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**Datasheet for the decision
of 14 September 2020**

Case Number: T 0316/18 - 3.2.04

Application Number: 09753562.9

Publication Number: 2300710

IPC: F03D11/00

Language of the proceedings: EN

Title of invention:

A WIND TURBINE ROTOR, A WIND TURBINE AND USE THEREOF

Patent Proprietor:

Vestas Wind Systems A/S

Opponent:

Siemens Aktiengesellschaft

Headword:

Relevant legal provisions:

EPC Art. 54(1), 56, 123(2)

Keyword:

Novelty - main request (no) - auxiliary request (yes)

Inventive step - auxiliary request (yes)

Amendments - allowable (yes)

Decisions cited:

Catchword:



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Case Number: T 0316/18 - 3.2.04

D E C I S I O N
of Technical Board of Appeal 3.2.04
of 14 September 2020

Appellant: Vestas Wind Systems A/S
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Appellant: Siemens Aktiengesellschaft
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Decision under appeal: **Interlocutory decision of the Opposition
Division of the European Patent Office posted on
1 December 2017 concerning maintenance of the
European Patent No. 2300710 in amended form.**

Composition of the Board:

Chairman A. de Vries
Members: S. Oechsner de Coninck
T. Bokor

Summary of Facts and Submissions

- I. The Opponent and the Proprietor both appeal against the Opposition Division's decision dated 1 December 2017 to maintain the European patent N° 2 300 710 in amended form. The Opponent filed a notice of appeal on 1 February 2018, paying the appeal fee on the same day, and filed the statement of grounds on 27 March 2018. The Proprietor filed a notice of appeal on 2 February 2018, paid the appeal fee the same day, and filed the statement of grounds on 11 April 2018.
- II. The opposition was based on the grounds of Article 100 (c) and 100(a) EPC in combination with lack of novelty and inventive step. In its written decision the Opposition Division held that the patent as amended according to the auxiliary request 3 complied with the requirements of the EPC, having regard in particular to the following documents:
- D1: DE 10 2006 002 708 A1
D2: US 7 059 822
D4: J.C. Sabel: "Optical 3D Motion Measurement", IEEE Instrumentation and Measurement Technology Conference, Brussels, Belgium, 04.-06.06.1996
D5: EP 1 742 015 A2
D6: G.P, Corten: "Optical Motion Analysis of Wind Turbines", European Union Wind Energy Conference, Göteborg, Sweden, 20.-24.05.1996
- III. The appellant opponent requests that the decision under appeal be set aside, and that the European patent No. 2 300 710 be revoked.

IV. The appellant proprietor requests that the decision under appeal be set aside and the patent be maintained as granted (main request), or alternatively the patent be maintained in an amended form on the basis of any of the First to Third and Fifth to Seventh auxiliary requests filed with letter dated 24th August 2020, partly re-filing auxiliary requests filed with the grounds of appeal dated 11 April 2018.

V. The wording of claim 1 of the main request and the First auxiliary request is as follows:

Main request

"A wind turbine rotor (4), comprising

a hub (6),

at least one wind turbine blade (5), wherein said at least one wind turbine blade (5) being mounted on said hub (6), and

at least one image capturing device (12),

characterised in that two or more markers (11) are arranged on said blade (5) so that said at least one image capturing device (12) may detect the position of said markers (11), and

said at least one image capturing device (12) is connected to the hub (6) or is connected rigidly to said blade (5)."

First auxiliary request (with amendments underlined)

"A wind turbine rotor (4), comprising

a hub (6),

at least one wind turbine blade (5), wherein said at least one wind turbine blade (5) being mounted on said hub (6), and

at least one image capturing device (12),

characterised in that two or more markers (11) are arranged on said blade (5) so that said at least one image capturing device (12) may detect the position of said markers (11),

said at least one image capturing device (12) is connected to the hub (6) or is connected rigidly to said blade (5), and

wherein at least one of said two or more markers (11) are arranged on an outside surface of said blade (5). "

VI. The Appellant-Opponent argued as follows:

- D1 discloses all the features of granted claim 1 and explicitly discloses to use several reflectors.
- Claim 1 according to the first auxiliary request also lacks novelty with respect to D1 that discloses the provision of markers on the outer surface. If novel, claim 1 lacks an inventive step starting from D1 in view of the common general knowledge of the skilled person or starting from either D4 or D6 in combination with D5.
- Claim 1 comprises the alternative to connect the image capturing device to the hub. However this has not been originally disclosed and extends the subject-matter beyond the content of the application as filed.

