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D E C I S I O N
of 18 November 1993

Case Number: T 0760/91 - 3.3.3

Application Number: 84300743.6

Publication Number: 0121983

IPC: C08G 69/26

Language of the proceedings: EN

Title of invention:
Polyamide compositions from mixtures of trimethylhexamethylene diamine, hexamethylene diamine and diacids

Patentee:
Amoco Corporation

Opponent:
Hüls Aktiengesellschaft

Headword:
-

Relevant legal norms:
EPC Art. 56

Keyword:
"Inventive step (affirmed after amendment)

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0760/91 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 18 November 1993

Appellant: (Opponent)
Hüls Aktiengesellschaft
Patentabteilung/PB 15
D - 45764 Marl (DE)

Representative:
-

Respondent: (Proprietor of the patent)
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Representative:
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Decision under appeal:
Decision of the Opposition Division of the European Patent Office of 10 June 1991, issued on 14 August 1991 rejecting the opposition filed against European patent No. 0 121 983 pursuant to Article 102(2) EPC.

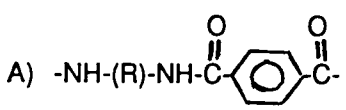
Composition of the Board:

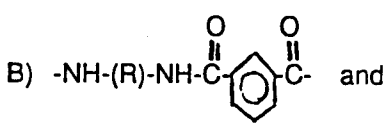
Chairman: F. Antony
Members: P. Kitzmantel
G. Davies

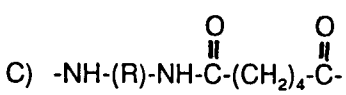
Summary of Facts and Submissions

I. European patent application No. 84 300 743.6, filed on 7 February 1984, claiming priority from a US application filed on 16 February 1983, was granted as European patent No. 0 121 983 on 28 June 1989, with two sets of claims, a main set for BE, FR, GB, DE, IT, LU, CH, LI, NL and SE and a set for AT. The main set comprised nine claims, independent Claim 1 reading as follows:

"A crystalline polyamide copolymer comprising the following recurring units A and C and, optionally, unit B:







wherein R is a mixture of a straight chain aliphatic hydrocarbon radical consisting of six carbon atoms and an alkyl substituted saturated hydrocarbyl chain, six carbon atoms in length, in which the alkyl substitution comprises three methyl groups with two of the three methyl groups on the same carbon atom wherein the mole ratio of the straight chain aliphatic hydrocarbon radical to the alkyl substituted saturated hydrocarbon radical is 55/45 to 95/5 and wherein the molar proportions of A, B and C units are as follows: ≥61% A-units, ≤25% B-units and ≥5% C-units."

Granted Claims 5, 6 and 7 related to the co-polyamide of Claim 1 in the form, respectively, of a moulded object, a fibre or a laminate, and granted Claim 8 related to an injection moulding composition comprising a co-polyamide of Claim 1 and 10 to 60 per cent of certain fillers. Granted Claims 2 to 4 and 9 were dependent claims.

II Notice of opposition was filed by Hüls AG on 9 November 1989, requesting revocation of the patent in its entirety, on the ground of lack of inventive step, having regard to

D1: DE-A-2 651 534,
D2: DE-B-1 805 921,
D3: Dolden, "Structure-property relationships in amorphous polyamides", Polymer, 1976, Vol. 17, 875 to 892 and, later,
D4: Handbook of Fillers and Reinforcements for Plastics, H.S. Katz and J.V. Milewski, Van Nostrand Reinhold Company, page 43, 1978,

and on the ground of insufficient disclosure.

III. With its decision announced orally on 10 June 1991, and posted on 14 August 1991, the Opposition Division rejected the opposition holding that the subject-matter of the opposed patent was sufficiently disclosed and novel; it also met the requirements of inventive step, because the cited documents were silent on fillers as well as on HDT (heat distortion temperature) and could not provide, therefore, any incentive to a skilled person setting out to improve the HDT of filled polyamide compositions.

IV. The Appellant (Opponent) lodged an appeal, received on 30 September 1991, against the rejection of his

opposition and paid the appeal fee on the same date. A Statement of Grounds of appeal was received on 11 November 1991.

The Appellant requested that the decision under appeal be set aside and the patent be revoked.

V. The Respondent (Patentee) requested dismissal of the appeal and maintenance of the patent on the basis of the main request or the auxiliary request, both filed during the oral proceedings held on 18 November 1991.

The main request differs from the claims as granted in that in Claim 1, line 1 the word "comprising" was replaced by the term "consisting essentially of" and that Claims 5 to 7 were deleted, with corresponding renumbering of granted Claims 8 and 9, as 5 and 6. Likewise deleted was the separate set of claims for AT.

VI. The Appellant essentially argued as follows:

Starting from D1 as the closest prior art, it needed only a reduction of the isophthalic acid (IA) content and the incorporation of trimethylhexamethylene diamine (TMH) to arrive at the subject-matter of the patent in suit. Both these measures were obvious in view of D2 and D3, which disclosed that too high an amount of IA resulted in non-crystallinity, and that TMH, again a monomer disturbing a crystalline structure, was a commonly used comonomer for terephthalic acid (TA)/hexamethylene diamine (HMD) based polyamides. From D2 it was also clear that crystalline polyamides were required for achieving high heat distortion temperatures (HDT).

