BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS | BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE | CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

Internal distribution code:
(A) [ ] Publication in OJ
(B) [ ] To Chairmen and Members
(C) [X] To Chairmen

D E C I S I O N
of 27 May 1998

Case Number: T 0249/93 - 3.3.3

Application Number: 84300760.0

Publication Number: 0117664

IPC: C08L 59/02

Language of the proceedings: EN

Title of invention:
Impact resistant polyoxymethylene compositions

Patentee:
E.I. Du Pont De Nemours and Company

Opponent:
BASF Aktiengesellschaft, Ludwigshafen
Degussa AG, Frankfurt - Zweigniederlassung Wolfgang- Zentrale Abteilung Patente
Hoechst Aktiengesellschaft Zentrale Patentabteilung

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56, 83

Keyword:
"Disclosure - sufficiency (yes)"
"Public prior use (no) - insufficient probative value of evidence submitted"
"Novelty (yes) - onus of proof on opponents to provide adequate basis of comparison using the same method of measurement"
"Inventive step (yes) - no incentive"

Decisions cited:
G 0009/91, T 0472/92, T 0097/94

Catchword:
-

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0249/93 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 27 May 1998

Appellant: (Proprietor of the patent)
E.I. Du Pont de Nemours and Company
1007 Market Street
Wilmington
Delaware 19898 (US)

Representative:
Jones, Alan John
Carpmaels and Ransford
43 Bloomsbury Square
London WC1A 2RA (GB)

Respondent I: (Opponent 01)
BASF Aktiengesellschaft, Ludwigshafen
-Patentabteilung - C6-
Carl-Bosch-Strasse 38
67056 Ludwigshafen (DE)

Respondent II: (Opponent 02)
Degussa AG, Frankfurt
- Zweigniederlassung Wolfgang -
Zentrale Abteilung Patente
Rodenbacher Chaussee 4
Postfach 1345
63403 Hanau (D)

Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 29 December 1992 revoking European patent No. 0 117 664 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: C. Gérardin
Members: H. H. Fessel
S. Perryman

Summary of Facts and Submissions

I. European patent No. 0 117 664 in respect of European patent application No. 84 300 760.0 filed on 7 February 1984 and claiming two US priorities of 7 February 1983 and 16 January 1984 (US 464412 and US 570036 respectively) was granted on 1 February 1989 (Bulletin 89/05) on the basis of 53 claims, independent Claims 1, 37 and 40 reading as follows:

"1. An impact resistant thermoplastic polyoxymethylene composition consisting essentially of

(a) 5-15 weight percent of at least one thermoplastic polyurethane, which polyurethane has a soft segment glass transition temperature of lower than 0°C, and

(b) 85-95 weight percent of at least one polyoxymethylene polymer, which polyoxymethylene polymer has a number average molecular weight of from 20,000 to 100,000,

the above-stated percentages being based on the total amount of components (a) and (b) only, the thermoplastic polyurethane being dispersed throughout the polyoxymethylene polymer as discrete particles, and the composition having a Gardner impact value of greater than 9 J.

37. Shaped articles made from the composition of any one of Claims 1 to 36.

40. A method of preparing the compositions of any one of Claims 1 to 36 comprising mixing the thermoplastic polyurethane with the polyoxymethylene polymer under high shear at a temperature above the melting points of the ingredients of the composition and below the temperature at which degradation of the ingredients will occur."

The other Claims 2 to 36, 38 and 39 as well as 41 to 53 are dependent thereupon.

II. Notices of Opposition were filed on respectively 24 October, 20 October and 1 November 1989 by the three Opponents

OI: BASF Aktiengesellschaft,
OII: Degussa Aktiengesellschaft and
OIII: Hoechst Aktiengesellschaft.

With a letter of 30 November 1992 Hoechst (OIII) withdrew its opposition, thus being no longer a party to the proceedings as of right.

The Opponents requested revocation of the patent in its entirety based on the grounds of lack of novelty and inventive step.

The opposition was supported inter alia by the following documents:

D1: EP-A-115 847;

D2: DE-C-1 193 240 corresponding to GB-A-1 017 244 (D2A);

D3: An internal correspondence within Hoechst Company dated 26 May 1982 and 13 July 1982 concerning the test products Hostaform S VP 27063 respectively 27064, and Hostaform S VP 9063 respectively 9064;

D4: A leaflet dated 11/81 issued by Elastogran Polyurethan-Chemie concerning, inter alia, the polyester polyurethane "Elastollan S 80 A 55";

D5: A letter written by Elastogran Polyurethane GmbH to Hoechst dated 17 July 1991;

D6: Two pamphlets "Kunststoffe Hoechst, Verkaufsinformation" VM 364 and VM 365 issued by Hoechst and dated July 1982 concerning the plastic products Hostaform S VP 27063 and 27064 as well as Hostaform S VP 9063 and 9064;

D7: A leaflet "Hoechst Engineering Polymers" issued in June 1986;

D8: A letter written by "Société Française Hoechst" dated 26 August 1982;

D9: Three Articles concerning the products Hostaform S VP 9063/64 and Hostaform S VP 27063/64 published in

(a) "K-Plastic- & Kautschuk Zeitung", Nr. 244, page 16, dated 28 October 1982;

(b) "PLASTverarbeiter" 1982, page 1436; and

(c) "GAK" 12/1982, page 664.

III. By a decision given orally on 2 December 1992, issued in writing on 29 December 1992 the Opposition Division revoked the patent on the ground that the product as

claimed, whose definition had been amended in order to overcome an objection of lack of novelty within the meaning of Article 54(3) EPC in view of the teaching of D1 (cf. Claim 1 submitted by letter of 7 May 1991), was available to the public before the priority date of the contested patent.

