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D E C I S I O N
of 16 July 1997

Case Number: T 1063/93 - 3.2.5

Application Number: 87118798.5

Publication Number: 0285705

IPC: B29C 67/14

Language of the proceedings: EN

Title of invention:

Novel reinforcements for pultruding resin reinforced products
and novel pultruded products

Patentee:

PPG Industries, Inc.

Opponent:

BASF Aktiengesellschaft, Ludwigshafen
HOECHST Aktiengesellschaft Zentrale Patentabteilung

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (yes) - third auxiliary request"

Decisions cited:

-

Catchword:

-



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D E C I S I O N
of the Technical Board of Appeal 3.2.5
of 16 July 1997

Other party:
(Opponent)

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Appellant:
(Opponent)

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Respondent:
(Proprietor of the patent)

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Representative:

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Decision under appeal:

Decision of the Opposition Division of the
European Patent Office posted 25 October 1993
rejecting the opposition filed against European
patent No. 0 285 705 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: G. O. J. Gall
Members: W. D. Weiß
H. P. Ostertag

Summary of Facts and Submissions

- I. The appellant (opponent II, Hoechst Aktiengesellschaft) lodged an appeal against the decision of the Opposition Division on the rejection of its opposition against the European patent No. 0 285 705.

Two oppositions were filed against the patent as whole and based on Article 100(a) in conjunction with Articles 54 and 56 EPC (lack of novelty and inventive step).

The Opposition Division held that the grounds for opposition mentioned in Article 100(a) EPC did not prejudice the maintenance of the patent unamended, having regard to 8 documents cited by the opponents including the following documents:

(E2) GB-A-2 088 282;

(E3) FR-A-1 167 764, and

(E8) EP-A-0 113 209.

- II. The appellant as well as the respondent having filed an auxiliary request in this respect, the Board summoned for oral proceedings.

In a communication issued together with the summons, the Board expressed as its provisional opinion that, although novel, the subject-matter of claim 1 as granted appeared not to involve an inventive step. Starting from document E2 as the closest prior art, it would turn out that the known mat disclosed therein suffered from the drawback of lacking structural stability and therefore tending to disintegrate and that, therefore, a call for increased stability would

necessarily arise. Looking for a solution to this problem a person skilled in the art would come across document E3 suggesting the provision of a gauze backlayer as a remedy for just this problem.

The appellant, by letter of 7 April 1997, withdrew its request for oral proceedings. The party as of right (not appealing opponent I, BASF), by letter of 6 March 1997, notified that it would not participate in the oral proceedings.

Only the respondent was represented at the oral proceedings which took place on 16 July 1997.

During the oral proceedings the Board introduced the technical dictionary (E9) "The Textile Institute: Textile Terms and Definitions", Eighth Edition 1986, pages 15 and 214, and referred to the definitions of the terms "basecloth (needling)" and "scrim" for the purpose of interpreting the term "scrim cloth" used in claim 1.

III. The appellant, in its written submissions, requested that the decision under appeal be set aside and that the patent be revoked in its entirety.

The respondent, at the end of the oral proceedings, requested that the appeal be dismissed and the patent be maintained as granted (main request) or that the decision be set aside and the patent be maintained according to the first or second auxiliary requests submitted on 16 June 1997 or be maintained according to the third auxiliary request presented at the oral proceeding on 16 July 1997.

IV. The independent claims 1 as granted reads as follows:

"1. A fiber containing reinforcing mat (64) comprising two mats of strands mechanically bonded together wherein the second mat of continuous strands is coextensive with the first mat (62) and the reinforcing mat (64) having a spiked major surface and a non-spiked major surface, characterized in that the first mat (62) of synthetic or natural or glass fibers has the form of a scrim cloth having at least four holes per 6.452 cm² (square inch) therein and the second mat is formed by needling continuous glass fibers (4, 5, 6, 7) to the first mat (62) so that the mats are bonded together by needling."

