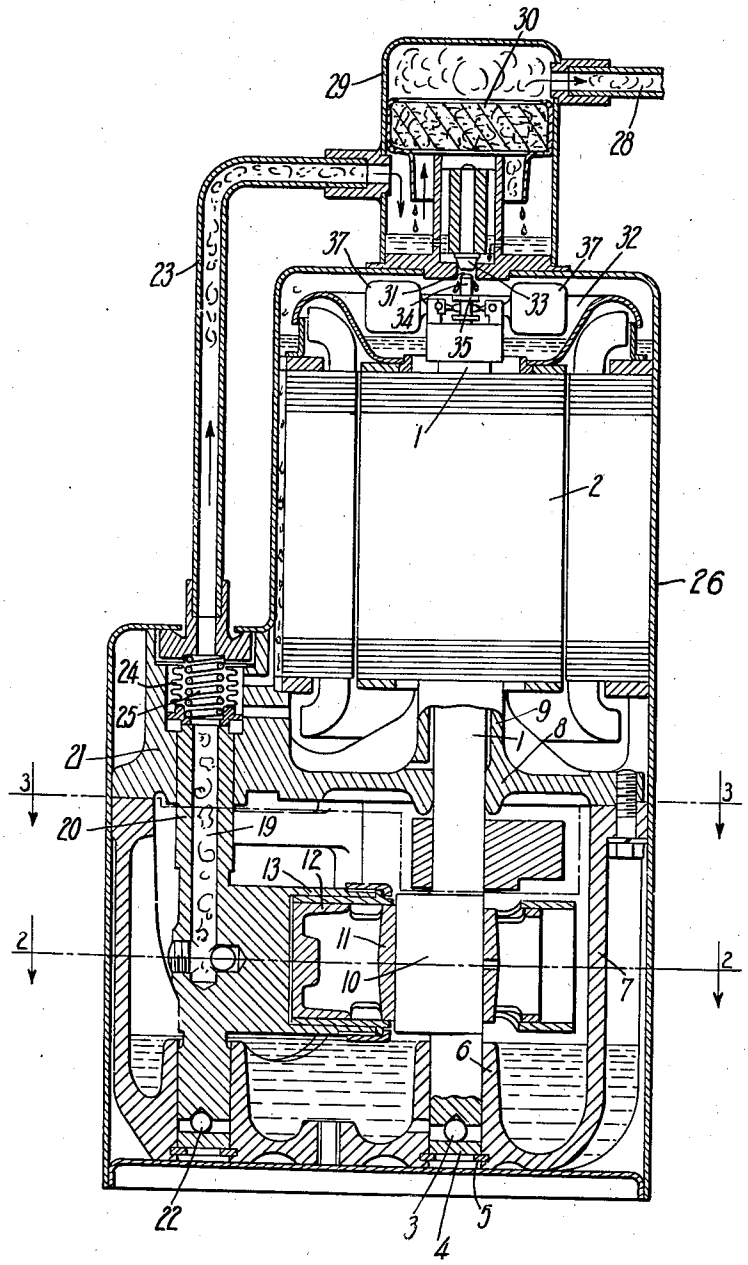
May 7, 1940. L. PATRIGNANI 2,199,414

COMPRESSOR UNIT FOR REFRIGERATION AND OTHER APPLICATIONS

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Fig. 1.



INVENTOR.
Leonida Patrignani.

BY Louis L. Ansart
his ATTORNEY.

May 7, 1940. L. PATRIGNANI 2,199,414

COMPRESSOR UNIT FOR REFRIGERATION AND OTHER APPLICATIONS

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Fig. 2.

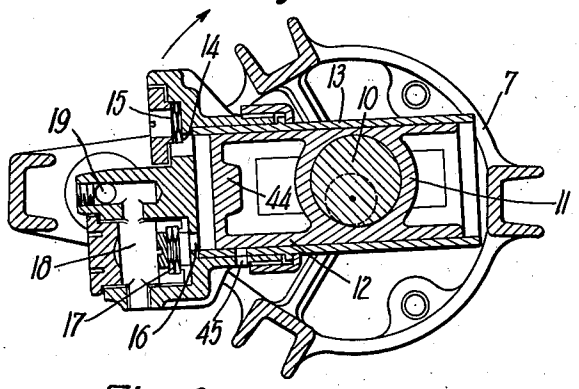


Fig. 3.

