Internal distribution code:

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

Datasheet for the decision of 20 September 2023

Case Number: T 2108/21 - 3.2.04

Application Number: 13716530.4

Publication Number: 2828521

IPC: F03D1/06

Language of the proceedings: EN

Title of invention:
WINGLET FOR A WIND TURBINE ROTOR BLADE

Patent Proprietor:
General Electric Company

Opponent:
Vestas Wind Systems A/S

Headword:

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - (no)

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

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 2108/21 - 3.2.04

D E C I S I O N
of Technical Board of Appeal 3.2.04
of 20 September 2023

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)	Vestas Wind Systems A/S Hedeager 42 8200 Aarhus N (DK)
Representative:	Beetz, Joeri Keltie LLP No.1 London Bridge London SE1 9BA (GB)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 4 October 2021 concerning maintenance of the European Patent No. 2828521 in amended form.**

Composition of the Board:

Chairman	A. de Vries
Members:	S. Oechsner de Coninck
	C. Heath

Summary of Facts and Submissions

I. The proprietor and the opponent both appeal the interlocutory decision of the Opposition Division to maintain the European Patent in amended form.

II. In its decision the Opposition Division held that claim 1 as granted lacked novelty. However it found claim 1 as amended according to an auxiliary request 1 to involve an inventive step having regard to the following documents in particular:

D1: US 2011/0142677 A1

III. In a communication in preparation for proceedings the Board gave a provisional opinion on the relevant issues.

IV. Oral proceedings were held on 20 September 2023 by videoconference.

V. The appellant-opponent requests that the decision be set aside and the patent be revoked.

VI. The appellant-proprietor requests that the decision under appeal be set aside and that the patent be maintained as granted (Main Request), in the alternative that the patent be upheld on the basis of one of Auxiliary Requests 1 - 9, all filed in opposition with letter dated 16 April 2021 and re-filed with the grounds of appeal.

VII. The independent claim 1 according to the relevant requests reads as follows (additions and deletions with respect to granted claim 1 emphasised by the Board):

Main request (patent as granted)

"A rotor blade (100) comprising a winglet (120), the winglet comprising: a winglet body (122) extending at least partially between a winglet origin and a blade tip, the winglet body defining a sweep and a pre-bend, wherein the sweep defined between the winglet origin and the blade tip ranges from about 0.5% to about 4.0% of a span of the rotor blade, wherein the pre-bend defined between the winglet origin and the blade tip ranges from about 1.5% to about 4.5% of the span of the rotor blade, characterized in that the winglet body (122) further defines a chord, the chord at the blade tip ranging from about 0.0% to about 0.5% of the span of the rotor blade."

Auxiliary request 1

"A rotor blade (100) comprising a winglet (120), the winglet comprising: a winglet body (122) extending at least partially between a winglet origin and a blade tip, the winglet body defining a sweep and a pre-bend, wherein the sweep defined between the winglet origin and the blade tip ranges from about ~~0.5~~ **1.7%** to about ~~4.0~~ **2.8%** of a span of the rotor blade, wherein the pre-bend defined between the winglet origin and the blade tip ranges from about ~~1.5~~ **2.4%** to about ~~4.5~~ **3.6%** of the span of the rotor blade, characterized in that the winglet body (122) further defines a chord, the chord at the blade tip ranging from about 0.0% to about 0.5% of the span of the rotor blade."

Auxiliary request 2

"A rotor blade (100) comprising a winglet (120), the winglet comprising: a winglet body (122) extending at least partially between a winglet origin and a blade tip, the winglet body defining a sweep and a pre-bend, wherein the sweep defined between the winglet origin and the blade tip ranges from about ~~0.5~~ **2.2%** to about ~~4.0~~ **2.8%** of a span of the rotor blade, wherein the pre-bend defined between the winglet origin and the blade tip ranges from about ~~1.5~~ **2.4%** to about ~~4.5~~ **3.2%** of the span of the rotor blade, characterized in that the winglet body (122) further defines a chord, the chord at the blade tip ranging from about 0.0% to about 0.5% of the span of the rotor blade"

Auxiliary request 3

"A rotor blade (100) comprising a winglet (120), the winglet comprising: a winglet body (122) extending at least partially between a winglet origin and a blade tip, the winglet body defining a sweep and a pre-bend, wherein the sweep defined between the winglet origin and the blade tip ranges from about ~~0.5~~ **1.7%** to about ~~4.0~~ **2.8%** of a span of the rotor blade, wherein the pre-bend defined between the winglet origin and the blade tip ranges from about ~~1.5~~ **2.4%** to about ~~4.5~~ **3.6**% of the span of the rotor blade, characterized in that the winglet body (122) further defines a chord, the chord at the blade tip ranging from about 0.0% to about 0.5% of the span of the rotor blade, wherein the winglet body (122) further defines a chord, the chord at the winglet origin ranging from about 1.25% to about 2.63% of the span of the rotor blade."

