

Internal distribution code:

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

**Datasheet for the decision
of 21 May 2021**

Case Number: T 2296/17 - 3.2.04

Application Number: 09781993.2

Publication Number: 2334932

IPC: F03D1/06, F16B11/00

Language of the proceedings: EN

Title of invention:

ASSEMBLY AND METHOD OF PREPARING AN ASSEMBLY

Patent Proprietor:

Vestas Wind Systems A/S

Opponent:

GE Wind Energy GmbH

Headword:

Relevant legal provisions:

EPC Art. 54, 56

Keyword:

Novelty - main request (no) - auxiliary request 1 (yes)
Inventive step - auxiliary request 1 (yes)

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 2296/17 - 3.2.04

D E C I S I O N
of Technical Board of Appeal 3.2.04
of 21 May 2021

Appellant: Vestas Wind Systems A/S
(Patent Proprietor) Hedeager 42
8200 Aarhus N (DK)

Representative: Worthington, Richard Easton
Withers & Rogers LLP
4 More London Riverside
London SE1 2AU (GB)

Appellant: GE Wind Energy GmbH
(Opponent) Holsterfeld 16
48499 Salzbergen (DE)

Representative: Zimmermann & Partner
Patentanwälte mbB
Josephspitalstr. 15
80331 München (DE)

Decision under appeal: **Interlocutory decision of the Opposition
Division of the European Patent Office posted on
4 August 2017 concerning maintenance of the
European Patent No. 2334932 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 against the Opposition Division's concerning maintenance of the European Patent No. 2334932 in amended form.

- 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 2 complied with the requirements of the EPC, having regard in particular to the following documents:

ZP1: J.L. Clarke et al: "Structural Design of Polymer Composites", EUROCOMP Design Code and Handbook, (Preface, EUROCOMP Design Code pages 7-236 and EUROCOMP Handbook pages 553-559)
ZP2: W.D.Nelson et al: "Composite Wing Conceptual Design", US Government, Technical Report AFML-TR-73-57, approved for public release 3 Nov 1983.

- III. Oral proceedings were held on 21 May 2021 in the form of a videoconference.

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

- V. The appellant proprietor requests that the decision under appeal be set aside and that the patent be maintained as granted (Main Request), or on the basis of one of Auxiliary Requests 1, 1a, 2 - 7, whereby Auxiliary Requests 1-7 were filed during the opposition procedure and re-filed in appeal, 1a was filed in

response to the appellant-opponent's grounds of appeal with letter dated 11 April 2018.

VI. The wording of claim 1 of the main request and the first auxiliary request is as follows:

Main request

"A method of preparing an assembly, comprising:
providing a first structure (1, 21, 27);
providing a second structure (2, 22, 27);
providing at least one flexible adhesive limiting member (7, 9) extending between said structures;
and
providing an adhesive (3) between said structures to bind said structures to each other;
characterized in that the adhesive (3) is limited by the flexible adhesive limiting member (7, 9) such that a concave front line surface of the adhesive (3) is defined."

Auxiliary request 1 (with amendments underlined)

A method of preparing an assembly, comprising:
providing a first structure (1, 21, 27);
providing a second structure (2, 22, 27);
providing at least one flexible adhesive limiting member (7, 9) extending between said structures; and
providing an liquid adhesive (3) between said structures to bind said structures to each other;
wherein the flexible adhesive limiting member (7, 9) functions as a glue dam whereby ~~characterized in that~~
the adhesive (3) is limited by the flexible adhesive limiting member (7, 9) such that a concave front line surface of the adhesive (3) is defined."

VII. The Appellant-Opponent argued as follows:

- ZP1 discloses a boundary angle that limits a concave front line surface of the adhesive and is thus novelty destroying for granted claim 1.
- The adhesive used in ZP1 is liquid in the broad understanding of this term and thus also anticipates claim 1 according to auxiliary request 1.
- Starting from ZP1, the skilled person would obviously change the order of the steps of applying resin in the laminated joint and arrive at the assembly method of claim 1 according to auxiliary request 1.

VIII. The Appellant-Proprietor argued as follows:

- In ZP1 the boundary angle is laminated on a surface that is no longer deformable and thus cannot form the limit of the adhesive as in granted claim 1.
- The adhesive used in ZP1 is not liquid and thus fails to anticipate claim 1 according to auxiliary request 1.
- Starting from ZP1, the skilled person would need to depart from the sequence of steps disclosed. This is well beyond their routine skills so that the subject-matter of claim 1 according to auxiliary request 1 involves an inventive step.

