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Datasheet for the decision of 13 November 2024

Case Number: T 0767/23 - 3.2.04

Application Number: 18176764.1

Publication Number: 3418556

IPC: F03D1/06, F03D13/10, B29D99/00, B29C70/52

Language of the proceedings: EN

Title of invention:
A WIND TURBINE BLADE WITH HYBRID SPAR CAP AND ASSOCIATED METHOD FOR MAKING

Patent Proprietor:
General Electric Company

Opponent:
Vestas Wind Systems A/S

Headword:

Relevant legal provisions:
EPC 1973 Art. 56

Keyword:
Inventive step

Decisions cited:

Catchword:

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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

Case Number: T 0767/23 - 3.2.04

D E C I S I O N
of Technical Board of Appeal 3.2.04
of 13 November 2024

Appellant: (Patent Proprietor)	General Electric Company 1 River Road Schenectady, NY 12345 (US)
Representative:	ZBM Patents - Zea, Barlocci & Markvardsen Rambla de Catalunya, 123 08008 Barcelona (ES)
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 9 March 2023 concerning maintenance of the European Patent No. 3418556 in amended form.**

Composition of the Board:

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

Summary of Facts and Submissions

I. The opponent and the proprietor both appeal against the decision of the Opposition Division of the European Patent Office concerning maintenance of the European Patent No. 3418556 in amended form.

II. The Opposition Division held that the patent and the invention to which it related according to the second auxiliary request met the requirements of the EPC, having regard in particular to the following documents:

D4: WO2011/135306 A1
D12: US2017/0080648

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

IV. Oral proceedings were held on 13 November 2024 per videoconference.

V. At the end of the oral proceedings the appellant-proprietor requested to set aside the impugned decision and to maintain the patent on the basis of the main request or auxiliary request 20 filed with the grounds of appeal of 7 July 2023.

VI. The appellant-opponent requested that the decision be set aside and the patent be revoked.

VII. The independent claim 1 according to the relevant requests read as follows (features numbering and amendments added by the Board):

Main Request(as granted):

1. "A method (100) for manufacturing a wind turbine blade shell component (22), comprising:
1a) providing a plurality of first pultrusion plates (42) formed of a first pultrusion fiber material (44);
1b) providing a plurality of second pultrusion plates (46) formed of a second pultrusion fiber material (48);
1c) the first pultrusion plates (42) are different from the second pultrusion plates (46);
1d) the first and second pultrusion plates having a length corresponding to an entire length of a spar cap (20) for a wind turbine blade shell (21);
1e) stacking the first and second pultrusion plates in a hybrid pattern (52) that contains both first and second pultrusion plates;
1f) arranging the stacked hybrid pattern of first and second pultrusion plates on blade shell material (21) in a mold (54) for the blade shell component; and
1g) bonding the stacked hybrid pattern of first and second pultrusion plates with the blade shell materials to form the blade shell component."

Auxiliary request 20

Claim 1 of auxiliary request 20 adds to granted claim 1 the features of granted claims 2 and 3, corresponding to claims 2 and 3 of the application as originally filed, as follows:
" wherein the stacked hybrid pattern (52) of first (42) and second (46) pultrusion plates are bonded with the

blade shell material (21) in a resin infusion process;" and
"wherein the stacked hybrid pattern (52) of first (42) and second (46) pultrusion plates are un-bonded when arranged on the blade shell material (21) in the mold (54), the bonding step comprising co-bonding the stacked hybrid pattern of first and second pultrusion plates and blade shell materials by the resin infusion process."

VIII. The appellant-opponent argues as follows:
- The subject-matter of claim 1 of the main request and of the auxiliary request 20 lacks an inventive step starting from D4 in view of the skilled person's common general knowledge or in combination with D12.

IX. The appellant-proprietor argues as follows:
- The subject-matter of claim 1 of the main request and of the auxiliary request 20 involves an inventive step starting from D4 in combination with the skilled person's common general knowledge or with D12.

Reasons for the Decision

1. The appeals are admissible.

2. Background

The patent concerns the structure and manufacture of a pultruded spar cap for a wind turbine blade. It is sought to optimize the amount of more expensive and less expensive materials for a more cost efficient structure, paragraph 012. The core of the solution relies on the provision of a spar cap comprising a hybrid stack of plates. The hybrid stack is made from a plurality of first and second pultrusion plates formed

from different pultrusion fiber materials, paragraph 014. According to paragraph 015, the hybrid stack is either made by arranging the un-bonded pultrusions in the mold, or pre-bonding the pultrusion plates together before placement in the blade mold.

3. Main request - inventive step starting from D4

3.1 D4 discloses a modular structural composite beam for use in a wind turbine. Each blade can be made as two half shells with separate or integral beam, which operation requires a bonding step of the beam on the blade shell according to feature 1g, page 1, lines 11-15. Each beam 10 comprises a flange 5, 105 as load bearing component or spar cap, made of elongate elements 40, 140 made as pultrusions. A relevant embodiment is disclosed on page 10, second paragraph with elongate elements which are made of different plastic materials, glass fiber reinforced plastic 10, and carbon fiber reinforced plastic 140. These form a hybrid pattern of first and second pultrusions (features 1a, 1b, 1c, 1e).

