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Datasheet for the decision of 22 January 2010

Case Number: T 1146/07 - 3.3.01

Application Number: 96943716.9

Publication Number: 0874817

IPC: C07D 201/12

Language of the proceedings: EN

Title of invention:
Process for depolymerizing nylon-containing waste to form caprolactam by superheated steam in the absence of catalysts

Patentee:
AlliedSignal Inc., et al

Opponent:
Polymer Engineering GmbH

Headword:
Process for depolymerizing carpet waste/ALLIEDSIGNAL INC. and KONINKLIJKE DSM N.V.

Relevant legal provisions:
EPC Art. 123(2)(3), 84, 54, 56
RPBA Art. 13(1)(3)

Relevant legal provisions (EPC 1973):
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Keyword:
"Late filed request: admitted (no new issue raised)"
"Main request: amendments - supported by application as filed (no)"
"First auxiliary request: novelty (yes) - inventive step (yes) - non-obvious solution"

Decisions cited:

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Catchword:

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 1146/07 - 3.3.01

D E C I S I O N
of the Technical Board of Appeal 3.3.01
of 22 January 2010

Appellant: Polymer Engineering GmbH
Breitscheldstrasse 148
D-07407 Rudolstadt-Schwarza (DE)

Representative: Feldkamp, Rainer
Patentanwälte
Wallach, Koch, Dr. Haibach, Feldkamp
Postfach 20 20 40
D-80020 München (DE)

Respondent: (Patent Proprietors)
AlliedSignal Inc.
101 Columbia Road
P.O. Box 2245
Morristown NJ 07962-2245 (US)

and

Koninklijke DSM N.V.
Het Overloon 1
NL-6411 TE Heerlen (NL)

Representative: Smaggasgale, Gillian Helen
W.P. Thompson & Co
55 Drury Lane
London WC2B 5SQ (GB)

Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 15 May 2007 concerning maintenance of the European patent No. 0874817 in amended form.**

Composition of the Board:

Chairman: P. Ranguis
Members: J.-B. Ousset
C.-P. Brandt

Summary of Facts and Submissions

I. An appeal was lodged by the appellant (opponent) against the decision of the opposition division to maintain European patent No. 0 874 817 on the basis of the second auxiliary request submitted during oral proceedings before the opposition division and the corresponding amended version of the description.

II. The following document has been cited:

(1) EP-A-0 608 454

III. Claim 1 of the second request read as follows:

"1. A process for depolymerising multi-component waste material comprising polycaprolactam and non-polycaprolactam components to form caprolactam, wherein said multi-component waste material does not include waste material composed solely of scrap polycaprolactam polymeric and/or oligomeric material, said process comprising the step of:
in the absence of added acid catalyst, contacting said multi-component waste material with superheated steam at a temperature of about 250°C to about 400°C and at a pressure within the range of about 1 atm to about 100 atm and substantially less than the saturated vapor pressure of water at said temperature wherein a caprolactam-containing vapor stream is formed,
wherein the non-caprolactam components comprise at least one of jute, polypropylene, latex, calcium carbonate, clay, hydrated alumina filler, dye, soil repellent, stabiliser, dirt or up to 10% by weight of

polyethylene terephthalate with respect to polycaprolactam."

IV. The opposition division considered that the amendments carried out by the patentee (respondent) were in agreement with the requirements of Articles 123(2) (3) and 84 EPC. Novelty vis-à-vis document (1) has been acknowledged, because the starting material used in the process described in document (1) was different from the one used in the process of the patent in suit. An inventive step for the claimed subject-matter of the patent in suit was also acknowledged, since the person skilled in the art would not find in document (1) any information mentioning that the process described therein could be run in the presence of non-caprolactam components, that is to say that the process of document (1) could be performed on a multi-component waste material.

V. Annexed to the invitation to oral proceedings, the board gave the following preliminary opinion:

- The passage relied upon to justify the amendments related to carpet material, whereas the claimed process was not limited to treat carpets. Moreover, this passage was part of the background of the invention.

- The clarity of the word "dirt" will have to be discussed during oral proceedings.

- If necessary, novelty and inventive will be discussed.

