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Datasheet for the decision of 7 April 2016

T 0756/12 - 3.3.03 Case Number:

Application Number: 03766815.9

Publication Number: 1534766

IPC: C08G18/18, C08J9/08

Language of the proceedings: EN

Title of invention:

PROCESS FOR PREPARING POLYURETHANE FOAM

Patent Proprietor:

GENERAL ELECTRIC COMPANY

Opponent:

Air Products and Chemicals, Inc.

Relevant legal provisions:

EPC Art. 123(2), 123(3), 56

Keyword:

Amendments - added subject-matter (no) Inventive step - (yes) - non-obvious alternative

Decisions cited:

T 0287/11, G 0001/10, G 0003/14



Beschwerdekammern Boards of Appeal Chambres de recours

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Case Number: T 0756/12 - 3.3.03

DECISION
of Technical Board of Appeal 3.3.03
of 7 April 2016

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Decision under appeal: Interlocutory decision of the Opposition

Division of the European Patent Office posted on 6 February 2012 concerning maintenance of the European Patent No. 1534766 in amended form.

Composition of the Board:

Chairman D. Marquis Members: M. C. Gordon

R. Cramer

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Summary of Facts and Submissions

- I. The appeal lies from the interlocutory decision of the opposition division announced on 22 November 2011 and posted on 6 February 2012 according to which European patent number EP-B1-1 534 766 (granted on European patent application number 03766815.9, derived from international application number PCT/US2003/018313, published under the number WO-A-2004/13201) could be maintained in amended form on the basis of the main request, submitted with letter of 23 April 2010.
- II. The application as originally filed had 24 claims. Claim 1 read as follows:

"A process for preparing a polyurethane foam comprising the step of reacting a polyisocyanate and an active hydrogen-containing component, including water and an organic polyol, in the presence of a catalytically effective amount of a delayed action amine catalyst system comprising a reaction product of (a) one or more carboxylic acids having hydroxy and/or halo functionality and (b) one or more tertiary amine ureas."

Claims 2-4 defined the carboxylic acid.
Claim 5 defined the tertiary amine ureas and read as follows:

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5. The process of Claim 1 wherein the tertiary amine ureas of the reaction product correspond to the general formula:

in which A represents CH or N; R1 represents hydrogen or the group

$$\begin{pmatrix} R^2 \\ C \end{pmatrix}_n = A \begin{pmatrix} R^4 \\ R^3 \end{pmatrix}$$

n is an integer from 1 to 6; R^2 and R^3 each represent hydrogen or a C_1 - C_6 alkyl group; R^4 and R^5 each represent a C_1 - C_6 alkyl group or together represent a C_2 - C_6 alkylene group which may contain heteroatoms or NR^8 where R^8 is hydrogen or a C_1 - C_4 alkyl group, or the group

and R⁶ and R⁷ which may be the same or different and each represent hydrogen or the group

$$\begin{bmatrix} R^2 \\ C \\ R^3 \end{bmatrix} = R^4$$

wherein R², R³, R⁴ and R⁵ have the aforestated meanings.

Claim 13 was directed to a polyurethane foam and read as follows:

"A polyurethane foam having repeating units derived from the reaction comprising an organic polyisocyanate and an active hydrogen-containing component, including water and an organic polyol, and a catalytically effective amount of a delayed action amine catalyst - 3 - T 0756/12

system comprising a reaction product of (a) one or more carboxylic acids having hydroxy and/or halo functionality and (b) one or more tertiary amine ureas."

Subsequent dependent claims defined the acid component (claim 14) and the tertiary amine urea (claim 17) analogously as discussed above.

The patent was granted with 11 claims whereby claim 1 read as follows, amendments compared to the claims as originally filed being indicated in **bold**:

"A process for preparing a polyurethane foam comprising the step of reacting a polyisocyanate and an active hydrogen-containing component, including water and an organic polyol, in the presence of a catalytically effective amount of a delayed action amine catalyst system comprising a reaction product of (a) one or more carboxylic acids having hydroxy and/or halo functionality and (b) one or more tertiary amine ureas, wherein the one or more tertiary amine ureas are prepared by reacting an urea and a tertiary alkylamine."

