BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

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File Number: T 394/88 - 3.3.1

Application No.: 82 106 027.4

Publication No.: 0 069 387

Title of invention: Liquid crystal display device

Classification: C09K 3/34

D E C I S I O N
of 7 February 1991

Applicant:

Proprietor of the patent: Hitachi Ltd.

Opponent: OI Merck Patent GmbH
OII Hoffmann-La Roche & Co. AG

Headword: Liquid crystal/HITACHI

EPC Articles 54 and 83

Keyword: "Sufficiency (yes)"
"Novelty (No) - prior public use involving commercial products"

Headnote

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number : T 394/88 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 7 February 1991

Appellant : (Proprietor of the patent)
Hitachi, Ltd.
5-1, Marunouchi 1-chome
Chiyoda-ku
Tokyo 100 (JP)

Representative :
Ebbinghaus, Dieter
v. Füner, Ebbinghaus, Finck
Patentanwälte European Patent Attorneys
Mariahilfplatz 2 & 3
W-8000 München 90 (DE)

Respondent OI : (Opponent OI)
Merck Patent GmbH
Frankfurter Strasse 250
Postfach 41 19
W-6100 Darmstadt 1 (DE)

Representative :

Respondent OII : (Opponent OII)
F. Hoffmann-La Roche & Co. AG
Grenzacherstrasse 124
CH-4002 Basel

Representative :
Lederer, Franz, Dr.
van der Werth, Lederer & Riederer Patentanwälte
Lucile-Grahn-Strasse 22
W-8000 München 80

Decision under appeal :
Decision of Opposition Division of the European Patent Office of 13 April 1988, posted on 7 June 1988, revoking European patent No. 0 069 387 pursuant to Article 102(1) EPC.

Composition of the Board :

Chairman : K.J.A. Jahn
Members : R.W. Andrews
J. Jonk
W. Moser
J. Stephens-Ofner

Summary of Facts and Submissions

I. The grant of European patent No. 0 069 387 in respect of European patent application No. 82 106 027.4, filed on 6 July 1982 and claiming priority from a prior application filed in Japan on 8 July 1981, was published on 7 November 1984 (cf. Bulletin 84/45).

II. Notices of opposition were filed on 6 August 1985 requesting the revocation of the patent on the grounds that its subject-matter lacked novelty and did not involve an inventive step.

Respondent OI (Opponent OI) alleged that the liquid crystal products ZLI-1557, ZLI-1694, ZLI-1701 and ZLI-1816, which were made available to the public before the claimed priority date of the disputed patent, had glass transition temperatures (Tg) of -85°, -82°, -90° and -93°C respectively. In a later submission filed on 1 December 1986, Respondent OI stated that a remeasurement of the glass transition temperature of ZLI-1701 and ZLI-1816, in which the samples were heated at a rate of 1°K/min in accordance with the disclosure of the disputed patent on page 2, lines 9 and 10, gave values of -90° to -91°C and -91° to -92°C respectively.

III. By a decision delivered orally on 13 April 1988, with written reasons posted on 7 June 1988, the Opposition Division revoked the patent on the ground that it did not disclose the invention in a manner sufficiently clear and complete for it to be carried out by the skilled person. The Opposition Division held that the patent was insufficient since there is no indication in the disputed patent which definition of Tg is valid with respect to the Tg values referred to in Claim 1.

IV. An appeal was filed against this decision on 17 August 1988 with payment of the prescribed fee. In the statement of grounds of appeal filed on 17 October 1988 and during the oral proceedings held on 7 February 1991, the Appellant (proprietor of the patent) contended that it was not necessary to give details regarding the determination of the glass transition temperatures since these were well known to the skilled person at the claimed priority data as demonstrated by the document ASTM D-3418-75.

With his statement of grounds and his letter filed on 4 September 1989, the Appellant submitted two experimental reports in which details were given of the method used to determine the glass transition temperatures (Tg) of the two liquid crystal materials ZLI-1701 and ZLI-1816. According to these reports these products had Tg values of -85.1° and -86.8°C (±0.5°C) respectively and, therefore, the subject-matter of the present Claim 1 was novel. However, the Appellant did not contest the fact that these products were made available to the public before the claimed priority date.

The Appellant also argued that of the three points on the thermal analysis curve (initial deflection (Ta), extrapolated onset (Tb) and point of inflection of the curve (Tc)), which may be taken to represent the Tg of a substance, only Tb would be used by the skilled person in view of the accuracy and reproducibility with which this point can be determined.

In his letter filed on 4 September 1989 the Appellant reported the results of experiments the object of which was to demonstrate that the thermal history of the liquid crystal sample, i.e. the rate of heating and cooling of the sample, had very little influence on the observed Tg.