VI. Oral proceedings took place on 22 January 2010 before the board.

During these proceedings, the respondent filed a set of 10 claims as an auxiliary request, whose claim 1 reads as follows:

"1. A process for depolymerising multi-component carpet waste material comprising polycaprolactam and non-polycaprolactam components to form caprolactam, wherein said multi-component waste material does not include waste material composed solely of scrap polycaprolactam polymeric and/or oligomeric material, said process comprising the step of:
in the absence of added acid catalyst, contacting said multi-component waste material with superheated steam at a temperature of about 250°C to about 400°C and at a pressure within the range of about 1 atm to about 100 atm and substantially less than the saturated vapor pressure of water at said temperature wherein a caprolactam-containing vapor stream is formed,
wherein the non-caprolactam components comprise at least one of jute, polypropylene, latex, calcium carbonate, clay, hydrated alumina filler, dye, soil repellent, stabiliser, dirt or up to 10% by weight of polyethylene terephthalate with respect to polycaprolactam."

During these proceedings the appellant filed document

(2) Superheated steam, wikipedia, the free encylcopedia, 25 November 2009.

The respondent did not object to the admissibility of this document.

VII. The arguments of the appellant in the course of the written proceedings and during the oral proceedings as far as they are relevant for the present case can be summarized as follows:

– The amendments carried out in claim 1 of the auxiliary request were not allowable given that the non-caprolactam components listed were directly related to the process involving an acidic catalysis, that the list required "the presence of at least one …" and mentioned, among others, the undefined term "dirt",

– All the features of the process defined in claim 1 of the auxiliary request were already disclosed in document (1) except that the feed was a carpet. In particular the preparative oil disclosed therein was a "dirt" and document (1) disclosed explicitly a process involving a superheated steam as confirmed by document (2). No prejudice could be seen by the person skilled in the art to use the process of document (1) in the presence of one of the components mentioned as non-caprolactam components, so that the subject-matter of claim 1 did not involve an inventive step.

VIII. The arguments of the respondent in the course of the written proceedings and during the oral proceedings as far as they are relevant for the present case can be summarized as follows:

– The detailed description of the invention made it clear that the multi-component waste material used in the claimed process may be provided as carpet material. The expression "carpet material" being defined on page 7, lines 13 to 20 of the description as originally filed. By citing different passages of the description, it was inferred that there was a clear relationship between the definition of the invention and the background to it.

– A basis for the expression "at least one of..." in claim 1 could be found in the description (paragraph spanning pages 2 and 3).

– The word "dirt" in the technical art has a well recognized meaning, especially in view of the disclosure reciting: "Waste carpet may also contain a host of other impurities, which will collectively be referred to herein as "dirt", in conjunction with the definition of the "waste carpet material". Moreover, the removal of the "preparative oil", regarded as "dirt" by the appellant required the use of sulphuric acid.

– The process of document (1) did not relate to a feed as defined in the patent in suit. Furthermore, superheated steam was required in the patent in suit whereas superheated steam would not be formed in the process described in document (1), since document (1) did not disclose any apparatus for making superheated steam. The appellant appeared to pick features from different passages of the description of document (1) and to combine them in

order to conclude a lack of novelty of the claimed subject-matter. This was not in line with the Jurisprudence of the EPO. Document (1) did not suggest that a feed containing the material listed in claim 1, known to inhibit the production of the product suitable for recycling, could or should be used. Document (1) related only the treatment of "scrap" polyamide-6, which was a clean waste contrary to the multi-component feed of the patent in suit regarded as dirty.

– Document (1) did not relate to the same problem as the one of the patent in suit. The multi-components products present in the feed of the claimed process were clearly different to the by-products formed in polyamide-6 production as described in document (1). Document (1) did not suggest that the process described therein could be applied to multi-components products such as carpets. Furthermore, the claimed process overcame the formation of caprolactam dimer during depolymerisation. Document (1) related to the formation of a polymeric material (paragraph spanning columns 1 and 2). In contrast, the claimed subject-matter aimed at the formation of monomeric material.

IX. The appellant requested that the decision under appeal be set aside and that European patent No. 0874817 be revoked.

X. The respondent requested that the appeal be dismissed or in the alternative, that the decision under appeal be set aside and the patent be maintained on the basis

of the auxiliary request (claims 1-10) as filed during the oral proceedings.

XI. At the end of the oral proceedings, the decision of the board was announced.

Reasons for the Decision

1. The appeal is admissible.

Main request

2. Added matter

2.1 The expression "...wherein the non-caprolactam components comprise at least one of jute, polypropylene, latex, calcium carbonate, clay, hydrated alumina filler, dye, soil repellent, stabiliser, dirt or up to 10% by weight of polyethylene terephthalate with respect to polycaprolactam." has been added to the granted version of claim 1.