- VII. The Appellant-Proprietor argued as follows:
- The subject-matter of granted claim 1 is novel with respect to D1, because D1 does not directly and unambiguously disclose the provision of two or more markers.
 - Claim 1 according to the first auxiliary request is novel with respect to D1 that does not disclose the provision of markers on the outer surface of the blade. Its subject-matter also involves an inventive step starting from D1 in view of the skilled person's knowledge or starting from either D4 or D6 in combination with D5.
 - The alternative to connect the image capturing device to the hub was also disclosed in the application as filed, independently of whether the turbine was rotor stall or pitch controlled.

Reasons for the Decision

1. The appeals are admissible.
2. Background of the invention

The patent relates to a device for measuring deflection of a wind turbine blade. It is sought to provide an advantageous technique for detecting the shape of a wind turbine blade (paragraph 008). According to claim 1 this is done by providing an image capturing device connected to the hub or rigidly to the blade and two or more markers arranged on the blade, so that the image capturing device may detect the position of the markers, from which the blade deflections can be calculated.

3. Main request - Novelty with respect to D1

3.1 D1 discloses a wind turbine rotor, comprising a hub ("Nabe" 31), and at least one wind turbine blade ("Rotorblätter" 32) mounted on said hub (paragraph 032). A measuring device serves to measure the deflection of the blade (see paragraph 001). The device is explained in paragraph 034 as being composed of a transmitter ("Sendeeinheit" 41) transmitting radiation in the longitudinal direction to at least one reflection means ("Reflexionsmittel" 44), and a receiver ("Empfangseinheit" 42) capturing the reflected radiation, see also figure 1.

Paragraph 020 of D1 foresees the realisation of the receiver 42 as a "Zeilenkamera". Such a device is a camera with a one-dimensional array capable of detecting reflected light. It is comparable to the alternative described in paragraph 0101 of the patent ("one dimensional light sensor"), and in the judgement of the Board it falls within the broad scope of an "image capturing device", also in view of the wide range of possible embodiments of the image capturing device as given in paragraph 101 of the patent.

The transmitter and receiver are provided in the hub near the root (third sentence of paragraph 032) and the reflection means are either attached to the outer wall of the blade ("Außenwand" 32A) or to a spar of the blade ("Mittelsteg" 32M).

The provision of the transmitter and receiver in the hub corresponds to the first alternative of claim 1 that requires that the image capturing device to be connected in any unspecified way to the hub.

- 3.2 The appellant proprietor points argues that paragraph 11, point b) is ambiguous where it mentions at least one reflector in conjunction with at least one rotor blade; thus the more than one reflector need not be provided on the same one of plural blades. The embodiment explained in detail in D1 relies on a single reflector 44 and does not provide an enabling disclosure for providing a second reflector, because the skilled person would not know how to realise that without further information.
- 3.3 The Board disagrees. If paragraph 011 leaves some room for interpretation, paragraph 012 does not. Paragraph 012 describes the "at least one reflector means", the resultant light path, the drift due to deformation of the blade and detection of the drift in relation to a *single* rotor blade only. The skilled person understands immediately that the "at least" one reflector is attached in or on the same blade ("Indem das mindestens eine Reflektionsmittel am oder im Rotorblatt befestigt wird "). The Board also does not see why it would be particularly difficult for the skilled person to realize an arrangement with more than one reflector on a single blade. Arrangements where the reflectors are arranged along the length of a very long blade, either paired with respective detectors, or reflecting back to a single reflector immediately spring to mind. In either case the same basic measurement principle described in D1 would apply.
- 3.4 Therefore the Board concludes that the indication of at least one reflector in paragraph 011 and 012 constitutes a direct and unambiguous, enabling disclosure of at least a further reflector attached on the same blade and thus also anticipates the contested

feature of claim 1 requiring that two or more markers are arranged on said blade.