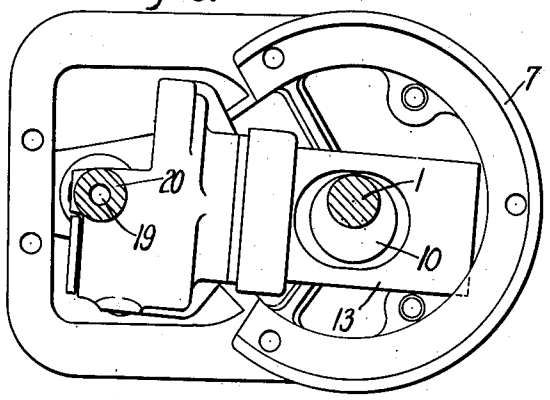
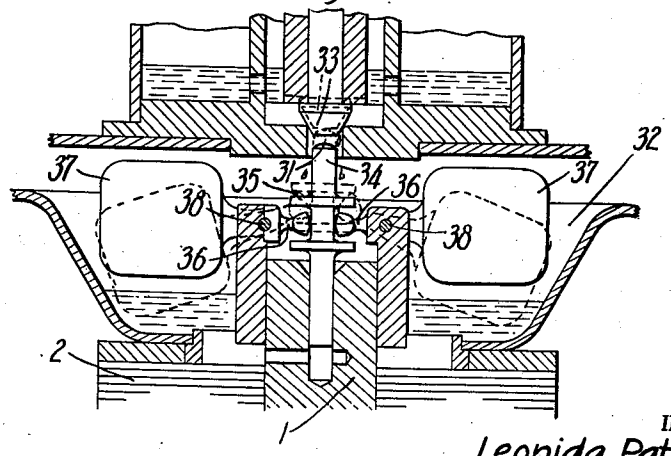


Fig. 4.



INVENTOR.
Leonida Patrignani.

BY Louis L. Amato
ATTORNEY.

May 7, 1940. L. PATRIGNANI 2,199,414

COMPRESSOR UNIT FOR REFRIGERATION AND OTHER APPLICATIONS

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Fig. 5.

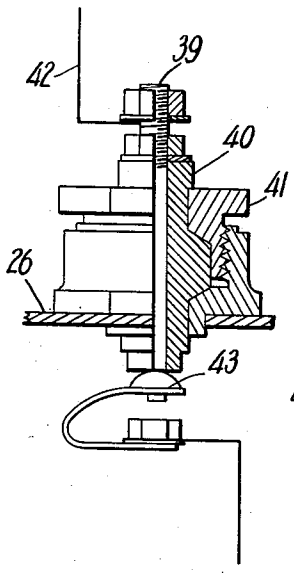
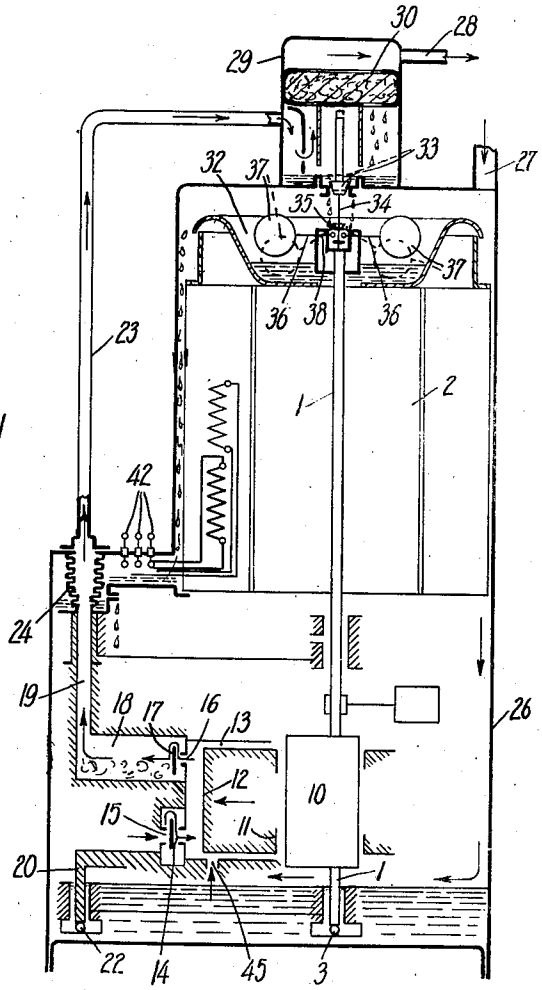


Fig. 6.



