June 15, 1965 A. F. ENEMARK 3,189,255

MOTOR-COMPRESSOR FOR SMALL REFRIGERATING MACHINES

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FIG. 1

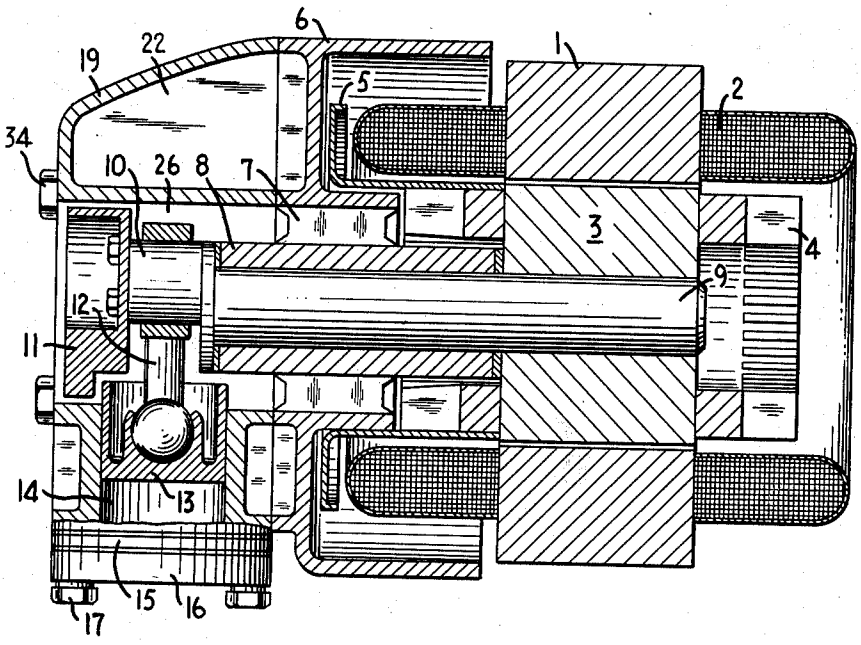

FIG. 2

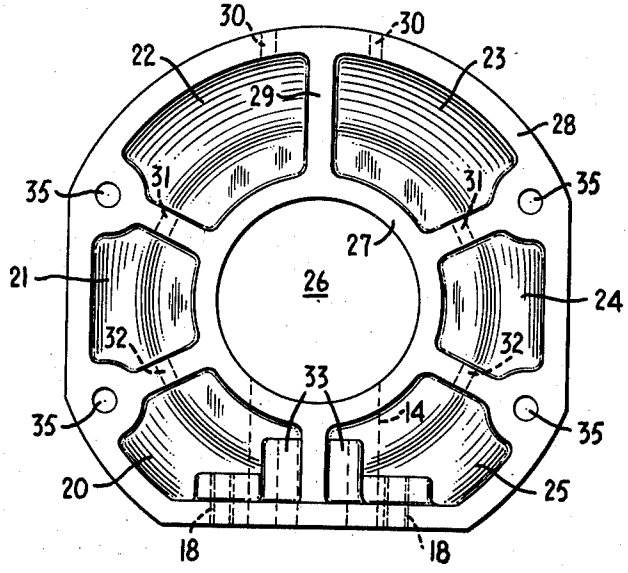

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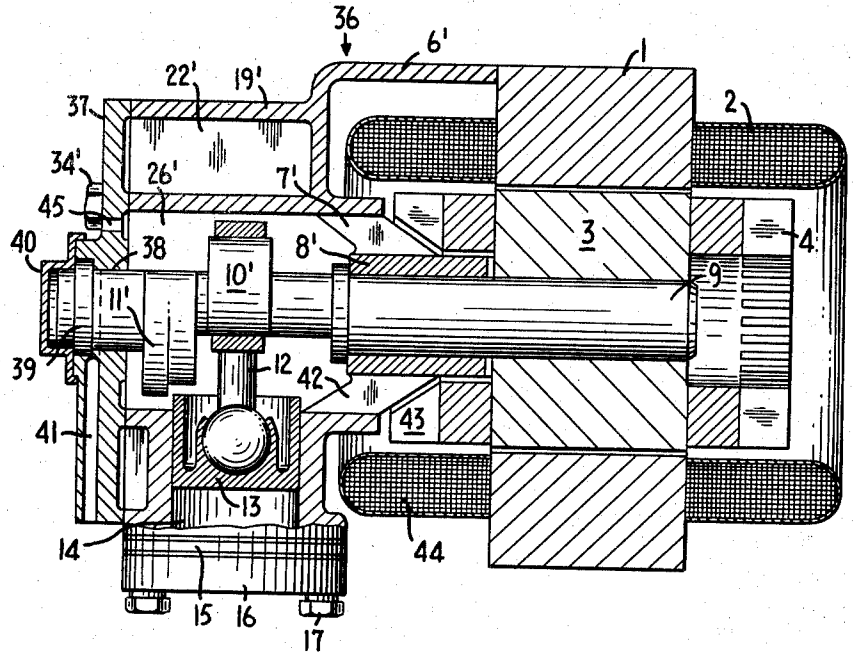
FIG. 3