- 3.5 From the above, it follows that D1 anticipates all the features defined in claim 1. Thus the Board confirms the opposition division's finding that the subject-matter of claim 1 of the main request lacks novelty, Articles 52(1) and 54 EPC.
4. First auxiliary request - Novelty with respect to D1
- 4.1 Claim 1 of the first auxiliary request adds that one of the markers is arranged on the outside surface of the rotor blade, corresponding to the second alternative of granted claim 3.
- 4.2 The appellant opponent considers that the expression "im oder am Rotorblatt 32" used e.g. in paragraphs 011 and 34, and also in claim 1, discloses arranging the reflector either in ("im") or on ("am") the blade. Thus, also paragraph 034, describing the arrangement of a reflector on the inner surface or a spar, should be read that way, as otherwise the "am" alternative would be meaningless. That same sentence in paragraph 0034 indeed suggests other suitable locations.
- 4.3 The Board does not agree with this interpretation of the disclosure of D1. The core concept of D1 as illustrated in the detailed embodiments relies on the transmitter 41 being located within the hub from where it emits a light beam towards the reflector 44 and the receiver 42 sensing the reflected light. In all embodiments the transmitter 41 and receiver unit 42 (421) are only ever shown or described as located within the hub 32, cf. paragraph 032 ("... sind innerhalb der Nabe "), paragraph 034 ("In der Nabe ..."), figures 1 to 4. The location of the

transmitter and receiver within the hub is difficult if at all possible to reconcile with an external location of the reflectors. Indeed, in all specific examples given the reflectors are only ever shown or described as being within the rotor blade, see paragraph 032, sentence bridging the left and right hand columns, and again figures 1 to 4. Likewise, in paragraph 034 the two specific examples have the reflectors attached either to the inside of the outer wall 32A, as shown in figure 2, or to an inner center spar 32M; these two examples correspond to claims 11 and 12 which expressly claim arrangement *within* the blade ("innerhalb"). Thus, where D1 gives specific detail it consistently does so for an internal arrangement of the reflectors. This is technically particularly meaningful in the light of paragraph 023, which explains that such an internal arrangement provides protection from the atmospheric conditions.

Paragraphs 023 and 034 shed light on how the indication "am Rotorblatt" is to be understood by the skilled person within the overall disclosure of D1. For the first example the text has the reflector arranged "an der Außenwand" using the same preposition "an" as in "am Rotorblatt" and translated as "on" or "at". In corresponding figure 2 the reflector is arranged on the inside of the outer wall 32A, as also expressly stated in corresponding claim 11. Thus, the only possible example of an arrangement "am Rotorblatt" also has an internal arrangement of the reflector, which is entirely consistent with the rest of D1. The sentence immediately following and referring to other connecting locations "in or on" the blade ("Es sind aber auch andere geeignete Befestigungsorte im oder am Rotorblatt") must be understood by the skilled person within this same context, i.e. as suggesting other

unspecified locations (only) within the rotor blade, e.g. cross spars.

- 4.4 In view of the above the Board thus concludes that the subject-matter of claim 1 according to the first auxiliary request is novel over D1.
5. First auxiliary request - Inventive step
- 5.1 Starting from D1 and as concluded above, the subject-matter of claim 1 differs from D1 by the feature of two or more markers arranged on the outside surface of the rotor blade.
- 5.1.1 The objective technical problem should be formulated in accordance with the technical effect associated with this particular differing location on the outside surface of the blade. According to established case law an objective definition of the problem to be solved by the invention should normally start from the problem described in the contested patent, see Case Law of the Boards of Appeal (CLBA), 9th edition, 2019, I.D.4.3.2.
- 5.1.2 The technical effects derivable from providing the markers on the outside surface are given in paragraph 034, 035 and 130 of the patent. In particular, location on the outside allows for easy access for installation and retrofitting, servicing and repair.
- 5.1.3 Rather than merely finding an alternative location for the markers as suggested by the appellant opponent, the objective technical problem based on the technical effects derivable from the disclosure of the patent may be formulated as improving ease of maintenance or serviceability.