Reasons for the Decision

1. The appeals are admissible.
2. Background
 - 2.1 The patent concerns a method of preparing a joint assembly that uses an adhesive. Paragraph 002 explains that when assembling a conventional joint the formation of sharp edges results in notches that weaken the joint, which is particularly detrimental in wind turbine blades subject to stress over long periods of time. It is therefore sought to provide a joint less

prone to be weakened by notches, paragraph 008. The core idea resides in the provision of a flexible adhesive limiting member to better shape the adhesive. More specifically, according to Claim 1 the adhesive is limited by the flexible adhesive limiting member such that a concave front line surface of the adhesive is defined.

- 2.2 The last feature of claim 1, which is directed at a method of preparing an assembly, expresses its last step as a result to be obtained by the adhesive limiting member: the adhesive is limited by a flexible limiting member *such that a concave front line is defined*. This functional requirement is understood as meaning that the adhesive has a boundary or limit surface - called front line - which is of a concave shape and bears against the flexible limiting member. This in turn implies some sort of action of the adhesive limiting member on the adhesive outer surface which, because of its relative stiffness, is able to actively provide the outer concave shape of the soft adhesive surface. The claim however does not define any further limitation on the adhesive limiting member other than that it should be *flexible*, which (paragraph 037) implies an ability to be flexed or bent without breaking. For the limiting member to define a front line surface it must moreover be distinct from the adhesive.

3. Main request - Novelty with respect to ZP1

- 3.1 ZP1 is a handbook that generally concerns structural design in glass fibre composites (page 7, P(1)), and more particularly includes a chapter 5 on connection design including joints, where chapter 5.3.6 more particularly relates to laminated joints and is

relevant for the present case. An example of a tee (T) joint design, its structure and manufacture are discussed in section 5.3.6.7 on page 225 with reference to figure 5.51. Figure 5.51 shows a laminated tee joint that comprises a horizontal flat panel as first structure on which the end of another panel or section as second structure is attached by the joint structure. According to P(2) on page 225, these parts making up the joint are bonded to either side of the leg of the tee using a boundary angle. According to item (1) on page 225 the boundary angle comprises reinforcement plies that are laminated over a radiused resin fillet. As such each boundary angle is structurally distinct from the underlying resin fillet, and indeed, as is also apparent from the figure, forms a concave shape that is coincident with the concave outer limit for the resin.

3.2 The question is now what state the resin fillet is in in ZP1 when the boundary angle plies are laminated over it. Is the fillet pre-shaped with a predefined contour though still tacky as argued by the appellant-proprietor, or is it in a semi cured, solidified but still malleable state as argued by the appellant opponent. In the latter case the boundary angle would define or help to define the concave front line surface of the fillet, in the former the boundary angle plies would merely conform to the pre-existing fillet contour.

The boundary angle in figure 5.51, which shows design variables of a typical laminated joint (see caption), is associated with *number of plies* and *material makeup of plies*, while its outer surface is labelled as *fillet radius*. Paragraph P(5) bridging pages 225 to 226 further explains that the boundary angles consists of

CSM (Chopped Strand Mat) and woven roving having a number of key parameters, including in particular a certain radius. This radius is, according to the previous paragraph P(4), essential to provide adequate strength and thickness to transmit the loads. Being made of a limited number of plies made from mats or roving this structure before being fully cured will be bendable and thus necessarily exhibit a certain flexibility. Section 5.3.6.8 discloses manufacturing aspects common for forming laminated joints in general and therefore supplements the preceding section 5.3.6.7 which focused more on the manufacture of the laminated tee joint. On page 228, paragraph P(12) explains that the gap shown in figure 5.51 between the vertical leg and flange panel should be filled with filleting resin in such a quantity so as to be able to provide the design radius, furthermore preventing the formation of voids. According to P(13) over-laminating of the angle joints (where plies extend beyond the fillet onto the parts that are joined, see figure 5.51) is commenced at an appropriate stage of the cure of the filleting resin, therefore before it is fully solidified in the finished cured stage.

3.3 The observation by the appellant proprietor that the radius fillet is already in place before the angle is laminated over its surface does not contradict the fact that both angle joints on either side, as flexible limiting members, may be applied at an intermediate stage of curing of the resin in the gap and fillet region.