Claim 11 as granted was identical to original claim 13 (see above)

III. A notice of opposition against the patent was filed on 18 November 2009 in which revocation of the patent on the grounds of Art. 100(a) EPC (lack of novelty, lack of inventive step), Art. 100(b) EPC and Art. 100(c) EPC was requested.

The opposition relied, inter alia on the following documents:

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D3: US-A-6 423 756 D5: EP-A-877 042

granted.

IV. The decision of the opposition division was based on a main request and five auxiliary requests all filed with letter of 23 April 2010.
Claim 1 of the main request corresponded to claim 1 as

According to the decision, the requirements of Art. 123(2) EPC were satisfied.

Novelty was also acknowledged.

Regarding inventive step it was held that the closest prior art was D3. The distinguishing feature was that the operative claims required the presence of tertiary amine ureas whereas D3 disclosed tertiary amine carbamates.

The problem to be solved was to provide an alternative process to that of D3 for providing polyurethane (PU) foams having improved Humid Aging Compression Set (HACS) values. Although there was no evidence of any advantage over the teachings of D3, there was no teaching in the prior art to replace the tertiary amine carbamate of D3 by a tertiary amine urea. This consideration applied in particular to D5 which disclosed the use of tertiary alkylamine ureas in a process for preparing polyurethane foams. However D5 contained no teaching that the additional use of a carboxylic acid would improve the HACS.

V. On 2 April 2012 the opponent lodged an appeal against the decision, the prescribed fee being paid on the same date.

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- VI. The statement of grounds of appeal was submitted on 6 June 2012.

 Further experimental evidence was provided in the body of the letter.
- VII. The respondent/patent proprietor replied with a letter dated 10 October 2012 submitting a main request and 10 auxiliary requests. The main request and first to fifth auxiliary requests were identical to the requests filed with letter of 23 April 2010 in the response to the notice of opposition. Auxiliary requests 6-10 were new and took account of arguments presented for the first time in the statement of grounds of appeal.

 Furthermore a test report given the designation D24 by the Board was submitted.
- VIII. On 14 August 2015 the Board issued a summons to attend oral proceedings.
- IX. By letter of 3 September 2015 the appellant/opponent, filed further observations.
- X. With letter dated 26 October 2015 the respondent/patent proprietor made a further written submission.
- XI. On 17 December 2015 the Board issued a communication setting out its preliminary views on the case.
- XII. With a letter dated 29 February 2016 the respondent/
 patent proprietor made further observations, in
 particular addressing some of the points raised by the
 Board. In this letter the respondent further indicated
 that it would "be willing" to withdraw the main request
 and auxiliary requests 1, 2, 5, 6, 7 and 8, leaving
 auxiliary requests 3, 4, 9 and 10 for discussion. A
 formal request to this effect was however not

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submitted.

- XIII. With letter of 7 March 2016 the appellant/opponent withdrew its request for oral proceedings, and stated that it would not be represented. The request for revocation of the patent was maintained.
- XIV. With a letter of 29 March 2016 the respondent/patent proprietor formally withdrew the main request and auxiliary requests 1, 2, 5, 6, 7 and 8. Thus auxiliary requests 3, 4, 9 and 10 were left for discussion.

Auxiliary request 4 had 8 claims all of the "process" category whereby claim 1 read as follows, differences compared to claim 1 as originally filed being indicated in **bold**:

"A process for preparing a polyurethane foam having repeating units, wherein the polyurethane foam is derived from the reaction comprising an organic polyisocyanate and an active hydrogen-containing component, including water and an organic polyol, in the presence of a catalytically effective amount of a delayed action amine catalyst system comprising a reaction product of (a) one or more carboxylic acids having hydroxy and/or halo functionality and (b) one or more tertiary amine ureas corresponding to the general formula

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in which

A represents CH or N; R1 represents hydrogen or the group

n is an integer from 1 to 6;

R² and R³ each represent hydrogen or a C₁-C₆ alkyl group,

 R^4 and R^5 each represent a C_1 - C_6 alkyl group or together represent a C_2 - C_6 alkylene group which may contain heteroatoms or NR^8 where R^8 is hydrogen or a C_1 - C_4 alkyl group,

and R⁶ and R⁷ which may be the same or different and each represent hydrogen or the group

$$\begin{array}{c|c}
R^2 \\
C \\
R^3
\end{array}$$

$$\begin{array}{c}
R^4 \\
R^5
\end{array}$$

wherein R², R³, R⁴ and R⁵ have the aforestated meanings.