3.1.1 Apart from the considerations on the number of elongated elements in the stack to achieve different depths, page 9, third paragraph, D4 does not disclose any information about the relative length of each elongated element. Thus it is common ground that the subject-matter of claim 1 differs from D4's disclosure by at least the feature 1d, requiring the length of the plates to be the entire length of the spar cap.

3.1.2 D4 also lacks any precise information on how each flange 5, 105 with its elongate elements 10, 140 is attached to the shell of the wind turbine blade, so that the subject-matter of claim 1 further differs from

D4 by step 1f, the arranging of the plates on the blade shell in a mold.

3.1.3 The appellant-proprietor further argues that the beam in D4 needs to be manufactured before being bonded to the previously formed half shell of the blade, therefore D4 cannot disclose the step of bonding the stacked hybrid pattern to form the blade shell according to step 1g. Moreover the plates 40 are located in the skin element 20, 120, and therefore they are not in direct contact with the skin in the mold.

3.1.4 The Board however considers that irrespective whether the flanges 5, 105 of the beam are pre-formed before attachment to the blade shell or rather the beam plates are co-bonded only when the plates are already within the blade, the attachment of the flange to the blade implies a bonding step to an interior surface of the blade skin resulting in the formation of an assembled blade shell component. This last bonding step expressed in 1g covers both possibilities of pre-bonding the stack before bonding to the blade shell or co-bonding the plates of the hybrid stack with the blade shell component. Furthermore neither the wording of feature 1f nor of feature 1g requires a direct contact between the plates in the stacked hybrid pattern and the blade shell material.

3.1.5 Thus the Board finds that the subject-matter of claim 1 differs from D4 by its features 1d and 1f.

3.2 Based on the above identified differences, the Board concurs with the appellant-opponent that neither selecting the entire length of the spar cap according to feature 1d nor arranging the hybrid stack on the blade shell in a mold before bonding according to

feature 1f (and 1g) is associated with any technical effect or advantage identified or derivable from the disclosure of the patent.

3.2.1 That the pultrusion plates have a length dimension corresponding to an entire length of the spar cap is merely mentioned in paragraphs 018, 021 and 032 of the patent but lack any further technical explanation, apart from the additional comment that it allows a continuous and unbroken design. At best the skilled person would derive for this feature some general structural advantage.

3.2.2 As for the other technical effect related to the further distinguishing feature 1f (even with 1g) of claim 1, the Board is also unable to recognise any particular effect or advantage in the patent from selecting a suitable way to attach spar caps formed by a hybrid stack to half shells of a wind turbine blade. This is especially so as claim 1 does not exclude pre-forming the hybrid stack before arranging the stack in the mold and then co-bonding the hybrid stack together with the blade shell. The relevant passages of the patent in paragraphs 015 and 019 present pre-bonding the pultrusion plates prior to bonding to the shell, and co-bonding the pultrusion plates with the blade shell materials as two possible options without any specific advantage.

3.2.3 As explained above, D4 is silent on those technical details which is specified in the distinguishing features as set out in point 3.1.5 above. This means that a meaningful comparison of the claimed subject-matter and the prior art cannot be performed by the skilled person on any of these aspects, so that no effect or advantage over D4 can be established on the

basis of these features. Therefore the objective technical problem may be formulated, as suggested by the appellant-opponent at the oral proceedings, as how to implement the teaching of D4 to manufacture a complete blade.

3.3 When looking for an suitable way to manufacture a complete wind turbine blade using the beam concept disclosed in D4, the skilled person need only select appropriate design options, in particular an appropriate length for the stack of elongate elements within the flange and to find a suitable way to attach this flange made of a hybrid stack to the blade shell. These two considerations can be taken independently.

3.3.1 Avoiding any discontinuity in the material of the pultrusion would be considered by the skilled person as the desirable and most efficient way of spreading load distribution along a spar cap, thereby achieving a improved strength. Selecting the length of the elongate elements such that they span the entire length of the spar cap would therefore be the most obvious choice of the skilled person. The effect of compensating inferior mechanical properties of one of the fibers, an effect on which the appellant proprietor relies for the formulation of a more specific problem, is already solved in D4. D4 already provides the same hybrid pattern of glass and carbon pultrusion plates, page 10, lines 8-13.

3.3.2 Furthermore, when considering how to bond the flanges disclosed in D4 to the material of the shell of the blade, the skilled person is faced with a single alternative already disclosed on page 1, last paragraph of D4. D4 teaches that either the flanges of the spar cap are moulded within the half shells, or a pre-formed

or pre-cured spar cap is moulded to the half shell. Selecting the first of these two options, that is arranging the hybrid stack, pre-formed or not into the mold, according to feature 1f and co-bonding the flanges to the blade shell material to obtain the blade shell component, constitutes an obvious choice between two essentially equivalent options.