However, contrary to the appellant proprietor's view, the Board is of the opinion that in the appropriate stage of curing explicitly disclosed in ZP1, the resin still exhibits a degree of deformability that makes it soft rather than almost hard but with a tacky surface

before being solidified in the fully cured state. In the Board's view this can be directly inferred from the fact that the boundary angle, which is the part of the tee-joint that provides its structural integrity, according to P(4) must have a certain definite design radius to provide adequate stiffness and resistance. In the Board's understanding for these design characteristics to be obtained, the boundary angle has to be applied with such a pressure that the free surface of the still soft and deformable resin is pushed to its finished filleted state having the predefined design radius of the boundary the angle. This design radius would otherwise not be achievable in an almost fully solidified state of the resin, because in such a state the open surface of the resin would define the radius. The design angle would then not be a design parameter of the boundary angle, but rather be determined by the solidified resin fillet. That the resin is still soft and deformable before being shaped to the correct radius can furthermore also be inferred directly from the fact that the formation of detrimental bubbles or voids should be prevented. In the Board's understanding this is only possible if the resin fillet is sufficiently malleable for trapped air to move to the surface. For the fillet to have a tacky surface, as argued by the appellant proprietor, it would have to be in a progressed state of solidification, in which case air could no longer escape easily from within the resin when the boundary angle is put in place.

- 3.4 The Board concludes therefore that in the laminated tee joint of ZP1, the concave front line surface of the adhesive is defined by the boundary angle applied at an intermediate stage of curing the resin. Thus, application of the boundary angle of ZP1 realises the

final steps of claim 1 of limiting the adhesive such that a concave front line is defined.

3.5 From the above, it follows that ZP1 anticipates all the method steps 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

4.1 Claim 1 specifies in claim 1 as granted that the adhesive is liquid and that the flexible adhesive limiting member functions as a glue dam. At the oral proceedings before the Board the appellant opponent argued that the added qualification of the adhesive as liquid was unclear, and challenged both novelty and inventive step of the subject-matter of claim 1 based on ZP1 and ZP2.

4.2 Clarity & Claim Interpretation

4.2.1 The usual understanding of the term *liquid* is "flowing freely like water" (Merriam Webster) or "in that condition (familiar as the normal condition of water, oil, alcohol, etc.) in which its particles move freely over each other" (OED). As the example of water and oil shows, liquids may flow faster or slower depending on viscosity. This normal reading is further confirmed by the added feature that the flexible adhesive member acts as a glue *dam*, that latter term understood as "a barrier to check the flow of liquid, gas, or air". For the flexible adhesive member to act as a glue *dam* the adhesive must be in a liquid state, the member preventing escape of adhesive from the joint location before curing.

Therefore the term *liquid* in the context of claim 1 is sufficiently clear and well understood by the skilled person for it to delimit the type of the adhesive from other types or forms of adhesive. Paragraph 0012 referred to by the appellant opponent confirms this understanding rather than casting doubt on it. That "...depending on the viscosity of the adhesive in a liquid form, the adhesive may be prone to spilling from the joint even without a pressure..." states (for the mind willing to understand) that whether the adhesive is more or less likely to spill from the joint depends on its viscosity. Liquids of high viscosity flow slower and are therefore slower and less likely to flow out of the joint or do so to a lesser extent. Indeed the term *viscosity* is used to describe resistance of fluids, i.e. liquid or gas, to flow. As is also evident from the statement in paragraph 0012, in order that spilling occurs even without pressure, the term liquid is understood to refer to the natural state of the adhesive. When applied to the assembly of structures that is the subject of the method of claim 1, the liquid adhesive is understood to be able to escape from the area between both structures without further measures such as a containment structure or dam.

In conclusion, the Board finds that the term "liquid" is not given any other than its usual clear meaning, and thus denotes an adhesive which in its natural state is in liquid form. It most certainly does not denote the state of semi cured resin, in which the resin has already solidified but is still malleable. The claim is thus clear, Article 84 EPC.

- 4.2.2 The Board reads the further requirement that the flexible adhesive member acts as a glue dam as implying

that the adhesive is liquid when the member is in place. This follows from its understanding of the function of a glue dam as impeding or preventing flow of glue beyond a confined area.

4.3 Novelty with respect to either ZP1 or ZP2

4.3.1 As concluded in relation to novelty of the main request the boundary angle of ZP1 as adhesive limiting member is applied on the resin in an appropriate stage of curing. In such a partly cured state the filleting resin is still deformable by pressure at least in an interface region between the adhesive and limiting member. However, the semi cured resin is no longer able to freely flow as it is no longer in liquid form, and, perforce the flexible member does not act as a glue dam.