- 5.1.4 Tasked with this problem, the Board does not see that the skilled person would be merely confronted with a simple choice between two straightforward options with known advantages and disadvantages, as argued by the appellant opponent.

- 5.1.5 As discussed in the framework of novelty, D1 is based on the central idea of a receiver arranged within the hub and receiving light reflected from the reflectors arranged inside the rotor blade, in order to protect the arrangement from outside conditions, see above. For this reason the Board is unconvinced that the skilled person would of their own accord - e.g. because they wish to improve serviceability - consider placing the entire measuring arrangement, much less only the reflectors, on the outside of the hub: they would be exposed to the elements and the stated benefits of an internal arrangement would thus be lost. Nor does the Board have reason to believe that it is common knowledge or practice in the field of wind turbines to place various devices on the outside for ease of access.

- 5.1.6 Therefore, in the Board's view, starting from the system of D1 the skilled person would not, from his common general knowledge, consider positioning the reflectors of D1 on the outer surface of the blade.

- 5.2 The other suggested lines of argument against inventive step starting from D4 or D6 in combination with D5 also fail to convince the Board.

- 5.2.1 D4 and D6 both relate to the monitoring of wind turbines from a remote location.

D4 (see abstract) concerns a camera-based system for accurate measurement of the three-dimensional movement of reflective targets. As explained on page 369, this system uses two cameras located on either side of a test wind turbine and arranged for sensing nine optical markers attached on all the blades and on the tower (page 369, right hand column, last two paragraphs). D6 discloses a similar set-up with two spaced apart cameras sensing retroreflective stickers attached to the rotor blades and hub as well as on the tower, as shown in figure 1 and explained in item 1.3.2 bridging pages 1 and 2. On page 2 the first paragraph under figure 1 further explains that all cameras visualize the complete rotor plane and the spatial coordinates of the markers to determine the position of the blades and tower.

- 5.2.2 The subject-matter of claim 1 differs from the device disclosed in either D4 or D6 by arranging the image capturing device on the hub or rigidly to a blade.
- 5.2.3 The opponent appellant submits that the objective technical problem should be formulated as to provide an on-board measurement method of the deformation of the blades. The argument is that the skilled person in search of an on-board method would then as a matter of obviousness have looked toward D5 showing such a system.
- 5.2.4 The Board firstly does not agree with this formulation of the technical problem. By mentioning the provision of an *on-board* measurement method, the formulation of the problem includes a clear pointer to the claimed solution, contrary to established case law, see CLBA, 9th edition, 2019, I.D.4.3.1. As D4 and D6 already provide improved serviceability, the objective

technical problem starting from these documents must be reformulated, see CLBA, I.D.4.4. Starting from the patent (in accordance with CLBA, I.D.4.3.2), e.g. paragraph 008, the Board formulates the objective technical problem as providing an *alternative* technique for detecting the shape of a wind turbine blade.

- 5.2.5 Moreover, the Board is unconvinced that the skilled person would have looked toward D5 for a solution.

D5 relates to in situ component monitoring of in particular turbine blades of a gas turbine engine (paragraph 001). Though D5 suggests more general applications, see paragraphs 024 and 050, its main field of application is gas turbines. The measuring arrangement shown in the embodiments are specifically adapted to such turbines, their dimensions and geometry and the dynamics of such systems. For example the camera is meant to sense distortions of relatively short blades of the turbine rotating at high speed and thus submitted to high frequency vibration modes of small amplitude in both twisting and bending directions. The camera will be calibrated accordingly to focus on short lengths and include a high frequency capturing mode. The other applications suggested (aircraft or aero engines) are of similar dimension and dynamics.