INVENTOR.
Leonida Patrignani.

BY Louis L. Ansart

ATTORNEY.

Patented May 7, 1940 2,199,414

UNITED STATES PATENT OFFICE

2,199,414

COMPRESSOR UNIT FOR REFRIGERATION AND OTHER APPLICATIONS

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

Application February 11, 1937, Serial No. 125,188
In France October 31, 1936

4 Claims. (Cl. 230—29)

The present invention relates to improvements in compressor units for refrigeration and other applications and more particularly to compressor units of the type in which a compressor and an electric motor for driving the same are enclosed in a gas-tight casing. The present invention involves improvements on certain features of my compressor unit described and claimed in my copending application, Serial No. 65,979, filed February 27, 1936.

It is difficult to develop compressor units of this general type which will not take up very much space, which are relatively light in weight and which are free from leaks and other trouble that would involve frequent inspection and repair. Another feature which is difficult to overcome is the tendency to cause excessive noise which would be prohibitive for compressor units to be used in domestic refrigerators. Also it has also been found difficult to start such units unless the compressors are arranged so as not to compress during starting, thus avoiding the use of a more powerful motor than would be required for running the compressor after starting. Other difficulties encountered in the development of such compressor units arise from the tendency of the oil to be carried out of the compressor unit by the compressed gases. Difficulty in starting and in maintaining proper lubrication tend to cause high current consumption by the electric motor.

The principal object of the invention is to provide novel and advantageous devices of the general character specified. Another important object of the invention relates to the provision of means whereby the motor may be started substantially under no load thereby enabling the use of a motor of lower power than would otherwise be required. A further object of the invention relates to the provision of means whereby oil passing out of the compressor with the gas or gaseous medium, such as a refrigerant, will be returned to the compressor case. A further object of the invention relates to improved compressing means involving one or more oscillating units arranged along a driving shaft and having improved means for controlling the drawing-in and expulsion of the gaseous material to be compressed. It is also an object of the invention to provide a self-contained unit adapted for economical operation and which will be not only almost absolutely tight but will not require frequent repair.

In carrying out the invention in a preferred form, the compressor may comprise one or more oscillating cylinders, the piston of each cylinder being driven by an eccentric on the motor shaft, the eccentric also serving to oscillate the cylinder about a fixed axis. The admission of gas into the cylinder may be through a check valve in the bottom of the cylinder and through an opening in the side of the cylinder which is opened by the piston when the latter has been drawn back to nearly its final limit. This arrangement of intakes enables the intake check valve to close before heavy pressure is placed thereon. From each cylinder the compressed gas passes to a duct along the stationary axis and is passed into a separating chamber from which the oil is automatically returned to the compressor case. The return of the oil to the compressor case is effected in connection with a device which automatically connects the separating chamber with the interior of the compressor case so as to take the load off the compressor in starting. The load-removing device may comprise a centrifugal device arranged on the motor shaft which when the motor shaft is at rest, will open the connection between the separating chamber and the compressor case and upon starting the motor will serve to close the connection as soon as the motor has gotten up speed.

Other objects, features and advantages will appear upon consideration of the following detailed description and of the drawings in which:

Fig. 1 is a sectional view of a preferred embodiment of the invention;

Fig. 2 is a sectional view on the line 2—2 of Fig. 1;

Fig. 3 is a plan view of the compressor casing seen from above the line 3—3 of Fig. 1, the top of the casing being removed;

Fig. 4 is a view on a larger scale of part of the structure shown in section in Fig. 1;

Fig. 5 is a detail partly in section showing the arrangement of a current terminal of the motor; and

Fig. 6 is a diagrammatic view illustrating the circulation of the lubricant, the electrical connections of the motor, and the path of the compressed fluid or refrigerant.

