Internal distribution code:

(A) [-] Publication in OJ
(B) [-] To Chairmen and Members
(C) [-] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 11 February 2022

Case Number: T 1305/19 - 3.2.04

Application Number: 10166738.4

Publication Number: 2273105

IPC: F03D7/04, F03D7/02

Language of the proceedings: EN

Title of invention:
Method and system for noise controlled operation of a wind turbine

Patent Proprietor:
General Electric Company

Opponents:
ENERCON GmbH
Vestas Wind Systems A/S

Headword:

Relevant legal provisions:
EPC Art. 54(2), 83

Keyword:
Novelty - (no)
Sufficiency of disclosure - (no)

Decisions cited:

Catchword:

Beschwerdekammern

Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 1305/19 - 3.2.04

D E C I S I O N
of Technical Board of Appeal 3.2.04
of 11 February 2022

Appellant: (Patent Proprietor)
General Electric Company
1 River Road
Schenectady, NY 12345 (US)

Representative:
Zimmermann & Partner
Patentanwälte mbB
Postfach 330 920
80069 München (DE)

Appellant: (Opponent 1)
ENERCON GmbH
Dreekamp 5
26605 Aurich (DE)

Representative:
Eisenführ Speiser
Patentanwälte Rechtsanwälte PartGmbB
Postfach 10 60 78
28060 Bremen (DE)

Party as of right: (Opponent 2)
Vestas Wind Systems A/S
Hedeager 42
8200 Aarhus N (DK)

Representative:
Samson & Partner Patentanwälte mbB
Widenmayerstraße 6
80538 München (DE)

Decision under appeal:
Interlocutory decision of the Opposition Division of the European Patent Office posted on 1 March 2019 concerning maintenance of the European Patent No. 2273105 in amended form.

Composition of the Board:

Chairman	A. de Vries
Members:	G. Martin Gonzalez
	K. Kerber-Zubrzycka

Summary of Facts and Submissions

I. The appeals were filed by the appellant-proprietor and appellant-opponent 1 against the interlocutory decision of the opposition division finding that the patent as amended met the requirements of the EPC.

The Opposition Division held inter alia that granted claim 1 lacked novelty while the claims as upheld were novel and involved an inventive step.

II. The appellant-proprietor requests that the decision under appeal be set aside and the patent be maintained as granted, or, auxiliarily, according to one of auxiliary requests 1, 2, 6, 7 or 8 all filed with the statement of grounds of appeal of 4 July 2019.

The appellant-opponent 1 requests that the decision under appeal be set aside and the patent revoked.

The respondent-opponent 2 requests dismissal of the proprietor's appeal.

III. Oral proceedings were held by videoconference before the Board on 11 February 2022.

IV. Independent claim 1 of the requests relevant for this decision reads as follows:

(a) Main request (as granted)

"A method for controlling noise generated from a wind turbine (10) having a blade (24) attached to a hub (22) having a rotor shaft (30), and a generator (26) in communication with the rotor shaft (30), and the at

least one blade (24) having an adjustable pitch angle, the method comprising:
providing a wind turbine (10) acoustical profile;
providing a wind turbine (10) power profile;
comparing the wind turbine (10) acoustical profile and the wind turbine (10) power profile to determine a noise reduced operational condition; and
controlling the wind turbine (10) to provide a rotor speed and the pitch angle of the blade (24) corresponding to the noise reduced operational condition, characterized in that controlling includes selectively adjusting the rotor speed and selectively adjusting the pitch angle of the blade (24) to the desired power coefficient and amount of noise."

(b) Auxiliary request 1

Claim 1 as in the main request with the addition of the following features (emphasis by the Board to indicate added text):

"...providing a wind turbine (10) acoustical profile, wherein the wind turbine acoustical profile includes a plurality of pitch angles to noise relationships for rotor angular velocities or tip speed ratios throughout the wind turbine operational range;
providing a wind turbine (10) power profile;..."

(c) Auxiliary request 2 (as upheld)

Claim 1 as in auxiliary request 2 where the option "or tip speed ratios" has been removed (emphasis by the Board to indicate modified text):

"...providing a wind turbine (10) acoustical profile, wherein the wind turbine acoustical profile includes a

plurality of pitch angles to noise relationships for rotor angular velocities ~~or tip speed ratios~~ throughout the wind turbine operational range;
providing a wind turbine (10) power profile;..."

