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**D E C I S I O N**  
of 15 December 1997

**Case Number:** T 0483/94 - 3.3.1

**Application Number:** 87107157.7

**Publication Number:** 0248254

**IPC:** C09J 175/04

**Language of the proceedings:** EN

**Title of invention:**  
Process for bonding laminates

**Patentee:**  
Mobay Corporation, et al

**Opponent:**  
Ashland Chemical Inc.

**Headword:**  
Laminates/MOBAY

**Relevant legal provisions:**  
EPC Art. 56, 114(1)

**Keyword:**  
"Inventive step (no) - no effect made credible for alleged distinctive feature - obvious solution"

**Decisions cited:**  
T 0037/82, T 0120/81, T 0181/82, T 0184/82, T 0258/84

**Catchword:**  
-



Case Number: T 0483/94 - 3.3.1

**D E C I S I O N**  
of the Technical Board of Appeal 3.3.1  
of 15 December 1997

**Appellant:** Ashland Chemical Inc.  
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**Decision under appeal:** Interlocutory decision of the Opposition Division  
of the European Patent Office posted 7 April 1994  
concerning maintenance of European patent  
No. 0 248 254 in amended form.

**Composition of the Board:**

**Chairman:** A. Nuss  
**Members:** P. P. Bracke  
W. Moser

## Summary of Facts and Submissions

I. This appeal lies from the Opposition Division's interlocutory decision, announced orally on 25 November 1993, with the reasoned decision being issued on 7 April 1994, that the process of the then valid Claims 1 and 2, corresponding with granted Claims 4 and 5 of European patent No. 0 248 254, was novel and inventive over the teachings of the three documents cited during the opposition proceedings.

II. More particularly, the Opposition Division was of the opinion that the use of adhesives obtained by admixing an isocyanate with a solution of a di- or triamine in a polyol in a counter-current mixing device was neither known nor suggested in any of those documents.

One of the three cited documents was document

(1) EP-A-0 068 209.

III. With the statement setting out the grounds of appeal, the Appellant (Opponent) introduced three additional documents into the proceedings, in particular document

(6) US-A-3 979 364,

and he maintained that the claimed process was neither novel nor inventive over the teaching of, *inter alia*, document (6), which described adhesive compositions prepared by admixing an isocyanate with a mixture of a polyhydroxy polyether and an amine.

IV. In response thereto, the Respondent (Proprietor of the patent) essentially argued in his letter of 14 December 1994, received by the EPO on 16 December 1994, that the claimed method could not be unambiguously derived from

the cited prior art since it was the essence of the claimed method that the organic isocyanate was admixed with a solution of a di- or triamine in a polyhydroxy polyether in a counter-current mixing device, so that beads were formed which adhered to vertical surfaces without sagging, even in the absence of fillers or thickeners, and counter-current mixing was not proposed in any of the cited documents.

Additionally, with the said letter, he filed two claims reading as follows:

"1. A process for bonding substrates comprising applying to the surface of at least one substrate an adhesive consisting of a reaction mixture and bringing the surfaces to be bonded into contact one with the other, characterised in that said reaction mixture comprises

- (a) 100 parts by weight of at least one polyhydroxy polyether having a viscosity, at 23°C of at most 2000 mPa.s;
- (b) 2 to 20 parts by weight **per 100 parts of component (a)** of at least one aromatic, aliphatic or cycloaliphatic diamine or triamine having a molecular weight of from 60 to 400; and
- (c) an organic isocyanate having a viscosity at 23°C of at most 1000 mPa.s **in a sufficient amount to render the isocyanate index of the adhesive 70 to 150**

and is prepared by admixing said (c) with a solution of said (b) in said (a) in a counter current mixing device forming beads of said reaction mixture." (emphasis added)

"2. The process of Claim 1 characterised in that said reaction mixture also comprises

(d) up to 50 parts by weight **per 100 parts of component (a)** of one or more aliphatic polyol having a hydroxyl functionality of at least 2 and a molecular weight of below 300." (emphasis added)

V. At the oral proceedings held on 14 May 1997, at which the Respondent was not represented, as had been announced in his letter of 3 January 1997, the Appellant contested that the claimed method was novel over the teaching of document (6). Moreover, he contested that the claimed method was *inventive, inter alia*, over the teaching of document (1) combined with the teaching of document (6), since the problem mentioned in document (1) was the same as the one underlying the present invention and it would have been obvious to replace the mixture proposed in document (1) with those described in document (6). Finally, he submitted that, due to the stirring motion, mixing always took place against the direction of the adducts addition and, consequently, that the mixing of a solution of an amine in a polyhydroxy polyether with polymethylene polyphenylisocyanate in the caulking gun, as described in example IX of document (6), was to be understood as an admixing of a component (c) with a solution of a component (b) in a component (a) in a counter-current mixing device.