In the form of construction illustrated in the drawings, by way of example, there is represented a compressor with a single cylinder driven by an electric motor. Obviously a plurality of cylinders might be used. Shaft 1 of rotor 2 of the motor is preferably vertical and may be supported at its lower end by means of a thrust bearing comprising a ball 3 resting on a member or base 4 which in turn may be supported by an ex-

pansible ring 5 engaged in a groove or annular seat of a lower bearing 6. Said bearing 6 is included in a case for the compressor proper, the case being closed by a top 8 provided with a second bearing 9 for the shaft 1.

Shaft 1 of the electric motor may be provided, between the bearings 6 and 9, with an eccentric 10 engaged by a driving ring 11 of a piston 12 mounted in an oscillating cylinder 13. The oscillating cylinder 13 may be provided at its bottom with an intake opening 14 closed by an automatic check-valve 15 preferably of the flap valve type and also with an additional or complementary intake opening 45 arranged in the cylinder wall near the end of the suction stroke. By this arrangement the valve 15 may close before the piston starts its compressing stroke. The cylinder is also provided with an outlet opening 16 and a check valve 17 for said opening, the outlet 16 communicating with a chamber 18 adapted to discharge into a duct 19 provided in a shaft 20 which may be integral with and form the pivot for the oscillating cylinder 13. This shaft 20 may be journaled at its upper end in a bearing 21 carried by the top plate 8 and may rest at its lower end on a ball thrust bearing 22 forming part of an assembly similar to that at the lower end of shaft 1.

After assembly in suitable alignment, the compressor and motor unit may be enclosed within a suitably secured or welded case 26, thus providing a completely tight unit except for an intake pipe 27 for return of gases from an evaporator, a conduit 28 for delivery of the compressed fluid or refrigerant to the condenser, and an oil separator 29 receiving compressed refrigerant from a pipe 23 preferably welded to the casing of the oil separator and connected to duct 19 by a metal bellows sleeve or syphon 24 provided with a pressure spring 25.

The oil separator 29 comprises an oil retaining device 30 including material such as glass wool, metal chips or the like. At the lower part of oil separator 29 there may be provided an opening 31 terminating above a shallow cup 32 mounted on a rotor 2 of the electric motor, so that oil passing downwardly through the opening 31 will be caught in the cup 32. The opening 31 may be closed by a check-valve 33 below which is arranged a rod 34 movable freely in a seat in the upper end of shaft 1 and, in a collar 35 of which rod 34 are engaged the ends of two pivoted levers 36 provided at their outer ends with counter-weights 37, the levers being pivoted to members 38 integral with shaft 1.

Each of the terminals for the motor may comprise a rod 39 passing through the case 26 through a bore in an insulating member 40 and held in position by means of a screw-threaded member 41. The outer end of each rod 39 may be connected with a conductor 42 while the inner end is engaged by a spring contact 43 connected with the motor.

In operation the rotation of the motor reciprocates the piston 12 in the cylinder 13 and at the same time oscillates the cylinder about its support or shaft 20. In the movement of the piston 12 from the bottom of the cylinder 13, fluid or refrigerant in the case 7 and the case 26 is drawn into the cylinder. Such drawing-in of fluid is started by movement of the flap 15 of the intake valve and afterwards by uncovering an opening 45 in the wall of the cylinder by moving the end of the piston past said opening. The uncovering of the opening 45 assures perfect filling of the cylinder before the compression stroke begins and also permits early closing of the flap valve 15. During each compression movement of piston 10 the opening 45 is covered and then the compressed fluid or refrigerant is forced through check valve 17, chamber 18 and duct 23 to the oil separator 29 where the fluid is freed from substantially all of the oil suspended therein. The oil thus separated collects in the lower part of the separator 29 and remains there as long as the compressor operates due to the fact that the valve 33 remains closed. The refrigerant in passing over the lubricant in the casing will tend to take up some of the lubricant and carry it into the cylinder and during the operation of the apparatus, oil from the oil separator will be passing downwardly through the casing and the refrigerant therein and will tend to be carried into the cylinder.

During the operation of the motor the levers 36 are held in substantially horizontal position and the rod or pin is held in lowered position. As the motor stops the weights 37 bring the levers 36 into the positions indicated in dotted lines in Figs. 4 and 6 and raise rod 34 so as to open check valve 33 and permit the downflow of oil from the oil separator into cup 32. When the compressor is again operated, the oil thus collected in cup 32, is thrown outwardly by centrifugal force and splashed over the inner surface of the case in channels provided for such purpose, without entering the rotor.

