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**Datasheet for the decision  
of 3 February 2016**

**Case Number:** T 0195/13 - 3.3.03

**Application Number:** 07703300.9

**Publication Number:** 1981931

**IPC:** C08G69/46, C08G69/14, C08G69/16

**Language of the proceedings:** EN

**Title of invention:**  
PROCESS FOR INCREASING THE MOLECULAR WEIGHT OF A POLYAMIDE

**Patent Proprietor:**  
DSM IP Assets B.V.

**Opponent:**  
Bühler AG

**Headword:**

**Relevant legal provisions:**  
EPC Art. 56  
RPBA Art. 13(1), 13(3)

**Keyword:**  
Inventive step - main request (no)  
Late-filed auxiliary requests - admitted (no)

**Decisions cited:**

T 0035/85, T 0197/86



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Case Number: T 0195/13 - 3.3.03

**D E C I S I O N**  
**of Technical Board of Appeal 3.3.03**  
**of 3 February 2016**

**Appellant:** Bühler AG  
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**Decision under appeal:** **Interlocutory decision of the Opposition  
Division of the European Patent Office posted on  
3 December 2012 concerning maintenance of the  
European Patent No. 1981931 in amended form.**

**Composition of the Board:**

**Chairman** D. Marquis  
**Members:** O. Dury  
R. Cramer

### **Summary of Facts and Submissions**

I. The appeal by the opponent lies against the decision of the opposition division maintaining European patent No. 1 981 931 in amended form.

II. Notice of opposition was filed requesting revocation of the patent on the grounds of Art. 100(a) EPC (lack of inventive step only) and Art. 100(b) EPC.

III. The contested decision was based on the sole main request filed by fax on 7 September 2012, claim 1 of which read as follows:

"1. Process for increasing the molecular weight of a polyamide comprising a first step, wherein the polyamide is contacted in countercurrent with a first stream comprising 15 to 100 wt.% H<sub>2</sub>O and 85 to 0 wt.% N<sub>2</sub> at a temperature between 90 and 180 °C and for a time between 5 and 10 hours and a second step, wherein the polyamide obtained in the first step is contacted in countercurrent with a second stream comprising 90 to 100 wt% N<sub>2</sub> and 10 to 0 wt% H<sub>2</sub>O at a temperature between 130 and 200 °C and for a time between 10 and 30 hours and wherein the polyamide is polyamide-6."

IV. The documents referred to in the decision under appeal include the following:

E1: WO 01/39947 A1

E2: WO 03/062302 A1

E3: DE 195 10 698 A1

E11: DE 195 10 698 C2

E12: patent proprietor's submission dated

7 September 2012

According to that decision the above main request *inter alia* fulfilled the requirements of Art. 83 EPC and Art. 56 EPC, the latter starting from either E1 or E3 as closest prior art. An inventive step over E3 in combination with E2 was in particular acknowledged in view of the improvements demonstrated in E12 (section 6.2.1.4).

- V. The opponent (appellant) lodged an appeal against that decision. Together with its statement of grounds of appeal the appellant requested that the opposition division's decision be set aside and that the patent be revoked.
  
- VI. In its rejoinder to the statement of grounds of appeal the patent proprietor requested that the appeal be dismissed. Document E3\_C2 cited therein corresponded to the above-mentioned E11.
  
- VII. In a communication following the summons to oral proceedings, the Board set out its preliminary view of the case. In respect of inventive step it indicated in particular that it would have to be discussed if either or both of E1 and E3 represented a promising starting point. Also, should E3 represent a suitable closest prior art document and the problem effectively solved be formulated as an improvement over E3, the relevance of the comparative data contained in E12 would have to be assessed (section 6.6.2.b).
  
- VIII. With letter of 1 December 2015, the patent proprietor submitted two auxiliary requests.

