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DECISION
of 7 June 2000

Case Number: T 1144/97 - 3.3.3

Application Number: 90101133.8

Publication Number: 0380002

IPC: G11B 7/24

Language of the proceedings: EN

Title of invention:

Optical disk substrate and optical information-storage medium

Patentee:

IDEMITSU PETROCHEMICAL CO., LTD.

Opponent:

Bayer AG

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56

Keyword:

"Amendments - broadening of claims (no) - support by description (yes)"

"Novelty - identification of residual impurities - implicit disclosure (no)"

"Inventive step - criticality of impurities content for a property not considered in the prior art"

Decisions cited:

T 0205/83, T 0629/90

Catchword:

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Case Number: T 1144/97 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal
of 7 June 2000

Appellant: IDEMITSU PETROCHEMICAL CO., LTD.
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 2 October 1997
revoking European patent No. 0 380 002 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: C. Gérardin
Members: P. Kitzmantel
J. De Preter

Summary of Facts and Submissions

- I. Mention of the grant of European patent No. 0 380 002 in respect of European patent application No. 90 101 133.8 in the name of IDEMITSU PETROCHEMICAL CO. LTD., which had been filed on 20 January 1990, was announced on 2 November 1994 on the basis of eight claims, independent Claims 1 and 8 reading as follows:

"1. An optical disk substrate formed from a polycarbonate resin which may contain additives, said polycarbonate resin being characterized by having a viscosity-average molecular weight of 10000 to 22000 and that each metal belonging to the IA-group and the VIII-group of the Periodic Table - if present in said polycarbonate resin - does not exist in an amount of more than 1 ppm."

"8. An optical information-storage medium, comprising an optical recording layer formed on the optical disk substrate according to any one of claims 1 to 7."

Claims 2 to 7 were dependent on Claim 1.

- II. Notice of Opposition requesting revocation of the patent in its entirety on the grounds of Article 100(a) EPC was filed by BAYER AG on 15 May 1995.

The opposition was i.a. based on documents

E4: DE-A-3 301 963,

E9: EP-A-0 205 192,

E17: EP-A-0 293 769,

E18: Analytical report, "Anlage" of Opponent's submission dated 11 May 1995,

E20: Plastics 85, proceedings of the SPE 43rd annual technical conference and exhibition, 1985, "Polycarbonate Resins for Optical Memories and Compact Disks" by R. Riess and H. Loewer,

E22: DE-A-3 734 681,

E23: "Material Testing Data", February 1988, "Anlage 1" of Opponent's submission dated 17 April 1997, and

E24: evidence comprising (i) an internal letter of the Opponent dated 19 June 1997 relating to test results of two compact disks (CD Polygram and CD Männerchor Bayer in Japan), (ii) a letter of the Opponent's Representative Dr. Goddar dated 10 July 1997, (iii) a copy of the front side of the compact disk "Männerchor Bayer in Japan, 1986" dated 20 May 1997, (iv) a copy of the cover of the afore-mentioned compact disk, and (v) eight pages of analytical data.

Documents E18, E23 and E24 had been submitted by the Opponent as evidence of prior public use; however, with respect to E18 and E23 this objection was abandoned by the Opponent during the oral proceedings before the Opposition Division.

III. By its decision issued in writing on 2 October 1997, the Opposition Division revoked the patent.

It held *inter alia* that the maximum sodium and iron contaminations of the claimed optical disk substrate did not qualify as distinguishing features and that the subject-matter of Claim 1 was therefore anticipated by a number of the citations, including E4, E9 and E17. The reason was that, in application of the principle laid down in decision T 205/83 (OJ EPO 1985, 363) these impurity features did not amount to genuine substance parameters.

Document D24, submitted as evidence of prior public use by the Opponent one day before the oral proceedings, was disregarded by the Opposition Division under Article 114(2) EPC.

IV. On 20 November 1997 the Patentee (Appellant) lodged an appeal against the decision of the Opposition Division and paid the appeal fee on the same day. The Statement of Grounds of Appeal was submitted on 10 February 1998.

