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**Datasheet for the decision
of 17 January 2017**

Case Number: T 0092/11 - 3.4.03

Application Number: 08170139.3

Publication Number: 2034469

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Language of the proceedings: EN

Title of invention:

Organic electroluminescent display device

Applicant:

Intellectual Keystone Technology LLC

Headword:

Relevant legal provisions:

EPC 1973 Art. 56

EPC Art. 52(1)

Keyword:

Inventive step - (yes)

Decisions cited:

Catchword:



Beschwerdekammern
Boards of Appeal
Chambres de recours

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Case Number: T 0092/11 - 3.4.03

D E C I S I O N
of Technical Board of Appeal 3.4.03
of 17 January 2017

Appellant: Intellectual Keystone Technology LLC
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Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 29 July 2010
refusing European patent application No.
08170139.3 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman G. Eliasson
Members: S. Ward
C. Schmidt

Summary of Facts and Submissions

I. The appeal is against the decision of the Examining Division refusing European patent application No. 08 170 139 on the grounds that the claimed subject-matter did not involve an inventive step within the meaning of Article 56 EPC (main request) and did not meet the requirements of Article 123(2) EPC (auxiliary request).

II. At the end of the oral proceedings held before the Board the appellant requested that the decision under appeal be set aside and that a patent be granted in the following version:

- claims 1 to 4 of the second auxiliary request, filed with letter dated 16 December 2016;
- description: pages 1 and 8 to 25 (not containing pages 4 to 7) as originally filed and pages 2, 3 and 26 as filed at the oral proceedings before the Board; and
- drawings: figures 1 to 6 as originally filed.

III. The following documents cited by the Examining Division are referred to in this decision:

D1: JP 2001 109398 A

D3: JP 05 307183 A

IV. Claim 1 of the sole request reads as follows:

*"An organic electroluminescent device comprising:
a substrate (64);
a plurality of organic electroluminescent elements (50)
provided over the substrate (64) and defining an
operating region (54);*

a first wiring pattern (10) provided over the substrate (64) at a position closer to an edge portion of the substrate (65) than the operating region (54);

a first electrode (72) provided in a layer different from the first wiring pattern (10), at least partially overlapping the first wiring pattern (10) in a region, and arranged for supply of electrical energy to the plurality of organic electroluminescent elements (50) in common;

a conductive section (70) provided in the region in which the first wiring pattern (10) overlaps the first electrode (72), and arranged to electrically connect the first wiring pattern (10) to the first electrode (72),

a second electrode (52) disposed opposite from the first electrode (72) with a first element (50) that is one of the plurality of organic electroluminescent elements (50) interposed between the first electrode (72) and the second electrode (52), the second electrode (52) being interposed between the first element (50) and the substrate (64), and arranged for the supply of the electrical energy to the first element (50);

a driving element (120) electrically connected to the first element (50);

a second wiring pattern (20) electrically connected to the second electrode (52) through the driving element (120);

a third wiring pattern (60) supplying a data signal for driving the first element (50); and

a terminal (62) provided between a first side of the substrate (64) and the operating region (54) and coupled to the third wiring pattern (60),

characterised in that:

the first wiring pattern (10) and the conductive section (70) extend continuously around the operating

*region (54), while having an opening facing said first side of the substrate (64);
the first wiring pattern (10) has a plurality of layers including a first layer and second layer, the first layer being disposed between the substrate (64) and the second layer; and
the third wiring pattern (60) extends from the terminal (62) through the opening toward the operating region (54)."*

- V. The findings of the Examining Division, insofar as they are relevant to the present decision, may be summarised as follows:

The device recited in claim 1 differed from the device disclosed in figure 1 of D1 in that the first wiring pattern extended continuously around the operating region while having an opening facing the first side of the substrate, wherein the third wiring pattern extended through the opening. The technical effect of this difference was the reduction of the resistance of the counter electrode, and hence the objective technical problem could be defined as how to decrease the resistance of the cathode electrode 3 in the device of D1.

As explained in the abstract of D1, the extension part 3b of the cathode electrode 3 formed in the connection area 8 had the purpose of decreasing the contact resistance that arose between the cathode electrode and the cathode bias pad by enlarging the contact area 8 in comparison to the device of the prior art shown in figure 6, which has a very narrow contact area 68.

The skilled person was aware that the cathode electrode 3, having a large surface in the display region 2 and

being made of ITO, exhibited a large electrical resistance in the display region, and hence there was a strong motivation to reduce the cathode resistance in the display region, since this resistance negatively affected the display quality. Consequently the skilled person would look for documents in the domain of displays addressing the technical problem of reducing the resistance of the counter electrode in the display region.

