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**Datasheet for the decision
of 2 October 2007**

Case Number: T 0428/05 - 3.3.03

Application Number: 98964426.5

Publication Number: 1036103

IPC: C08G 18/00

Language of the proceedings: EN

Title of invention:

Modified polyurethane hotmelt adhesive

Patentee:

Henkel Kommanditgesellschaft auf Aktien

Opponents:

Sika Technology AG
Klebchemie M. G. Becker GmbH & Co. KG

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56
RPBA Art. 10a(2), 10b(1), (3)

Keyword:

"Novelty - (yes)"
"Novelty - implicit disclosure - (no)"
"Inventive step - (yes)"

Decisions cited:

T 0131/01

Catchword:

-



Case Number: T 0428/05 - 3.3.03

D E C I S I O N
of the Technical Board of Appeal 3.3.03
of 2 October 2007

Appellant
(Opponent OI)

Sika Technology AG
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Representative:

-

Appellant
(Opponent OII)

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Respondent:
(Patent Proprietor)

Henkel Kommanditgesellschaft auf Aktien
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Decision under appeal:

Interlocutory decision of the Opposition
Division of the European Patent Office dated 25
January 2005 and posted on 10 February 2005
concerning maintenance of European patent
No. 1036103 in amended form.

Composition of the Board:

Chairman: R. Young
Members: M. C. Gordon
C. Brandt

Summary of Facts and Submissions

I. Mention of the grant of European Patent No. 1 036 103 in the name of Henkel Kommanditgesellschaft auf Aktien in respect of European patent application No. 98964426.5, filed on 21 November 1998 as international application No. PCT/EP98/07496, published as WO 99/28363 on 10 June 1999, and claiming priority of US patent application no. 60/067,197 dated 1 December 1997, was announced on 11 September 2002 (Bulletin 2002/37) on the basis of 26 claims, claim 1 of which read as follows:

"1. A solvent-free moisture-curing polyurethane hot melt adhesive composition, wherein said hot melt adhesive composition is solid at room temperature, comprising the product of combining:

- a) 95 to 3 % by weight of the reaction product of a first polyisocyanate and a polymer of ethylenically unsaturated monomers having an average molecular weight below 60 000, wherein said polymer has active hydrogen groups; and is not a copolymer of ethylene, vinylacetate and of an ethylenically unsaturated monomer containing at least one primary hydroxyl group,
- b) 5 to 90 % by weight of at least one polyurethane prepolymer with free isocyanate groups prepared from at least one polyol selected from the group consisting of polyether diols, polyether triols, polyester polyols, aromatic polyols and mixtures thereof and at least one second polyisocyanate which may be the same as or different from the first polyisocyanate; and

c) 0 to 40 % by weight of at least one additive selected from the group consisting of catalysts, tackifiers, plasticizers, fillers, pigments, stabilizers, adhesion promoters, rheology improvers and mixtures thereof, wherein the sum of a), b) and c) is 100 % by weight."

Claims 2-17 and 20-26 were directed to preferred embodiments of the solvent-free, moisture-curing polyurethane hot melt adhesive of claim 1.

Claims 18 and 19 were directed to a process for joining substrates with the hot melt adhesive of claim 1 and the resulting joined substrates, respectively.

II. Notices of opposition against the grant of the patent were filed by:

Sika Technology AG (OI) on 11 June 2003 and

Klebchemie M.G. Becker GmbH + Co. KG (OII) also on 11 June 2003.

Both opponents invoked the grounds of opposition pursuant to Art. 100(a) EPC, specifically that the subject matter of the patent was not novel (Art. 54 EPC) and was not founded on an inventive step (Art. 56 EPC) and the ground of opposition pursuant to Art. 100(c) EPC.

The following documents, *inter alia* were cited together with the notices of opposition:

D2: EP-A-369 607
D3: US-A-5 155 180
D4: EP-B1-777 695 (and D4a WO-A-96/06124)
D7: EP-A-246 473
D8: US-A-4 214 061
D9: US-A-3 532 652
D10: WO-A-91/15530
D13: DE-A-195 18 656.

In their written submissions with respect to Art. 56 EPC, the opponents relied *inter alia* on D7 as the closest state of the art. However at the oral proceedings held before the opposition division a new approach, based on D3 as the closest state of the art was introduced.

III. By a decision announced orally on 25 January 2005 and issued in writing on 10 February 2005 the opposition division held that the patent could be maintained in amended form on the basis of the second auxiliary request (claims 1 to 25), filed during the oral proceedings.

Claim 1 of this request read as follows, the additions compared to claim 1 of the patent as granted being indicated in **bold** and the deletions compared to claim 1 as granted being indicated in ~~strikethrough~~.

"1. A solvent-free moisture-curing polyurethane hot melt adhesive composition, wherein said hot melt adhesive composition is solid at room temperature, comprising the product of combining:

a) 95 to 3 % by weight of the reaction product of a first polyisocyanate and a **copolymer** of ethylenically unsaturated **comonomers** having an average molecular weight below 60 000, wherein said polymer has active hydrogen groups; and ~~is not a copolymer of ethylene, vinylacetate and of an ethylenically unsaturated monomer containing at least one primary hydroxyl group,~~ **said monomers are selected from the group consisting of C₁ to C₁₈-alkylesters of acrylic acid, C₁ to C₁₈-alkylesters of methacrylic acid, acrylic acid, methacrylic acid, hydroxyethylacrylate, hydroxyethylmethacrylate (HEMA), hydroxypropylacrylate, hydroxypropylmethacrylate, hydroxybutylacrylate, hydroxybutylmethacrylate, and/or the corresponding aminofunctional (meth)acrylates, esters of (meth)acrylic acid and glycol oligomers and polymers, esters of (meth)acrylic acid and glycol ethers, vinylesters, vinylethers, fumarates, maleates, styrene, alkylstyrenes, butadiene, acrylonitrile and mixtures thereof**

b) 5 to 90 % by weight of at least one polyurethane prepolymer with free isocyanate groups prepared from at least one polyol selected from the group consisting of polyether diols, polyether triols, polyester polyols, aromatic polyols and mixtures thereof and at least one second polyisocyanate which may be the same as or different from the first polyisocyanate; and

c) 0 to 40 % by weight of at least one additive selected from the group consisting of catalysts, tackifiers, plasticizers, fillers, pigments, stabilizers, adhesion promoters, rheology improvers and mixtures thereof, wherein the sum of a), b) and c) is 100 % by weight."

