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VIA ELECTRONIC FILING

Attn: Ms. Jennie Ong Bee Lian

Dear Sirs

Singapore Patent Application No. 201102480-9
MOUNTING ARRANGEMENT FOR AN OIL PUMP IN A REFRIGERATION COMPRESSOR
Whirlpool S.A.

We refer to the Written Opinion issued with the letter of 30 May 2012. We enclose the following amendments:

1) Replacement Pages 20 to 22 to replace original pages 20 to 24.

The Examiner is of the opinion that original claims 1-6 lack novelty and original claims 1-7, 9-13, and 15-18 lack inventiveness in view of the cited documents:

D1: EP 16050163A; and
D2: WO 00/01949A.

The claims have been amended to better define the invention.

The new independent claims 1 and 13 are now directed to "a refrigeration compressor" to overcome the objections in Box VI of the Written Opinion. Further, in original claims 7-9 and 13-15, the objected term "telescopically" has been cancelled in the new claims to overcome the unclearness objection in Box VI of the Written Opinion.

Claim 1 has been re-arranged such that the feature "and a lower portion around which a lower end portion of the pump body is axially retained and slidably mounted, according to a direction orthogonal and coplanar to the rotation axis of the rotor...", appears earlier in the claim.

Further, in new claim 1, the term "articulated" (of the upper portion of the fixation rod, to one of the parts of cylinder block and stator) has been replaced by "mounted". Support for the

use of "mounted" can be found e.g. in the specification, page 11, lines 24/25 ("... being mounted in respective bearings carried by one of the parts of ...") or on page 12, lines 29/30 ("... each articulation shaft portion 41c is mounted in a respective cradle 7a").

In addition, new claim 1 now further defines, inter alia, "wherein the upper portion of the fixation rod is mounted to one of the parts of cylinder block and stator in a manner that allows rotation movement of the fixation rod around an articulation axis ...", support for which may be found in e.g. original claim 1 by use of the word "articulated" which implies the ability of allowing a rotational movement around an articulation axis. Moreover, reference is also made to the specification, e. g. page 12, lines 30-34 ("... mounted ... so as to present a rotation movement around its mounting axis ... This rotation movement causes an oscillating movement of the fixation rod, as indicated in said figure 5 by a pair of lower arrows in opposite directions"), or to the specification, page 13, lines 22 ff. ("However, the fixation of said fixation rod to the part that carries it should be effected by fixation means which allow the fixation rod to rotate around an axis ...").

As far as new claim 13 is concerned, the order in which the features appear in the claim have been rearranged. All features of new claim 13 have previously been included in original claim 13.

The language of the new dependent claims 2-12 and 14-18 remained unchanged, with the exception of being now directed to a "refrigeration compressor" instead of an "arrangement" as originally filed, and the term "telescopically" cancelled in claims 7-9, 14 and 15.

As the Examiner has fully understood the claims, reference numerals are not included in the amended claim set, given that there are no requirements in Singapore for such numerals.

The applicant turns now to the Examiner's objections.

New independent claim 1 defines, inter alia, "the upper portion of the fixation rod is mounted to the rotor wherein the upper portion of the fixation rod is mounted to one of the parts of cylinder block and stator in a manner that allows rotational movement of the fixation rod around an articulation axis...".

D1 discloses a refrigeration compressor in which a rod (as a supporting member), such as an iron spring wire (see D1 col. 12, lines 6 to 10), has its ends fixed to the stator of the motor (see D1, col. 5, lines 55/56: "Both ends of the supporting member ...are fixed to the ... stator") and slidingly carrying, in a medium portion, a pump body (see D1, col. 5, line 56, to col. 6, line 1). In stark contrast to the feature of new claim 1 cited above, the fixed mounting of the ends of the rod in D1 does not allow said rod an angular movement around an axis including the ends of the rod. As a result, in this compressor of D1, the rod is to be made in an elastic material, as a thin wire, able to be deformed in order to correct oscillations in pump displacement (see e. g. D1, col. 5, line 53-55: "Supporting member 31, 32 ... is made from elastic material such as iron spring wire"). Thus, the motor of D1 does not act as a journal bearing for allowing freedom degrees of angular movements for the rod.

There is thus no teaching or any suggestion in D1 of a rod being mounted by its upper ends in a manner that allows a rotational movement of the rod around an axis including the ends, in order to provide different degrees of freedom to the rod. As claimed, the motor of the compressor of new claim 1, however, acts as a journal bearing of the rod, allowing an

articulation of the rod around an axis including its end portions.

