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

Case Number: T 0759/91 - 3.3.3

Application Number: 84300745.1

Publication Number: 0122688

IPC: C08G 69/26

Language of the proceedings: EN

Title of invention:

Crystalline copolyamides from terephthalic acid, isophthalic acid and C6 diamines

Patentee:

Amoco Corporation

Opponent:

Hüls Aktiengesellschaft

Headword:

-

Relevant legal norms:

EPC Art. 54, 56

Keyword:

"Novelty (affirmed)"
"Inventive step (affirmed)"

Decisions cited:

-

Catchword:

-



Case Number: T 0759/91 - 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: Hüls Aktiengesellschaft
(Opponent) Patentabteilung/PB 15
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Representative: -

Respondent: Amoco Corporation
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office of 10 June 1991 dated
8 August 1991, rejecting the opposition filed
against European patent No. 0 122 688 pursuant to
Article 102(2) EPC.

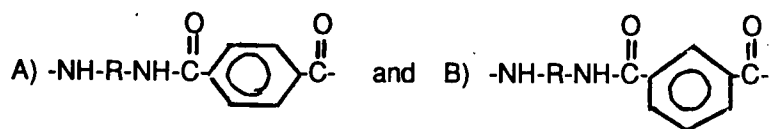
Composition of the Board:

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

Summary of Facts and Submissions

I. European patent application No. 84 300 745.1, filed on 7 February 1984, claiming priority from a US application filed on 16 February 1983, was granted as European patent No. 0 122 688 on 20 September 1989, with ten claims, independent Claim 1 reading as follows:

"A crystalline polyamide copolymer of terephthalic acid and isophthalic acid and aliphatic diamines, said copolymer comprising substantially the following recurring structural units:



wherein the mole ratio of Units A to Units B is between 81/19 to 99/1 and the R groups in said copolymer are a mixture of a straight chain aliphatic hydrocarbon radical consisting of 6 carbon atoms and a radical consisting of an alkyl substituted saturated hydrocarbon chain, 6 carbon atoms in length, in which the alkyl substitution consists of 3 methyl groups with two of the three methyl groups on the same carbon atom, wherein the mole ratio of the straight chain hydrocarbon to the alkyl substituted hydrocarbon is 55/45 to 98/2."

Granted Claim 4 related to an injection moulding composition comprising a co-polyamide of Claim 1 and 10 to 60% of certain fillers; granted Claims 6, 9 and 10 related to the co-polyamide of Claim 1 in the form of a moulded object, a fibre or a laminate, respectively; and granted Claims 2, 3, 5, 7 and 8 were dependent claims.

II. Notice of opposition was filed by Hüls AG on 9 May 1990, requesting revocation of the patent in its entirety, on the ground of lack of inventive step, having regard to

D1: DE-B-1 805 921,

D2: Dolden, "Structure-property relationships in amorphous polyamides", Polymer, 1976, Vol. 17, 875 to 892 and, later,

D3: 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 8 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 requested that the appeal be dismissed and that the patent be maintained on the basis of the

main request dated 15 October 1993 as amended during oral proceedings held on 18 November 1993.

The said main request, which is in fact the sole request before the Board, differs from the claims as granted only by deletion of granted Claims 6 to 10 and the introduction of a new Claim 6 directed to the composition of Claim 4 or 5 in the form of a moulded object.

VI. The Appellant argued essentially as follows:

Starting from D1 as the closest prior art, it needed only a variation of the monomer proportions to arrive at the subject-matter of the patent in suit. This was obvious in view of D2, which disclosed that mixtures of terephthalic acid (TA), isophthalic acid (IA), hexamethylenediamine (HMD) and trimethylhexamethylene diamine (TMH) yielded crystalline polyamides having high softening points if the amount of the asymmetric monomers IA and TMH was kept within certain indicated limits.

Melting point and melt enthalpy data provided by the Appellant supported the information in D2 and showed that only a few experiments were necessary to arrive at crystalline polyamides.

Moreover, 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 D3 that the HDT of crystalline polymers was close to their melting point and that fillers increased the HDT.

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

- VII. 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

Granted Claims 6 to 10 have been cancelled, new Claim 6 is a combination of granted Claims 6 to 8 (which were identical to the same original claims). These amendments do not contravene Article 123(2) or (3) EPC.

2.2 Interpretation of Claim 1

Considering that the term "comprising substantially" in Claim 1 lacks clear explicit boundaries, its scope needs interpretation, there being no legal basis for objection to this lack of clarity under Article 84 EPC at the present stage of the proceedings.