At the oral proceedings held on 7 June 2000 the Appellant submitted as its sole request an amended set of five claims superseding thereby all previous requests, particularly the main request and the three auxiliary requests of its submission dated 10 May 2000.

Claim 1 of this sole request reads as follows:

"1. An optical disk substrate formed from a polycarbonate resin which may contain additives, said polycarbonate resin being characterized by having a viscosity-average molecular weight of 10000 to 22000 and that each metal belonging to the IA-group and the VIII-

group of the Periodic Table - if present in said polycarbonate resin - does not exist in an amount of more than 1 ppm, containing a maximum of 10 ppm of a chlorinated compound solvent, and foreign-substances, the foreign-substances index being generally 30000 $\mu\text{m}^2/\text{g}$ or less, said index being calculated from the following equation:

$$I = \Sigma\{[\frac{1}{2} (d_{i+1} + d_i)]^2 \times (n_i - n_i')\}/W,$$

wherein I denotes the foreign-substances index, d_i denotes an i-th numerical value (μm) for dividing a range of the particle diameter, and n_i denotes the number of foreign-substances having a particle diameter of less than d_{i+1} and not less than d_i , and detected in the solvent, n_i' denotes the number of foreign substances involved in the solvent before use, and W denotes the weight (g) of a material."

Claims 2 to 4 are dependent on Claim 1, independent Claim 5 relates to an optical information-storage medium, comprising an optical recording layer formed on the optical disk substrate according to any one of Claims 1 to 4.

V. The arguments presented by the Appellant in its written submissions and during the oral proceedings may be summarized as follows:

- (i) The finding of T 205/83, namely to disregard the amount of impurities in a copolymer for the assessment of its novelty, could not be applied to the optical disk substrates according to the subject-matter of the patent in suit. These

substrates were products comprising polycarbonate and additives, whose properties - as evidenced by the data in the Table 2 attached to the Statement of Grounds for Appeal - were considerably affected by the contents of sodium and iron, as well as of chlorinated solvents and foreign substances.

- (ii) Furthermore, T 205/83 was at variance with the EPO's jurisprudence concerning the novelty of natural occurring products and of enantiomers.
- (iii) The claimed subject-matter was not anticipated by any of the citations on file, because these did not make available disk substrates made from polycarbonate resin having the specified low contents of metals of group IA and group VIII of the Periodic Table (hereinafter "metals" for short).
- (iv) In particular, the resin purification methods disclosed in the prior art, e.g. in E4, E9, E17 and E22, would not automatically lead to the desired low metal contents, because they lacked an alkaline washing step, which was mandatory according to the patent in suit, and, above all, they did not take account of the necessity to reduce the metal contents to the required low amounts.
- (v) The same conclusion applied to the evidence of alleged prior public use contained in documents E18 and E24. Though being one of the biggest European suppliers of polycarbonate resins for

optical disks, the Opponent, which has the burden of proof to establish a case of anticipation, failed to do so.

- (vi) The closest prior art for the assessment of inventive step was E22. However, this document did not refer to the deterioration of the disk substrate **itself**, but to the corrosion of the recording layer thereupon. Moreover, the bit error ratio curve D in Figure 2 of E22 showed that the existing technical problem was not solved by the disks prepared according to this document.
 - (vii) Nor would the statement in E20 that the raw material used for optical disks had "to be extremely pure to guarantee an error-free data retrieval", suggest that, in order to achieve the desired long term stability of the polycarbonate resin it was necessary to set a limit of 1 ppm to the metal content.
- VI. By letter dated 8 September 1998 the Opponent withdrew its opposition and, consequently, ceased to be a party to the appeal proceedings, as far as the substantive issues were concerned (cf. EPO's communication of 24 September 1998).
- VII. The Appellants requested that the decision under appeal be set aside and that the patent be maintained on the basis of the set of claims submitted at the oral proceedings.