Auxiliary request 4

"A rotor blade (100) comprising a winglet (120), the winglet comprising: a winglet body (122) extending at least partially between a winglet origin and a blade tip, the winglet body defining a sweep and a pre-bend, wherein the sweep defined between the winglet origin and the blade tip ranges from about ~~0.5~~ **2.2%** to about ~~4.0~~ **2.8%** of a span of the rotor blade, wherein the pre-bend defined between the winglet origin and the blade tip ranges from about ~~1.5~~ **2.4%** to about ~~4.5~~ **3.2%** of the span of the rotor blade, characterized in that the winglet body (122) further defines a chord, the chord at the blade tip ranging from about 0.0% to about 0.5% of the span of the rotor blade, wherein the winglet body (122) further defines a chord, the chord at the winglet origin ranging from about 1.5% to about 2.3% of the span of the rotor blade."

Auxiliary request 5

1. A rotor blade (100) comprising a winglet (120), the winglet comprising:

a winglet body (122) extending at least partially between a winglet origin and a blade tip, the winglet body defining a sweep and a pre-bend,

wherein the sweep defined between the winglet origin and the blade tip ranges from about ~~0.5~~1.7% to about ~~4.0~~2.8% of a span of the rotor blade,

wherein the pre-bend defined between the winglet origin and the blade tip ranges from about ~~1.5~~2.4% to about ~~4.5~~3.6% of the span of the rotor blade,

~~characterized in that~~ wherein the winglet body (122) further defines a chord, ~~the chord at the blade tip ranging from about 0.0% to about 0.5% of the span of the rotor blade~~,

wherein the winglet body defines cross-sectional profiles at a plurality of radial locations along the winglet body, the cross-sectional profiles being joined so as to define a nominal shape of the winglet body, the cross-sectional profiles being in accordance with the values shown in the table below wherein the nominal shape lies in an envelope within +/- 25% of the spanwise radius and chord values provided in the table:

Radial Location	Spanwise Radius (% of Span)	Chord (% of Span)
1	0.00 %	1.92 %
2	0.44 %	1.89 %
3	0.90 %	1.85 %
4	1.37 %	1.78 %
5	1.83 %	1.67 %
6	2.26 %	1.51 %
7	2.64 %	1.29 %
8	2.94 %	0.99 %
9	3.12%	0.70%
10	3.19 %	0.18 %

Auxiliary request 6

1. A rotor blade (100) comprising a winglet (120), the winglet comprising:

a winglet body (122) extending at least partially between a winglet origin and a blade tip, the winglet body defining a sweep and a pre-bend,

wherein the sweep defined between the winglet origin and the blade tip ranges from about ~~0.5~~1.7% to about ~~4.0~~2.8% of a span of the rotor blade,

wherein the pre-bend defined between the winglet origin and the blade tip ranges from about ~~1.5~~2.4% to about ~~4.5~~3.6% of the span of the rotor blade,

~~characterized in that~~ wherein the winglet body (122) further defines a chord and a twist angle, ~~the chord at the blade tip ranging from about 0.0% to about 0.5% of the span of the rotor blade,~~

wherein the winglet body defines cross-sectional profiles at a plurality of radial locations along the winglet body, the cross-sectional profiles being joined so as to define a nominal shape of the winglet body, the cross-sectional profiles being in accordance with the values shown in the table below wherein the nominal shape lies in an envelope within +/- 25% of the chord values and +/-3.0 degrees of the twist angle values provided in the table:

Radial Location	Spanwise Radius (% of Span)	Chord (% of Span)	Twist Angle (deg)
1	0.00 %	1.92 %	-1.63
2	0.44 %	1.89 %	-1.70
3	0.90 %	1.85 %	-1.94
4	1.37 %	1.78 %	-2.37
5	1.83 %	1.67 %	-2.96
6	2.26 %	1.51 %	-3.29
7	2.64 %	1.29 %	-1.74
8	2.94 %	0.99 %	-1.08
9	3.12%	0.70%	-1.02
10	3.19 %	0.18 %	-1.00

