

SUSPENSION SPRING FOR HERMETIC COMPRESSOR AND HERMETIC COMPRESSOR HAVING SAME

Field of the Invention

The present invention relates to hermetic compressors in general and more
5 particularly to a suspension spring for a hermetic compressor and a hermetic
compressor having the same.

Background of the Invention

Suspension springs are provided in hermetic compressors to dampen
vibrations generated during use.

10 During abnormal operation, a compressor assembly in a hermetic
compressor may vibrate so vigorously that the compressor assembly becomes
displaced from a suspension spring, causing the hermetic compressor to fail.

It is therefore desirable to provide a suspension spring that is able to engage
more securely to a compressor assembly in a hermetic compressor.

15 Summary of the Invention

Accordingly, in a first aspect, the present invention provides a suspension
spring for a hermetic compressor. The suspension spring includes a series of coils.
In an unassembled state, at least a portion of a first coil in the series of coils is at a
greater angle of inclination relative to a transverse plane of the suspension spring
20 than successive coils in the series of coils.

In a second aspect, the present invention provides a hermetic compressor
including a motor, a pump assembly coupled to the motor, and a housing in which
the motor and the pump assembly are received. A suspension spring in accordance
with the first aspect is disposed between the motor and the housing.

Other aspects and advantages of the invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

Brief Description of the Drawings

5 Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

FIG. 1 is a perspective view of a suspension spring in accordance with an embodiment of the present invention in an unassembled state;

FIG. 2 is a cutaway view of a hermetic compressor employing the suspension
10 spring of FIG. 1;

FIG. 3 is a perspective view of the suspension spring of FIG. 1 in both an assembled state and an unassembled state; and

FIG. 4 is an enlarged cross-sectional view of the suspension spring of FIG. 1 in an assembled state.

15 Detailed Description of Exemplary Embodiments

The detailed description set forth below is intended as a description of presently preferred embodiments of the invention, and is not intended to represent the only forms in which the present invention may be practiced. It is to be understood that the same or equivalent functions may be accomplished by different
20 embodiments that are intended to be encompassed within the scope of the invention.

Referring now to FIG. 1, a suspension spring 10 for a hermetic compressor (not shown) in an unassembled state is shown. The suspension spring 10 includes a series of coils 12. As can be seen from FIG. 1, at least a portion of a first coil 12a
25 in the series of coils 12 is at a greater angle of inclination relative to a transverse or

horizontal plane 14 of the suspension spring 10 than successive coils 12b in the series of coils 12.

The suspension spring 10 may be made of an elastic material such as, for example, steel.

5 The series of coils 12 may define any shape, such as, for example, a conical shape or a cylindrical shape. In the present embodiment, the series of coils 12 defines a conical shape to match a conical shape of a bolt head over which the suspension spring 10 is to be received. Advantageously, the conical shape of the suspension spring 10 makes it difficult for the suspension spring 10 to slip off the
10 bolt head.

Because the at least a portion of a first coil 12a in the series of coils 12 is at a greater angle of inclination relative to the transverse or horizontal plane 14 of the suspension spring 10 than successive coils 12b in the series of coils 12 and by having the at least a portion of a first coil 12a in the series of coils 12 inclined at an
15 angle before assembly, a spring force is provided when tightening a bolt to a a compressor assembly. This allows the suspension spring 10 to engage more securely to a compressor assembly (not shown) in a hermetic compressor (not shown) and solves the problem of bolt loosening.

In the unassembled state, the at least a portion of the first coil 12a in the
20 series of coils 12 may be at an angle of inclination A of between about 20 degrees ($^{\circ}$) and about 80° with respect to a longitudinal axis 16 of the suspension spring 10.

The at least a portion of the first coil 12a in the series of coils 12 may define a circumference that is smaller than that of a bolt head (not shown) over which the suspension spring 10 is to be received. Advantageously, this helps prevent the
25 suspension spring 10 from slipping off the bolt head during vibrations and consequently becoming separated from the bolt head as a result.

A diameter of the first coil 12a in the series of coils 12 may be smaller than that of the successive coils 12b in the series of coils 12.

Referring now to FIG. 2, a hermetic compressor 50 employing the suspension spring 10 of FIG. 1 is shown. The hermetic compressor 50 includes a
5 motor 52, a pump assembly 54 coupled to the motor 52, and a housing or shell 56 (partially shown) in which the motor 52 and the pump assembly 54 are received. The suspension spring 10 is disposed between the motor 52 and the housing 56.

