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D E C I S I O N
of 1 December 2000

Case Number: T 1026/97 - 3.4.2

Application Number: 90114173.9

Publication Number: 0410387

IPC: G02F 1/1343

Language of the proceedings: EN

Title of invention:
Liquid crystal display device and method of manufacturing the same

Patentee:
Casio Computer Co., Ltd.

Opponent:
Manfred Kirchhoff Technische Beratung

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - main request (no) - auxiliary request (yes)"

Decisions cited:
T 0939/92

Catchword:
-

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Case Number: T 1026/97 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 1 December 2000

Appellant: (Opponent)
Manfred Kirchhoff
Technische Beratung
Otterweg 69
D-85598 Baldham (DE)

Representative:
Schaich, Axel
Dr. Wiedemann & Schaich
Patentanwälte
Josephsburgerstrasse 88a
D-81673 München (DE)

Respondent: (Proprietor of the patent)
Casio Computer Co., Ltd.
6-2, Hon-machi 1-chome
Shibuya-ku
Tokyo 151-8543 (JP)

Representative:
Grünecker, Kinkeldey,
Stockmair & Schwanhäusser
Anwaltssozietät
Maximilianstrasse 58
D-80538 München (DE)

Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 31 July 1997 rejecting the opposition filed against European patent No. 0 410 387 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: E. Turrini
Members: S. V. Steinbrener
B. J. Schachenmann

Summary of Facts and Submissions

I. The appellant (opponent) lodged an appeal against the decision of the Opposition Division rejecting the opposition against European patent No. 0 410 387.

II. The opposition filed by the appellant against the patent as a whole was based on Article 100(a) and (b) EPC since the subject-matter of the patent in suit allegedly was not novel and/or lacked an inventive step, and the claimed invention was not disclosed sufficiently clear and complete for it to be carried out by a person skilled in the art.

In its decision, the Opposition Division had no doubt that the patent as a whole, in particular Figure 7 and the related description, provided a sufficiently clear teaching for the skilled person to make a device complying with claim 1. Furthermore, the subject-matter of independent claims 1 and 6 as granted, which were maintained in unamended form, was considered both novel and inventive with respect to the available prior art comprising (in the numbering of the Opposition Division), *inter alia*, the following documents:

D1: JP-A-64 20525 and its English translation

D3: US-A-4 779 957, and

D4: JP-A-1 121820.

III. The above documents were again cited by the appellant in the statement of grounds of appeal which additionally referred to document

D5: EP-A-0 315 319.

IV. Oral proceedings which had been arranged at the parties' respective subsidiary requests took place on 1 December 2000 in the appellant's absence who had informed the Board by a letter dated 30 August 2000 that he would not attend the oral proceedings and requested a decision on the file as it stands instead.

At the end of the oral proceedings, the decision of the Board was given.

V. The appellant requested in the statement of grounds of appeal that the decision under appeal be set aside and that the European patent be revoked.

VI. The respondent requested that the appeal be dismissed and that the patent be maintained as granted (main request) or, alternatively, that the patent be maintained as amended in the following version (auxiliary request):

Description: pages 2 to 11 as filed during the oral proceedings;

Claims: 1 to 10 as filed during the oral proceedings; and

Drawings: as in the patent specification.

VII. The wording of the independent claims of the respective requests reads as follows:

Main request

"1. A liquid crystal display device in which at least one first electrode (105) and second electrodes (106) is arranged respectively on or above opposing surfaces of a pair of substrates (101, 102), said paired substrates being arranged to oppose each other, said paired substrates being hermetically bound through a sealing member (108) with a predetermined gap interposed therebetween, a liquid crystal material (109) being filled in a space surrounded by the paired substrates and the sealing member,
a thin film member (103) is mounted on the opposing surface of at least either one of said paired substrates (101, 102), and
an insulating film (104, 204, 224, 304, 404) is formed above a predetermined area of said either one of said substrates to cover said thin film member, said insulating film having a plurality of insulation layers characterized in that
the surface area of the upper one of the plurality of insulation layers (104a, 104b, 104c or 204a, 204b, 204c or 224a through 224n or 304a, 304b or 404a through 404d) is smaller than that of the lower one of the plurality of insulation layers, the lower one being located just below the upper one, so that the outer peripheries of the plurality of insulation layers are arranged like stairs."

"6. A method of manufacturing a liquid crystal display device according to claim 1 having a first step of forming the thin film member on one of the paired substrates while an electrode or electrodes is formed on the other of the paired substrates, a second step of forming the insulation film including the plurality of insulating layers arranged like stairs by sequentially laminating a film material to cover the thin film

member, a third step of forming at least one electrode or a plurality of electrodes on the insulation film, a substrate binding step of binding the pair of substrates to each other through the sealing member with a predetermined gap therebetween to oppose the surfaces thereof, above which the electrodes are formed to each other and a liquid crystal filling step of filling the liquid crystal material into a space surrounded by the sealing member between the paired substrates, wherein
the second step includes the sub-steps of forming a layer of soft material, leaving the soft-material layer for a predetermined time period to improve flatness of the soft-material layer, and hardening the soft-material layer."