Auxiliary request 7

1. A rotor blade (100) comprising a winglet (120), the winglet comprising:

a winglet body (122) extending at least partially between a winglet origin and a blade tip, the winglet body defining a sweep and a pre-bend,

wherein the sweep defined between the winglet origin and the blade tip ranges from about 0.5% to about 4.0% of a span of the rotor blade,

wherein the pre-bend defined between the winglet origin and the blade tip ranges from about 1.5% to about 4.5% of the span of the rotor blade,

characterized in that the winglet body (122) further defines a chord, a twist angle and a cant angle~~the chord at the blade tip ranging from about 0.0% to about 0.5% of the span of the rotor blade~~,

wherein the winglet body defines cross-sectional profiles at a plurality of radial locations along the winglet body, the cross-sectional profiles being joined so as to define a nominal shape of the winglet body, the cross-sectional profiles being in accordance with the values shown in the table below wherein the nominal shape lies in an envelope within +/- 5% of each length value provided in the table, within +/- 20 degrees of each cant angle value provided in the table and within +/- 0.5 degrees of each twist angle value provided in the table:

Radial Location	Spanwise Radius (% of Span)	Chord (% of Span)	Sweep (% of Span)	Pre-bend (% of Span)	Twist Angle (deg)	Cant Angle (deg)
1	0.00 %	1.92 %	0.00%	0.00 %	-1.63	0.00
2	0.44 %	1.89 %	0.05%	0.02%	-1.70	4.03
3	0.90 %	1.85 %	0.13%	0.09 %	-1.94	11.74
4	1.37 %	1.78 %	0.25%	0.23 %	-2.37	19.70
5	1.83 %	1.67 %	0.41%	0.44 %	-2.96	29.07
6	2.26 %	1.51 %	0.63%	0.75 %	-3.29	39.82
7	2.64 %	1.29 %	0.92%	1.14 %	-1.74	51.70
8	2.94 %	0.99 %	1.29%	1.61 %	-1.08	64.73
9	3.12%	0.70%	1.67%	2.14 %	-1.02	79.00
10	3.19 %	0.18 %	2.25%	3.00 %	-1.00	86.06

Auxiliary request 8

1. A rotor blade (100) comprising a winglet (120), the winglet comprising:

a winglet body (122) extending at least partially between a winglet origin and a blade tip, the winglet body defining a sweep and a pre-bend,

wherein the sweep defined between the winglet origin and the blade tip ranges from about 0.5% to about 4.0% of a span of the rotor blade,

wherein the pre-bend defined between the winglet origin and the blade tip ranges from about 1.5% to about 4.5% of the span of the rotor blade,

characterized in that the winglet body (122) further defines a chord, a twist angle and a cant angle~~the chord at the blade tip ranging from about 0.0% to about 0.5% of the span of the rotor blade~~,

wherein the winglet body defines cross-sectional profiles at a plurality of radial locations along the winglet body, the cross-sectional profiles being joined so as to define a nominal shape of the winglet body, the cross-sectional profiles being in accordance with the values shown in the table below wherein the nominal shape lies in an envelope within +/- 5% of each length value provided in the table, within +/- 20 degrees of each cant angle value provided in the table and within +/- 0.5 degrees of each twist angle value provided in the table:

Radial Location	Spanwise Radius (mm)	Chord (mm)	Sweep (mm)	Pre-bend (mm)	Twist Angle (deg)	Cant Angle (deg)
1	0.00	958.25	0.00	0.00	-1.63	0.00
2	220.91	946.06	24.74	10.43	-1.70	4.03
3	449.68	924.51	64.58	47.37	-1.94	11.74
4	683.36	889.20	123.49	115.33	-2.37	19.70
5	914.48	834.88	206.03	222.29	-2.96	29.07
6	1131.82	755.77	317.05	373.21	-3.29	39.82
7	1321.59	645.30	462.07	568.77	-1.74	51.70
8	1468.88	496.45	647.09	805.00	-1.08	64.73
9	1559.45	334.76	840.25	1071.00	-1.02	79.00
10	1595.20	90.19	1125.41	1500.00	-1.00	86.06

