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D E C I S I O N
of 20 February 2002

Case Number: T 0690/00 - 3.3.3

Application Number: 93910596.1

Publication Number: 0636149

IPC: C08F 8/14

Language of the proceedings: EN

Title of invention:
Crosslinked hydrophilic resins and method of preparation

Patentee:
THE DOW CHEMICAL COMPANY

Opponent:
Stockhausen GmbH & Co.KG

Headword:
-

Relevant legal provisions:
EPC Art. 114(2), 84, 83, 54, 56

Keyword:
"Late submitted material - document admitted (no)"
"Claims - clarity (yes)"
"Disclosure - sufficiency (yes)"
"Novelty (yes)"
"Inventive step - improved balance of properties"

Decisions cited:
G 0009/91, G 0010/91, T 0124/87, T 0301/87, T 1002/92, T 0877/99, T 0819/00

Catchword:

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0690/00 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 20 February 2002

Appellant: (Opponent)
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Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 25 May 2000 concerning maintenance of European patent No. 0 636 149 in amended form.**

Composition of the Board:

Chairman: R. Young
Members: W. Sieber
J. De Preter

Summary of Facts and Submissions

I. The mention of the grant of European patent No. 0 636 149, with 11 claims, in respect of European patent application No. 93 910 596.1, which had been filed on 14 April 1993 as PCT/US93/03489, claiming a GB priority of 16 April 1992 (GB 9208449), was published on 15 May 1996 (Bulletin 1996/20). Claim 1 read as follows:

"1. A crosslinked hydrophilic resin comprising a carboxyl-containing hydrophilic resin crosslinked with a compound of the formula

$$R^1\text{-}(O(CH(R^3)CH(R^3)O)_YC(O)\text{-}R^2)_X$$

wherein

each R^1 is independently a polyvalent $C_{2\text{-}10}$ straight- or branched-chain alkyl moiety;
each R^2 is independently a $C_{2\text{-}10}$ straight- or branched-chain alkenyl moiety;
each R^3 is independently hydrogen or methyl;
each x is independently 2 or more; and

when x is 2, each y is independently from 3 to 8; and when x is 3 or more, each y is independently from 2 to 7."

Claims 2 to 6 were dependent claims directed to elaborations of the resin according to Claim 1. In particular, Claim 6 read as follows:

"6. A resin as claimed in any one of Claims 1 to 5 which exhibits a centrifuge capacity of 25 g/g or greater, an absorption under load of 25 g/g or greater

and a ratio of absorption under load over centrifuge capacity of 0.6 or greater."

Claim 7, an independent claim, was directed to a process for the preparation of a crosslinked hydrophilic resin according to any one of Claims 1 to 6, involving the use, *inter alia*, of the crosslinking agent according to Claim 1.

Claims 8 to 10 were dependent claims directed to elaborations of the process according to Claim 7. In particular, Claims 9 and 10 referred to heating the crosslinked hydrophilic resin particles under conditions such that the crosslinked hydrophilic resin exhibited the features of Claim 6.

Claim 11, an independent claim, was directed to an absorbent structure comprising a support structure and crosslinked hydrophilic resin particles according to one of Claims 1 to 6.

II. A notice of opposition was filed on 14 February 1997, by the opponent Stockhausen GmbH & Co. KG, on the grounds of Article 100(a) EPC, ie lack of novelty and lack of inventive step, and on the grounds of Article 100(b) EPC, ie insufficiency of disclosure. The opposition was supported *inter alia* by the following documents:

D1: EP-A-0 372 981;

D2: EP-A-0 370 646;

D3: EP-A-0 317 106;

D4: EP-A-0 238 050;

D5: DE-C-40 20 780; and

D6: EP-B-0 242 478.

III. By an interlocutory decision which was announced orally on 30 March 2000 and issued in writing on 25 May 2000, the opposition division decided that the patent could be maintained in amended form, on the basis of a set of Claims 1 to 11 filed on 30 March 2000 at the oral proceedings.