Claim 1 of auxiliary request 1 read as follows  
(additions as compared to claim 1 of the main request filed by fax on 7 September 2012 are here indicated in

**bold)** :

"1. Process for increasing the molecular weight of a polyamide **to a molecular weight of more than 23,000 g/mol, wherein the molecular weight is calculated using the formula:**

$$Mn = \frac{2 \text{ equivalents / mole}}{(\text{sum of final groups}) \text{ equivalents / g}}$$

comprising a first step, wherein the polyamide is contacted in countercurrent with a first stream comprising 15 to 100 wt.% H<sub>2</sub>O and 85 to 0 wt.% N<sub>2</sub> at a temperature between 90 and 180 °C and for a time between 5 and 10 hours and a second step, wherein the polyamide obtained in the first step is contacted in countercurrent with a second stream comprising 90 to 100 wt% N<sub>2</sub> and 10 to 0 wt% H<sub>2</sub>O at a temperature between 130 and 200 °C and for a time between 10 and 30 hours and wherein the polyamide is polyamide-6."

Claim 1 of auxiliary request 2 read as follows:

"1. Process for increasing the molecular weight of a polyamide comprising a first step, wherein the polyamide **having 2 to 12 wt% of caprolactam** is contacted in countercurrent with a first stream comprising 15 to 100 wt.% H<sub>2</sub>O and 85 to 0 wt.% N<sub>2</sub> at a temperature between 90 and 180 °C and for a time between 5 and 10 hours and a second step, wherein the polyamide obtained in the first step is contacted in countercurrent with a second stream comprising 90 to 100 wt% N<sub>2</sub> and 10 to 0 wt% H<sub>2</sub>O at a temperature between 130 and 200 °C and for a time between 10 and 30 hours and wherein the polyamide is polyamide-6 **and having less than 0.5 wt% of caprolactam**

**after the second step."**

- IX. With letter of 21 December 2015 the appellant submitted further arguments.
- X. Oral proceedings were held on 3 February 2016, at the end of which the Board's decision was announced.
- XI. The appellant's arguments, as far as relevant for the present decision, may be summarised as follows:

Main request - Art. 56 EPC

- a) Either E1 or E3 could be selected as closest prior art. In respect of E3, example 2 was in particular the most promising starting point.
- b) The subject-matter of operative claim 1 differed from example 2 of E3 in that (i) it was specifically directed to polyamide 6 (and not polyamide 66), (ii) the first stream comprised 15 to 100 wt.% H<sub>2</sub>O and 85 to 0 wt.% nitrogen and (iii) the temperature in the second stream was between 130 and 200°C.
- c) No fair comparison between a process according to operative claim 1 and a process according to E3 was on file. In particular, the comparative examples of E12 neither illustrated the teaching of E3 nor allowed a fair comparison with the examples of E12 illustrating the subject-matter being claimed. Therefore, the problem effectively solved over E3 could only be formulated as providing an alternative process.

- d) The teaching of E3 was not limited to polyamide 66 but was also directed to polyamide 6, as was derivable from its claim 1 and example 5 of its family document E11. Besides, E2 taught a process for increasing the molecular weight of polyamides by using a two-step process in which the gas used in the first step had a higher water content than that used in the second step. It was further derivable from the information given in the description and in the examples of E2 that the water content of the gas used in both steps was in the ranges defined in operative claim 1. Also, the indicated temperatures to be used as disclosed in E2 were, if polyamide 6 was used, in the range mentioned in operative claim 1. In that respect E2 contained several references to polyamide 6, contrary to the respondent's view. Therefore, it was obvious to solve the problem as defined above by combining example 2 of E3 with the teaching of E2.

Auxiliary requests 1 and 2 - admissibility

- e) Auxiliary requests 1 and 2 were late-filed. Besides, each of those requests contained amendments taken out of the description, which took the appellant by surprise. In particular, the appellant was not in a position to carry out additional experiments to show that the added features either raised new issues in respect of sufficiency of disclosure (auxiliary request 1) or that they were not relevant in respect of inventive step (both auxiliary requests). Also, the respondent had not explained why those requests would possibly remove any objection raised against the main request. Therefore, neither of auxiliary



requests 1 and 2 should be admitted into the proceedings.

