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## (54) Liquid crystal display panel

(57) A liquid crystal display panel (300), including: a first substrate (200) including a common electrode (270); a second substrate (100) including a plurality of pixels (PX) which are arranged in a matrix form and face the common electrode (270), wherein at least one of the pixels (PX) includes first and second subpixels (190h,190l); the first subpixel (190h) including a first subpixel electrode (191h), wherein the first subpixel electrode includes a plurality of first micro branches (197h), which are arranged at a first angle (θ1) with respect to a polarization axis (D1) of a polarizer disposed adjacent to the first or second substrate; the second subpixel (190l) including a second subpixel electrode (191l), wherein the second subpixel electrode includes a plurality of second micro branches (197l), which are arranged at a second angle (θ2) with respect to the polarization axis of the polarizer, wherein the first angle is different from the second angle by about 20° or less; and a liquid crystal layer (3) interposed between the first and second substrates.

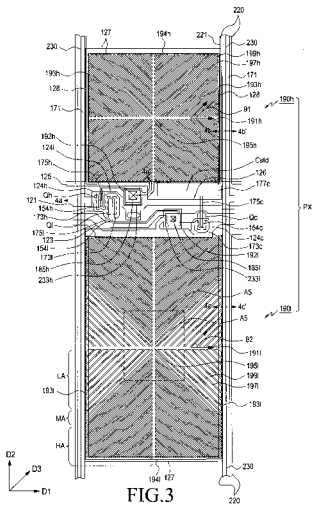

FIG.3

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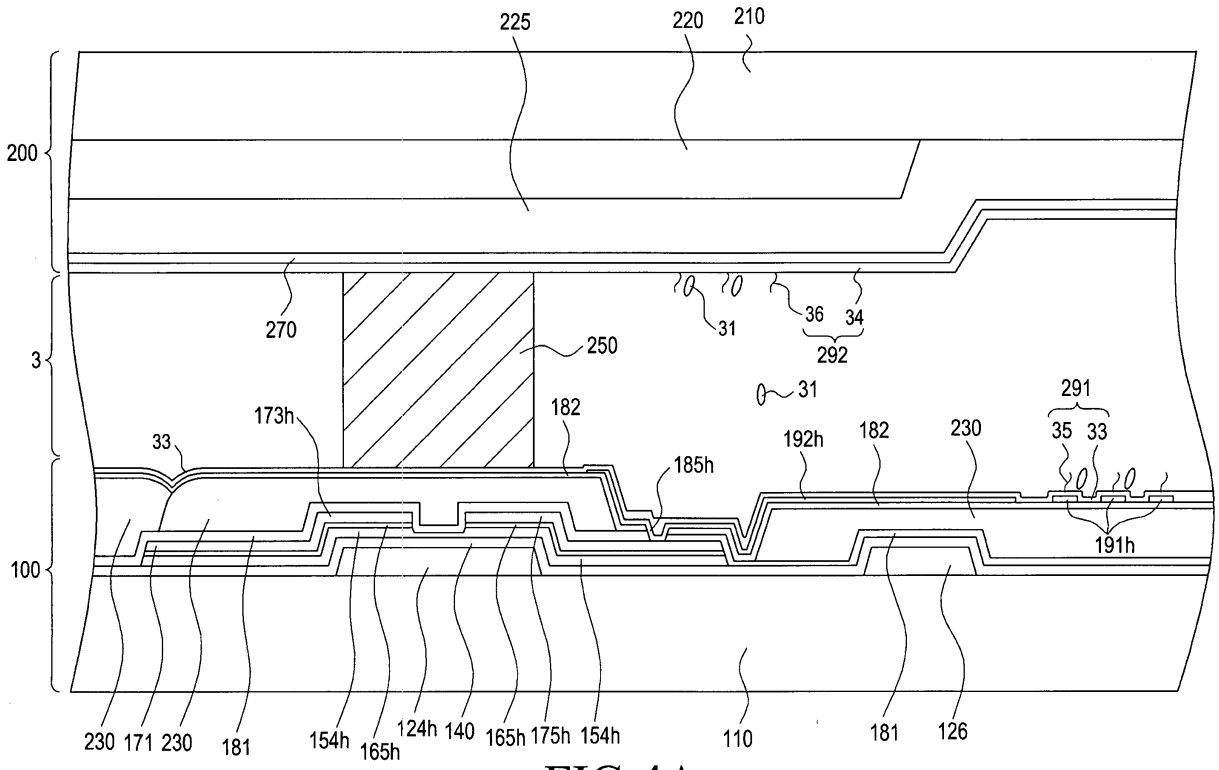
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220
210
200
270
3
250
31
36
34
292
31
291
173h
182
33
192h
182
230
35
33
185h
191h
100
230
171
230
181
154h
165h
124h
140
165h
175h
154h
110
181
126

