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Aktenzeichen / Case Number / N° du recours : T 383/89 - 3.4.2

Anmeldenummer / Filing No / N° de la demande : 84 307 677.9

Veröffentlichungs-Nr. / Publication No / N° de la publication : 0 142 326

Bezeichnung der Erfindung: Liquid crystal display

Title of invention:

Titre de l'invention :

Klassifikation / Classification / Classement : G02F 1/137

### ENTSCHEIDUNG / DECISION

vom / of / du 16 January 1991

Anmelder / Applicant / Demandeur : International Standard Electric Corp.

Patentinhaber / Proprietor of the patent /  
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPU / EPC / CBE Art. 56

Schlagwort / Keyword / Mot clé : "Inventive step (no)"

Leitsatz / Headnote / Sommaire



Case Number : T 383/89 - 3.4.2

**D E C I S I O N**  
of the Technical Board of Appeal  
of 16 January 1991

**Appellant :** International Standard Electric Corp.  
West Road  
Harlow  
Essex CM20 2SH (GB)

**Representative :** J.P.W. Ryan  
STC Patents  
West Road  
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**Decision under appeal :** Decision of Examining Division 040  
of the European Patent Office dated  
5 September 1988 refusing European  
patent application No. 84 307 677.9  
pursuant to Article 97(1) EPC

**Composition of the Board :**

**Chairman :** E. Turrini  
**Members :** M. Chomentowski  
L. Mancini

**Summary of Facts and Submissions**

I. European patent application No. 84 307 677.9 (publication No. 0 142 326) was refused on the grounds that the subject-matter of Claim 1 lacked an inventive step with regard to the following documents:

(D1) FR-A-2 373 849 and

(D2) EP-A-0 092 181.

II. The Appellant (Applicant) lodged an appeal against this decision.

III. The appeal procedure is based on the following application documents:

**Description:**

Pages 1, 3 and 4, as originally filed, with the deletion of the three last lines of page 4, as requested by the Appellant with letter of 8 April 1988,

Pages 2 and 2a as filed with letter of 8 April 1988;

**Claims:**

Nos. 1 and 2 filed with letter of 8 April 1988;

**Drawings:**

Sheet 1/1 as originally filed.

Claim 1 reads as follows:

"1. A liquid crystal display, including a plurality of liquid crystal display cells disposed on a silicon semiconductor substrate incorporating means for operating the display, each cell of the display comprising a reflective back electrode supported on the substrate and a transparent front electrode supported on a transparent

front cover whereby, in use, a liquid crystal material disposed therebetween may be switched between the stable states, and single polariser disposed adjacent the front cover whereby the display may be viewed by specular reflection of light from the back electrodes, characterised in that the liquid crystal is a ferro-electric liquid crystal, and that the polariser is so orientated with respect to the display so as to provide a maximum contrast ratio between the two stable states of the display."

Claim 2 relates to a data terminal incorporating a display as claimed in Claim 1.

- IV. In the statement setting out the grounds of appeal, the Appellant provided the following arguments.

At the date of the application, it was known that some liquid crystals could be employed in a reflective display mode, but that by no means all liquid crystals could be used in this manner and that thus the ability to operate in a reflective mode is not a general property common to all liquid crystals and that, therefore, the reader of D1 could not assume that the ferro-electric materials described in D2 could in fact be employed in a reflective display.

The mechanism whereby ferro-electric switches from one state to the other is wholly distinct from that of conventional non ferro-electric materials; all liquid crystals, with the exception of ferro-electric materials, switch between two directions in a plane perpendicular to the plane of the display, while ferro-electric materials however are unique in that they switch between two directions in the plane of the display, whereby the

material has this property both in the presence and absence of a dye.

It is unreasonable to include ferro-electric materials in the general class of liquid crystals and then to infer that a property possessed by some, but not all, liquid crystals can be automatically applied to ferro-electric materials; although the reader of D1 is told that a liquid crystal reflective display may be constructed from conventional liquid crystal materials, this teaching cannot, without an inventive step, be applied to the wholly different class of ferro-electric materials; from the above it is submitted that the combination of D1 and D2 which, in effect, relate to incompatible materials, is improper. The invention as claimed is non obvious over either D1 or D2 taken alone.

#### Reasons for the Decision

1. The appeal is admissible.
2. Novelty
  - 2.1 A liquid crystal display, including a plurality of liquid crystal display cells disposed on a silicon semiconductor substrate (34) incorporating means for operating the display, each cell of the display comprising a reflective back electrode (36) supported on the substrate and a transparent front electrode (32) supported on a transparent front cover (30) whereby, in use, a liquid crystal material (28) disposed therebetween may be switched between the stable states, whereby the display may be viewed by specular reflection of light from the back electrodes, is known from D1 (see page 2, line 1 to page 3, line 2; page 3, line 29 to page 5, line 28; Fig. 1 to 5).

