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**Datasheet for the decision
of 29 November 2017**

Case Number: T 1036/14 - 3.4.02

Application Number: 06702874.6

Publication Number: 1839084

IPC: G02F1/1335

Language of the proceedings: EN

Title of invention:

LIQUID CRYSTAL DISPLAY DEVICE AND MOBILE STATION HAVING THE
SAME

Applicant:

LG Display Co., Ltd.

Relevant legal provisions:

EPC 1973 Art. 56

Keyword:

Inventive step (yes - amended claims)



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Case Number: T 1036/14 - 3.4.02

D E C I S I O N
of Technical Board of Appeal 3.4.02
of 29 November 2017

Appellant: LG Display Co., Ltd.
(Applicant) 20, Yoido-dong,
Youngdungpo-gu,
Seoul (KR)

Representative: Hirsch & Associés
137, rue de l'Université
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Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 11 December
2013 refusing European patent application No.
06702874.6 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman R. Bekkering
Members: F. J. Narganes-Quijano
G. Decker

Summary of Facts and Submissions

I. The appellant (applicant) lodged an appeal against the decision of the examining division refusing European patent application No. 06702874.6 (published as international application with the publication No. WO 2006/078118).

In its decision the examining division held that claim 1 of the sole request then on file did not involve an inventive step (Article 56 EPC 1973) in view of the disclosure of the following documents:

D1: US 2005/0001796 A
D2: WO 02/071131 A
D3: US 5 796 451 A.

II. With the statement setting out the grounds of appeal the appellant filed two sets of claims as a first and a second auxiliary request. The appellant requested that the decision under appeal be set aside and a patent be granted on the basis of the set of claims underlying the decision under appeal, as a main request, or the set of claims of one of the first and the second auxiliary requests filed with the statement of grounds of appeal.

III. In a communication annexed to summons to oral proceedings scheduled for 7 December 2017, the board referred to the following document cited in the Supplementary European search report:

D4: US 2003/0231268 A,

introduced the following documents into the proceedings:

A1: US 5 396 350 A
A2: US 5 748 828 A
A3: US 5 845 035 A,

and gave a preliminary assessment of the case.

IV. In reply to the summons to oral proceedings, the appellant filed with its letter dated 6 November 2017 two sets of amended claims as a main and an auxiliary request replacing the previous sets of claims.

In reply to a telephone conversation with the rapporteur of the board held on 14 November 2017, the appellant filed with the letter dated 17 November 2017 a new set of claims 1 to 15 replacing the previous sets of claims. The appellant requested the grant of a patent on the basis of the following application documents:

- claims: No. 1 to 15 filed with the letter dated 17 November 2017;
- description: pages 1 to 3 filed with the letter dated 17 November 2017, and pages 4 to 7 of the application as published; and
- drawings: sheets 1/4 to 4/4 of the application as published.

V. In view of the application documents of the sole request of the appellant, the oral proceedings were cancelled.

VI. Claim 1 of the present request of the appellant reads as follows:

"A liquid crystal display device, LCD, having a front side and a rear side for selectively displaying and viewing an image either on the front side or on the rear side of the device, said liquid crystal display comprises:

a transmissive liquid crystal panel (100) having a front side and a rear side corresponding to the front side and the rear side of the liquid crystal display device;

a front light unit (170) placed in front of the transmissive liquid crystal panel (100) and providing light for image display;

a light control unit (180) including one single Polymer-Dispersed Liquid Crystal (190), PDLC, and placed at the rear of the transmissive liquid crystal panel (100) for reflecting or transmitting incident light;

wherein the transmissive liquid crystal panel (100) comprises:

a first substrate (110) provided at the rear side of the transmissive liquid crystal panel (100);

a second substrate (120) provided at a position facing the first substrate (110) at the front side of the transmissive liquid crystal panel (100);

a liquid crystal layer (130) filled between the first substrate (110) and the second substrate (120);

a first polarization plate (140) placed between the light control unit (180) and the first substrate (110);

a second polarization plate (150) placed between the front light unit (170) and the second substrate (120), and

a microlens sheet (160) placed between the front light unit (170) and the second polarization plate (150),

wherein the image is displayed in a first mode in which, the single PDLC (190) of the light control unit

(180) reflects the incident light when a voltage is not applied, so that the light control unit (180) reflects light emitted by the front light unit and transmitted through the transmissive liquid crystal panel (100), thereby displaying the image on the front side of the transmissive liquid crystal panel (100), and in a second mode in which, the single PDLC (190) of the light control unit (180) transmits incident light when a voltage is applied thereto so that the light control unit (180) transmits light emitted by the front light unit and transmitted through the transmissive liquid crystal panel (100), thereby displaying the image on the rear side of the transmissive liquid crystal panel (100)."