The design known from D1 clearly differs from the construction of new claim 1 according to which the ends of the rod are rotatively supported to the motor. It is clear in document D1 that the rod should be a wire of elastically deformable material fixed to the stator. The movements of the pump are obtained with the elastic deformation of the rod and not by an articulated mounting of the rod to the motor, as in the case of new claim 1, thus, said prior art mounting is rigid. The elasticity in D1 is obtained only by the material constitution and by the geometrical characteristics of the rod construction and not by the mounting of the rod to the stator. This is the reason by which the specification and the claims of said prior art document D1 emphasize the feature of the wire as being of an elastic material (see D1, e.g. col. 5, lines 53/54: "Supporting member... is ... made from elastic material such as iron spring wire").

Thus, the applicant respectfully submits that new claim 1 is different and novel over D1.

Similarly, D2 discloses a refrigeration compressor arrangement in which a rod carrying a pump body has its ends fixed to the stator (see D2, claim 3: "... whose side arms ... are anchored to the stator of the electric motor"). In D2, the rod is also constructed (like D1) in order to allow its vibration through elastic deformation, damping and accommodating movements of the pump body.

However, in D2, rotational movements are not compensated, which allows forces/efforts acting over the rod, during the operation of the compressor. Since the rod of D2 is not articulated to the motor, the rod's fixations do not have different degrees of freedom. Thus, D2 does not teach or suggest "the upper portion of the fixation rod is mounted to the rotor wherein the upper portion of the fixation rod is mounted to one of the parts of cylinder block and stator in a manner that allows rotational movement of the fixation rod around an articulation axis...", as defined in new independent claim 1.

The applicant therefore submits that new claim 1 is also different and novel over D2.

In essence, neither D1 nor D2 describe an upper portion of the fixation rod being mounted to one of the parts of cylinder block or stator in a manner that allows rotational movement of the fixation rod around an articulation axis which is orthogonal and coplanar to the rotation axis of the rotor. Instead, both D1 and D2 use a fixation rod, the ends of which are fixedly mounted to the cylinder block or stator. Therefore, the applicant respectfully submits new claim 1 is novel over the cited prior art.

Next, it will be appreciated by a person skilled in the relevant art that both solutions according to D1 and D2 require a great precision for the pump body construction. In addition, a high flexibility of the rod is required, and is defined by its material and by its constructive shape.

The subject matter of new claim 1 can provide a refrigeration compressor arrangement allowing the pump body of the oil pump carried by the rod to be concentrically mounted inside the tubular sleeve of the oil pump, with freedom to move in a radial direction orthogonal to the crankshaft, with a rotatively locking in relation to the pump rotor and without allowing generation of undesirable noises during operation of the compressor at high rotation speeds by intermittent contacts between the pump body and the supporting or fixation rod. The concentric mounting of the claimed solution also minimizes problems regarding wear. The concentric mounting can also reduce the energy consumption of the parts of the oil pump, due to loss of concentricity and friction between those parts.

Thus, in the compressor according to new claim 1, there can be an increase of the freedom degrees for the movement of the pump body, with a reinforced rod construction. There is no requirement for precise mounting of the pump components, since the great degree of freedom allows the self adjustment of the positioning between the pump body and the sleeve. This increase of freedom of degrees for the movement of the pump body can also advantageously produce lower noise at high rotation speeds when compared with the solutions according to D1 and/or D2.

Further, in contrast with the solutions of D1 and/or D2, the example embodiments of the present application, advantageously, do not require a construction with high precision, as the example embodiments of the present application can be easily mounted and can further allow cost reductions and easy construction. As discussed, D1 and D2 disclose only solutions in which the supporting member (fixation rod) is mounted such that both ends of the supporting member are rigidly fixed to the stator of the motor and allow only a certain angular movement of the pump body around the geometric axis of the pump. Since the pump body (of D1 or D2) is not free to be totally displaced in directions orthogonal to the crankshaft axis, as a function of the rigid fixation of the rod to the motor, the pump body cannot compensate construction or mounting misalignments in order to keep the geometric axis of the pump body parallel to the geometric axis of the tubular sleeve.

In essence, in contrast to the solutions of D1 and/or D2, the subject matter of new claim 1 does not provide for a rigid fixation of the ends of the fixation rod to the stator or motor, but, instead, for a mounting arrangement in which the ends of the rod are articulated to the motor or stator. Both citations D1 and D2 completely fail to disclose or even suggest a concept of using the motor as a journal bearing for the fixation rod, and, by this way, to provide for a freedom to the pump body to move in radial directions orthogonal to the crankshaft and, thereby, minimizing the problems regarding wear and regarding increase in energy consumption of the parts of the oil pump.

