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**D E C I S I O N**  
of 16 September 1997

**Case Number:** T 0982/94 - 3.4.2

**Application Number:** 91200611.1

**Publication Number:** 0448173

**IPC:** G02F 1/137

**Language of the proceedings:** EN

**Title of invention:**  
Liquid crystal display device

**Applicant:**  
Philips Electronics N.V.

**Opponent:**  
-

**Headword:**  
-

**Relevant legal provisions:**  
EPC Art. 123(2), 54, 56

**Keyword:**  
"Admissible disclaimer - narrowed range"  
"Novelty and inventive step (yes)"

**Decisions cited:**  
-

**Catchword:**  
-



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Boards of Appeal

Chambres de recours

Case Number: T 0982/94 - 3.4.2

**D E C I S I O N**  
of the Technical Board of Appeal 3.4.2  
of 16 September 1997

**Appellant:** Philips Electronics N.V.  
Groenewoudseweg 1  
5621 BA Eindhoven (NL)

**Representative:** Raap, Adriaan Yde  
Internationaal Octrooibureau B.V.  
Prof. Holstlaan 6  
5656 AA Eindhoven (NL)

**Decision under appeal:** Decision of the Examining Division of the  
European Patent Office posted 15 November 1994  
refusing European patent application  
No. 91 200 611.1 pursuant to Article 97(1) EPC.

**Composition of the Board:**

**Chairman:** E. Turrini  
**Members:** A. G. Klein  
M. Lewenton

## Summary of Facts and Submissions

- I. European patent application No. 91 200 611.1 (publication No. EP-A-0 448 173) was refused by the Examining Division.
- II. The reason for the refusal was that the subject-matter of claim 1 was considered to lack novelty in the sense of Article 54 EPC in view of the contents of document EP-A-0 264 667 (D1). In the Examining Division's opinion, the liquid crystal display device disclosed in document D1 exhibited all the features set out in claim 1, there being in particular an overlap between the ranges disclosed in D1 for the twist angle, and for the angle between the direction of orientation of the liquid crystal molecules and the direction of polarization of the polarizer at the same side of the device, and the corresponding ranges set out in claim 1.
- III. The appellant filed an appeal against the decision. In response to a communication of the Board pursuant to Article 11(2) of the Rules of Procedures of the Board of Appeal, the appellant requested that a patent be granted on the basis of an amended set of claims 1 to 4 of which claim 1, the only amended claim reads as follows;

"A liquid crystal display device comprising a layer of liquid crystalline material between two substrates, the substrates each being provided with electrodes and orientation means in contact with the liquid crystal material giving the liquid crystalline molecules first and second directions of orientation such that the liquid crystalline material has a twist angle of value  $\phi_T$  across the thickness of the layer, said device further comprising polarizers at opposite

sides of the layer of liquid crystalline material having directions of polarization which cross each other substantially perpendicularly, characterized in that the twist angle has a given value  $60^\circ < \varphi_T < 90^\circ$  and the angle between the direction of orientation provided by the orientation means one of the substrates is provided with and the direction of polarization of the polarizer at the same side of the layer of liquid crystalline material as said orientation means has a value  $\alpha$  in the range

$$30^\circ + \varphi_{T/2} < \alpha < 60^\circ + \varphi_{T/2} \quad (\text{read } \varphi_T/2)$$

wherein  $\varphi_T$  is the given value of the twist angle."

### Reasons for the Decision

1. The appeal is admissible.
2. *Compliance of the amendments with the requirements of Article 123(2) EPC*
  - 2.1 Besides a few amendments of merely editorial nature, claim 1 has been amended by changing the original lower limit of  $40^\circ$  for the twist angle to a new lower limit of  $60^\circ$ , which was not explicitly disclosed in the original application documents.

This modification, which amounts to disclaiming the values between  $40^\circ$  and  $60^\circ$  from the originally claimed range for the twist angle, was introduced in order to overcome the novelty objection based on the contents of document D1 as rightfully raised by the Examining Division in the appealed decision. In document D1 the limit of  $60^\circ$  was not explicitly disclosed as the upper limit of the preferred range of between  $20^\circ$  and  $60^\circ$  for

the twist angle (see page 3, lines 27 to 29 and claim 3). Disclaiming this preferred range as explicitly disclosed in D1 from the range originally defined in claim 1 of the present application results in the range as now amended.

Alternately, for the angle between the direction of orientation of the liquid crystal molecules and the direction of polarization of the polarizer at the same side of the device, which is designated by the Greek letters  $\alpha$  in claim 1 and  $\theta$  in document D1, the latter discloses values up to  $60^\circ$  (see claim 1). Since according to claim 1 the values of angle  $\alpha$  and of the twist angle  $\varphi_T$  are linked by the relationship  $30^\circ + \varphi_T/2 < \alpha$ , disclaiming the values lower than, and up to,  $60^\circ$  for angle  $\alpha$  as known from document D1 also results, by virtue of the above relationship in excluding the values lower than, and up to,  $60^\circ$  for the twist angle.

For these reasons the disclaimer introduced into claim 1 as amended is adequately supported by the disclosure of document D1, and the amendment therefore complies with the requirements of Article 123(2) EPC.

2.2 The same conclusion applies to the amendments brought to the description, which has merely been adapted to the wording of amended claim 1 and provided with corrected bibliographic references to document D1.