Furthermore, even if the heat distortion temperature (HDT) of glass fibre filled mouldings could be accepted

as evidence for a property of the co-polyamide *per se* (which was contested by the Appellant), this effect could not provide an inventive step, since it was known from D4 that the HDT of crystalline polymers was close to their melting point and that fillers increased the HDT.

A high HDT of glass fibre filled mouldings was typical for crystalline polyamides as demonstrated by Appellant's experiments X1 and Y1, submitted as counter-evidence to experimental data filed by the Respondent during the opposition proceedings.

From a remark in the Statement of Grounds, continuing doubt as regards the sufficiency of the disclosure could also be inferred.

VIII. The Respondent contested the allegations of the Appellant and referred to his arguments presented during the opposition proceedings and in the related appeal cases T 63/91 and T 522/91.

Reasons for the Decision

1. *Admissibility*

The appeal is admissible.

2. *Main request*

2.1 Compliance with Article 123(2) and (3) EPC

In Claim 1 the narrower term "consisting essentially of" has been substituted for the word "comprising" used in the granted version. Granted Claims 5 to 7 have been

cancelled. These amendments clearly do not contravene Article 123(2) or (3) EPC.

2.2 Novelty

None of the documents D1, D2 and D3 discloses a polyamide comprising all mandatory features of Claim 1. The subject-matter thereof is therefore new. Since this is not in dispute, no more detailed explanations are necessary.

2.3 Closest prior art

Because of the close structural similarity to the subject-matter of the patent in suit, D1 is regarded as the nearest prior art. It discloses polyamide fibres made from TA (terephthalic acid), IA (isophthalic acid), AA (adipic acid) and HMD (hexamethylene diamine). The molar amount of units derived from IA is from 30 to 40% and hence above the maximum IA amount of 25 mole% in the patent in suit. The extruded fibres are amorphous, but are made crystalline by stretching and annealing. The purpose of D1 was the prevention of heterogeneous domains in the batchwise production of TA/IA/HMD co-polyamides, which object was accomplished by co-condensation of AA. D1 is silent about crystalline mouldings, either filled or unfilled, and their HDT.

2.4 Problem to be solved

As can be inferred from the original application papers of the patent in suit (cf. page 2, lines 19 to 22; granted patent page 2, lines 62, 63), it was the original **subjective** problem of the patent in suit to provide polyamides which, when filled and moulded, have a HDT (ASTM D-668, 264 psi) of from 240° to 305°C.

Since D1, as well as D2 and D3, is silent about crystalline mouldings (filled or unfilled) and their HDT, there is no reason in formulating the **objective** problem to depart from the original subjective problem, which - for the purpose of assessing an inventive step - is therefore recognised as the one the skilled person set out to solve when starting from the closest prior art in D1.

In view of the results reported in Table 3 of the patent in suit the Board is satisfied that this problem has indeed been solved by the provision of the particular TA-(IA)-AA-HMD-TMH copolyamides according to Claim 1.

The Appellant's argument that the HDT property of the filled mouldings was not capable of accounting for a property of the co-polyamide *per se* (and that consequently in view of the HDT-problem Claim 1 was lacking the filler as an essential feature) is inconclusive, since the enhanced HDT of a filled moulding must stem from a property inherent to the polyamide itself though becoming manifest only in the presence of fillers.

2.5 Inventive step

2.5.1 The acknowledgement of an inventive step turns on whether there was an incentive in the state of the art for the skilled person to incorporate TMH units into the TA-IA-AA-HMD copolyamides of D1 and at the same time to decrease their IA content to at most 25 mole%, in the expectation of thereby enhancing the HDT of filled mouldings made from those polyamides to a range of from 240°C to above 300°C.

2.5.2 D1 discloses crystalline polyamide fibres but is silent about mouldings made therefrom, about the incorporation of fillers, and about the HDT of the polyamides. As set out below in detail, neither any of the further documents on file, nor the general common knowledge of the skilled person at the priority date of the patent in suit, comprised any complementary information enabling him to solve the present problem. There was therefore no reason for the skilled person starting from D1 and wishing to solve the problem set out in section 2.4 above to carry out the required structural changes.

2.5.3 In the Board's judgment, the argument of the Appellant that it was to be expected that the present problem could be solved by turning to crystalline polyamides, because these - in view of their high softening points (Vicat >200°C: D3, page 879, left-hand column, half way down) - must have correspondingly high HDTs, is inconclusive. It is disproved by the uncontested fact that the crystalline polyamides referred to in Table 3 of the patent in suit have HDTs (unfilled) of (only) 112 and 118°C, respectively, which are far below their melting points of up to more than 300°C (cf. Table 1 of the description as filed of the patent in suit); only by incorporating 45% glass fibres into these polyamides is their HDT enhanced to 299 and 304°C, respectively (cf. Table 3 of the patent in suit). The Appellant's allegation that the softening point and the HDT can be put on a par is therefore not tenable.