Together the motor 52 and the pump assembly 54 form a compressor assembly. The motor 52 includes a crankshaft and the pump assembly 54 includes
10 a connecting rod, a piston and a cylinder head. The connecting rod is coupled to both the crankshaft of the motor 52 and the piston of the pump assembly 54 which is housed inside the cylinder head. The suspension spring 10 is disposed between the compressor assembly and the housing 56.

During operation, the crankshaft of the motor 52 rotates at a predetermined
15 speed. This rotary motion is translated into a linear reciprocating motion via the connecting rod coupled to the piston. Vibrations are generated by the rotary motion of the motor 52 and also by the reciprocating motion of the connecting rod and the piston of the pump assembly 54.

As hermetically sealed reciprocating compressors are well known in the art, a
20 detailed explanation of the workings of the hermetic compressor 50 is not required for a complete understanding of the present invention.

Referring now to FIGS. 3 and 4, the suspension spring 10 is shown in an assembled state. As can be seen from FIG. 3, the suspension spring 10 has a first end that is coupled to a stator bolt 58 and a second end that is received over a
25 snubber 60 provided at a base of the housing 56.

In the embodiment shown, the at least a portion of the first coil 12a in the series of coils 12 is received in a space between a bolt head 62 of the stator bolt 58

and a stator 64 of the motor 52. As can be seen from FIG. 4, the at least a portion of the first coil 12a in the series of coils 12 in the present embodiment defines a circumference that is smaller than that of the bolt head 62 over which the suspension spring 10 is received. Expressed differently, a diameter of the uppermost coil 12a is smaller than a diameter of the bolt head 62 such that the uppermost coil 12a is disposed between the bolt head 62 and the compressor assembly. More particularly, when the diameter of the first coil 12a is smaller than the bolt head 62 and the stator bolt 58 goes through the first coil 12a, the bolt head 62 rests on and is adjacent to the first coil 12A. Advantageously, this helps prevent the suspension spring 10 from slipping off the bolt head 62 during vibrations and consequently becoming separated from the bolt head 62 as a result. This helps improve the reliability of the hermetic compressor 50.

The inclined uppermost coil 12a provides a spring force when tightening the stator bolt 58 to the compressor assembly. More particularly, when tightening, the uppermost coil 12a is tightened between the compressor assembly and the bolt head 62. This inclination acts like a spring force when tightening. Hence, the stator bolt 58 and the compressor assembly will be tightened tightly.

As can be seen also from FIGS. 3 and 4, a diameter of the first coil 12a in the series of coils 12 in the present embodiment is smaller than that of the successive coils 12b in the series of coils 12

As is evident from the foregoing discussion, the present invention provides a suspension spring that is able to engage more securely to a compressor assembly in a hermetic compressor and this improves the reliability of the hermetic compressor over prolonged operation. The present invention also provides a hermetic compressor employing the suspension spring.

While preferred embodiments of the invention have been described, it will be clear that the invention is not limited to the described embodiments only. Numerous modifications, changes, variations, substitutions and equivalents will be apparent to

those skilled in the art without departing from the scope of the invention as described in the claims.

Further, unless the context clearly requires otherwise, throughout the description and the claims, the words "comprise", "comprising" and the like are to be
5 construed in an inclusive as opposed to an exclusive or exhaustive sense; that is to say, in the sense of "including, but not limited to".

CLAIMS

1. A hermetic compressor, comprising:
a motor;
5 a pump assembly coupled to the motor;
a housing in which the motor and the pump assembly are received; and
a suspension spring, comprising:
a series of coils, wherein in an unassembled state, at least a portion of a first
coil in the series of coils is at a greater angle of inclination relative to a transverse
10 plane of the suspension spring than successive coils in the series of coils,
wherein the at least a portion of the first coil in the series of coils is received
in a space between a bolt head of a stator bolt and a stator of the motor and the at
least a portion of the first coil in the series defines a circumference that is smaller
than that of the bolt head of the stator bolt such that the at least a portion of the first
15 coil is held between the bolt head and the stator.
2. The hermetic compressor of claim 1, wherein in the unassembled state, the
at least a portion of the first coil in the series of coils is at an angle of inclination of
between 20 degrees (°) and 80° with respect to a longitudinal axis of the suspension
20 spring.
3. The hermetic compressor of any one of the preceding claims, wherein a
diameter of the first coil in the series of coils is smaller than that of the successive
coils in the series of coils.
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4. The hermetic compressor of any one of the preceding claims, wherein the
series of coils defines a conical shape.
5. The hermetic compressor of any one of the preceding claims, wherein the
30 series of coils defines a cylindrical shape.