Auxiliary request 9

1. A rotor blade (100) comprising a winglet (120), the winglet comprising:

a winglet body (122) extending at least partially between a winglet origin and a blade tip, the winglet body defining a sweep and a pre-bend,

wherein the sweep defined between the winglet origin and the blade tip ranges from about 0.5% to about 4.0% of a span of the rotor blade,

wherein the pre-bend defined between the winglet origin and the blade tip ranges from about 1.5% to about 4.5% of the span of the rotor blade,

characterized in that the winglet body (122) further defines a chord, a twist angle and a cant angle~~the chord at the blade tip ranging from about 0.0% to about 0.5% of the span of the rotor blade~~,

wherein the winglet body defines cross-sectional profiles at a plurality of radial locations along the winglet body, the cross-sectional profiles being joined so as to define a nominal shape of the winglet body for a nominal span of the rotor blade of 50.000mm, the cross-sectional profiles being in accordance with the values shown in the table below wherein the nominal shape lies in an envelope within +/- 5% of each length value provided in the table, within +/- 20 degrees of each cant angle value provided in the table and within +/- 0.5 degrees of each twist angle value provided in the table:

Radial Location	Spanwise Radius (mm)	Chord (mm)	Sweep (mm)	Pre-bend (mm)	Twist Angle (deg)	Cant Angle (deg)
1	0.00	958.25	0.00	0.00	-1.63	0.00
2	220.91	946.06	24.74	10.43	-1.70	4.03
3	449.68	924.51	64.58	47.37	-1.94	11.74
4	683.36	889.20	123.49	115.33	-2.37	19.70
5	914.48	834.88	206.03	222.29	-2.96	29.07
6	1131.82	755.77	317.05	373.21	-3.29	39.82
7	1321.59	645.30	462.07	568.77	-1.74	51.70
8	1468.88	496.45	647.09	805.00	-1.08	64.73
9	1559.45	334.76	840.25	1071.00	-1.02	79.00
10	1595.20	90.19	1125.41	1500.00	-1.00	86.06

VIII. The appellant proprietor argues as follows:
- The geometry of the winglet disclosed in the patent is unique and provides an improved performance. The proprietor is not obliged to demonstrate a technical effect once the patent has been granted. The skilled person would not have any reason to provide a winglet with pre-bend and sweep values falling within the ranges defined in claim 1 of any request.

IX. The appellant opponent argues as follows:
- Because an effect is not plausible from the patent, which lacks any data, the burden proof of any effect has shifted to the proprietor. Starting from the winglet disclosed in D1, the skilled person would obviously have provided a pre-bend and sweep within the range defined in claim 1, using routine dimensioning skills.

Reasons for the Decision

1. The appeals are admissible.

2. Background

The patent concerns an optimised design for a wind turbine winglet. It is sought to provide a winglet that improves overall performance and efficiency of a wind turbine, paragraphs 003, 004. The design parameters influencing winglet performance are given in a non exhaustive manner in paragraph 012 and include spanwise radius, chord, sweep, pre-bend, twist angle and cant angle. Amongst these parameters claim 1 focuses on sweep, pre-bend (winglet height) and tip chord and defines ranges in terms of dimension relative to blade span.

3. Main and auxiliary request 1 - inventive step

In the oral proceedings the Board first considered inventive step for claim 1 of the auxiliary request 1 starting from D1, the rationale being that any negative conclusion would apply also to the broader granted claim 1. This decision will deal with the requests in the same order.

3.1 D1 cited in paragraph 005 of the patent is from the same applicant and also discloses a winglet geometry for a wind turbine blade. As is evident from paragraph 005 D1 also seeks to improve a winglet to achieve an increase in performance. The rotor blade 16 disclosed in D1 thus includes a winglet 40, located on the suction side, paragraphs 018 and 020, and is stated to provide numerous performance advantages over prior winglets, including increased power coefficient, paragraph 019. Angle values for the sweep angle 62, see paragraph 028, are within a wider range of 0° to 80° with further narrower ranges of 30°-80°, 30°-70° and 45°-65°. Preferred values for the height, corresponding to pre-bend values of the winglet range from 0,1% to 15% of the length or span 50 of the blade for the narrow range, paragraph 035. Furthermore, since the winglet of D1 has a pointed tip its chord value must decrease to 0% at the tip, thus clearly within the range define in the characterising part of claim 1.

