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File Number: T 17/92 - 3.3.3

Application No.: 83 900 075.9

Publication No.: 0 108 068

Title of invention: Method to produce composites based on cellulose or
lignocellulosic materials and plastics

Classification: C08J 3/20

D E C I S I O N
of 11 June 1992

Applicant: KUBAT, Josef, et al

Headword:

EPC Articles 56, 84

Keyword: "Inventive step (yes)"
"Clarity (yes) - clear concept - functional definition"

Headnote



Case Number : T 17/92 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 11 June 1992

Appellant : KUBAT, Josef
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Decision under appeal : Decision of Examining Division of the European
Patent Office dated 16 August 1991 refusing
European patent application No. 83 900 075.9
pursuant to Article 97(1) EPC.

Composition of the Board :

Chairman : R. Lunzer
Members : C. Gérardin
F. Benussi

Summary of Facts and Submissions

- I. European patent application No. 83 900 075.9, publication No. WO 83/02118, filed on 10 December 1982, and having a priority date of 11 December 1981 derived from Swedish application No. 8 107 444.5, was refused by a decision of an Examining Division of the European Patent Office dated 25 November 1986 on the sole ground of lack of novelty in the light of the cited prior art. The decision was based on Claims 1 and 2 as originally filed.
- II. An appeal against that decision (T 157/87) was filed on 27 March 1987. On the basis of new claims filed on 15 March 1988, the decision of Board 3.3.1 dated 25 April 1988 set aside the decision of the Examining Division, and remitted the case for further prosecution.
- III. By a further decision dated 16 August 1991, the Examining Division again refused the application, this time on the grounds of lack of clarity of the claims insofar as they involved the concept of pre-hydrolysis (Articles 83 and 84 EPC), and lack of any inventive step (Articles 52(1) and 56 EPC) having regard to the following cited documents;
- (1) Chemical Abstracts, Vol. 72 (1970), abstract No. 134357s, Valina V I, Zakoshchikov A P (Mosk. Tecknol. Inst. Moscow, USSR), and
 - (2) Chemical Abstracts, Vol. 87 (1977), abstract No. 169399u, Charina M. V. (Ural Lesotekh. Inst., Sverdlovsk, USSR).

Claims 1 to 4 as filed on 28 December 1990 were in the following form:

- "1. A method for producing plastic composites containing cellulose or lignocellulose in a plastic matrix characterised by subjecting the cellulose or lignocellulose to a pre-hydrolytic treatment prior to the compounding or processing step by means of which step the cellulose or lignocellulose is comminuted and dispersed throughout the plastic phase.
2. A method according to claim 1 wherein the plastic is a thermoplastic resin.
3. Use of a pre-hydrolysed cellulose or lignocellulose as additive for plastics at normal concentrations or in concentrates (masterbatch) without the need of prior grinding or other comminution before the compounding or processing of the plastics.
4. Use according to claim 3 as additive for thermoplastic resins."

IV. An appeal against that decision was lodged on 11 October 1991, the appeal fee was paid on the same day, and the Grounds of Appeal were filed on 9 December 1991. In the Statement of Grounds of Appeal, and during oral proceedings held on 11 June 1992, the Appellant argued that Claim 1 was sufficiently clearly defined, when referring to pre- or partial hydrolysis, which terms had the same meaning, because the skilled reader would understand from the context of the specification as a whole that what was intended was a degree of hydrolysis sufficient to render the cellulose brittle, but not so great as to cause a serious loss of cellulosic material through its conversion into sugar. As for inventiveness, it was contended that the cited prior art contained no suggestion at all of the positive advantage of pre-hydrolysing cellulosic materials to the extent that they

became brittle, and then using this brittle material, without further comminution, as a filler in plastics. In fact document (2), which had been relied on by the Examining Division, pointed in the opposite direction because it taught that an increasing degree of hydrolysis had a detrimental effect.