(i) The amendment in Claim 1 consisted in the addition of "prepared using only aromatic isocyanate" after thermoplastic polyurethane in the definition of component (a). This was alleged to be a positive disclaimer to delimit the claimed subject-matter vis-à-vis D1, which concerned similar compositions wherein the polyurethane (PUR hereinafter) was obtained from aliphatic diisocyanates. Although the Opposition Division expressed some doubts as to the admissibility of that amendment, non compliance with Article 123(2) was not, however, a ground of revocation.

(ii) As to prior public use, evidence had been provided by the Opponents that Gardner values of commercial products were within the range required in Claim 1 and that these products also had the structure of discrete PUR particles dispersed in polyoxymethylene polymer (POM hereinafter). Moreover it was accepted that the compositions had not changed between the priority date and 1991 and that the products had been available to the public before the priority date without any limitations.

(iii) Novelty over D1 was acknowledged, not only because of the disclaimer, but also because the Opponents had failed to provide evidence that

the molecular weight of the POM and the soft segment glass transition temperature of the PUR in the comparative examples in D1 met the requirements of Claim 1.

Regarding the objection of lack of novelty over D2 the Opponents also failed to reproduce exactly Run 5 in Example 1 and to determine whether these mixtures were within the terms of Claim 1.

(iv) In conclusion, it was stated that there was no need to consider the issue of sufficiency under Article 100(b)EPC.

IV. On 25 February 1993 an appeal together with payment of the prescribed fee was lodged against that decision by the Appellant (Patentee).

In the Statement of Grounds of Appeal received on 29 April 1993 and in a later written submission the Appellant disputed the finding that the claimed composition was already available to the public prior to the priority date. It was alleged that the factual matters, namely (i) the date on which the alleged use occurred, (ii) what had been used, and (iii) all the circumstances relating to the use, had not been determined beyond any reasonable doubt. Documents D3 to D9 did not have such evidential weight; these documents, in particular, did not demonstrate clearly and unambiguously that the product of 1991 referred to in several of them was identical to a 1982 product.

Regarding the issue of insufficiency, that objection had not been raised in time by any of the Opponents and should thus be disregarded by the Board pursuant to G 0009/91 (OJ EPO 1993, 408).

V. In their various written submissions the Respondents (Opponents) admitted that specific runs particularly relevant for the issue of novelty could no longer be reproduced. By analogy, however, enough evidence had been provided to clearly demonstrate that the claimed subject-matter lacked novelty vis-à-vis D2. Gardner impact strength was, at least in Europe, a rather unusual parameter and it was not clear what measurement it related to, so that a lower limit of Gardner impact strength in a claim could not serve as distinguishing feature.

It had to be concluded that on the balance of probabilities the evidence provided by Opponent III during opposition proceedings regarding the morphology and impact strength parameters of the commercial products was sufficient to demonstrate prior public use. Moreover evidence had also been provided that the composition of these commercial products had not changed over the years between 1982 and 1991. Furthermore the claimed subject-matter did not involve any inventive step, since it was nothing more than the obvious combination of D2 with US-A-3 749 755 mentioned in the introduction of the patent specification.

VI. At the oral proceedings held on 27 May 1998 the following further submissions were made:

(i) Regarding the issue under Article 123(2) EPC the Appellant did not dispute the fact that the application as originally filed did not provide any explicit support for the amendment "aromatic isocyanates". This led the Appellant to file three auxiliary requests which differ from the main request as follows (emphasis by the Board):

- auxiliary request I: "prepared using only aromatic **diisocyanates**"

- auxiliary request II: "prepared using only non-aliphatic **diisocyanates**"

- auxiliary request III: method claim combining the features of Claims 1 and 40 wherein the PUR is "prepared using only aromatic **diisocyanates**".

(ii) Concerning the issue of sufficiency of disclosure, the Appellant objected to it being discussed at all on the basis that it represented a fresh ground of opposition within the meaning of G 0009/91. The Respondents disagreed, since the objection had already been introduced into the proceedings by the Opposition Division which did, however, not decide on its merits (see Summary of Facts and Submissions as well as point 5 of the Reasons for the Decision). In substance, the Respondents argued that a direct measurement of the Gardner impact value was not possible and that, consequently, one had to rely on indirect comparisons. The Appellant argued that the Respondents had not demonstrated that the examples of the patent in suit could not be reproduced.

(iii) As to the issue of prior public use the Board indicated that it would adopt the stricter criteria set out in the decisions T 0472/92 (OJ EPO 1998, 161) and T 0097/94 (now published OJ EPO 1998, 467). This approach, which was also advocated by the Appellant in the Statement of Grounds of Appeal (cf. points 38 to 41), was not objected to by the Respondents. In substance the Appellant disputed the alleged prior use since there was in particular no compelling evidence (a) that a Hostaform modified POM product containing Elastollan S 80 A had a Gardner

impact value of greater than 9 J, (b) that a product falling within the terms of Claim 1 was available to the public without any obligation of confidentiality, and (c) that the Hostaform modified POM products could not be analysed and reproduced by a skilled person.

The Respondents stated again that it had not been possible to test the relevant commercial compositions according to the method of measurement used in the patent in suit, but that the evidence provided by Opponent III in opposition proceedings was sufficient to demonstrate prior public use.

(iv) Regarding the issue of novelty over D2 the Respondents conceded that an exact reproduction of Run 5 of Example 1 of D2 had not been carried out, but that nevertheless the only possible conclusion was that on the balance of probabilities the prior art composition also had the required Gardner impact value. The Appellant argued that such assumption was clearly inappropriate, since neither the critical composition nor the required mixing device had been used in the comparative test.

