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**Datasheet for the decision  
of 9 September 2009**

**Case Number:** T 1109/07 - 3.3.03

**Application Number:** 95102022.1

**Publication Number:** 0668302

**IPC:** C08G 18/20

**Language of the proceedings:** EN

**Title of invention:**

Catalyst for reactive hot melt adhesives

**Patentee:**

National Starch and Chemical Investment Holding Corporation

**Opponent:**

3M Innovative Properties Company

**Headword:**

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**Relevant legal provisions:**

EPC Art. 54, 56, 84, 123(2)

**Relevant legal provisions (EPC 1973):**

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**Keyword:**

"Main request - novelty - no"

"First auxiliary request - clarity - no"

"Second auxiliary request added subject-matter - yes"

"Third auxiliary request - maintenance in amended form"

**Decisions cited:**

T 0201/83, T 0644/97

**Catchword:**

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Case Number: T 1109/07 - 3.3.03

**D E C I S I O N**  
of the Technical Board of Appeal 3.3.03  
of 9 September 2009

**Appellant:** National Starch and Chemical Investment  
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**Decision under appeal:** Interlocutory decision of the Opposition  
Division of the European Patent Office, dated  
21 March 2007 and posted 9 May 2007 concerning  
maintenance of the European patent No. 0668302  
in amended form.

**Composition of the Board:**

**Chairman:** R. Young  
**Members:** M. C. Gordon  
C.-P. Brandt

## Summary of Facts and Submissions

I. Mention of the grant of European Patent No. 0 668 302 in the name of National Starch and Chemical Investment Holding Corporation in respect of European patent application No. 95102022.1 filed on 14 February 1995, published on 23 August 1995 and claiming a priority date of 22 February 1994 from US 08/200131 was announced on 22 December 1999 (Bulletin 1999/51) on the basis of 13 claims.

Independent claims 1 and 7 read as follows:

1. A catalyzed polyurethane hot melt adhesive being reactive in the presence of ambient moisture comprising :
  - a) a polyurethane prepolymer being reactive in the presence of ambient moisture and
  - b) 0.05 to 0.15% by weight of 2,2'-dimorpholinodiethyl ether or di(2,6 -dimethylmorpholinoethyl) ether catalyst.
  
7. A method for improving the curing speed of a polyurethane hot melt adhesive being reactive in the presence of ambient moisture comprising the step of incorporating therein 0.05 to 0.15% by weight of 2,2' dimorpholinodiethyl ether or di(2,6-dimorpholinoethyl)ether catalyst.

Claims 2-6 and 8-13 were dependent claims directed respectively to preferred embodiments of the adhesive of claim 1 and the method of claim 7.

II. Two notices of opposition to the patent were filed on 21 September 2000 by:

- 3M Innovative Properties Company ("OI") and
- Henkel KGaA ("OII").

Both opponents invoked the grounds of opposition pursuant to Art. 100(a) EPC (lack of novelty, lack of inventive step) and Art. 100(c) EPC (extension of the subject-matter of the patent beyond the content of the application as filed).

OI also invoked the ground of opposition pursuant to Art. 100(b) EPC (insufficiency of disclosure).

The following documents, *inter alia* were cited by the opponents:

D2: WO-A-92/13017

D3: EP-B1-455 400

D14 EP-A-532 765.

III. By an interlocutory decision announced at the conclusion of oral proceedings held on 21 March 2007 and issued in writing on 09 May 2007, the opposition division held that the patent in suit could be maintained on the basis of the fourth auxiliary request consisting of 6 claims and filed at the oral proceedings. The decision was also based on a main request and first to third auxiliary requests whereby the main request and first auxiliary request had been submitted with a letter dated 14 March 2007 and the second and third auxiliary requests had been submitted with a letter dated 16 March 2007.

(a) The claims of the main request were, with the exception of the correction of typographical errors in claim 6, 7 and 13 identical to the claims of the patent as granted. With regard to the upper limit of the catalyst in claims 1 and 7, i.e. 0.15 wt%, the decision held that this feature had been disclosed in example 3 of the application as originally filed and consequently met the requirements of Art. 123(2) EPC. The decision however held that the subject-matter of

claims 1 and 7 lacked novelty in view of the disclosure in examples 1-8 of D2.

- (b) The first auxiliary request differed from the main request in that claims 7-13 had been deleted and further in that in claim 1 the following wording had been added to the end of paragraph b):

", wherein the prepolymer is prepared by the condensation polymerization of a polyisocyanate with a substituted polyalkylene ether glycol".

According to the decision, the subject-matter of this claim did not meet the requirements of Art. 123(2) or 84 EPC. The objection in respect of Art 123(2) arose since the application as filed was held not to disclose a combination of the defined group of prepolymers with the specified catalysts employed in the amount of 0.15 wt%. The objection pursuant to Art. 84 EPC related to the wording "substituted polyalkylene ether glycol". For the skilled person the term "substituted" implied that the respective component contained a functional group or substituent, e.g. an alkyl group replacing another functional group or a hydrogen atom (in the polymer backbone as well as in branching groups). In the case in suit this interpretation gave rise to uncertainty since prepolymers based on 1,2-polypropylene glycol could be considered on the one hand as an unsubstituted polypropylene ether glycol and simultaneously interpreted as a methyl-substituted polyethylene ether glycol. The patent in suit

contained no indication for a possible interpretation of this wording. The different possible interpretations therefore rendered the definition of the subject-matter of claim 1 of the first auxiliary request unclear contrary to Art. 84 EPC.

- (c) The second auxiliary request differed from the main request in that claims 7-13 had been deleted and further in that in claim 1 the following phrase had been inserted at the end of paragraph b):

", wherein the prepolymer is prepared by the condensation polymerization of a polyisocyanate with polypropylene glycol".

According to the decision the subject-matter of this claim did not meet the requirements of Art. 123(2) EPC.

The patent disclosed urethane prepolymers based on polypropylene glycol in different contexts. On the one hand urethane prepolymers could be based on a glycol component including a polyamino- or a polymercapto-containing compound, including corresponding derivatives of propylene glycol. On the other hand, the examples of the patent disclosed a prepolymer derived from reaction of polypropylene glycol of molecular weight 1000 with a specific diisocyanate. The use of polypropylene glycol *in general* (emphasis of the decision) would constitute an intermediate generalisation and introduced subject-matter extending beyond the

content of the application as filed, contrary to the requirements of Art. 123(2) EPC.

