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**Datasheet for the decision
of 5 September 2012**

Case Number: T 2202/11 - 3.4.02
Application Number: 05014215.7
Publication Number: 1677140
IPC: G02F1/1337, G02F1/1343
Language of the proceedings: EN

Title of invention:

In-plane switching mode liquid crystal display device and
fabrication method thereof

Applicant:

LG Display Co., Ltd.

Headword:

Relevant legal provisions:

EPC 1973 Art. 83, 84

Keyword:

Clarity and sufficiency (yes)

Decisions cited:

Catchword:



**Beschwerdekammern
Boards of Appeal
Chambres de recours**

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Case Number: T 2202/11 - 3.4.02

D E C I S I O N
of the Technical Board of Appeal 3.4.02
of 5 September 2012

Appellant: LG Display Co., Ltd.
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Seoul (REPUBLIQUE DE COREE)

Representative: Viering, Jentschura & Partner
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 20 May 2011
refusing European patent application No.
05014215.7 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman: A. Klein
Members: M. Rayner
B. Müller

Summary of Facts and Submissions

- I. The applicant has appealed against the decision of the examining division refusing European patent application number 05 014 215.7 concerning in-plane mode switching liquid crystal devices.
- II. The decision under appeal invoked lack of clarity of the claims and insufficiency, the reasons concerned can be summarised as follows.

The word "strength" when referred to a property of a liquid crystal layer such as the spontaneous polarisation, is ordinarily regarded as being synonymous with "magnitude". The magnitude of the spontaneous polarisation of a given material is an inherent property of the material.

Claim 1 is directed to a liquid crystal display device comprising inter alia a first and a second ferroelectric liquid crystal layer, wherein the first and the second ferroelectric liquid crystal layer differ in the strengths of their spontaneous polarisations. Method claim 7 includes two steps allegedly leading to the generation, in the first and the second ferroelectric liquid crystal layer, respectively, of a first and a second spontaneous polarisation differing in strength.

In the absence of claiming different materials for the first and second ferroelectric liquid crystal layer, no difference in the strength of the spontaneous polarisation of the first and second ferroelectric liquid crystal layers exists. The description of the method in paragraphs [0037] and [0038] is likewise silent on the use of different materials, so that the

description offers no possible explanation for the claimed difference in the strength of the spontaneous polarisations of the first and second ferroelectric liquid crystal layers.

Therefore, neither claim 1 nor claim 7 satisfies the requirements of Article 84 EPC, since it is not clear from the claims how the ferroelectric layers differ in the strengths of their spontaneous polarisations.

Claim 7 and the description of the fabrication process in paragraphs [0037] and [0038] refer to exposure of the first and second ferroelectric liquid crystal layers to a first and a second atmosphere or to a first and a second electric field, whereby different strengths of the spontaneous polarisation can allegedly be achieved (see the beginning of paragraph [0037] of the description). Exposure of a ferroelectric liquid crystal layer either to an atmosphere of a polar or non-polar substance (as described in paragraph [0037]) or to an electric field (as described in paragraph [0038]) cannot change the magnitude of the spontaneous polarisation of a ferroelectric material, the only effect on this material possibly being the change of sign of the spontaneous polarisation, i.e. the reversal of direction of the dipoles associated to the ferroelectric molecules. Since the application in its entirety does not disclose the use of different materials for the first and second ferroelectric liquid crystal layers or a fabrication process capable of imparting a different magnitude of spontaneous polarisation to said layers, as claimed in claim 1 and claim 7, the application does not disclose the invention in a manner sufficiently clear and complete to be carried out by a person skilled in the art and so does not satisfy Article 83 EPC.

- III. The appellant requested that the decision under appeal be set aside and a patent granted on the basis of a main or first auxiliary request. Oral proceedings were requested on an auxiliary basis.
- IV. In support of its case, the appellant advanced arguments including the following.

Claim 1 clearly and unambiguously recites that the strengths (magnitudes) of the spontaneous polarisations of the two ferroelectric liquid crystal layers are different. The question of whether it is clear or not how the two ferroelectric liquid crystal layers might differ in the strengths of their spontaneous polarisations, is not an issue of clarity of claim 1.

