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(54) Title: LED DISPLAY PANEL WITH INTEGRATED QUANTUM DOTS

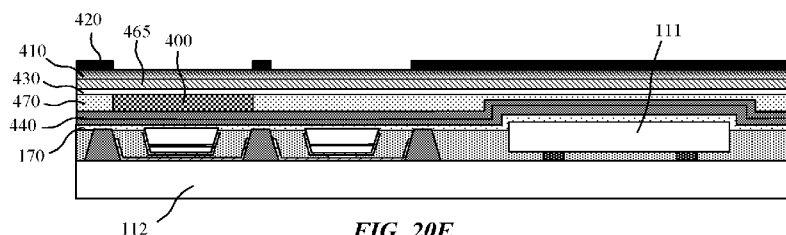


FIG. 20E

(57) Abstract: Display panels and methods of manufacture are described for down converting a peak emission wavelength of a pump LED within a subpixel with a quantum dot layer. In some embodiments, pump LEDs with a peak emission wavelength below 500 nm, such as between 340 nm and 420 nm are used. QD layers in accordance with embodiments can be integrated into a variety of display panel structures including a wavelength conversion cover arrangement, QD patch arrangement, or QD layers patterned on the display substrate.

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/041005

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01L33/50
ADD. G02F1/1335

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)
G02F 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 practicable, 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	US 2014/339495 A1 (BIBL ANDREAS [US] ET AL) 20 November 2014 (2014-11-20)	1-5, 9-13, 16-20, 22,35, 36, 38-41, 47,50,51
Y	paragraphs [0030] - [0078]; figures 2A, 2B, 2C, 4A, 6	6-8,14, 15,21, 23-28, 30-33, 37,48, 49,52
Y	----- US 2014/264412 A1 (YOON CHANG BUN [KR] ET AL) 18 September 2014 (2014-09-18) paragraphs [0177], [0178]; figure 20 ----- -/--	6,14,31, 37,48,49

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
- "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 13 December 2016	Date of mailing of the international search report 02/01/2017
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Ammerlahn, Dirk
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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 2006/145137 A1 (WANG TE-CHUNG [TW] ET AL) 6 July 2006 (2006-07-06) paragraphs [0045] - [0047]; figure 5A -----	7,8,15, 21,32,52
Y	US 2015/187987 A1 (SIM MUN-KI [KR] ET AL) 2 July 2015 (2015-07-02) paragraphs [0057] - [0062], [0074] - [0082]; figures 2,6,7A-7E -----	23-28, 30-33
A	EP 2 395 569 A2 (SAMSUNG LED CO LTD [KR]) 14 December 2011 (2011-12-14) paragraphs [0071] - [0072]; figures 14-17 -----	22-34
A	US 2014/367633 A1 (BIBL ANDREAS [US] ET AL) 18 December 2014 (2014-12-18) the whole document -----	42-46

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/041005

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.:

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: 1-22, 35-41, 47-52

A display panel comprising a display substrate, a plurality of LEDs mounted on the display substrate and a quantum dot layer aligned over an LED, wherein a Bragg reflector layer is present either between the LED and the quantum dot layer or above the quantum dot layer in order to improve the ratio between light emitted by the quantum dot layer and the pump light emitted by the LED.

2. claims: 23-34

A display panel comprising a display substrate, an array of LEDs mounted on the display substrate and a cover film in which an array of cavities is formed, wherein the cavities contain respective quantum dot layers which are aligned over the array of LEDs.

3. claims: 42-46

A method of forming a display panel comprising steps of electrostatically transferring an array of LEDs and an array of quantum dot patches from a respective carrier to a display substrate.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2016/041005

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