- (d) The third auxiliary request, in the version annexed to the decision differed from the main request in that in claim 1 the lower limit of catalyst content had been amended to 0.075, giving a range of 0.075 to 0.15% by weight and further in that claims 7-13 had been deleted.

Paragraph 6.1 of the decision, however stated that the upper limit of the amount of catalyst in claim 1 had been amended to 0.125 wt%. The subject-matter of this claim was held to be based on a combination of claims 1 and 2 of the patent as granted and hence to meet the requirements of Art. 123(2) EPC.

The subject-matter of the claims of this request was also held to be distinguished from the disclosure of D2 due to the selection of the nature of the specific catalysts and the weight range for the amount of catalyst present. This reasoning applied also with respect to the disclosure of D3. Thus the subject-matter of claim 1 of the third auxiliary request consisted not only in the selection of a sub-range of the numerical values disclosed in D2 and/or D3 but in the selection of a specific combination of the nature of the catalyst and amount.

With regard to Art. 56 EPC it was held (section 6.3 of the reasons for the decision) that the patent in suit aimed at improving the curing

speed of polyurethane reactive hot melt adhesives without significantly reducing their thermal stability.

D3 was also concerned with curing properties of polyurethane reactive hot melt adhesives and disclosed similar adhesives to those of operative claim 1. However a wider range of catalyst was disclosed (0.05-0.5 wt%).

The skilled person knew that a certain minimum amount of catalyst was required, whereas increasing the catalyst beyond a certain value would lower the thermal stability leading to premature gelation.

Document D14 addressed the problem of enhancing both the moisture curing reactivity and the thermal stability of polyurethane reactive hot melt adhesives and suggested to employ tertiary amine compounds having morpholino substituents as the catalysts, i.e. molecules having structural features similar to the claimed compounds in an amount ranging from 0.1 to 2 pbw per 100 pbw polymer.

Hence it would have been obvious to the person skilled in the art, aiming to achieve the same result as in D14 to select the preferred catalyst disclosed in D2, namely 4,4'-(oxydi-2,1-ethanediyl) bis-morpholine [Board's comment: alternative name for 2,2'-dimorpholinodiethyl ether - "DMDEE" - the first catalyst specified in part (b) of claim 1 of the patent as granted - see section I, above]. In



view of the general information regarding the amount of catalyst provided by D14 it would also have been obvious to modify the amount of DMDEE catalyst within the preferred range disclosed in D3 to keep both properties in balance. Minor modifications of the amount of the components came within the scope of routine for the skilled person. Accordingly the subject-matter of claim 1 of the third auxiliary request was held to lack an inventive step in view of a combination of D3 and D14 (Art. 56 EPC).

- (e) The fourth auxiliary request, consisting of 6 claims whereby the sole independent claim was directed to the use of a catalysed polyurethane hot melt adhesive for book binding, was considered to meet the requirements of the EPC.

IV. A notice of appeal against the decision was filed on 5 July 2007 by the patent proprietor, the prescribed fee being paid on the same day.

V. The statement of grounds of appeal was received on 19 September 2007.

The main request and first to third auxiliary requests as considered by the opposition division were maintained.

An amended fourth auxiliary request was submitted in which the use was directed to "in open air applications of bookbinding or roller coating".

- (a) With respect to the main request, the appellant/patent proprietor submitted that the amount of catalyst present in the compositions of examples 1-8 of D2 was 0.034 % by weight and hence outside the range specified in operative claim 1.
  
- (b) With respect to the first auxiliary request and the objection pursuant to Art. 84 EPC it was submitted that the breadth of a term generally had no relevance for the clarity of the claim. Even if the expression "substituted" included many different substituents and position, this could not constitute a lack of clarity. Submissions were also made with respect to Art. 123(2) EPC, which submissions are not of relevance for this decision.
  
- (c) With respect to the second auxiliary request and the objection pursuant to Art. 123(2) EPC, it was submitted that examples 1 to 3 and 5 disclosed polypropylene glycol. This was clear evidence that polypropylene glycol was an important embodiment of the invention. Accordingly, the corresponding feature had sufficient disclosure in the application as filed.
  
- (d) With regard to the third auxiliary request and the objection of lack of inventive step, it was submitted that neither D2 nor D3 addressed the technical problem of optimising two independent technical aspects like the cure speed and stability. Further both D2 and D3 disclosed a wider range of possible catalyst compounds in a broader range of amounts than specified in claim 1

of the third auxiliary request.

In order to arrive at the subject-matter of claim 1 of the third auxiliary request on the basis of D2 or D3 an *ex post facto* analysis was required.

Taking D14 into consideration would not lead to a different conclusion. D14 disclosed moisture-curable hot melt adhesive compositions. D14 however did not disclose the catalysts specified in operative claim 1, but disclosed catalysts comprising not only nitrogen in a morpholino ring system but also additional nitrogen leading effectively to non-cyclic amines.

D14 disclosed a very broad concentration range for the catalysts (0.01 to 5 parts by weight, preferably - in the examples - 0.1 to 2 parts by weight in relation to the urethane prepolymer). The concentration range of D14 did not assist the skilled person in arriving at the concentration specified in operative claim 1.

Whilst D14 disclosed an objective which related to curing hot melt adhesives superior in reactivity with moisture and also superior in thermal stability, D14 employed different catalysts in different concentrations. Thus it would be necessary to replace the catalysts of D14 by the morpholino compounds specified in operative claim 1 and further to select specific concentration ranges for these.

Although these catalysts were disclosed - in very different concentrations - in D2 and D3 there was no motivation for the skilled person to substitute the catalysts of D14 with those of D2 or D3. Further the required concentration range could only be arrived at by employing an *ex post facto* analysis.

- (e) Submissions were also made with respect to the fourth auxiliary request, which submissions are however not of relevance to the present decision.

VI. The opponent, now the respondent, replied with a letter dated 5 May 2008.

- (a) With respect to the main request it was submitted *inter alia* that the claims did not meet the requirements of Art. 123(2) EPC. The upper limit of catalyst content in claims 1 and 7 i.e. 0.15% had been introduced in the examination proceedings. This limit had been disclosed in the application as originally filed only in example 3 relating to a specific composition and could not be generalised.