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3,189,255

MOTOR-COMPRESSOR FOR SMALL REFRIGERATING MACHINES

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8 Claims. (Cl. 230—58)

This invention is concerned with a motor compressor of the type used in small refrigerating machines e.g. machines adapted to be enclosed in a hermetically-sealed capsule, and the invention is more particularly concerned with the compressor and related portions of such machines.

It is well known to form the cylinder of the compressor of a refrigerating machine integrally with one or several muffler chambers as one unitary component. Usually, such a component is integrally cast. Since the cylinder has to be located radially in one direction, and since the muffler chambers normally are connected directly to the cylinder, prior devices have had a very eccentrically-directed construction. As the same time, the crank has been located in the open and, therefore, splashing of oil in all directions has occurred, which is undesirable in most cases.

It is an object of this invention to provide a motor compressor having a unitary cylinder and muffler chamber assembly which avoids the foregoing drawbacks and disadvantages.

In accordance with the invention, there is provided a unitary casting containing the cylinder and the muffler chambers, with these components being disposed in such manner that the casting, at least in the radial direction, creates a closed or substantially closed crank case.

It is a feature of the construction of the invention that the cylinder and the muffler chambers are contained in a collar surrounding the central shaft of the motor compressor. This collar is essentially rigid and it has a relatively large surface which bears against adjacent components of the motor compresor e.g. the motor support, thus the forces acting on the collar can be better dissipated. It is no longer necessary, as in prior constructions, to locate the securing means, such as screws, on only one side of the axis of the machine, because the entire circumference of the collar can be used for this purpose. Indeed, the symmetrically-disposed connecting means between the stator of the electric motor and the motor support can be used as securing means for the unitary collar and related parts. Furthermore, with the construction of this invention, it is possible to intercept and collect the oil splashed out radially by the crank, and hence the oil can be prevented from entering into contact with the piping containing the compressed, and therefore heated, refrigerant which would cause the oil to absorb heat from the piping, which would result in an increased temperature inside the hermetically-sealed capsule. In motor compressors of the type in which the driving shaft is disposed horizontally, it is preferable to locate the cylinder in the lowest possible portion of the unitary casting forming the above-described collar. The splashed oil automatically flows to the lowest part of the crank case and the cylinder will thus be lubricated automatically, thus making the use of supplementary lubrication feeder components unnecessary.

Moreover, it is possible to provide the lowest part of the crank case with a hole or passage leading into the area containing the motor so that blades carried by the motor rotor will rotate directly adjacent this hole. The

oil collecting in the crank case will flow through this hole and then will be thrown in an outward direction by the rotor blades, thus cooling the stator windings on the side facing the motor support.

The construction according to the invention will further have a larger volume available for noise suppression which, by dividing the collar into a suitable number of muffler chambers, will mean a more effective noise reduction. The collar, however, does not need to be as wide as the mufflers heretofore employed, thus making it possible to use capsules of a smaller diameter.

Because of casting requirements, the muffler chambers must be open towards one of the end surfaces of the collar. However, if the muffler chambers are open in the direction of the motor, the motor support can serve to form a closure for the open chamber ends. In this case, no supplementary components are necessary. If the open muffler chambers are open in a direction away from the motor, then a unitary end plate suitably forms the necessary closure.

Such an end plate suitably fits tightly against the collar which contains the muffler chambers and the cylinder and form the crank case. The same is true even if the cylinder and the muffler chambers do not form an entirely closed collar around the crank case. This closing plate, therefore, can take over supplementary functions. In particular, it can form a support for a crank bearing, thus relieving the main bearing, which can then be made shorter. The bearing support can also form at least one section of an oil pump housing and advantageously contain an inlet channel for the pump.