XV. Oral proceedings were held before the Board, in the absence of the appellant (see above) on 7 April 2016. Following discussion during the oral proceedings the respondent/patent proprietor withdrew the set of claims designated "Auxiliary Request 3" with the consequence that the set of claims designated "Auxiliary Request 4" became the main request.

The respondent further stated that it did not raise objections to the admission to the procedure of the experimental report of the appellant submitted with its

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statement of grounds of appeal.

- XVI. The arguments of the appellant/opponent insofar as relevant for the present main request (filed as "Auxiliary Request 4" with letter of 23 April 2010) can be summarised as follows:
 - (a) Clarity

The generic formula did not necessarily relate to tertiary amine ureas since combinations of substituents were permitted which would not result in such a compound.

(b) Art. 56 EPC

Either of D3 or D5 could be considered as the closest prior art.

D3 related to a process for improving PU foam performance, in particular HACS, in which a tertiary amine carbamate with salicylic acid and optionally other catalysts, including "tertiary amines" was employed as catalyst.

Operative dependent claim 5 permitted the presence of a reactant selected from the group consisting, inter alia, of "specific" tertiary amine carbamates corresponding to those of D3. Thus combinations of the defined urea and "defined carbamates" were encompassed by operative claim 1.

Consequently the subject-matter claimed differed from that of D3 in the mandatory presence of the defined tertiary amine ureas.

There was no improvement in the level of HACS shown in the patent compared to the level of D3; in some cases it was even lower. The technical problem could only be formulated as being to provide alternative catalyst systems which did not impair the HACS value too much.

The specified tertiary amine ureas were known as

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catalysts e.g. from D5. The selection of these tertiary amines ureas as a further reactant was an arbitrary choice to modify the teaching of D3. The teaching in D3 (col 7-8) that a second catalyst could be present, which could be a tertiary amine catalyst, did not specify that the catalyst should further improve the HACS meaning any such compound would be applicable. Furthermore the term "tertiary amines" in D3 had to be interpreted in a generic fashion as relating to compounds which in the broadest sense could be considered in some form to be classified as "tertiary amines" thus including derivatives such as ureas.

Comparative examples 40-43 of D3 related to ureas which were different from those of the operative claim since they were derived from an isocyanate and a tertiary amine rather than urea itself. Because these ureas yielded poor results (in particular HACS) they would not be taken into account by the skilled person seeking an alternative to the teachings of D3. However when seeking an alternative to the catalyst systems of D3 nothing taught away from the use of different tertiary amine ureas e.g. such as those now claimed.

It was also known that adding salicylic acid to catalyst systems based on tertiary amine compounds in general resulted in improvements in HACS further rendering it obvious to employ tertiary amine ureas as claimed.

Starting in the alternative from D5 as the closest prior art, this document disclosed the use of tertiary amine urea catalysts from reaction of urea and a tertiary alkylamine, corresponding to those defined in operative claim 1, in the production of

PU foams. Salicylic acid was not employed, but this was well known in the art to improve foam properties in the context of a wide range of tertiary amine derived catalyst systems as shown, for example, by D3. Thus it would be obvious to employ salicylic acid in addition to the tertiary amine ureas of D5. Comparative example 41 of D3 would not teach against this course of action because, as noted, the tertiary amine ureas of D5 were different from those shown in D3 to give poor results.

XVII. The arguments of the respondent/patent proprietor can be summarised as follows.

(a) Clarity

The objection was inadmissible since the formula in question had been present in the granted patent. However since the claim was directed to tertiary amine ureas the claim would mandatorily be interpreted in the light of this feature and thus directed to such compounds. Reference was made to T 287/11.

(b) Art 56 EPC

The closest prior art was D3 which addressed the same problem as the patent in suit i.e. delayed action catalysts for PU foam which foams were required to exhibit good durability (reflected by the HACS value).

It was accepted that the wording of the claim was not restricted to the specified ureas but permitted inter alia the presence of the carbamates of D3. It was furthermore acknowledged that there was no evidence that the - additional - presence of the ureas compared to the tertiary amine carbamates of D3 resulted in any improvement compared to the

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properties of the foams of D3. The results achieved on modifying the constitution and proportion of catalysts were at most only marginally different, providing support for the objective problem being the provision of an alternative.