- V. The Appellant requested that the decision under appeal should be set aside, and that a patent be granted on the basis of Claims 1 to 4 set out above, and by way of auxiliary request, on the basis of Claims 1 and 2 filed on 9 December 1991.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC, and is admissible.

2. Admissibility of Amendments

The Board agrees with the finding by the Examining Division to the effect that there is no objection to the Claims as at present formulated under Article 123(2) EPC. These Claims are based on Claims 1 and 2 as originally filed, subject to further limitations which were clearly disclosed in the application as filed. In particular, the limitation that the pre-hydrolytic treatment must take place prior to the compounding or processing step is to be found at page 2, lines 30 to 33 of the application as filed.

3. The Alleged Invention

At page 1 and page 2 (second full paragraph) it is explained that although it had been known in the past to

use fibrous lignocellulosic materials, including cellulose fibre, cellulose flour, wood flour, and nut shell flour, it had been discovered, contrary to what might have been expected, that filler materials in a fibrous form were no better than finely divided particulate matter, which has the advantage of being easy to disperse in the plastic matrix during the normal compounding operation. It was also known that a pre-hydrolysis of cellulosic or lignocellulosic materials results in a substantial embrittlement. The alleged invention took advantage of those two items of information, by proposing to use as a filler lignocellulose which had previously been embrittled by subjecting it to a suitable degree of pre-hydrolysis, relying on the brittleness of this material to ensure its dispersion throughout the plastic matrix during the normal compounding operation, without needing to employ any comminution step to reduce the particle size of the cellulosic material before mixing with the plastic.

4. Problem

The application in suit concerns a method for producing composites based on cellulose or lignocellulose materials and plastics. Such a method is disclosed in document (1) which the Board, like the Examining Division, regards as the closest prior art. According to the second embodiment disclosed in this brief abstract, lignocellulose is used as a substitute for more costly cork and wood flour fillers in the manufacture of PVC linoleum or glyptal linoleum. It exemplifies the replacement of 31% of cork by 42% of lignocellulose, or, if replacing both the cork and the wood flour, 31 parts of cork, and 89 parts of wood flour could be replaced by 120 parts of lignocellulose. Although the resulting linoleums are said to have

advantageous insulating properties, the drawbacks of incorporating lignocellulose are that it requires to be finely ground, and that, to achieve an acceptable dispersion with such fibrous matter, the mixture has to be subjected to such an intense and repeated kneading action during the compounding stage, that the time and energy consumed make such an approach prohibitive.

In the light of that shortcoming, the technical problem underlying the application can thus be seen in providing composite materials having improved mechanical properties.

5. Solution

This is achieved, according to the main claim, by subjecting the cellulosic material to a partial hydrolysis. In the light of the experimental results contained in the application in suit (page 7, paragraphs 2 and 3), and in particular the comparative data which show that the breaking elongation is significantly improved as the result of a better dispersion of the cellulosic component (6.7% compared with 1%), the Board is satisfied that the above-defined technical problem has been effectively solved.

6. Novelty

Novelty was found by the decision of the Board previously concerned with this application. No fresh documents have been cited, and novelty was therefore not in issue.

7. Inventive Step

7.1 Mention has already been made in paragraph 4 above of one of the examples in document (1), which proposed the

addition of lignocellulose as a filler, and its consequent drawbacks. The other embodiment referred to in document (1) illustrates the use of hydrolysis lignin, which is an entirely different substance. The Appellant explained that, contrary to the understanding of the Examining Division, although hydrolysis lignin is a product of the complete hydrolysis of wood, it is not a completely hydrolysed lignocellulose, but rather the residue after the hydrolysis has gone to completion, and the sugar produced by scission of the cellulose chains has been removed. Thus document (1) contains no suggestion of using partially hydrolysed lignocellulose as a filler. Of the two fillers there disclosed, one is the residue of the hydrolysis reaction, and the other is a non-hydrolysed material, both being relatively finely divided free flowing powders.

