Dec. 28, 1948. E. P. GIRARD 2,457,221

ROTARY COMPRESSOR SEALING MEANS

Filed Nov. 11, 1943

Fig. 1.

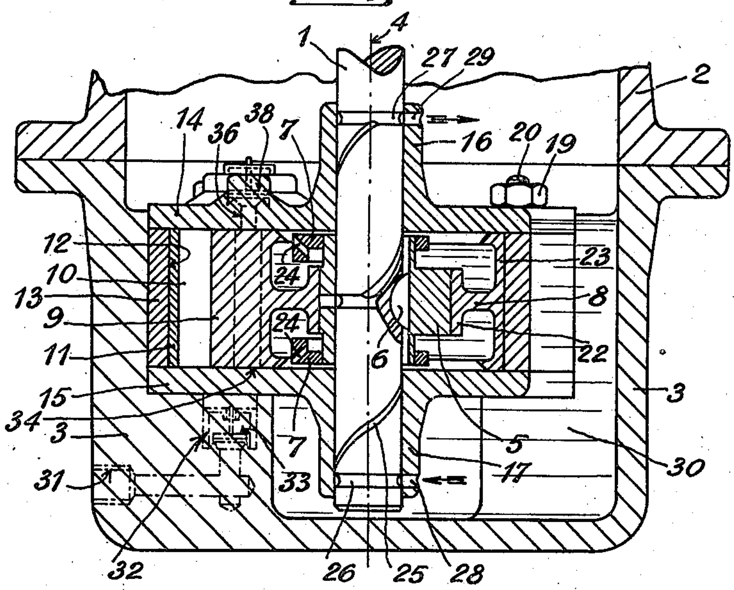
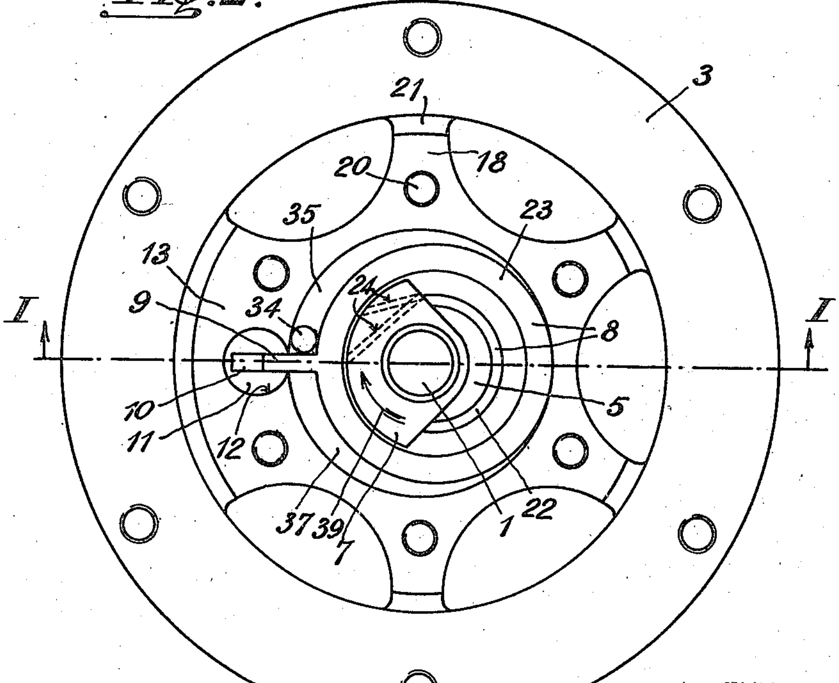


Fig. 2.



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ROTARY COMPRESSOR SEALING MEANS

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1

It is known that rotary compressors, while presenting many advantages over compressors with reciprocating linear-movement pistons, have nevertheless the drawback of a very difficult realization, owing, on the one hand, to the necessity for extremely slight clearances between the parts working in relation, which expand by reason of the rise in temperature due to their operation, and, on the other hand, to the necessity for ensuring an efficient lubrication, these two desiderata of tightness and lubrication being more or less antagonistic.

Defective tightness is specially apt to occur in small rotary compressors such as those employed in household refrigerating machines. These compressors are of numerous kinds, either of the type with a revolving piston or of the type with a piston at once revolving and oscillating. In the latter type, tightness is particularly defective, as can be noted by measuring the vacuum they produce at the intake. For example, it has been remarked that, with an ordinary rotary compressor pumping sulphur dioxide, this vacuum is 99.04% when the discharge is made into the atmosphere and that this vacuum falls to 27.5% when the compression reaches 3.5 atmospheres.

Now, it is obvious that the vacuum at the intake directly represents the degree of tightness of the compressor; it is obvious too that a low degree of tightness would provoke a churning and throttling of the gases or vapours which would lower the volumetric yield and aggravate internal losses; in other words, a compressor with a high degree of tightness has, other things being equal, a good volumetric yield and a good general yield, as well as being of reduced compass and weight.