(d) Auxiliary requests 6, 7, 8

Claim 1 of these requests have in common that they add to claim 1 as in auxiliary request 2 the following feature at the end of the claim (emphasis by the Board to indicate added text):

"controlling includes selectively adjusting the rotor speed and selectively adjusting the pitch angle of the blade (24) to the desired power coefficient and amount of noise,
wherein the method further comprises controlling rotor speed by controlling generator rotor shaft torque and alternating between changing and maintaining blade pitch angle."

V. In the present decision, reference is made to the following documents:

(E1) Leloudas, Giorgos, "Optimization of Wind Turbines with respect toNoise" MEK, DTU in collaboration with SIEMENS WIND POWER A/S, November 2006

VI. The appellant-proprietor's arguments can be summarised as follows:

The subject-matter of claim 1 according to the main request and auxiliary requests 1 and 2 is novel over the cited prior art. The invention as claimed in auxiliary requests 6-8 is sufficiently disclosed.

VII. The opponents' arguments can be summarised ad follows:

Claim 1 of the main request and auxiliary requests 1,2 lacks novelty over E1. Auxiliary requests 6-8 are insufficiently disclosed in the sense of Article 83 EPC.

Reasons for the Decision

1. The appeals are admissible.

2. Background

The invention is directed to a method and a system for the control of noise emissions in wind turbines while maintaining a desired power coefficient, see specification paragraph [0001]. Noise emissions are controlled by adjusting the rotor speed and the pitch angle of the blades. Control rules are derived from a combination of a wind turbine acoustic profile and a wind turbine power profile, see figures 5,6 and paragraphs [0033]-[0034].

3. Claim Interpretation

3.1 Granted claim 1 is directed to a method for controlling noise generated from a wind turbine. The method comprises the step of comparing a wind turbine acoustical profile and a wind turbine power profile to determine a noise reduced operational condition. The scope and meaning of the above set of features are in dispute in these proceedings. It is also in dispute whether the feature *a method for controlling* imposes an implicit requirement that all claimed steps are performed in real time in a controller.

3.2 The Board is unconvinced by the appellant-proprietor's contention that the feature *a method for controlling* imposes an implicit requirement that all claimed steps are performed in real time in a controller.

The claim specifies a sequence of separate steps ("providing...", "comparing", "controlling"), without providing any explicit detail as to where, when and by what particular means these steps are carried out. Nor is it implicit in the terminology used in the claim that, for example, providing the profiles and then comparing them must take place in the controller immediately prior to pitch angle adjustment. Thus, the common terms "providing" or "comparing" of themselves do not imply anything other than the fact that profiles are s*upplied or made available* (Merriam Webster) and then *viewed in relation to* each other (Merriam Webster again). Similarly, the term *control* in its usual sense is understood as meaning *to cause (something) to act or function in a certain way* (Merriam-Webster), thus in this context to cause the wind turbine to function according to desired target operational conditions, without any limitations as to time, place or means. Therefore as long as a known control method is able to cause the wind turbine to function according to target conditions as defined in the contested method claim, it meets this limitation, irrespective of whether the desired target conditions are the result of previous "off-line" calculations or calculated in real time.

3.3 Moreover, the Board finds that the Opposition Division correctly held, see section 20 of the impugned decision, that an *acoustic profile* in its broad sense is to be understood as any form of acoustic behavioural information and not only the specific noise curves shown in figure 5 of the contested patent. The same holds for the feature of a *power profile,* which was seen to denote any form of power behavioural information and not only the specific curves of figure 6 of the patent. No argument has been put forward that these terms would have a limited meaning in the present field.

3.4 As regards the nature of the comparison the Board agrees with the Division's finding in section 16 of the written decision, that "*comparing... cannot be within the classical meaning of a comparison of two things which are expressed in the same units of measurement e.g. height, temperature, speed etc. As the profiles concern completely different things then it will be immediately obvious to the skilled person that another meaning is intended than a classical comparison and he will look into the description to find out what he is meant to do.*" Thus, see also above, comparing is to be understood in its broader sense of viewing the two profiles in relation to each other.