4.3.2 ZP2 is a technical report concerning composite wing conceptual design. Page 259 reproduces a technical drawing, nr. Z3578686, of a "truss web joint" structure used in a tension test. An enlarged section of the joint is depicted in the lower right hand of the drawing and shows a filler material delimited by what is referred to as a angle (-5), see also the accompanying table. The figure includes the instruction to "fill with chopped fiber filler material. Densify to form (illegible) radius before co-cure with -5 angle". The particular test is discussed on page 44 in reference to figure 29 on page 45 showing a number of test modifications. Scheme A (top left) is the concept with co-cured reinforcing angles that corresponds with the joint shown in the above technical drawing (Z3578686) also mentioned on page 44. The penultimate paragraph identifies the relevant adhesive of the adhesive fillet as "Hysol EA9306" also used in similar

joints using boundary angles as shown in figure 62, page 90. This type of adhesive is known to be in the form of a paste at room temperature as acknowledged by the appellant opponent at the oral proceedings before the Board. Pastes are formed of a mixture of solid material and liquid. Due to the high density of solid content pastes have a solid-like character in their natural state, which in this case will be even more so by the addition of chopped fibre filler. Consequently, ZP2 fails to disclose a liquid adhesive in the context of the truss web joint shown, and consequently also fails to disclose the angle acting as a glue dam.

4.3.3 For the above reasons, and contrary to the opposition division's finding, the Board finds that the subject-matter of claim 1 of the auxiliary request 1 is novel with respect to either one of ZP1 or ZP2 Articles 52(1) and 54 EPC.

4.4 Inventive step

4.4.1 Inventive step is challenged starting from both ZP1 and ZP2. The appellant opponent submits that the liquid form is associated with improved properties of the adhesive. The skilled person would as a matter of course consider their use in the joints of ZP1 and ZP2. When selecting a liquid adhesive, they would also by way of obviousness modify the order of the manufacturing steps to first form a containment space between joint and boundary angle before then supplying the liquid adhesive into it and thus arrive at the method of claim 1.

4.4.2 The Board cannot concur with the opponent that the skilled person would find it obvious to depart from the specific method of forming the laminated joint detailed

in either document. The Board sees that method to be predicated on the steps of forming a resin fillet, partly curing it and only then applying the boundary angle over the fillet joint and finishing curing. There is no suggestion in either document that it could be done otherwise. Even if ZP1 at page 553 in section 5.3.6.1 mentions resin (a highly viscous, but liquid adhesive), it is clear that then also the joint is formed by laminating fibre layers onto parts (in this case the resin fillet) that are already cured, i.e. that they are applied *after* application and curing of the resin. In that case, the boundary angle does not act as a glue dam as the resin has already solidified. Thus, the skilled person would have no need to change its method as ZP1 already teaches to apply the same method if they use a liquid adhesive. The same can be said for ZP2: even if the skilled person might consider liquid adhesives such as resin, this does not of itself require any change in its basic methodology. Otherwise, the Board has no reason to believe that it would be within the skilled person's routine skills to simply change the order of steps and cure the resin at a later stage.

4.4.3 The Board concludes, therefore, that the subject-matter of claim 1 of auxiliary request 1 involves an inventive step over ZP1 and ZP2 and the skilled person's common knowledge, and therefore fulfills the requirements Article 52(1) and 56 EPC.

5. Sufficiency of disclosure

5.1 In the communication in preparation for the oral proceedings, see section 3.1, the Board gave its provisional opinion on the grounds of sufficiency of disclosure as follows:

"The mere fact that dependent claim 3 of the patent as upheld (as granted claim 4) might refer to an embodiment not covered by claim 1 and thus in conflict therewith is at best an issue of clarity and support (Art 84 EPC) already present in the granted claims and thus not subject to scrutiny. No argument is presented why this discrepancy between claims and between claims and description cannot be resolved by the skilled person."

- 5.2 As the appellant did not provide any further arguments on that particular question, the Board does not see any reason to depart from its provisional assessment.
6. At the oral proceedings before the Board the appellant opponent raised no further objections against claim 1 of the auxiliary request 1. But for the necessary amendments to the description in accordance with the new definition of the invention, the patent as amended according to the claims of the auxiliary request 1 and the invention to which it relates, meet the requirements of the EPC, and the patent can be maintained in this amended form, 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 department of first instance with the order to maintain the patent in the version of Auxiliary Request 1 filed in opposition and re-filed with statement of grounds of 17 December 2017 with claims 1 - 13, and a description to be adapted thereto.

The Registrar:

The Chairman:



N. Schneider

A. de Vries

Decision electronically authenticated