The independent claim 1 according to the first auxiliary request reads as follows:

"1. A fiber containing reinforcing mat (64) having a spiked major surface and a non-spiked major surface comprising a first mat (62) of synthetic or natural or glass fibers having the form of a scrim cloth having at least four holes per 6.452 cm² (square inch) a second mat of continuous strands which is coextensive with the first mat (62) and wherein the second mat is formed by needling continuous glass fibers (4, 5, 6, 7) having a size in the range from 5.07 to 24.1 μm (20 x 10⁻⁵ to 95 x 10⁻⁵ inches) to the first mat (62) so that the mats are mechanically bonded together by needling."

The independent claim 1 according to the second auxiliary request reads as follows:

"1. A fiber containing reinforcing mat (64) having a spiked major surface and a non-spiked major surface comprising a first mat (62) of synthetic or natural or glass fibers having the form of a scrim cloth having at least four holes per 6.452 cm² (square inch) a second

mat of continuous strands which is coextensive with the first mat (62) and wherein the second mat is formed by needling with needles ranging from 15 gauge to 32 gauge having barbs pointing in the downward direction with respect to the mat passed through the needling machine continuous glass fibers (4, 5, 6, 7) having a size in the range from 5.07 to 24.1 μm (20×10^{-5} to 95×10^{-5} inches) to the first mat (62) so that the mats are mechanically bonded together by needling and the glass strands are carried through the first mat (62) located below the fiber glass mat during manufacture and forming the spiked major surface."

The independent claim 1 according to the third auxiliary request reads as follows:

"1. A pultruded fiber reinforced resin article (81) having a roving material (70) and at least two resin impregnated reinforcing mats (77, 78) wherein a plurality of resin impregnated fiber strands (70) running parallel to each other in at least one axis of the article (81) in spaced relationship to each other, and the mats (77, 78) having a spiked major surface (83, 84) and a non-spiked major surface and the mats (77, 78) comprising a first mat (62) of synthetic or natural or glass fibers having at least four holes per 6.452 cm^2 (square inch) a second mat of continuous strands which is coextensive with the first mat (62) and wherein the second mat is formed by needling continuous glass fibers (4, 5, 6, 7) having a size in the range from 5.07 to 24.1 μm (20×10^{-5} to 95×10^{-5} inches) to the first mat (62) so that the mats are mechanically bonded together by needling, and the mats (77, 78) are positioned on opposite sides of the strands (70) in the article (81)."

- V. The respondent, in its letter of 13 June 1997, received on 16 June 1997, and at the oral proceedings argued as follows:

Document E3 did not disclose the bonding of two mats by needling. The French term "des points de piqûre" for the purpose of bonding the thicker yarn to the thin flexible woven fabric or gauze did not teach needling but referred to stitching. Moreover, if a parallel arrangement of threads was to be bonded to a fabric, needling would make no sense, because needling would inevitably destroy the parallel structure. Consequently, the teaching of document E3 had no relevancy with respect to the subject-matter of the patent.

The specific selection for the size of the glass fibres and for the size of the needles contained in the claims 1 according to the first and the second auxiliary requests constituted a compromise between sufficient stiffness of the product and the requirement that the fibres should not be excessively destroyed. Claim 1 according to the second auxiliary request contained the additional feature that the spiked surface was at the side of the scrim cloth.

Document E8 was the prior art closest to the subject-matter of claim 1 according to the third auxiliary request. This document, on page 17, first paragraph, stated, however, that only non-woven random matting should be used in connection with this known pultrusion process. Moreover, only chemically bonded or stitched mats had hitherto been used, because there had been a prejudice that spiked surfaces might affect the formfilling capacity.

Reasons for the Decision

1. *Main Request*

1.1 Novelty

The appellant has still maintained a novelty objection on the basis of document E3.

Document E3 (Figure 1) discloses a fibre reinforced mat comprising two mats of strands bonded together wherein a second mat of continuous strands is coextensive with a first mat in the form of a woven gauze. The two mats may be bonded together mechanically by means of "points de piqûre" (see page 2, right column, fourth paragraph). The Board concurs with the respondent that this French expression has to be translated as meaning "stitching" rather than "needling". This translation necessarily implies that the known fibre reinforced mat cannot have a spiked and an unspiked main surface, because the precondition for this structure is that the composite has been needled with specifically designed needles.