While in common language the word "comprise" may have both the meanings "include" or "comprehend" and "consist of" ("The Concise Oxford Dictionary of Current

English", 8th Ed. by R.E.Allen, Clarendon Press, Oxford, 1990), in drafting patent claims legal certainty requires its interpretation to be normally restricted to the broader meaning "include" or "comprehend".

The word "substantially", imposes a restriction on the word "comprising", in the sense that "to a large extent only that is comprised which is specified". The boundaries of the term "comprising substantially" are therefore to be drawn where the essential characteristics of the specified subject-matter cease. The scope of the term "comprising substantially" is therefore interpreted as being identical to that of "consisting essentially of" (see T 472/88 of 10 October 1990, not published in OJ EPO, point 3 of Reasons). However, due to the unequivocal character of the words "consisting of" as compared to "comprising" the expression "consisting essentially of" is to be given preference.

2.3 Novelty

2.3.1 Since, as explained in the preceding paragraph, the term "comprising substantially" does not totally exclude the presence of unspecified recurring units, polyamide copolymers having units A and B according to present Claim 1 and having further units of a nature and in amounts not affecting the essential characteristics of the polyamides, would come under the scope of Claim 1.

2.3.2 D1 discloses amorphous blow-moulding compositions consisting of blends of a Nylon-type polyamide; and of an amorphous polyamide based on aromatic dicarboxylic acids, such as terephthalic acid (TA) and isophthalic acid (IA), and on a diamine mixture of at most

30 weight% of a straight chain aliphatic diamine, preferably hexamethylene diamine (HMD), and of at least 70 weight% trimethylhexamethylene diamine (TMH) (corresponding to a mole ratio HMD/TMH \leq 0.43).

As compared thereto, the polyamides of the patent in suit comprise at least 55 mole% HMD (corresponding to a mole ratio HMD/TMH \geq 0.87) and are crystalline.

The subject-matter of the patent in suit is therefore novel over D1 irrespective of any presence of further comonomers covered by the term "comprising substantially" in Claim 1 as discussed in section 2.3.1 above.

2.3.3 D2 is a scientific paper investigating structure-property relationships in polyamides. The authors discovered that the factor having the greatest impact on the properties of the polyamides is their morphology, amorphous or crystalline, which is in turn determined by the symmetry of the monomers. In contrast to symmetrical monomers enhancing crystallinity, asymmetrical monomers promote an amorphous structure. Dependent on their degree of asymmetry, D2 distinguishes between asymmetrical monomers of types AM1, AM2 and AM3, IA and TMH being classified as AM2 monomers (page 880, third paragraph). As regards novelty, the most pertinent disclosure in D2 is polymer No. LXXXI in Table 3 on page 878, comprising, in mole%, 30% IA, 20% TA, 32.5% HMD, 10% TMH and 7.5% MPXD (= mixture of m- and p-phenylene diamine). To be comparable with the mole% figures of the patent in suit, these figures have to be multiplied by two. Therefrom, it follows that the polymer No. LXXXI of D2 has a much higher content of IA (60 mole%) than the polyamides of the present Claim 1, and moreover is amorphous. The latter difference can be inferred from

equation (1) on page 880 of D2 and the subsequent paragraph, where it is specified that a "summed asymmetry value" higher than 60 results in amorphous polymers; the "summed asymmetry value" of polymer No. LXXXI being at least 80, taking into account the contribution to asymmetry of IA and TMH, but disregarding MPXD (whose contribution to asymmetry cannot be estimated because it is an unspecified mixture of m- and p-isomers).

The subject-matter of the patent in suit therefore is novel over D2, irrespective of any presence of further comonomers covered by the term "comprising substantially" in Claim 1 as discussed in section 2.3.1 above.

2.4 Closest prior art

In selecting the most appropriate starting point for analysing inventive step, polymer No. LXXXI of D2 is considered to be the embodiment coming closest to the subject-matter of the present Claim 1.

2.5 Problem to be solved

As can be inferred from the original application papers of the patent in suit (cf. page 2, lines 13 to 18; granted patent page 2, lines 36 to 38) it was the original **subjective** problem of the patent in suit to provide polyamides which, when filled and moulded, have a HDT (ASTM D-648, 264 psi) of from 240° to 305°C.

Since D1 and D2 (the only documents in the proceedings relating to polyamides) are 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 man set out to solve when starting from the closest prior art in D2.