XII. The respondent's arguments, as far as relevant for the present decision, may be summarised as follows:

Main request - Art. 56 EPC

- a) Whereas E1 was not suitable closest prior art, Example 2 of E3 constituted the most promising starting point.
- b) The subject-matter of operative claim 1 differed from E3 in that gas streams having different compositions were used in both steps.
- c) The examples and comparative examples of both the patent in suit and E12 showed that the problem effectively solved over E3 was to provide a process for increasing the molecular weight of polyamide 6 which leads to (i) faster increase in molecular weight, (ii) reduced amounts of extractables (unreacted caprolactam monomers and oligomers) initially present in the polyamide and (iii) reduced difference in amine and carboxyl end groups of the starting polyamide 6.
- d) E3 itself contained no hint to arrive at the subject-matter of operative claim 1, in particular not in order to provide the above improvements (i), (ii) and (iii). On the contrary, the indication provided in E3 in respect of the dew temperature of the gas stream to be used rather taught away from using in the first step a gas stream with a water content higher than 15 wt.% as specified in

operative claim 1.

- e) E2 was not directed to polyamide 6; so its combination with E3 would not have been considered by the skilled person.

Besides, considering that E2 did not deal with above improvements (ii) and (iii), the skilled person would have had no reason to consider combining E2 with E3 in order to solve the above problem.

Also, E2 merely taught to use in the first step a gas stream with a higher dew temperature than that used in the second step but failed to disclose that gas streams having water contents as specified in operative claim 1 were used in both steps.

Finally, using gas streams having different compositions according to E2 would necessitate considerable modification of the installation according to e.g. Fig. 1 of E3. In view of the complications involved, such a modification of E3 based on the teaching of E2 was not obvious.

Auxiliary requests 1 and 2 - admissibility

- f) Both auxiliary requests were submitted in reply to the Board's communication. They had been filed as soon as possible and well in advance of the oral proceedings. Both requests constituted a limitation of the subject-matter defined in the main request in order to further distinguish the subject-matter being claimed from both E1 and E3. Also, both requests aimed at overcoming the appellant's objections of lack of inventive step.

Therefore, auxiliary requests 1 and 2 should be admitted into the proceedings.

XIII. The appellant (opponent) requested that the decision under appeal be set aside and that the patent be revoked.

The respondent (patent proprietor) requested that the appeal be dismissed (main request) or, alternatively, that the decision under appeal be set aside and the patent maintained in amended form according to the first or the second auxiliary request filed with the letter of 1 December 2015.

### **Reasons for the Decision**

1. The appeal is admissible.

Main request

2. Inventive step

2.1 Closest prior art

2.1.1 Operative claim 1 is directed to a process for increasing the molecular weight of polyamide 6 which comprises two steps in each of which the polyamide is contacted in countercurrent with a gas stream and whereby the gas stream in each of those steps has a different composition. In particular, although both gas streams are constituted of nitrogen and/or water, the first gas stream must contain at least 15 wt.% water, whereas the second gas stream should at most contain 10 wt.% water.

According to paragraphs 3, 7-8, and 15-18 and the examples of the patent in suit, the problem to be solved is to provide a (two-step) process for increasing the molecular weight of polyamide 6, which

- requires shorter time in order to increase the molecular weight to a desired level than the known process;
- reduces the amount of unwanted extractables (caprolactam monomers and oligomers) initially present in the polyamide; and
- reduces the loss of carboxyl groups in the polyamide.

2.1.2 Both parties considered that E3 represented a suitable closest prior art document.

E3 discloses a two-step process for increasing the molecular weight of a polyamide (as derivable from the fact that E3 deals with solid state polymerisation) characterised in that

- in a first step the polyamide granulate is heated to a first temperature of e.g. between 90 and 150 °C and is held for a predetermined period of e.g. between two and six hours at this temperature and then
- in a second step it is post-condensed at a second, higher temperature, but which is below the melting point of the polyamide, e.g. between 170 and 10 °C under the melting point of the polyamide, until the desired average degree of polycondensation is achieved (claims 1-4).

Preferably, the post-condensation step is carried out in an inert gas stream or under vacuum and the inert gas used for after-condensation preferably has a dew temperature between 0 and 30 °C (claims 5-6; page 3,

lines 47-56). In that respect, the "dew temperature" mentioned in E3 corresponds, according to common general knowledge, to the temperature at which the air can no longer "hold" all of the water vapour which is mixed with it and some of the water vapour must condense into liquid water, i.e. the temperature at which air is saturated with water vapour. It was further agreed by the parties during the oral proceedings before the Board that the higher the dew temperature, the higher the water content of the gas stream and that e.g. dew temperatures of 100 °C, 30 °C and -60 °C correspond to water contents of 100 wt.%, 2.8 wt.% and almost 0 wt.%, respectively.