The objection of lack of novelty in respect of the disclosure of examples 1 to 8 of D2 was maintained.

- (b) With regard to the first auxiliary request an objection pursuant to Art. 123(2) EPC was raised in respect of the specified catalyst range, as for the main request.

With respect to Art. 84 EPC it was also submitted that the conclusions of the opposition division had been correct (see section III.(b), above).

- (c) With regard to the second auxiliary request in addition to the objection pursuant to Art 123(2) raised for the main request, it was submitted that the conclusions of the opposition division with respect to the feature "polypropylene glycol" had been correct (see section III.(c), above).
- (d) With regard to the third auxiliary request an objection pursuant to Art 123(2) EPC was raised for the same reason as for the main request.

An objection of lack of novelty was raised with respect to D2 and D3. D2 disclosed a list of non-individualised general types of catalyst and only one individualised catalyst, i.e. DMDEE.

Accordingly no selection in respect of the type of catalyst was required. Only a single selection, i.e. of the range of catalyst concentration had to be made. This selection was not associated with an unexpected technical effect. Analogous arguments were presented with respect to the disclosure of D3.

With regard to inventive step, it was submitted that the decision under appeal had found the claims of this request to lack inventive step in view of a combination of D2 or D3 with D14, reference being made to section 6.3 of the reasons of the decision (cf section III.(d), above).

It was submitted that the problem solved by the patent in suit was to provide a catalyst for reactive hot melt adhesives that increased the curing speed without significantly reducing the thermal stability of the adhesive.

D3 was also concerned with the curing properties of such adhesives and taught that various types of catalysts improved the curing speed, the catalyst DMDEE being individualised, which was to be used at a level of 0.01 to 2 wt% based on the prepolymer.

The examples of D3 employed an amount of 0.2 wt%, based on the prepolymer, of the catalyst. Similar arguments applied to D2.

Neither D2 or D3 explicitly disclosed specific thermal stabilities of the adhesives. This was however a standard requirement for hot melt adhesives. When seeking to provide catalysts with good curing behaviour and thermal stability the skilled person would start from good hot melts disclosed in the examples of D2 or D3, i.e. using the catalyst DMDEE. Accordingly the subject-matter of the claims lacked inventive step over D2 or D3 in combination with common general knowledge.

D14 was concerned with moisture curing hot melt compositions having thermal stability and high curing speed. Thus the problem of the patent had already been solved by D14. It was correct, as submitted by the appellant/patent proprietor, that the catalysts of D14 were not identical to those

of the patent in suit. Hence the problem to be solved by the subject-matter of the third auxiliary request was to provide an alternative polyurethane hot melt adhesive having high curing speed and thermal stability.

D14 provided a very detailed study of the performance of dimorpholino and trimorpholino catalysts. Both gave good curing speeds and thermal stability. The dimorpholino analogue performed better in increasing the curing speed and performed equally well with respect to thermal stability as was apparent from Table 1 of D14. Hence when seeking alternative catalysts the skilled person would employ other dimorpholino catalysts including those specified in the claims of the patent in suit.

From the data of D14 the skilled person would conclude that the amino moiety was not important for achieving the desired curing speed and thermal stability since studies carried out with substituted amine catalyst revealed that these did not perform well. Hence the skilled person was directed to maintain the dimorpholino residues but to replace the tertiary amine nitrogen linking them. Replacement of the tertiary amine with an ether was obvious.

Finally the skilled person would investigate similar catalysts which were commercially available, such as those specified in the patent in suit. The range specified in the operative claims was within the broad range specified in D14

and would have been identified by routine experiments.

Hence the subject-matter claimed in the third auxiliary request lacked inventive step over the teaching of D14 alone or over D14 in combination with common general knowledge of the person skilled in the art.

In the alternative the skilled person would arrive at the compositions claimed by combining the teaching of D14 with D2 or D3, whereby these documents related to the same technical field as D14 and singled out the dimorpholino catalysts of the claims for providing fast cure and good adhesive strength in reactive polyurethane hot melt adhesive compositions.

- (e) Objections were also raised with respect to the fourth auxiliary request, which objections are not relevant for the present decision.
- (f) The respondent/opponent also requested an apportionment of costs.

VII. With a letter dated 25 July 2008 opponent OII withdrew its opposition.

VIII. The appellant/patent proprietor made a further submission dated 12 December 2008 in which, *inter alia* it was submitted with respect to the third auxiliary request that D3 failed to disclose the specified amount of catalyst (Art. 54 EPC).



With regard to Art. 56 EPC and D14 it was submitted that according to the data given in D14 (Table I, examples 1-b and 1-d) the di- and trimorpholino catalysts provided comparable thermal stability. However the trimorpholino catalyst provided a faster moisture curing rate than the dimorpholino catalyst. Accordingly the data of D14 taught that using a trimorpholino catalyst was advantageous compared to using a dimorpholine catalyst, which was the opposite of what the opponent had concluded (see section VI.(d), above).

It was also disputed that the data of D14 allowed the conclusion, as submitted by the opponent, that the amine moiety was not important for achieving the desired properties (curing speed and thermal stability). Accordingly the skilled person was not directed to maintain the dimorpholino residues and to replace the linking tertiary amine nitrogen.

Further it was not clear why the skilled person should try catalysts of similar structure since the trimorpholino catalysts already performed better than dimorpholino catalysts. Hence it would not make sense to screen for other dimorpholino catalysts.

Finally, example 5 of the patent in suit provided a direct comparison of the trimorpholino catalyst of D14 ("U-CAT-2046"). This evidence showed that both the dimorpholino ether catalysts [specified in the operative claims] showed an improved thermal stability as opposed to the similar catalyst containing amino functionality, reference being made to paragraph [0054]

of the patent in suit.

These conclusions also applied to the proposed combination of D14 with D2 or D3.

IX. On 26 June 2009 the Board issued a summons to attend oral proceedings.

In an accompanying communication the Board raised objections pursuant to Art. 123(2) EPC in respect of the feature "a polyurethane prepolymer being reactive in the presence of ambient moisture" in claim 1 of all requests.

The Board observed that this feature was disclosed in the application as relating to prepolymers that were isocyanate terminated. This feature was however absent from the respective claims 1 of all requests, contrary to Art. 123(2) EPC.