Claims 2 to 5 and 7 to 10 as granted are appended to independent claims 1 and 6, respectively.

Auxiliary request

"1. A liquid crystal display device, in which at least one first electrode (105) and second electrodes (106) are arranged respectively on or above opposing surfaces of a pair of substrates (101, 102), said paired substrates being arranged to oppose each other, said paired substrates being hermetically bound through a sealing member (108) with a predetermined gap interposed therebetween, a liquid crystal material (109) being filled in a space surrounded by the paired substrates and the sealing member,
a thin film member (103) is mounted on the opposing surface of at least either one of said paired substrates (101, 102), and
an insulating film (104, 204, 224, 304, 404) is formed

above a predetermined area of said either one of said substrates to cover said thin film member, said insulating film having a plurality of insulation layers, said first electrode being arranged on said insulating film,
characterized in that
the surface area of the upper one of the plurality of insulation layers (104a, 104b, 104c or 204a, 204b, 204c or 224a through 224n or 304a, 304b or 404a through 404d) is smaller than that of the lower one of the plurality of insulation layers, the lower one being located just below the upper one, so that the outer peripheries of the plurality of insulation layers are arranged like stairs."

The wording of claims 2 to 10 of the auxiliary request is identical to that of claims 2 to 10 of the main request.

VIII. The appellant advanced the following arguments in writing:

According to the pre-characterising portion of claim 1 as granted, the electrodes are arranged "on or above" the opposing surfaces of the substrates so that an embodiment having electrodes "on", i.e. directly in contact with, the substrate is covered by the wording of the claim. Furthermore, a thin film member is "mounted on" the surface of the respective substrate, which implies that the thin film member may be fixed on said surface either directly or via an additional intermediate adhesion layer. This means that a configuration including electrodes in direct contact with the substrate surface and thin film members mounted on the surface via said intermediate electrodes

also falls under the wording of claim 1.

However, such a configuration known from document D3 cannot be considered to suffer from the drawbacks of the prior art referred to in the introductory part of the patent in suit. In consequence, any advantages of the claimed stair like arrangement of the insulation layers do hardly exist with respect to the teaching of D3 so that the problem underlying the alleged invention merely relates to an alternative layout of said insulation layers.

The claimed layout is disclosed in document D1 and - as an alternative design without any particular technical effect - could be obviously utilised for an electrode/filter configuration of the type provided in D3.

The subject-matter of claim 6 can also be derived in an obvious way from the prior art disclosed in documents D1 and D3, an arrangement of the electrodes on the insulation layers being known from document D4.

Moreover, a stepped electrode layer is disclosed in document D5.

IX. The respondent's written and oral arguments in support of its requests may be summarised as follows:

As discussed in the introductory portion of the patent in suit, document D3 relates to another type of LCD since an electrode formed on the inner surface of a glass substrate is covered by a colour filter layer and a protective layer, i.e. the sequence of layers is entirely different from that claimed in the patent in

suit. In particular, the prior art thin member cannot be said to be mounted on the opposing surface of at least one of the paired substrates. Moreover, D3 does not disclose a multi-layer insulating film covering the thin film member, nor does it disclose a stair like multi-layer structure.

Document D1 does not provide a plurality of insulation layers on a thin film member. Nowhere is it described in this prior art that the insulation layers have different surface areas so that the outer peripheries are arranged like stairs. The structure of Figure 6 cannot be considered to constitute a meaningful disclosure since no technical function achieved is derivable.

Therefore, even if a combination of the teachings of D1 and D3 were considered, this would not lead to the subject-matter of claim 1 of the main request. However, there would be no incentive either for a skilled person to seriously contemplate such a combination.

Claim 1 of the auxiliary request has been clarified with respect to claim 1 of the main request in that the sequence of layers has been made explicit. Hence, there can be no doubt about the LCD type claimed.

Reasons for the Decision

1. *Admissibility of appeal*

The appeal meets the requirements of Rule 65 EPC and is therefore admissible.

2. *Main request*

2.1 Novelty

Novelty of the subject-matter of claim 1 has not been contested by the appellant in the present proceedings, nor has the Board any doubts in this respect.

2.2 Inventive step

2.2.1 According to the wording of claim 1 as granted, the first and second electrodes are arranged "on or above" opposing surfaces of a pair of substrates, a thin film member is "mounted on" the opposing surface of at least one of said paired substrates, and an insulating film is formed "above a predetermined area of said either one of said substrates to cover said thin film member".

In the Board's view, the subject-matter of claim 1 is therefore not unambiguously restricted to the sequence of layers shown in Figure 7 of the patent in suit (substrate -> thin film member -> insulating film -> first or second electrode), but also covers embodiments having a different sequence of layers (substrate -> first or second electrode -> thin film member -> insulating film) in that

- the first and second electrodes may be "on" the opposing substrate surfaces, and

- the thin film member must then be "mounted on", i.e. fixed on, the substrate with the aid of the first or second electrode. In the Board's view, the meaning of "mounted on" does not necessarily imply a direct contact with the substrate so as to

exclude the alternative "on" for the associated electrode.

