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REFRIGERANT COMPRESSOR WITH SOUND ABSORBING STRUCTURE

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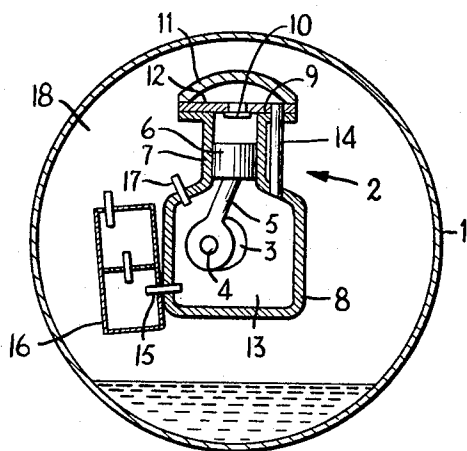


FIG. 1

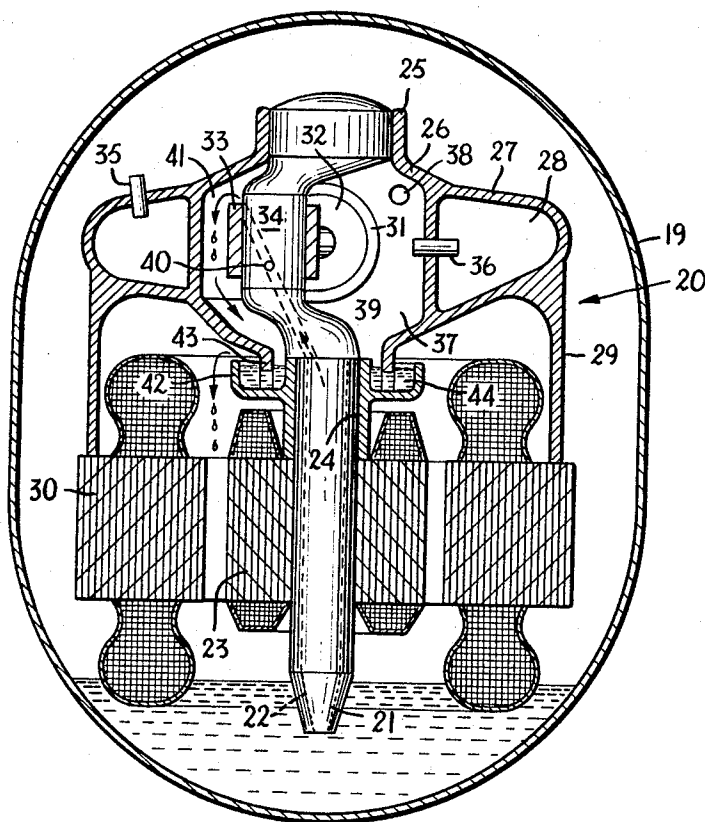


FIG. 2

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REFRIGERANT COMPRESSOR WITH SOUND ABSORBING STRUCTURE

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ABSTRACT OF THE DISCLOSURE

A hermetic refrigerant compressor unit in which the compressor is hermetically enclosed in a capsule which is in communication with the crankcase of the compressor. The crankcase is serially connected with a suction chamber of the compressor upstream or downstream thereof and functions as a sound-absorbing chamber reducing transmission of noise vibrations from the crank and crankpin and suction valves to the interior surfaces of the walls of the hermetic capsule.

The present invention relates generally to a refrigerant motor compressor unit and more particularly to a hermetically sealed motor compressor unit for a refrigerant and having sound absorbing characteristics and structure.

Refrigerant motor compressor units used in household refrigerators, air-conditioning units and the like generally must operate quietly. Therefore, sound-absorbers are placed upstream of the suction valve and downstream of the pressure valve. These sound-absorbers will absorb or dampen the unavoidable noise or sounds caused by valve operation and pressure pulsations on the suction and pressure side of the compressor.

It is a principal object of the present invention to provide an encapsulated or hermetic refrigerant motor compressor unit with sound-absorbing structure capable of eliminating suction noise and compressor noise caused by the crankpin and piston and the various driving links to the piston.

A feature of the invention is the recognition that the bearings, crankpin, piston and connecting rod between the piston and the motor drive of a refrigerant compressor generate noise and provision is made for dampening the noise within a crankcase.