The respondent argued that such an amendment is fully supported by the paragraphs spanning pages 2 and 3 of the application as originally filed. It also further argued that the detailed description of the invention makes it clear that the multi-component waste may be provided as carpet material (see page 7, lines 29 to 31 of the application as originally filed).

The board does not share this view. Although the passage introduced into claim 1 is mentioned in the paragraphs spanning pages 2 and 3, it however, clearly

relates to carpets (see first word of the last paragraph on page 2 of the application as originally filed). Furthermore, lines 1 to 3 on page 7 of the application as originally filed mentions, as a preferred embodiment of the invention, that the caprolactam is recovered from waste carpet material. However, such a wording does not allow concluding that the wording of claim 1 is limited to carpet waste. In view thereof and since claim 1 of the main request is not limited to carpet waste, the introduction into claim 1 of the passage cited above would also include material containing one of the constituents listed in the said added passage but not being necessarily a carpet. Such a teaching cannot be inferred directly and unambiguously from the description as originally filed.

2.2 Claim 1 of the main request thus contravenes the requirements of Article 123(2) EPC.

First auxiliary request

3. Late filed request

3.1 Facing a request, which was late filed, the board has to decide whether such a request can be admitted into the proceedings in view of the requirements set out in Article 13(1) and (3) of the RPBA.

3.2 The appellant argued that this request was late filed and that such a request could have been filed previously, e.g. with the respondent's response to the annex to oral proceedings set by the board and requested therefore that this request not be admitted by the board.

3.3 Although the appellant's assertion, as to the late filing of the first auxiliary request, is correct, it remains that the amendment carried out by the respondent (adding of the word "carpet") was made in order to overcome the reason for which the main request was assessed not to be allowable by the board. Moreover, the adding of the word "carpet" into claim 1 cannot be regarded as a complex amendment. Furthermore, the board is convinced that this amendment does not raise any new unexpected issue, since dependent claim 3 as granted, whose wording is identical to claim 3 of the first auxiliary request, unambiguously refers to waste caprolactam carpet. Hence, the limitation of the claimed scope to carpets does not constitute a new and unexpected subject-matter requiring the postponement of the oral proceedings.

3.4 As a consequence, the board admits this late filed request into the proceedings.

4. Amendments

4.1 With respect to claim 1:

The feature "A process for depolymerizing multi-component carpet waste material comprising polycaprolactam and non-polycaprolactam components to form caprolactam" finds an unambiguous basis in claim 1 as filed and on page 7, lines 1-3. Indeed, nylon-6 is polycaprolactam and the term non-nylon-6 is identical to non-polycaprolactam components.

The feature "wherein said multi-component … and/or oligomeric component" finds support on page 6, lines 11-13.

The feature "in the absence of … is formed" is recited in claim 1 as filed".

The added feature "wherein the non-caprolactam … with respect to polycaprolactam", was contested on the basis of two grounds by the appellant:

The definition of the impurities which may be present in a carpet is found in the preamble of the description and moreover **in direct relationship** with the process defined in the further paragraph related to a process involving an acidic catalyst. Furthermore, the expression "at least one" has no basis in the description.

However, the definition of the impurities present in a carpet such as set out in the bridging paragraph of pages 2-3 has no link with the subsequent paragraph related to the process involving an acidic catalyst.

Moreover, although the definition of the impurities can be found in the preamble of the invention, this matter is not insuperable if the person skilled in the art can unambiguously derive from the description as a whole that the information present in the preamble apply to the claimed invention. This is the case here since the application as originally filed discloses that "a preferred embodiment is the recovery of caprolactam from waste carpet material that includes nylon-6 face fiber and non-nylon 6 components" (see page 7, lines 1-

3). The definition of the carpet given in the preamble applies directly to the term "carpet" of the preferred embodiment cited above and claim 1 reflects this clear and unambiguous relationship.

Regarding the feature "at least one", it is to be noted that the description indicates that the carpets "may" include jute … (see page 2, line 25). This term "may" means of course that one or several impurities can be included but also that no impurity is present. However, it is unambiguously derivable from the application as filed that the process is **directed** to the depolymerizing nylon-**containing waste**. An impurity is necessarily present and the term "include" can only be understood if "at least one" impurity is present. The term "at least one" derives, therefore, unambiguously from the description as originally filed.