Independent Claims 1 and 7 of this set differed from the corresponding granted claims in that, in the formula, the number of carbon atoms of R^1 had been limited to 3 to 6 and R^3 had been limited to hydrogen. In addition, the dependency in Claim 7 was amended to "... according to any one of claims 1 to **5**" (amendment in bold type). A minor amendment of an editorial nature was made in dependent Claim 3, necessitated by the amendment of Claim 1. The remaining claims were identical with the corresponding granted claims.

According to the decision, the subject-matter defined in these claims met the requirements of Articles 123, 83, 84, 54 and 56 EPC.

IV. A notice of appeal against the above decision was filed by the opponent (appellant) on 6 July 2000, the prescribed fee being recorded as paid on the same day.

In the statement of grounds of appeal, filed on 2 October 2000, the appellant argued in substance as follows:

(a) Claims 1 and 7 were unclear (Article 84 EPC) since R^1 was defined as an polyvalent alkyl moiety which was a contradiction in terms. Furthermore, the wording "... wherein the crosslinking agent is present in an amount of ..." in Claim 4 was objected to as being unclear since the wording referred to an unreacted monomer component whereas Claim 4 was directed to a resin. The appellant considered it allowable to raise these clarity objections in the opposition appeal procedure because the decision under appeal was based on an amended set of claims.

(b) The subject-matter of Claims 6, 9 and 10 was objected to for insufficiency of disclosure with the arguments that (i) the method of measurement of the centrifuge capacity was not sufficiently disclosed in the patent in suit, and that (ii) the process features described in Claims 9 and 10 did not always yield a minimum value of 0.6 for the ratio of absorption under load to centrifuge capacity as required in Claims 6, 9 and 10. Comparative tests were filed to substantiate the latter objection.

(c) The subject-matter of Claim 1 was not novel over D4. This document related to crosslinked water-absorbing polymers and disclosed a list of equivalent crosslinking agents where adducts of ethylene oxide with trimethylol propane which had been triesterified with acrylic acid or methacrylic acid were explicitly mentioned. Although the number of ethylene oxide units was not specified, the general class of crosslinking agents of D4 embraced the crosslinking agents

required in Claim 1. Therefore, following decision T 124/87, the subject-matter of Claim 1 was not novel. Nor could the claimed subject-matter be considered as a selection invention over D4 because the selected range, ie the number of ethylene units in the crosslinking agent, was not narrow and the range was merely an arbitrary selection without any surprising technical effect.

(d) Even if novelty were acknowledged, nothing inventive could be seen in the subject-matter of Claim 1. The only difference of the claimed subject-matter over the prior art was the use of a crosslinking agent where R^1 was a polyvalent C_{3-6}-straight- or branched-chain hydrocarbon moiety instead of R^1 being a C_2-hydrocarbon moiety as in the prior art, eg Examples 7, 8 and 16 of D1. No unexpected technical effect was associated with this difference so that the technical problem could only be seen in the provision of further crosslinked hydrophilic resins. The slight modification of R^1 was, however, trivial for a person skilled in the art.

V. The proprietor (respondent) disagreed, in a submission filed on 8 February 2001, with the objections of the appellant, and argued in essence as follows:

(a) According to established case law in the EPO, objections under Article 84 EPC could only be considered in opposition proceedings if such objections arose out of the amendments made during the opposition procedure. Since, however, the objected unclarities, if any, were already present in the granted claims, the appellant's objections

in this respect were inadmissible. Apart from that, these objections were not justified.

(b) Although the grounds for opposition under Article 100(b) EPC had been brought forward in the initial letter of opposition, objections under Article 83 EPC against present Claims 6, 9 and 10 had never been raised before. Thus, these objections at least contravened the principles of the decisions G 9/91 and G 10/91 and should be rejected as inadmissible. Apart from that, the objections under Article 100(b) EPC were not founded at all because (i) there was no need to define every detail of a measuring method for a well known property of an absorbent, ie the centrifuge capacity, that itself was familiar to a person skilled in the art, and (ii) the experimental data of the patent in suit clearly demonstrated that, under specific conditions, the preferred resins having the properties as defined in Claim 6 could be prepared via the process steps described in Claims 9 and/or 10.