A specific embodiment of E3 is directed to the process according to Fig. 1 (see also page 3, line 65, to page 4, line 6; page 4, lines 12-42 and example 2), which deals with a two-step process comprising the following steps:

- the polyamide is contacted in countercurrent with a first stream (inlet D) at a temperature between 90 and 150 °C and for a time between 2 and 6 hours (zone B);
- the polyamide obtained in the first step is contacted in countercurrent with a second stream (inlet E) at a temperature between 180 and 230 °C under the melting point of the polyamide (zone C).

E3 also aims, as does the patent in suit, at increasing the molecular weight of polyamides (solid-state polymerisation) and at reducing the amounts of "sublimatable" oligomers (page 3, lines 15-20 and 25-46; page 5, lines 21-31; page 7, line 4; Table 1), which correspond to the extractables mentioned e.g. in paragraph [17] of the patent in suit.

Although E3 does not specifically disclose polyamide 6, which is the polyamide specifically mentioned in operative claim 1, it does deal with polyamides in general (E3: claim 1). The appellant's argument that there was no reason why the skilled person would not have considered that the teaching of E3 applied to polyamide 6 was not contested by the respondent, either in the first-instance proceedings or in particular during the oral proceedings before the Board after receipt of the Board's communication in which that aspect was specifically addressed (end of section 6.3.1). It was also not contested by the respondent that example 5 of E11, which is the C2 family document of E3, confirmed that the teaching of E3 was applicable to polyamide 6.

In such circumstances, the Board is convinced that E3 is a suitable closest prior art document.

- 2.1.3 E3 mentions different kinds of suitable reactors, including but not limited to those in which the polyamide is contacted with a gas stream in countercurrent (claims 7, 9; examples 1-4). However, example 2 of E3 is specifically directed to a solid-state polymerisation process of polyamide 66 in a moving-bed reactor according to Fig. 1 and page 3, line 65, to page 4, line 45, of E3. The process comprises two steps (defined by zones B and C in Fig. 1) in which the same nitrogen/water gas stream having a dew temperature of 15°C (page 7, lines 5-7) is injected in countercurrent both at the bottom and in the upper part of the reactor (Fig. 1: lines E and D, respectively). The first step is performed at 110 °C for 4 hours (page 6, lines 64-65) and the second at 210 °C for 20 hours (page 7, lines 1-2). Therefore, example 2 of E3

constitutes the most promising starting point for the assessment of inventive step.

## 2.2 Problem solved in view of the closest prior art

Based on the passages of the patent in suit cited in section 2.1.1 above, the respondent formulated the problem to be solved in view of example 2 of E3 as residing in the provision of a process for increasing the molecular weight of polyamide 6, which provides (i) a faster increase in molecular weight, (ii) a reduction of extractables (caprolactam and oligomers) and (iii) a reduction in the difference in amine and carboxyl end groups of the starting polyamide 6.

## 2.3 Solution

The subject-matter of claim 1 differs from example 2 of E3 in that

- (i) it is specifically directed to polyamide 6 (and not polyamide 66);
- (ii) the first stream comprises 15 to 100 wt.% H<sub>2</sub>O and 85 to 0 wt.% nitrogen;
- (iii) the temperature of the second step is between 130 and 200 °C (instead of 210 °C).

Concerning distinguishing feature (ii), it is shown in Fig. 1 of E3 that the gas stream of the first step (zone B) consists in the mixture of the inert gas coming from line D with that coming from line E that has passed through reacting zone C. According to page 3, lines 47-56, of E3, the inert gas in line D further has a dew temperature between 0 and 30 °C, which corresponds to a water content of at most 2.8 wt.%, as agreed by the parties during the first-instance proceedings (see e.g. first paragraph on page 9 of the decision) and confirmed

during the oral proceedings before the Board. Although the exact water content of the gas stream used in the first step of E3 is not specifically disclosed, it was not disputed by the parties that E3 fails to disclose a water content of at least 15 wt.%.