Reasons for the Decision

1. The appeal is admissible.
2. The competence of the Board for reviewing the first instance's decision of revocation of the patent in suit is not affected by the Opponent's withdrawal of the opposition (cf. T 629/90, OJ EPO 1992, 654).
3. *Amendments*

Claim 1 is based on its version as originally filed, on the statement on page 5, lines 5 to 6 of the original application (optional presence of additives), on original Claim 4 (viscosity-average molecular weight of 10000 to 22000), on original Claim 5 (maximum of 10 ppm of a chlorinated compound solvent), on the statement on page 5, lines 7 to 10 (foreign-substances index being generally 30000 $\mu\text{m}^2/\text{g}$ or less), and on the statement on page 5, line 23 to page 6, line 5 (equation defining the foreign-substances index).

Claims 2 to 5 are, respectively, based on Claims 2, 3, 6 and 7 of the original application.

Owing to the introduction of further restricting features the scope of Claim 1 is narrower than that of its granted version.

The claims, therefore, comply with the requirements of Article 123(2) and (3) EPC.

The introduction of the afore-mentioned features into Claim 1 also fulfils the requirement according to

Article 84 EPC of consistency of the claims and the description, because - according to page 2, lines 31 to 37 and page 3, lines 20 to 23 of the patent in suit - these features are mandatory characteristics of the claimed invention.

4. *Citations*

4.1 Document E4

This document relates to shaped articles, e.g. to storage disks for digital signals, obtainable by injection molding of a polycarbonate resin having an average molecular weight from 12000 to 18000 (cf. Claim 1; page 4, lines 13 to 17). According to production Example A (page 12, lines 10 to 27) the polycarbonate solution resulting from the polycondensation of bisphenol A and phosgene, prior to evaporation of methylene chloride solvent, is washed with water, an aqueous solution of hydrochloric acid and again with water.

4.2 Document E9

This document relates to a polycarbonate resin composition comprising polycarbonate having a viscosity average molecular weight from 13000 to 18000, which may be used for the production of substrates for information recording devices (Claim 1; page 2, lines 10 to 14). According to Examples 1 to 9 and Comparative Examples 1 to 10 (page 17, lines 17 to 27) the methylene chloride layer resulting from the polycondensation of bisphenol A and phosgene is repeatedly washed with water.

4.3 Document E17

This document relates to a polycarbonate for use in production of a disk substrate, having a low molecular weight polymer content of not more than 3% by weight, an unreacted bisphenol content of not more than 20 ppm, and a methylene chloride content of not more than 20 ppm, prepared by extracting the impurity containing powdery polycarbonate with a ketone, e.g. acetone or methyl ethyl ketone (Claims 1, 3, 5).

4.4 Document E18

This letter of the Opponent, dated 20 July 1994, comprises results of the determination of the sodium and iron contents of two polycarbonate production samples dating back, respectively, to 26 September 1984 and to 15 June 1988, which contents are each below 1 ppm.

4.5 Document E20

This article comprises a review of polycarbonate developments for optical memories and compact disks. The Section "3. Special Polycarbonate Resin" on page 471 summarizes some of the requirements of compact disks, the first two lines in the right hand column reading: "Finally, the plastic raw material has to be extremely pure to guarantee an error-free data retrieval."

On page 471, right hand column, third paragraph E20 sets out that this requirement is attained by the polycarbonate Makrolon CD-2000, which has a melt flow index of 55 to 60 g/10 min (at 300°C). According to the uncontested statement of the Opponent (letter dated

11 May 1995, page 14, paragraph (b)(2)) this melt flow index corresponds to a weight average molecular weight of about 20000 (and, consequently, to a similar viscosity average molecular weight: "Die Kunststoffe, Kunststoff-Handbuch 1, edited by Dr. Bodo Carlowitz, Hanser Verlag 1990, page 923, last two paragraphs").

4.6 Document E22

This document relates to an optical information storage medium comprising an optical information recording layer on a polycarbonate resin substrate. The use of a polycarbonate resin, which had repeatedly been washed with water in order to reduce the chlorine content of the substrate to not more than 1.0 ppm, provides an improved corrosion resistance of the information recording layer (Claims 1 and 3; column 1, lines 24 to 27; column 3, lines 14 to 28).

5. *Novelty*

5.1 Decision T 205/83

That decision sets out in point 3.2.3, last paragraph that "a known product does not necessarily acquire novelty merely by virtue of the fact that it is prepared in a purer form".