(c) As regards the novelty objection in view of D4, numerous selections had to be made from the general disclosure of D4 to arrive at the adducts of ethylene oxide with trimethylol propane which had been triesterified with (meth)acrylic acid. Additionally, D4 was completely silent with respect to the number of ethylene oxide units whereas the subject-matter of Claim 1 was restricted to a specific number thereof.

(d) Starting from D4 as the closest prior art, the object of the patent in suit was to provide a

superabsorbent polymer having improved absorption under load, reduced extractable percentage and at the same time high centrifuge capacity. The optimal balance of properties of the claimed resins was demonstrated in the figures in the patent in suit. None of the cited prior art documents gave any hint to select a specific crosslinker as defined in the claims to achieve these advantages.

VI. In a communication dated 20 November 2002 accompanying a summons to oral proceedings, the salient issues were identified by the board as being, firstly, whether the determination of centrifuge capacity, in particular with respect to the use of a blank, was sufficiently disclosed, and secondly, whether the claimed subject-matter was novel and inventive in view of the cited documents, in particular in view of D4.

VII. In a letter filed on 20 January 2003, the appellant went more deeply into the issue of raising objections under Article 84 EPC against claims which had been amended in opposition and opposition appeal proceedings culminating in an auxiliary request to refer three questions relating to this issue to the Enlarged Board of Appeal. During the oral proceedings, however, the auxiliary request was withdrawn (see point XI).

Documents D12 and D13 were submitted to support the lack of clarity objection:

D12: K.P.C. Vollhardt, "Organische Chemie", 1. korrigierter Nachdruck, 1990, of the 1st Edition, 1988, VCH, page 41; and

D13: Römpp, "Lexikon der Chemie", 10th fully revised edition, 1996, Georg Thieme Verlag, page 116.

As to inventive step, the appellant presented a new line of argumentation based on a document D14 submitted with this letter:

D14: US-A-US-A-4 459 396.

To support the objection under Article 83 EPC, the appellant filed comparative tests with tea bags made of different types of filter paper. Further information and documents concerning the filter paper used in these tests were submitted on 27 and 31 January 2003:

D15: "Specification" of filtering material;

D16: "Chemical composition filtering material"; and

D17: "Description filtration bag".

VIII. In a submission filed on 20 January 2003, the respondent argued that the method of measurement for centrifuge capacity, including the use of a blank, was a well-known and standard method in the superabsorbent industry at the filing date of the opposed patent. To support this argumentation, the respondent referred to D4 and filed the following documents:

D18: EP-A-0 372 706;

D19: DE-A-41 27 814;

D20: WO-A-91/18031;

D21: EP-A-0 532 002;

D22: US-A-5 149 335; and

D23: WO-A-92/18171.

IX. A further set of 11 claims forming an auxiliary request was filed by the respondent on 12 February 2003 where, in comparison with the claims of the main request, x in the formula of Claims 1 and 7 was restricted to 3 or more. In addition, the dependency in Claim 7 was amended to "... according to any one of Claims 1 to **6**" (amendment in bold type). Claims 2 to 6 and 8 to 11 corresponded to those of the main request.

X. Finally, in a submission of 19 February 2003, the appellant provided a list of the documents cited in the proceedings, ie D1 to D23.

XI. Oral proceedings were held on 20 February 2003.

At the oral proceedings, issues relating to clarity, sufficiency of disclosure and novelty were discussed, all of them already submitted in writing. Following the discussion of clarity, the appellant withdrew its auxiliary request to refer three questions to the Enlarged Board of Appeal (see point VII, above).

In its assessment of inventive step, the appellant started from D4 as the closest prior art, and in particular from a hydrophilic resin crosslinked with trimethylol propane triacrylate. As the closest prior art provided all the technical effects that the claimed subject-matter provided (in this context, reference was made to Table A submitted on 31 January 2000 during the

opposition proceedings), the problem to be solved could only be seen in the provision of further crosslinked hydrophilic resins. However, nothing inventive could be seen in the use of a crosslinking agent already generically disclosed in D4. In reply, the respondent highlighted the importance of the balance of centrifuge capacity and absorption under load in crosslinked hydrophilic reins. As demonstrated by the data in the patent specification, and in particular by the figures therein, the use of a crosslinking agent as specified in Claim 1 of the main request led to an improved balance of these properties. Since none of the documents contained a hint in this respect, the claimed subject-matter was based on an inventive step.