Document D3 addressed the technical problem of reducing the dispersion of brightness and crosstalk in a display by providing an electrode lower in the resistance per unit area than a transparent electrode in a display region outside of a display region. The skilled person, wishing to solve the objective technical problem, would therefore modify the device in figure 1 of D1 in accordance with the teaching of D3, i.e. by forming a wiring pattern made of a material having good conductivity around the periphery of the cathode electrode 3 in the device of D1. The skilled person would form this wiring pattern all around the periphery of the operating region 2 of D1 except where the third wiring pattern is already present, i.e. in the bottom part of figure 1 of D1. Hence, by applying the teaching of D3 to the device of D1 in order to solve the objective technical problem, the skilled person would arrive at the subject matter of claim 1 without the exercise of an inventive activity.

VI. The Board issued a summons to oral proceedings and an accompanying communication under Article 15(1) RPBA expressing its provisional opinions. The Board questioned *inter alia* whether, starting from the embodiment of Figs. 1 and 2 of document D1, the claimed subject-matter could be considered inventive.

Reasons for the Decision

1. The appeal is admissible.
2. *Amendments (Articles 76(1) and 123(2) EPC)*

The objections of inadmissible added subject-matter raised in the examination and appeal procedures do not apply to the present sole request, and the Board is satisfied that the requirements of Art 76(1) and 123(2) EPC are met.

3. *Inventive step: closest prior art, difference and technical problem*
- 3.1 Claim 1 is directed to an organic electroluminescent (EL) device, and both the Examining Division and the appellant have started from the organic EL device of document D1 - in particular the embodiment of Figs. 1 and 2 - as the closest prior art. The Board finds no reason to deviate from this choice, or to question the findings in the contested decision (Reasons, point 1.1) in relation to those features of claim 1 disclosed in document D1.
 - 3.2 Consequently, the subject-matter of present claim 1 differs from the EL device disclosed in document D1 in the following features:
 - *the first wiring pattern (10) and the conductive section (70) extends continuously around the operating region (54), while having an opening facing said first side of the substrate (64); and*

- *the third wiring pattern (60) extends from the terminal (62) through the opening toward the operating region (54).*

3.3 In the application as filed (page 2, lines 1-6) the invention is said to solve the technical problem of providing a device "in which electrical connection to an electrode can be achieved with reduced resistance". The Board agrees that this is a reasonable statement of the technical problem.

4. *Inventive step on the basis of document D1 alone*

4.1 Figs. 1 and 2 of document D1 show an embodiment of an EL display which is a development of the prior art device depicted in Fig 6. This prior device includes a cathode bias input terminal 67 which is arranged on the periphery of the glass substrate 61 between the left and right terminal input groups 66 (paragraph [0010]), and which is connected to the cathode electrode 63 in an area shown as the relatively small connection part 68.

The small size of the connection part 68 leads to an undesirably high resistance. According to the solution proposed in document D1 (paragraph [0030], point 1; Figs. 1-4), a cathode electrode extension 3b and a cathode bias extension part 7 of increased width are provided, thereby enlarging the connection part 8 and reducing the resistance accordingly.

4.2 Starting from the arrangement of Fig. 1, and given the objective problem of (further) reducing the resistance, a solution involving extending the widths of elements 3b, 7 and 8 further along the lower external edge - for

example as far as the lower right-hand corner - would presumably occur to the skilled person, especially as width variations in this direction are already depicted in the figures (cf. Fig. 4 and Figs. 1 and 2).

It is therefore natural to ask whether additional measures would occur to the skilled person in order to reduce the resistance yet further. In particular, would it be obvious to the skilled person to extend elements 3b, 7 and 8 not just on the lower edge, as shown in the figures, but also along other edges of the device? If so, would it be obvious to extend these elements essentially all the way around the perimeter of the device to achieve a maximum reduction in resistance? Finally, would it be obvious to leave an opening on the lower edge for the terminals 6?

If the skilled person were to carry out all of these measures, then the resulting arrangement would correspond to that of present claim 1. However, for the reasons which follow, the Board does not believe that the modifications set out in the previous paragraph would be obvious to the skilled person on the basis of document D1 alone.

4.3 Firstly, although various arrangements and widths of the elements 3b, 7 and 8 on the lower edge of the substrate are shown in the figures, there is no disclosure or hint of locating such elements on any of the other edges of the substrate.

Moreover, even if such an idea somehow arose, the skilled person - who is devoid of imagination - would have no model to follow other than that presented in Fig. 2, according to which the cathode bias input terminal 7 is flush with the edge of the substrate and

the cathode electrode extension 3b extends almost to the edge of the substrate.

Extending this arrangement around the other three sides would lead to a significant enlargement of the common electrode. Other than in the terminal region, the common electrode would cover almost the entire substrate, and the cathode bias input terminal 7 would be flush with the edge of the substrate around the entire perimeter. The two vertical drivers and the horizontal driver would no longer be free standing, but would be sandwiched between the substrate and the overlying cathode, and embedded in the interlayer insulation film 12 (and possibly the flattening film 13) shown in Fig. 2.