The set of claims of the appellant's request also includes dependent claims 2 to 14 directed to particular embodiments of the liquid crystal display device defined in claim 1, and independent claim 15 directed to a mobile station comprising the liquid crystal display device according to any one of claims 1 to 14.

Reasons for the Decision

1. The appeal is admissible.
2. *Amendments and formal requirements*

The board is satisfied that the amended application documents of the present request of the appellant meet the requirements of Article 123(2) EPC, and also the formal requirements of the EPC. In particular,

- claim 1 is based on claims 1, 2, 16 and 17 as originally filed, together with Fig. 1, 4 and 5 and the corresponding description, in particular paragraphs [27], [32] and [40] of the description of the application as originally filed;

- dependent claims 2 to 4 are respectively based on claim 18, claims 3 and 4, and claims 5 and 6 as originally filed, dependent claims 5 to 13 are respectively based on claims 7 to 15 as originally filed, and dependent claim 14 is based on paragraph [29] of the description as originally filed; and

- independent claim 15 is based on independent claim 19 of the application as originally filed.

In addition, the description has been brought into conformity with the invention as defined in the claims (Article 84 and Rule 27(1)(c) EPC 1973), and the pertinent state of the art (documents D1, D2 and D4) has been acknowledged in the introductory part of the description (Rule 27(1)(b) EPC 1973).

3. *Novelty and inventive step*

3.1 Claim 1 is directed to a liquid crystal display (LCD) for selectively displaying and viewing an image on the front or on the rear side of the device. The LCD device comprises a transmissive LCD panel, a front light unit placed in front of the LCD panel, and a light control unit including a Polymer-Dispersed Liquid Crystal (PDLC) placed at the rear side of the LCD panel. The LCD panel is of the type comprising a liquid crystal filled between two substrates each having a polarization plate, and the device also includes a microlens sheet placed between the LCD panel and the front light unit. According to the claimed invention, light incident on the PDLC layer is transmitted or

reflected by the layer, depending on whether a voltage is being applied or not thereto. The PDLC is therefore switchable between a light reflecting state in which the light emitted by the front light unit and transmitted through the LCD panel is reflected, thus displaying the image generated by the LCD panel on the front side of the device, and a light transmissive state in which the light from the front light unit transmitted through the LCD panel is transmitted by the PDLC layer, thus displaying the image on the rear side of the device.

- 3.1.1 Document D1 discloses an LCD device arranged to simultaneously display images on both sides of the device (abstract, together with Fig. 3, 4, 14, 16 and 18, and the corresponding description, in particular paragraphs [0038] and [0039]) and comprising a transmissive LCD panel (48; 66; 118; 140; 170) constituted by a liquid crystal layer disposed between two substrates and two polarizers (Fig. 4 and paragraph [0029]), and a front light unit (112, 114; 132, 134, 136; 162, 164, 166). The LCD device further comprises a light transflective layer (502; 70; 1202; 1422; 17222, 17224) that simultaneously reflects and transmits light incident thereon (paragraph [0008]). In a first embodiment, the transflective layer is constituted by a thin semi-reflective and semi-transmissive layer, so that the image generated by the LCD panel is simultaneously displayed on both sides of the LCD device (Fig. 4, and paragraphs [0029] and [0030]). In a second embodiment, the transflective layer is constituted by a structured layer having alternate reflective and transmissive regions, and depending on the image generated by the LCD pixels optically aligned with the reflective and the transmissive regions of the transflective layer (Fig. 3, and paragraphs [0029],

[0030], [0032], [0038] and [0039]), the same or a different image is simultaneously displayed on both sides of the LCD device.

As held by the examining division in its decision in respect of claim 1 then on file, the LCD device of document D1 does not comprise a switchable PDLC light control unit as claimed. In addition, while the LCD device of document D1 is arranged to simultaneously display images on both sides of the device, claim 1 requires the selective display of an image on the front or on the rear side of the device depending on whether the switchable PDLC layer is in the reflective or in the transmissive state. Already for these reasons, claim 1 is new over the disclosure of document D1.