Following this line of thought, the novelty of a vinyl ester/crotonic copolymer, which was defined by reference to known conditions of preparation, was denied, because the fact that the so prepared copolymers had a lower content of bad-smelling monomer impurity was not

considered a substance parameter of the copolymer (point 3.2.3 first and second paragraphs).

The above-mentioned finding of T 205/83 is not applicable to the optical disk substrates according to present Claim 1, because these are not chemical substances (compounds), but moulded three-dimensional bodies, which have been prepared by melt shaping of a polycarbonate raw material, which may or may not comprise additives (page 3, line 20). The essence of these optical disk substrates is, thus, not restricted to the features of the polycarbonate resin *per se*, but also comprises the features contributed by any further components, including "impurities", and, furthermore, the features resulting from the shaping operation.

- 5.2 Consequently, the features in Claim 1 concerning the maximum contents in the polycarbonate resin of IA and VIII group metals, of chlorinated solvent and of foreign-substances are to be considered as characteristics of the claimed optical disk substrate.
- 5.3 Although the prior art documents are concerned with the elimination of impurities (including "foreign substances"), in particular chlorine, none of them mentions the contents of IA and VIII group metals in the polycarbonate resin.
- 5.4 In spite of the fact that the washing and solvent extraction steps of the polycarbonate resin raw material, which are referred to in the patent in suit (page 3, lines 14 to 19; page 4, lines 13 to 18), are not essentially different from the purifying methods applied according to E4, E9, E17 and/or E22 (cf. points 4.1 to

4.3 and 4.6 supra), these documents cannot be considered to implicitly disclose the required low metal contents, because the available evidence does not suggest that the intensity of the prior art purification was sufficient to achieve this degree of purity.

- 5.5 In particular, though being an important supplier of polycarbonate resins for the production of compact disks, the Opponent failed to provide convincing evidence of prior public use of optical disk substrates having the low metal contents specified in Claim 1; documents E18, E23 and E24 submitted in this respect, lack sufficient substantiation (cf. decision under appeal: points 6 and 7 of Statement of Facts and Submissions, point 5 of Reasons).

This failure underscores that the low metal content required by Claim 1 was indeed not achieved by hitherto conventional polycarbonate purifying processes.

- 5.6 The subject-matter of Claim 1 is, thus, novel over the cited prior art.

6. *Inventive step*

While the decision under appeal was only concerned with the issue of novelty, the Board, exercising its competence under Article 111(1) EPC to act on behalf of the first instance, decides to also investigate into the issue of inventive step, because the Appellant requested the Board to decide on the maintenance of the patent and presented arguments with regard to that issue in the Statement of Grounds for Appeal.

6.1 Problem to be solved and solution thereof

6.1.1 According to page 2, lines 28 to 30 and 38 to 40 of the patent in suit (page 2, lines 17 to 21 and page 2, line 36 to page 3, line 3 of the original application) the problem underlying the claimed invention was the provision of an optical disk substrate, and an optical information-storage medium prepared therefrom, which maintains a high reliability for a long time.

In view of the available evidence and the cited prior art the Board is satisfied that this is the objective technical problem with which the skilled person was confronted.

6.1.2 According to present Claim 1 this problem is solved by the use of a polycarbonate resin within a certain molecular weight range whose contents of metals belonging to the IA-group and the VIII-group of the Periodic Table - if present in said polycarbonate resin - is not more than 1 ppm, whose contents of a chlorinated compound solvent does not exceed 10 ppm, and whose foreign-substances index is generally 30000 $\mu\text{m}^2/\text{g}$ or less.

6.1.3 The available evidence shows that the existing technical problem is effectively solved by adapting the sodium and iron contents as well as the amount of methylene chloride to the requirements of Claim 1: after humid aging at 80°C the appearance of the substrate and the molecular weight of the polycarbonate resin are unaltered and the bit error ratio (BER) does not increase after 2000 hours (Examples A and B as well as Figure 3 of the patent in suit; Table of experimental

results submitted at the oral proceedings on 7 June 2000).

6.2 Obviousness

This issue turns on the question whether the prior art contained any suggestions to solve the existing technical problem as set out in point 6.1 supra by the measures taken according to present Claim 1.