VI. Since this last argument was submitted during the oral proceedings for the first time in the absence of the Respondent, and since the Board considered this submission to be of importance for the outcome of the

appeal, the Board decided to continue the proceedings in writing in order to give the Respondent an opportunity to express himself on this technical point before taking a final decision.

VII. However, as specifically expressed in the telefax of 8 August 1997, he did not use the opportunity offered to him by a communication pursuant to Article 110(2) EPC of 19 May 1997 to shed light on the question of whether the properties of the beads in the claimed method were influenced by the fact that they were obtained in a counter-current mixing device and, more specifically, whether the properties of beads prepared with a caulking gun, as described in example IX of document (6), differed from those obtained in a counter-current mixing device.

VIII. The Appellant requested that the decision under appeal be set aside and that the patent be revoked in its entirety.

The Respondent requested that the appeal be dismissed and that the patent be maintained on the basis of the set of claims, ie claims 1 and 2, and the description, pages 2 to 10, both filed on 16 December 1994.

**Reasons for the Decision**

- 1. The appeal is admissible.
- 2. *Article 123(2) and (3) EPC*

Claim 1 only differs from granted Claim 4, which literally corresponds with originally filed Claim 8, by the features described in the emphasised part of present Claim 1 (see point IV above), which features were disclosed in the following passages of the application as filed, with the corresponding reference in the patent in suit between brackets:

- "per 100 parts of component (a)": page 11, lines 22 to 25 (page 4, lines 42 and 43); and
- "in a sufficient amount to render the isocyanate index of the adhesive 70 to 150": page 11, lines 1 to 5 (page 4, lines 31 to 33).

Claim 2 corresponds with granted Claim 5, which literally corresponds with originally filed Claim 9.

Since those amendments do not add subject-matter extending beyond the content of the application as filed and also do not lead to an extension of the protection conferred by the patent in suit, the requirements of Article 123(2) and (3) EPC are met.

- 3. *Patentability*  
Document (6) had not been cited during the opposition procedure but was cited for the first time in the statement setting out the grounds of appeal.

However, since this document was cited by the Appellant in order to illustrate that, contrary to the Opposition Division's finding, the use of adhesives obtained by admixing an isocyanate with a solution of an amine in a polyol in a counter-current mixing device was known and since therefore this document is highly relevant in assessing the patentability of the claimed process, the Board considers it appropriate to take document (6) into consideration under Article 114(1) EPC (see eg T 258/84, OJ EPO 1987, 119).

### 3.1 Novelty

The Appellant contested that the claimed process was novel over document (6), especially, in view of the teachings in

- column 1, lines 12 to 16, in combination with column 2, lines 44 to 51, indicating that polyurethane elastomers containing the components (a), (b) and (c) may be used as adhesives;
- column 3, line 18 to column 4, line 22, embracing di- and triamines having a molecular weight of 60 to 400;
- column 4, lines 23 to 53, citing polyhydroxy polyethers;
- column 6, lines 47 to 67, specifically citing 2,4-toluene diisocyanate and polymethylene polyphenyl polyisocyanate, corresponding with the ones cited on page 4, lines 16 and 20, of the patent in suit;
- column 5, lines 15 to 31, stating that 5 to 15 equivalents of amine may be used per 100 equivalents of polyhydroxy polyether;



- column 7, lines 1 to 8, indicating that the isocyanate index may range from 0.9:1 to 1.4:1; and
- column 2, lines 44 to 51, mentioning the possibility of mixing (c) with a solution of (a) and (b).

He also contested the novelty of the claimed process over example IX, describing a method for using a gelled elastomer system in a caulking operation, wherein a caulking gun is used for mixing an isocyanate with a solution of an amine in a polyhydroxy polyether.

However, although document (6) is concerned with polyurethane elastomers, which may be used as adhesives (column 1, line 23), this document is completely silent about a process for bonding substrates by applying to the surface of at least one substrate an adhesive. This alone is sufficient to conclude that document (6) cannot destroy the novelty of the present pending Claims 1 and 2. Neither are the other cited documents novelty destroying.