3.1.2 Document D2 discloses an LCD device (abstract, and Fig. 1 to 5, together with the corresponding description) comprising a transmissive LCD panel of the type comprising an LCD layer (16) disposed between two substrates (15, 17) and two polarizers (13, 18) (page 3, lines 25 to 38), and having two switchable PDLC layers (12 and 20, and page 4, lines 1 to 23), each disposed on a respective side of the LCD panel. In operation, while one of the PDLC layers is switched to the reflective or the transmissive state, the other one of the PDLC layers is switched to the transmissive or the reflective state, respectively (page 4, lines 1 to 34), so that the image generated by the LCD panel is selectively displayed on either one of the front and the rear sides of the device (page 5, line 2 to 17).

Claim 1 differs from the disclosure of document D2 in the provision of the claimed arrangement constituted by the front light unit and the microlens sheet. In addition, while document D2 requires two switchable

PDLC layers for the selective display of an image on either side of the LCD device, claim 1 achieves the same selective image display capability with only one PDLC layer in cooperation with the front light unit.

It is noted that document D2 discloses a second embodiment in which the LCD device comprises one single switchable PDLC layer on the rear side of the LCD panel (Fig. 7 and 8, and page 6, lines 25 to 39). However, in this embodiment the image generated by the LCD panel is reflected by the PDLC layer when switched to its reflective state and the image is then displayed on the front side of the device, and when the PDLC layer is switched to its transparent state no image is generated by the LCD panel, and the LCD device is only used as a transparent device (abstract, page 3, lines 10 to 13, and page 7, lines 11 to 21).

Therefore, the LCD device of claim 1 is also new over the disclosure of document D2.

- 3.1.3 Document D4 discloses an LCD device (abstract, and Fig. 1A and 1B together with the corresponding description) comprising a transmissive LCD panel (130, 140, 150, 160) and, on the rear side of the panel, a light control unit constituted by a switchable PDLC layer (120, and paragraphs [0008], [0016], and [0024] to [0028]) and a back light unit (paragraph [0029]). When the PDLC layer is switched to the transmissive state, the back light unit illuminates the LCD panel and the image generated by the LCD panel is then displayed on the front side of the LCD device, and when the PDLC layer is switched to the reflective state, light from a light source located outside the LCD device (paragraph [0029], together with paragraph [0006]) is transmitted through the LCD panel and reflected by the PDLC layer,

and the image generated by the LCD panel is then displayed on the front side of the device (paragraph [0029]).

In addition, although the LCD device of document D4 is disclosed in the technical context of apparatuses such as portable televisions, mobile telephones, computers and the like (paragraph [0004]) in which the LCD device is mounted in such a way that its rear side is generally concealed, the structure of the LCD device of document D4 is such that, when the PDLC is in the transmissive state, the image generated by the LCD panel is also displayed, and therefore in principle viewable - although possibly with a relatively low contrast or brightness -, on the rear side of the LCD device when considering external or ambient light incident on the front side of the LCD device.

The LCD device defined in claim 1 differs from the LCD device disclosed in document D4 in that

- the LCD panel comprises, in this order from the rear side, a first polarization plate, a first substrate, a liquid crystal layer, a second substrate, and a second polarization plate, while the LCD panel of document D4 comprises a pixel electrode layer (130), a liquid crystal layer (140), an electrode layer (150), and a colour filter plate (160) (Fig. 1A and paragraphs [0026] and [0027]);

- a front light unit for image display and a microlens sheet are placed in front of the LCD panel; and

- the PDLC layer, when switched to the reflective state for displaying the image on the front side of the LCD device, reflects light emitted by the front light unit and, when switched to the transmissive state, transmits light emitted by the front light unit,

thereby displaying the image on the rear side of the LCD device.

Therefore, the LCD device of claim 1 is also new over the disclosure of document D4.

- 3.1.4 The remaining documents on file are less pertinent for the issue of novelty.
- 3.1.5 It follows from the above analysis that, as already concluded by the examining division in its decision in respect of claim 1 then on file, the subject-matter of present claim 1 is new over the available prior art (Article 54(1) EPC 1973).
- 3.2 In its decision the examining division considered that the closest state of the art in the assessment of inventive step was represented by document D1. Alternatively, each of documents D2 and D4 can also be considered in the board's opinion as representing the closest state of the art.
 - 3.2.1 In its decision the examining division held that, when starting with document D1 as the closest state of the art, it would be obvious for the skilled person to replace the light transfective layer of the LCD device of document D1 by a PDLC layer of the type disclosed in document D2 in order to solve the problem of enabling a dynamical control of the dual display capability of the LCD device of document D1. The board is not persuaded by this line of argument. As already noted above, document D1 is directed to the simultaneous display of images on both sides of an LCD device, and document D2 is directed to the selective display of an image on either one of the two sides of an LCD device. The application of the teaching of document D2 to the LCD

device of document D1 along the line of argument of the examining division would therefore endow the LCD device of document D1 with a dynamical control of the display capability as found by the examining division, but it would also change the nature of the display capability of document D1 from a simultaneous display of the same or a different image on both sides of the LCD device, to a selective display of an image on one or the other of the sides of the device. For this reason, and as submitted by the appellant during the appeal proceedings, the skilled person would not have considered the combination of the disclosure of document D1 and the teaching of document D2.