The subject-matter of claim 1 is, therefore, novel.

1.2 Inventive step

1.2.1 Document E2 is the state of the art which is closest to the subject-matter of claim 1 as granted. This document discloses a fibre containing reinforcing mat having a spiked major surface and a non-spiked major surface comprising a mat of continuous strands which is formed by needling continuous glass fibres. These known

reinforcing mats are preferably used to produce laminates from which stamped parts for various uses such as automotive seat shells, motor housings, musical instrument cases and the like can be prepared.

Document E2 (see page 2, lines 69 to 81) states that continuous glass strand mats which are needled in the manner described emerge from the needler in a cohesive state and have sufficient mechanical integrity that they can be handled without distorting their generally flat shape. Nevertheless, it is obvious that the structural stability and mechanical strength of the mat may no longer be sufficient even for the use in a lamination process as disclosed in document E2 (Figure 4) as soon as, following the usual trend, the production speed is increased. In particular when used in a continuous process (see E2, page 2, lines 73 to 81) any breakage of the mat is an intolerable event which has to be reliably avoided.

- 1.2.2 Therefore starting from document E2, the call for an increased mechanical strength of the mat inevitably arises.

The subject-matter of claim 1 as granted solves this problem by providing a mat in form of a scrim cloth of synthetic or natural or glass fibres having at least four holes per 6.452 cm^2 and that the reinforcing mat is formed by needling continuous glass fibres to the scrim cloth so that the mat of continuous fibres and the scrim cloth are bonded together by needling.

- 1.2.3 The fibre glass mats disclosed in document E2 are successfully produced by needling which has been a well known technique conventionally used to produce a non-woven product known as needlefelt. Needlefelt equally has been known to suffer from the drawback that its strength and dimensional stability was insufficient

for certain uses. In these cases, a lightweight basecloth called "scrim cloth" has been included, i.e. incorporated by needling, in the needlefelt (see for instance the encyclopaedia E9, page 214, the entry "scrim"). This basecloth has normally been a woven fabric (see E9, page 15, the entry "basecloth").

Once the conventional technique of "needling" had been successfully applied to produce the mats of continuous glass fibres disclosed in document E2, no inventive step can be recognised in the idea to use a another measure equally known from this technology to reinforce these known mats.

The choice of the particular fabric used as basecloth belongs to the routine task of a person skilled in the production of needlefelt and is ruled by the strength requirements and the dimensions of the article into which the reinforcing mat is to be incorporated. The indication of the parameter "holes per square inch" is not highly meaningful anyway as long as it does not go together with the dimensions of the threads the interstices between which define the holes.

Consequently, the subject-matter of claim 1 as granted lacks an inventive step in the meaning of Article 52(1) in conjunction with Article 56 EPC.

The main request is, therefore, not allowable.

2. *First and second auxiliary requests*

2.1 Novelty

Claim 1 according to the first auxiliary request differs from the one of the main request by an additional feature specifying the continuous fibres as being glass fibres and defining a range for their size.

Claim 1 according to the second auxiliary request additionally defines the size and structure of the needles and states that the scrim cloth is located at the spiked side of the reinforcing mat.

Consequently, the fact that the subject-matter of claim 1 according to the main request is novel implies the novelty of the subject-matter of the claims 1 of the first and the second auxiliary requests.

2.2 Inventive step

The size of the continuous fibres in the second mat has to be chosen by the practitioner in dependence of the dimensions of the articles into which the reinforcing mat is envisaged to be incorporated.

The respondent, at oral proceedings, has confirmed that the needles are not particularly designed but have a conventional design and size which can be freely ordered on the market. The specific selection of the size is ruled by the requirement that the needling action stiffens the composite mat without breaking an excessive amount of fibres of the scrim cloth which would result in a loss of strength. In particular the design of the needles must be similar to that of the needles used in document E2, because the downward pointing barbs of the needles are responsible for the spiked-unspiked configuration of the final mat.

The location of the scrim cloth has necessarily to be chosen on the side of the mat of continuous strands on which the most intense entanglement of its fibres with the continuous fibres of the second mat is obtained.