Since the appellant could not show that the late filed document D14 was more relevant than the documents on file, the board decided that D14 should not be admitted into the proceedings.

XII. The appellant requested that the decision under appeal be set aside and that the European patent No. 0 636 149 be revoked.

The respondent requested that

- the appeal be dismissed and that the patent be maintained on the basis of claims 1 to 11 underlying the decision under appeal (main request), or in the alternative,

- the patent be maintained on the basis of the auxiliary claim set (claims 1 to 11) submitted on 12 February 2003.

Reasons for the Decision

1. The appeal is admissible.

2. *Late filed submissions*

2.1 The disclosure of document D14, referred to in the letter filed on 20 January 2003 for the first time, goes beyond the factual framework of the proceedings thus far. The appellant did not advance any specific circumstances which could excuse the delay in producing D14. Furthermore, it is established case law that late filed evidence should only very exceptionally be admitted into the proceedings at the appeal stage if its content is *prima facie* so highly relevant to prejudice the maintenance of the patent in suit (see eg T 1002/92, OJ EPO 1995, 605, point 3.4 of the reasons). The appellant could not, however, demonstrate at the oral proceedings that D14 was more relevant than the documents in the proceedings up to then, in particular more relevant than D1. Consequently, the board decided that D14 should not be admitted into the proceedings (Article 114(2) EPC).

2.2 As regards the other late filed documents, ie D12, D13, and D15 to D17 (all filed by the appellant) and D18 to D23 (all filed by the respondent), none of the parties relied on those documents during the oral proceedings nor was there a specific request to introduce them into the proceedings which would have made it necessary for the board to decide on this issue. Therefore, those documents are disregarded.

3. *Amendments (main request)*

According to the decision under appeal, the subject-matter of the amended claims meets the requirements of Article 123 EPC (point 2 of the reasons for the decision). The board sees no reason to depart from that view. Nor was any objection under Article 123 EPC raised by the appellant against the amendments.

4. *Clarity (main request)*

4.1 According to established jurisprudence of the boards of appeal, Article 102(3) EPC does not allow objections to be based upon Article 84 EPC if such objections do not arise out of the amendments made in opposition or opposition appeal proceedings (see eg T 301/87, OJ EPO, 1990, 335, point 3.8 of the reasons; G 9/91, OJ EPO, 1993, 408, point 19 of the reasons; T 877/99, 31 July 2001, point 6.1 of the reasons and T 819/00, 9 December 2002, point 3.1 of the reasons; the latter two decisions not published in the OJ EPO).

In the present case, the appellant argued that Claims 1 and 7 were not clear for the reason that R^1 was defined as an "alkyl" moiety although it contained two or more substituents (x is two or more) which was a contradiction in terms. However, the objected terminology was already in granted Claims 1 and 7, and has not been amended. Thus, the clarity objection does not arise out of an amendment made, and the appellant's objection under Article 84 EPC against these claims is in the light of the above cited case law not admissible.

4.2 Having regard to Claim 4, the appellant objected against the wording "... wherein the crosslinking agent is present in an amount of ..." as being unclear.

Apparently, that wording referred to an unreacted monomer component whereas Claim 4 as such was directed to a resin. However, Claim 4 corresponds exactly to granted Claim 4 and has not been amended at all. For the reasons given in point 4.1 above, it is not admissible to raise a clarity objection against granted Claim 4 which is not affected by an amendment at all.

4.3 Apart from that, it is considered that a person skilled in the art would have no difficulty in interpreting the meaning of Claims 1 and 7. Although it is true that the term "alkyl" according to IUPAC nomenclature stands for a monovalent aliphatic saturated hydrocarbon moiety, it is clear from the formula given in Claims 1 and 7, ie x is two or more, as well as from the requirement that R^1 is a polyvalent moiety, that "alkyl" in the sense of Claims 1 and 7 should stand for a polyvalent aliphatic hydrocarbon moiety. This interpretation is supported by the granted patent specification where it is stated on page 4, line 20 that "R^1 is preferably a polyvalent C_{3-6} straight- or branched-chain hydrocarbon". Thus, a person skilled in the art has no difficulty in construing the true meaning of Claims 1 and 7.