3.2 Inventive step

3.2.1 The Board considers that document (1), which corresponds with US-A-4 336 298, mentioned on page 2, line 43, of the patent in suit, is representative of the closest prior art.

Document (1) describes an adhesive process for bonding together panels by using a polyurethane adhesive composition that has excellent resistance to flow between the time that it is applied to the panels and the time the adhesive sets (page 1, lines 34, to page 2, line 1). The adhesive system is taught to be a two-part adhesive, the parts of which are mixed

together prior to being used for bonding the panels together, consisting of a base component, including an aromatic diisocyanate and a hardener component, containing a polyester or polyether triol, a para- or ortho-phenylene diamine and, desirably, a tin compound catalyst and preferably having a viscosity of from 800 to 4 000 cps at 25°C (page 2, lines 16 to 29). Moreover, it is said on page 4, lines 25 to 27, that an inert powder filler, added to the base component of the adhesive system, aids in controlling the viscosity of the base component (page 4, lines 25 to 27).

3.2.2 According to the patent in suit the known adhesive systems used in bonding substrates were typically highly filled pastes, which are not amenable to bulk handling operations, are difficult to pump and mix, present waste disposal problems and are highly sensitive to temperature and/or moisture conditions. Moreover, it was said that some form of surface preparation on the SMC (sheet moulding compound) is required for these adhesives to form a good structural bond (page 3, lines 18 to 22).

Contrary thereto, the adhesive system according to the claimed process is said to be superior to the known ones and that it exhibits low raw material viscosity, contains no abrasive fillers, forms an excellent bond to SMC without the need for special prior surface preparation, has an improved adhesion level to untreated SMC surfaces at elevated temperatures, has an excellent adhesion to SMC and to steel even after exposure to 200°C for 1 hour, and an excellent adhesion to SMC after exposure to heat moisture, including a 7 day immersion in water at 55°C and at 60°C (page 3, lines 22 to 26).

3.2.3 However, according to the jurisprudence of the Boards of Appeal, alleged advantages vis-à-vis the closest state of the art can only be retained in the definition of the technical problem underlying the claimed invention if they are adequately verified (see T 120/81, OJ EPO 1982, 217; T 181/82, OJ EPO 1984, 401; T 184/82, OJ EPO 1984, 261).

The question therefore arises to what extent there is support for the fact that the stated advantages can be achieved by proceeding according to the patent in suit, ie by applying to the surface of at least one substrate an adhesive consisting of a reaction mixture as defined in Claim 1.

3.2.4 Since, however, an adhesive composition prepared by using a **counter-current mixing device**, thus forming beads of the reaction mixture, is described only in one example (example 26 in the patent as granted) of the patent in suit, and since it was merely mentioned there that the non-sagging properties of the beads are evident from the fact that the beads do not change their shape when applied to a vertical surface and that the shear strength of the bond, having a thickness of 0.8 mm, between two SMC substrates after curing at 140°C for 40 minutes, is 10 N/mm<sup>2</sup>, it has only been made credible that with the claimed process substrates may adhere to one another and that the beads do not sag.

3.2.5 Therefore, in view of the teaching of document (1), the problem underlying the present invention can only be seen in providing a further process for bonding substrates wherein the adhesive composition does not sag.

3.2.6 Consequently, it remains to be decided whether, in the light of the prior art, a skilled person, when trying to solve this problem, would have arrived at a reaction mixture as defined in the characterising part of Claim 1.

3.2.7 Document (6) describes polyurethane elastomer compositions useful as adhesives, which do not sag when applied in thick films or layers on non-horizontal surfaces, which are easy to handle (column 1, line 7 to 10, and column 2, lines 6 to 17) which may be in the form of beads and which thicken immediately after mixing

- (a) a component A, which contains an organic compound having free isocyanate moieties, with
- (b) a component B, which is free of unreacted isocyanate groups, which does not thicken before mixing and which contains from 1 to 50, preferably 5 to 15, equivalents of a polyalkyloxyalkylene polyamine per 100 equivalents of polyether polyol,

in such a ratio that the isocyanate index ranges from 90 to 140 (column 2, lines 24 to 33 and 51 to 56, column 3, lines 3 to 14, column 5, lines 24 to 31, and column 7, lines 1 to 8).

Moreover, in column 6, lines 50 to 68, it is taught that the preferred polyisocyanates are toluene diisocyanate and polymethylene polyphenyl polyisocyanate, which are, according to the patent in suit, page 4, lines 19 to 21, preferred polyisocyanates in the claimed process. Consequently, it must be assumed that such polyisocyanates have the same viscosity as that of component (c) mentioned in Claim 1, ie at most 1000 mPa.s at 23°C.