(v) If it turned out necessary to discuss inventive step, Respondent II requested that the case be remitted to the first instance for examination of this issue, so that it could be considered by two instances. The Appellant, on the other hand, requested that the Board exercise its discretion under Article 111(1) EPC and consider the issue itself, as otherwise such further procedure and

any possible subsequent appeal might not be concluded until after the patent had expired. Respondent I also expressed the view that the issue of inventive step should be dealt with by the Board.

(vi) In the discussion of inventive step the parties relied on the teaching of D2, a document which they had already dealt with in writing in opposition proceedings, and on US-A-3 749 755. According to the Respondents the positive influence of mixing intensity on the mechanical properties of POM/PUR compositions was an incentive to operate according to the requirements of Claim 40 of the patent in suit. By contrast, the Appellant pointed out that the skilled person would not have envisaged increasing the toughness of POM/PUR compositions by ensuring that the PUR was present as discrete particles dispersed throughout the POM, since D2 emphasised the beneficial effects of homogeneity on the general properties of such compositions.

VII. The Appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of the main request submitted by letter of 7 May 1991 or one of the auxiliary requests I, II or III submitted at the oral proceedings.

The Respondents requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

2. *Procedural matters*

2.1 Concerning the issue of sufficiency of disclosure, the objection had already been introduced into the proceedings by the Opposition Division, even though it found it unnecessary to decide it on its merits (see Summary and Facts and Submissions as well as point 5 of the Reasons for the Decision). Thus, the consideration of that issue in the appeal proceedings does not alter the legal and factual framework, within which the substantive examination of the opposition was conducted (cf. G 0009/91, supra). The Board considers that the issue has therefore been introduced into the proceedings, which means that it needs to be decided on the evidence available. The allowance by the Opposition Division of this issue into the proceedings was within the discretion of the Opposition Division, and cannot be considered as an abuse of procedure.

2.2 Under Article 111(1) EPC, whether the Board itself decides an issue, or whether it refers the matter back to the first instance for decision is within the discretion of the Board. Parties do not have a right to have each issue decided by two instances, however late a stage the proceedings have reached. Whereas at an early stage of the proceedings, the Board usually exercises its discretion to remit the matter to the first instance for decision, in cases such as the present, where remittal of the case might mean that a final decision is not reached until after the expiry of the patent, the position is different and the Board will be inclined to decide the issue itself, unless there are strong reasons for not doing so.

Here there were no such strong reasons, the question of inventive step having been extensively discussed by Respondent II in its submission of 27 July 1995. Thus the issue was one that the parties could be expected to have to argue at the oral proceedings, and were in fact in a position to do so. Accordingly the Board decided to deal with the issue itself, despite the objections by Respondent II.

2.3 In his submission of 27 July 1995 Respondent II for the first time referred in some detail to US-A-3 749 755, in particular to the specific blending method used in this citation to compatibilize, possibly homogenize a POM and an elastomeric graft copolymer. Since the disclosure of this document was already acknowledged in the patent specification (page 3, lines 12 to 15) and, moreover, the Appellant did not object to it being admitted for consideration in the discussion of the issue of inventive step of the process claims, the Board in its discretion pursuant to Article 114(2) EPC decided to permit it into the proceedings. This document will be referred to as D10 hereinafter.

3. *Article 123(2) and (3) EPC*

3.1 The amendment in Claim 1 must be regarded as an attempt to overcome the objection of lack of novelty within the meaning of Article 54(3) EPC with respect to D1. This citation describes blends of POM which contain 5 to 60 p.b.w. of a PUR derived from aliphatic diisocyanates (Claim 1). The latter term encompasses linear and branched aliphatic diisocyanates as well as optionally substituted cycloaliphatic diisocyanates (page 7, line 29 to page 8, line 30). Although the Opposition Division indicated that a 'negative' disclaimer excluding these compounds would have been more

appropriate to distinguish the claimed compositions from the known blends, the admissibility of the actual amendment, namely the specification of "aromatic diisocyanate" as a 'positive' disclaimer, was not formally decided.

3.2 Main request

According to the patent specification (page 4, lines 51 to 56) the thermoplastic polyurethanes (TPU hereinafter) are prepared by reacting a hydroxy difunctional polymeric soft segment material with an organic diisocyanate. Although some branching may be present, which suggests the presence of minor amounts of a trifunctional compound, the resulting polymer should be substantially linear. In line with this method of preparation the only aromatic isocyanate compounds specified in the original application are **diiso**cyanates, as it appears from the list given on page 12, lines 16 to 33 corresponding to page 5, lines 19 to 27 of the patent specification. In the light of that disclosure and the worked examples there is thus no support for compounds falling under the broader category of "**aromatic iso**cyanates". The reference to monoisocyanates (page 4, lines 58/59) cannot be regarded as a support for the amendment introduced during opposition proceedings, since these compounds together with monofunctional alcohols are used to control the molecular weight. Therefore Claim 1 of the main request contains subject-matter which extends beyond the content of the application as filed and is thus not admissible (Article 123(2) EPC).

3.3 Auxiliary Request I

3.3.1 As mentioned above, a list comprising different suitable organic diisocyanates is disclosed on page 12, lines 16 to 33 of the application as originally filed.

That list comprises numerous examples of aliphatic, cycloaliphatic and aromatic diisocyanates. A specific aromatic diisocyanate, i.e. 4,4'-methylene bis(phenylisocyanate) (MDI) is also used in more than 90% of the worked examples. The Board considers this to provide enough support for the general term **"aromatic"** diisocyanate which is thus to be regarded as a restrictive, but positive definition of the suitable diisocyanates complying with the requirements of Article 123(2) EPC.