Such a comparison in its broadest sense is apparent from figures 5 and 6 and corresponding paragraphs [0031]-[0034]. In this sole detailed example the acoustic profiles setting out noise level against angular velocity for different pitch angles (figure 5) are used to identify in the power profiles, which set out power coefficient against angular velocity for different pitch angles (figure 6), those points in the power profiles that are associated with a given or required noise limit. In the described example, this results in the graph "Cp curve for NRO Target" of figure 6. Operation of the wind turbine at angular velocity and power coefficient values below the *Cp curve for NRO Target* will then meet the required noise limitation. This graph or curve, which can be seen to result from a comparison of the profiles of figures 5 and 6 in the broadest sense of the term, informs the operator of the desired noise reduced operational condition. For instance, they might set the turbine to the maximum possible power production under the given noise level constraints, which corresponds to the maximum of the curve *Cp curve for NRO Target* of figure 6. These steps can be described in general terms as the joint use of the acoustic and the power profile to determine a noise reduced operational condition.

4. Main Request - Novelty

4.1 Turning to document E1, this document is evidently concerned with optimizing wind turbines with respect to noise, see its title. In Chapter 5 "Optimization", starting at page 41, it describes approaches for changing operational settings (angular velocity ω and pitch angle θ), i.e. controlling the turbine in accordance with these settings.

4.2 As stated in the third paragraph of the introductory section 5.1 (page 41) the aim of E1's optimization scheme is generally to *"to optimize a wind turbine's performance, in this case the SWT-2.3-92, with respect to noise, by changing the combination of its operational settings* (ω, θ_{pitch})*."* One of the approaches is referred to as "power maximization" which, as stated in the same paragraph, is intended "*to maximize the power production, constraining however the noise not to exceed a maximum value*".

4.3 As explained in the following paragraphs of chapter 5.1, on page 42, first full paragraph, these known methods use an optimization tool known as *fmincon* from the MATLAB toolbox (a well-known proprietary programming and numeric computing platform for analyzing data, developing algorithms and modelling) for "*constrained non-linear optimization of an objective function*". The objective function is identified as BEM-NOISE, which is described in earlier Chapter 2, section 2.2: "The code BEM-NOISE", page 7 ff. As explained in the first paragraph of chapter 2 this function combines a noise prediction model with a BEM code to give both *estimated noise and power production levels,* see also page 42, lines 9 - 11. This prediction model uses wind turbine and other parameters such as blade chord, twist, thickness, airfoil distributions and observer position as well as operational parameters such as wind speed, rotational (angular) velocity and pitch angle (page 7, 3rd paragraph onwards). Data is collected for combinations of wind speeds, rotational velocities and pitch angles, see page 7, last paragraph and the flowchart of the code BEM-NOISE shown in figure 2.2 on page 8. The function BEM-NOISE therefore provides wind turbine behavioural information in the form of predicted or estimated noise and power production levels for different (user specified) values of wind speed, angular velocity and pitch which are seen to constitute separate sets of acoustic and power behavioural data that correspond to the broadly defined acoustic and power profiles of claim 1.

4.4 Both sets of data, predicted noise and power production levels, are then viewed together and used jointly in the power maximization approach using the optimization routine *fmincon,* as cited above, to determine a noise reduced operational condition. Section 5.1.2 "Power Maximization" details that "[*I]n this type of optimization, we impose an upper limit in noise and look for the optimum settings that will maximize* *power*". As will be evident to the skilled reader this means that fmincon determines those operational settings or control variables , namely angular velocity ω, and pitch angle θ_{pitch}, for which power production level is maximum under the constraint that noise does not exceed the upper limit. This is in fact a typical optimization problem, in which one function of variables - here power production as a function of pitch angle and angular velocity - must be optimized under the constraint of another function of those variables - here noise level as function of pitch angle and angular velocity. This maximum possible power production level below set noise limit corresponds to the noise reduced operational condition of claim 1, resulting from the comparison (in its broadest sense) of the acoustic and power profiles obtained from the BEM-NOISE model.

4.5 Page 44, first paragraph, in reference to figures 5.4 and 5.5, moreover presents the results in terms of required turbine settings pitch angle and angular velocity (ω, θ) to obtain this desired maximized power output. Naturally, these settings are values meant to be used in practice to that very end (in a turbine of the type SWT-2.3-92). Thus, E1 also discloses selectively adjusting (that is setting) pitch angle (as well as angular velocity) to the desired power coefficient and amount of noise, corresponding to the control features of claim 1.