The skilled person is aware that the strength of the spontaneous polarisation is an inherent material property that cannot be influenced by application of an external force. It is therefore immediately apparent that claimed difference in strength of spontaneous polarisations is not achieved by exposure to different atmospheres or electric fields applied during phase transition but must stem from a difference in materials used for the first and second ferroelectric liquid crystal layers. Claim 7 provides the clear technical teaching that the ferroelectric liquid crystal layers are exposed to different atmospheres with substances of different strength of polarity or to electric fields of different intensity in order to align the directions of the spontaneous polarisations of the ferroelectric liquid crystal layers in such a manner that the direction of the first spontaneous polarisation and the direction of the second spontaneous polarisation are the same when the liquid crystal layers face each other

(that is, after the first and second substrates have been attached).

Half V mode liquid crystal material is used for the first and second ferroelectric liquid crystal layers and the spontaneous polarisations of the ferroelectric liquid crystal layers are different, thus the first ferroelectric liquid crystal layer has to be made of a Half V mode liquid crystal material of a different strength of spontaneous polarisation to the Half V mode liquid crystal material of the second ferroelectric liquid crystal layer. Since Half V mode liquid crystal materials with different strengths (magnitudes) of the spontaneous polarisation are well known in the art, the skilled person has no problem choosing suitable materials among the known materials such that the first and second ferroelectric liquid crystal layers have spontaneous polarisations with different strength, and thus has no difficulties in carrying out the invention.

V. Independent claims 1 and 7 according to the main request of the appellant are worded as follows.

"1. A liquid crystal display device, comprising:
a first substrate (210) including a pixel electrode (220) in a pixel region;
a second substrate (270) facing the first substrate (210) and including a common electrode (272);
a first alignment layer (222) disposed on the pixel electrode (220);
a second alignment layer (275) disposed on the common electrode (272);
a first ferroelectric liquid crystal layer (233) disposed on the first alignment layer (222) and including a first spontaneous polarization (Ps1);

a second ferroelectric liquid crystal layer (280) disposed on the second alignment layer (275) and including a second spontaneous polarization (Ps2), and a nematic liquid crystal layer (440) interposed between the first and second ferroelectric liquid crystal layers (233, 280); wherein a direction of the first spontaneous polarization (Ps1) is the same as a direction of the second spontaneous polarization (Ps2), and wherein the first and second ferroelectric liquid crystal layers (233, 280) differ in the strengths of the spontaneous polarizations (Ps1, Ps2), wherein the first and second ferroelectric liquid crystal layers (233, 280) include a 20 Half V mode liquid crystal of a continuous director rotation ("CDR") mode group, wherein, when a voltage is applied, liquid crystal molecules (491a, 491b) in the nematic liquid crystal layer (490) rotate in the same rotational direction as liquid crystal directors (435, 482) in the first and second ferroelectric liquid crystal layers (433, 480).

7. A fabrication method of a liquid crystal display device, comprising:
supplying a pixel electrode (220) on a first substrate (210);
supplying a common electrode (272) on a second substrate (270);
disposing a first alignment layer (222) on the pixel electrode (220);
disposing a second alignment layer (275) on the common electrode (272);
forming a first ferroelectric liquid crystal layer (233) by coating a first ferroelectric liquid crystal (230) of an isotropic phase on the first alignment layer (222);

forming a second ferroelectric liquid crystal layer (280) by coating a second ferroelectric liquid crystal (277) of an isotropic phase on the second alignment layer (275), wherein forming the first and second ferroelectric liquid crystal layers (233, 280) comprises forming the first and second ferroelectric liquid crystal layers (233, 280) with a Half V mode liquid crystal of a continuous director rotation ("CDR") mode group;

exposing the first ferroelectric liquid crystal layer (233) to a first atmosphere of a first substance with a first strength of polarity or to an electric field having a first intensity when the first ferroelectric crystal (230) of the first ferroelectric liquid crystal layer (233) makes a transition from the isotropic phase to a smectic phase to reveal a first spontaneous polarization (Ps1) in the first ferroelectric liquid crystal layer (233);

exposing the second ferroelectric liquid crystal layer (280) to a second atmosphere of a second substance with a second strength of polarity or to an electric field having a second intensity when the second ferroelectric crystal (277) of the second ferroelectric liquid crystal layer (280) makes a transition from the isotropic phase to a smectic phase to reveal a second spontaneous polarization (Ps2) in the second ferroelectric liquid crystal layer (280), wherein the first and second ferroelectric liquid crystal layers (233, 280) differ in the strengths of the spontaneous polarizations (Ps1, Ps2) and wherein the second atmosphere is different from the first atmosphere and the second intensity is different from the first intensity such that directions of the spontaneous polarizations (Ps1, Ps2) of the first and second ferroelectric liquid crystal layers (233, 280) are aligned in such a manner that, when the first and

second ferroelectric liquid crystal layers (233, 280) face each other a direction of the first spontaneous polarization (Ps1) is the same as a direction of the second spontaneous polarization (Ps2); attaching the first and second substrates (210, 270) such that the first and second ferroelectric liquid crystal layers (233, 280) face each other; and interposing a nematic liquid crystal layer (440) between the first and second ferroelectric liquid crystal layers (233, 280), wherein, when a voltage is applied, liquid crystal molecules (491a, 491b) in the nematic liquid crystal layer (490) rotate in the same rotational direction as liquid crystal directors (435, 482) in the first and second ferroelectric liquid crystal layers (433, 480)."