3.3.2 With regard to the extent of the protection the polyurethanes used in the granted version were not specified and thus broadly defined, whereas they have now be restricted to those prepared by using only aromatic diisocyanate. The scope of protection of the amended Claim 1 thus being restricted vis-à-vis that of Claim 1 as granted, Claim 1 cannot be objectionable under Article 123(3) EPC.

4. *Sufficiency*

That issue must be examined in the light of the technical information contained in the patent specification, e.g. both the description and the examples.

4.1 Following the general statement that "polyoxymethylene compositions with exceptionally high impact resistance ... can be made only when several important parameters or conditions coexist" (page 3, lines 44 to 48), the description considers in detail the various compositional and process features which contribute to such high Gardener impact value. Reference is made successively (i) to the requirements which the POM has to meet in terms of structure, molecular weight, composition and amount (page 3, line 49 to page 4,

line 24), (ii) to the requirements which the TPU has to meet in terms of glass transition temperature of the soft segment and amount (page 4, line 24 to page 5, line 61), further in terms of shape and particle size distribution of the granules (page 7, lines 18 to 25) as well as, to a lesser extent, in terms of molecular weight of the soft segment, melt viscosity and moisture content (page 6, line 36 to page 7, line 10), and (iii) to the processing conditions concerning both the mixing device to perform melt compounding (page 7, line 29 to 52) and the preparation of shaped articles (page 7, lines 53 to 62 and page 8, lines 8 to 27).

4.2 As a general rule the optimum result will be obtained by choosing polymer components and conditions corresponding to the optimum value of the above parameters described as essential (page 5, line 62 to page 6, line 14). By deviating from the optimum on one or more of these parameters, one would still obtain impact resistant POM compositions within the terms of the patent in suit. That may not be the case, however, if one operated at the fringe with respect to several or all of the parameters, since the effect of deviating from the optimum on each of them might be cumulative.

In such cases the experimental results obtained in the numerous worked examples would assist the skilled person in optimizing the impact resistance. These examples show the specific influence of (i) the amount of TPU in the composition (Examples 2 to 9), (ii) the glass transition temperature of the PUR soft segment (Examples 10 to 13), (iii) the PUR inherent viscosity (Examples 14 to 17), (iv) the mold temperature (Example 18), (v) the type of PUR (Examples 19 to 31), (vi) the use of POM copolymers (Examples 32 to 36), and (vii) the use of mixtures of POM (Example 37) on the Gardner impact strength of the blend.

4.3 The patent in suit also provides accurate information regarding the processing conditions used in the preparation and molding of the compositions in order to ensure high impact resistance.

Any intensive mixing device capable of developing high shear at temperatures above the melting points of the ingredients can be used to disperse the PUR in the POM (page 7, lines 29 to 52). Such devices include rubber mills, internal mixers, single or multiblade internal mixers with a cavity heated externally or by fraction, "Ko-kneaders", multibarrel mixers, injection molding machines and extruders, both single screw and twin screw, both co-rotating and counter rotating. Suitable ranges of temperature are also indicated as well as the necessity to exclude oxygen and preserve dryness of the ingredients.

Concerning the molding conditions a prerequisite is that the PUR intimately mixed and dispersed as discrete particles in the POM be maintained in that state during the preparation of the shaped articles (page 7, lines 53 to 61). The actual molding can be made by any conventional method, including compression molding, injection molding, extrusion, blow molding, rotational molding, melt spinning, thermoforming and stamping. Usual post treatments, such as orientation, stretching, coating, annealing, painting, laminating and plating are also mentioned.

Furthermore, it is indicated that the conditions used in the preparation of shaped articles should be similar to those required for melt compounding (page 8, lines 8 to 21). General considerations are made about the melt temperature and the residence time as well as about the influence of these parameters on impact resistance.

Generally, (i) the mold should be as cold as possible consistent with the intricacy of the shape being produced, and (ii) shorter total hold-up times in the melt have a beneficial effect on the quality of the shaped article.

4.4 The last aspect of the objection of insufficient disclosure concerns an alleged difficulty to measure the impact resistance of the blends by the Gardner method, not because that would not be sufficiently disclosed in the patent specification (cf. page 6, lines 16 to 21), but because it was not usual in Europe.

This specific objection is not acceptable for various reasons. First, the possible inaccuracy regarding the measurement of a particular property of the blends (here the impact resistance), which determines the exact scope of the claims, is rather an objection under Article 84 EPC, which is not a ground of opposition. Secondly, the objection under Article 83 EPC is inconsistent with the objection of lack of novelty relying on the results of experimental tests carried out by the Respondents. Thirdly, the Respondents, which as the Opponents have the onus of proof, failed to demonstrate that the general process as defined in Claim 40 or the particular examples of the patent specification could not be reproduced without undue burden.

4.5 In view of these considerations, there can be no doubt that a skilled person would know how to combine the various information regarding the polymer components and the processing conditions in order to prepare impact resistant compositions within the terms of the patent in suit. It follows that the requirements of Article 83 EPC must be regarded as met.

5. *Prior use*

In order to determine whether an invention has been made available to the public by prior use, the following circumstances must be clarified:

(a) the date on which the prior use occurred ("when" issue)

(b) exactly what was in prior use ("what" issue)

(c) the circumstances surrounding the prior use (place, confidentiality).

In view of the evidence provided by the Respondent, e.g. D3 to D9, and the arguments presented by the parties (cf. Statement of Grounds of Appeal, points 7 to 33; Counterstatement of Appeal by Respondent I, point D) it is clear that the issue of prior use boils down to the question whether specific commercial products had beyond any reasonable doubts an identical composition before and after the priority date of the patent in suit.