2.2.2 A liquid crystal display device having this specific layer configuration is known from document D3 (see Figure 1 and Example I: first electrode 7; second electrodes 2; substrates 1 and 6; liquid crystal material 9; thin film member 3; plurality of insulation layers 4 and 5, orientation layer 5 being a polyimide layer and thus also insulating).

In consequence, the claimed subject-matter differs from the known device only by the stepped outer peripheries of the plurality of insulation layers, i.e. in that each upper layer does not extend as far as the respective lower layer, whereas in the prior art both layers 4 and 5 extend to the sealing member (see Figure 1).

2.2.3 However, for the specific layer sequence known from D3 the said difference is not seen to provide any technical effect, at least not in the context of the problem set out in the patent in suit (see page 4, lines 9 to 12) since the objectives concerning flatness and absence of cracks are already achieved by the provision of a plurality of insulating layers in the prior art (see page 4, lines 15 to 20 of the patent in suit), whereas any advantages of a stair like arrangement having regard to breakage of electrodes evidently do not exist in a device of the type known from D3. The Board therefore considers the stepped arrangement in this case to be a simple workshop variation of no technical significance.

2.2.4 The wording of claim 1 of the main request as it covers

obvious subject-matter does not meet the requirements of Articles 52(1) and 56 EPC and is not allowable for this reason (see decision T 939/92, OJ EPO 1999, 309; point 2.4.2 of the reasons).

3. *Auxiliary request*

3.1 Admissibility and clarity

Claim 1 of the auxiliary request filed at the oral proceedings, the wording of which - apart from the correction of a clerical error - corresponds to that of claim 1 of the auxiliary request filed with the respondent's letter dated 2 November 2000, in substance differs from claim 1 of the main request in that the location of the first electrode has been specified to be on said insulating film. This specification is, e.g., disclosed in Figure 7 and related description of the patent in suit (see also page 4, lines 9 to 12 and 23 to 29 in this context). Moreover, the sequence of layers has now been unambiguously defined in the claims.

The requirements of Articles 123 and 84 EPC, respectively, are therefore met.

3.2 Novelty

Having regard to novelty, an argument analogous to that given in point 2.1 with respect to claim 1 of the main request holds for the subject-matter of claim 1 of the auxiliary request.

3.3 Inventive step

3.3.1 The subject-matter of claim 1 being now restricted to an LCD type different from that described in document D3, document D4 (see in particular Figures 1 and 2 and associated text) constitutes the closest prior art and anticipates the features of the pre-characterising portion of claim 1, as acknowledged in the introductory part of the patent in suit (see page 4, lines 7 to 8).

The subject-matter of claim 1 differs from this prior art by the features of the characterising portion, i.e. the stair like arrangement of the plurality of insulation layers. This arrangement is to prevent breakage of the electrodes deposited on the insulating film by providing the latter with a more gently sloping peripheral end surface. In D4, the shape of the outer periphery of the insulating film is not disclosed.

3.3.2 Nor is a stair like arrangement of the insulating layers obvious from the remaining prior art cited by the appellant.

Document D3 is no longer pertinent since it relates to a device which has the thin film member on the electrodes formed on the substrate and thus is not subject to the problem of electrode breakage. Nor does this document disclose any stair like arrangement of insulating layers.

Document D1 shows a stepped arrangement of insulating layers in Figure 6, however without mentioning its existence and purpose in the related description so that a skilled person would be inclined to consider it as a fantasy of the draughtsman. However, even if it were not taken as a mere ornament without any real

meaning, its application for a device in accordance with D4 would not be obvious since no electrode is provided on the insulating layers in D1 so that the known stair like arrangement does not serve the purpose to be achieved by the patent in suit.

Finally, document D5 (see in particular Figure 2 and associated text) is not relevant since it neither relates to an LCD device having the claimed sequence of layers, nor to a stepped arrangement of a plurality of insulating layers, nor does it give a hint to the solution of the problem underlying the patent in suit. Although in Figure 2 of D5 protective insulating film 5 has a smaller surface than the semiconductor film 4 below, this layout is due to the fact that film 4 is to be contacted by the source and drain electrodes 6, 11 via said insulating film. However, in contrast to the claimed structure the prior art connection 14 of the drain electrode 11 steps down abruptly over a rather high vertical step formed by the combined thicknesses of layers 4, 12 and 13.

3.4 Therefore, the subject-matter of claim 1 of the auxiliary request involves the inventive step required by Articles 52(1) and 56 EPC, and claim 1 is accordingly allowable.

3.5 Claim 1 of the auxiliary request being allowable, independent claim 6 relating to the method of manufacturing an LCD device according to claim 1 is also allowable.

The dependent claims and the patent specification as amended at the oral proceedings also meet the requirements of the EPC.

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 to maintain the patent as amended in the following version:

Description: pages 2 to 11 as filed during the oral proceedings;

Claims: 1 to 10 as filed during the oral proceedings; and

Drawings: as in the patent specification.

The Registrar: The Chairman:

P. Martorana E. Turrini