Another feature is the use of the compressor crankcase as a suction-sound-absorbing chamber downstream of other sound-absorbing chambers on the suction side of the compressor in one embodiment and upstream of the suction chamber in another embodiment.

Another feature of the invention is the provision of communication between the suction chamber in the head of a refrigerant compressor and the compressor crankcase so that on the suction stroke of the piston the refrigerant in the crankcase is compressed causing an earlier opening of the suction valve thus tending to load or increase the charge of the compressor on the suction stroke.

Another feature is the provision of a choke opening in the crankcase providing direct communication between the crankcase and the interior of a capsule hermetically sealing the compressor and motor unit. The use of such a choke provides for using the crankshaft housing or crankcase, alone, if need be, as a single suction-sound-absorbing chamber of a simplified embodiment of the invention.

Still another feature of the invention is the provision of an oil seal in conjunction with other seal means so that a crankcase of a compressor is completely sealed and communication to the exterior thereof can only be through sound-absorbing structure provided in the compressor.

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Other features and advantages of the motor compressor unit, in accordance with the present invention, will be better understood and described in the following specification and appended claims, in conjunction with the following drawings in which:

FIG. 1 is a diagrammatic vertical section view of a hermetically sealed refrigerant motor compressor unit provided with sound-absorbing structure in accordance with the invention; and

FIG. 2 is a diagrammatic vertical section view of a second refrigerant motor compressor unit provided with sound-absorbing structure in accordance with the invention.

As illustrated in FIG. 1, a capsule 1 hermetically encloses a refrigerant motor compressor unit 2 in which a drive or crankshaft 3 driven by a motor, not shown, is connected by a crankpin 4 to a connecting rod 5 reciprocally driving a piston 6 in a cylinder 7 integral with a crank housing or crankcase 8.

The compressor is provided with a valve plate 9 in which is disposed a suction valve 10 operable under control of the piston for providing communication, during suction to a head 11 suction chamber 12. It will be understood that the compressor head 11 is provided with a pressure chamber, not shown, and is provided with a pressure valve, not shown, in the valve plate 9 in known manner.

The interior 13 of the crank chamber 8 is connected or in communication with the suction valve chamber 12 through a tube 14. A choke tube 15 provides communication between the interior of a two-compartment sound-absorbing chamber 16 having the compartments serially connected through a tube as illustrated and disposed serially in communication between the interior of the crankcase and the interior of the capsule. Another choke 17 provides direct communication between the interior of the crankcase and the interior 18 of the capsule.

The sound or noise generated in the crank chamber is dampened by the above structure as well as the sound in the suction valve chamber. Before noise waves or vibrations reach the interior of the capsule 18 they have been considerably dampened so that minimum noise is transmitted through the capsule walls.

It will be understood that since the suction chamber and crankcase are in communication through the tube 14 on a compression stroke of the piston gas refrigerant is sucked in from the suction chamber into the crankcase or housing and on the suction or downward stroke this gas is compressed and assists in charging the cylinder through the tube 14. The choke resistance of the suction-sound-absorber 16 and the choke tube 17 are substantially greater than the choke resistance of the tube 14. The tube 17 is of a very small dimension, the cross section area of this tube is less than the cross section area of tube 14. The muffler or suction sound-absorber 16 has, due to its chambers and tubes, a quite larger resistance for pulsation than the tube 14 as this chamber contains three tubes, each of them having an inlet-resistance, a friction and an outlet-resistance. The cross section area of each of these three tubes is less than the cross section area of tube 14.

A second embodiment of a compressor making use of a crankcase as part of the sound-absorbing structure of the compressor is illustrated diagrammatically in FIG. 2. In this embodiment a hermetic capsule 19 hermetically encloses a refrigerant motor compressor unit 20 having a vertical motor shaft 21 which is hollow and is provided with a bore 22 which is tapered or conical at a lower end thereof as illustrated and is immersed in lubricating oil for lubricating the unit as hereinafter described.

A rotor 23 of an electrical drive motor is mounted on the shaft 21 and supported on a bearing 24. The bearing

24 and a second bearing 25 enclose a crankcase or chamber 26 as hereinafter described. The bearings 24, 25 as well as the crank chamber 26 are integral with a casing support portion 27 defining a sound-absorbing chamber 28 and has a downwardly extending skirt 29 enclosing the upper part of a motor stator 30 of the electrical motor of the unit. The casing is provided with a cylinder 31 in which a piston 32 is reciprocally driven by a connecting rod 33 and a crankpin 34 connected to a crank and crankshaft, not shown, driven from the motor.