A further objection pursuant to Art. 123(2) EPC was raised in respect of the upper limit of catalyst in claim 1 of all requests (i.e. 0.15 % by weight). It was noted that this limit was disclosed only in the context of a specific example of the application as filed, and hence it was not permissible to generalise this.

The Board also indicated that it was disinclined to allow the request for costs made by the respondent/opponent (see section VI.(f) above).

X. Together with a letter dated 7 August 2009 the appellant/patent proprietor submitted amended sets of claims forming a main request and a first to a fourth

auxiliary request. The newly filed claims differed from the sets of claims submitted with the statement of grounds of appeal *inter alia* by insertion into the first line of the respective claims 1 (all requests) and claims 5, 6 and 7 (main request) and claims 5 and 6 (first-fourth auxiliary requests) of the words "isocyanate terminated" before the term "polyurethane" so that, for example claim 1 of the main request referred to a "catalyzed **isocyanate terminated** polyurethane hot melt adhesive" (emphasis of the Board).

Further the upper limit of the catalyst content in claim 1 of all requests and in claim 7 of the main request had been amended to 0.125 % by weight. It was submitted, that the amendments had been made in order to address the objections raised by the Board pursuant to Art. 123(2) EPC (See section IX, above).

XI. Oral proceedings were held on 09 September 2009.

In the course of the oral proceedings the respondent/opponent withdrew the request for an apportionment of costs.

Following a preliminary discussion of the sets of claims filed with the letter of the appellant/patent proprietor of 7 August 2009 (see section X, above) and the indication by the Board that the amendments made in respect of the feature "isocyanate terminated" had not successfully addressed the deficiencies identified pursuant to Art. 123(2) EPC (see section IX, above), the appellant/patent proprietor withdrew these requests and submitted five amended sets of claims forming a main request and a first to a fourth auxiliary request.

(a) *Main request*

The main request consisted of 6 claims, whereby claim 1 read as follows, the differences compared to claim 1 as granted being indicated in **bold**:

"A catalyzed polyurethane hot melt adhesive being reactive in the presence of ambient moisture comprising:

a) **an isocyanate terminated** polyurethane prepolymer being reactive in the presence of ambient moisture and

b) 0.05 to **0.125%** by weight of 2,2'-dimorpholinodiethyl ether or di(2,6-dimethylmorpholinoethyl) ether catalyst."

Claims 2, 3 and 4 were identical to claims 2, 3 and 4 of the patent as granted.

Claims 5 and 6 differed from the corresponding granted claims in that the term "isocyanate terminated" had been inserted before the term "polyurethane prepolymer". Further a clerical error in claim 6 had been corrected.

(i) The respondent/opponent did not raise any objections pursuant to Art. 83, 84 or 123(2) or (3) EPC in respect of the amended claims of the main request.

(ii) The respondent/opponent maintained the objection of lack of novelty in respect of

the disclosures of D2 and D3, reference being made to the decision of the opposition division and the written submissions (see sections III.(a), and VI.(a) above).

The appellant/patent proprietor submitted that the examples in Table 1 on page 21 of D2 constituted only a hidden disclosure as the speed of reaction and thermal stability were not discussed. It was conceded that calculation of the weight percentage of catalyst in the examples of D2, presented in the statement of grounds of appeal (see section V.(a) above) had not been correct. The disclosure of D3 was submitted not to be novelty destroying.

(iii) Following deliberation the Board informed the parties that the main request was refused.

(b) *First auxiliary request*

The first auxiliary request consisted of 6 claims, and corresponded to the first auxiliary request considered in the decision under appeal (See section III.(b), above) however amended in the manner as noted in the foregoing section (a) for the main request.

(i) The respondent/opponent did not raise any objections pursuant to Art. 83 or 123(2) or (3) EPC in respect of the claims of the first auxiliary request.

(ii) With respect to the finding of lack of clarity in the decision under appeal (cf section III.(b), above), the appellant/patent proprietor submitted that the term "substituted" could apply only to polyalkylene and meant "non-linear". This meant that since polypropylene glycol bore a pendant methyl group it had to be considered to be substituted whereas for example polyethylene glycol would be considered to be unsubstituted. It was referred to the discussion in the patent in suit of substituted and unsubstituted compounds and submitted that this distinction only made sense if polypropylene glycol was considered to be a substituted compound. It was however conceded that the patent in suit contained no explanation or definition of the term "substituted".

The respondent/opponent observed that in view of the explanations of the appellant/patent proprietor the term "branched" would have been more appropriate than "substituted".

(iii) After deliberation the Board announced that the first auxiliary request was refused.

(c) *Second auxiliary request*

The second auxiliary request consisted of 6 claims and corresponded to the second auxiliary request considered in the decision under appeal (see

section III.(c), above) however amended in the manner as noted in the foregoing section (a) as for the main request.

- (i) The respondent/opponent did not raise any objections pursuant to Art. 83 or 84 EPC in respect of the claims of the first auxiliary request.
  
- (ii) With respect to the finding with respect to Art 123(2) EPC in the decision under appeal (see section III.(c), above) the appellant/patent proprietor submitted that polypropylene glycol had been employed in all examples of the patent in suit and hence that this was disclosed. It was acknowledged that claim 1 of the second auxiliary request did not specify the molecular weight as given in the examples (1000) but submitted that the skilled person would have generalised the disclosure of the examples since it was known that the molecular weight was not critical and that polypropylene glycols with other molecular weights would also fall within the terms of the invention.

The respondent/opponent disputed this, referring to the findings of the decision under appeal. Further it was submitted that the examples related to certain optimised compositions the individual features of which were not individually generalisable.

(iii) After deliberation the Board announced that the second auxiliary request was refused.

(d) *Third auxiliary request*

The third auxiliary request consisted of 5 claims and differed from the main request in that the amount of catalyst in feature (b) in claim 1 was restricted to the range of 0.075 to 0.125% by weight.

(i) The respondent/opponent did not raise any objections pursuant to Art. 83, 84 or 123(2) in respect of this request.

(ii) With respect to Art. 54 EPC the respondent/opponent referred to the findings of the opposition division in respect of the disclosures of D2 and D3 (see section III.(d), above). These documents disclosed various classes of catalysts. However in each only a single catalyst was individualised namely DMDEE. The skilled person would however combine the disclosure of a specific catalyst in the examples with the generic disclosure of the amounts in the descriptions of D2 or D3 so arriving at a disclosure within the scope of claim 1 of the third auxiliary request. Accordingly only a single selection from the disclosures of D2 or D3 was required. As there was no evidence of any effect associated with this range it was arbitrary and could not support



a finding of novelty.