Claim 2, which had no counterpart in the claims of the patent as granted read as follows:

"2. A solvent-free moisture-curing polyurethane hot melt adhesive composition of claim 1, wherein the glycol oligomers and polymers are selected from di-, tri-, tetra and/or polyethylene glycol, and/or the glycol ethers are selected from methoxyethanol and/or ethoxyethanol, and/or the vinylesters are selected from vinylacetate, vinylproprionate, vinylesters of highly branched monocarboxylic acids, vinyl ester of the versatic acid."

Claims 3-7 corresponded to claims 2-6 of the patent as granted. Claims 8-25 corresponded to claims 9-26 of the patent as granted, whereby claims 8-14, 19, 20 and 23-25 were further amended to take account of the restriction of the subject matter of part a) of claim 1 to co-polymers.

According to the decision:

- (a) The claims of the second auxiliary request satisfied the requirements of Articles 84 and 123(2) EPC.

- (b) With regard to novelty, *inter alia* the decision held with respect to the disclosure of D3:
- (i) that at least three selections of the soft segment had to be made:
 - firstly two soft segments of different nature had to be selected;
 - secondly one had to be an acrylic polyol in component (B) of D3 which corresponded to component a) of the second auxiliary request and
 - thirdly it had to be a polyester or polyether polyol in component (A) of D3 which corresponded to component b) of the second auxiliary request.
 - (ii) Furthermore the origin of the alcohol moieties in the acrylic polyols of D3 was not disclosed.
 - (iii) Therefore it was concluded that the subject matter claimed was novel.
- (c) With regard to inventive step the decision held:
- (i) Considering D7 as the closest state of the art:

The subject matter of claims 1 and 2 of D7 corresponded to the comparative example of the patent in suit. The subject matter claimed differed from the disclosure of D7 in that the copolymer of ethylenically unsaturated monomers contained active hydrogen and was reacted with a polyisocyanate.

With reference to the experimental results reported in the patent in suit, in particular example 4 (according to the

invention) compared with the comparative example, the problem underlying the invention could be regarded as the provision of hot-melt adhesives with improved solvent resistance and adhesion to problematic substrates such as fluorinated polyethylene. With respect to an objection by the opponents that only the more "modest" problem formulated in paragraph [0019] of the patent had been solved, i.e. to retain the favourable properties of reactive polyurethane hot melt adhesives containing low molecular weight polymers and to improve their resistance to solvents and/or plasticizers, the opposition division considered that there was little doubt that the firstly formulated more demanding problem had been solved.

D7 was only concerned with the provision of hot-melt adhesives having superior initial adhesion to a broad range of substrates and having heat resistance, and did not contain any suggestion to replace the copolymer of ethylenically unsaturated monomers having no active hydrogen atoms with one such having active hydrogen atoms. Thus it was extremely doubtful that the skilled person following the teachings of D7 would have arrived at the claimed subject matter, let alone have foreseen the improved adhesion to substrates such as fluorinated polyethylene.

- (ii) The arguments advanced - for the first time at the oral proceedings before the opposition division - with respect to D3 as

the closest state of the art were likewise not held to be convincing. The substance of these arguments is however not relevant for the present decision (see section 8 below) and will not be further discussed.

(iii) Thus it was concluded that the subject matter of claims 1 to 25 of the second auxiliary request met the requirements of Art. 56 EPC.

(d) Accordingly the opposition division held that the patent could be maintained in amended form on the basis of the set of claims (1-25) according to the second auxiliary request.

IV. Notices of appeal against this decision were filed on: 11 April 2005 by OI and on 19 April 2005 by OII, the appeal fees being paid on the respective same dates.

Both opponents - now appellants - requested that the decision under of the opposition division be set aside and patent revoked. As an auxiliary measure, OII requested oral proceedings.

V. Statements of grounds of appeal were filed on 9 June 2005 and 16 June 2005 by OI and OII respectively.

(a) OI, in its statement of grounds of appeal submitted four further documents:

D27: "Epoxy Resins, Chemistry and Technology", Clayton A. May (ed), 2nd edition, 1988, pp. 506-509, 536-550;

D28: S.J. Shaw in "Chemistry and Technology of Epoxy Resins" B. Ellis (ed), 1993, pp. 117-121
D29: US-A-4 115 472
D30: US-A-6 001 931.

An auxiliary request for oral proceedings was made. OI also stated:

"Es werden alle im Einspruchsverfahren aufgebrauchten Einspruchsgründe nach Art 100 a) EPÜ bezüglich Neuheit und erfinderische Tätigkeit und Art 100 c) aufrecht erhalten und damit alle im Einspruchsverfahren angeführten Dokumente und Argumente ins Beschwerdeverfahren mit übernommen" ("All the grounds for opposition pursuant to Art. 100(a) EPC concerning novelty and inventive step and Art. 100(c) EPC put forward in the opposition procedure are maintained and therewith all the documents and arguments advanced in the opposition procedure are likewise taken over into the appeal procedure"- translation by the board).

(b) With regard to Art. 54 EPC, OI maintained its objections with respect to D3.

The finding of the decision under appeal that the subject matter of claim 1 was novel with respect to D3 on the one hand since three selections were necessary (see section III.(b).(i) above) and on the other hand since the nature of the origin of the alcohol group in the acrylic polyol was not disclosed (see section III.(b).(ii) above) were disputed.

Firstly, only a single selection from a small list was necessary.

With regard to the first selection identified (see section III.(b).i first bullet above) according to operative claim 1, the polyol components of prepolymer b) could be mixtures. The named polyols could result in both hard and soft segments in the sense of D3. Thus reaction of a soft-segment polyol and a hard-segment polyol (polyesterpolyol) with excess polyisocyanate, as disclosed at column 5, lines 35-38 of D3 would automatically result in a polyurethane prepolymer b) according to the patent in suit, with no need for a selection.