3.4 The appellant-proprietor essentially argues that there is an incompatibility between the disclosure of D4 and the method according to claim 1. In its view, D4 discloses a pre-manufactured modular beam. Taking into account the taper of a wind turbine blade would require a segmented and stepped configuration, which would be incompatible with the provision of elongate elements having the entire length of the blade. Furthermore, beams can only be fitted to the taper of the blade when the hybrid stack having the required length according to feature 1d is located in the mold. The modular pre-fabricated segments of the beams in D4 are thus incompatible with the provision of steps 1f and 1g.

3.4.1 The Board is not convinced. The different passages of D4 on which the appellant-proprietor relies do not suggest that the length of the pultrusion elements 40, 140 should differ from the total length of the flanges 5, 105. Nor are these passages exclusively limited to segments of pre-fabricated beam as a complete box with shear webs before their bonding to the blade shell, nor exclude to provide these shear webs at a later stage of the production process.
On page 2, the passages in lines 9-10 and lines 14-15 concern general background considerations of making the beam separately, possibly using automation. No particular constraint on the beam length or cross section is derivable from such general manufacturing

options. The sentence bridging pages 4 to 5 discloses the possibility to make the shear webs in a continuous process, but does not impose any limitation on the possibility to provide a varying height to accommodate a taper of the wind turbine blade. This possibility of also providing the shear webs as separate pieces of a kit is further supported by the explicit provision of a kit for the flanges themselves, see paragraph bridging pages 6 and 7. Such kit allowing to form a modular flange made of the elongate elements is not related to a particular length, especially as the last sentence of this paragraph clearly contemplates providing flanges of varying sizes and mechanical properties.
Rather than requiring a segmented configuration of beams having a constant height, the sentence bridging pages 9 to 10 encourages the skilled person to provide shear webs of varying depth to accommodate the blade taper. Therefore, the Board sees no incompatibility of this passage with the provision of flanges of any length.

As concerns the varying depth of the flange itself relied on from the context of page 11, lines 13 to 15, the Board is unable to recognise an implied segmented configuration of flanges of discrete constant height or thickness, contrary to the submissions by the appellant-proprietor. By contrast, the Board considers that the skilled person would obviously have derived the possibility to provide a flange or spar cap having two elongate elements depth spanning over its entire length, while increasing the depth within the same flange with a third element closer to the blade root. Such configuration would fit well with the example given on page 11, lines 9 to 15 in relation to figure 2 of D4 that discloses a depth of two elements in parenthesis in line 11, while the figure 2 depicts

three elements in depth, the third layer elements would be seen as the change in depth at some intermediate location of the same flange. The Board again emphasises that claim 1 is limited to pultrusion plates having the entire length of a spar cap, this spar cap not necessarily having the full length of wind turbine blade shell itself.

3.4.2 It follows that the Board is not convinced by the alleged incompatibilities of the teaching of D4, as argued by the appellant-opponent. Rather, the skilled person would contemplate in an obvious manner and relying on common workshop practice the direct implementation of the disclosure of D4, in order to manufacture a blade shell component equipped with a flange made of a hybrid stack, as required by features 1d and 1f of claim 1.

3.5 Thus contrary to the opposition division positive finding, granted claim 1 lacks an inventive step when starting from D4 in combination with the skilled person's common general knowledge.

4. Auxiliary request 20 - inventive step

4.1 Claim 1 of this request adds to granted claim 1 the features of claims 2 and 3 of the patent as granted, corresponding to claims 2 and 3 of the application as originally filed. The added features further specify that the the stacked hybrid pattern of first and second pultrusion plates are un-bonded when arranged on the blade shell material in the mold and the stack and blade shell are co-bonded by a resin infusion process.

4.2 This further specification follows one of the first alternative presented in paragraph 015 of the patent

where the plates are un-bonded when arranged on the blade shell materials, the second alternative being to pre-bond the plates in the hybrid stack before placement in the mould. Both alternative ways are presented as equivalents, and no particular technical effect or advantage can be associated from the selection of the first way, as convincingly argued by the appellant-opponent.

4.3 Absent any such advantage, the skilled person would have considered the possibility of stacking the elongate elements 40 in an un-bonded state, before co-bonding these elements with the blade shell to form a finished blade shell component as an obvious manufacturing option. This would then include the use of a resin infusion process, as it is undisputedly one of the known and widespread processes for feeding the resin before curing.

4.4 The appellant-proprietor also considers these further steps incompatible with the teaching of D4. They argue that the resin infusion process would not work reliably with the large and long stack of the un-bonded pultrusion elements according to D4.

4.5 The Board does not recognise any such incompatibility. It is considered to be common practice for the person skilled in manufacturing composite blades to bond components having a very long dimensions. As further convincingly submitted by the appellant-opponent, page 8, lines 21 to 26 of D4 already contemplates vacuum infusion process as one of the processes to adhere the elongate elements together. Using the very same method when co-bonding the same elements with material of the blade shell only involves routine measures.

4.6 Therefore the subject-matter of claim 1 according to auxiliary request 20 also lacks an inventive step.

5. As the Board finds that the opposition division was wrong to find that the subject-matter of granted claim 1 involves an inventive step it must set the decision aside. Given that auxiliary request 20 was found not allowable on the grounds of lacking inventive step, no allowable request remains. Thus 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. Pieracci

Decision electronically authenticated