The subject-matter of claim 1 derives directly and unambiguously from the application as originally filed.

4.2 Claims 2 to 10 are identical to claims 2 to 10 as originally filed.

4.3 Furthermore, such an amendment limits the scope of the patent as granted.

4.4 The requirements of Articles 123(2) and (3) EPC are thus met.

5. Clarity

5.1 The passage added into claim 1 contains the word "dirt". It has to be assessed whether such a word has a clear meaning in the context of the invention.

5.2 The appellant pointed out that this word is not clear, since there is nothing in the description as originally filed describing what it is meant by "dirt" in the context of the invention.

5.3 It is true that the word "dirt" is not given a specific meaning in the description as originally filed. In its preliminary opinion (see paragraph V above), the board had pointed out that the term "dirt" might not be clear. However, this objection had been raised in conjunction with the undefined feed mentioned in claim 1 of the main request, namely "multi-component waste material".

5.4 By contrast, the board has no reason to doubt that in the technical field of the carpets, the term "dirt" has a well recognized meaning. In that respect, the board notes that the preparation oil can be present when manufacturing the fiber (see document (1)), this oil is removed (see document (1)) before the said fiber is further used to make carpets.

5.5 The board concludes that the amendments carried out do not render claim 1 unclear. The requirements of Article 84 EPC are fulfilled.

6. Novelty

6.1 Novelty has not been disputed by the appellant and the board is also convinced that the claimed subject-matter

is novel vis-à-vis the disclosure of document (1) (Article 54 EPC).

7. Inventive step

7.1 Document (1) describes a process for the depolymerisation and reprocessing of material consisting of polyamide-6 waste and/or oligomer-containing polyamide-6 waste and/or oligomer-containing lactam residue and/or oligomer-containing lactam by hydrolysis in a pressurized reactor with the addition of water, wherein the material is melted and the melt is maintained continuously at a predetermined temperature and conveyed through the pressurized reactor, the internal pressure of which is regulated by the metered supply of water or water vapor (see col. 1, lines 1-4 and Claim 1). Preferably, the material is brought in the pressurized reactor at a temperature from 230°C to 290°C to a uniformly low degree of polymerization with a solution viscosity of more than 1.5 (see col. 2, lines 24-27). In order to save energy, the temperature of the water or water vapor is raised by a heat exchanger beyond the melting point of the polyamid-6 (see col. 4, lines 22-27). The examples 1 to 3 and 5 disclose specific embodiments. In example 1, the waste falling during the spinning of the polyamide silk is melt in an extruder, where a preparative oil in the double scroll extruder, which attaches the waste, is removed during the melting process (see col. 6, lines 18-22). Steam is introduced into the reactor under a pressure of 9.5 bar. After three hours at a temperature of 280°C, the polymer obtained contains around 10% of monomer (water soluble extract).

Example 7 discloses the reprocessing of polyamid-6 and -66 waste material.

7.2 At issue was the question whether or not the process according to document (1) made use of superheated steam. The appellant argued that superheated steam was, as per its definition, steam above its vaporization temperature. Several possibilities for providing steam were indicated in col. 4, lines 10 to 31 of document (1), and a heat exchanger was mentioned as one possibility, so that also superheated steam might be used. In support of its contention, document (2) was provided during oral proceedings. The respondent agreed that this document represented a correct definition of the so called "superheated steam". Therefore, although late-filed and post published the board has no reason not to admit this into the proceedings as common general knowledge.

7.3 The respondent argued that superheated steam would not be formed in any of the arrangements described in document (1). It is necessary in order to form superheated steam to expose saturated steam to surfaces with a higher temperature to bring the temperature of the steam above its evaporating temperature. The saturated seam must be passed through an additional heat exchanger. This may be a second heat exchange stage in the boiler or a separate superheating unit. It was not indicated in example 1 that no liquid water was present.

7.4 Document (2) teaches that superheated steam is steam at a temperature higher than water's boiling point. However, to produce superheated steam in a power plant

or for processes (such as drying paper) the saturated steam, from the steam drum, is passed through a super heater. The superheating unit may be radiant, convection or separately fired.