With regard to the third selection identified by the opposition division (see section III.(b).(i) third bullet) it was submitted that no such selection was necessary since all the polyurethane polymers (B) of D3 containing hard and soft segments were based on polyesters.

Therefore the only necessary selection was that identified as the second selection - namely to select "acrylic polyol" from the short list of soft segment polymers disclosed in D3. Such a single selection from a short list could however not confer novelty. Nor could it constitute a selection invention.

It was also disputed that the nature of the alcohol group in the acrylic polyols of D3 was not disclosed (see section III.(b).(ii) above). The skilled person would understand by the term "acrylic polyols" copolymers of hydroxyalkyl esters of ethylenically unsaturated carboxylic acids with one or more ethylenically unsaturated monomers. In particular, copolymers of hydroxyethyl acrylate or -methacrylate and one or

more lower alkylacrylates would be understood by this term. As evidence that this was the prevailing view of the skilled person at or before the application date of the patent in suit, reference was made to D29 (col. 3 lines 30-62). Thus the subject matter of claim 1 and also that of claims 17 and 18 lacked novelty with respect to the disclosure of D3. OII did not advance any arguments with respect to novelty.

- (c) Objections with respect to Art. 56 EPC were maintained with respect to D7 as the closest prior art by both opponents. OI also advanced objections based on each of D1 and D4a as the closest prior art.

According to both appellants the technical problem to be solved was, consistently with the statement at paragraph [0019] of the patent in suit, to improve the resistance of the hot melt adhesives to solvents and plasticizers, while retaining the other properties thereof.

- (i) With respect to D7 OI invoked, with reference to D2, D8, D13 and to the newly introduced D27, D28 and D30 for the first time in the statement of grounds of appeal, the principle of reactive diluents, which diluents became chemically bound to the polymer to which they were added. The skilled person would be aware of the benefits of reactive diluents which provided enhanced chemical resistance and based on

this knowledge would consider replacing the acrylic copolymers of D7, which were submitted to be non-reactive diluents, by reactive analogues. These were well known to the skilled person as "acrylic polymers".

- (ii) It was also submitted that the subject matter claimed was rendered obvious by the combination of D7 with D9. D9 disclosed an acrylic/ethylenic interpolymer whereby two types of olefinic monomers were employed, one of which contained active hydrogen groups. The interpolymer thus corresponded to component a) of the patent in suit. D9 taught further that the use of a polyisocyanate reaction product of such an interpolymer resulted in improved adhesion to a range of substrates as well as improved solvent resistance. The combination of the teaching of D9 with that of D7 in order to solve the problem set out in D7, was obvious, even though D9 related to pressure sensitive adhesives.

- (iii) Regarding a combination of D7 with D10 it was submitted that D10 taught that in order to provide hot melts with solvent resistance it was necessary to ensure that chemical curing and not merely physical bonding took place, thus rendering it obvious to provide hot melts which underwent such a chemical reaction on curing.

- (iv) With respect to D1 as the closest prior art, it was submitted that this related to a reactive hot melt adhesive, which, after curing, in particular with atmospheric moisture, exhibited good mechanical properties. Solvents were not disclosed as one of the constituents thereof. The adhesive of D1 differed from the subject matter of the patent in suit in that component a) was not mentioned. Thus the objective problem to be solved with respect to D1 was to provide hot melt adhesives with improved resistance to solvents and/or plasticizers, whilst maintaining the other properties. The solution to this problem, i.e. to incorporate copolymers according to component a) of operative claim 1 was known from a number of documents (D2, D13, D8, D9).
- (v) With respect to D4a it was submitted that this disclosed a hot melt adhesive. According to the examples solvents were not employed. The adhesive contained components a) and b) according to operative claim 1. The relative amounts of the two components was however not disclosed. This however was a matter of routine for the skilled person who would find indications in D2 and D7. Thus the proportions of components could not support an inventive step.

VI. In its response, dated 19 October 2005 the patent proprietor, now the respondent requested that the appeals be dismissed. A further document was submitted

D31: Römpf Chemie Lexikon, "Reaktivverdünner".

(d) With respect to Art. 54 EPC and the objection on the basis of D3, it was submitted that D3 failed to give a definition of "acrylic polyols". It was disputed that this was a term that would be unambiguously understood by the skilled person. The newly cited D29 also did not provide evidence that the average skilled person would understand the term "acrylic polyols" as employed in D3 to be exclusively those compounds as set out at column 3, lines 30 to 35 of D29. Reference was made in this respect to the reference in D29 to "so-called" acrylic polyols. Had "acrylic polyols" been a standard term then it would not have been necessary to describe these as "so-called" acrylic polyols. It was also submitted that D29 related to a different technical field (coating compositions) to that of the patent in suit (hot melt adhesives), and that it was not correct to consider that the terminology employed in each of these two distinct technical fields would necessarily be identical. Thus the subject matter claimed was novel with respect to the disclosure of D3.

(e) With regard to Art. 56 EPC:

(i) With respect to the objections based on D7 it was disputed that the skilled person would derive from D7 the teaching to replace the nonfunctionalised low molecular weight component derived from ethylenically unsaturated monomers by one containing active hydrogen. On the contrary, D7

explicitly emphasised that the low molecular weight component should be non-functional. The submissions of OI (see section V.(c).(i) above) that the low molecular polymer from ethylenically unsaturated monomers fulfilled the function of a reactive diluent was dismissed with reference to D31 which showed that such diluents were monomeric or oligomeric.

- (ii) With respect to the objections based on D7 in combination with D9 it was submitted that D9 related to a pressure sensitive adhesive - PSA - (Haftklebstoff) that was employed on flexible carriers or as an adhesive film. These adhesives were applied to the substrate in solution form or were applied to a transfer substrate and then fully cured. It was submitted that a PSA was not a reactive adhesive, the latter being supplied to the end user in a reactive form and which only developed its final properties by chemical reaction after being applied to the substrate. On the other hand, a PSA had to be permanently tacky in order to fulfil its function. Thus the skilled person starting from D7 would have derived no information from D9 that would lead to the subject matter of the present invention. Similarly, D10 taught only to include further non-reactive components, as long as these did not affect the essential character of the composition. Thus this teaching, when combined with the disclosure of D7 would not

provide any guidance to the claimed subject matter.