In view of the HDT results reported in Table 4 of the patent in suit, and considering the fact that the HDT of the unfilled polyamide referred to in line 1 of this Table 4, according to the Appellant's uncontested statement (letter of 8 March 1991, page 1, last paragraph), is only about 130°C, the Board is satisfied that this problem has indeed been solved by provision of the particular copolymers defined in Claim 1.

The Appellant's argument that the HDT property of the filled mouldings was incapable 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.

2.6 Inventive step

2.6.1 The acknowledgement of an inventive step turns on whether there was an incentive in the state of the art for the skilled person to reduce the IA content of the TA-IA-HMD-TMH-MPXD co-polyamide No. LXXXI of D2 to the range of 1 to 19 mole%, in the expectation of thereby enhancing the HDT of filled mouldings made from these polyamides to a range of from 240°C to above 300°C.

2.6.2 D2 discloses crystalline polyamides 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 D1 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 D2 and wishing to solve the problem set out in section 2.5 above, to reduce the IA content of polymer No. LXXXI to the range indicated.

2.6.3 D1 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 D1.

2.6.4 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: D1, 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 polyamide used in the first run of Table 4 of the patent in suit has a HDT (unfilled) of (only) about 130°C; only by incorporating 45% glass fibres into this polyamide is the HDT enhanced to above 304°C (cf. runs 2 and 3 in Table 4 of the patent in suit).

2.6.5 The Board is not convinced either by the contention of the Appellant that the choice of filled crystalline polyamides was obvious, because it had been common general knowledge of the skilled person (as evidenced by D3) that fillers increased the HDT and that the HDTs of crystalline polymers were near to their melting points.

2.6.5.1 While the first assertion is in agreement with D3, the second is not, since this conclusion is not founded on the actual disclosure in D3, reading as follows:

"**Because of the manner** in which deflection tests are conducted, ... for highly crystalline polymers, deflection temperatures are nearer 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.

Consequently, the relevant information in D3 is reduced to the statement that fillers increase the deflection temperature (HDT) and the question can therefore 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 selecting TA/IA molar ratios in accordance with the present Claim 1.

2.6.5.2 For answering the above question, the evidence in Table 4 of the patent in suit is relevant. This exhibits a HDT enhancement obtained by the incorporation of glass fibres of more than 170°C (cf. section 2.6.4 above). While the skilled person could expect, on the basis of the information in D3, some moderate improvement of the HDT to result from the incorporation of fillers, he would certainly not have expected a solution to the above defined problem, unless he knew of the synergistic effect resulting from the combination of a **crystalline** polymer and **fillers**.

Reference is also made in this respect to the parallel case T 63/91 (EP-A-121 985, claiming the same priority

date), whose subject-matter differs from the present one only by the absence of IA units. In that case evidence was submitted, by the Respondent in the present case, demonstrating a surprising enhancement of the HDT of glass fibre filled mouldings owing to a reduced TMH content, thereby getting a crystalline in lieu of an amorphous structure (cf. Reasons 2.5.4.2). This evidence is equally applicable to the present case and reinforces the non-obviousness finding set out above by proving the critical importance of the molar ratios of the present Claim 1.

2.6.5.3 The conclusions of the preceding paragraph are not invalidated by the argument of the Appellant that the strong HDT enhancement in the present case could have been expected in view of the considerable HDT enhancement resulting from 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. Leaving even aside the fact that the EP-A-121 984 is not 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.

2.6.5.4 In the opinion of the Board, the melting point and melt enthalpy data submitted by Appellant I in order to demonstrate that the high HDT achieved by the filled mouldings of the patent in suit went together with high melting points and crystalline character have no persuasive character, but are again mere *ex post facto* explanations of the combined effect of crystallinity and filler content on the HDT of mouldings, which effect was unknown prior to the patent in suit.

2.6.6 In the Board's judgment, therefore, the Appellant has failed to discharge the burden of proving the obvious

character of the claimed solution to the technical problem underlying the patent in suit.

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 Board finds that the subject-matter of Claim 1 is patentable.

The above conclusions apply equally to the subject-matter of Claim 4 directed towards an injection moulding composition comprising the polyamide of Claim 1 and 10 to 60% of certain fillers, and to the subject-matter of Claim 6 pertaining to compositions of Claim 4 in the form of a moulded object.

The same applies to the dependent Claims 2, 3 and 5.

The main request is therefore allowable.

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

Claims 1 to 6 of the main request submitted during oral proceedings and a description yet to be adapted.

The Registrar:


E. Gorgmaier

The Chairman:


F. Antony

Ki
25.1.94