2.1.1 The subject-matter of Claim 1 differs therefrom in that:

- the liquid crystal is a ferro-electric liquid crystal, and that
- a single polariser disposed adjacent the front cover and so orientated with respect to the display so as to provide a maximum contrast ratio between the two stable states of the display.

2.2 A liquid crystal display, including a plurality of liquid crystal display cells disposed on a substrate (122), each cell of the display comprising a back electrode (11) supported on the substrate (122) and a transparent front electrode (11) supported on a transparent front cover (121) whereby, in use, a liquid crystal material (10) disposed therebetween may be switched between the stable states, and single polariser (131) disposed adjacent the front cover (121) whereby the display may be viewed by specular reflection of light, whereby the liquid crystal is a ferro-electric liquid crystal, is known from D2 (see page 4, line 2 to page 3, line 3; page 6, line 20 to page 8, line 17; Fig. 2).

2.2.1 The subject-matter of Claim 1 differs therefrom in that, in the claimed ferro-electric liquid crystal display, the substrate is a silicon semiconductor substrate incorporating means for operating the display, in that back electrodes are the reflecting elements, and in that the polariser is so orientated with respect to the display so as to provide a maximum contrast ratio between the two stable states of the display.

2.3 The other documents of the available prior art are considered as less relevant.

2.4 Therefore, the subject-matter of Claim 1 is novel in the sense of Article 54 EPC.

3. Inventive step

3.1 Since D1 discloses a liquid crystal display including in particular a plurality of liquid crystal display cells disposed on a silicon semiconductor substrate (34) incorporating means for operating the display, each cell of the display comprising a reflective back electrode (36) supported on the substrate and a transparent front electrode (32) supported on a transparent front cover (30) whereby, in use, a liquid crystal material (28) disposed therebetween may be switched between the stable states, whereby the display may be viewed by specular reflection of light from the back electrodes, it is considered as representing the nearest prior art. The skilled person to be considered is a person skilled in the art of display devices comprising liquid crystals.

3.1.1 According to the description of the patent application in suit (see page 1, lines 6-12), since in known devices that have employed liquid crystals that do not exhibit ferro-electricity the material interacts with an applied electric field by way of an induced dipole, said devices are not sensitive to the polarity of the applied field; moreover, said devices are not fast but respond to the applied RMS voltage averaged over approximately one response time at that voltage.

3.1.2 There was therefore a need to solve this problem. It is known that, in contrast to other known liquid crystals, ferro-electric liquid crystals exhibit a permanent

electric dipole and it is this permanent electric dipole which will interact with an applied electric field; therefore, ferro-electric liquid crystals are expected to show a greater coupling with an applied field and hence a faster response (see the application in suit, page 1, lines 16-28).

3.2 Moreover, the use of ferro-electric liquid crystals in displays in a reflection mode is already known (see D2, in particular page 8, lines 3-17 and Fig. 2). D2 also pertains to the technical field of display devices comprising liquid crystals, and the person skilled in the art of D1 will also be aware of the possibilities offered by the teaching of D2.

3.2.1 In view of the above mentioned problem to be solved, of the known properties of the ferro-electric liquid crystals and of the teaching of D2, it would therefore be obvious for the person skilled in the art to modify the device of D1 by using a ferro-electric liquid crystal as claimed in the application in suit. Moreover, the use of a single polariser disposed adjacent the front cover is generally known to people skilled in the art (see D2) and, therefore, this feature does not contribute to an inventive step of the subject-matter of Claim 1.

3.2.2 Moreover, the second distinguishing feature of Claim 1, mentioned in paragraph 2.1.1 above, that the polariser is so orientated with respect to the display so as to provide a maximum contrast ratio between the two stable states of the display, is considered to be the result of the normal activity of a person skilled in the art who, when designing a new device, uses at least a trial and error method to arrive at the best possible device in accordance with the principles of said device. Since the resulting device is a device in accordance with said principles and



since no unexpected effect appears to result from said design procedure, the Board considers that the person skilled in the art does not make any inventive effort by adding said second distinguishing feature.

3.3 The Appellant has provided the argument that, at the date of the application, it was known that some liquid crystals could be employed in a reflective display mode, but that by no means all liquid crystals could be used in this manner and that thus the ability to operate in a reflective mode is not a general property common to all liquid crystals and that, therefore, the reader of D1 could not assume that the ferro-electric materials described in D2 could in fact be employed in a reflective display.