- (iii) With regard to the arguments based on D1, the respondent disputed that this teaching represented the closest state of the art. The compositions thereof contained a non-reactive thermoplastic, and the document contained no hint or suggestion to provide an adhesive composition containing as a reactive component a product of a polyisocyanate with a copolymer of ethylenically unsaturated monomers containing active hydrogens. This deficit was not overcome by combination of D1 with any of the other documents invoked (D2, D13, D8, or D9).

- (iv) With regard to the arguments based on D4a as the closest state of the art it was submitted that D4a related to the preparation of polyurethane compositions with a low content of monomeric diisocyanates, which compositions preferably were prepared on the basis of specifically defined trifunctional isocyanates, optionally with a monofunctional terminator. It was taught that these compositions could also be employed as hot melt adhesives. Although it was stated in D4a that lightly branched acrylic ester copolymers could be used in preparing the polyurethane compositions, there was no disclosure of a solvent free hot melt adhesive according to

the operative claims and there was no teaching in D4a that the addition of such lightly branched acrylic copolymers compound would be appropriate in particular for the preparation of hot melt adhesives.

VII. In a second letter dated 31 January 2006 OII submitted three further documents:

D32: EP-A-0 544 672

D33: Datasheet HL-9637

D34: Datasheet of Forbo Helmitin.

D33 and D34 which were cited as "expert opinions" ("gutachtlich").

On the basis of these documents, it was submitted that the skilled person would not consider there to be a clear and precise distinction between the two classes adhesives hot melt adhesives and pressure sensitive adhesives.

VIII. The board issued on 11 July 2007 a summons to attend oral proceedings.

IX. The respondent in a letter dated 14 August 2007 submitted three sets of claims forming a first, second and third auxiliary request, the details of which are however not of relevance for the present decision.

A further document:

D35: Römpf Chemie Lexikon, (CD-ROM version 1.0, 1995), relating to the term "Haftklebstoff" (pressure sensitive adhesive) was submitted.

X. Appellant OII in a letter dated 22 August 2007 submitted a further argument against inventive step. This was based on D9 as the closest prior art.

It was submitted that the problem addressed by D9 was to provide polyurethane based adhesives which, while maintaining the other properties, exhibited improved resistance to solvents and resistance to plasticizers. The problem was solved according to D9 by providing a combination of an organic polyisocyanate with an acrylic interpolymers containing a functional monomer with active hydrogen atoms, and which therefore was coreactive with the polyisocyanate. It was implicit and unambiguous from D9 that curing occurred by reaction of the free isocyanate groups with free hydrogen after application of the adhesive. It was submitted that it was this reaction which was responsible for the reported improved resistance to solvents and plasticisers in D9.

Although the adhesives of D9 were pressure sensitive adhesives and not reactive hot melt adhesives which were solid at room temperature, these two classes of adhesive were closely related, and partially overlapped.

As D9 disclosed that the polymers derived from ethylenically unsaturated monomers were "normally tacky" this implied that they were of low molecular weight. The proportions of the two polymers was not disclosed in D9. The range specified in the operative claims was however very broad and further was conventional, as indicated *inter alia* by D7.

All technical features of the claimed subject matter - with the exception of the active hydrogen component - were known from D7. Thus the combination of D9 in particular with D7 rendered the claimed subject matter obvious.

XI. Oral proceedings were held on 2 October 2007.

- (f) The appellants stated that they had no objections on formal grounds (Article 84 or Article 123 EPC) to the claims of the main request.
- (g) With regard to novelty the appellants maintained their objections with respect to the disclosure of D3.

In particular it was submitted that component (A) of the composition of D3, had hard and soft segments, the soft segments being derived from polyester polyols or polyether polyols.

Accordingly, component (A) of D3 was equivalent to component b) of the operative claims.

Regarding component (B) of D3 it was submitted that this was a polymer with soft segments, the soft segments having a molecular weight less than or equal to 8 000, the polymer being derived from a polyol and a diisocyanate. The polyol could be selected *inter alia* from acrylic polyols. By reference to D29 it would be understood that this term corresponded to the hydroxy (meth)acrylate monomers specified in operative claim 1 for component a). Thus component (B) of D3 corresponded to component a) of the operative claims.

The two components of D3 were present in amounts of 10-90 wt% and 90-10 wt% and thus anticipated the ranges of 95-3 wt% a) and 5-90 wt% b) specified in operative claim 1.

The compositions of D3 were solvent free and were used as a hot melt adhesive, from which

information it was inherent that these were solid at room temperature.

The respondent submitted that the definition of feature a) of claim 1 with respect to the acrylic polymers was much narrower than D3. D3 did not give any emphasis to acrylic polyols, which were presented as monomers which could be used interchangeably with the others listed. D3 further provided no information about the constitution of this class of monomer. The cited passages of D29 did not demonstrate that the term "acrylic polyols" as employed in D3 inevitably meant the monomers defined in claim 1.

(h) With regard to inventive step, objections based on D7 and D9 as closest prior art were discussed.

(i) With regard to D7 as the closest prior art the appellants submitted that the only difference of the claimed subject matter was that the acrylate polymer of D7 had no functional groups and hence could not become incorporated into the polymer. The objective problem to be solved was, with reference to paragraph [0019] of the patent, to improve the stability of the adhesive to solvents maintaining the favourable properties reactive polyurethane hot melt adhesives. This problem was solved by bonding the acrylic polymer to the network. The skilled person was however aware of the concept of reactive diluents from polyurethane and epoxy chemistry. By analogy with this concept, the skilled person would

realise that in order to solve the objective technical problem, it would be necessary chemically to link the acrylic polymer to the network. D7 itself contained a hint to this by the reference to interpenetrating networks on page 4 lines 37-44 where it was taught that such networks arose by crosslinking reactions.