FIG.4A

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# EUROPEAN SEARCH REPORT

Application Number
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## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| X<br>Y | US 2003/197819 A1 (SUNOHARA KAZUYUKI [JP] ET AL) 23 October 2003 (2003-10-23)<br>* paragraphs [0030] - [0037]; figures 1-2 *<br>* paragraph [0049] - paragraph [0062]; figure 4 *<br>* paragraph [0067] - paragraph [0074]; figure 5 *<br>* paragraphs [0079] - [0080]; figure 7 *<br>* paragraph [0086] - paragraph [0089] *<br>* paragraphs [0098], [0104] - [0105], [0110]; example 1 *<br>* paragraph [0111]; figure 11 *<br>* paragraphs [0122], [0125] *<br>----- | 1-7, 14-20, 23,25,26<br>2,8-13, 18,21, 22,24,27 | INV.<br>G02F1/1343<br>G02F1/139 |
| Y | EP 0 330 428 A2 (RCA LICENSING CORP [US] RCA THOMSON LICENSING CORP [US])<br>30 August 1989 (1989-08-30)<br>* column 1, line 3 - column 4, line 4; figure 1 *<br>----- | 2,18,24 | TECHNICAL FIELDS SEARCHED (IPC) |
| A | US 2003/071952 A1 (YOSHIDA HIDEFUMI [JP] ET AL) 17 April 2003 (2003-04-17)<br>* paragraphs [0007], [0010]; figure 1B *<br>* paragraphs [0097] - [0105]; figures 3-5B *<br>* paragraph [0111]; figure 1B *<br>* paragraph [0143]; figure 18 *<br>* paragraphs [0145] - [0148]; figures 19A-19C *<br>-----<br>-/-- | 1,2,5-7, 23-26 | G02F |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 18 November 2011 | Cossu, Alessandro |

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Application Number
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## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| Y | EP 2 105 786 A1 (SAMSUNG ELECTRONICS CO LTD [KR]) 30 September 2009 (2009-09-30)<br>* paragraphs [0006] - [0010] *<br>* paragraphs [0033] - [0041], [0053]; figures 1,3 *<br>* paragraphs [0067] - [0078]; figures 5,6 *<br>* paragraphs [0089] - [0090] *<br>* paragraphs [0105] - [0121]; figures 9-11 *<br>* figure 14 *<br>* paragraphs [0128] - [0135]; figures 15-17 *<br>* paragraphs [0139] - [0145]; figures 18-19 * | 8,9 | |
| Y | US 2002/159018 A1 (KATAOKA SHINGO [JP] ET AL) 31 October 2002 (2002-10-31)<br>* paragraph [0085]; figure 4 *<br>* paragraphs [0102] - [0107]; figure 8 *<br>* paragraphs [0158] - [0170]; figure 26 *<br>* paragraph [0173]; figure 28 * | 10-13, 21,22 | TECHNICAL FIELDS SEARCHED (IPC) |
| A | US 2003/086044 A1 (INOUE YUICHI [JP] ET AL NAKANISHI YOHEI [JP])<br>8 May 2003 (2003-05-08)<br>* paragraph [0168]; figure 35 * | 13 | |
| Y | WO 2009/098747 A1 (SHARP KK [JP]; HASHIMOTO YOSHITO; OHGAMI HIROYUKI; SHIBASAKI MASAKAZU;)<br>13 August 2009 (2009-08-13)<br>* paragraphs [0040] - [0042], [0048]; figure 1 *<br>* paragraphs [0049] - [0057]; figure 3 *<br>* paragraphs [0058] - [0060]; figure 4 *<br>* paragraphs [0061] - [0064]; figure 5 * | 27 | |

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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 18 November 2011 | Cossu, Alessandro |