5.1 The documents relied upon by the Respondents can be summarized as follows:

5.1.1 The internal letters (3) describe two types of impact resistant blends:

(i) Hostaform S VP 27063 respectively 27064 which are said to be based on Hostaform C 27021 modified with 10 respectively 20% by weight of Elastollan S 80 A 55;

(ii) Hostaform S VP 9063 respectively 9064 which are said to be based on Hostaform C 9021 modified with 10 respectively 20% by weight of Elastollan S 80 A 55.

5.1.2 The leaflet (4) is a table providing technical information about various thermoplastic polyurethane elastomers Elastollan S which are said to be polyesterurethanes. The polymer identified as "Elastollan S 80 A" is said to have a freezing temperature of -40°C. At the bottom left hand of the page there is the caption "PUG 0125-11-81".

5.1.3 From document (5) it appears that "Elastollan S 80 A" used to modify POM is a polyesterurethane derived from (i) polybutyleneethylene adipate copolyester having a molecular weight of preferably 1000 to 2500 g/mol, (ii) 2,4'-diphenylmethanediisocyanate, and (iii) 1,4-butanediol.

5.1.4 The pamphlets (6) confirm the internal letters (3) regarding the compositions of Hostaform S VP 27063 respectively 27064 and Hostaform S VP 9063 respectively 9064. Additionally, it appears from the introduction (page 2, paragraph "Produktbeschreibung") in conjunction with Table 1 of the respective documents that Hostaform C 27021 respectively 9021 are POM with a melt flow index of 27 respectively 9 g/10 min.

5.1.5 Document (7) provides numerous data concerning physical and mechanical properties of various high impact grade acetal copolymers, in particular "Hostaform S 27063, S 27064, S 9063 and S 9064".

5.1.6 The letter (8) first indicates that the commercial products "Hostaform S VP 9063, 9064, 27063 and 27064" are now available (26 August 1982), then specifies that the new qualities are more expensive than the standard qualities and quotes the price supplements for the four products.

5.1.7 In addition to a reference in documents 9a, 9b and 9c to the good mechanical properties common to the products "Hostaform S VP 9063 respectively 9064 and Hostaform S VP 27063 respectively 27064", there is an indication in documents 9a and 9c that these are experimental products on the basis of Hostaform C 9021 and C 27021.

5.2 As pointed out by the Appellant in both its written and oral submissions, the chain of evidence adduced by the Respondents cannot be regarded as continuous.

5.2.1 A comparison between the data disclosed in the pamphlets (6) for certain physical properties of the above commercial products and the figures mentioned in document (7) four years later for the same properties of allegedly identical products reveals substantial discrepancies. This applies in particular to the Vicat softening point, the yield stress, the ball identation hardness, the heat distortion temperature, the flexural stress and the flexural crop modulus (Statement of Grounds of Appeal, point 18).

The argument that such differences are to be attributed to experimental errors in the measurement of these properties cannot be accepted for several reasons. First, it is noted that the brochures (6) refer to "Hostaform S VP 27063 respectively 27064" and to "Hostaform S VP 9063 respectively 9064" and that, by contrast, document (7) refers to "Hostaform S 27063 respectively 27064" and to "Hostaform S 9063

respectively 9064". Secondly, if nevertheless one takes the view that the products reported in (6) and (7), which both originate from the technical department of the same company (Opponent III), are indeed identical in all respects, it is not clear why the figures from the older document have not been reproduced in extenso in the later document, in other words why it was necessary to carry out numerous tests for the sole purpose of a more recent publication. Thirdly, if some differences may be accepted as lying within the margin of experimental errors, in other cases the differences reach an order of magnitude (yield stress of Hostaform S VP 27063/S 27063: 55 in 1982 and 50 in 1986) which would call for another explanation.

5.2.2 Whilst documents (3) and (6) clearly identify the commercial products as being based on a POM (e.g. Hostaform C 27021 or C 9021) and 10 or 20% by weight of a TPU (e.g. Elastollan S 80 A 55), the latter is defined as "Elastollan S 80 A" in both documents (4) and (5). Thus, even if the caption "PUG 0125-11-81" is interpreted in accordance with the Respondents' submission as a date of publication (e.g. November 1981), there is no certainty that the same TPU is meant in these various documents.

5.2.3 From points 5.1.6 and 5.1.7 above, it is evident that the product mentioned in documents (8), (9a) and (c) is an experimental product not necessarily identical with the product eventually put on the market. This is even implicitly accepted in Opponent III's submission of 2 November 1990, where it is stated in conclusion: "... Consequently the products will likewise be identical, subject to the usual policy of product improvement."

5.2.4 It is thus far from evident that the various documents relied upon by the Respondents are actually concerned with products which had been identical in all respects over several years.

5.3 It follows that the evidential weight of the experimental report submitted by Opponent III in its statement of 1 November 1989, according to which Hostaform S 9063 respectively 9064 would have a Gardner impact value of 23.7 to 24.9 J respectively 27.1 to 30.5 J, is not sufficient to demonstrate beyond any reasonable doubt that a product within the terms of Claim 1 was actually available before the priority date of the patent in suit.

6. *Novelty over D2*

6.1 Composition according to Claim 1

6.1.1 Claim 1 of the patent in suit is directed to a composition consisting essentially of 2 components, i.e. 5 to 15 weight % of a TPU with a soft segment Tg < 0°C and 85 to 95 weight % of a POM with an M_n of from 20,000 to 100,000. That composition is characterized by a specific morphology, i.e. a dispersion of TPU in POM, and a Gardner impact value >9 J measured according to ASTM D-3029, Method G, Geometry D using a 3.6 kg weight (cf. patent specification, page 6, lines 16 to 21). Moreover the TPU component is now limited to those prepared by using only aromatic diisocyanate.