The same applies to the objections with respect to Claim 4. A person skilled in the art considering the specification as a whole would inevitably come to the conclusion that Claim 4 refers to the amount of crosslinking agent moieties introduced into the resin by crosslinking.

5. *Sufficiency of disclosure (main request)*

5.1 The subject-matter of Claims 6, 9 and 10 was objected for insufficiency of disclosure with the arguments

that (i) the method of measurement of the centrifuge capacity was not sufficiently disclosed in the patent in suit, and that (ii) the process features described in Claims 9 and 10 did not always yield a minimum value of 0.6 for the ratio of absorption under load to centrifuge capacity as required in Claims 6, 9 and 10.

5.2 The respondent requested to reject these objections as inadmissible since the claims of the main request were identical with the claims of the decision under appeal, and the appellant (opponent) had raised no objection under Article 100(b) EPC against these claims during the oral proceedings at first instance. However, notice of opposition had been filed *inter alia* on the grounds of Article 100(b) EPC and the appealed decision found that the amended claims met the requirements of Article 83 EPC. Consequently, Article 100(b) EPC is not a new ground of opposition in the sense of G 9/91 and G 10/91 (OJ EPO, 1993, 408 and 420) relied upon by the respondent. The objections are admissible.

5.3 From the very beginning of the appeal proceedings, the appellant challenged sufficiency of disclosure of the parameter "centrifuge capacity" on the basis of insufficient description of the measuring method for this parameter.

5.3.1 The measurement of the absorbency capacity of a superabsorbent polymer by means of the centrifuge capacity is described on page 7, lines 54 to 57 of the patent specification. Thereby a defined mass of polymer particles is allowed to swell inside a tea bag which is dipped into a saline solution. After swelling for a given time, the excess of water is removed by centrifuging the entire bag containing the polymer gel.

The weight ratio of saline solution absorbed to water-absorbent resin particles is the centrifuge capacity (CC).

5.3.2 By this method, not all of the excess water is separated so that some water remains in the tissue material of the tea bag. Usually, a spare empty tea bag is treated in the same way to create a blank value. However, as pointed out by the appellant, the patent in suit does not describe the use of a "blank" in the determination of the centrifuge capacity. Therefore, it is not clear whether or not a "blank" had to be used in the measurement of the centrifuge capacity.

5.3.3 The appellant has never questioned whether the method of measurement disclosed in the patent in suit can be carried out with or without a "blank". The gist of its arguments aims rather at the problem of how the presence of absence of a "blank" influences the values for CC.

The board is satisfied that in the present case the lack of indication of a "blank" is not detrimental to the sufficiency of the disclosure of the method but could raise a clarity problem with the consequence that the particular value for CC in Claims 6 and 9 might have to be interpreted in a broad manner or, in other words, any value obtained by the described centrifuge capacity method which falls within the claimed range of 0.6 or greater, regardless of whether a "blank" was used or not, might be held to anticipate the claimed range. However, such a clarity problem, if any, was present in the granted claims and is, for the reasons given in point 4 above, not open to objection under Article 84 EPC.

5.3.4 Even if it were assumed, in favour of the appellant, that the missing indication of a "blank" does not amount to a mere clarity problem but has to be considered under Article 83 EPC, such an objection does not succeed for the following reasons. As stated on page 7, line 50 of the patent in suit, "performance and quality of the crosslinked hydrophilic resins prepared are measured by the following methods", one of these methods being centrifuge capacity. Thus, the interest is in the very nature of the polymer particles. This fact embraces the concept of having a "blank" in the measurement of centrifuge capacity in order to exclude any influence not attributable to the polymer particles, such as the amount of water remaining in the tea bag or the type of the paper used for the tea bag. Without using a "blank", one cannot arrive at a value being representative for the performance and quality of the polymer particles themselves.

5.3.5 In view of the above, the board comes to the conclusion that a person skilled in the art would inevitably employ a "blank" when measuring the centrifuge capacity in the present case. Therefore, the lack of indication of a "blank" in the patent specification in suit neither leads to a clarity objection as regards the values for CC in Claims 6 and 9 nor to insufficiency of disclosure as regards the method of measurement for centrifuge capacity.