- 5.2.6 By contrast ,the cameras used to capture the position of the markers attached to the wind turbine of D4 or D6 are designed to sense these from a remote static location and monitor all the markers attached to the whole wind turbine including both blades, hub and tower. Geometry and dimensions of a tower and rotor of a wind turbine are clearly very different from those of

a gas turbine, as is also the dynamics of the system and the type of movement.

5.2.7 On the basis of these differences the Board concludes that the skilled person, an engineer designing and developing wind turbines, would not have looked at D5, dealing mainly with gas turbines, in search for an alternative. But even if they did, those differences would make the application of D5's approach to the wind turbine far from straightforward. Thus, if they were to try they would have to adapt the D5 methodology to the rather different geometry, dimensions and dynamics of a wind turbine. In the Board's view this goes well beyond the routine skills of the average skilled person in the field of wind turbines.

5.3 The Board concludes, therefore, that the subject-matter of claim 1 of the first auxiliary request involves an inventive step over D4 or D6 in combination with D5, and therefore fulfills the requirements Article 52(1) and 56 EPC.

6. Added subject-matter

6.1 The Board considers the limitation added in granted claim 1 of the image capturing device connected to the hub to be directly and unambiguously derivable from the application as originally filed.

6.2 Page 18 of the published application discloses in its first three paragraphs the advantages of connecting the image capturing device either to the hub or to the blade. In particular paragraph 2 compares accessibility and improved accuracy of the connection to the hub compared to the connection to the blade. Both these solutions are compared as separate, independent

alternatives without an apparent close structural or functional relationship to further features of any particular application. Nor does the skilled person from their own technical understanding recognize any such relationship. For them it is immediately clear that, whether the blades are pitch controlled or the turbine is stall controlled, is irrelevant for the measurement methodology, in particular whether the imaging device is placed on the hub or blade.

6.3 The opponent appellant's reference to the third paragraph of page 18, although beginning with the statement "in this embodiment" and clearly referring to the case of a pitch controlled blade, where the image capturing device is advantageously connected to the blade root does not change this. The preferred connection to the blade root in this embodiment does not imply the inverse conclusion that a connection to the hub is inevitably foreseen for stalled controlled turbines only.

6.4 In the Board's view the mention of connection to the hub in a stall controlled wind turbine in the last paragraph of page 25, is only by way of example as is evident from the use of "e.g." This is also what the skilled person understands from their technical understanding. Indeed they would be unable to see any relationship between a measurement system comprising an image capturing device located on the hub and a stall type of control of the rotor speed. Such a relationship is thus not expected by the skilled person, nor has the appellant opponent argued that there would be one. This view is further confirmed by the second paragraph on page 26 which compares accuracy of the two possible placements of an image capturing device without any reference to the particular type of wind turbine.

6.5 Therefore the addition of the alternative to connect the image capturing device to the hub in claim 1 of the first auxiliary request does not extend beyond the content of the application as filed and thus complies with the provisions of Article 123(2) EPC. The Board thus confirms the conclusion of the Opposition Division concerning the ground of appeal under Art. 100b) EPC.

7. In conclusion the Board confirms the decision's finding of lack of novelty for the main request (patent as granted). However, contrary to the decision's finding for the corresponding request (then auxiliary request 2), the Board holds that the subject-matter of claim 1 of the auxiliary request 1 is novel over the cited prior art. It also holds that that subject-matter involves an inventive step over the cited prior art, and that no subject-matter has been added. The Board is also satisfied that the description has been brought into line with the amended claims of the first auxiliary request.

Considering the amendments made to the patent according to the first auxiliary request, the Board concludes that the patent and the invention to which it relates meet the requirements of the EPC, and that therefore the patent can be maintained as amended, Art 101 (3) (a) EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the Opposition Division with the order to maintain the patent as amended in the following version:

Claims

Number 1-15 of the First auxiliary request filed with the grounds of appeal dated 11 April 2018,

Description

Pages 2-10 as filed in the oral proceedings before the Board,

Drawings

Figures 1 to 8 of the published patent specification.

The Registrar:

The Chairman:



G. Magouliotis

A. de Vries

Decision electronically authenticated