3.2 Since the values of sweep are expressed in terms of angles in D1, whereas claim 1 uses percentages of offset instead, these must first be converted to allow a meaningful comparison. Taking the end values of sweep and prebend ranges as in claim 1 of the auxiliary request 1, a range of corresponding sweep angles may be calculated using trigonometric formulas, as shown in

sections 15 and 35 of the impugned decision, which is undisputed. It is also undisputed that the range of sweep values between 1.7% to 2.8% for prebend values between 2.4% and 3.6° in claim 1 of auxiliary request 1 after conversion corresponds to an angular range of sweep angles 25° to 49°. Thus, the sweep range defined in claim 1 of auxiliary request 1 lies within D1's broadest range (0°-80°) and overlaps the narrower ranges, (30°-80°, 30°-70° and 45°-65°). As for the pre-bend, the claimed values 2.4% to 3.6% of auxiliary request 1 are well within the narrower range from 0,1% to 15% in D1. In the following it is assumed that the claimed range of values between 1.7% to 2.8% for the sweep, and 2.4% to 3.6% for the pre-bend establish novelty over D1, and thus form the distinguishing features of the winglet body of claim 1 of the auxiliary request 1 over D1.

3.3 Formulation of the technical problem

3.3.1 Applying the problem solution approach, it is well established case law that the objective technical problem must be formulated based on the assessment of the technical effects achieved by the claimed invention in comparison with the closest prior art. In the present case, this requires assessing any effects or advantages associated with the claimed range of values for sweep and pre-bend as can be derived from the patent in the light of the cited prior art. The Board notes that the decision does not mention any associated effect nor formulate an objective technical problem associated with the claimed parameter ranges. The appellant proprietor only offers (brief, page 10, penultimate paragraph) a "completely different design".

3.3.2 In its preparatory communication, section 4, the Board considered the effect of similar differences over another document, stating:

"4.2 Applying the problem solution approach, the objective technical problem must be formulated based on any effects or advantages associated with the claimed range of values and as can be derived from the patent in the light of the cited prior art. Paragraph 0012 states the general benefits of improved performance that are associated with the use of winglets on a wind turbine per se and which are well known. Paragraphs 0036, 0039 and 0041 refer to advantages of the design, but without identifying what these might be. Overall, the patent only seems intent on describing a "unique" winglet design in terms of "design parameters", some of which may be new, but without any discussion of whether or how those parameters might effect the performance or efficiency of the blade. Thus, no specific technical effect related to the ranges of values for either of the geometrical parameter sweep or pre-bend appears to be described, let alone plausibly demonstrated in the patent, especially paragraphs 028 and 029 explaining the measurements and range of values chosen. The appellant proprietor submits that the effectiveness of winglets is based on a combination of parameters and not a mere juxtaposition, but the patent lacks any information that a particular combination of sweep and pre-bend would achieve particular effectiveness or performance, let alone unexpected ones. The patent also does not contain any data or comparative tests that might suggest a special benefit or effect associated with the claimed ranges. The Board notes that the decision does not mention any associated effect nor formulate an objective technical problem associated with the claimed parameter ranges. The appellant

proprietor only offers (brief, page 10, penultimate paragraph) a "completely different design".

..

4.6 *The same considerations apply when starting from either D1 or D2 as starting point."*

3.3.3 The appellant proprietor disagrees, stating that the burden of proof regarding any effect and comparative data must lie with the opponent, see pages 3 and 4 of their reply of 20 July 2023 which quotes Chapter III.G. 5.1.2b, CLBA (10th edition, 2022):

*"In **T 862/11** the appellant (opponent) failed to submit comparative tests in support of its own assertion that an improvement was implausible owing to the lack of any evidence. In the absence of such tests, however, it failed to convince the board, which therefore regarded the problem as solved, and saw no need to reformulate it (see also in this chapiter III.G.4.2.2 "Test and experimental evidence").*

*The problem stated in a granted patent is deemed to have been plausibly solved by the claimed invention when there are no grounds to suspect otherwise. According to the established case law of the boards of appeal, in opposition (or any subsequent appeal) proceedings it is insufficient for the opponent to attack a granted patent with an unsubstantiated assertion. The opponent bears the burden of proving its assertion or must at least furnish evidence liable to raise doubts that the problem has indeed been solved (**T 534/13**, citing **T 1797/09**, point 2.7 of the Reasons)"*

with emphasis added by the appellant proprietor.