In Fig. 1 the space near the lower edge of the substrate has been made relatively large to ensure that the leads 11 for connecting the vertical and horizontal drivers and the cathode bias input terminal arrangements 7 do not interfere with each other, as shown in Fig. 2. In a re-design of the type under discussion, the size of the substrate and the layout of the drivers and associated wirings would have to be selected to avoid such interference all around the perimeter. Consideration would also have to be given to the dimensions of the drivers.

4.4 In short, document D1 teaches that the cathode resistance may be reduced by extending the contact area along a relatively small portion of the side of the substrate which does not have a driver circuit. There is nothing in document D1 which suggests extending the contact area along the three other sides (which have driver circuits), while leaving an opening for the terminals 6. Moreover, carrying out such a modification

in a manner consistent with the teachings of document D1 would, as set out above, involve a substantial re-design of the entire device, going beyond what could reasonably be considered obvious for the skilled person.

5. *Inventive step on the basis of a combination of documents D1 and D3*

5.1 Document D3 (see Fig. 1) is concerned with arrangements for the transfer electrodes 4 and wiring 5 for a common transparent electrode 2 on one of the substrates 1 of a liquid crystal display.

As depicted in Fig. 2 of document D3, the common electrode is located on a first substrate 111, while the pixel electrodes 105, active elements 104 and associated wirings 103 are located on a second substrate 101 on the opposite side of the liquid crystal layer 120. In the electroluminescent display of document D1, all elements are mounted on a single substrate 1 (see Fig. 2).

The design considerations for the two types of display are therefore entirely different. For example, the issue of ensuring electrical isolation of the anode and cathode wirings in the device of document D1 does not arise in the case of the liquid crystal display of document D3, since the cathode and anode (pixel electrodes) are located on two spatially separated substrates. For this reason alone, the Board does not find it plausible that the skilled person would consult document D3.

5.2 Even if it were assumed, *arguendo*, that the skilled person would look to document D3, and would derive from

it the idea of extending the cathode electrode extension 3b and the cathode bias input terminal 7 of document D1 in the manner of the wiring 5 of document D3 (which the Board does not find credible), a straightforward combination of the teachings of these two documents would not lead the skilled person to the claimed subject-matter.

Two possibilities for the wiring 5 are presented in document D3. In the embodiments of Figs. 1 and 4, the wirings 5 extend along two opposite sides of the display area 3, and in the embodiment of Fig. 5, the wirings 5 extend continuously around the entire perimeter of the display area. No arrangement corresponding to the claimed subject-matter - in which the wiring extends continuously around the operating region, while having an opening facing a first side of the substrate - is disclosed in document D3.

5.3 The argument in the contested decision appears to be that, in order to reduce the resistance, the skilled person would adopt an arrangement based in part on that of Fig. 5 of document D3, i.e. "a wiring pattern all around the periphery of the operating region 2", but would modify it by adding an opening to take account of the terminals ("except where the third wiring pattern is already present, i.e. in the bottom part of figure 1 of D1").

5.4 The Board does not agree. This argument rests on a combination of documents which - for the reasons already given - the Board does not consider plausible, together with the addition of a further feature (an opening on one side of the arrangement, which otherwise continuously extends around the operating region) which is disclosed in neither document.

5.5 Apart from that, the Board does not see how combining these two prior art disclosures in the suggested manner would lead to a functioning display device.

The only arrangement disclosed either in document D1 or D3 suitable for providing an electrical connection to the common cathode electrode 3a of document D1 - which is located above and spaced apart from the substrate - is that shown in detail in Fig. 2 of document D1.

Hence, the suggestion that the skilled person would find it obvious to modify the cathode wiring pattern to extend continuously around the operating region, amounts to asserting that it would be obvious for the skilled person to extend the elements 3b, 7a, 7b and 7c around three sides of the display area 2. The result would be that the connecting elements 3b, 7a, 7b and 7c would form a continuous conductive wall in the space between the outer edge of the cathode electrode 3a and the inner sides of the drivers 4,5 around the left, right and upper sides of the display area 2.

It is however implicit in Fig. 1 of document D1, and explicit in Fig. 5, that for the device to operate, wirings GL, DL must extend from the vertical and horizontal drivers to the active elements of the display. The Board does not see how this would be compatible with the modification described in the previous paragraph, which would erect a continuous conductive barrier between the display area 2 and the drivers 4, 5. For this reason also, the Board does not believe that the skilled person would modify the device of document D1 in the manner suggested in the contested decision.

6. Since the subject-matter of claim 1 is not rendered obvious by the prior art, the Board concludes that it involves an inventive step within the meaning of Article 52(1) EPC and Article 56 EPC 1973.

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 in the following version:
 - Claims 1 to 4 of the second auxiliary request, filed with letter dated 16 December 2016;
 - Description: pages 1 and 8 to 25 (pages 4 to 7 deleted) as originally filed and pages 2, 3 and 26 as filed at the oral proceedings before the Board; and
 - Drawings: figures 1 to 6 as originally filed.

The Registrar:

The Chairman:



S. Sánchez Chiquero

G. Eliasson

Decision electronically authenticated