The construction according to the invention is especially advantageous in that a single unitary component can be formed containing the cylinder, muffler chambers as well as the motor support in one assembly, particularly adapted for precision casting. It is thus possible to reduce the strength of the walls of the motor support in relation to known constructions because the walls of the cylinder and of the muffler chambers on all sides form a bracing.

Further objects, features and characteristics of the invention will appear from the following detailed description of two embodiments thereof, and from the accompanying drawing, wherein:

FIG. 1 is a longitudinal sectional view of a motor compressor embodying features of the present invention and wherein the muffler chambers are open in the direction of the motor;

FIG. 2 is a plan view of the component defining the muffler chambers and the crank case in the construction shown in FIG. 1; and

FIG. 3 is a longitudinal sectional view of a second embodiment of the invention wherein the muffler chambers open in the direction opposite that shown in FIG. 1, viz. away from the motor, and wherein the motor support, the main bearing, the cylinder and the muffler chambers are encased integrally in a single unit.

The motor compressor shown in FIG. 1 is driven by an electric motor consisting of a stator 1, with windings 2, and a rotor 3, with cage winding 4. The rotor 3 is provided with a disc 5 that serves to deflect and distribute lubrication oil.

Motor compressors commonly have additional means for distributing lubricating oil but they form no part of the invention and are not shown.

The motor support 6 is connected to the main bearing 8 by means of the fins or webs 7. The main bearing 8 guides the motor compressor driving shaft 9. The crank 10, one end of which is provided with a counter balance 11, has mounted upon it the connecting rod 12, which in turn is connected to the piston 13, which re-

ciprocates inside the cylinder 14. Cylinder 14 is closed by means of the valve plate 15 and the valve cover 16. The two latter parts are fastened to the unit 19 containing the cylinder 14 by means of screws 17 which are seated in the threaded holes 18 (FIG. 2).

The cylinder 14 forms part of the single cast unit 19 which also contains the muffler chambers 20, 21, 22, 23, 24 and 25. The relationship of the cylinder and the muffler chambers to each other is such that they extend radially around the radially-closed crank case 26. The unit 19 has a surrounding exterior wall 28, and an inner wall 27 which surrounds the crank case 26. The walls 27 and 28 are connected to each other by means of the spacers 29 which also serve as separators between adjacent mufflers.

In the above-described embodiment, it will be seen that the muffler chambers 20, 21 and 22 are located on one side and that the muffler chambers 23, 24 and 25 are located on the other side, and it will be understood that they are suitably connected in parallel and connected to the suction side of the compressor.

The gas enters through the openings 30 into the first muffler chambers and then flows through the openings 31 and 32 to the succeeding muffler chambers, finally passing through the channels 33 to the valve cover 16.

The motor support 6 axially closes the six muffler chambers 20 to 25. The cast unit 19 is provided with bores 35 (FIG. 2) and is connected to the motor support 6 and stator 1 by means of the four screws 34, or similar fastening means, which extend through the cast unit and engage with the motor support and with the stator. The screws 34 are of equal length and are disposed symmetrically in relation to two planes running at right angles to each other through the central axis of the compressor.

In the embodiment shown in FIG. 3, identical parts have been given the same reference numerals used in FIGS. 1 and 2, whereas corresponding parts have been given the same number as corresponding parts in FIGS. 1 and 2 but to which have been added primes. A unitary casting 36 forms the motor support 6^1 which, by means of webs or fins 7^1, is connected to the main bearing 8^1, and it also forms cylinder 14 and the muffler chambers 20', 21', 22', 23', 24' and 25^1, corresponding to muffler chambers 20 to 25 of FIG. 2, but only muffler chamber 22^1 is visible in FIG. 3. The free ends of the muffler chambers, as well as of the crank case 26^1, is closed by a common plate 37 which, by means of the screws 34^1, or similar fastening means, is fastened to the casting unit 36 and to the stator 1.

The plate 37 also serves to provide a bearing 38 for the driving shaft 9. Furthermore, the plate 37 forms part of the housing for an oil pump 39 carried on the end surface of the driving shaft and closed by a cover 40. An inlet channel 41 to pump 39 is formed in plate 37. Other lubrication channels, which are suitably provided in conventional manner, are not shown.