6.1.2 The general teaching of D2 concerns a thermoplastically deformable composition, which comprises a polyurethane of high molecular weight at least 8000 and a polyoxymethylene of molecular weight at least 4000, the weight ratio of the polyurethane to the polyoxymethylene being from 5 : 9 to 95 : 5 (Claim 1).

6.1.3 The last experiment in Table II of D2 describes pressed plates of various TPU and POM compositions, in particular a composition comprising 90 weight % of a POM "B" and 10 weight % of TPU "A". The TPU was prepared from a hydroxy functional polyester and diphenyl methane-4,4'-diisocyanate, e.g. an aromatic diisocyanate, but it is not specified whether the TPU had a soft segment glass transition temperature of lower than 0°C and the POM a molecular weight of from 20,000 to 100,000 (column 6, lines 8 to 24). That composition was homogeneously mixed on a mixing roller (temperature 170-180°C). The characteristics of the resulting products, such as the Notch toughness and the breaking elongation, are given in Table II, but a value for the Gardner impact strength or a direct hint to the morphology of that product is not mentioned.

6.1.4 The issue of novelty thus hinges on the question whether the composition disclosed in the last experiment (run 5) in Table II of D2 has the Gardner impact strength and the morphology of the compositions required in Claim 1, i.e. a TPU dispersed throughout the POM as discrete particles.

6.1.5 For the assessment of novelty it is therefore important (i) to have a product reproduced with exactly the means disclosed in that example and to demonstrate that said product is characterized by (ii) a dispersion of discrete TPU particles in POM as well as (iii) a Gardner impact value of greater than 9 J.

(i) In the Board's view run 5 of Example 1 of D2 has not been reproduced exactly and the product obtained cannot thus, a priori, be considered as evidence for lack of novelty of the claimed composition.

In support of their objection the Respondents filed the following evidence:

(a) With his letter dated 14 October 1993 Respondent I reported that he had reproduced Example 1 of D2 by mixing a POM having a M_n of 22,000 and a TPU with a T_g of the soft segment of -49°C (T_g of TPU as a whole about -20°C) in an amount of 90 to 10 in an extruder (page 12, point F in conjunction with experimental report). The attached micrograph showed discrete particles of TPU dispersed in POM.

(b) Respondent II filed on 16 September 1993 experimental data said to be based on a reproduction of Example 1 of D2. The aromatic diisocyanate used was, however, diphenyl ethane-4,4'-diisocyanate instead of diphenyl methane-4,4'-diisocyanate according to D2. In the Board's view, the use of another diisocyanate without proper justification represents a major difference which does not allow a proper comparison with the critical POM/TPU composition. Moreover the heating step up to a temperature of 235°C, whereby a relatively low viscosity was obtained, does not correspond to the procedure followed in D2.

(c) Further evidence was filed by Respondent II on 16 March 1994. That evidence was based on POM/TPU 70/30 mixtures produced by Bayer in 1989 mixing the components on a mixing roller, thus with the means specified in run 5, i.e. under equivalent shear conditions.

As pointed out by the Appellant in its statement of 8 February 1995 (page 8, point 77), 70/30 compositions not only do not correspond to the 90/10 compositions according to run 5 of Example 1 of D2, but are even outside the relative amounts required in the patent in suit.

(ii) There can be no doubt that the micrographs of the products (a) to (c) show particles of one component dispersed in the other component. But even if one would accept that enough evidence was provided to demonstrate that in run 5 a dispersion of discrete particles of TPU in POM was produced, a further condition, i.e. that the composition should have a Gardner value of greater than 9 J, should be met.

(iii) No Gardner values were given in D2 and all the evidence provided by the Respondents, namely the experimental reports (a) to (c) above, is silent as to Gardner impact values. The reason alleged by the Respondents was that impact resistance expressed in Gardner impact values was quite unusual in Europe and it proved to be impossible to measure the Gardner impact value, even with the aid of US-companies which had been contacted.

6.1.6 For the following reasons the Board is not satisfied that the Respondents, which as the Opponents have the onus of proof, given the circumstances tried their best to demonstrate that the POM/TPU composition according to run 5 of Example 1 of D2 must inevitably have a Gardner impact value within the terms of Claim 1 of the patent in suit.

First, regarding the experimental evidence provided by the Respondents, there are major differences in the compositions used for comparison purposes, in particular a TPU derived from diphenyl ethan-4,4'-diisocyanate instead of diphenyl methan-4,4'-diisocyanate and a 70/30 instead of a 90/10 composition. It is evident that such differences, for which no plausible explanation was provided by the Respondents, do not represent an objective basis of comparison. Secondly, the alleged impossibility to carry out a measurement according to an ASTM norm, in the present case the ASTM D-209 as described on page 3, lines 38 to 40 of the patent specification, is not convincing, because an essential requirement of these norms must be the ease of reproducibility to allow proper material testing and thereby meaningful comparison. The Board is not aware - and no argument has been provided by the Respondents in this respect - why this particular ASTM norm should be an exception or why the given definition was incompatible with reliable experimentation. Thirdly, the Respondents could not convince the Board that over the nine year period following the grant of the patent in suit it had not been possible to commission an independent expert, for example in the USA, to have the specific composition of run 5 tested on an adequate equipment. The arguments presented at the oral proceedings that one did not know which prior art example had to be reproduced or that the expert contacted could not carry out such experiments cannot be accepted; on the one hand, it was

clear from the very beginning of the opposition proceedings that the critical composition was that of run 5 of Example 1 of D2 and, on the other hand, evidence that the independent expert contacted was not able to test this particular composition according to the required ASTM norm has not been provided.