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Application Number
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## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| Y,P | -& EP 2 246 733 A1 (SHARP KK [JP]) 3 November 2010 (2010-11-03)<br>* paragraphs [0040] - [0042], [0048]; figure 1 *<br>* paragraphs [0049] - [0057]; figure 3 *<br>* paragraphs [0058] - [0060]; figure 4 *<br>* paragraphs [0061] - [0064]; figure 5 *<br>----- | 27 | |
| | | | TECHNICAL FIELDS SEARCHED (IPC) |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 18 November 2011 | Cossu, Alessandro |

CATEGORY OF CITED DOCUMENTS

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Application Number
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## CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

## LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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## LACK OF UNITY OF INVENTION
## SHEET B

Application Number
EP 11 00 2282

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-7, 14-20, 23-26

Liquid crystal display panel, comprising a first substrate including a common electrode and a second substrate including a plurality of pixels which are arranged in a matrix form and face the common electrode, wherein at least one of the pixels includes first and second sub-pixels, the first sub-pixel including a first sub-pixel electrode, wherein the first sub-pixel electrode includes a plurality of first micro branches which are arranged at a first angle with respect to a polarization axis of a polarizer disposed adjacent to the first or second substrate ( implicit for claims 23-26), the second sub-pixel including a second sub-pixel electrode, wherein the second sub-pixel electrode includes a plurality of second micro branches which are arranged at a second angle with respect to the polarization axis of the polarizer (implicit for claims 23-26), and a liquid crystal layer interposed between the first and second substrates, wherein either the first angle is different from the second angle by about 20° or less; or the first sub-pixel electrode includes a plurality of first micro slits having first widths and the second sub-pixel electrode includes a plurality of second micro slits having second widths and at least one of the first or second widths of the first or second micro slits formed on at least one of the first or second sub-pixels in the pixel group is different from at least one of the first or second widths of the first or second micro slits formed on the rest of the first or second sub-pixels in the pixel group; or the first sub-pixel electrode includes a first sub-domain having a plurality of first micro branches and a second sub-domain having a plurality of second micro branches, while the second sub-pixel electrode includes a third sub-domain having a plurality of third micro branches and a fourth sub-domain having a plurality of fourth micro branches, and a plurality of first, second, third and fourth micro slits formed, respectively, between the plurality of first, second, third and fourth micro branches, at least one of the first, second, third or fourth micro slits increasing in width as the micro slit extends from an inner portion to an outer portion of the first or second sub-pixel electrode, and wherein the ratio of the second area of the second sub-pixel electrode to the area of the first sub-pixel electrode being about 1.5 to about 2.

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2. claims: 8, 9

Liquid crystal display panel, comprising a first substrate including a common electrode and a second substrate including a plurality of pixels which are arranged in a

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**LACK OF UNITY OF INVENTION**
**SHEET B**

Application Number
EP 11 00 2282

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

matrix form and face the common electrode, wherein at least one of the pixels includes first and second sub-pixels, the first sub-pixel including a first sub-pixel electrode, wherein the first sub-pixel electrode includes a plurality of first micro branches which are arranged at a first angle with respect to a polarization axis of a polarizer disposed adjacent to the first or second substrate, the second sub-pixel including a second sub-pixel electrode, wherein the second sub-pixel electrode includes a plurality of second micro branches which are arranged at a second angle with respect to the polarization axis of the polarizer, and a liquid crystal layer interposed between the first and second substrates, wherein the first angle is different from the second angle by about 20° or less and wherein a first or second stripe-shaped micro branch connection portion is formed in the outer portion of the first or second sub-pixel electrode.

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3. claims: 10-13, 21, 22

Liquid crystal display panel, comprising a first substrate including a common electrode and a second substrate including a plurality of pixels which are arranged in a matrix form and face the common electrode, wherein at least one of the pixels includes first and second sub-pixels, the first sub-pixel including a first sub-pixel electrode, wherein the first sub-pixel electrode includes a plurality of first micro branches which are arranged at a first angle with respect to a polarization axis of a polarizer disposed adjacent to the first or second substrate, the second sub-pixel including a second sub-pixel electrode, wherein the second sub-pixel electrode includes a plurality of second micro branches which are arranged at a second angle with respect to the polarization axis of the polarizer, and a liquid crystal layer interposed between the first and second substrates, wherein the first angle is different from the second angle by about 20° or less or wherein the first and second sub-pixel electrode respectively comprise first and second micro slits having first and second widths, at least one of the first or second widths of the micro slits on at least one sub-pixel being different from at least one of the first or second widths of the micro slits formed on the rest of the sub-pixels. The claims of the third grouping further comprise the feature of at least the first or the second sub-pixel electrodes including a first and a second (sub)-domain which have micro branches or micro slits of uniform width and which sandwich a third (sub)-domain having different widths of the micro branches or micro slits.