V. Respondent OI contended that at present no generally accepted convention exists for determining glass transition temperatures from experimentally obtained differential thermal analysis (DTA) and differential scanning calorimetry (SDC) curves. In the literature, for example, ICTA certificate for glass transition measurements distributed by the United States National Bureau of Standards as GM-754, three different temperatures, which differ considerably from each other, are used to represent glass transition temperatures. In addition to the omission of any definition of Tg, the disputed patent is deficient in that details of the apparatus and the experimental procedure used to obtain the thermal analysis curves are not disclosed. This viewpoint is supported by the fact that two different laboratories could not obtain comparable results for the liquid crystal compositions ZLI-1701 and ZLI-1816.

VI. Respondent OII (Opponent OII) argued that it was not a question of whether the method for determining Tg presented in the Appellant's experimental reports was known to the skilled person, but that several methods which lead to different results, were known. In this Respondent's opinion, the statements and data filed by the Appellant cannot explain the discrepancy between the Tg value, obtained by Respondent OI and the Appellant for the products ZLI-1557, ZLI-1694, ZLI-1701 and ZLI-1866.

VII. The Appellant requested that the decision under appeal be set aside and the case remitted to the first instance for further examination on the basis of Claims 1 to 8 filed on 14 December 1990. The only independent claim of this set of claims reads as follows:

"A liquid crystal display device comprising upper and lower substrates each having an electrode and an

orientation controlling film formed on the surface of said substrate, a layer of a liquid crystal composition interposed between said substrates, and a sealing means disposed at the periphery of said substrates, characterized in that the aforesaid liquid crystal composition contains a liquid crystal material base and an additive of an organic compound having a glass transition temperature (Tg) of -90°C or lower, and in that said liquid crystal composition has a Tg of -90°C or lower."

Both Respondents requested that the appeal be dismissed.

VIII. At the conclusion of the oral proceedings, the Board's decision to dismiss the appeal was announced.

Reasons for the Decision

1. The appeal is admissible.

2. There are no formal objections to the present claims under Article 123 EPC. Thus, Claim 1 is a combination of Claims 1 and 2 as originally filed and granted. Claims 2 to 8 correspond to Claims 5 to 9, 11 and 15 as originally filed and granted.

3. The patent in suit relates to a liquid crystal display device containing a layer of a liquid crystal composition containing a mixture of compounds forming the basic liquid crystal component and an additive. The liquid crystal composition is characterised in that it and the organic compound added to the basic liquid crystal component both have Tg values of at least -90°C. Therefore, clearly in order to be able to carry out the alleged invention, the skilled person must be in a position to determine the glass transition temperature of a liquid crystal mixture.

3.1 In view of this, the first question to be answered is whether the information in the paragraph bridging pages 3 and 4 of the disputed patent combined with the common general knowledge of the skilled person in the field of thermal analysis is sufficient to enable the skilled person to obtain the thermal analysis curves necessary to determine the glass transition temperature of a liquid crystal composition. In the Board's judgment, the question is to be answered in the affirmative. This conclusion is supported by the fact that Respondent OI was able to measure the glass transition temperatures of the liquid crystal compositions ZLI-1701 and ZLI-1816 (cf. his letter filed on 25 November 1986).

3.2 It is true that, although the rate of heating during the actual thermal analysis is specified in the patent in suit, the rate of cooling of the sample to the temperature of liquid nitrogen is not. Normally, the sample is cooled at a known constant rate in order to impart a fixed thermal history. However, in view of the results reported in the Appellant's letter filed on 4 September 1989, the Board is satisfied that with low molecular weight liquid crystal compositions the rate of cooling has little influence on the Tg value. Thus, the Tg of the liquid crystal composition NP-5, cooled at 120°C/min and reheated at 1°C/min, was -59.1°C, whereas when the sample was cooled at 2°C/min and reheated at the same rate the observed Tg was 59.0°C.

3.3 With respect to the points raised by Professor Dr. B. Blachnik in the annex to Respondent OI's letter filed on 23 February 1989, the Board takes the view that a skilled person would, as a matter of course, take all measures necessary to achieve accurate and reproducible Tg values.

Thus, it is not necessary to specify the steps routinely taken by the skilled person to obtain reliable results.

3.4 According to the Respondents, even if the skilled person were able to obtain the thermal analysis curves, the disclosure of the disputed patent is still insufficient in the absence of any indication which point on the thermal analysis curve is to be taken as the glass transition temperature of the liquid crystal composition.

3.5 It is not disputed by the parties that there are at least three points on the thermal analysis curve which may be used to define the glass transition temperature viz the initial deflection or initial onset temperature (Ta), the extrapolated onset temperature (Tb) and the inflexion point of the curve (Tc) (cf. page 7 of the document GM-754). However, it is clear from the document GM-754 that the point Ta would be ruled out of consideration by the skilled person since its measurement is too subjective (cf. page 7, paragraph 3.3).

Therefore, in the Board's judgment, the skilled person would consider the points Tb and Tc as the only possible alternatives for Tg. Support for this is provided by the document ASTM-D3418-75 where, in the thermal analysis curve on page 789, the two points corresponding to Tb (Tf) and Tc (Tm) are both also characterised as Tg.