5.4 As regards the appellant's second objection in the written proceedings, namely that the process features described in Claims 9 and 10 did not always yield a minimum value of 0.6 for the ratio of absorption under load (AUL) to centrifuge capacity (CC) as required in Claims 6, 9 and 10, this objection was not pursued in

the oral proceedings.

5.4.1 Objected Claim 9 requires to heat the crosslinked hydrophilic resin particles under conditions such that the hydrophilic resin exhibits *inter alia* a ratio of AUL/CC of 0.6 or greater. Furthermore, Claim 10 that is dependent upon Claim 9 defines heating temperature (170 to 250°C) and heating time (1 to 6 minutes) to exemplify the heat treatment mentioned in Claim 9.

5.4.2 Apparently, the appellant took the view that any possible combination of temperature and time from the two ranges in Claim 10 should yield a ratio of AUL/CC of 0.6 or greater. The board can, however, not share this view for the following reason: Firstly, this view ignores the fact that Claim 10 is dependent upon Claim 9 and the prerequisite of Claim 9 is that such process conditions have to be chosen so that the desired result is achieved. Secondly, temperature and heating time in a post-heat treatment are normally not independent of each other, and it is not possible freely to select from the two ranges. Thus, a lowering of the temperature on the one hand necessitates a raising of the heating time on the other in order to achieve the desired result and *vice versa*. Thirdly, the conditions for the post-heat treatment vary from one resin to another. A specific combination of temperature and heating time suitable for one resin might not be suitable for another.

5.4.3 This view is supported by the data in the patent in suit and the comparative tests filed by the appellant with the statement of grounds of appeal. Table 2 in the patent in suit shows the data of a particular crosslinked hydrophilic resin, ie Resin B, that is

post-heat treated for 20 minutes at various temperatures. A temperature of 180°C (Example 24), 190°C (Example 26) or 200°C (Example 28) is not enough to reach the preferred value of AUL/CC of at least 0.6. In fact, that particular Resin B has to be heated to at least 210°C for 20 minutes in order to achieve such a ratio (Examples 30, 32 and 34).

The same correlation between temperature and heating time and, in addition, the influence of the nature of the resin itself is apparent from the comparative tests filed by the appellant. According to these tests, polyacrylic acid having a crosslinker level of 3500 ppm requires a post-heat treatment of at least 30 minutes at 200°C in order to reach a ratio of AUL/CC of 0.63. Increasing the amount of crosslinking agent in the polyacrylic acid to 6500 ppm and 8000 ppm, respectively, reduces the temperature and/or the heating time necessary to reach the desired result. Thus, at a crosslinker level of 6500 ppm, a ratio of AUL/CC of at least 0.60 is reached when the resin is heated to 180°C for 45 minutes, or to 190°C for 30 minutes.

5.4.4 Hence, the objection that there exist combinations of temperature and heating time within the two ranges indicated in Claim 10 which do not yield the desired result is not an indication of lack of sufficiency. It is rather due to a misinterpretation and/or a misunderstanding of the relevant claims.

5.5 Summing up, Claims 6, 9 and 10 meet the requirement of sufficiency.

6. *Novelty (main request)*

6.1 The only document cited by the appellant as being relevant for the question of novelty is D4. This document relates to a process for the batchwise preparation of a crosslinked, finely divided, water-absorbing polymer, which comprises multistage copolymerization in a batchwise mixing apparatus of a monomer selected from group (a), optionally in admixture with water-soluble and/or water-insoluble monoethylenically unsaturated monomers. The monomers of group (a) are acrylic acid or methacrylic acid, each of which has been neutralized with from 0 to 100 mol% of an alkali metal or ammonium base, acrylamide, methacrylamide and N-vinylpyrrolidone (Claim 1). In column 3, line 49 to column 4, line 12 various crosslinking agents are listed, *inter alia* adducts of ethylene oxide with trimethylol propane which had been triesterified with acrylic acid or methacrylic acid. The number of ethylene oxide units in these adducts is, however, not specified in D4.

