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**Datasheet for the decision  
of 26 February 2021**

**Case Number:** T 1205/18 - 3.2.04

**Application Number:** 10704961.1

**Publication Number:** 2401507

**IPC:** F04D29/26, F04D29/056

**Language of the proceedings:** EN

**Title of invention:**

ROTOR ASSEMBLY

**Patent Proprietor:**

Dyson Technology Limited

**Opponent:**

WTS PATENT ATTORNEYS  
Witek, Sniezko & Partners

**Headword:**

**Relevant legal provisions:**

EPC Art. 123(2), 84, 56

**Keyword:**

Amendments - allowable (yes)

Claims - clarity - main request (yes)

Inventive step - (yes)

**Decisions cited:**

**Catchword:**



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Case Number: T 1205/18 - 3.2.04

**D E C I S I O N**  
**of Technical Board of Appeal 3.2.04**  
**of 26 February 2021**

**Appellant:**

(Opponent)

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**Respondent:**

(Patent Proprietor)

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**Representative:**

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**Decision under appeal:**

**Interlocutory decision of the Opposition  
Division of the European Patent Office posted on  
2 March 2018 concerning maintenance of the  
European Patent No. 2401507 in amended form.**

**Composition of the Board:**

**Chairman**

G. Martin Gonzalez

**Members:**

C. Kujat

W. Van der Eijk

## Summary of Facts and Submissions

- I. The appellant (opponent) lodged an appeal, received on 11 May 2018, against the opposition division's interlocutory decision posted on 2 March 2018 to maintain the European patent No. 2 401 507 in amended form and simultaneously paid the appeal fee. The statement of the grounds of appeal was received on 12 July 2018.
- II. In its decision the opposition division held that the patent as amended met the requirements of the Convention, having regard to the following evidence, *inter alia*:
- (D1) US 5,520,008 A  
(D4) US 2,911,138  
(D14) US 6,652,246 B1
- III. The parties were summoned to oral proceedings by summons of 9 June 2020. In an accompanying communication pursuant to Article 15(1) RPBA the board made provisional observations on the relevant issues.
- By letter of 19 January 2021 the appellant-opponent stated that it would not attend the oral proceedings.
- Oral proceedings were duly held by videoconference before the board on 26 February 2021 in the absence of the appellant-opponent.
- IV. The appellant-opponent requests that the decision under appeal be set aside and that European patent No. 2 401 507 be revoked.

The respondent-proprietor requests that the appeal be dismissed and that the patent thus be maintained as upheld by the opposition division (main request) or, in the alternative, that the patent be maintained on the basis of the claims of auxiliary requests 1 or 2, both as filed during opposition proceedings on 17 November 2017 as auxiliary requests 2 and 3, respectively, and re-filed with its letter of 26 January 2021.

V. The wording of claim 1 according to the main request (as upheld by the opposition division) is as follows:

"A rotor assembly (20,30) for a compressor comprising a shaft (2) to which an impeller (21,31) and a bearing assembly (4) are directly mounted, wherein the bearing assembly (4) is located at least partly within the profile of the impeller (21,31), characterised in that the impeller (21,31) is a centrifugal impeller and comprises a hub (22,32) supporting a plurality of blades (23,33), the bearing assembly (4) comprises a pair of spaced bearings (13,14) surrounded by a sleeve (16), and the bearing assembly (4) is located at least partly within a recess (27,41) formed in a top end (24,39) of the hub (22,32)."

VI. The appellant-opponent argued as follows:

The addition of the term "directly" introduces added subject-matter to claim 1 of the main request. It also makes the claim unclear. Moreover, its subject-matter lacks an inventive step in the light of the teaching of D1, D4 and D14, and the common general knowledge of the skilled person.

VII. The respondent-proprietor argued as follows:

The subject-matter of claim 1 of the main request is clear and does not contain added subject-matter. It also involves an inventive step in the light of the cited prior art.