3.6 The skilled person in this field is aware that the point Tb can be determined with the least margin of error (cf. Table 2 on page 10 of GM-754) and, therefore, the Board considers that the skilled reader of the disputed patent would understand, in the absence of any indication to the contrary, that the glass transition temperatures referred to therein correspond to the point Tb on the thermal analysis curve.

3.7 In reaching this conclusion the Board has taken into consideration the fact that both the Appellant and Respondent OI selected, independently of each other, this point to determine the glass transition temperatures cited during the opposition and appeal proceedings (cf. Respondent OI's letters filed on 6 August 1985 and 1 December 1986 and the telecopy received on 21 February 1988, and the results filed by the Appellant during the oral proceedings on 13 April 1988, and the experimental reports filed on 17 October 1988 and 4 September 1989).

3.8 In view of the above the Board has concluded that the disclosure of the patent in suit is sufficient both in respect of the method used to obtain the thermal analysis curve and of the determination of Tg therefrom.

4. It still remains to be examined whether the subject-matter of the present Claim 1 is novel:

4.1 The Board is convinced by the unchallenged written evidence submitted by Respondent OI and the oral evidence of Mr. Weber, an employee of Respondent OI, which was taken by the Opposition Division on 13 April 1988 that liquid crystal display devices having the features referred to in the pre-characterising part of the present Claim 1 and containing the products ZLI-1706 and ZLI-1816 were made available to the public before the claimed priority date of the patent in suit.

According to Mr. Weber's testimony, a sample of the product ZLI-1816 was dispatched to the Appellant. On 17 June 1981, employees of Respondent OI visited the Appellant's firm and were given the results of an investigation into the relationship between response time

and temperature for ZLI-1816 (cf. annex 7 filed on 6 August 1985). In Mr. Weber's expert opinion, which the Board accepts, these results were obtained using a liquid crystal display device in accordance with the present Claim 1.

Therefore, it must be decided whether these prior art liquid crystal compositions have Tg values of -90°C or lower and whether they contain, as additives, organic compounds also having Tg values of at least -90°C.

4.2 It has not been disputed that, in addition to the basic liquid crystal component, these products contain trans-1-p-ethylphenyl-4-propylcyclohexane, which has a Tg of -114°C (159°K) (cf. Physical Review A, Volume 26(5), 1982, page 26 compound 3PCH2). Furthermore, according to Respondent OI the Tg's, defined as point Tb and measured at a heating rate of 1°K per minute, of ZLI-1701 and ZLI-1816 are -90° to -91°C and -91° to -92°C respectively (of Respondent OI's letters filed on 1 December 1986 and 23 February 1989).

According to the Appellant the Tg's of ZLI-1706 and ZLI-1816 are -85.1°C and -86.8°C respectively. The temperature at the point Tb was also taken to be the glass transition temperature (cf. Experimental Reports filed on 17 October 1988 and 4 September 1989). Therefore, in the Appellant's opinion, the subject-matter of the present claim is novel with respect to liquid crystal display devices containing these known products.

4.3 Thus, in order to resolve the question of novelty in the light of this conflicting evidence, the Board must decide which glass transition temperatures, on the balance of probabilities, are the correct ones for these known liquid crystal compositions.

Since both the Appellant and Respondent OI selected the extrapolated onset temperature as the glass transition temperature the differences in the values cannot lie in the determination of the glass transition temperature from the thermal analysis curves.

4.4 It is known that in producing the time-temperature curve from which the glass temperature of a material is determined, the test material should be heated at a controlled rate. It is clear that the Appellant realised the importance of this feature for achieving accurate and reproducible results since the heating rate (1°K/min) to be employed for the determination of the glass transition temperatures of the material contained in the liquid crystal display device of the present Claim 1 is specified in the disputed patent (cf. page 4, lines 9 and 10).

However, there is no indication in the Experimental Reports submitted by the Appellant on 17 October 1988 and 4 September 1989 that any attempt was made to ensure that the samples were heated at the rate specified in the disputed patent. In fact, clearly a controlled heating rate was not maintained during the measurement since, according to paragraph (5) of the above-mentioned reports, the sample was allowed to warm up from the temperature of liquid nitrogen to room temperature simply by removing the liquid nitrogen container.

In contrast to this, the Tg's cited by Respondent OI were measured using different DSC apparatus at a heating rate of 1°K/min (cf. first paragraph on page 5 of the letter filed by Respondent OI on 1 December 1986).

In the Board's judgment, the disagreement between the Appellant's results and those of Respondent OI may be

explained by the difference in heating rates employed during the determination of the glass transition temperatures.

Having regard to the fact that Respondent OI used the heating rate specified in the patent in suit, the Board considers that the known products ZLI-1701 and ZLI-1816 have glass transition temperatures of -90° to -91°C and -91° to -92°C respectively. Therefore, since liquid crystal display devices containing the products ZLI-1701 and ZLI-1816 have been made available to the public before the claimed priority date, the subject-matter of the present Claim 1 lacks novelty.

4.5 In the absence of any request to consider the subject-matter of dependent Claim 2 to 8 separately, these claims must fall together with Claim 1.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

E. Görgmaier K.J.A. Jahn