The respondent accepted that D7 represented the closest state of the art. It was submitted that the teaching of D7 explicitly excluded the presence of hydrogen functional acrylic polymers. The crosslinking groups which were disclosed in D7 as resulting in - undesired - interpenetrating networks were not necessarily hydrogen groups but could be multiply unsaturated groups, which were common in acrylate chemistry. The argument based on the analogy to reactive diluents was dismissed as irrelevant to the teaching of D7.

- (ii) With regard to D9 as the closest prior art the appellants submitted that D9 concerned pressure sensitive adhesives and hence concerned a technical area related to that of the patent in suit. The aim of D9 was to improve the stability of the pressure sensitive adhesives to solvent and plasticizers. This was achieved by a reaction between a polyisocyanate prepolymer and a compound with active hydrogen. The composition of D9 was applied as a hot melt and formed a pressure sensitive adhesive.

There was no clear distinction between these two types of adhesives - the transition was continuous.

The respondent disputed that D9 could represent the closest state of the art since it was not concerned with hot melt adhesives, but with pressure sensitive adhesives, e.g. for adhesive tapes. Further although the compositions of D9 could, in principle, be solvent free all the examples employed solvents. All the NCO groups had been reacted thus in the adhesive there was no residual reactivity. Further the respondent submitted that D9 addressed a different problem from that of the patent in suit, namely to prevent the plasticizer migrating **into** the bond line. The patent in suit however was concerned with preventing components of the adhesive migrating **out**.

- (i) The appellants sought to introduce a further line of argument concerning inventive step based on D3 as the closest prior art.

The respondent objected to this, submitting that this argument had not been advanced in the statement of grounds of appeal and hence was late filed.

The appellants submitted that since a novelty objection had been based on the disclosure of D3 it would have been illogical also to base an objection of lack of inventive step on the same document. In any case an attack of lack of novelty by implication included an attack of lack of inventive step.

The appellant further referred to the statement in the statement of grounds of appeal referring to all the arguments from the opposition procedure (see section V.(a) above). In support of this approach reference was made to T 131/01 (OJ EPO 2003, 115 and 282).

Following deliberation, the board informed the parties, that, with reference to the Rules of Procedure of the Boards of Appeal, Article 10b(1) it had decided not to exercise its discretion to admit the line of argument concerning inventive step based on D3 as the closest prior art.

XII. The appellants (opponents I and II) requested that the decision under appeal be set aside and that the European patent No. 1 036 103 be revoked.

The respondent (patent proprietor) requested that the appeals be dismissed (main request) or in the alternative that the patent be maintained on the basis of the sets of claims according to the first, second or third auxiliary requests, all filed with the letter dated 14 August 2007.

Reasons for the Decision

1. The appeals are admissible.
2. *Main request - admissibility of amendments.*

The opponents raised no objection on formal grounds (Art. 84 or 123 EPC) to the admissibility of the amendments made to the claims according to the main request.

Nor has the board any objections of its own in these respects.

Consequently the requirements of Art. 84 and 123 EPC are held to be met.

3. *Main request - Novelty*

Claim 1 of the main request (see full wording in section III above) is directed to an adhesive which is:

- solvent free
- a hot melt adhesive
- solid at room temperature
- comprising the product of combining
 - a): 95 to 3 % by weight of the reaction product of a first isocyanate and a copolymer of ethylenically unsaturated comonomers having an average molecular weight below 60,000, which polymer has active hydrogen groups. The comonomers are selected from *inter alia* hydroxyethyl acrylate, hydroxyethylmethacrylate, hydroxypropylacrylate, hydroxypropylmethacrylate, hydroxybutylacrylate and hydroxybutyl methacrylate;
 - b): 5 to 90 % by weight of a polyurethane prepolymer with free isocyanate groups prepared from *inter alia* polyether diols or polyester polyols.
 - c): optionally 0-40 % by weight of various additives.

- 3.1 D3 relates according to claim 1 to a moisture-curing hot-melt adhesive comprising:
- (A): A urethane prepolymer, having an NCO group at the terminus and a specified NCO/OH ratio and comprising *inter alia* soft and hard segment moieties, based respectively on a polyol of molecular weight 1 000-8 000 and a polyester polyol of molecular weight 1 000-6 000;
 - (B): A urethane prepolymer comprising a soft segment moiety and having a NCO group at the terminus based on a polyol of molecular weight of not more than 8 000 and a diisocyanate in a specified NCO/OH ratio.
- 3.2 The polyols which can be employed to form the soft segments are recited in column 3 starting at line 28 of D3. One of the types of polyols listed is "acrylic polyols" (column 3, line 32).
- 3.3 This term is however not further elaborated. In particular it is not explained in D3 what is to be understood by this term. In order to elucidate the term "acrylic polyols", the appellants have referred to D29.
- 3.3.1 Firstly, the board notes that there is no connection between D3 and D29. These documents are assigned to different companies and relate to different technical fields, namely hot melt adhesives and coating compositions, respectively. There is no basis for assuming that the terminology employed by the authors of D29, addressing one technical field necessarily coincides with that employed by the authors of D3, addressing a different technical field.

3.3.2 Secondly, there is also is no reference in D3 to D29 as providing an explanation of the term "acrylic polyols" as employed in D3.

3.3.3 Thirdly, D29 contains two references to "acrylic polyols". At column 3 line 32 it is taught generally that "the so-called acrylic polyols" can be used. It is however not elucidated what molecular species are to be understood by this term. At column 3 lines 58-62 it is explained that "one particularly preferred class of acrylic polyols comprises interpolymers of hydroxyethyl acrylate or methacrylate, one or more lower alkyl acrylates and, if desired, an unsaturated nitrile and an N-alkoxymethyl acrylamide."

This "particularly preferred" class of acrylic polyol does indeed meet the requirements of operative claim 1 part a) as regards the permissible monomers. The molecular weight is however not disclosed.

