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[Continued on next page]

(54) Title: DISPLAYS WITH LOCAL DIMMING ELEMENTS

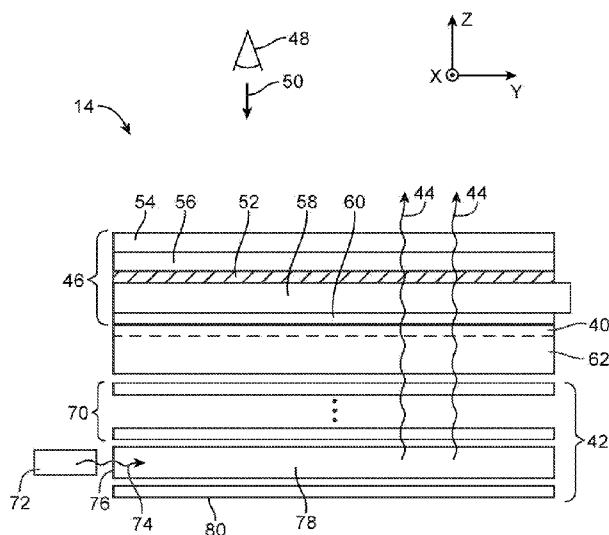


FIG. 6

(57) Abstract: An electronic device is provided with a display such as a liquid crystal display. The display includes a liquid crystal display module an array of display pixels. A backlight unit is used to provide backlight illumination to the display module. A shutter module having local dimming elements is used to locally control the amount of light that is transmitted through the display. The local dimming elements can be formed from liquid crystal display structures, polymer-dispersed liquid crystal display structures, photovoltaic material, electrowetting display structures, and/or other suitable light controlling elements. Each local dimming element controls the amount of light that is transmitted through an overlapping region of the array of display pixels. The local dimming elements may be arranged in a uniform array having rows and columns or may be shaped and sized differently and located in specific regions of the display.



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INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER

INV. G09G3/34 G02F1/1334 G09G3/36 G02F1/1335
ADD.

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)

G09G G02F

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 practicable, search terms used)

EP0-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	US 2010/020265 A1 (SENOUE MASAHARU [JP] ET AL) 28 January 2010 (2010-01-28)	1,2,5-7, 9,11,17, 18,20
Y	paragraphs [0081] - [0097]; figures 9,10 -----	3,10,19
X	US 2009/207613 A1 (FURUKAWA NORIMASA [JP] ET AL) 20 August 2009 (2009-08-20)	1,2,5, 11,17, 18,20
	paragraphs [0046] - [0049]; figures 8,9 -----	
X	WO 2004/079437 A1 (KONINKL PHILIPS ELECTRONICS NV [NL]; JAK MARTIN J J [NL]; CORNELISSEN) 16 September 2004 (2004-09-16) page 7, line 22 - line 25 page 11, line 31 - page 13, line 7; figure 10 ----- -/--	1,5,7, 11,17,18



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 application or patent but published on or after the international filing date

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"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

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"&" document member of the same patent family

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Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
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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 2011/279749 A1 (ERINJIPPURATH GOPAL [US] ET AL) 17 November 2011 (2011-11-17) page 2, paragraph 36-45; figure 1 -----	3, 19
Y	WO 2012/149001 A2 (DOLBY LAB LICENSING CORP [US]; ERINJIPPURATH GOPAL [US]; WAN CHUN C [U]) 1 November 2012 (2012-11-01) page 10, line 1 - line 8 page 15, line 1 - line 5 -----	3, 19
Y	US 2010/110097 A1 (NAM HYOUNG-SIK [KR] ET AL) 6 May 2010 (2010-05-06) paragraphs [0053], [0054] -----	10
X	US 2011/085095 A1 (YAMAUCHI TAISUKE [JP]) 14 April 2011 (2011-04-14) page 2, paragraph 11-92; figures 1-4 -----	1, 3, 4, 17-19

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/024986

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 all searchable 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.:

1-7, 9-11, 17-20

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: 1-7, 9-11, 17-20

A display comprising a display module having an array of display pixels and a shutter module having a plurality of local dimming elements, wherein each of the local dimming elements comprises a polymer-dispersed liquid crystal layer and is configured to control the amount of light that is transmitted through at least one of the display pixels; further comprising backlight structures configured to provide backlight illumination to the display module, wherein the display module is interposed between the shutter module and the backlight structures; wherein each local dimming element comprises photovoltaic material interposed between the polymer-dispersed liquid crystal layer and the display module.

2. claims: 8, 12-16

A display comprising a display module having an array of display pixels and a shutter module having a plurality of local dimming elements, wherein each of the local dimming elements comprises a polymer-dispersed liquid crystal layer and is configured to control the amount of light that is transmitted through at least one of the display pixels; wherein the local dimming elements comprise a first elongated local dimming element that runs along a first edge of the display and a second elongated local dimming element that runs along a second edge of the display.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2014/024986

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