The oil dispersed inside the crank case 26^1 by the eccentric parts is collected in the lower part of the crank case, thus automatically lubricating the piston 13. Then the oil flows through the holes or spaces 42 between the ribs 7^1 to the lower part of the machine. On its way down, the oil is intercepted by the rotor blades 43 and is splashed over the stator windings 44. The plate 37 is provided with one or more air vents 45 so as to permit ventilation of the crank case.

It will be understood that the embodiments illustrated and described can be modified and changed without departing from the invention as defined in the claims. Thus, the casting which forms the crank case, and associated parts, can have a wall disposed at right angles with respect to the driving shaft, and in the center of the casting so that the muffler chambers can extend on both sides, i.e., towards the plate 37 and towards the motor support 6. It is also possible to interconnect the muffler chambers in other ways, although simple bores are best, and

preferably these bores are lined with inserted pieces of tubing. In addition, it is possible to combine the muffler chambers, i.e. partly as suction muffler chambers, and partly as pressure muffler chambers.

It will also be understood that the present invention is concerned with improvements in motor compressors of a known type and that many elements which serve to make up the complete motor compressor, and which form no part of the present invention, e.g. the capsule, the suspension system, the valves, the refrigerant conduits, and the like, have been omitted from the drawings and have not been described. A typical compressor of the type with which the invention is concerned is described, for example, in U.S. Patents 2,285,754 and 2,836,349.

Similarly, while reference has been made to precision casting, this is a standard casting procedure which is described for example, in Casting Method Handbook "Die Casting" by C. O. Herb (1958).

It is intended, therefore, that all matter contained in the foregoing description and in the drawings is to be interpreted as illustrative only and not as limitative of the invention.

The present application is related to my applications being filed on even date herewith and entitled "Refrigerating Machines" and "Motor Compressor Especially for Small Refrigerating Machines."

What I claim is:

1. In a refrigeration compressor, in combination, a unitary body casting having a central annular portion defining a compressor chamber, an elongated tubular bearing portion disposed coaxially with said annular portion extending axially therein spaced radially inwardly therefrom defining jointly therewith a crank case, radial ribs fixed to said annular holding said bearing portion in fixed position, annular partition means defining a cylinder disposed radially outwardly of said compressor chamber having one end in communication with said chamber and an opposite end open, radially extending partitions disposed angularly spaced on said annular portion, an outer wall defining in conjunction with said angularly spaced partitions angularly spaced muffler chambers disposed circumferentially of said compressor chamber and at least some of which are in communication with each other, a rotary driven crankshaft in said chamber, a piston reciprocably driven in said cylinder from said crankshaft, a motor rotor connected to said crankshaft and rotatably supported in said bearing portion, a stator circumferentially of said rotor having windings extending axially, an other wall having an annular portion defining a collar extending axially in a direction away from said muffler chambers radially spaced outwardly from said compressor chamber for receiving said rotor winding therein.

2. In a refrigeration compressor, in combination, a unitary body casting having a central annular portion defining a compressor chamber, an elongated tubular bearing portion disposed coaxially with said annular portion extending axially therein spaced radially inwardly therefrom defining jointly therewith a crank case, radial ribs fixed to said annular portion holding said bearing portion in fixed position, annular partition means defining a cylinder disposed radially outwardly of said compressor chamber having one end in communication with said chamber and an opposite end open, radially extending partitions disposed angularly spaced on said annular portion, an outer wall defining in conjunction with said angularly spaced partitions angularly spaced muffler chambers disposed circumferentially of said compressor chamber and at least some of which are in communication with each other, a rotary driven crankshaft in said chamber, a piston reciprocably driven in said cylinder from said crankshaft, a motor rotor connected to said crankshaft and rotatably supported in said bearing portion, a stator circumferentially of said rotor having winding extending axially, said other wall having an annular portion defining a collar extending axially in a direction away from said

muffler chambers radially spaced outwardly from said compressor chamber for receiving said rotor windings therein, said muffler chambers in said casting being cast opening in a direction towards said motor rotor and stator, and means closing the open ends of said muffler chambers.