The appellant/patent proprietor submitted that both D2 and D3 disclosed several catalysts and broad ranges for the permissible amounts. In both cases a selection from two lists was required to arrive at the specified catalyst in the specified amount. Even if it were considered that only one catalyst had been individualised in D2 or D3 then it had to be borne in mind that this was individualised in association only with amounts which were outside the scope of the operative claims.

- (iii) With regard to Art 56 EPC the respondent/opponent proposed a number of different approaches.

D2 disclosed a hot melt adhesive as claimed in the operative claims, the difference being the amount of catalyst. It was known that catalysts affected the curing speed. Hence the problem with respect to D2 was to accelerate curing and also provide thermal stability.

Although neither D2 nor D3 mentioned thermal stability, based on their teachings the skilled person would as a matter of course adjust the amount of catalyst in order to optimise this property. This effect was in any case already disclosed in the examples

of D3 but was not explicitly recognised.

Alternatively D14 was also concerned with the same type of moisture curable hot melt adhesives, addressed the same problems as the patent in suit and employed closely related catalysts. The claimed catalysts differed from those of D14 in that the amino group had been replaced by an ether oxygen. Hence based on D14 as the closest state of the art the technical problem was to provide an alternative catalyst. It would be obvious to try the - closely related - catalyst disclosed in D2 or D3. The required amount could be determined by routine optimisation, the effect of improved thermal stability not being restricted to a narrow range. D14 itself taught that the amount of catalyst to use depended on various factors (D14 page 4 line 11ff). Possible amounts were disclosed in Table 1 of D14, which teaching was identical to that of D2 and D3.

The appellant/patent proprietor submitted that the problem as set out in paragraph [0005] of the patent in suit was to improve the curing speed without reducing the thermal stability. This problem was not mentioned in either D2 or D3, but was addressed in D14 which accordingly was the only document which could be considered to represent the closest state of the art. The examples of D14 showed that the best result was obtained with a trimorpholino compound

in an amount of 0.5 wt%. The dimorpholino compounds provided poorer performance. Hence D14 taught neither the amount nor the general type of catalyst to employ. Example 5 of the patent in suit employed the trifunctional compound designated "Formula III" in D14 ("U-CAT 2046"). Although the examples of D14 showed that this catalyst gave the best results, according to the examples of the patent in suit this catalyst gave poorer results than either of the catalysts specified in operative claim 1. Hence also based on this evidence, D14 would not lead to the claimed solution to the technical problem. It was also noted that based on the evidence of the examples of D14 the difunctional compounds disclosed in D2 and D3 would be expected to lead to inferior results.

Even if, nevertheless D2 or D3 were to be considered as the closest state of the art their teachings would not lead to the claimed subject-matter as the ranges of catalyst disclosed in these documents was outside the range of the operative claims. The respondent/opponent reiterated the arguments presented in the written procedure (see section VI.(d), above) concerning the significance of the morpholino moiety and the determination of the optimum amount simply by routine experimentation. It was disputed that the claimed ranges were critical and submitted that other ranges

would also give rise to the demonstrated effect.

In response, the appellant/patent proprietor reiterated its arguments, submitted in the written procedure (see section VIII, above) that according to D14 the trimorpholino compound was superior.

It was submitted that the combination of D14 with D2 or D3 could only arise as the result of an *ex post facto* analysis.

XII. The appellant/patent proprietor requested that the decision under appeal be set aside and that the patent be maintained on the basis of one of the sets of claims according to the main request, or the first, second, third, or fourth auxiliary request, filed at the oral proceedings, in that order.

The respondent (opponent OI) requested that the appeal be dismissed. The respondent (opponent OI) withdrew its request for an apportionment of costs.

## **Reasons for the Decision**

1. The appeal is admissible.
2. *Main request*
  - 2.1 *Art 83, 84 and 123(2) EPC*

No objections pursuant to these requirement of the EPC were raised by the respondent/opponent. The Board is

also satisfied that the requirements of these Article are met by the main request.

2.2 *Art. 54 EPC*

Claim 1 of the main request specifies that the catalyst is present in an amount of from 0.05 to 0.125 wt%.

D2 discloses in Table 1 on page 21 compositions consisting of one, two or three prepolymers, whereby prepolymer 1 is prepared by reaction of 1,6-polyhexamethylene adipate (a polyester polyol - see footnote (1) to Table 1 of D2) with 4,4'-diphenylmethane diisocyanate (D2, page 18 line 7). The compound produced had an isocyanate index of 2, indicating that it was isocyanate terminated (D2, page 19, line 17). In example 1 of D2 100 parts of the aforementioned isocyanate terminated prepolymer were combined with 0.05 parts of DMDEE, i.e. the first catalyst specified in part (b) of claim 1 of the main request.

Hence, to the same precision as specified in operative claim 1, i.e. to 2 significant figures, the composition of example 1 of D2 contained 0.05 wt% of the catalyst.

This amount corresponds to the lower limit specified in claim 1 of the main request, with the consequence that the composition disclosed in example 1 of D2 falls within the scope of this claim.

2.3 Accordingly the subject-matter of claim 1 of the main request is anticipated by the disclosure of D2, example 1, contrary to the requirements of Art. 54 EPC.

2.4 The main request is therefore refused.

3. *First auxiliary request*

3.1 No objections pursuant to Art. 83 or 123 EPC were raised in respect of this request, and the Board is satisfied that no objections under these provisions of the EPC arise.

3.2 *Art. 84 EPC*

As noted in sections III.(b) and XI.(b), above, claim 1 of the first auxiliary request specifies that the prepolymer is prepared by the condensation polymerisation of a polyisocyanate with a "substituted" polyalkylene ether glycol.

The term "substituted" in respect of a (poly)alkylene compound indicates that in addition to the main chain, i.e.  $-(CH_2)_n-$  other groups are present, replacing one or more of the hydrogens. However the term "substituted" does not impose any limitation on the nature of these other groups.

The consequence of this non-differentiated definition of "substituted" leads in the case of an alkylene group such as 1,2-propylene to an ambiguity concerning the status of the pendant methyl groups.