#### 2.4 Success of the solution - Reformulation

2.4.1 Since operative claim 1 is specifically directed to polyamide 6, assessment of whether the improvements over the closest prior art relied upon by the respondent (see section 2.2 above) are credibly demonstrated can only be made by comparing processes both carried out with the same polyamide 6. The fact that example 2 of E3 is directed to polyamide 66 does not affect that conclusion, since it was agreed by the parties that the teaching of E3 is also applicable to polyamide 6 (see section 2.1.2, one before last paragraph).

2.4.2 It was not contested by the respondent that no comparison between a process according to operative claim 1 and the exact process of example 2 of E3 is present on file, in particular either in the patent in suit or in E12.

2.4.3 During the oral proceedings before the Board and as indicated in the Board's communication (section 6.6.2.b.i), the question arose whether comparative examples A and/or B given in Table 1 of E12 represent embodiments according to the closest prior art lying closer to the subject-matter claimed than the process of example 2 of E3, i.e. whether those examples could demonstrate that an advantageous effect attributable to the feature distinguishing the claimed subject-matter from the closest prior art, in particular the composition of the first stream, is in fact more clearly



demonstrated (T 35/85; T 197/86). In the Board's mind the conclusions drawn in those decisions were arrived at on the prerequisite that the comparative examples submitted by the patent proprietor, while not being identical to the closest prior art which had been specifically disclosed (in the present case, this would correspond to example 2 of E3), did however have to correspond to a newly prepared variant of the closest prior art (T 35/85: section 4 of the reasons; T 197/86: section 6.1.3 of the reasons), i.e a process carried out according to the general teaching of the prior art.

E12 deals with the comparison of examples I, III and IV of the patent in suit with two examples illustrative of E3 using, according to the statement made by the respondent during the oral proceedings before the board, the same starting polyamide (Table 1 of E12 is given below; comparative examples A and B are to be compared with examples I and III/IV, respectively).

As indicated in Table 1 of E12, the gas stream used in both steps of the comparative examples was 100% nitrogen. It was not contested by the respondent, in particular during the oral proceedings before the board, that said gas stream did not have a dew temperature of 15°C according to example 2 of E3 nor a dew temperature of between 0 °C and 30 °C as taught on page 3, lines 47-53, of E3, which is also relevant for the moving-bed reactor of Fig. 1 (example 2; page 4, lines 38-45). In that respect, the appellant indicated during the oral proceedings that pure nitrogen has a dew temperature of -60 °C, as shown in E2 (Examples I and II; Table I). In view of the above, it has to be concluded that the comparative examples of E12 were not performed using in any of the two process steps a gas stream corresponding to the teaching of the closest prior art E3.

**Table 1; Examples according to the invention compared to process according to E3**

Features claim	Example I; as disclosed in patent	Comp example A; as disclosed in patent; according to E3	Example III; according to processing conditions Example I	Comp example B; according to processing conditions comp example A and E3	Example IV; difference with respect to Example I shown
1. Process for increasing mw of a PA (K1) comprising	Starting Mw: 21000	Starting Mw: 21000	Starting Mw: 18000	Starting Mw: 18000	Starting Mw: 18000
first step (K2) PA is contacted in countercurrent (K2c) with a first stream 15-100 wt%H <sub>2</sub> O 85-0 wt% N <sub>2</sub> (K2d) at a temperature 90-180 degC (K2a); 120°C between 5-10 hours (K2b); 10h	Composition 1 <sup>st</sup> stream  100% H <sub>2</sub> O	Composition 1 <sup>st</sup> stream  100%N <sub>2</sub>	Composition 1 <sup>st</sup> stream  100% H <sub>2</sub> O	Composition 1 <sup>st</sup> stream  100%N <sub>2</sub>	Composition 1 <sup>st</sup> stream  100% H <sub>2</sub> O
And a second step (K3) contacted in countercurrent (K3c) second stream 90-100 wt% N <sub>2</sub> 10 to 0 wt% H <sub>2</sub> O (K3d) at a temperature of 130-200 degC (K3a); 180 °C Time 10-30 h (K3b): 20h	Composition 2 <sup>nd</sup> stream  5.7wt%H <sub>2</sub> O; 94.3wt% N <sub>2</sub>	Composition 2 <sup>nd</sup> stream  100%N <sub>2</sub>	Composition 2 <sup>nd</sup> stream  5.7wt% H <sub>2</sub> O; 94.3wt% N <sub>2</sub>	Composition 2 <sup>nd</sup> stream  100%N <sub>2</sub>	Composition 2 <sup>nd</sup> stream  100% N <sub>2</sub>