While this claim comprises several distinguishing features (contents of metals, chlorine and foreign substances; cf. point 5.2 supra), for the establishment of non-obviousness of the claimed subject-matter it is sufficient that one of these features, here the low contents of group IA and group VIII metals, is not obvious over the prior art.

This is indeed the case, since the prior art is completely silent on the impact of the groups IA and VIII metal content on the long-term reliability of optical information-storage media comprising a polycarbonate substrate.

- 6.2.1 Document E20, although referring in general terms to the necessity of extremely high purity of the polycarbonate raw material for the achievement of an error-free data retrieval, neither mentions the criticality of a low metal content, nor does it in any way hint at particular purity requirements for the achievement of an improved **long-term** reliability (long-term stability of the BER). Therefore, this document cannot provide any guidance to the skilled person seeking to solve the existing technical problem.

Concerning the interpretation of the purity requirements stressed in E20 the Appellant referred to the document:

Kunststoffe 76 (1986) 10, pages 917 to 919,
"Polycarbonate- ein Werkstoff für optische
Speichermedien", by W. Siebourg, which originated from
an employee of the Opponent, and pointed out that
according to Section 2.5 (page 919) of this paper a CD-
Player-system might tolerate a certain number of
impurities without impairing the quality of the sound.
From that the Appellant justly inferred that it was by
no ways clear that the purity criteria referred to by
E20 were nearly as strict as those imposed by present
Claim 1.

6.2.2 Document E22 mainly relates to an improvement of the
corrosion resistance of the recording layer of an
optical disk by reduction of the amount of residual
chlorine ions to not more than 1.0 ppm (cf. point 4.6
supra). Figure 2 illustrates the time-dependency after
humid aging of the BER of optical disks comprising
substrates having different contents of residual
chlorine ions. Curves B, C and D of Figure 2, relating
to polycarbonate substrates having a content of,
respectively, 1.2, 1.3 and 1.9 ppm chlorine exhibit a
deterioration of the BER, whereas curve A, relating to a
chlorine content of 0.9 ppm, exhibits an unaltered BER
(after 150 hours) (cf. E22 column 3, line 63 to column 5,
line 19).

A comparison of these results with Figure 3 of the
patent in suit reveals that the measures taken by E22,
especially the very low chlorine content, are by no

means sufficient to achieve a satisfactory long-term stability of the BER, within the terms required by the patent in suit: according to Figure 3, Example B1 of the patent in suit, relating to a content of 3 ppm methylene chloride (~2.5 ppm chlorine; polycarbonate substrate A2, Table 1) the BER remains unaltered after 2000 hours (aging conditions of 80°C and 90% rel. humidity), whereas according to Figure 2 of E22, curve D the BER of a disk comprising a substrate containing 1.9 ppm chlorine is deteriorated by a factor of 10 already after 150 hours at comparable aging conditions (90°C, 85% rel. humidity).

It stands to reason, therefore, that the lowering of the chlorine contamination recommended by E22 and taken over by the claimed invention is not able, by itself, to solve the existing technical problem.

6.2.3 While, as set out in point 5.4 supra, documents E4, E9 and E17 are also to some extent concerned with the purity of the substrate of optical disks in that they stress the necessity of some purification of the polycarbonate raw material, these documents do not comprise any information concerning the amount of metal contaminations that may be permitted, nor do they suggest any measure in order to safeguard the quality of the data retrieval from optical disks prepared with such substrates.

6.2.4 The subject-matter of Claim 1 of the patent in suit is. thus, not obvious over the cited prior art.

6.2.5 The same conclusion applies a *fortiori* to the subject-matter of Claims 2 to 4, which are dependent on Claim 1,

as well as to the subject-matter of Claim 5, which relates to an optical information-storage medium comprising an optical disk substrate according to Claim 1.

7. The grounds of opposition, thus, do not prejudice the maintenance of the patent in amended form according to Article 102(3) EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the Opposition Division with the order to maintain the patent on the basis of the set of claims (5 claims), submitted at the oral proceedings, the description and the figures as granted.

The Registrar:

The Chairman:

E. Görgmaier

C. Gérardin