The present invention relates to a compressor of the revolving-piston type, one particularly intended for refrigerating plants.

This compressor is characterised in that it presents at least one inner chamber limited partly by the piston and partly by at least one immobile member with which this piston is in contact, in that it comprises means for drawing fluid into this chamber and means, disposed in the said chamber and revolving with the shaft, for rapidly rotating the fluid contained in it and for driving it, by reason of the centrifugal force created by this rotation, into the joints between this piston and these immobile members, so as to ensure their tightness.

As can be easily understood, the fluid is forcibly driven into the clearances through which gas could eventually leak and so seals such leaks.

The most appropriate fluid is obviously a lubricant, lubricating oil, for example; both efficient lubrication and perfect tightness are thus obtained.

2

The annexed drawing shows, as an example, an embodiment of the compressor to which the invention relates, specifically intended for a household refrigerating machine.

Figure 1 is a section in axial elevation of this compressor and

Figure 2 is a plan view of the same, its upper part being removed.

The compressor shown is of the type with a piston at once revolving and oscillating. Its shaft 1 is driven by a motor (not shown) the housing 2 of which is fixed to the casing 3 of the compressor. The shaft 1, which may be an extension of the motor shaft, revolves on the axis 4. A crank 5 is keyed at 6 on this shaft 1, which also bears a counterpoise 7 of the crank 5. Parts 1, 5 and 7 revolve integrally.

A piston 8 which at once revolves and oscillates is mounted round the crank 5. This piston bears a vane 9 integral with it and sliding in a slot 10 of an oscillating member 11 of a circular cylindrical shape fitted in a cavity 12 of a jacket 13 of a general cylindrical shape. This jacket is closed by a top cover 14 and a bottom cover 15, each presenting a bearing 16 and 17, respectively, for the shaft 1. The two covers 14 and 15 bear flanges 18 by which they are fixed, by means of nuts 19 and bolts 20, to brackets 21 integral with the casing 3.

As can be seen in Figure 1, the piston 8 is recessed. It bears an annular part 22 encircling the crank 5 and a cylindrical part 23 by the outer surface of which it acts on the gas to be drawn in and compressed. A chamber is thus contrived inside the piston 8, limited by the piston itself and the covers 14 and 15. The counterpoise 7 revolves in this chamber. The counterpoise 7 presents two passages 24.

On the shaft 1 is a helical groove 25 leading at either end into an annular groove 26 and 27 respectively. The groove 26 communicates through an aperture 28 and the groove 27 through an aperture 29 with the interior of the casing 3 and of the housing 2. The casing 3 is filled with oil 30 and so provides a reserve of this fluid, which also fills the chamber constituted by the recessing of the piston 8, thus forming a container for this fluid.

A gas intake port 31 is made in the casing 3 and leads into a chamber 32 in which is a flap-valve 33. This chamber 32 communicates, through an aperture 34, with the cell 35 of variable volume situated between the piston 8 and the jacket 13. An exhaust port 36 is made in the cover 14 and communicates, on the one hand, with the other cell 37 and, on the other hand, with the interior of the housing 2, through the intermediary of a flap-valve 38.

The compressor shown functions as follows:

When the shaft 1 revolves in the direction of the arrow 39, driven by the motor (not shown and which is preferably electric), the crank 5 imparts to the piston 8, which is retained by the vane 9 engaged in the member 11, a movement at once oscillating and rotary in the interior of the jacket 13. The effect of this movement is to vary periodically the volume of the cells 35 and 37 between practically zero and a maximum quantity. In the position of the members shown in the drawing, these two cells 35 and 37 have the same volume; cell 35 tends, by reason of the rotation of the shaft 1 in the direction of the arrow 39, to increase in volume until it reaches the maximum, while cell 37 tends to diminish until its volume is nil, which occurs when the shaft 1 has made a half-revolution in relation to the position shown. The sum of the volumes of the two cells is practically constant; when the volume of one of the cells is nil, the other has the form of a lunula; the gas imprisoned in this lunula is driven out by the piston 8 through the exhaust port 36 and the cell 35 increases in volume, sucking in gas meanwhile through the intake port 31.

The oil 30 held in reserve in the casing 3 penetrates into the interior of the piston 8 through the hole 28, the annular groove 26 and the helical groove 25. When the shaft 1 revolves, the oil is made to circulate by entering through the hole 28 and leaving through the hole 29.

The oil in the container formed by the interior of the piston 8 is made to rotate by the counterpoise 7, which revolves in the piston at the same speed as the shaft 1. This speed can attain, for example, 3,000 revolutions per minute. The oil in the container thus yields to the centrifugal force and is consequently driven between the part 23 of the piston on the one hand and the covers 14 and 15 and the jacket 13 on the other. Despite the close fitting of these parts, oil penetrates into the cells 35 and 37; it lines the clearances between the piston 8 and the members 13, 14 and 15; in particular, it seals any leaks that might occur along the theoretical ridge of contact between the cylindrical surface of the part 23 of the piston and the inner cylindrical wall of the jacket 13. A wedge of oil, playing the role of a stopper, is maintained in front of the piston between its cylindrical surface and the cylindrical wall of the jacket 13.