It is further noted that whereas the first process step was carried out for 10 hours in comparative examples A and B of E12, the first step of example 2 of E3 was performed for 4 hours, whereas the general teaching of E3 in that respect is a duration of 2 to 6 hours (page 6, lines 64-65). Therefore, in that respect too the comparative examples of E12 deviate from both the specific disclosure according to example 2 and the more general teaching according to the description of E3.

Finally, it was argued by both parties during the oral proceedings before the Board that the improvements relied upon by the respondent (see section 2.2.1 above) were achieved as a result of the combination of specific

conditions defined in operative claim 1 in terms of the gas composition, temperature and duration of both process steps. It is further derivable from E3 that the dew temperature of the gas stream is critical, both in terms of the molecular weight to be attained and in respect of reduction of the oligomers (E3: page 3, lines 48-53; page 4, lines 40-45). As a consequence it cannot be concluded that comparative examples A and B given in E12, which deviate from the general teaching of the closest prior art, represent newly prepared variants of the closest prior art lying closer to the subject-matter claimed than the process of example 2 of E3. Therefore, E12 is not suitable for showing any advantageous effect attributable to the feature(s) distinguishing the claimed subject-matter from the closest prior art.

For those reasons and in the absence of any other evidence than E12 in that respect, none of the improvements relied upon by the respondent can be taken in consideration in order to formulate the problem effectively solved over the closest prior art.

2.4.4 Examples I and II of the patent in suit as well as examples III and IV of E12 show that a process according to operative claim 1 constitutes at least an alternative process to the process of E3, which was not contested by the appellant.

2.4.5 In view of the above, the technical problem effectively solved has to be reformulated in a less ambitious manner than that proposed by the respondent and is seen as residing in the provision of a further process for increasing the molecular weight of polyamide 6 as an alternative to the process according to example 2 of E3.

## 2.5 Obviousness

2.5.1 The question to be answered is whether the skilled person desiring to solve the problem identified above would, in view of the prior art, have modified the disclosure of the closest prior art in such a way as to arrive at the claimed subject-matter.

2.5.2 As explained in section 2.1.2 above, using polyamide 6 instead of polyamide 66 as in example 2 of E3 is in accordance with the teaching of E3. It has been neither argued nor shown by the respondent that the use of polyamide 6 is related to any difficulty and/or could in any way have contributed to an inventive step.

In that respect, it was argued by the appellant, in particular during the oral proceedings before the Board, that working with polyamide 6 instead of polyamide 66 would mandatorily have led the skilled person to work with a temperature lower than 210 °C, which was not contested by the respondent and further appears plausible considering the lower melting point of polyamide 6 as compared to polyamide 66.

For those reasons, the use of polyamide 6 together with the range of temperature of the second step specified in operative claim 1 (i.e. distinguishing features (i) and (iii) as identified in section 2.3 above) cannot constitute an inventive step.

2.5.3 Regarding the composition of the gas stream in the first step (distinguishing feature (ii) as identified in section 2.3 above), the appellant's objection was based on the combination of E3 with E2.