6.1.1 In order to arrive at something falling within the scope of Claim 1, one would have to make the following selections from the general disclosure of D4: (i) a carboxyl-containing monomer from group (a), (ii) the adduct of ethylene oxide with trimethylol propane which has been triesterified with acrylic acid or methacrylic acid from the list of crosslinking agents, and (iii) a specific number of ethylene oxide units in such a crosslinking agent.

6.1.2 In such a situation, where the selection from various possibilities disclosed in the prior art is to be considered, a careful comparison has to be carried out

whether such a "multiple selection" or "combined selection" was available as such to the skilled person from a particular piece of prior art.

6.1.3 Although acrylic acid is the preferred monomer in D4 (see eg column 2, lines 48 to 51), the adduct of ethylene oxide with trimethylol propane which has been triesterified with acrylic acid or methacrylic acid is merely a member of a list in D4. Thus, quite apart from the fact that the number of ethylene oxide units in the adduct is not disclosed at all, the **combination** of acrylic acid and adduct is not made available to the skilled person from the general disclosure of D4.

6.1.4 Furthermore, none of the examples of D4 discloses the combination of features required in Claim 1 of the main request. Although Examples 1 to 3 use acrylic acid as the major monomer component, the crosslinking agents are N,N'-methylenebisacrylamide (Example 1), butanediol divinyl ether (Example 2) and divinylbenzene (Example 3), all of them being outside the scope of Claim 1.

6.2 The appellant's novelty objections focussed **only** on the number of ethylene oxide units and took the combination of monomer and crosslinking agent for granted, which was, as shown in the above novelty assessment, not justified. Therefore, the questions regarded by the appellant as decisive in the present case, namely whether the general class of crosslinking agents of D4 discloses already the specific crosslinking agents required in Claim 1 (in analogy to T 124/87 (OJ EPO, 1989, 491)), or whether the selection of a certain number of ethylene oxide units is an arbitrary selection, do not arise. Consequently, appellant's

novelty objections in this respect must fail.

6.3 Summing up, the combination of features required in Claim 1 was neither made available from the general disclosure of D4 nor from a specific example in D4. Consequently, the subject-matter of Claim 1 and, by the same token, of Claims 2 to 11, is novel within the meaning of Article 54 EPC.

7. *Problem and solution*

7.1 The patent in suit is concerned in general terms with crosslinked hydrophilic resins (also referred to as superabsorbent polymers) which are primarily used in personal care products which absorb body fluids (page 2, lines 3 to 6 of the granted specification).

7.2 Superabsorbents are known *inter alia* from D1 and D4. At the oral proceedings, both parties identified D4 as the closest prior art and in explicitly referred to a hydrophilic resin crosslinked with trimethylol propane triacrylate. Trimethylol propane triacrylate is structurally close to the crosslinking agents represented by the formula in Claim 1 when x = 3, and differs from these compounds only in that it does not contain any ethylene oxide units, ie y is zero if expressed in terms of that formula. Although trimethylol propane triacrylate is mentioned as a possible crosslinking agent in D4 (column 3, line 56), D1 is the only prior art document which exemplifies the use of trimethylol propane triacrylate in combination with a carboxyl-containing monomer, ie Examples 5 and 6. Thus, the board considers D1 as a more appropriate starting point for the assessment of inventive step.

7.3 As pointed out by the respondent, centrifuge capacity and absorption under load are opposite requirements of a superabsorbent. Usually it is not possible to improve one of these two characteristics without sacrificing the other. Therefore, the problem of the patent in suit is not to achieve high absolute values in centrifuge capacity or absorption under load, but to provide an optimized balance of these two opposite properties (see page 6, lines 54 to 56 of the granted patent specification).

7.4 The patent in suit suggests, as the solution to this problem, a hydrophilic resin crosslinked with a compound of the formula as defined in Claim 1.