### **Reasons for the Decision**

1. The appeal is admissible.
2. Background of the invention

The invention relates to a rotor assembly for a compressor; see paragraph [0001] of the patent specification. The rotor assembly comprises a shaft to which an impeller hub is mounted. A bearing assembly is also mounted to the shaft. The bearing assembly is partly located within a recess formed in an end of the hub; see paragraph [0007]. Due to the proximity of the bearing assembly to the impeller hub, the loading of the bearing assembly due to impeller imbalance is reduced. Consequently the lifetime of the bearing assembly is prolonged. Additionally, the cantilever length of the rotor is also reduced and, with it, its stiffness, which in turn results in a higher first flexural natural frequency. The rotor is therefore able to operate at much higher sub-critical speeds; see paragraph [0009].

3. Added subject-matter - main request.

The term "directly", which was added during opposition proceedings before the department of first instance to the feature "a compressor comprising a shaft (2) to which an impeller (21,31) and a bearing assembly (4) are *directly* mounted", is not explicitly mentioned in the original description; see in particular passages on

page 7, lines 5-6 or page 8, lines 9-10, e.g. "Figure 2 illustrates an alternative rotor assembly 20 comprising a shaft 2 to which are mounted an impeller 21 and a bearing cartridge 4". The respondent-proprietor additionally cites Figures 2 and 3 as a basis for this feature. The board must thus examine whether support for this feature can be found in these drawings.

According to the Case Law of the Boards of Appeal, the EPC does not prohibit the amendment of claims to include features from drawings, provided the structure and the function of such features are clearly, unmistakably and fully derivable from the drawings by the skilled person and not at odds with the other parts of the disclosure. Nor could any element be dropped. See Case Law of the Boards of Appeal, 9th edition 2019 (CLBA), II.E.1.13.1.

In the present case, the board holds that it is immediately evident to the skilled person when looking at Figures 2 or 3, to which the cited passages are directed, that both elements are each mounted directly to the shaft without any intervening element, for the following reasons. A skilled person, in this case an engineer involved in the design of compressors with the ability to interpret technical drawings, would unmistakably identify in the originally filed drawings an impeller and a bearing assembly that are physically separated by a corresponding gap, while the impeller and the shaft are shown to contact each other, as are the shaft and the bearing assembly. The drawings also show a high level of detail, with the shape of the different components, even down to the detail of individual elements of the bearing assembly, being very realistically represented. All this information taken together will inevitably lead the skilled person to

unequivocally conclude that a direct connection of the impeller to the shaft and of the shaft to the bearing assembly is shown and that nothing else is intended. Also, following from the intrinsic basic functionality of a bearing assembly to allow relative rotation and the intrinsic basic functionality of an impeller to rotate for compressing the fluid, it is immediately evident to the skilled person that the shaft and the impeller rotate as a unit, while the shaft is journaled on the bearing assembly. The functionality of the added feature is thus also unmistakably and fully derivable from the drawings.

3.1 The board thus concludes that claim 1 as upheld does not contain subject-matter which extends beyond the content of the application as filed (Article 123(2) EPC).

4. Clarity - main request

4.1 The appellant-opponent objects that the addition of the term "directly" introduces a lack of clarity to the wording of claim 1. According to the appellant-opponent, it is not clear whether the new formulation defines an impeller and a bearing, each being directly mounted to the shaft, or a unit formed by an impeller together with a bearing that is directly mounted to the shaft.

In the board's view the skilled person is able to understand without difficulty the term "directly mounted" as being attached without intervening components. Moreover, the claim uses the plural "are directly mounted". In the board's view this formulation unequivocally means that the impeller is directly mounted and also that the bearing is directly mounted.



Therefore, with each element being directly mounted, embodiments in which a unit formed by an impeller together with a bearing where only the bearing is directly mounted to the shaft are excluded without ambiguity.