Thus, because the constructive concept realized by the subject matter of new claim 1, is very different from the constructive concepts reflected by both cited references D1 and D2, the applicant respectfully submits that the refrigeration compressor according to new claim 1, cannot be considered obvious to a person skilled in the relevant art and new claim 1 therefore involves an inventive step over the cited prior art.

Consequently, based on at least the reasons presented above, new claim 1 is novel and involves an inventive step, and is therefore patentable over the cited art.

With regard to new claim 13, new claim 13 defines, inter alia, "a tubular connector mounting and retaining the tubular sleeve in one of the parts of rotor and crankshaft, wherein the tubular connector is a metallic connector...". D1 does not disclose a refrigeration compressor arrangement in which the tubular sleeve, surrounding the pump body, is mounted and retained in one of the parts of rotor and crankshaft by means of an additional tubular connector.

Since D1 is silent on such use of an additional tubular connector for the mounting and retaining of the tubular sleeve in one of the parts of rotor and crankshaft, therefore the subject matter of new claim 13, which is directed to such tubular connector and to its interference with the design of the tubular sleeve, is not only different thereto, but also cannot be regarded obvious thereover.

With regard to D2, it is mentioned that the sleeve (34) and the fluted member (36) should

be made from plastic material (see D2, page 5, lines 4/5), since plastic material has a lower heat conductivity than the metal material used for the hollow shaft 20 itself (see D2, page 5, lines 5/6). The mounting of the tubular connector 40 in D2 is obtained with a press-fitting of the connector into the shaft 20 (see D2, page 6, lines 9-14). From these details, a person skilled in the relevant art would understand that the connector in D2 should also be made of plastic material, in order to largely eliminate the problems associated to the mutual thermal expansion between the sleeve and the other members. In addition, it will be appreciated by a person skilled in the relevant art that the mounting of the tubular connector of the compressor in D2 by means of a press-fitting technique into the shaft requires a good elasticity of the plastic material of the tubular connector.

In stark contrast, as mentioned in the specification of the present application (e.g. page 4, lines 5 ff.), if the tubular sleeve and the pump body are in a material different from that of the crankshaft or rotor (as in D2), particularly a non-metallic material, such as plastic, there occurs with time a degradation in the quality of the fixation obtained. This is in particular applicable for fixations like press-fitting, since the operational conditions of the compressor, like heating, affect the degree of interference between the parts affixed to each other.

Contrary to the D2 construction, where a plastic connector is press-fitted in both the interior of the tubular sleeve and the outer circumference of the upper portion of sleeve, the compressor (according to new claim 13) comprises a metallic connector which is fitted and rotatively and axially retained in a circumferential groove provided in the upper tubular portion of the tubular sleeve. In this way, the tubular sleeve, even if made of plastic material, is in a form-locking engagement with the groove in the upper portion of the tubular sleeve (20) and, thus the problems associated with a simple press-fitting of two plastic parts (as disclosed in D2) can be avoided.

With reference to Fig. 2 of D2, the upper portion of the tubular sleeve (34) is provided with a rebounding recess of a cylindrical shape, which is evidently also press-fitted to the cylindrical inner surface of the connector 40. Thus, the problems associated with press-fitting fixation described earlier are again present, in particular if both parts are of plastic material.

D2 fails to disclose or even suggest the use of a metallic connector together with a form-locking engagement thereof with the tubular sleeve, which can avoid the problems associated with press-fitting described above. Since D2 is completely silent on a "tubular connector (that) is a metallic connector", and that the upper tubular portion of the tubular sleeve is provided with a circumferential groove inside which the tubular metallic connector is fitted and rotatively and axially retained", as defined in new claim 13, the solution provided cannot be regarded obvious over the state of the art according to Fig. 2 of D2, which does neither disclose the cited features, nor even the particular interference between them as claimed for in new claim 13.

Thus, based on at least the reasons presented above, the applicant respectfully submits that new independent claim 13 is novel and inventive over the cited prior art.

Similarly, for at least the reasons presented above for new claims 1 and 13, the applicant further submits their respective dependent claims 2-12, and 14-18 to be patentable over the cited prior art.

Unless evidence can be cited from the cited documents for substantiating any objections, the Examiner is respectfully requested to consider and withdraw all objections.

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Attention: Ms. Jennie Ong Bee Lian

We look forward to receiving a favourable Examination report soon.

Yours faithfully



DONALDSON & BURKINSHAW

Encs.