

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
10 July 2008 (10.07.2008)

PCT

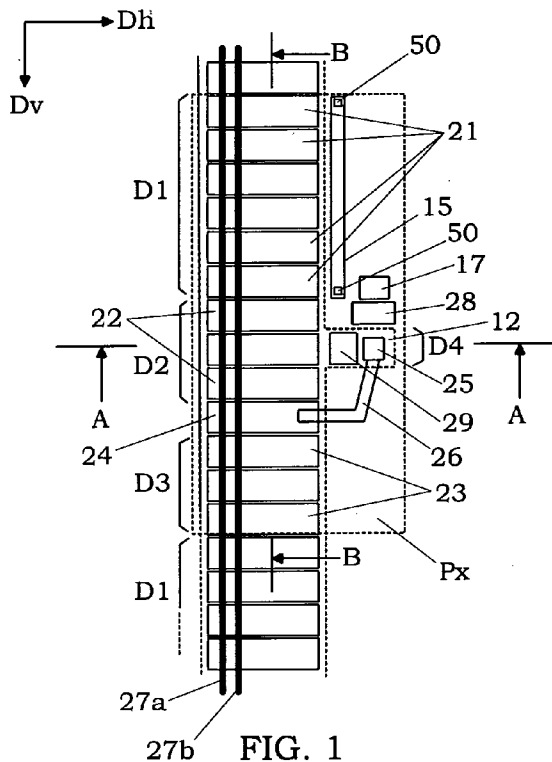
(10) International Publication Number  
**WO 2008/081997 A3**

- (51) International Patent Classification:  
H01L 27/148 (2006.01)
- (21) International Application Number:  
PCT/JP2007/075413
- (22) International Filing Date:  
27 December 2007 (27.12.2007)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
2006-356754 29 December 2006 (29.12.2006) JP
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- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL,

[Continued on next page]

(54) Title: CCD AND SPATIAL INFORMATION DETECTING DEVICE USING THE SAME



(57) Abstract: A photodetector capable of improving dynamic range for input signals is provided. This photodetector includes a photoelectric converting portion (D1), a charge separating portion (D2), a charge accumulating portion (D3), a barrier electrode (24) formed between the charge separating portion (D2) and the charge accumulating portion (D3), and a barrier-height adjusting portion (D4) electrically connected to the barrier electrode (24). Undesired electric charges such as generated when environment light is incident on the photoelectric converting portion (D1) are removed by the charge separating portion (D2). A potential barrier with an appropriate height is formed under the barrier electrode (24) by applying a voltage to the barrier electrode (24) according to an electric charge amount supplied from the charge separating portion (D2) to the barrier-height adjusting portion (D4). Electric charges flowing from the charge separating portion (D2) into the charge accumulating portion (D3) over the potential barrier are provided as an output of the photodetector.

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PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY,  
TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA,  
ZM, ZW.

PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM,  
GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**(84) Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL,

**Published:**

- *with international search report*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

**(88) Date of publication of the international search report:**  
18 September 2008

**INTERNATIONAL SEARCH REPORT**

International application No  
PCT/JP2007/075413

**A. CLASSIFICATION OF SUBJECT MATTER**  
INV. H01L27/148

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)  
EPO-Internal, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                           | Relevant to claim No. |
|-----------|--------------------------------------------------------------------------------------------------------------|-----------------------|
| X         | WO 90/16083 A (EASTMAN KODAK CO [US])<br>27 December 1990 (1990-12-27)                                       | 1,2,9-12              |
| Y         | page 4, line 21 - page 10, line 28<br>figures 1-3                                                            | 3                     |
| X         | US 2002/057356 A1 (TANABE AKIHITO [JP])<br>16 May 2002 (2002-05-16)                                          | 1,2,9-12              |
| A         | paragraphs [0004] - [0019], [0021]<br>figures 1,2,5                                                          | 3,4                   |
| P,X       | US 2007/045669 A1 (TSUNAI SHIRO [JP])<br>1 March 2007 (2007-03-01)<br>paragraphs [0089] - [0096]<br>figure 9 | 1,9-12                |
|           | -----<br>-/--                                                                                                |                       |

Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*&\* document member of the same patent family

Date of the actual completion of the international search

9 April 2008

Date of mailing of the international search report

11/07/2008

Name and mailing address of the ISA/

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## INTERNATIONAL SEARCH REPORT

International application No  
PCT/JP2007/075413

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                     | Relevant to claim No. |
|-----------|------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Y         | US 4 873 561 A (WEN DAVID D [US])<br>10 October 1989 (1989-10-10)<br>column 3, line 56 - column 4, line 10<br>figure 1 | 3                     |
| A         | WO 92/22091 A (EASTMAN KODAK CO [US])<br>10 December 1992 (1992-12-10)<br>page 6, lines 30-35                          | 1,2                   |
| A         | DE 195 19 743 A1 (DALSA INC [CA])<br>7 December 1995 (1995-12-07)<br>the whole document                                | 1,2                   |

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/JP2007/075413

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1.  As all required additional search fees were timely paid by the applicant, this international search report covers allsearchable claims.
2.  As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-4, 9-12

### Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1- 4, 9-12

CCD with photoelectric converting, charge separation,  
accumulation, charge discarding portion  
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2. claim: 5

Slit regions  
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3. claim: 6

Buffer electrode  
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4. claim: 7

Potential barrier under the barrier-height adjusting portion  
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5. claim: 8

Transfer gate electrode between charge separating portion  
and barrier-height adjusting portion  
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6. claims: 13, 14

Spatial information detecting device  
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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/JP2007/075413

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date           |
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