6.1.7 For these reasons, there is no basis for the assumption made by the Respondents that the impact values measured in the prior art or in their experimental reports should correspond to the Gardner impact values required in the patent in suit. It follows that the POM composition as defined in Claim 1 must be regarded as novel.

6.2 Method according to Claim 40

6.2.1 The subject-matter of Claim 40 of the patent in suit is a method of preparing the composition as defined in Claim 1, comprising mixing the TPU, which has a soft segment glass transition temperature of lower than 0°C, with a POM polymer having a number average molecular weight of from 20,000 to 100,000 under high shear at a temperature above the melting point of the ingredients of the composition and below the temperature at which degradation of the ingredients will occur. The composition, which consists essentially of 5 to 15 weight % TPU and 85 to 95 weight % POM, should be in the form of TPU particles dispersed in the POM. Moreover the composition should have a Gardner impact value of greater than 9 J.

6.2.2 Respondent I disputed novelty of process Claim 40 in arguing that identical process conditions should lead to the same product. This in principle reasonable assertion, however, relies on the assumption that the process conditions in D2, whether explicitly or implicitly disclosed, are identical with the features

required in the patent in suit, which has not been demonstrated. Due to its appendancy to the composition as defined in any of the product claims 1 to 36, Claim 40 must be regarded as a "process by product" claim, e.g. as a process claim directed to the method of preparing a composition having a Gardner impact value of greater than 9 J. Since the Respondents have not provided evidence that the known composition, e.g. the composition according to run 5 of Example 1 of D2, satisfied the latter requirement, this prior art process cannot be regarded as a method of preparing a composition within the terms of Claim 40. Since novelty can thus be acknowledged on the basis of that feature alone, there is no need to consider the other features of that claim.

7. *Inventive step*

The patent in suit relates to impact resistant POM compositions.

7.1 D2A relates to the modification of PUR by POM or vice versa to form interesting thermoplastically deformable compositions (cf. page 1, lines 21 to 26). According to that document it has been found that difficultly soluble POM's of high molecular weight have the surprising property of dissolving at temperatures >130°C in PUR (see page 1, lines 10 to 20) and that by simply mixing the two components homogeneous mixtures can be obtained (page 2, lines 117 to 129). The range of PUR/POM is 5/95 to 95/5 % by weight, wherein smaller quantities of PUR act as chemically incorporated plasticiser, thereby increasing the notch toughness of POM (page 3, lines 2 to 6). From Table II, page 4, wherein the mechanical properties of various POM/TPU blends are reported, it appears that the 90:10

composition identified above as run 5 of Example 1 has the most favourable balance of properties. However, as specified in the introduction of the patent specification, in certain applications it would be desirable to have greater impact resistance.

7.2 In line with this approach, which has not been disputed by the Respondents, the technical problem underlying the patent in suit may thus be seen in the provision of POM compositions with improved impact resistance, and at the same time, a minimal reduction of other characteristics, as also indicated in the patent specification (cf. page 2, lines 40 to 42 and 45 to 47).

7.3 According to the patent in suit, this problem is to be solved by a specific combination of compositional features, morphology and process features, namely (i) the proportion of TPU to POM, (ii) a soft segment T_g <0°C of the TPU, (iii) a specific TPU derived from aromatic diisocyanates, (iv) a molecular weight of POM in the range of 20,000 to 100,000, (v) discrete TPU particles dispersed throughout the POM, and (vi) a Gardner impact value of >9 J, as specified in Claim 1.

7.4 In view of the experimental results in the patent specification, especially Examples 1 and 2 versus 3 to 9 for (i), Examples 10 to 13 for the T_g (ii), Examples 14 to 17, as well as Example 18 for (vi), and Examples 19 to 31 for (ii) and (iii), the Board is satisfied that the problem is effectively solved with the above combination of features.

8. It remains to be decided whether this combination of features was obvious having regard to the documents relied upon by the Respondents.

8.1 As mentioned in point 7.1 above, in the preparation of blends of D2A the two polymer components are simply mixed on rollers or, if required, by melting together until homogenization is achieved (page 2, lines 117 to 129). This homogeneously mixing step is also mentioned in all the examples, in particular in the critical Example 1 (page 3, lines 83 to 90), and must thus be regarded as an essential feature of the prior art teaching from which, in the Board's view, there would be no incentive to depart.

For this reason the correlation required in the patent in suit between the morphology, e.g. a dispersion of discrete TPU particles throughout the POM, and the higher impact properties cannot be regarded as obvious in the light of D2A alone.

8.2 Although D10 is specifically concerned with POM having improved impact resistance, the features required there have little in common with the claimed subject-matter.

8.2.1 D10 is directed to a thermoplastic moulding composition of high impact resistance comprising a mixture of (A) a POM and (B) an elastomeric graft copolymer having a glass transition temperature below -20°C., obtained by polymerizing (2) from 10 to 65 p.b.w. of styrene and/or methyl methacrylate, (3) optionally up to 35 p.b.w. of acrylonitrile or methacrylonitrile and (4) optionally up to 20 p.b.w. of further monomers in the presence of (1) 100 p.b.w. obtained by polymerizing (a) from 10 to 99% by weight of an acrylic ester of a C_1 to C_{15} alcohol, (b) from 1 to 90% by weight of a monomer having two olefinic double bonds and (c) optionally up to 25% by weight of further monomers, the percentages given under (a), (b) and (c) adding up to 100%; the ratio of A to B being from 97:3 to 50:50, by weight (Claim 1).