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## LACK OF UNITY OF INVENTION
## SHEET B

Application Number
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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

4. claim: 27

Liquid crystal layer interposed between a first substrate and a second substrate, a common electrode formed on the first substrate, a plurality of pixels formed on the second substrate and arranged in a matrix form in rows and columns, at least one of the plurality of pixels having first and second sub-pixel electrodes that face the common electrode, the first sub-pixel electrode including a first sub-domain having a plurality of first micro branches, and a second sub-domain having a plurality of second micro branches, the second sub-pixel electrode including a third sub-domain having a plurality of third micro branches, and a fourth sub-domain having a plurality of fourth micro branches, and a plurality of first, second, third and fourth micro slits formed, respectively, between the plurality of first, second, third and fourth micro branches, wherein at least one of the first, second, third or fourth micro slits increases in width as the micro slit extends from an inner portion to an outer portion of the first or second sub-pixel electrode, and wherein the average of all widths of the plurality of first micro slits is greater than the average of all widths of the plurality of second micro slits.

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## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 00 2282

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| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| US 2003197819 A1 | 23-10-2003 | TW I225959 B | 01-01-2005 |
| | | US 2003197819 A1 | 23-10-2003 |
| EP 0330428 A2 | 30-08-1989 | DE 68915033 D1 | 09-06-1994 |
| | | DE 68915033 T2 | 10-11-1994 |
| | | EP 0330428 A2 | 30-08-1989 |
| | | JP 2005002 A | 09-01-1990 |
| | | US 4828365 A | 09-05-1989 |
| US 2003071952 A1 | 17-04-2003 | JP 2010244081 A | 28-10-2010 |
| | | KR 20030030822 A | 18-04-2003 |
| | | KR 20070091079 A | 07-09-2007 |
| | | KR 20070091080 A | 07-09-2007 |
| | | KR 20070092185 A | 12-09-2007 |
| | | KR 20070092186 A | 12-09-2007 |
| | | KR 20080047519 A | 29-05-2008 |
| | | TW 588171 B | 21-05-2004 |
| | | US 2003071952 A1 | 17-04-2003 |
| | | US 2007159585 A1 | 12-07-2007 |
| | | US 2011261297 A1 | 27-10-2011 |
| EP 2105786 A1 | 30-09-2009 | CN 101546073 A | 30-09-2009 |
| | | EP 2105786 A1 | 30-09-2009 |
| | | KR 20090103461 A | 01-10-2009 |
| | | US 2009244425 A1 | 01-10-2009 |
| US 2002159018 A1 | 31-10-2002 | JP 3877129 B2 | 07-02-2007 |
| | | JP 2002107730 A | 10-04-2002 |
| | | KR 20020025007 A | 03-04-2002 |
| | | KR 20070106672 A | 05-11-2007 |
| | | TW I249061 B | 11-02-2006 |
| | | US 2002159018 A1 | 31-10-2002 |
| | | US 2005099582 A1 | 12-05-2005 |
| | | US 2007132929 A1 | 14-06-2007 |
| | | US 2009141226 A1 | 04-06-2009 |
| | | US 2011216274 A1 | 08-09-2011 |
| US 2003086044 A1 | 08-05-2003 | CN 1410808 A | 16-04-2003 |
| | | CN 1573458 A | 02-02-2005 |
| | | CN 1924678 A | 07-03-2007 |
| | | CN 101429437 A | 13-05-2009 |
| | | CN 101825798 A | 08-09-2010 |
| | | JP 2009064035 A | 26-03-2009 |
| | | KR 20030028701 A | 10-04-2003 |
| | | TW 567358 B | 21-12-2003 |
| | | US 2003086044 A1 | 08-05-2003 |

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## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 00 2282