E2 discloses a process for increasing the molecular

weight of a polyamide via solid-state polycondensation by exposing the polyamide prepolymer contacted in the first step with an inert gas having a dew temperature  $T_{\text{dew-1}}$  and wherein the polyamide obtained in the first step is further contacted in the second step with an inert gas having a dew temperature  $T_{\text{dew-2}}$ , whereby  $T_{\text{dew-1}}$  is higher than  $T_{\text{dew-2}}$  (claim 1; page 8, lines 9-15). The polyamide may be polyamide 6 (claim 2; page 5, line 7; page 6, lines 22 and 32; page 7, lines 5-8). The gas stream used in the first step preferably has a dew temperature of at least 30, 50 or 70 °C and is e.g. dry heated steam (page 8, line 31, to page 9, line 6), whereas the gas stream used in the second step is dry nitrogen (page 8, lines 16-30). The combination of dry heated steam in the first step and dry nitrogen in the second step is specifically disclosed in example II of E2. The reaction temperature in both steps lies between 20 and 100 °C below the melting temperature of the polyamide. During the oral proceedings before the Board the appellant argued that that requirement would mean a temperature within the ranges defined for both steps according to operative claim 1, which was not contested by the respondent. That conclusion is also in line with the findings of the opposition division (bottom of page 11 of the decision). Finally the process of E2 may be carried out in any reactor suitable for solid-state polymerisation, in particular moving-bed reactors (page 4, lines 4-10; page 4, line 34, to page 5, line 2), i.e. a reactor as used in example 2 of E3.

E2 further teaches that the process taught therein allows the reaction rate of the post-condensation reaction to be increased as compared to the prior art (page 1, lines 31-37). In that respect, document EP-A-0732351, which corresponds to a family document of E3 (as is derivable from said passage of E2 itself and

from the indications on the second page of the international search report of E2), is specifically cited on page 2, lines 9-20, of E2. Therefore, there can be no doubt that E2 and E3 belong to the same technical field and address similar technical problems.

In particular, in view of the above, E2 is, like E3, directed to a process for increasing the molecular weight of a polyamide such as polyamide 6 and teaches the use of two gas streams that may have the compositions specified in operative claim 1. Also, the process of E2 is compatible with that of E3 in terms e.g. of the type of reactor, the working temperatures and the compositions of the gases, the specific combination of gas streams having compositions as indicated in operative claim 1 being e.g. specifically disclosed in an example of E2.

It is agreed with the respondent that it is taught in E3 (page 3, lines 51-53) that the dew temperature of the inert gas cannot be increased at will. However, said passage of E3 deals with a preferred embodiment of E3, as indicated by the wording "A further feature of the invention" at the beginning of the paragraph containing said passage of E3 and as derivable from the fact that neither claim 1 nor any of the other claims of E3 is limited in that sense. Besides, said passage of E3 is specifically directed to the composition of the gas stream in the second step, as is derivable from the first sentence of that paragraph (page 3, lines 47-48) and from the reference to the "speed of the chain elongation reaction" made in said lines 51-53. Although it is also specified on page 4, line 13, of E3 that nitrogen is preferred, it has not been shown that E3 prohibits the use in the first step of a gas stream having a water content of 15-100 wt.% as indicated in

operative claim 1 and/or a gas stream having a higher dew temperature than in the second step according to the teaching of E2. Therefore, the passage on page 3, lines 51-53, of E3 does not teach away either from using in the first step a gas stream with a water content according to operative claim 1 or from combining example 2 of E3 with the teaching of E2, contrary to the respondent's argument.

In those circumstances, it was obvious for the skilled person aiming at providing a mere alternative to the process of example 2 of E3 carried out with polyamide 6 to use, in the same process as that depicted in Fig. 1 of E3, two different gas streams, e.g. dry heated steam (100% water content) and dry nitrogen (less than 10 wt.% water content) as taught in E2.

- 2.5.4 Considering that E2 explicitly discloses polyamide 6 as a suitable polyamide (see passages cited in above section 2.5.3.b), the respondent's argument that E2 was not directed to polyamide 6 cannot be sustained.
- 2.5.5 In view of the formulation of the problem as a mere alternative to E3, the fact that E2 does not deal with some of the improvements relied upon by the respondent to formulate the problem to be solved is not a good reason for the skilled person to disregard the combination of E2 with E3. Therefore, that argument did not convince.
- 2.5.6 Although the most general teaching of E2 is indeed, as argued by the respondent, to use in the first step a gas stream with a higher dew temperature than that used in the second step, it was shown in section 2.5.3 above that E2 also provides a more specific teaching regarding the water content of the gas streams. It was in

particular shown that the information given in E2 points to the preferred embodiments of using dry heated steam in the first step and dry nitrogen in the second step, i.e. to gas compositions as defined for both steps according to operative claim 1.