7.2 Document (2) is not regarded as being any more pertinent. It discloses that in the acid-catalysed polycondensation of PhOH with CH₂OH in pinewood sawdust, the impact strength of moulding powders obtained decreased as the pH was lowered from 0.85 to 0.42, which decrease in strength was attributed to increasing hydrolytic degradation of the cellulose with increasing acidity. In other words, it teaches against, and not in favour of, hydrolytic degradation of lignocellulose. Therefore in the view of the Board this is not a pointer in the direction of the invention.

7.3 In addition to the technical advantages mentioned in paragraph 5 above, partial hydrolysis results in substantial economic advantage. As explained by the Appellant during the oral proceedings, the practical utility of the invention resides not merely in finding a more economic filler when using virgin materials, but equally in the field of recycling plastic waste material.

This material often contains a substantial proportion of paper, which is difficult to separate. However, if the paper is hydrolysed by an environmentally satisfactory agent, such as formic acid vapour, up to 50% of waste paper is capable of being incorporated as a filler in readily mouldable plastic materials. Thus it appears to the Board that the invention may have significant economic and environmental value.

7.4 For these reasons the claimed subject-matter involves an inventive step.

8. Clarity of Claims (Article 84 EPC)

8.1 The second ground of refusal was lack of clarity of the claims having regard to both the concept of pre-hydrolytic treatment, and the degree of hydrolysis. Even accepting the Appellant's contention that the term "pre-hydrolytic treatment" would be interpreted by the skilled reader as equivalent to "partial hydrolysis", the Examining Division held that that terms was unclear, because it could mean, either that all the lignocellulosic material was partially hydrolysed, or that some, but not all of it, was completely hydrolysed.

8.2 As argued by the Appellant during the oral proceedings, and actually illustrated in the Examples of the application in suit, pre-hydrolytic treatment means in fact hydrolysis to the extent that there is a sufficient degree of embrittlement of the whole of the cellulosic material, i.e. a reduction of the degree of polymerisation in such a way that the properties of that material are suitably modified.

8.3 Regarding the lack of any numerical limitation on the degree of pre-hydrolysis, the Appellant (who was himself

present during the oral proceedings) explained that as cellulose is a naturally occurring material the properties of which vary depending on its source, no figure can be put on the degree of hydrolysis necessary for the purposes of the alleged invention. Nevertheless, it is indirectly defined by the result which is to be achieved, i.e. the degree of hydrolysis must be sufficient to attain the desired degree of brittleness, which sets a lower limit, while an upper limit is set by the fact that excessive hydrolysis results in a loss of the desired cellulosic material, as it is converted into the form of sugar. For these reasons, the use of a functional definition in Claim 1 is regarded as adequate.

8.4 In the Board's view, therefore, the wording of Claim 1 is sufficiently clear, and complies with the requirements of Article 84 EPC.

9. Conclusion

The Board is satisfied that Claim 1 of the application in suit defines the invention with sufficient clarity for the purposes of Article 84. The invention as so defined involves an inventive step as required by Article 56 EPC, and the claim is therefore patentable. The same applies to the Claim 2, which relates to matter falling wholly within the scope of Claim 1. Claim 3 is an independent use claim, the validity of which is supported on the same grounds as the finding in favour of Claim 1, while Claim 4 falls wholly within the scope of Claim 3, and thus derives its validity from Claim 3. Having allowed the main request, the Board has no need to consider the auxiliary request.

As is apparent from paragraphs II and III above, well over three years elapsed between the matter being referred back to the Examining Division, and its decision the subject of

this appeal. The Board therefore expresses the hope that this application, which was filed nearly ten years ago, will now be dealt with expeditiously.

Order


For these reasons, it is decided that:

1. The decision under appeal is set aside.
2. The matter is referred back to the first instance, with the order that the patent be granted on the basis of Claims 1 to 4 as filed on 28 December 1990, the description to be adapted.

The Registrar:


E. Gorgmaier

The Chairman:


R. Lunzer