### 3. *Novelty*

3.1 Document D1 discloses a liquid crystal display device as defined in the preamble of claim 1. In order to reduce the steepness of its electro-optical characteristic, which relates the optical transmission of the liquid crystal cell to the applied voltage, and thus to achieve a high differentiation of the grey

scale in the display device, document D1 teaches to select a twist angle in the range from  $10^\circ$  to  $80^\circ$ , and an angle between the direction of orientation of the liquid crystalline molecules on the substrate and the direction of polarization of the polarizer on the same side of the device (for the sake of simplification this angle will be referred to hereinafter as the alignment angle  $\alpha$ ) in the range from  $-30^\circ$  to  $60^\circ$  at the light input side of the device; (see page 2, lines 15 to 19 and claim 1).

In contrast, the characterising portion of present claim 1 defines a range for the twist angle of between  $60^\circ$  and  $90^\circ$ , which partially overlaps with the corresponding range of from  $10^\circ$  to  $80^\circ$  disclosed in D1, but a value for the alignment angle  $\alpha$  which by virtue of the relationship given in the claim  $(30^\circ + \varphi_T/2 < \alpha)$  necessarily exceeds the upper limit of  $60^\circ$  as disclosed in D1 since the twist angle  $\varphi_T$  is itself greater than  $60^\circ$ .

The definition of the alignment angle  $\alpha$  in present claim 1 is not restricted to the alignment angle at the light input side of the device, which is the angle specifically referred to in document D1, and the claim accordingly also covers devices in which the conditions given for the value of the alignment angle would be fulfilled instead by the alignment angle at the light output side of the device. However, in any liquid crystal display device given values of the twist angle, of the alignment angle at the light input side of the device and of the angle of the directions of polarization necessarily result in a definite value of the alignment angle at the light output side of the device, which can be determined from elementary geometrical considerations. The Board is satisfied that for substantially perpendicular polarization directions, as is required by claim 1, the combination

of ranges actually disclosed in document D1, in particular an alignment angle of no less than  $-30^\circ$  at the light input side of the device, cannot possibly result in a value above  $60^\circ$  for the alignment angle at the light output side.

For these reasons the subject-matter of claim 1 is considered novel in view of the document D1.

- 3.2 The two other citations of the European Search Report do not come closer to the claimed subject-matter.

In particular, document US-A-4 039 252 (D2) discloses a liquid crystal display device in which the twist angle is comprised in the range from  $80^\circ$  to  $85^\circ$  in order to overcome the non-homogeneities and irregularities of conventional,  $90^\circ$  twisted devices; see claim 1.

Document D2 does not however comprise any information as to the relative orientation of the direction of orientation of the liquid crystal molecules on one of the substrates and the direction of polarization of the polarizer at the same side of the device.

JOURNAL OF APPLIED PHYSICS, vol. 48, no. 4, April 1977, pages 1426-1431, American Institute of Physics;  
M. GOSCIANSKI: "Optical characteristics of twisted nematic liquid crystals: Application to the improvement of the scanning capability in matrix displays" (D3) discloses liquid crystal matrix displays exhibiting improved scanning capability. Contrary to the claimed devices, the displays of document D3 exhibit a twist angle of  $90^\circ$  or more, and values of the alignment angle  $\alpha$  much smaller than  $60^\circ$ ; see Figure 4.

- 3.3 For these reasons, the subject-matter of claim 1 is considered novel in the sense of Article 54 EPC.

4. *Inventive step*

- 4.1 The novel combination of ranges for the twist angle and for the alignment angle  $\alpha$  as set out in claim 1 is not, in the Board's judgment, suggested by any of the documents on file.

None of these documents actually addresses the technical problem underlying the present invention, which is to avoid the occurrence of picture inversion under changing viewing angles. This problem is solved in substance by the combination of a twist angle smaller than  $90^\circ$  with a relatively large alignment angle  $\alpha$  exceeding  $60^\circ$ .

- 4.2 In contrast, the alignment angle  $\alpha$  as disclosed in terms of ranges in document D1 is between  $-30^\circ$  and  $60^\circ$ , and there is even no specific example disclosed with an alignment angle above  $30^\circ$ . Accordingly the skilled person in the Board's judgment had no obvious reason to select an alignment angle  $\alpha$  above  $60^\circ$  as is now set out in claim 1.

The remaining citations D2 and D3 of the European Search Report as summarised under point 3.2. above do not give any hint either at selecting an alignment angle above  $60^\circ$ .

- 4.3 Accordingly, the subject-matter of claim 1 is considered to involve an inventive step in the sense of Article 56 EPC.

5. Claim 1 is allowable for the above reasons, and so are claims 2 to 4 by virtue of their dependency on claim 1.



5.1 Since the application and the invention to which it relates meet the requirements of the Convention, a patent can be granted in accordance with appellant's request.

## 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 of granting a patent on the basis of the following documents:

Claims 1 to 4 as filed on 6 August 1997, with the amendment consisting of replacing the expression " $\phi_{T/2}$ " which appears twice in the penultimate line of claim 1 with the expression " $\phi_T/2$ ";

Description: page 1 as filed on 6 August 1997 and pages 2 and 3 as originally filed, with the amendment consisting of deleting lines 1 to 5 of page 2;

Page 1/1 of the drawings as originally filed.

The Registrar:

The Chairman:

P. Martorana

E. Turrini