Furthermore, example IX describes a method of preparing beads of adhesive, which do not flow, by mixing a polymethylene polyphenylisocyanate with a solution of an amine-terminated polyether in a polyhydroxy polyether in a caulking gun. This is further defined in column 8, lines 25 to 39, as meaning that it has a viscosity sufficient to enable the application of a relatively thick layer of the mixed elastomer to a non-horizontal surface without having the elastomer sag or run off the surface and that the beads retain their initial configuration.

3.2.8 Consequently, since it was known from document (6) that reaction mixtures prepared by admixing

- (i) an organic isocyanate (c), as defined in present Claim 1, with
- (ii) a solution of an amine (b) in a polyhydroxy polyether (a), containing (a) and (b) in the weight ratio as defined in Claim 1,

thicken immediately after mixing and do not sag, the question arises whether inventive skill was necessary to select

- (i) as a polyhydroxy polyether (a) one having a viscosity of at most 2000 mPa.s at 23°C and
- (ii) as an amine (b) one having a molecular weight from 60 to 400 and

to admix the component (c) with the solution of component (b) in component (a) in a counter-current mixing device.

3.2.9 Since it is clear that sag resistance is only a question of viscosity of the polyurethane elastomer obtained **after admixing**, there is no reason to consider the viscosity of the polyhydroxy polyether (a) as critical in the preparation of the polyurethane, as long as the solution of the amine (b) in the polyhydroxy polyether (a) is not too viscous in order to enable it to be added to the admixing device. This is also confirmed by document (1), mentioning on page 2, lines 24 to 29, viscosity-values of 800 to 4 000 cps (mPa.s) for the solution of (b) in (a). Moreover, it has never been put forward that the viscosity of the component (a) is a critical parameter.

There is also nothing to indicate to the Board that the selection of the molecular weight of the amine from 60 to 400 would be critical, since it appears not to be unusual that amines used to prepare polyurethane elastomers have such molecular weight, which is indeed confirmed in document (1), page 2, lines 20 to 24, mentioning the use of para- or ortho phenylene diamine in the preparation of polyurethanes.

Furthermore, in view of the uncontested detailed arguments submitted by the Appellant in his letter dated 23 May 1997 (see in particular points 1.1.1 to 1.1.4), the Board has no reason to doubt that the choice of the reaction components, ie those designated (a), (b) and (c) in Claim 1, can only be regarded as typical routine work expected to be carried out by any skilled person in the art without inventive skill, ie by merely choosing for the components considered to be suitable for solving the said technical problem the most appropriate viscosities in respect of non-sagging. In particular, it must be observed that the Respondent never contested the following submission contained in the last paragraph of point 1.1.4 of this letter: "A person skilled in the art reading reference D6

[document (6)] will readily consider the components of the reaction mixture which are marked preferred as being disclosed together and would not hesitate to actually use them" (emphasised part added).

3.2.10 As far as the admixing of component (c) with a solution of component (b) in component (a) is concerned, the Respondent's argument that mixing the components with a counter-current mixing device was not suggested was strongly contested by the Appellant during the oral proceedings.

Since, however, the Respondent was not prepared to respond to the Appellant's submission that the properties of the beads are not influenced by whether or not they are prepared in a counter-current mixing device and since the Board has no reason to call into question the correctness of this submission, the admixing in a counter-current mixing device cannot be considered to represent a distinctive technical feature, in the sense that it would have an effect or influence on the sag resistance.

Thus, in the absence of any established relationship with the technical problem to be solved, the feature "counter current mixing" figuring in present Claim 1 is irrelevant when assessing inventive step (see T 37/82 OJ EPO 1984, 71).

3.2.11 Consequently, in the Board's judgment, for the purpose of solving the underlying problem, a skilled person would have expected the adhesive so obtained not to sag. Therefore, without the use of inventive skill, he would have arrived at a reaction mixture as defined in the characterising part of Claim 1, with the consequence that the process according to Claim 1 was rendered obvious by the teaching contained in document (6).

For these reasons, the Respondent's request must fail.

**Order**

**For these reasons it is decided that:**

- 1. The decision under appeal is set aside.
- 2. The patent is revoked.

The Registrar:

*E. Görgmaier*  
 E. Görgmaier

The Chairman:

*A. Nuss*  
 A. Nuss