In addition, while document D1 relies on a light transfective layer which simultaneously reflects and transmits light incident thereon, the PDLC layers considered in document D2 are alternately switched between a reflective and a transmissive state, and the skilled person would not see in this PDLC arrangement an alternative to the light transfective layer of document D1 or an improvement to the function of this layer as it would change the nature of the display capability of the LCD device. Moreover, in the event that the skilled person would have had any incentive in replacing the simultaneous display capability of the LCD device of document D1 by the alternate - or, as considered by the examining division, dynamic - display capability of the LCD device of document D2, he would then have considered the replacement of the LCD device of document D1 by the LCD device of document D2, which, in effect, would amount to starting with document D2 as the closest state of the art (cf. point 3.2.2 below).

Furthermore, even assuming that the skilled person would have considered replacing in document D1 the transflective layer by the switchable PDLC arrangement disclosed in document D2, he would then have obtained an LCD device in which, when the front and the rear PDLC layers are respectively switched to the reflective and the transmissive states, the light from the front light unit of the device of document D1 would be reflected by the front PDLC layer and would not reach the LCD panel. Consequently, contrary to claim 1 as presently amended, in the resulting device no light emitted by the front light unit would be transmitted by the LCD panel and the rear PDLC layer so as to display the image generated by the LCD panel on the rear side of the LCD device.

Document D2 also discloses an LCD device comprising one single switchable PDLC layer. However, as already noted in point 3.1.2 above, third paragraph, the corresponding teaching does not pertain to the display of images on both sides of the LCD device, but to switching the LCD device between a state in which an image is displayed on only one side of the device, and a non-imaging state in which the LCD device is in a transparent state. It follows that the application of this teaching to the LCD device disclosed in document D1 would not suggest the claimed LCD device either.

Therefore, in the board's view the subject-matter of claim 1 involves an inventive step over document D1 as closest state of the art and the teaching of document D2.

In addition, neither the teaching of document D4, nor that of the remaining documents on file suggest

modifying the LCD device of document D1 so as to arrive at the claimed LCD device.

3.2.2 When considering document D2 as closest state of the art, the board notes that the document only relies on ambient light for the illumination of the LCD panel (page 3, lines 32 to 35) and the document does not disclose, among other features defined in claim 1, the provision of a front light unit and a microlens sheet as claimed. However, it was conventional in this art at the priority date of the application to improve the illumination, and therefore the imaging capability and the brightness and/or contrast of the displayed image (cf. paragraph [36] of the description of the application) of an LCD device by means of a light unit coupled to a microlens sheet and disposed on the side of the LCD panel opposite to the image display side, see for instance document A1 (Fig. 1 and 7 together with the abstract, column 3, lines 10 to 18, column 4, lines 29 to 49, column 8, lines 32 to 68, and column 21, lines 8 to 36), document A2 (Fig. 2 together with the abstract, column 5, lines 8 to 64, column 6, lines 39 to 46, and column 7, lines 45 to 62), and document A3 (Fig. 1 together with the abstract, column 3, lines 54 to 58, column 4, lines 63 to 67, and column 6, line 64 to column 7, line 2). Therefore, the claimed features relating to the provision of the front light unit and the microlens sheet do not involve an inventive step.

On the other hand, as already mentioned in point 3.1.2 above, while the alternate display capability of the LCD device of document D2 requires two PDLC layers, claim 1 achieves the same display capability with only one layer. In addition, when displaying the image on the rear side of the LCD device, the PDLC layer on the

front side of the LCD device of document D2 is switched to the reflective state and would therefore prevent the illumination light from the front light unit mentioned above from reaching the LCD panel and the PDLC layer on the rear side of the LCD panel, and the resulting device would not be configured to operate in the claimed mode requiring that the PDLC layer on the rear side transmits incident light emitted by the front light unit and transmitted through the LCD panel for the purpose of displaying the image on the rear side.

Document D2 also teaches eliminating one of the two PDLC layers (cf. point 3.1.2, third paragraph), but only for the purpose of displaying an image on the side of the LCD device opposite the remaining PDLC layer when this layer is switched to the reflective state, and for using the LCD device as a transparent device when this layer is switched to the transparent state.