The projection of oil between the piston 8 and the covers 14 and 15 is further facilitated by the passages 24. As is easily understood, the oil film lining the clearances between the parts of the compressor working in relation with one another and separating in particular the cells of different pressures, opposes, by its viscosity and adherence, the back-flow of the compressed gases or in process of compression.

As regards the tightness between the piston and the covers 14, 15, it is perfected owing to the fact that the oil is, so to speak, driven under pressure by reason of the centrifugal force acting on it in the inner chamber of the piston.

Oil particles might be carried along by the compressed gas and escape by the flap-valve 38; they fall into the casing 3 or are centrifuged by the rotor of the electric motor, which deflects them against its housing; this oil drains back into the casing 3.

Measures made on a compressor identical with the example just described have given the following results:

The vacuum at the intake was 99.8% when the discharge was made into the atmosphere; this vacuum remained at 99.8% when the discharge pressure increased to 3.5 atmospheres. These results are excellent as compared with those obtained previously with the ordinary rotary compressor.

Furthermore, the recessing of the piston 8 lightens the weight of the mass in movement and allows of fitting-in the counterpoise 7; the compressor shown consequently does not vibrate and can revolve at high speeds.

The embodiment described and shown may be modified in various ways. For example, the grooves in the shaft 1, instead of being helical, may be straight, the centrifugal force ensuring an adequate circulation of oil. These grooves, instead of being made in the shaft 1, may be made in the bearings 16 and 17. The oil container, instead of being formed by recessing the piston 8, may be contrived wholly or partially in the covers 14 and 15, members (counterpoises or other parts such as vanes, for example) being provided for rotating this oil and driving it into the clearances for lubrication through the centrifugal force to which it is subjected.

In the example described, the chamber containing the rotating oil revolves, being set entirely in the piston; in the case where this chamber is contrived wholly in the covers (actually a chamber in each cover), it is immobile. In the case where this chamber is contrived partially in the piston and partially in the cover, it is then partly revolving and partly immobile.

The compressor described has the advantage of ensuring a tightness at least equal to that which can be realised in similar known compressors at the cost of an exceptional precision of the tooling guaranteeing the micron. It can easily be seen that, in the compressor to which the invention relates, the degree of precision of the construction is quite ordinary, and this obviates the considerably higher costs incumbent on the scrupulous precision that certain known rotary compressors demand.

I claim:

1. In a rotary compressor, the combination of a vertical rotatable driving shaft, an eccentric mounted thereon, a substantially hollow piston encircling said eccentric, said piston being arranged and positioned to be gyrated in a horizontal plane by said eccentric, a cylinder surrounding said piston, the walls of said cylinder and of said piston defining a fluid chamber within said piston adapted to be filled with a lubricating fluid, and means carried by the eccentric and positioned within said chamber to impart a rotating movement in a horizontal plane to the fluid contained in said chamber whereby the fluid is driven by centrifugal force into the joints between said piston and said surrounding cylinder.

2. In a rotary compressor, the combination of a vertical rotatable driving shaft, an eccentric mounted thereon, a substantially hollow piston encircling said eccentric, said piston being arranged and positioned to be gyrated in a horizontal plane by said eccentric, a cylinder surrounding said piston, the walls of said cylinder and of said piston defining a fluid chamber

within said piston adapted to be filled with a lubricating fluid, a counter-balance carried by said eccentric for imparting a rotating movement in a horizontal plane to the fluid held in said chamber whereby the fluid is driven by centrifugal force into the joints between said piston and said surrounding cylinder.

3. In a rotary compressor, the combination of a vertical rotatable driving shaft, an eccentric mounted thereon, a substantially hollow piston encircling said eccentric, said piston being arranged and positioned to be gyrated in a horizontal plane by said eccentric, a cylinder surrounding said piston, the walls of said cylinder and of said piston defining a fluid chamber within said piston adapted to be filled with a lubricating fluid, one end of said driving shaft extending into a fluid reservoir, said shaft having spiral grooves on the surface thereof to provide a communication between said liquid reservoir and said inner fluid chamber, and a counter balance

carried by said eccentric for imparting a rotating movement in a horizontal plane to the fluid held in said chamber whereby the fluid is driven by centrifugal force into the joints between said piston and said surrounding cylinder.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,633,056	Wishart et al.	June 21, 1927
1,953,253	Ogilvie	Apr. 3, 1934
2,199,762	Smith	May 7, 1940
2,195,835	Bilderbeck	Apr. 2, 1940

FOREIGN PATENTS

Number	Country	Date
164,931	Switzerland	Jan. 2, 1934