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OIL PUMP FOR ENCLOSED MOTOR-COMPRESSOR, ESPECIALLY FOR SMALL REFRIGERATING MACHINES

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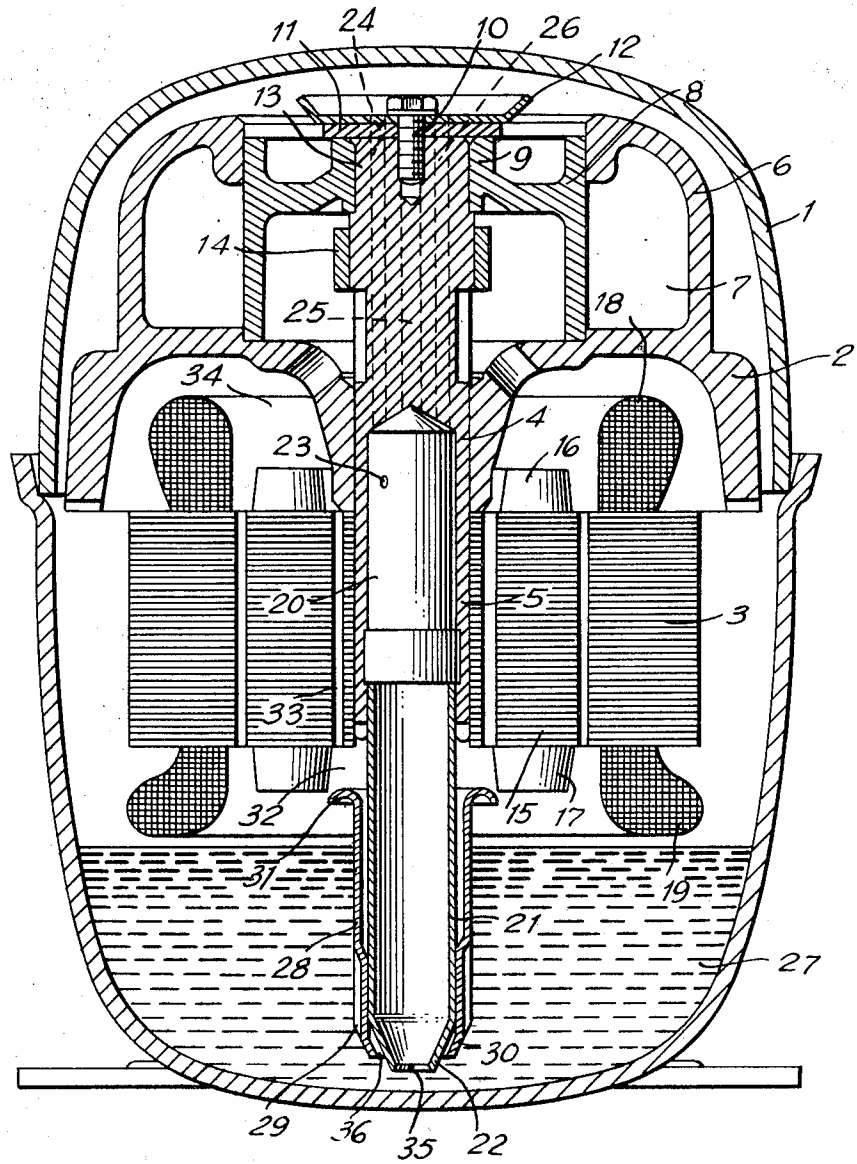

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OIL PUMP FOR ENCLOSED MOTOR-COMPRESSOR, ESPECIALLY FOR SMALL REFRIGERATING MACHINES

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ABSTRACT OF THE DISCLOSURE

An encapsulated refrigeration motor-compressor hermetically sealed in a capsule and in which the motor has a vertically disposed hollow motor shaft to which is attached a length of tubing in communication with the bore of the shaft defining a first centrifugal oil pump. A second length of tubing is mounted circumferentially and axially of the first-mentioned length of tubing spaced outwardly therefrom defining a second centrifugal oil pump driven in conjunction with the first pump from the common motor shaft.

This invention relates generally to hermetic motor-compressor units and particularly to a new and improved oil pump for small refrigeration motor-compressor units.

Motor-compressor units, for example refrigeration compressors, are known in which the motor shaft has an axial bore and is mounted vertically. A centrifugal pump is mounted on the vertical shaft constructed as a tubular element extending downwardly into the oil in an oil sump formed within the hermetic capsule. These pumps are simple to construct and have given excellent service in operation; however, their oil output capacity is generally too small.

It is an object of the present invention to provide an improved centrifugal pump for motor-compressor units of the type above described which is simply constructed, has a greater output capacity than the known similarly constructed centrifugal pumps.