As explained in the decision of the opposition division (see section III.(b) above) poly(1,2-propylene ether glycol) could be designated as a methyl substituted polyethylene. Equally validly the molecule could

instead be designated an "unsubstituted" 1,2-polypropylene. Although the description of the patent in suit (i.e. paragraph [0019]) does refer to the terms "substituted or unsubstituted" polyoxyalkylene ether glycols or polyhydroxy polyalkylene ethers, as referred to by the patent proprietor at the oral proceedings (see section XI.(b).(ii), above) this passage provides no explanation of what these terms actually mean. It is also not possible even implicitly to derive a meaning of these terms from the context in which these are employed in said passage.

Accordingly, depending on which of the interpretations is applied to the status of the pendant methyl group, i.e. whether this is considered to be a branch of the (unsubstituted) 1,2-propylene unit or a substituent on an ethylene unit, one and the same molecule could - arbitrarily - be designated either as unsubstituted or substituted.

As the term "substituted" does not provide a clear and unambiguous definition of the subject-matter covered by the scope of claim 1 of the first auxiliary request it has to be concluded that this claim is not clear.

3.3 Hence the subject-matter of claim 1 of the first auxiliary request does not meet the requirements of clarity of Art. 84 EPC.

3.4 The first auxiliary request is therefore refused.

4. *Second auxiliary request*

4.1 No objections pursuant to Art. 83 or 84 EPC were raised in respect of this request. The Board is satisfied that no objections under these provisions of the EPC arise.

4.2 *Art. 123(2) EPC*

As noted in sections III.(c) and XI.(c), above, claim 1 of the second auxiliary request specifies that the prepolymer is prepared by the condensation polymerisation of a polyisocyanate with **polypropylene glycol** (emphasis of the Board).

4.2.1 The discussion of the prepolymer in the description of the application underlying the patent in suit refers on page 4, lines 5-10 (reference being made to the A-publication) to reaction of a polyisocyanate with a polyol, preferably a diol, *inter alia* the ethylene or propylene oxide adducts of polyols and the monosubstituted esters of glycerol. In the following paragraph, commencing at page 4 line 11 of the A-publication reference is made to various derivatives of polypropylene glycol, e.g. diamino polypropylene glycol or products of thiodiglycol with *inter alia* 1,2-propylene glycol.

4.2.2 The general description of the application thus does not contain any disclosure of polypropylene glycol itself, but only of derivatives thereof.

4.2.3 In the examples of the application a specific representative of this class of compounds is disclosed, namely one with a molecular weight of 1000, which further is disclosed in association with other defined components, all present in defined quantities. However,



neither the specific features of this particular polypropylene glycol, the other components employed in the examples, nor the proportions thereof are specified in operative claim 1.

4.2.4 There is no statement - express or implied - in the application as filed that either this specific polypropylene glycol, or the other features of the example are merely illustrative of the broader classes of compounds to which they respectively belong or that one or more of these may be extracted from the specific context of the example and generalised (cf T 201/83, OJ EPO 1984, 481).

4.2.5 Accordingly the subject-matter of claim 1 of the second auxiliary request extends beyond the subject-matter of the application as filed, contrary to the requirements of Art. 123(2) EPC.

4.3 The second auxiliary request is therefore refused.

5. *Third auxiliary request*

No objections pursuant to Art. 83, 84 or 123(2) EPC were raised in respect of the claims of this request. Nor has the Board any objections of its own. In particular it is noted that the range of catalyst content was originally disclosed in claim 2 of the application as filed.

5.1 *Art. 54 EPC*

Claim 1 of the third auxiliary request specifies the amount of catalyst as being in the range of 0.075 to 0.125 wt%.

5.1.1 As explained in section 2.2 above, the specific disclosure of D2, i.e. the examples disclose a catalyst content of 0.05 wt%, which is below the minimum permitted by the claims of the third auxiliary request. Accordingly the specific examples of D2 do not disclose subject-matter falling within the scope of claim 1 of the third auxiliary request.

5.1.2 In its general disclosure, D2 discusses on page 17 that catalysts may be present.

- (a) This disclosure concerns however only general classes of compounds, namely tertiary amines, metal-organic compounds, and co-curatives. No individual compounds are specified.
- (b) The amounts of catalyst specified in the general disclosure of D2 are given as ranges, from 0.005 to 2 percent, preferably 0.01 to 0.5 percent, based on the total weight of the prepolymers employed.
- (c) Although the amount of catalyst specified in claim 1 of the third auxiliary request falls within these very broad ranges there is no explicit disclosure in D2, e.g. in the form of end-points of the disclosed ranges of an amount of catalyst falling within the said range.
- (d) The respondent/opponent submitted at the oral proceedings (See section XI.(d).(ii), above) that the subject-matter of the patent in suit constituted an arbitrary selection from the

teaching of D2 in respect of a single feature, namely the amount of catalyst.

This argument however relies on "reconstructing" the disclosure of D2 such that one part of the more general disclosure - the (very broad - see foregoing section) permissible range of catalyst content given on page 17 of D2 - is isolated from its context and combined with the more specific disclosure of the examples, namely a specific catalyst compound, which in turn is isolated from its context by disregarding the amount thereof disclosed in the examples.

This "reconstruction" itself entails a plurality of non-disclosed selections in that various parts of the disclosure of D2 have to be extracted and combined in a manner which is not derivable either implicitly from the structure or explicitly from the written disclosure of D2. However even this non-disclosed "reconstruction" of the disclosure of D2 is not sufficient to generate a disclosure of subject-matter falling within the scope of claim 1 of the third auxiliary request. Instead, a further selection from the broad range of catalyst content specified in the general disclosure of D2, page 17 is necessary, for which selection there also is no basis in D2, as explained in the foregoing section 5.1.2(c).

Accordingly for this reason the subject-matter of claim 1 of the third auxiliary request is not anticipated by the general disclosure of D2.

5.1.3 No different conclusion would be reached on the basis of the disclosure of D3. The examples in Table 1 of this document disclose a catalyst content (DMDEE) of 0.2 wt%, which is above the maximum permitted in the operative claims. The disclosure in the description (page 6 lines 12-15) relates to amounts of catalysts from about 0.01 to about 2, preferably about 0.05 to about 0.5 percent by weight, both of which ranges are considerably broader than that specified in the operative claim and fail to disclose either of the specified end points.