7.4.1 It follows from Figure 5 of the patent in suit that, by the aid of the specific crosslinking agent required in Claim 1, an improved balance of absorption under load (AUL) and centrifuge capacity (CC) can be achieved. Figure 5 is a plot of AUL against CC for Resin A and Resin B at post-heat temperatures ranging from 180 to 250°C (Examples 21 to 34) whereby Resin A represents the closest state of the art with trimethylol propane triacrylate (no ethylene oxide units) as the crosslinking agent. In Resin B, being within the scope of Claim 1, the crosslinking agent is trimethylol propane polyethyleneoxy triacrylate (5 moles of ethylene oxide units per polyoxyethylene chain). The curve shows that Resin B has a significantly better balance of the relevant properties than Resin A. At a selected AUL, Resin B exhibits a higher CC than Resin A. Alternatively at a selected CC, Resin B demonstrates a higher AUL than Resin A.

7.4.2 The board has no reason to doubt the results in the

patent in suit, in particular as the comparative examples use a compound not only explicitly mentioned in the closest prior art but also relied upon by both parties. Therefore, the board is satisfied that the technical problem was adequately defined and was in fact solved by the specific crosslinking agents required in Claim 1. Thus, the above identified technical problem is the objective technical problem that has to be accepted for the purpose of evaluating inventive step.

8. *Inventive step*

8.1 It remains to be decided if the proposed solution, ie the use of the crosslinking agent defined in Claim 1, is obvious from the prior art.

8.2 D1 discloses a method for the production of an absorbent resin excelling in durability where a specified concentration of a crosslinking agent and a chain transfer agent have to be present during the polymerisation of a water-soluble ethylenically unsaturated monomer with acrylic acid being particularly preferred (page 4, lines 21 to 25). Suitable crosslinking agents are *inter alia* (poly)ethylene glycol di(meth)acrylates and trimethylol propane tri(meth)acrylates (page 4, lines 30 and 32).

8.3 In D1 itself, there is no suggestion as to how the balance of centrifuge capacity and absorption under load might be further improved, let alone a hint to the use of a crosslinking agent as defined by the formula in Claim 1.

8.4 Although D4 mentions adducts of ethylene oxide with

trimethylol propane which had been triesterified with acrylic acid or methacrylic acid in general terms of as possible crosslinking agents, there is no suggestion in D4 as to whether the use of a certain number of ethylene oxide units would improve the balance of centrifuge capacity and absorption under load of a carboxyl-containing hydrophilic resin. Hence, the disclosure of D4 cannot offer any assistance in the solution of the technical problem.

8.5 A further obviousness attack of the appellant, but which was not pursued in the oral proceedings, started from a hydrophilic resin crosslinked with polyethylene glycol diacrylate.

8.5.1 The use of polyethylene glycol diacrylate containing 8 and 14 ethylene oxide units, respectively, is disclosed in Examples 7, 8 and 10 of D1. These polyethylene glycol diacrylates are structurally close to the crosslinking agents of the patent in suit when x = 2 in the formula of Claim 1, and differ only in R^1. In D1, R^1 is a C_2-hydrocarbon moiety instead of a C_{3-6}-hydrocarbon moiety as required in Claim 1.

8.5.2 According to the appellant, no technical effect was associated with the use of a different crosslinking agent so that the technical problem could only be seen in the provision of further crosslinked hydrophilic resins. The slight modification in R^1 of the crosslinking agent was obvious for a person skilled in the art.

8.5.3 It has, however, been demonstrated by the data in the patent in suit that the use of the specific crosslinking agent as defined by the formula in Claim 1

provides an improved balance of CC and AUL, at least when x = 3 in this formula. Since the appellant's allegation that there is no improvement in case of x = 2 is not supported by any evidence, the board sees no reason to doubt that the objective technical problem identified in point 7.3 above is solved by all resins covered by Claim 1.

8.5.4 There is no indication in D1 or in D4 that a change in the structure of the crosslinking agent, in particular with respect to R^1, would solve this problem. Therefore, appellant's further obviousness attack also does not succeed.

8.6 In summary, the documents cited by the appellant cannot render the claimed subject-matter obvious. The subject-matter of Claim 1, and by the same token, that of Claims 2 to 11, involves an inventive step in the sense of Article 56 EPC.

9. It follows, in view of the above, that the patent could be maintained on the basis of Claims 1 to 11 underlying the decision under appeal. Consequently, there was no need to consider the introduction of the respondent's auxiliary request into the proceedings.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

E. Görgmaier R. Young