This follows the well established principle that an alleging party bears the burden of proof for any allegation they make, as borne out by the cases cited. Thus, in **T 862/11**, reasons 6.5.4 because the appellant

opponent failed to substantiate allegations that an effect was not plausible, the Board did not reformulate the objective technical problem, while in **T 534/13**, reasons 4.3, the appellant opponent had failed to provide supporting evidence for their allegation that test results in the patent were insufficient to prove an improvement across the entire claimed range. **T0543/13**, reasons 4.2, underlines - this is the first sentence of the 2nd paragraph cited from Chapter III.G. 5.1.2b above - that the problem stated in a granted patent is deemed to have been plausibly solved by the claimed invention, when there are no grounds to suspect otherwise.

3.3.4 That is not the case here. In their statement of grounds, pages 7 and 8, the appellant opponent explains that the patent does not provide any "hint that a particular aspect of the ...claimed .. winglet", for which it does state six characteristic design parameters not all of which are mentioned in the claim, "leads to an advantageous technical effect or improvement over the prior art". The patent rather makes "general statements about performance" stating that "the unique geometric shape... [is] designed to improve the overall efficiency and performance of the rotor blade". Furthermore, "no indication is provided of a measured or expected extent [and] no tests have been described comparing the winglet of the patent to any other patent". Citing Chapter I.D.4.6 (CLBA 2019) (corresponding to I.D.4.3.3 , CLBA 2022), they then state that "the patent does not provide any data at all", that might have rendered a claimed effect plausible. In so doing it addresses an argument that there would be no technical effect and which was apparently discussed at the oral proceedings (see

minutes, middle of pages 11 and 13) but not addressed in the decision.

These statements regarding the content of the patent are easily verifiable and are confirmed by the Board. Thus, the patent provides no data or comparative tests whatsoever that might link any specific one of the various design parameters mentioned in paragraph 012 to the very broadly defined effect of improved efficiency and performance. It is the Board's view, see also Chapter D.I.4.3.1, CLBA 2022, that, given that the claimed invention resides in a specific ranges of values of specific design parameters, and unless this is not already apparent from common general knowledge, the patent must demonstrate either by a cogent explanation or by comparative test data that those specific value ranges are plausibly linked to alleged effects.

In the present case it is not immediately apparent for the person skilled in aerodynamics that the suction side winglet provided with the ranges of values for sweep and pre-bend defined in claim 1 would perform any better than the winglet of D1 disclosed with broader ranges of sweep and pre-bend. Thus, if any further or improved effect or advantage in terms of performance is alleged, then it should be supported by evidence in the patent. As both an explanation and data are missing any link between claimed parameter ranges and effect has not been plausibly demonstrated and thus the burden of proof shifts to the appellant proprietor.

3.3.5 In this context, the appellant proprietor has referred to paragraph 012 of the patent. It is undisputed that improved energy output can be obtained by using winglets as also stated in paragraph 003 of the patent.

Paragraph 0012 merely acknowledges in a very general and unspecific manner that this improved performance can be achieved by an appropriate design of a winglet on a wind turbine, by a judicious choice of a broad variety of different design parameters. This passage does not emphasize, let alone explain the relevance or importance of sweep, pre-bend or tip chord amongst this list of design parameters. Nor does it give the selected ranges any special significance.

3.3.6 Turning to paragraph 021, which the appellant proprietor also cites in this context, this passage merely defines in greater detail and in reference to the figures design parameters already mentioned in paragraph 012. These include but do not emphasize in any way the parameters that appear in claim 1. From paragraph 026 onwards each design parameter is discussed separately and independently with preferred ranges given : first the spanwise radius 138 is discussed (paragraph 026), then chord 140 (paragraph 027), then the sweep (paragraph 028), height or pre-bend (paragraph 029), twist (paragraph 030), and, finally, cant angle (paragraph 031). These passages do so neutrally, without placing any particular emphasis on one or other of these parameters, much less give selected ones special significance or a special role in improving performance.

Paragraphs 034 and 038, tables 1 and 2, describe a single example of a "nominal geometric shape" of a winglet characterized by specific (single) values for each of the above parameters at different radial positions of the winglet, expressed in absolute (table 1) or relative (table 2) values. Paragraphs 0036, 0039 and 0041, finally state that values of this design may be varied within various broad margins "without

impairment of the advantages provided by the disclosed winglet", but however do not state what these advantages might be, much less offer supporting evidence or even some form of explanation.