Accordingly the amount of catalyst specified in operative claim 1 is not disclosed in D3. The general disclosure in D3 relating to the nature of the catalyst is of similar scope to that of D2.

5.1.4 It is therefore concluded that the subject-matter of operative claim 1 of the third auxiliary request is not anticipated by the disclosures of D2 or D3. No other documents have been advanced as anticipating the subject-matter of operative claim 1.

5.1.5 The subject-matter of claim 1 of the third auxiliary request therefore meets the requirements of Art. 54 EPC.

5.2 *Art. 56 EPC*

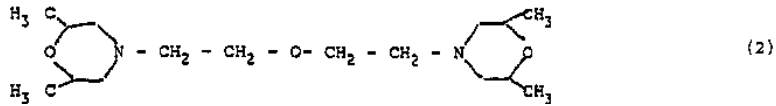
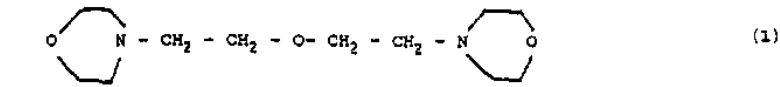
5.2.1 *The patent in suit, the technical problem*

It is explained in paragraph [0001] and [0002] of the patent in suit that reactive hot melts are one-component 100% solid, solvent-free urethane prepolymers. These undergo an irreversible reaction once dispensed in the presence of ambient moisture, reference being

made in this context to the isocyanate terminated prepolymers.

- (a) It is explained in paragraph [0004] that whilst progress has been made towards improving the green strength and other properties of said adhesives there remains a need to improve the curing speed. Catalysts which have been used for this purpose are not without sacrifice of other properties. Organo tin and bismuth catalysts are known to boost the curing speed but this is accompanied by a reduction in the thermal stability. Amine catalysts are stated to provide better thermal stability but are not as effective catalysts.
  
- (b) Thus there exists a need for a catalyst for reactive hot melt adhesives which improves the curing speed without significantly reducing the thermal stability (paragraph [0005]).
  
- (c) In paragraph [0006] it is stated that the curing speed of polyurethane hot melt adhesives may be significantly improved with little or no effect on thermal stability by the use of a catalyst containing both ether and morpholino functional groups. Thus the hot melt systems of the invention cure at substantially higher rates in the presence of water but are not accompanied by undesirable increases in viscosity or melt instability in the absence of moisture. This problem is stated to be solved by the subject-matter of the operative claims, specifically compositions containing as the catalysts either of the following catalysts, compound (1) being DMDEE, compound (2) being that

identified as "U-CAT 2041" in example 5 of the patent in suit:



- (d) The examples of the patent in suit show specific hot melt compositions. In example 1 a non-catalysed composition is prepared. In example 2 compositions containing the adhesive composition of example 1 together with 0.1 % of various catalysts are demonstrated. The evidence shows that the first catalyst specified in the claims - DMDEE - results in faster curing than a number of other catalysts including organo tin, organo bismuth and amine catalysts, this being demonstrated by the more rapid development of shear strength over time in the case of the composition containing DMDEE. It is also stated that the stability to heat of compositions containing the catalyst DMDEE was superior to all other catalysts investigated, and comparable to that of a control composition without any catalyst.

Example 3 demonstrates that for the exemplified composition (adhesive composition of example 1 with DMDEE catalyst) an optimum of stability and cure speed is obtained at a catalyst level of 0.10 wt% of catalyst, i.e. in the middle of the claimed range.

- (e) In example 5 a comparison is provided between the two catalysts specified in the operative claims (i.e. "U-CAT 2041" and "Texacat DMDEE") and one of the catalysts employed in D14, viz. tri[2-(2,6-dimethylmorpholine)ethyl] amine ("U-CAT 2046" - see submissions of the patent proprietor reported in sections VIII and XI.(d).(iii), above).

The results of this example demonstrate that the two catalysts as specified in the claims provide compositions with greater thermal stability, as demonstrated by the smaller increase in viscosity (3.07 and 3.47 % per hour for "U-CAT 2041 and "Texacat DMDEE" respectively) on aging at 250°F (121°C) than the catalyst employed in D14 ("U-CAT 2046" - 4.01% per hour). Similarly as regards the curing speed the evidence of Tables 8 to 10 demonstrates that compositions containing the catalysts as specified in the operative claims resulted in faster build up of lap shear strength than did the composition containing the comparative catalyst "U-CAT 2046", the ultimate adhesive strengths- after 24 or 72 hours being comparable.

- (f) In view of this evidence it can be concluded that the technical problem as set out in the patent in suit has been solved by the claimed measures.

#### 5.2.2 *The closest state of the art*

Of the two documents - D3 and D14 - considered in the decision under appeal (see section III.(d) above) as candidates for the closest state of the art only D14

addresses the problems of improving both the curing time (expressed with respect to the initial adhesive strength and/or the reactivity) and the thermal stability of moisture curing hot melt adhesives (D14 page 2 lines 3-5 and lines 34-37).

- (a) It is conspicuous to the Board that while the respondent/opponent during the written appeal proceedings (see section VI.(d), above) relied *inter alia* on D2 as closest state of the art and this allegedly in agreement with the decision under appeal (reference being made by the respondent to section 6.3 of the reasons for the decision), the decision itself started from D3 as closest state of the art (see section III.(d), above). According to the respondent/opponent either of D2 or D3 could be combined with common general knowledge or D14 to arrive at the claimed subject matter (see section VI.(d), above). The appellant/patent proprietor however argued at the oral proceedings (see section XI.(d).(iii), above) that it was in fact D14 which was the closest state of the art since only D14 addressed the problems of improving both the curing speed without reducing the thermal stability of moisture curing hot melt adhesives. The Board will consequently consider the matter from both points of view.

- (b) According to the decision under appeal document D3 is concerned with the curing properties of polyurethane reactive hot melt adhesives, in particular the initial bond strength, and discloses adhesive compositions which are similar



to those of operative claim 1. It is certainly true that document D3 refers to compositions consisting essentially of a first polyurethane prepolymer and a second polyurethane prepolymer, such a blend preferably exhibiting no zip or chatter and exhibiting a green strength build up of at most 5 minutes (page 4 lines 31 to 38). Thus this document could be said to address the problem of rapid curing. There is however no reference at all to the second aspect of the problem addressed by the patent suit namely that of retaining the thermal stability.