2.5.4 D2 relates to amorphous blow-moulding compositions, for example for the manufacture of bottles, and thus to a technology where materials having a high HDT, as desired in the patent in suit, are inapplicable. There was thus no reason for the skilled person seeking to solve the existing problem to even consider D2.

2.5.5 The Board is not convinced either by the Appellant's contention, that the choice of filled crystalline polyamides was obvious, because it had been common general knowledge of the skilled person (as evidenced by D4) that fillers increased the HDT and that the HDTs of crystalline polymers were near to their melting points.

2.5.5.1 While the first assertion is in agreement with D4, the second is not, since this conclusion is not founded on the actual disclosure in D4, reading as follows: "**Because of the manner** in which deflection tests are conducted, ... for highly crystalline polymers, deflection temperatures are near**er** to their melting points" (emphasis by the Board). On a fair reading, said statement can only be interpreted to mean that "because of some influence of the method of measuring the deflection temperature, the values measured are closer to the melting points than the actual deflection temperature." So, there is no information in this statement concerning the **absolute** distance between the HDT and the melting point. (Moreover, as explained in section 2.5.3 above, Table 3 of the patent in suit shows that the HDT of unfilled crystalline polyamides is in fact considerably below their melting points).

Consequently, the relevant information in D4 is reduced to the statement that fillers increase the deflection temperature (HDT) and the question therefore can only be whether this information results in a pointer to the skilled person that HDTs of from 240°C to above 300°C could be achieved by the choice of monomers and their proportions in accordance with the present Claim 1.

2.5.5.2 For answering the above question, the comparative Examples X and Y, submitted by the Respondent in his letter of 6 November 1990 are relevant. The polyamides

of these Examples are distinguished from the second polyamide in Table 3 of the patent in suit by higher amounts of IA, correspondingly lower amounts of TA and the absence of TMH. Their "filled" HDTs (30% glass fibres) are 125 and 144°C, respectively, and thus much lower than the HDT of 304°C of the second polyamide of Table 3 according to the patent in suit. As against this the Appellant has submitted his Examples X1 and Y1 as counter-evidence and - for the same chemical constitution as in Examples X and Y - reports "filled" HDTs of 287 and 261°C, explaining the apparent inconsistency of Examples X/X1 and Y/Y1 by the different morphology of the concerned polyamides, i.e. amorphous or crystalline, respectively.

In the judgment of the Board, supposing the HDT values of Examples X1 and Y1 to be correct, this could not detract from the fact that the considerable enhancement of the HDT in the case of filled mouldings made from crystalline polyamides was not suggested by D1 even when seen in combination with D3 and D4. These documents cannot suggest any different effect on the HDT of fillers when incorporated into amorphous or crystalline polyamides, let alone the very substantial enhancement of the HDT actually achieved with the crystalline polyamides of the subject-matter of the patent in suit; for these documents are completely silent about filled mouldings and therefore do not distinguish between the respective properties dependent on their amorphous or crystalline morphology.

All that the Appellant's counter-experiments could possibly show is that the desired HDT effect may be obtained also outside the molar proportions defined in Claim 1, provided care is taken to obtain crystalline polyamides; this cannot affect the inventivity of the subject-matter of present Claim 1. Appellant's opposite

conclusions are the result of an inadmissible *ex post facto* analysis.

2.5.5.3 The conclusions of the preceding paragraph are not invalidated by the Applicant's argument that the strong HDT enhancement in the present case could have been expected in view of the considerable HDT enhancement obtained by the incorporation of glass fibres into Nylon 6.6 as demonstrated in Table 12 of the Proprietor's own EP-A-121 984 claiming the same priority date. Even leaving aside that these data were not proved to belong to the state of the art under Article 54(2) EPC, the HDT effect exhibited therein is not *prima facie* recognisable as a consequence of the (partly) crystalline character of Nylon 6.6.

2.5.6 In the Board's judgment, therefore, the Appellant has failed to discharge the burden of proving the obvious character of the claimed solution for the technical problem underlying the patent in suit.

Hence the subject-matter of Claim 1 complies with the requirements of Article 56 EPC.

3. *Sufficiency of disclosure*

Considering that the Appellant failed to substantiate his observations under Article 100(b) EPC, and since - in view of the information contained in the patent in suit - the Board has no doubts concerning the fulfilment of the requirements of Article 83 EPC by the subject-matter of the patent in suit, there is no need to discuss this matter any further.

4. In view of the above conclusions, the Boards finds that the subject-matter of Claim 1 is patentable.

The same conclusions apply to the subject-matter of Claim 5 directed towards an injection moulding composition comprising the polyamide of Claim 1 and 10 to 60% of certain fillers.

The same applies to the dependent Claims 2 to 4 and 6.

5. Since the main request is allowable, there is no need to discuss the 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 main request and a description yet to be adapted.

The Registrar: The Chairman:

E. Görgmaier F. Antony

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