3.4 It is therefore apparent that although D3 discloses "acrylic polyols" these are not mandatorily present, or even preferred in D3. Further as regards the chemical nature of these species, and accepting, for the sake of argument, that the skilled person would consult D29 for elucidation of the term "acrylic polyols", the evidence thereof would only reveal that polymers meeting the monomer requirements of part a) of claim 1 are but one embodiment within the scope of the term "acrylic polyols".

Accordingly a number of selections must be made in order to arrive from the disclosure of D3 to the component a) of operative claim 1, namely:

- to select "acrylic polyols" as a monomer for component (B) of D3 from the list of monomers presented as equivalent alternatives;
- Having selected "acrylic polyols", then to select from the various classes of "acrylic polyols" that class identified as "particularly preferred" in the unrelated document D29, assuming that the skilled person would even consult D29 for elucidation of the meaning of a term in D3;
- then to select the molecular weight range for the polyol of the "acrylic polyol" to be that specified in operative claim 1.

3.5 None of these individual selections is disclosed - even implicitly - in D3. The combination of these three selections is consequently also not disclosed. Accordingly D3 does not disclose, (even implicitly) component a) of operative claim 1 and therefore does not disclose the subject matter of claim 1. Since claims 2-25 are dependent on claim 1, this conclusion applies also to these claims.

3.6 Therefore, the subject matter of the claims of the main request is novel.

4. *The patent in suit, the technical problem, its solution*

4.1 According to paragraph [0001] the patent in suit is directed to a quick-setting moisture-curing polyurethane hot melt adhesive.

4.1.1 It is taught that hot melt adhesives having a low molecular weight polymer and formed from ethylenically

unsaturated monomers which do not contain active hydrogen and a polyurethane polymer with free isocyanate groups are known (paragraph [0014] of the patent in suit). These compositions do not require addition of tackifiers or plasticizers (paragraph [0015] of the patent in suit).

4.1.2 According to paragraph [0018] of the patent in suit, known hot melt adhesives have a number of significant disadvantages *inter alia*:

- if the low molecular weight polymer incorporated in the adhesive does not contain any functional groups it does not become chemically bonded to the adhesive backbone after curing. Thus it is extractable by solvents in contact with the bond line, and by plasticizers migrating from the interface of the bondline. This is undesirable as it leads to changes in the physical, chemical and mechanical properties of the bondline.

4.1.3 The problem to be solved by the patent in suit is thus to retain the favourable properties of reactive polyurethane hot melt adhesives containing low molecular weight polymers and to improve on their resistance to solvents and/or plasticizers (paragraph [0019] of the patent in suit).

4.1.4 It is further taught in the patent in suit (paragraph [0047] that the adhesives prior to crosslinking exhibit a high initial adhesive and cohesive strength. This ensures a rapid high handling strength of the bonded substrates which can readily be subjected to further processing without the need for mechanical fixing and/or fastening.

4.2 According to paragraph [0020] of the patent the problem set out in paragraph [0019] thereof is solved by the combination of two polyurethane polymers as defined in the claims, whereby component a) is the product of a polyisocyanate and a low molecular weight polymer comprising ethylenically unsaturated monomers wherein said polymer has active hydrogen groups.

4.2.1 The examples of the patent provide comparisons between compositions in which component a) has active hydrogen groups, specifically hydroxyl groups, as required by the operative claims and a comparative composition in which these groups are absent from component a). These data show that both sets of compositions have broadly similar adhesive properties. The compositions according to the claims, i.e. those in which the component a) has active hydrogen groups, however exhibit a significantly lower - of the order of 50% - content of extractable matter than the comparative compositions (shown in the table on page 10 of the patent).

4.2.2 Accordingly the examples of the patent show that the technical problem specified in paragraph [0019] of the patent in suit is solved by the measures indicated in paragraph [0020] thereof.

4.3 Both appellants have further accepted that this was the technical problem underlying the patent in suit (see section V.(c) above).

5. *The closest state of the art*

According to the case law of the Boards of Appeal, the document selected as closest prior art must be a document which discloses subject-matter conceived for the same purpose or aiming at the same objective as the claimed invention and having the most relevant technical features in common (see "Case Law of the Boards of Appeal of the European Patent Office", 5th Edition, 2006, section I.D.3).

In view of the above formulated technical problem the closest prior art must therefore be a document which is related to the provision of moisture curing polyurethane hot melt adhesives, and which is concerned with maintenance of the bond under use conditions, for example with respect to solvents and plasticizers.

A number of documents have been advanced by the appellants as candidates for the closest state of the art, namely D1, D4a, D7 and D9. Of these only D7 and D9 were discussed at the oral proceedings before the board (see section XI.(c) above). Accordingly these two documents will be considered first.

5.1 D7 relates, like the patent in suit, to hot melt polyurethane adhesive compositions which are solid at room temperature (D7 claim 1).

These compositions comprise:

- 5 to 90 wt% of a urethane prepolymer prepared from a polyisocyanate and a polyol;
- 10 to 95 wt% of a low molecular weight polymer of ethylenically unsaturated monomers, which are explicitly stated to contain no active hydrogens.

According to page 2 lines 33-35 of D7 the problem to be solved was to provide polyurethane hot melt adhesive compositions having superior initial adhesion to a broad range of substrates, i.e. a similar aim to one of

those of the patent in suit (see section 4.1.4 above) as well as heat resistance even after aging of the bonds. According to page 4 lines 37 to 44 of D7 it is considered that the advantageous properties are due to the formation of a semi-interpenetrating network between the urethane prepolymer and the free radically polymerised polymer. It is further taught that such a semi-interpenetrating network could not arise if the free-radically polymerized polymer contained crosslinking groups. According to the respondent (section XI.(c).(i) above) the term "crosslinking" referred not only e.g. to active hydrogen atoms but to multiply unsaturated groups.

Thus the aim of D7 is closely aligned with that of the patent in suit and the means provided for achieving that aim are similar and differ only in one respect from that according to claim 1 of the patent in suit, namely that component a) does not have active hydrogen groups.

5.2 D9 relates to a pressure sensitive adhesive (PSA) usable on thin, flexible backings or as a film adhesive (abstract).