In the instant case, the supply refrigerant is in the interior of the capsule and suction gas refrigerant is taken into the compressor through a choke tube 35 which provides communication with the suction-sound-absorbing chamber 28 and through a choke tube 36 into the interior 37 of the crankcase or chamber and from there through a channel or passageway 38 to the suction valve chamber, not shown, of the compressor. Thus, it can be seen that in this embodiment the crankcase interior is upstream of the suction chamber and functions as a suction-sound-absorbing chamber in conjunction with the chamber 28 which is disposed circumferentially of the crankcase.

Lubricating oil is picked up by centrifugal force of the conical end of the shaft 21 and is transported upwardly into a passageway 39 in communication with other passageways, for example passageway 40, which distribute oil to the wearing parts of the compressor. Any excess lubricating oil not entering the transfer passageways leaves the compressor at a passageway 41. This oil is gathered into a ring-shaped flange 42 on the bearing 24 into which extends a ring-shaped fillet 43. The flange extends upwardly sufficiently so that the oil level before spilling into the bottom or sump of the capsule immerses the fillet 43 of the housing therefore defining an oil seal 44 sealing the interior 37 of the crank chamber so that it is completely sealed from the interior of the capsule and communication with the capsule is only through the sound-absorbing structure heretofore described.

The oil seal 44 allows oil to spill over the flange 42 and the oil drops on the windings of the motor and cools the motor. Thus, the oil seal provides an excellent and simple sound barrier or seal. Those skilled in the art will understand that radial ribs may be provided extending outwardly from the fillet 43 integrally with the flange 42 so that the entire housing of the unit can be made as a single integral or one-piece structure.

While preferred embodiments of the invention have been shown and described, it will be understood that many modifications and changes can be made within the true spirit and scope of the invention.

What I claim and desire to secure by Letters Patent is:

1. In a hermetic refrigerant motor compressor unit comprising, a hermetic capsule, a refrigerant compressor in said capsule having means defining a cylinder, a piston reciprocally driven in said cylinder for compressing a refrigerant in said cylinder, a motor driving said piston, means comprising a crankshaft connecting said motor to said piston for driving said piston from said motor,

said compressor having means defining a crankcase in which said crankshaft is disposed, the improvement which comprises sound-absorbing means comprising means defining a refrigerant suction chamber from which said piston takes a suction during operation, a choke tube placing the interior of said capsule in communication with the interior of said crankcase, said suction chamber being disposed in the head of said compressor, a suction valve for cyclically placing said suction chamber in communication with said cylinder under control of said piston, and means defining a passageway continuously open between said crankcase and said suction chamber, whereby said crankcase functions as a suction sound-absorbing chamber.

2. In a refrigerant motor compressor unit according to claim 1, including means defining two noise-absorbing chambers, a choke tube providing communication between said chambers, and choke tubes providing communication between the interior of said capsule, said chambers and said crankcase with said chambers connected serially between the interior of said capsule and the interior of said crankcase.

3. In a refrigerant motor compressor unit according to claim 1, including means defining a suction-sound-absorbing chamber integral with said crankcase, choke tubes providing communication between the interior of said crankcase and the interior of said capsule with said chamber serially between said capsule and said crankcase and disposed upstream of said crankcase, and said cylinder and piston being arranged for said piston to take a suction from the interior of said crankcase.

4. In a refrigerant motor compressor unit according to claim 3, seal means completely sealing said crankcase from communication with said capsule other than through said suction-sound-absorbing chamber.

5. In a refrigerant motor compressor unit according to claim 4, in which said unit comprises a hollow motor shaft vertically disposed, said capsule having lubricating oil in the bottom thereof from which said hollow shaft takes a suction, passageways in communication with said shaft for distributing lubricating oil to wearing parts of said unit, means cooperative with said means defining said crankcase entrapping oil therein dripping from said unit to effect an oil seal comprising a part of said seal means, whereby said crankcase communicates with the interior of said capsule only serially with said chamber.

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