7.5 In the board's judgment, the answer to the question is not clear cut. Indeed, it is not clear that the conditions prevailing in the process of document (1) mentioned above (… Steam is introduced into the reactor under a pressure of 9.5 bar. After three hours at a temperature of 280°C,) necessarily produces superheated steam because the heat exchanger through which the water or steam flows is not unambiguously described as a superheating unit. According to document (2) the superheating unit may be radiant, convection or separately fired. This information cannot be found in document (1). Furthermore, as pointed out by the respondent, it does not appear from document (1) that liquid water does not condense in the reactor, which condition being required by the term "superheated steam" in claim 1 (see claim 1: " … superheated steam at a temperature of about 250°C to 400°C and at a pressure within the range of about 1 atm to about 100 atm and substantially less than the saturated vapor of water at said temperature …" in conjunction with the description, page 13, lines 12-15 : "However, the pressure should be substantially less than the saturation vapor pressure of water under operating temperature to ensure that liquid water does not condense in the reactor" or "Therefore, it is clear that in the current process, no liquid aqueous phase is present", page 11, lines 16-17).

7.6 In conclusion, the claimed subject-matter differs from the process of document (1) at least by the fact that said process does not describe a process for the depolymerisation of carpet waste material comprising polycaprolactam and non-polycaprolactam "wherein the non-polycaprolactam components comprise at least one of jute, polypropylene, latex, calcium carbonate, clay, hydrated alumina filler, dye, soil repellant, stabilizer, dirt or up to 10% by weight of polyethylene terephthalate with respect to polycaprolactam" and involving superheated steam (see claim 1).

7.7 According to the Jurisprudence of the Boards of Appeal, in selecting the closest prior art, the first consideration is that it must be directed to the same purpose of effect as the invention (see Case law of the Boards of Appeal, 5th Ed., I. D. 3.2). This is clearly not the case of document (1) the sole document submitted in the opposition/appeal proceedings since this document does not aim at depolymerizing multi-component carpet waste material comprising polycaprolactam and non-polycaprolactam as defined in claim 1.

7.8 Furthermore, it had to be considered that an objective definition of the problem to be solved by the invention should normally start from the problem described in the contested patent. Only if examination showed that the problem disclosed had not been solved of if inappropriate prior art were used to defined the problem, was it necessary to investigate which other problems objectively existed (see Case law of the Boards of Appeal, 5th Ed., I. D. 4.3.2).

7.9 In view of document (1) the board has no reason to depart from the technical problem as defined in the patent. According to the patent in suit, the technical problem is to propose a method for the **recovery of caprolactam** from multi-component carpet that includes nylon-6 and non-nylon-6 components. The non-nylon-6 components interfere with caprolactam recovery. For example, alkaline components, such as calcium carbonate filler, neutralize acidic catalysts, such as phosphoric acid, that are conventionally used to promote nylon 6 depolymerization, thus requiring the use of increased amounts of catalysts. Furthermore, polypropylene and latex partially decompose to a mixture of hydrocarbons that co-distill with caprolactam. The remaining, partially decomposed, non-distilled portion, along with the filler and other inorganic components, renders the reaction mixture very viscous and difficult to process in conventional equipment.

7.10 Examples 1, 3 to 8 show that a yield of caprolactam between 87% and 95% can be obtained based on nylon present in the carpet in the conditions of temperature and pressure falling in the ranges defined in claim 1. The board is, therefore, satisfied that the technical problem defined in the patent in suit is solved.

7.11 No document in the prior art mentions a process for depolymerizing multi-component carpet waste material comprising polycaprolactam and non-polycaprolactam as defined in claim 1.

7.12 In contrast, the waste material feed of the method of document (1) is formed as a by-product in polyamide-6 production. Document (1) neither teaches nor suggests

that the process disclosed therein could be applied to multi-components products such as carpets. Furthermore, there is no teaching in document (1) to suppress the production of caprolactam dimer during the nylon-6 depolymerisation. On the contrary, document (1) states that the object of the invention discloses therein is to provide **polymeric material** (see col. 1 and 2, bridging paragraph), whereas the technical problem to be solved of the present invention is to provide **monomeric material**.

7.13 Therefore, the person skilled in the art seeking to solve the technical problem mentioned above would not have arrived in view of document (1) without inventive ingenuity at the solution defined in claim 1.

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 auxiliary request (claims 1 -10) filed at the oral proceedings and after any necessary consequential amendment of the description.

The Registrar The Chairman

B. Atienza Vivancos P. Ranguis