The properties of these blends will be discussed in the light of both the compositional features and the mixing step.

8.2.2 The prior art review in the introduction of this citation (column 1, lines 23 to 40) starts from the fact that POM are plastics materials of high rigidity and tensile strength, but that shaped articles made therefrom show relatively low impact resistance. The various solutions proposed hitherto to overcome that shortcoming, which consisted in the addition of low molecular weight compounds or specific polymers, were not entirely satisfactory in that the improvement in terms of impact strength was accompanied by a degradation of desirable properties, in particular mechanical properties and stability.

The composition disclosed in D10 must thus be regarded as a further attempt to improve the impact resistance properties of POM without impairing their otherwise desirable properties. The choice of a graft copolymer as defined above as the additive is thus the main teaching of this citation, which means that both the specific monomer composition and the glass transition temperature are to be regarded as essential features (column 1, lines 55 to 57 and column 2, lines 6 to 9).

8.2.3 The influence of the copolymer and, thereby, of the above particular features can be appreciated by reference to Example 1 and Comparative Example 1.

In Example 1 a POM copolymer is blended with a lower amount of a graft rubber on a conventional mixing apparatus, melt kneaded on a twin-screw extruder and converted to granules suitable for injection moulding applications. When subjected to impact resistance tests this moulding composition was found to have an impact resistance of 50 cm.kg.

In Comparative Example 1 the POM copolymer is compounded with a commercially available TPU and processed according to the same method, whereby an impact resistance of 15 cm.kg was measured.

That simple comparison would thus provide a strong incentive not to use a TPU additive in order to improve the impact resistance of POM, but the specific graft copolymer described above.

8.2.4 Regarding the blending of the two powder components the mixing may be carried out on mixing rolls or in an extruder at temperatures above the melting point or softening range of the POM (column 3, lines 38 to 52). The mixing is said to have a major influence on the mechanical properties of the polymer mixture, in particular on the impact resistance (column 5, lines 7 to 43). This clearly appears from the comparison of the mechanical properties of circular discs which have been made by injection moulding of granules of identical blends obtained with a single-screw extruder (impact resistance : 50 cm.kg).

These results, as pointed out by the Respondents, speak in favour of a high shear compounding.

8.2.5 The next feature to be considered is the physical aspect of the polymer blend in D10. As explained in column 3, lines 38 to 44, it is advantageous to mix the two polymer components as intimately as possible. Even though these do not show unlimited intersolubility such that the moulding compositions are not homogeneous mixtures, the latter should appear to be homogenous when viewed macroscopically.

Whatever the exact degree of homogeneity of the blends, this cannot be interpreted as the disclosure of a dispersion of the polymer additive in the POM as required in the patent in suit, let alone suggest a correlation between the morphology of the polymer blend and the impact resistance.

8.2.6 The solution proposed in D10 to improve impact resistance is thus based on (i) a specific graft copolymer additive, (ii) high shear compounding, and (iii) rather homogeneous blends. This combination of features cannot obviously lead to the claimed subject-matter.

8.3 Even a combination of the disclosures of D2A and D10 would not render obvious the combination of compositional features, morphology and process feature required in the patent in suit for the following reasons.

8.3.1 The first is that from a purely compositional viewpoint the teachings of these two documents are not combinable.

As it appears from Comparative Example 1 of D10 a moulding composition comprising a POM and a TPU additive, which is thus a composition within the terms of D2A, has a much lower impact resistance than a moulding composition containing a graft copolymer as impact modifier. This means that the authors of D10 were well aware that TPU had only a moderate influence on impact resistance of POM compositions; the addition of a graft copolymer must thus be regarded as an attempt to improve impact resistance by a totally different combination of features, as it appears from

the considerations made in paragraphs 7.1 and 8.2 above. This means that a skilled person would have had no incentive to consider in isolation a specific feature of one of these propositions in order to combine it with the other proposition.

8.3.2 The second reason is that both D2A and D10 failed to recognize the criticality of morphology. Whilst the former emphasizes the importance of homogenization (page 1, lines 10 to 20; page 2, lines 117 to 129; page 3, lines 83 to 90), the latter, although aware of the limited intersolubility of the two polymer components, nevertheless requires at least a certain degree of homogeneity referred to as macroscopic homogeneity (column 3, lines 38 to 44). None of these teachings can be interpreted as pointing to a dispersion of discrete particles of TPU throughout the POM, as required in the patent in suit.

8.4 The correlation between the combination of compositional features, morphology and process features, on the one hand, and the enhanced impact resistance, on the other hand, is thus not obvious in the light of the documents provided and evidence adduced by the Respondents and, therefore, involves an inventive step. This conclusion applies not only to Claim 1 (composition claim) but also to Claim 37 (product claim) and Claim 40 (method claim), since the latter through their appendancy to Claim 1 are both based on the same combination of features.

It further applies to (i) dependent Claims 2 to 36, which are directed to preferred compositions according to Claim 1, (ii) Claims 38 and 39, which concern particular shaped articles according to Claim 37, and

(iii) Claims 41 to 53, which deal with specific embodiments of the method according to Claim 40, which all derive their patentability from the inventiveness of the main composition, product and process claims.

9. Since the first auxiliary request is granted, there is no need to consider the second and the third auxiliary requests.

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 Claim 1 of auxiliary request I submitted at the oral proceedings on 27 May 1998, with adaptation of Claims 2 to 53 and the description thereto as necessary.

The Registrar: The Chairman:

E. Görgmaier C. Gérardin