Consequently, the additional features contained are the result of mere routine decisions which to take belongs to the daily work of a person skilled in the art and do, therefore, not add an inventive step.

The first and the second auxiliary requests are, therefore, not allowable either.

3. *Third auxiliary request*

3.1 Novelty

Claim 1 of this request is directed to "a pultruded fibre reinforced resin article" incorporating the specific needled reinforcing mats discussed above.

The novelty of these mats implies the novelty of the article in which they are incorporated.

3.2 Inventive step

3.2.1 Document E8 has been acknowledged in the description of the patent in suit and is still the only one of all the documents cited to represent a typical pultrusion process which has conventionally been used pultruded fibre reinforced resin articles and to articles thereby produced.

Document E8, therefore, constitutes the prior art closest to the subject-matter of claim 1 according to the third auxiliary request.

The article produced according to this document by pultrusion is a spacer for a sealed window comprising an elongate hollow body of substantially rectangular cross-section the hollow body preferably encircling unidirectional continuous glass fibres. The hollow body preferably comprises a resin impregnated bidirectional

arrangement of fibres provided by a non-woven random matting from continuous fibres or cut fibres or for example a stitched non-woven matting. Woven matting is not preferred since bias forces can be set up in the finished item from the forces in the weave which can be unsatisfactory (see document E8, page 17, first paragraph).

- 3.2.2 The subject-matter of this claim 1 according to the third auxiliary request differs from the disclosure of this state of the art essentially in that the matting used is of the type as is disclosed in document E2 which has been modified by needlebonding to it a specific scrim cloth and in that the pultrusion process is modified by using two of these composite reinforcing mats which are positioned on opposite sides of fibre strands extending between them.

According to the patent in suit (see EP-B-0 285 705, the paragraph bridging columns 1 and 2) this prior art suffers from some drawbacks: In preparing parts which have ribbing or sharp turns, it has been found that the mat used does not fill the turns or ribs to the full depth of either. Further, the parts do not possess surfaces that are acceptable in the aesthetic sense.

The patent in suit removes these drawbacks by the measures circumscribed above.

- 3.2.3 Document E8 teaches (see in particular the paragraph bridging the pages 5 and 6, and claim 4 in conjunction with claim 1) that the exterior shell of the known spacer should comprise bidirectional fibres, preferably a non-woven matting, enclosing a nucleus of unidirectional fibres.

Even if this teaching would be interpreted by a person skilled in the art as an invitation to take a bidirectional non-woven matting as disclosed in document E2 as material, it would not arrive at a pultruded article as claimed in claim 1 according to the third auxiliary request. To arrive at the subject-matter of claim 1, the structure of the matting would still have to be modified by the addition of a scrim cloth and the design of the pultruded article would have to be changed in the sense that two mats are used which are positioned on opposite sides of the unidirectional strands in the article.

There is no hint, however, in the prior art giving an incentive to these modifications. On the contrary, document E8 (see page 17, first paragraph) emphasizes that woven matting is not preferred, since bias forces can be set up in the finished item from the forces in the weave which can be unsatisfactory.

The argument of the respondent that a person skilled in the art would not even have considered to use the spiked mats disclosed in document E2 for pultrusion purposes, because it would have suspected that the elastic properties of the spikes would affect the formfilling capacity can also not be neglected. The only envisaged use suggested in document E2 is the use as a reinforcement in laminated articles.

- 3.2.4 From the above arguments it follows that the subject-matter of the independent claim 1 involves an inventive step.
4. Therefore, the subject-matter of claim 1 of the third auxiliary request constitutes a patentable invention in the meaning of Article 52(1) EPC, and this claim 1 is thus allowable.

The same applies to claims 2 to 8 appended thereto which refer to further embodiments of the subject-matter of claim 1.

The amended description is not subject to any objection.

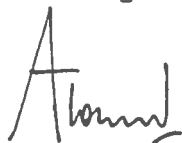
Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to maintain the patent in amended form in the following version:

Claims 1 to 8 ("Third auxiliary request") and a complete description pages 2, 2a and 3 to 8 as presented during the oral proceedings of 16 July 1997 and drawings as granted.

The Registrar:



A. Townend

The Chairman:



G. Gall