It was surprising that this problem could be solved by the subject-matter of operative claim 1 because D3 employed very specific tertiary amine carbamates. The comparative examples of D3 employed ureas which were very similar to those now claimed, but resulted in very poor foam properties, and so did not solve the underlying technical problem of D3. This teaching rendered the use of ureas to solve the problem non-obvious.

The evidence of the prior art was that only specific groups of compounds when used as catalysts gave rise to the required effect.

There was however no evidence in the cited documents that - in general - tertiary amines or derivatives thereof would be effective to solve the problem common to the patent and D3 or that - again in general - the combination of tertiary amines or derivatives thereof with functional acids resulted in improved HACS values.

Thus when D3 mentioned "tertiary amines" as further possible catalyst components the term had to be construed narrowly to mean precisely such compounds in which the tertiary amine was the only functional group and not to extend to encompass either derivatives of tertiary amines or compounds with further functionality in addition to the tertiary amine. Hence it would be incorrect to interpret the

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teaching of D3 as providing a suggestion to combine in general "derivatives" of tertiary amines with the carbamates, in particular not ureas.

Even if the skilled person had considered using different derivatives of tertiary amines, e.g. ureas in combination with the catalysts of D3 there were a large number of possible alternative tertiary amine derived compounds. With the problem of improving the HACS in mind, there was no reason for the skilled person to select from the group of tertiary amine derived catalysts specifically ureas since D3 provided a clear teaching that one group of ureas did not work. D3 furthermore provided no teaching in respect of the specific ureas defined by the operative claims.

D5 was less suitable as closest state of the art because it did not address the same problem as the patent, but rather aimed at improving the "force to crush" which property had no similarity to HACS. Further D5 taught use of the urea to reduce volatility compared to tertiary amines rather than to improve physical properties.

- XVIII. The appellant (opponent) requested that the decision under appeal be set aside and that the patent be revoked.
- XIX. The respondent (patent proprietor) requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of auxiliary request 4 filed with the letter of 23 April 2010 (now main request), or on the basis of one of auxiliary requests 9 or 10 filed with the reply to the statement of grounds of appeal (now auxiliary requests 1 or 2).

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Reasons for the Decision

- 1. The appeal is admissible.
- 2. Main Request (Set of claims designated "Auxiliary Request 4")
- 2.1 Art. 123(2) EPC

The subject-matter of claim 1 is based on originally filed claim 1. The definition of the reaction from which the polyurethane foam is obtained is based on originally filed claim 13.

The general formula of the tertiary amine urea is based on the disclosure of originally filed claim 5, however with the difference that the definition of R^8 is restricted to two of the originally disclosed embodiments thereof, i.e. the third possibility of R^8 having been deleted.

The remaining claims correspond to claims 2, 3, 6, 8, 9, 10 and 11.

With respect to claim 5, it is noted that the corresponding claim 6 of the patent as granted contained a reference to tertiary amine "carbonates". There was however no disclosure in the application as originally filed of this subject-matter. The corresponding claim 8 of the application as originally filed however disclosed tertiary amine carbamates. As a consequence claim 6 of the patent as granted did not meet the requirements of Art. 123(2) EPC. This defect constitutes a ground for opposition pursuant to Art. 100 EPC.

The amendment to operative claim 5 compared to granted claim 6 in order to address or correct this deficiency, i.e. adapting the wording to correspond to that of originally filed claim 8 is thus an allowable amendment

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pursuant to R. 80 EPC (see also G 1/10, reasons, 13 in respect of amendments to remove a perceived error in a patent).

The requirements of Art. 123(2) EPC are therefore satisfied.

2.2 Art. 123(3) EPC

As a result of the amendments undertaken during the opposition and appeal proceedings, the claims have been restricted compared to the patent as granted with the consequence that the requirements of Art. 123(3) EPC are likewise satisfied.

2.3 Clarity

The objection that the generic formula would not mandatorily define a tertiary amine urea since the substituent A could be NH and the substituents R^6 and R^7 could both be hydrogen relates to an alleged inconsistency or contradiction within the claim. An inconsistency within a claim is however a matter of clarity (Art. 84 EPC).