Reasons for the Decision

1. The appeal is admissible.
2. The board observes that no dispute was offered by the appellant to the statement by the examining division that the magnitude of the spontaneous polarisation of a given material is an inherent property of the material. The appellant affirmed that the skilled person is aware that the strength of the spontaneous polarisation is an inherent material property. The board sees no reason further to comment on this undisputed statement.
3. Clarity
 - 3.1 A feature contained in both claim 1 and 7 is that the first and second ferroelectric liquid crystal layers differ in the strengths of spontaneous polarisation. The board does not doubt that both the examining division and the appellant understand what this means,

as is evidenced by the appellant's observation in point 2 above. Claim 1 relates to a device claim for which a skilled person accordingly knows what is meant by the wording "differ in the strengths of their spontaneous polarisations" and is thus in a position to determine the specific polarisations concerned for a given device. The claim is therefore clear in this respect.

3.2 The argument of the division about lack of clarity concerning **how** the ferroelectric layers differ in the strengths of their spontaneous polarisations is not pertinent, just that they **are** different. The argument is not therefore persuasive. Moreover, since the division did not identify any lack of clarity deriving from, say, contradiction of the claim with the description, its reference to the latter does not justify its calling, with reference to clarity in the sense of Article 84, for an amendment, such as specific recitation that the materials are different.

3.3 A close reading of claim 7 reveals that it contains the following features (bold typeface added by the board), which were also present in fabrication method claim 8 as filed:-

- (1) forming a first ferroelectric liquid crystal layer (233) by coating **a first ferroelectric liquid crystal (230)** of an isotropic phase on the first alignment layer (222),
- (2) forming a second ferroelectric liquid crystal layer (280) by coating **a second ferroelectric liquid crystal (277)** of an isotropic phase on the second alignment layer (275).

3.4 Accordingly, there is a claiming of a **first** ferroelectric liquid crystal and a **second** ferroelectric liquid crystal, which by virtue of the use of first and second, the latter being preceded by the indefinite article, are not the same ferroelectric liquid crystal. It follows that the objection as to lack of clarity as made by the examining division is not to the point in the case of claim 7.

3.5 The decision under appeal did not therefore persuade the board that independent claims 1 and 7 should not be considered clear within the meaning of Article 84 EPC 1973.

4. Sufficiency

Since claim 7 (and also claim 8 as filed) specifies a first and a second liquid ferroelectric crystal and the examining division referred to no contrary disclosure, its position is untenable in relation to the view that the application in its entirety does not disclose the use of different materials for the first and second ferroelectric liquid crystal layers. The remainder of the division's line of argument pertaining to different atmospheres and fields is not pertinent to sufficiency in respect of spontaneous polarisation and does not therefore justify its conclusion that the application does not disclose the invention in a manner sufficiently clear and complete to be carried out by a person skilled in the art.

5. Further Procedure

5.1 The examination of the application resulted in a decision before the first instance dealing only with clarity and sufficiency. Of the matters normally dealt

with in the examination process, the file is not so unambiguous in relation to those matters other than dealt with in the decision that the board can determine unequivocally, and thus be in a position to review, the results of the examination process. Since the board is an appeal instance, its role is primarily to review the case as presented on appeal, rather than to exercise powers within the competence of the first instance to decide the case effectively in the role of first instance for the first time. In view of the foregoing and having settled the issues of clarity and sufficiency for points forming the basis of the decision under appeal in relation to the independent claims of the main request, the board considers it appropriate to remit the case to the first instance for further prosecution.

- 5.2 In relation to the independent claims of the main request, the present decision is in favour of the appellant regarding the issues forming the basis of the decision under appeal. It is not therefore necessary to consider the claims according to the first auxiliary request, nor are the oral proceedings requested on an auxiliary basis necessary.

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 for further prosecution.

The Registrar:

The Chairman:



M. Kiehl

A. Klein

Decision electronically authenticated