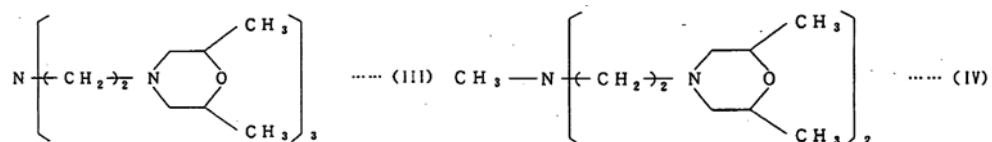
- (c) Furthermore in relation to document D2 the Board is unable to trace any reference to rapid curing or retention of thermal stability.
  
- (d) Consequently neither of these documents, chosen by the respondent/opponent as the starting point for the analysis of inventive step according to the problem and solution approach can be said to give rise to an incentive to achieve modifications with a view to achieving, in the case of document D2, either of these aims, or in the case of D3 the latter aim. Consequently neither of these documents can *a fortiori* give a hint to the solution of the problem of achieving both these aims. In other words, neither document D2 nor document D3 represents an appropriate starting point for the assessment of inventive step. On the contrary an assessment of inventive step based on either of these documents as closest state-of-the-art must lead to a finding that there is an inventive step, since any attempt to establish a

chain of logical considerations leading to the claimed subject matter gets stuck at the start (compare T 644/97, 22 April 1999, not published in the OJ EPO).

- (e) Document D14 on the other hand addresses both aspects of the problem with which the patent in suit is concerned and must, in the Board's view, consequently be considered to be the closest state of the art from which an analysis of inventive step can be commenced.

### 5.2.3 *The teaching of D14*

According to claim 1 of D14 the moisture curing hot melt adhesives contain as the catalyst an amino compound in which at least one of the substituents on the nitrogen is a morpholino residue. Example 1 of D14 discloses polyurethane hot melt adhesives containing as catalysts the following two compounds:



The first of these is the compound identified as "U-CAT 2046" in example 5 of the patent in suit (see section 5.2.1(e), above).

The examples 1-b and 1-d reported in Table 1 of D14, employ 0.5 parts per 100 parts urethane prepolymer respectively of the tertiary amine derivative of formula III and the secondary amine compound IV. The results show that the composition containing the tertiary amine derivative III has the better

combination of heat curing rate ("less than 4 hours") and thermal stability (viscosity increase after storage in a sealed aluminium cartridge at 130°C for 8 hours) of "less than 10%", than the composition containing the secondary amine derivative IV which had a slower moisture curing property of "4 to less than 12 hours" but the same thermal stability as example 1-b.

Thus according to the evidence of D14 the trimorpholino amine catalyst provides superior results to the dimorpholino amine analogue.

#### 5.2.4 *The objective technical problem*

As explained in section 5.2.1(e), above the compound "U-CAT 2046" employed in example 5 of the patent in suit is compound III of D14, which according to the evidence of that document provided the better results.

The evidence provided by said example 5 of the patent in suit is that the performance, in terms of curing speed and thermal stability, of both the catalysts specified in the operative claims is superior to that of the catalyst shown in D14 to provide the best combination of the required properties.

In the light of this evidence, the problem set out in paragraph [0005] of the patent in suit, namely to provide catalysts which improve the curing speed of reactive hot melt adhesives without significantly reducing the thermal stability can be adopted as the objective technical problem.

#### 5.2.5 *Obviousness*

The closest prior art D14 employs as the catalysts morpholino substituted **amines**, whereby the trifunctional (tertiary amine) analogue is demonstrated to exhibit superior properties to the difunctional analogue (secondary amine). The claims of the patent in suit are in contrast directed to morpholino **ether** compounds. As explained above the evidence of the examples of the patent in suit is that these compounds provide better results in terms of both the curing speed and thermal stability than the compound reported in D14 to provide the best results.

Accordingly based on the teachings of D14, in order to arrive at the subject-matter of the operative claims, it would be necessary to select the difunctional catalyst, i.e. that based on the secondary amine and then to replace the amine linking groups by an ether moiety.

The teaching of D14 is, however, that the difunctional analogue provides inferior results to the trifunctional analogue. Accordingly based on this evidence there would have been no incentive for the skilled person seeking to solve the objective technical problem to start from the difunctional analogue catalyst disclosed in D14.

Even if this decision had nevertheless been taken, it would then have been necessary to replace the amino functional linking group by an ether functionality. This step cannot be derived from D14, and is not even consistent with the invention of D14 which is to use

catalysts of a particular structure (amino) as explained at page 2, lines 41-55 and specified in claim 1 of D14.

Accordingly the subject-matter of claim 1 of the third auxiliary request is not obvious in view of the teachings of D14.

Consultation of either of D2 or D3 would also not provide the required information. Although these documents do disclose the catalyst specified in the operative claims, the technical problems addressed by these two documents are, as noted in sections 5.2.2(b)-(d) above, different from the problem common to D14 and the patent in suit. Further neither D2 or D3 contains any statement that the catalyst exemplified in these documents would be expected to provide an improvement in the properties of curing speed and thermal stability in general, let alone specifically with respect to the catalysts employed in D14. Accordingly for the skilled person seeking to provide an improvement on the teaching of D14 there would have been no incentive, *prima facie* to consider either of D2 or D3. On the contrary the relevance of these documents becomes apparent only in the light of the teaching of the patent in suit itself, i.e. relies on an *ex post facto* approach.

- 5.2.6 The conclusion is therefore that the subject-matter of claim 1 of the third auxiliary request is not derivable in an obvious manner either from D14 on its own or when this is considered in combination with either or both of D2 and D3.

5.2.7 The subject-matter of claim 1 of the third auxiliary request therefore meets the requirements of Art. 56 EPC. Since claims 2-5 are dependent on claim 1, this conclusion applies *mutatis mutandis* to the subject-matter of these claims.

5.3 It is therefore concluded that the subject-matter of the claims of the third auxiliary request meets the requirements of Art. 56 EPC.

6. Under these circumstances it is not necessary to consider the fourth auxiliary request.

## **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 on the basis of the third auxiliary request (claims 1-5) filed at the oral proceedings and after any necessary consequential amendment of the description.

The Registrar:

The Chairman:

E. Goergmaier

R. Young