The adhesive contains alkyl acrylate interpolymers having one or more functional groups such as carboxyl, hydroxyl, amino or amide (claims 1 and 3, col. 2 lines 1 to 5, and lines 50-54). The interpolymers are at least partially crosslinked with an organic polyisocyanate and the adhesives are resistant to heat, water and solvents and migration of plasticizers (D9, abstract).

According to column 1, lines 52-70 a problem with known pressure sensitive adhesives occurs when they are coated on substrates containing relatively low

molecular weight components such as plasticisers and other additive used in formulating plastics. These can migrate into the adhesive, thereby compromising it. Thus the aim of D9 is to provide an adhesive which can resist this migration.

According to the examples of D9 an interpolymer of ethylenically unsaturated polymers is combined in solution with an isocyanate terminated adduct of a diisocyanate and a polyol. This solution is cast onto a release paper, dried and then cured. The so formed adhesive is then transferred to a substrate, e.g. vinyl.

It is thus apparent that the adhesive formed in D9 is the result of reaction of the two named components and therefore the adhesive itself is no longer reactive. Thus D9 does not relate to a solvent-free, moisture-curing (i.e. reactive) hot melt adhesive but to a PSA. The argument of the opponents (see sections VII, X and XI.(c).(ii) above) that there was no clear distinction between these two types of adhesives, but rather that the transition was continuous is irrelevant in view of the non-reactivity of the compositions of D9. D9 clearly does not relate to a moisture-curing (i.e. reactive) hot melt adhesive as required by the claims of the patent in suit.

Accordingly, in the board's view D9 is a less relevant state of the art than D7.

- 5.3 D1, which was invoked for the first time by OI in the statement of grounds of appeal as forming the closest prior art, relates to reactive hot melt adhesives comprising a thermoplastic material, an isocyanate based binder and a thixotropic agent.

According to the only example, the thermoplastic is the product of polyoxypropyleneether diol of molecular weight 2 000 and 4,4'-diphenylmethane diisocyanate. This thermoplastic is combined with an isocyanate prepolymer obtained by reaction of polyoxypropyleneether triol of molecular weight 5 000 and 4,4'-diphenylmethane diisocyanate. According to Page 2 lines 46-53 the problem to be solved by D1 is to provide a hot melt adhesive which is form-stable after application, can be plastically deformed at room temperature and after curing with water, in particular atmospheric humidity, exhibits good mechanical, rubbery and adhesive properties. In this connection it is disclosed that D1 is directed to the provision of adhesives which after application are processable and plastically deformable. This requirement is inconsistent with the requirements on initial strength set out in the patent in suit (see paragraph 4.1.4 above) and indeed in D7 (see section 5.1 above). Intended areas of use are in the automobile and ship building industries, e.g. for adhering windscreens, plastic trim and wood (D1, page 2 lines 46-53). Whilst D7 contains a component which corresponds, at least in terms of its general structure, to component a) of operative claim 1 (the difference being the absence of active hydrogen groups - see section 5.1 above), no such component is present in the compositions of D1. Consequently both the aims of D1 and the technical means for achieving these are more distant from the corresponding aspects of the patent in suit than those of D7. Accordingly D1 is less relevant state of the art than D7.

5.4 D4a relates to moisture curable reactive hot melt adhesives based on polyols, polyisocyanates and optionally monofunctional stoppers. The problem addressed by D4a is to reduce the amount of residual isocyanate (D4a, page 1, first paragraph, page 3 final paragraph to page 4 first complete paragraph). The polyols that may be employed (claim 5 and the passage starting at the final paragraph of page 10 of D4a) include polyester polyols, polyether polyols and acrylic ester-copolymer polyols. According to page 12, first paragraph, the acrylic ester copolymer polyols can be obtained by reaction of (meth)acrylic acid esters with hydroxy-functional (meth)acrylic acid compounds. It is apparent that whereas the operative claims of the patent in suit mandatorily require two types of polyurethane polymer, distinguished by the nature of the polyols employed, D4a, in contrast relates to a single compound and makes no distinction between the polyols that may be employed. Thus the aim of the compositions of D4a is different from that of the patent in suit and again one of the two compositional components required by claim 1 of the patent in suit is entirely absent. Accordingly D4a is a less relevant state of the art than D7.

5.5 From the above analysis it is furthermore apparent that none of the cited documents considers the problem of extraction of low molecular weight components from the adhesive by solvents or plasticisers. It follows however from the foregoing analysis that, of the documents proposed by the appellants as the closest prior art, that with the most aspects in common with

the patent in suit, both in terms of the problem to be solved, and the means adopted for solving it is D7. Accordingly this is the document which is considered to represent the closest state of the art.

6. *The objective technical problem compared to D7, its solution*

6.1 The comparative example of the patent in suit corresponds to the teaching of D7, as noted in the decision under appeal (see section III.(c).(i) above). This finding has not been challenged by the appellants, and as explained in section 4.2 above, the board is satisfied that this assessment is correct.

The aforementioned considerations (section 4.2 above), lead the board to conclude that the technical problem set out in paragraph [0019] of the patent in suit can be adopted as the objective technical problem to be solved with respect to the closest prior art D7.

6.2 This problem is solved according to the subject matter of the operative claims by the feature that the polymer of ethylenically unsaturated monomers having no functional groups of D7 is replaced by a component which is the reaction product of a polyisocyanate and a copolymer having active hydrogen groups, i.e. component a) of the operative claims.

7. *Obviousness*

It must now be decided whether the claimed solution to the objective technical problem is obvious in the light of the prior art.