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18-11-2011

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| | | US 2005253988 A1 | 17-11-2005 |
| WO 2009098747 A1 | 13-08-2009 | CN 101939696 A | 05-01-2011 |
| | | EP 2246733 A1 | 03-11-2010 |
| | | US 2011025970 A1 | 03-02-2011 |
| | | WO 2009098747 A1 | 13-08-2009 |
| EP 2246733 A1 | 03-11-2010 | CN 101939696 A | 05-01-2011 |
| | | EP 2246733 A1 | 03-11-2010 |
| | | US 2011025970 A1 | 03-02-2011 |
| | | WO 2009098747 A1 | 13-08-2009 |

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|---|---|---|---|
| 专利名称(译) | 液晶显示面板 | | |
| 公开(公告)号 | EP2375279A3 | 公开(公告)日 | 2011-12-28 |
| 申请号 | EP2011002282 | 申请日 | 2011-03-21 |
| [标]申请(专利权)人(译) | 三星电子株式会社 | | |
| 申请(专利权)人(译) | SAMSUNG ELECTRONICS CO.，LTD. | | |
| 当前申请(专利权)人(译) | 三星DISPLAY CO.，LTD. | | |
| [标]发明人 | CHOI KYONG SIK<br>PARK MYUNG JAE<br>PARK MIN WOOK<br>KIM SUNG HOON<br>LEE GAK SEOK<br>SHIN WOO JUNG<br>LEE JUN HYUP<br>OH KEUN CHAN<br>KIM SANG GYUN<br>KIM SU JEONG<br>PARK SEUNG BEOM<br>JEONG YOUN HAK | | |
| 发明人 | CHOI, KYONG-SIK<br>PARK, MYUNG-JAE<br>PARK, MIN-WOOK<br>KIM, SUNG-HOON<br>LEE, GAK-SEOK<br>SHIN, WOO-JUNG<br>LEE, JUN-HYUP<br>OH, KEUN-CHAN<br>KIM, SANG-GYUN<br>KIM, SU-JEONG<br>PARK, SEUNG-BEOM<br>JEONG, YOUN-HAK | | |
| IPC分类号 | G02F1/1343 G02F1/139 | | |
| CPC分类号 | G02F1/134309 C08G8/12 C08G73/12 G02F1/133707 G02F1/133723 G02F1/133753 G02F1/133788 G02F1/1393 G02F2001/133531 G02F2001/133742 G02F2001/133746 G02F2001/133761 | | |
| 优先权 | 1020100052878 2010-06-04 KR<br>1020100121019 2010-11-30 KR<br>1020100047746 2010-05-20 KR<br>1020100069254 2010-07-16 KR<br>1020100030591 2010-04-02 KR | | |
| 其他公开文献 | EP2375279A2 | | |
| 外部链接 | Espacenet | | |


摘要(译)

一种液晶显示面板（300），包括：第一基板（200），包括公共电极（270）;包括多个像素（PX）的第二基板（100），所述多个像素以矩阵形式布置并面向公共电极（270），其中至少一个像素（PX）包括第一和第二子像素（190h，1901）;包括第一子像素

电极（191h）的第一子像素（190h），其中第一子像素电极包括多个第一微分支（197h），其相对于偏振轴（D1）以第一角度（θ1）排列偏振器的设置与第一或第二基板相邻;包括第二子像素电极（191l）的第二子像素（190l），其中第二子像素电极包括多个第二微分支（197l），其相对于偏振器的偏振轴以第二角度（θ2）布置，其中第一角度与第二角度相差约20°或更小;以及插入在第一和第二基板之间的液晶层（3）。

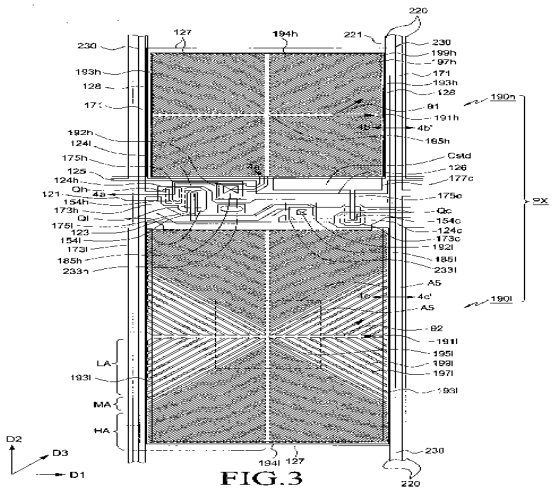

FIG.3