4.2 The appellant-opponent also objects to the inclusion of the new feature in the preamble of the claim. The new preamble would not clearly reflect an identifiable instance of prior art; this would make the claim unclear in the sense of Article 84 EPC. However, Article 84 EPC does not require the preamble to reflect an identifiable instance of prior art. It only requires the claims to define the matter for which protection is sought in a clear and concise manner and requires the claims to be supported by the description.

4.3 Since, as explained above, the board otherwise finds the added term and the scope limitations that it defines to be clear, it concludes that its introduction does not contravene Article 84 EPC.

5. Inventive step - main request

5.1 The scope of the feature "a shaft to which an impeller and a bearing assembly are directly mounted" is in dispute. As explained above for clarity, in the board's view this formulation unequivocally means that the impeller is directly mounted, and also that the bearing is directly mounted. Therefore each element is directly mounted, as held by the opposition division.

As regards the feature "a top end of the hub", a top end may be understood as the upper side or end of an object. In this understanding, determining which is the top end would be dependent on how the object is placed

or oriented. A top end may also be understood to define a part of a shape of an object or of a geometric figure irrespective of its orientation. This is the case for instance for the top of a jar, which corresponds to its opening no matter whether the jar is standing up or lying on its side, or for the apex or the shorter parallel side of a cone or a truncated cone, no matter how they are oriented. In the present case, the claim is defining a centrifugal impeller. It is generally known to the skilled person, from their common general knowledge, that such impellers have axial inlets, and blades which turn and eject air through radial outlets adjacent to the opposite side of the inlet. Their shape thus approximates that of a truncated cone, in which the suction or upstream side can be similarly identified as the top side. It is also common in the field to refer to a "top shroud" which covers the outermost edges of the impeller blades, towards the suction side, from the hub. Since the claim is defining the geometry of the impeller, the skilled person would immediately understand that what is meant by the expression "top end" of the hub is its suction side, and not the spatial position of the claimed hub end. This is all the more applicable since it can hardly be said that the claim is concerned with or requires any specific orientation, e.g. horizontal or vertical orientation, of the claimed rotor assembly. The board therefore concludes that the feature "a top end" is to be understood as the suction side of the claimed hub.

- 5.2 The appellant-opponent regards D1 or D4 as suitable starting points for the assessment of inventive step.
- 5.3 D1 describes a bearing assembly 28 and an impeller hub 14 each mounted directly to the shaft 24, the bearing assembly located partly within a recess 25 in the hub.

In the compressor of D1, the bearing assembly is, however, located at the bottom of the hub, i.e. at the side opposite the top end or suction side of the impeller.

The contested claim 1 thus differs from this known rotor assembly in that the bearing assembly is located in a top end of the hub.

- 5.3.1 The appellant-opponent puts forward that the patent does not mention what technical problem is solved by locating the bearing assembly at the top side of the hub; however, according to the Case Law of the Boards of Appeal the problem-solution approach requires that objective criteria must be used to determine the technical problem, i.e. the problem which can be seen to have been actually solved in the light of the closest prior art which may be different from the prior art which was at the disposal of the inventor; see CLBA, I.D.4.1. Therefore, while the objective technical problem must be objectively derivable from the technical effects that are directly and causally related to the technical features of the claimed invention, it does not need to be expressly mentioned in the patent application or in the patent specification.

In the present case, it is clearly derivable for the skilled person from their common general knowledge that air flowing over a bearing assembly located at a top or suction end of a hub will be cooler than air flowing over a bearing assembly located at the bottom end of the hub of a centrifugal impeller. A recess in a bottom end is located downstream whilst a recess formed in a top end of the hub is located upstream. Air upstream of the impeller has not been acted on by the impeller and

will be cooler than downstream air which has been acted on by the impeller. Relative to the arrangement of D1, the claimed bearing location may provide increased cooling, which may lead to reduced wear and an increased lifetime of the bearing assembly. The associated objective technical problem may thus be viewed as how to increase the lifetime of the bearing, as formulated by the respondent-proprietor; see reply of 7 November 2018, paragraph bridging pages 7-8.