The wording in question was present in claim 4 of the patent as granted.

Consequently the ground of Art. 84 EPC is not available in respect of this feature (following G 3/14).

For the sake of completeness, the Board observes that the compound is defined as being a tertiary amine urea. This "functional" definition imposes a constraint on the values that the different substituents may take to the extent that these must be selected so as to ensure that the resulting compound is indeed a tertiary amine urea (cf. T 287/11 reasons 6.5).

3. Art. 83 EPC

Objections were not raised in respect of the operative

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main request.

- 4. Art. 54 EPC

 An objection of lack of novelty was not raised by the appellant.
- 5. Art. 56 EPC
- 5.1 The patent in suit the technical problem

 The patent is directed to a process for preparing polyurethane foams.

One problem associated with known delayed action amine catalysts is emission of residual catalyst from the finished foams (paragraph [0011]). Although this problem can be addressed by incorporating reactive groups which lead to the amine being chemically incorporated into the foam, such catalysts result in degradation of foam physical properties in particular durability or fatigue, as indicated by the measurement Humid Aging Compression Set (HACS).

The specific problem addressed by the patent is to provide delayed action catalysts which yield foams with excellent physical properties, which catalysts are incorporated into the polyurethane structure as set out in paragraph [0020].

The solution according to operative claim 1 is a process in which the catalyst system comprises one or more tertiary amine ureas of the specified generic formula. However claim 1 does not impose any restriction such that said tertiary amine urea is the only catalyst present. On the contrary, the wording of the claim permits the presence of other catalysts. For example, "specific" tertiary amine carbamates as further catalysts are recited in claim 5 as a possible "further" reactant. Consistently therewith some of the examples employ as a component a carbamate (designated

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- C3), such carbamates being disclosed as catalysts for example in D3.
- 5.2 The closest prior art

 Two documents have been advanced as candidates for the closest prior art:
- 5.2.1 D3 (US-A-6 423 756) relates to a process for preparing polyurethane foams by reaction in the presence of a tertiary amine carbamate and, in the examples, a hydroxy functional carboxylic acid, specifically salicylic acid. Among the problems explicitly addressed by D3 are emission of amine residues from the final foams (col 2 line 37) and the physical properties of the foam, in particular durability as assessed by the HACS measurement (col. 4 line 25ff). It is stated that the observed improvement is obtained only with specific tertiary amine carbamates (col. 4 lines 33-35).
- 5.2.2 D5 (EP 877 042) is directed to a reactive catalyst for polyurethane foams, which catalyst comprises a tertiary amino alkyl urea and/or bis(tertiary amino alkyl) urea which ureas fall within the general formula of operative claim 1.
 - Among problems addressed by D5 is the emission of noxious fumes deriving from residual tertiary amine catalyst employed in known processes (page 2 line 27-29). It is stated that the reactive catalyst becomes incorporated into the foam. A further problem addressed in D5 is to improve the physical properties of the foam, with emphasis on reducing force-to-crush in order to minimise foam shrinkage during processing (section "Summary of the Invention"). Although HACS values are reported in the examples of D5, this property is not emphasised in the context of the problem to be solved.
- 5.2.3 Of these two documents, only D3 addresses specifically the problem outlined in the patent, i.e. improved

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durability together with reduced odour.

Consequently it is concluded that D3 represents the closest prior art.

The subject-matter claimed is distinguished from the disclosure of D3 by the feature that a urea of the defined generic formula is employed as a catalyst, however- it is repeated - other catalyst components not being excluded.

- 5.3 The problem effectively solved
- 5.3.1 As noted above, operative claim 1 relates to a process in which the catalyst system comprises a reaction product of (a) one or more carboxylic acids having hydroxy and/or halo functionality and (b) one or more tertiary amine ureas, wherein the one or more tertiary amine ureas are prepared by reacting an urea and a tertiary alkylamine of the specified generic formula. However, the open formulation of claim 1 allows for the presence of other catalysts.

The examples in the patent in suit show the effect of including in the catalyst system an acid having halo and/or hydroxy functionality. The patent in suit does not provide comparative examples based on the presence of a catalyst system wherein the amine component (b) would not be according to claim 1.

Consequently the examples of the patent in suit are not suitable to demonstrate whether any effect arises over the closest prior art D3 as a result of including in the catalyst system the specified urea component.