4.6 Hence the method described in E1 shows all features of granted claim 1, which thus lacks novelty over this disclosure.

5. Novelty - Auxiliary requests 1,2

5.1 Both requests are amended to specify that the wind turbine acoustical profile includes a plurality of pitch angles to noise relationships for rotor angular velocities "throughout the wind turbine operational range".

5.2 This further definition of acoustical profile fails, in the Board's opinion, to differentiate the claimed subject-matter from the known method of E1.

It goes without saying that the noise and power levels calculated by the known BEM-NOISE modelling function for different pitch angle and angular velocity values necessarily comprise a plurality of data sets that relate noise (or power level) to pitch angle for different angular velocities. Put differently, the BEM-NOISE function can be seen to span noise level across a two dimensional space formed by ordinates pitch angle and angular velocity. Thus, it comprises any number of relationships of noise to pitch angle for different values of angular velocity (or noise to angular velocity for different values of pitch angle). The acoustic behavioural information generated by the model - the resultant acoustic profile in the wording of claim 1 -, is thus seen to include a plurality of pitch angle dependent noise relationships for different angular velocities.

The added feature requires the above relationships *throughout the wind turbine operational range,* for which the claim however t does not provide any definition. Considered in context a reasonable reading relates operational range to the two operational parameters pitch angle and angular velocity across which the noise level is spanned. It is readily apparent from the fact that the known method is an optimization in the two dimensional space (ω,θ), that acoustic and power behavioural information of the wind turbine throughout the range of relevant values of rotor speed ω and pitch angle θ needs to be available in the BEM-NOISE function.

5.3 From the above it follows that the subject-matter of claim 1 of auxiliary request 2 lacks novelty. This corresponds to the first (angular velocity) option covered by claim 1 of auxiliary request 1, so that the subject-matter of that claim lacks novelty for the same reason.

6. Sufficiency of disclosure - Auxiliary requests 6-8.

In all requests the feature *wherein the method further comprises controlling rotor speed by controlling generator rotor shaft torque and alternating between changing and maintaining blade pitch angle* has been added.

6.1 In conjunction with the step of claim 1 of selectively adjusting pitch angle the further step of alternating between changing and maintaining blade pitch angle is unclear. On the face of it the two requirements seem at odds: the first requires pitch angle to be *set* to obtain the desired power coefficient and amount of noise, while the added requirement would have pitch angle also *changed* and then *maintained* in some alternating sequence.

6.2 At the oral proceedings the appellant proprietor explained in reference to figure 6 that the added feature was meant to cover a two-step process of setting the turbine to a desired operational state (with desired power output at set noise level) in which pitch angle was first changed and angular velocity held constant and angular velocity then changed at constant pitch angle. This would "*facilitate reducing an amount of pitch movement required to control rotor speed*" as stated in paragraph [0035] cited as basis for the amendment.

6.3 This explanation appears plausible to the Board. However, it has no direct and unambiguous basis in the original application which is very scant on detail on this added aspect. The sole basis is cited paragraph [0035]. Other than stating the above effect of facilitating reduction of pitch angle that paragraph repeats verbatim the formulation added to claim 1. The reader is thus none the wiser when attempting to resolve the lack of clarity of claim 1 by referring to the description. Consequently this aspect of the claimed invention and thus the invention as a whole is not so clearly and completely disclosed for it to be carried out by the skilled person.

6.4 The Board is therefore not convinced by the appellant-proprietor's arguments that the invention in the amended form can be carried out by the man skilled in the art with the information given in the patent specification. Therefore auxiliary requests 6-8 fail for insufficiency of disclosure, Article 83 EPC.

7. For the above reasons the Board finds that the decision was wrong in concluding novelty for the upheld claims (present auxiliary request 2) and that therefore it must be put aside. It also finds for the remaining requests that taking into consideration the amendments made by the appellant-proprietor, the patent and the invention to which it relates do not meet the requirement of the Convention. The Board must thus revoke the patent pursuant to Article 101(3)(b) EPC.

Order

For these reasons it is decided that:

1. **The decision under appeal is set aside.**

2. **The patent is revoked.**

The Registrar: The Chairman:

G. Magouliotis A. de Vries

Decision electronically authenticated