3.3.1 This argument is not considered as relevant because D2 already mentions the use of ferro-electric liquid crystals in displays in a reflection mode (see D2, in particular page 8, lines 3-17 and Fig. 2). Since D2 does not restrict the disclosed ferro-electric liquid crystal materials to some specific class thereof (see D2, page 1, lines 1-4; page 1, lines 5-9 and Table 1, for examples of ferro-electric liquid crystal materials; see also page 4, line 10 to page 5, line 3; page 6, line 27 to page 7, line 4 and page 8, lines 5-17), the reader of D1, who was also aware of the teaching of D2, was not restrained from combining the teachings accordingly by substituting ferro-electric liquid crystal for conventional liquid crystal in the device of D1.

3.4 The Appellant has provided the argument that the mechanism whereby ferro-electric switches from one state to the other is wholly distinct from that of conventional non ferro-electric materials; all liquid crystals, with the exception of ferro-electric materials, switch between two

directions in a plane perpendicular to the plane of the display, while ferro-electric materials however are unique in that they switch between two directions in the plane of the display, whereby the material has this property both in the presence and absence of a dye.

3.4.1 This argument is already not considered as relevant because D2 teaches the use of ferro-electric liquid crystal in a display in the reflective mode and, therefore, there is nothing in D2 which can be considered as inciting the person skilled in the art not to use ferro-electric liquid crystal in a display in the reflective mode. Moreover, there is nothing in the teaching of D1 which can be interpreted as forbidding the use of such ferro-electric liquid crystal in a display in the reflective mode having the constructional features of the device of D1. It is further to be noted that Claim 1 in suit does not mention whether the claimed display includes dye or not. Therefore, since the subject-matter of Claim 1 in suit is not restricted to devices without dye, the combination of D1 and D2 leads to particular forms of said subject-matter. Moreover, the arguments concerning the particular plane of switching of ferro-electric liquid crystals is further not considered as relevant since D2 discloses such a switching element and since the person skilled in the art will, in the duties which are part of his normal activity, design by trial and error methods an adapted construction of the device which will result in a working device.

3.5 The Appellant has provided the argument that it is unreasonable to include ferro-electric materials in the general class of liquid crystals and then to infer that a property possessed by some, but not all, liquid crystals can be automatically applied to ferro-electric materials; although the reader of D1 is told that a liquid crystal

reflective display may be constructed from conventional liquid crystal materials, this teaching cannot, without an inventive step, be applied to the wholly different class of ferro-electric materials; from the above it is submitted that the combination of D1 and D2 which, in effect, relate to incompatible materials, is improper.

3.5.1 This argument is not considered as relevant for the following reasons. Ferro-electric liquid crystals are indeed generally considered by persons skilled in the art as particular liquid crystals. Ferro-electric liquid crystals are known as materials used in displays according to the reflective mode (see D2). Therefore, in relation with displays working according to the reflective mode, ferro-electric liquid crystals cannot be considered by persons skilled in the art as being members of a totally different class of materials and they cannot be considered as being incompatible materials in relation with the liquid crystals of D1. Therefore, the combination of D1 and D2 cannot be considered as improper for this reason.

3.6 Therefore, the argument of the Appellant that the combination of the teachings of D1 and D2 is obvious only with the benefit of hindsight cannot be considered as relevant.

3.7 Appellant's argument that the invention as claimed is non-obvious over either D1 or D2 taken alone has been taken into consideration. However, this argument is not relevant since the Board is of the opinion that the invention is obvious with regard to the teaching of D1 and D2, which can be combined without inventive effort by a person skilled in the art, for the reasons given in the paragraphs 3.1 to 3.6 above.

4. For these reasons, the subject-matter of Claim 1 lacks an inventive step in the sense of Article 56 EPC. Therefore, Claim 1 is not allowable (Art. 52(1) EPC).
- 4.1 Since data terminals incorporating a display are generally known in the relevant field, no feature could be detected in dependent Claim 2 which, in combination with Claim 1, could lead to an allowable claim.

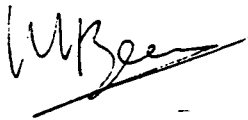
**Order**

For these reasons, it is decided that:

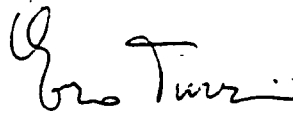
The appeal is dismissed.

The Registrar

The Chairman



**M. Beer**



**E. Turrini**

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