The open condition of the check valve 33 when the motor is at rest results in equalizing the pressure in duct 23 and casing 26 so that there will be substantially no resistance to compression strokes during the starting of the compressor, the compressor being started in vacuo.

In the structure described the bearings are accessible and are placed close to the parts of the apparatus where stresses are produced in operating the piston or pistons, thus making it feasible to omit a bearing at the upper end of the rotor shaft. Consequently friction is reduced to a very great extent. Furthermore, the range of oscillation of the cylinder is slight and there is no particular tendency to effect a churning or emulsifying of the lubricating oil. The separation of the oil from the fluid delivered by the compressor may be effected in any suitable manner, for instance, by making use of the speed of circulation of the fluid containing the oil in suspension.

The compressor may have any desired power and capacity and the invention is applicable to all kinds of refrigerating plants, but more particularly to household installations. Obviously, the compressor cylinder may have only one of the intake ports 14 and 45. Furthermore either single acting or double acting pistons may be used.

It should be understood that various changes may be made in the construction and arrangement of parts, and that certain features may be used without others without departing from the true scope and spirit of the invention.

What I claim is:

1. In an enclosed motor-compressor unit a compressor cylinder having a closed end and arranged to oscillate about a fixed axis, a piston in said cylinder, a driving shaft parallel to said axis and connected to said piston to operate the same and oscillate the cylinder, a tight casing enclosing the unit and receiving at low pressure the fluid to be compressed, said casing having a lim-

ited amount of lubricant therein, said cylinder having intake means for admission of low pressure fluid from the casing to the cylinder during the suction stroke of the piston and a discharge device through which the compressed fluid passes, a duct leading compressed fluid from said discharge device and along said fixed axis to the outside of the casing, an oil collector comprising a chamber on said casing above the upper end of said shaft and to which said duct leads, a check valve connection between said chamber and the interior of said casing, and means controlled by the shaft for opening the valve when the motor stops and closing the same after the motor starts.

2. In an enclosed motor-compressor unit, a tight casing enclosing the unit and receiving low pressure fluid to be compressed, a compressor in the lower part of said casing, a vertical shaft for operating said compressor, a driving motor comprising a rotor mounted on said shaft above said compressor, a duct through which compressed fluid passes from the compressor to the outside of the casing, a chamber on the casing above said shaft and through which the compressed fluid passes, a check valve between the chamber and the casing, and means for controlling the check valve comprising a vertically moving pin at the upper end of said shaft and weighted arms carried by said shaft and connected with said pin so that rotation of the shaft will cause the arms to spread by centrifugal force and lower the pin and stopping of the shaft will cause the arms to fall under the influence of gravity and lift the pin to open the check valve.

3. In an enclosed motor-compressor unit, a tight casing enclosing the unit and receiving low pressure fluid to be compressed, a compressor in the lower part of said casing, a vertical shaft for operating said compressor, a driving motor comprising a rotor mounted on said shaft above said compressor, a duct receiving compressed fluid and some lubricating oil from the compressor, an oil separator at the top of said casing receiving the compressed fluid and oil from said duct and removing the oil from the compressed fluid, a check valve normally preventing compressed fluid and oil from passing from the separator to the interior of the casing, means for opening said check valve when the motor comes to rest and letting the collected oil and some compressed fluid pass downwardly into the upper part of the casing, and a round oil pan over said motor to keep the oil from falling thereon, said oil pan rotating with said shaft so as to throw off the oil by centrifugal force to enable its later use for lubrication.

4. In a compact enclosed motor-compressor unit having an electric motor and a shaft coaxial therewith and actuated thereby, an eccentric carried by said shaft, a tubular piston closed at one end and having intermediate its ends a bearing in which said eccentric fits, a cylinder for said piston having a closed end and an open end and mounted to oscillate on an axis adjacent to said closed end but outside of and beyond the same, said cylinder being open around said shaft to receive the eccentric, the closed end of the cylinder guiding the effective portion of said piston and the open end of the cylinder guiding the corresponding end of the piston beyond the eccentric.

LEONIDA PATRIGNANI.