- 2.5.7 In the Board's mind, the question of whether or not using two gas streams having different compositions according to E2 instead of a single gas stream according to E3 would necessitate considerable modification of the installation according e.g. to Fig. 1 of E3, as argued by the respondent, does not mean, in the absence of any evidence or even argument in that respect, that it could not be achievable by the skilled person without inventive activity based e.g. on the teaching of E2. In particular, such an argument is not persuasive because it can at most be valid for modifying a pre-existing installation. Besides, it is not clear to the Board why a modification would be non-obvious merely because it is complicated to carry out, in particular when the problem to be solved merely resides in the provision of a further process to that of the closest prior art. Therefore, that argument was not retained by the Board.
- 2.5.8 For the above reasons the subject-matter of operative claim 1 is not inventive in the light of the combination of example 2 of E3 with the teaching of E2.
3. Therefore, the main request is not allowable.
4. In view of the above, there is no need to address the other objections raised by the appellant in respect either of Art. 83 EPC or of lack of inventive step over E1 as closest prior art.



Auxiliary requests 1 and 2

5. Admissibility

5.1 Auxiliary requests 1 and 2 were both filed after the Board's communication accompanying the summons to oral proceedings. Therefore, they represent an amendment to a party's case pursuant to Art. 13(1) RPBA and their admission into the proceedings is subject to the Board's discretion (Art. 13(1) RPBA) and to the terms of Art. 13(3) RPBA.

5.2 The respondent explained during the oral proceedings before the Board that both requests had been filed in reply to the Board's communication.

5.2.1 However, the respondent has not indicated which part of said communication had rendered necessary the amendments made. In that respect, the Board's preliminary opinion in respect of Art. 83 EPC was in favour of the respondent (section 5.4), and the issues identified in respect of inventive step (see e.g. choice of the closest prior art in section 6.3; relevance of E12 in section 6.6.2) had already been addressed in the first-instance proceedings and in the appellant's statement of grounds of appeal. Also, no new objection was raised *ex officio* by the Board and no new line of argument was raised by the appellant after filing the statement of grounds of appeal. Therefore, in the present circumstances of the case, it was not shown that an unexpected development of the case may have justified the late filing of either of auxiliary requests 1 or 2.

5.2.2 The Board further notes that no substantiation was provided by the respondent together with the auxiliary requests to explain why those requests might have been

suitable to remove any of the appellant's objections in respect of Art. 83 EPC and/or Art. 56 EPC. In the Board's mind, it is not appropriate, for either the Board or the appellant, to be confronted with such arguments that would be submitted for the first time during the oral proceedings. Admitting auxiliary requests 1 or 2 in such circumstances would further run counter to the terms of Art. 12(2) RPBA, according to which the statement of grounds of appeal and the reply shall contain a party's complete case.

- 5.2.3 Each of auxiliary requests 1 and 2 may further raise new issues which had not been addressed earlier in the proceedings. Regarding auxiliary request 1, a question which arises is whether or not it is possible to achieve the molecular weight now specified in claim 1 at a temperature of 130 °C in both steps, in particular when starting from any polyamide having a molecular weight according to paragraph 14 of the patent in suit. Regarding auxiliary request 2, a question that may be asked is whether the requirement now defined by the amendment made is present over the whole scope of the claims.

In the present case, both amendments are further directed to features taken out of the description and for which the appellant had no reason to assume that those specific features were in any way special, meaning that the appellant had no reason to concentrate on them. Besides, it has to be taken into account that the appellant argued that, should any of the auxiliary requests be admitted, it would have had no time to perform experiments in support of its objections related to the amendments made, which appears credible in particular in view of the new issues in relation to Art. 56 EPC and Art. 83 EPC identified above. In fairness to

the appellant, should any of auxiliary requests 1 or 2 have been admitted into the proceedings, the oral proceedings would have had to be adjourned, which runs counter to the terms of Art. 13(3) RPBA.

- 5.3 In view of the above, auxiliary requests 1 and 2 were not admitted into the proceedings pursuant to Art. 13(1) and 13(3) RPBA.

## Order

### **For these reasons it is decided that:**

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chairman:



B. ter Heijden

D. Marquis

Decision electronically authenticated