3.3.7 The appellant proprietor further submits that the effectiveness of the claimed winglet is based on a combination of parameters and not a mere juxtaposition. However, as explained above the patent lacks any indication that the selected parameters pre-bend, sweep and tip chord are *the* key design parameters, either alone or in combination, for improving performance or how they might combine to provide an improved effect. As stated earlier from paragraphs 026 onwards the various design parameters are discussed separately and independently.

3.3.8 Finally, the appellant proprietor's contention that the winglet design defined in claim 1 would implicitly perform better than D1 by the mere fact that D1 is acknowledged as prior art, is nothing more than unsubstantiated allegation.

3.3.9 In the light of the above, the Board concludes that overall, the patent is only intent on describing a "unique" winglet design in terms of "design parameters", some of which may be new or newly reformulated, but without any discussion of whether or how and to what degree those parameters might effect the performance or efficiency of the blade, whether separately or in combination. Nor does the patent provide any comparative data - as also not disputed by the appellant proprietor - that might have allowed for a comparison of the claimed winglet design to prior art winglet designs. It thus follows that the patent does not credibly or plausibly associate any specific

technical effect to the particular parameter value ranges claimed.

3.3.10 Absent any evident or plausible associated effect the Board formulates the objective technical problem starting from the winglet designs of D1 as providing a rotor blade winglet with different design or geometry.

3.4 Obvious alternative design

3.4.1 In the Board's view, the skilled person seeking to design a different winglet than that of D1 would as a matter of obviousness do so by choosing different parameter values or by choosing parameters that define the winglet differently. Comparing the values of sweep angle and prebend that can be derived from the values of sweep and prebend as defined in the claim with the corresponding broader or overlapping ranges disclosed in D1, see section 3.2 above, the Board sees no cogent reason why the skilled person would not seriously contemplate selecting values in the claimed ranges if they are looking for a different design.

3.4.2 Alternatively, assuming for the sake of argument that the ranges of values for sweep and pre-bend defined in claim 1 might have resulted in improved performance compared to other values in the range of values disclosed in D1, they are then seen to amount to nothing more than the result of routine optimization effort. Such routine optimization as a matter of course considers the relevant parameters that characterize winglet design, such as sweep angle and prebend or height (see D1), cant and twist angle and radius of curvature. That the patent chooses to use (some) differently defined parameters is immaterial as, see section 3.2 above, these are seen to correspond by appropriate conversion to those of D1. Certainly no

inventive step can be seen in the redefinition of parameters per se. Routine optimization could be by empirical testing of model winglets or by modelling and simulation. These techniques belong to the "tool box" of the skilled person, here an engineer developing wind turbine blades.
The Board is furthermore unconvinced that this routine optimisation would require extensive testing and modelling, thus putting an undue burden on the skilled person as submitted by the appellant proprietor. Even if less precise and accurate than fluid flow tests of scaled models in wind channels, conventional computer simulations with CFD models are commonly used by the person skilled in aerodynamics to perform a first estimation of expected fluid behaviour around a blade equipped with a winglet. Because such computer calculations are straightforward and well known to the skilled person for the purpose of routine optimisation, it would provide a sufficient degree of precision to assess a range of pre-bend and sweep values around the claimed range.

3.5 The Board thus finds, contrary to the decision under appeal, that the winglet including the ranges of values for sweep and pre-bend defined in claim 1 of auxiliary request 1 does not involve an inventive step. This finding must naturally also apply to claim 1 of the main request that defines broader ranges of values the subject-matter of claim 1 of the auxiliary request 1.

4. Auxiliary requests 2-9

4.1 These requests either narrow down the parameter ranges claimed (auxiliary requests 2 to 4) or add ranges for other design parameters (auxiliary requests 5 to 9). However, as for claim 1 of the previous requests the patent fails to identify any particular effect or advantage associated with the claimed ranges. The lack of a credible technical effect therefore constitutes a fatal flaw of the patent that cannot be remedied by further narrowing the range, as was done in the further auxiliary requests 2 to 9.

4.2 Contrary to the appellant proprietor's opinion, this conclusion is also applicable to claim 1 according to auxiliary request 9. Although related to a more limited embodiment because it includes all the parameter values expressed in table 1 of the patent, as stated under point 3.4 above, paragraph 034 lacks any indication of a particular effect or advantage provided by these specific parameter values. Thus, the reasons given above apply also to this request.

5. As the Board finds the decision to have erred in its finding of inventive step, it must set it aside. Furthermore, as the patent as amended according to the remaining requests does not meet the requirements of the EPC the Board must revoke the patent pursuant to Article 101(2) and (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