5.3.2 Both parties submitted further evidence during the course of the appeal proceedings.

Together with the statement of grounds of appeal the opponent submitted experimental data consisting of variations of examples 2 and 9 of the patent in suit.

The variant examples - designated "2v" and "9v"

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differed from the examples of the patent by the omission of the tertiary amine urea component required by the patent in suit, and thus corresponded to the teaching of D3 in that as the sole amine-derived catalyst component the carbamate designated C3 in the examples of the patent was employed.

In both cases the results showed that the composition according to the teaching of D3 had better HACS than the composition according to the claim, i.e. containing in addition to the tertiary amine carbamate of D3 the tertiary amine urea required by the operative claims. Other properties such as density were only marginally affected.

The further evidence of the respondent - submitted with the rejoinder to the statement of grounds of appeal and designated D24 - did not address D3 but, similarly to the examples of the patent focused on the effect of the presence of the acid.

Consequently the only available evidence with respect to a comparison between the subject-matter claimed and the teaching of D3 is the data provided by the appellant.

- 5.3.3 The respondent objected that the evidence of the appellant did not show whether any effect arose from the presence of the acid. However such examples are not necessary or relevant since the presence of the acid does not represent a distinguishing feature over the disclosure of D3.
- 5.3.4 On the basis of the examples provided in the statement of grounds of appeal, which is the only relevant evidence available with respect to the teaching of D3, it can not be concluded that any technical effect

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arises as a result of the distinguishing feature, i.e. the additional presence of the defined tertiary amine urea.

Consequently the technical problem effectively solved compared to D3 has to be formulated as the provision of a further process for the production of foams having good or acceptable durability properties.

5.4 Obviousness

The teaching of D3 is that specific tertiary amine carbamates have to be used as catalysts in a process to produce foams having good durability and low odour. The explicit wording of D3, column 4 line 33-36 is that the observed improvement in HACS is obtained only in conjunction with the specific tertiary amine carbamates and mixtures thereof.

D3 envisages the presence of additional catalyst compounds that can be employed together with the defined tertiary amine carbamates, e.g. at col. 7 line 50 or col. 8 line 25-29, reference being made to tertiary amines, organotin or carboxylate urethane catalysts. That passage however does not point to tertiary amine ureas as it only mentions tertiary amines in general. The sole teaching concerning ureas that is offered in D3 is that of examples 40 to 43. In these examples, a catalyst system was used that was obtained from specific ureas instead of tertiary amine carbamates.

The ureas employed, having the structure

do not fall within this scope defined for the tertiary

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amine ureas of operative claim 1.

The polyurethane foams obtained from the process of the process of these examples have significantly poorer HACS values than the examples according to the claims of D3.

Since these examples of D3 show that the use of tertiary amine ureas result in poorer foams, D3 would not lead the skilled person to consider using tertiary amines ureas at all in the catalyst system. As a consequence no indication can be derived from D3 that would lead the skilled person to consider that tertiary amine ureas as defined by the operative claim 1 might be used in a process that would provide foams having properties approximating to those according to the teaching of D3.

This conclusion is not modified by reference to other documents, e.g. D5 which does disclose the tertiary amine ureas according to the definition of the operative claims as catalysts for PU foams. Firstly, as noted above, the problem addressed by D5 is not the same as that common to the patent and D3. Furthermore D5 does not disclose the reaction of the tertiary ureas with an acid component which is a mandatory component of the composition of the operative claims and D3. Hence even if - despite the explicit teaching of D3 the skilled person would consider employing tertiary amine ureas in addition to the carbamates of D3, D5 would provide no incentive or indication that the disclosed tertiary amine ureas would be useful to solve the technical problem of providing further foams having substantially similar properties to those of D3.

5.5 It is therefore concluded that the requirements of Art. 56 EPC are satisfied.

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Order

For these reasons it is decided that:

- 1. The decision under appeal is set aside.
- 2. The case is remitted to the department of first instance with the order to maintain the patent in amended form on the basis of the main request (corresponding to auxiliary request 4 filed with the letter of 23 April 2010) and after any necessary consequential amendments of the description.

The Registrar:

The Chairman:



B. ter Heijden

D. Marquis

Decision electronically authenticated