In a motor-compressor unit according to the invention, the motor shaft is disposed vertically within a capsule and has an axial bore through which oil is delivered to the unit from a first centrifugal pump defined by a first length of tubing connected to the shaft for rotation therewith. This first length of tubing is mounted as an extension of the shaft and its bore in communication therewith for taking an oil suction from the oil sump. A second length of tubing is fixed on the first length of tubing disposed outwardly and circumferentially thereof extending axially of the first length of tube and spaced therefrom defining a second pump suction.

The second length of tubing is mounted on the first length of tubing by radially inwardly extending depressions defining projections extending into the second length of tubing and bearing against the outer periphery of the first length of tubing for fixing the second pump on the first centrifugal pump.

Since the second length of tubing has a greater inner diameter than the first length of tubing, it produces a greater centrifugal force when driven by the motor shaft common to both sumps so that a large volume of oil is delivered through the inner or first length of tubing and a large volume is delivered outwardly thereof in the space formed between the two tubes. The two oil flows can therefore be either combined or maintained separately for lubricating specific bearings or portions of the unit

independently of each other. Moreover, one stream can be used for lubrication and the other flow can be used for cooling the unit.

The second length of tubing has an outwardly flaring collar at the top thereof whereby it bears against a short-circuiting ring of the motor-rotor thereby defining a fluid-tight annular chamber between the collar and the short-circuiting ring. This chamber is in communication with the space between the two tubes and is in communication with axially extending passages which extend upwardly in or on the rotor so that the axial bore in the motor shaft is available for usual cooling and lubricating purposes while oil supplied through the above-mentioned rotor passages can be used for cooling the motor itself.

In a preferred embodiment, oil from the second centrifugal pump is used for cooling the coil ends of the motor while bearing lubrication takes place by the oil flow through the axial bore of the motor shaft. In this way, a fairly large quantity of oil is available for delivery over the motor coils so that the motor heat is dissipated without the oil undergoing any great increase in temperature.

Preferably, the inner or first length of tubing has a conical lower end portion or element extending downwardly into the oil sump a greater length beyond a lower conical end portion or element of the second or outer length of tubing defined in the second centrifugal pump. In this way suction through the first length of tubing is not interfered with by the outer second length of tubing. Nevertheless, the output capacity of the second pump is not adversely affected since, as a result of its greater diameter, it generates a greater effective centrifugal force than the inner pump and the outer surfaces of the lower conical end portion of the first length of tubing or inner pump delivers oil into the space or chamber between the two lengths of tubings.

Other features and advantages of the motor-compressor unit and oil pump in accordance with the present invention will be better understood as described in the following specification and appended claims, in conjunction with the following drawing in which the single figure is an axial section of a hermetically sealed motor-compressor unit constituting a small refrigeration compressor.

As illustrated in the drawing, a motor-compressor unit according to the invention comprises a hermetic capsule **1** in which is resiliently suspended, by a suspension system not shown, a refrigeration machine constituting a compressor having a downwardly extending portion **2** which supports a stator **3** of an electric drive motor and defines a bearing **4** for a shaft **5** of the motor. Upward extensions **6** on the motor support **2** form noise-reducing or absorbing chambers **7** of the compressor and a cylinder having an axis perpendicular to the plane of the drawing. An insert member **8**, inserted into a central space defined by the extensions **6**, seals or closes off the noise-reducing chambers **7** and forms or defines a second bearing **9** for the motor shaft. A support plate **11** supports the shaft vertically and a centrifuging disc **12** fixed to the rotatably driven shaft by a bolt **10**, as illustrated.

The shaft **5** carries on a crank **13** a crank bearing **14** to which is connected a connecting rod of a compressor piston, not shown. The motor has a rotor **15** mounted on the shaft **5**. This rotor is provided with an upper short-circuiting ring **16** and a lower short-circuiting ring **17**. The motor stator **3** has upper coil ends **18** extending axially upwardly of the rotor and lower coil ends **19** extending and projecting axially downwardly of the rotor.

The motor shaft **5** has an axial bore **20** into which a first length of tubing **21** is inserted axially. This tubing extends axially downwardly and provides communication between it and the bore of the shaft. The tube is provided with a hollow conical element or lower end portion **22**

and is rotationally driven with the shaft **5** to function as a centrifugal oil pump. A transverse opening or passage **23** extends from the shaft bore **20** for lubricating the bearing **4** and three parallel axial passages or bores of reduced diameter **24**, **25** and **26** extend axially upwardly from the main axial bore and terminate within the centrifuging disc **12**, as illustrated in the drawing. A branch passage, not shown, for lubricating the crank bearing **14** extends from the bore **24** and another branch lubricating passage, not shown, for applying lubricating oil to the bearing **19** is in communication with the bore **26**. Surplus oil not entering the branch passages passes upwardly to the inside of the centrifuging disc **12** and is flung onto the inner wall of the capsule **1** over which it flows back into an oil sump **27** and is cooled in so doing.