- 7.1 Since the very essence of the teaching of D7 is the presence of the low molecular weight copolymer of ethylenically unsaturated monomers not having active hydrogen atoms, and in view of the fact that D7 provides a technical explanation linking the obtained technical effects to this feature (see section 5.1 above), it would not only not be obvious but would in fact be in direct contradiction with the teaching of D7 to modify this component so that it contained active hydrogen atoms.
- 7.2 In particular, it has not been alleged, let alone proven that the mode of action, involving semi-interpenetrating networks, outlined in D7 would be incorrect, and hence that, in contrast to the explicit teaching of D7, there was in fact no requirement for the ethylenically unsaturated monomer to be free of functional groups. Nor have the appellants succeeded in establishing that some other technical considerations derivable from documents cited in the procedure would lead to the skilled person to carry out the required modification to the teaching of D7 for any other reason.
- 7.3 Regarding the arguments advanced with respect to the concept of "reactive diluents" by OI, in connection with the documents D2, D8, D13, D27, D28 and D30 (see sections V.(c).(i) and XI.(c).(i) above), it is noted that "reactive diluents" are compounds which become chemically bound to the polymer. Not only is the inclusion of such functional components not disclosed or suggested in D7, it is in fact incompatible with the concept underlying the teaching of D7 as explained in section 5.1 above. Thus there is no teaching in D7 that

would lead the skilled person to consider the use of reactive diluents.

7.4 Regarding the combination of D7 with other documents, i.e. D9 (see section V.(c).(ii) above) or D10 (see section V.(c).(iii) above), it is noted that these arguments rely as a first step on the desirability or obviousness of modifying the teaching of D7 by replacing the non-reactive component by one which can undergo chemical reaction. Since however, as explained in section 7.3 above, such a modification is alien to the concept underlying the teaching of D7, this would not be obvious.

7.5 Accordingly the subject matter of claim 1 is not obvious in the light of the cited prior art and accordingly meets the requirements of Article 56 EPC.

7.6 This conclusion applies to the subject matter of the dependent claims 2-25.

7.7 Accordingly the requirements of Article 56 EPC are met by the subject matter of the main request.

8. *Request to consider D3 as the closest state of the art*

At the oral proceedings, after discussion of inventive step based on D7 and D9 as the closest prior art, the opponents sought to have D3 considered as the closest state of the art for the consideration of inventive step (see section XI.(d) above).

8.1 The board notes that such a line of argument was not advanced at any point of the written part of the opposition procedure.

- 8.1.1 From the file, it is apparent that this argument was advanced for the first time at the oral proceedings before the opposition division, and was admitted and considered by the opposition division, but not found convincing (see section III.(c).(ii) above).
- 8.1.2 Despite the existence of a decision by the opposition division in respect of inventive step based on D3 as the closest prior art, no reference to this approach was made in the whole of the written phase of the appeal procedure. The presentation of this line of argument for the first time at the oral proceedings before the board is therefore inconsistent with the case presented to the board in writing and hence constitutes a change of the case presented to the board.
- 8.1.3 According to Article 10a(2) of the Rules of Procedure of the Boards of Appeal (RPBA) the statement of grounds of appeal shall contain a party's complete case.
- 8.1.4 According to Article 10b(1) RPBA any amendment to a party's case after filing the grounds of appeal may be admitted and considered at the boards discretion, which discretion shall be exercised in view of *inter alia* the complexity of the new subject matter and the current state of the proceedings.
- 8.1.5 According to Article 10b(3) RPBA amendments to a party's case sought to be made after oral proceedings had been arranged shall not be admitted if they raise issues with the board or the other party cannot reasonably be expected to deal with without adjournment of the oral proceedings.

8.1.6 Since there had not been any indication that such an argument would be raised, let alone a written exchange in respect thereof, the respondent could not reasonably be expected to address this matter without adjourning the oral proceedings.

8.1.7 Therefore the attempt to initiate a further attack against inventive step on the basis of D3 constituted:

- a change to the case of the appellant which was
- presented at a late stage of the proceedings, namely
- after oral proceedings had been convened and which
- raised issues which the respondent could not reasonably be expected to address without necessitating adjournment of the oral proceedings.

8.1.8 Therefore in view of the lateness of this argument and the complexity of the issues which it raises the board, also taking into account the need for procedural economy (Art. 10b(1) RPBA) considers it appropriate to exercise its discretion pursuant to Art. 10b(1) RPBA not to admit this approach at such a late stage of the procedure.

8.2 It was further submitted that since a novelty objection had been based on D3 it would have been illogical or inappropriate to base also an objection of inventive step, and hence that there had in effect been no change of case (See section. XI.(d) above).

8.2.1 In support of this position the appellant referred to T 131/01 (OJ EPO, 2003, 115 and 282). The publication of this decision was in April 2003, and hence predated the filing of the Notices of Opposition by 2 months. This decision concerned a case in which an objection of lack of novelty was raised in the notice of opposition and the opponent further submitted, as a precautionary measure that, if the citation did not anticipate the claimed subject matter, then the distinction did not require an inventive step.

This "dual" approach, and in particular the "provisional" objection of lack of inventive step which was not reasoned in any detail was held to be admissible, since an objection of inventive step on the basis of a document cited against novelty could, logically only be considered if there was - nevertheless - some difference between the invention and the prior art (T 131/01, reasons 3.1). The ground was also considered to be substantiated (T 131/01 reasons 3.2).

8.2.2 Accordingly, the case law cited by the appellant comes to the opposite conclusion to that argued by the appellant, namely that a "dual attack" against novelty and inventive step on the basis of the same document is admissible.

8.2.3 Accordingly, it is concluded that neither the EPC, nor the case law forbids such a "dual" approach. Thus the argument of the appellant in this respect is not supported by the facts.

8.3 With respect to second paragraph under "Anträge" in the statement of grounds of appeal filed by OI, indicating

in a general manner that all the documents and arguments advanced in the opposition procedure were "likewise taken over into the appeal procedure" (see section V.(a) above), the board notes that according to Article 10a(2), second sentence of the Rules of Procedure of the Boards of Appeal the statement of grounds of appeal "...should specify expressly all the facts, arguments and evidence relied on".

This requirement is not met by a general reference to the arguments advanced in the opposition proceedings since it is impossible for the other parties, or the board to comprehend to which specific arguments from the opposition proceedings reference is being made.

8.4 Accordingly the request by the appellants to be permitted present arguments against inventive step on the basis of D3 as the closest prior art was not allowed.

Order

For these reasons it is decided that:

The appeals are dismissed.

The Registrar:

The Chairman:

E. Görgmaier

R. Young