In addition, neither document D1, nor document D4, nor the remaining documents on file suggest further modifying the LCD device of document D2 so as to arrive at the claimed LCD device.

For these reasons, the LCD device defined in claim 1 involves an inventive step over document D2 as closest state of the art.

- 3.2.3 When starting with document D4 as the closest state of the art (cf. point 3.1.3 above), the board notes that the transmissive LCD panel defined in claim 1 and constituted by a LC layer between two substrates each having a polarization plate constitutes a well-known transmissive LCD panel conventionally used in the technical field of LCD devices, see for instance

document D1 (Fig. 3, and paragraph [0029]), document D2 (Fig. 1, together with page 3, last paragraph, and page 1, lines 24 to 28), document D3 (Fig. 1, and column 3, lines 16 to 27), and document A1 (Fig. 1, and column 4, lines 29 to 41). It was therefore obvious for the skilled person, faced with the problem of finding an alternative to the device of document D4, to replace the transmissive LCD panel used in document D4 and constituted by an LC layer between two electrode layers and further comprising a colour filter layer, by this conventional transmissive LCD panel when circumstances make it desirable.

However, the LCD device of document D4 with this obvious technical modification would still operate in two different modes both displaying the image on the front side of the LCD device, i.e. in a first mode in which the PDLC layer is switched to the reflective state and the illumination is provided by an external light, i.e. by ambient light, and in a second mode in which the PDLC is switched to the transmissive state and the illumination is provided by the back light unit (paragraph [0029]). The skilled person would understand in this teaching that the second mode is to be used when the external or ambient light is insufficient to reach an appropriate level of illumination of the LCD panel in the first mode (paragraphs [0006] and [0029]). In this context, the skilled person would have no incentive in considering the provision of a front light unit and a microlens sheet of the type disclosed, for instance, in documents A1, A2 and A3 (see point 3.2.2 above, first paragraph) because such front light unit would only have the same functionality as that already provided by the back light unit and would then render superfluous in the device of document D4 the back light unit and also the switchable PDLC layer which could

then be replaced by a conventional reflective layer. The invention, however, requires both the front light unit and the switchable PDLC layer for selectively displaying the image on the front and on the rear side of the LCD device. In any case, in the event that the skilled person would have considered the incorporation of the front light unit while maintaining the back light unit, the PDLC layer would then be used in its reflective state when the LCD device is operated with ambient light and/or with the front light unit, and switched to the transparent state when the LCD device is operated with the back light unit, and in none of these operation modes light emitted by the front light unit and transmitted through the liquid crystal panel would reach the rear side of the LCD device so as to display the image on the rear side as required by one of the modes of the claimed LCD device.

As noted in point 3.1.3 above, second paragraph, when the LCD device of document D4 is operated with the back light unit, the PDLC layer is in the transparent state and the image is also displayed and, in principle, viewable on its rear side upon the action of external or ambient light incident on the panel - as it is also optionally the case in the invention, see Fig. 4 and 6 of the application together with paragraphs [37], [48] and [51] of the description. However, the claimed illumination arrangement ensures that the image is displayed on the rear side with higher brightness and/or contrast, and this technical effect is far from being suggested in document D4 because, as already noted above, its teaching is confined to LCD devices assembled within an apparatus in which the display of the image on the rear side of the LCD device plays no role.

None of the remaining documents on file teaches or suggests modifying the LCD device of document D4 so as to arrive in an obvious way to the claimed LCD device.

For these reasons, the LCD device defined in claim 1 also involves an inventive step over document D4 as closest state of the art.

- 3.3 The board concludes that the subject-matter of claim 1 is new and involves an inventive step over the prior art on file (Articles 54(1) and 56 EPC 1973).

The same conclusion applies to dependent claims 2 to 14 by virtue of their dependency on claim 1, and to independent claim 15 directed to a mobile station comprising the liquid crystal display device according to any one of claims 1 to 14.

4. In view of the above considerations, the board concludes that the sole request of the appellant is allowable.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance with the order to grant a patent on the basis of the following application documents:
 - claims: No. 1 to 15 filed with the letter dated 17 November 2017;

- description: pages 1 to 3 filed with the letter dated 17 November 2017, and pages 4 to 7 of the application as published; and
- drawings: sheets 1/4 to 4/4 of the application as published.

The Registrar:

The Chairman:



M. Kiehl

R. Bekkering

Decision electronically authenticated