5.3.2 There is no indication or suggestion in D1 of moving the bearings 28 to the suction side of the impeller. Moreover, moving the bearings 28 of D1 in order to be located upstream of the impeller would also require the stationary support 14 and the stationary back plate 18 to be moved. These would interfere with the air intake into the impeller. It would also be required to move the driving motor 43, located adjacent to the back plate, to the upstream side. The upstream side of the compressor in the known installation in D1 is surrounded by the cylindrical compressor vessel 4, with one compressor at either opposite end; see Figure 3a and column 6, lines 17-23. Therefore, there is also no readily apparent location for locating the motor or the other components upstream of the compressor. In the light of the above, the board concludes that the subject-matter of claim 1 is not rendered obvious by the teaching of D1 in combination with common general knowledge of the skilled person.

5.4 D4 is also regarded by the appellant-opponent as a suitable starting point for assessing inventive step. It describes an impeller 48,50 and a bearing assembly 88,90 mounted as a unit via the bearing assembly to a shaft 76. It therefore does not disclose the difference whereby the hub is also directly mounted to the shaft.

Therefore, in the claimed assembly, the impeller and the shaft rotate as a unit supported on the bearing assembly, which in turn must be secured to a stationary frame, housing or the like. In contrast, in D4 the shaft is fixed and the impeller 48,50 is journaled to the stationary shaft 76 by the bearing assembly 88,90.

- 5.4.1 The appellant-opponent submits that the skilled person would regard modifying the impeller of D4 so that the hub is also directly mounted to the shaft so that shaft and impeller rotate as a unit as an obvious alternative arrangement. The subject-matter of claim 1 would thus lack an inventive step. It cites in this connection the teaching of D14 or common general knowledge to be combined with D4.

The board is not convinced by this argument. The fixed shaft 76 from D4 is central to the invention in D4. The invention in D4 relates to preventing tilting of the rotor axis and avoiding gyroscopic disturbances; see D4, column 1, lines 48-52. This effect is predicated on the mounting arrangement of the stationary shaft 76 on arms 70, acting as leaf springs; see column 4, lines 7-30. It is not readily apparent whether such a mounting arrangement would be at all possible or effective with a rotating shaft. In the board's view, given the centrality of this idea for avoiding angular tilting and gyroscopic disturbances, the skilled person would not consider, as a matter of obviousness, departing from this central teaching of D4 by replacing the bearing arrangement in the manner as claimed and thus implementing a rotating shaft.

Additionally, as regards D14, cited by the appellant-opponent, the board holds that the skilled person would not, as a matter of obviousness, consider the teaching

in the rather different field of fans for notebook computers in order to modify the turbo-compressor taught by D4. The technical requirements in terms of fluid dynamics or mechanical loads are substantially different. The impeller, shaft or bearing arrangements have very different constraints and design requirements.

- 5.4.2 In summary, the subject-matter of claim 1 is not rendered obvious by the prior-art combinations starting from D4 either.
6. As the appellant's arguments against the findings in the opposition division's decision fail to convince, the board upholds the opposition division's decision.
7. As announced in advance, the duly summoned appellant-opponent did not attend the oral proceedings. According to Rule 115(2) EPC, oral proceedings may continue in the absence of a duly summoned party. Further, pursuant to Article 15(3) RPBA, the board is not obliged to delay any step in the proceedings, including its decision, by reason only of the absence at the oral proceedings of any party duly summoned, who may then be treated as relying only on its written case. Hence, the board was in a position to announce a decision at the conclusion of the oral proceedings, in accordance with Article 15(6) RPBA.

The board is also satisfied that, by way of its written communication, the appellant-opponent was made aware of the central points underlying this decision and has had sufficient opportunity to present its comments. It is thus satisfied that the requirements of Article 113(2) EPC have been met.

**Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chairman:



G. Magouliotis

G. Martin Gonzalez

Decision electronically authenticated