3. In a refrigeration compressor, in combination, a unitary body casting having a central annular portion defining a compressor chamber, an elongated tubular bearing portion disposed coaxially with said annular portion extending axially therein spaced radially inwardly therefrom defining jointly therewith a crank case, radial ribs fixed to said annular portion holding said bearing portion in fixed position, annular partition means defining a cylinder disposed radially outwardly of said compressor chamber having one end in communication with said chamber and an opposite end open, radially extending partitions disposed angularly spaced on said annular portion, an outer wall defining in conjunction with said angularly spaced partitions angularly spaced muffler chambers disposed circumferentially of said compressor chamber and at least some of which are in communication with each other, a rotary driven crankshaft in said chamber, a piston reciprocably driven in said cylinder from said crankshaft, a motor rotor connected to said crankshaft and rotatably supported in said bearing portion, a stator circumferentially of said rotor having windings extending axiallly, said other wall having an annular portion defining a collar extending axially in a direction away from said muffler chambers radially spaced outwardly from said compressor chamber for receiving said rotor winding therein, said muffler chambers and said compressor chamber in said casting being cast opening in a direction away from said motor rotor, and means closing the open ends of said muffler chambers and said compressor chamber.

4. In a refrigeration compressor according to claim 3 in which said means closing said open ends of said chambers comprising a plate having second bearing means for rotatably receiving said crankshaft.

5. In a refrigeration compressor according to claim 4, in which said plate comprises an oil pump housing and defines an oil channel for said pump.

6. In a refrigeration compressor, in combination, a unitary body casting having a central annular portion defining a compressor chamber, an elongated tubular bearing portion disposed coaxially with said annular portion extending axially therein spaced radially inwardly therefrom defining jointly therewith a crank case, radial ribs fixed to said annular portion holding said bearing portion in fixed position, annular partition means defining a cylinder disposed radially outwardly of said compressor chamber having one end in communication with said chamber and an opposite end open toward a bottom side of said compressor, radially extending partitions disposed angularly spaced on said annular portion, an outer wall defining in conjunction with said angularly spaced partitions angularly spaced muffler chambers disposed circumferentially of said compressor chamber and at least some of which are in communication with each other, a rotary driven crankshaft in said chamber, a piston reciprocably driven in said cylinder from said crankshaft, a motor rotor connected to said crankshaft and rotatably supported in said bearing portion, a stator circumferentially of said rotor having windings extending axially, said other wall having an annular portion defining a collar extending axially in a direction away from said muffler chambers radially spaced outwardly from said compressor chamber for receiving said rotor winding therein, and a valve plate closing said opposite open end of said cylinder.

7. In a refrigeration compressor, in combination, a unitary body casting having a central annular portion defining a compressor chamber, an elongated tubular bearing portion disposed coaxially with said annular portion extending axially therein spaced radially inwardly therefrom defining jointly therewith a crank case, radial ribs fixed to said annular portion holding said bearing portion in fixed position, annular partition means defining a cylinder disposed radially outwardly of said compressor chamber having one end in communication with said chamber and an opposite end open, radially extending partitions disposed angularly spaced, an outer wall defining in conjunction with said angularly spaced partitions angularly spaced muffler chambers disposed circumferentially of said compressor chamber and at least some of which are in communication with each other, a rotary driven crankshaft in said chamber, a piston reciprocably driven in said cylinder from said crankshaft, a motor comprising a rotor connected to crankshaft and rotatably supported in said bearing portion, a stator circumferentially of said rotor having windings extending axially, said other wall having an annular portion defining a collar extending axially in a direction away from said muffler chambers radially spaced outwardly from said compressor chamber for receiving said rotor windings therein, said casting comprising a lower aperture, and said motor having blades adjacent said aperture.

8. For use in a refrigeration compressor, a unitary body casting having a central annular portion defining a compressor chamber, an elongated tubular bearing portion disposed coaxially with said annular portion extending axially therein spaced radially inwardly therefrom defining jointly therewith a crank case, radial ribs fixed to said annular portion holding said bearing portion in fixed position, annular partition means defining a cylinder disposed radially outwardly of said compressor chamber having one end in communication with said chamber and an opposite end open, radially extending partitions disposed angularly spaced on said annular portion, an outer wall defining in conjunction with said angularly spaced partitions angularly spaced chambers comprising muffler chambers in operation disposed circumferentially of said compressor chamber and at least some of which communicate with each other in operation, said compressor chamber being dimensioned to receive a rotary driven crankshaft in said chamber, said cylinder having a bore to receive a piston reciprocably driven in said cylinder from said crankshaft in operation by a motor rotor connected to said crankshaft and rotatably supported in said bearing portion and a stator circumferentially of said rotor having windings extending axially, and said outer wall of said casting having an annular portion defining a collar extending axially in a direction away from said muffler chambers radially spaced outwardly from said compressor chamber for receiving said rotor winding therein.

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