According to the invention, a second length of tubing **28** is mounted on the first length of tubing **21** outwardly thereof and spaced therefrom extending axially of the inner or first length of tubing. The outer tubing is provided with a number of circumferentially spaced axially extending depressions **29** which extend radially inwardly defining inwardly-extending projections parallel with the axis of the two tubes to function as spacing elements and mounting the second length of tubing onto the inner or first length of tubing **21**.

This outer length of tubing is provided at the lower end thereof with a hollow conical element or lower end portion **30** which terminates in an opening **36** disposed axially spaced upwardly of an opening **35** of the hollow conical element **22**. The hollow conical element **30** functions as a second centrifugal pump to deliver oil upwardly by way of centrifugal action and delivers oil in the space formed between the two tubes.

The second length of tubing **28** is provided with an outwardly extending collar **31** at the upper end thereof by which the tube contacts the lower short-circuiting ring **17** of the motor and defines an annular chamber **32** into which oil is delivered. This annular chamber is in communication with circumferentially disposed and axially extending passages **33** which extend upwardly through the rotor **15** and terminate in a chamber **34** defined by the upper end of a stator coil. The oil entering this chamber is flung outwardly by the upper short-circuiting ring **16** and strikes the upper coil ends **18** and thereby cools them and flows back into the sump **27**.

Since the lower opening **35** of the hollow conical element **22** is positioned below the annular opening **36** of the outer hollow conical element **30**, the inner pump hollow conical element **22** is capable of delivering oil into its centrifugal pump without interference from the outer conical element.

Those skilled in the art will understand that the embodiment of the invention illustrated can be modified in a number of ways without departing from the basic concepts of the invention. For example, the passages **33** can be used for lubricating the bearing **14**. Moreover, the second length of tubing **28** can be secured to the short-circuiting ring, to the stator or to the shaft **5** and simply centered around the first length of tubing **21**. Furthermore, the outer hollow conical element **30** can, of course, extend downwardly just as far as the inner hollow conical element **22** and, if required, may extend downwardly beyond the inner element.

While a preferred embodiment of the invention has 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 we claim and desire to secure by Letters Patent is:

1. In a motor-compressor unit having an oil sump and a vertically disposed driven shaft having an axial bore, a centrifugal oil pump comprising a first length of tubing connected to said shaft as an extension of said shaft in communication with said bore and rotationally driven therewith for taking an oil suction from said oil sump, a second length of tubing fixed relative to said first length of tubing disposed circumferentially and axially of said first length of tubing and spaced therefrom defining a second pump suction, a hermetic capsule enclosing said motor-compressor hermetically and defining said oil sump, and means on said second length of tubing mounting said second length of tubing on said first length of tubing and comprising inwardly projecting projections extending axially on said second length of tubing circumferentially spaced thereon bearing against said first length of tubing fixing said second length of tubing thereon.

2. In a motor-compressor unit according to claim **1**, in which said projections comprise axial depressions on said second length of tubing extending radially inwardly.

3. In a motor-compressor unit according to claim **1**, in which motor-compressor unit comprises an electric motor having a rotor circumferentially of said shaft and fixed thereto, said second length of tubing having an upper end having a collar thereon extending outwardly and disposed engaging said rotor defining jointly therewith an annular chamber in communication with said second length of tubing.

4. In a motor-compressor unit according to claim **3**, in which rotor comprises a lower short-circuiting ring, and in which said collar of said second length of tubing bears against an underside of said short-circuiting ring.

5. In a motor-compressor unit according to claim **3**, in which said rotor defines axially extending oil flow paths in communication with said chamber for allowing oil flow through said rotor, and a stator circumferentially of said rotor cooled by oil flowing through said flow paths.

6. In a motor-compressor unit having an oil sump and a vertically disposed motor shaft for driving the compressor of said unit, said shaft having an axial bore, a first centrifugal pump comprising a first tube connected to said shaft in communication with said bore, said first inner tube having a lower end conical portion disposed in said oil sump for taking a suction therefrom for delivering oil into said axial bore for distribution therefrom, and a second centrifugal pump comprising a second outer tube disposed circumferentially outwardly of said inner tube and extending axially thereof and spaced outwardly therefrom, said outer tube having a lower end conical portion disposed in said oil sump for taking an oil suction from said sump and delivering oil in a space defined between the inner and outer tubes, and means in communication with said space for distribution of oil therefrom for cooling.

7. In a motor-compressor unit according to claim **6**, in which each of said conical portions has an opening, and in which the openings of said conical portions are axially spaced from each other.

8. In a motor-compressor unit according to claim **7**, in which the inner conical portion is disposed lower in said sump and extends outwardly of the opening of said outer conical portion.

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