

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 8,198,574 B2
APPLICATION NO. : 12/496854
DATED : June 12, 2012
INVENTOR(S) : Olsen et al.

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the Title Page

On Page 2, in Item (56), under "OTHER PUBLICATIONS", in Column 2, Line 8, delete "eyet," and insert -- eye," --, therefor.

On Page 2, in Item (56), under "OTHER PUBLICATIONS", in Column 2, Line 62, delete "caputring" and insert -- capturing --, therefor.

On Page 2, in Item (56), under "OTHER PUBLICATIONS", in Column 2, Line 63, delete "idgital" and insert -- digital --, therefor.

In the Specification

In Column 5, Line 49, delete " $(t=T_{\text{long}}/T_{\text{short}})$ " and insert -- $(t=T_{\text{long}}/T_{\text{short}})$, --, therefor.

In Column 18, Line 62, delete "foe" and insert -- for --, therefor.

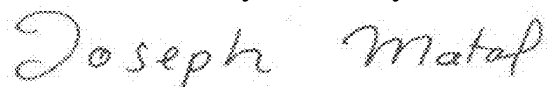
In Column 21, Line 59, delete "extreme" and insert -- extreme. --, therefor.

In Column 23, Line 9, delete "know" and insert -- known --, therefor.

In the Claims

In Column 26, Line 49, in Claim 18, delete "on or" and insert -- on one or --, therefor.

Signed and Sealed this
Thirtieth Day of January, 2018



Joseph Matal
*Performing the Functions and Duties of the
Under Secretary of Commerce for Intellectual Property and
Director of the United States Patent and Trademark Office*

UNITED STATES PATENT AND TRADEMARK OFFICE CERTIFICATE OF CORRECTION

Page 1 of 1

PATENT NO. : 8,198,574 B2

APPLICATION NO. : 12/496,854

ISSUE DATE : June 12, 2012

INVENTOR(S) : Olsen , et al.

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On Page 2, in Field (56), under "OTHER PUBLICATIONS", in Column 2, Line 8, delete "eyet," and insert - - eye," - -, therefor.

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In Column 5, Line 49, delete " $(t=T_{\text{long}}/T_{\text{short}})$ " and insert - - $(t=T_{\text{long}}/T_{\text{short}})$, - -, therefor.

In Column 18, Line 62, delete "foe" and insert - - for - -, therefor.

In Column 21, Line 59, delete "extreme" and insert - - extreme. - -, therefor.

In Column 23, Line 9, delete "know" and insert - - known - -, therefor.

In Column 26, Line 49, in Claim 18, delete "on or" and insert - - on one or - -, therefor.

MAILING ADDRESS OF SENDER (Please do not use customer number below):

Maschoff Gilmore & Israelsen
1441 West Ute Boulevard, Suite 100
Park City, UT 84098 United States

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The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

PATENT NO.: 8,198,574

USPTO CONFIRMATION CODE: 5298

APPLICATION NO.: 12/496,854

FILED: July 2, 2009

EXAMINER: Seung C Sohn

GROUP ART UNIT: 2878

FOR: LARGE DYNAMIC RANGE CAMERAS

37 CFR 1.322 & 37 CFR 1.323 REQUEST FOR CERTIFICATE OF CORRECTION
FOR USPTO AND/OR APPLICANT MISTAKE

Commissioner for Patents
Office of Patent Publication
ATTN: Certificate of Correction Branch
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

A certificate of correction under 35 USC 254 is respectfully requested in the above-identified patent.

It is believed that all errors identified herein were the fault of both the applicant and USPTO and, accordingly, please charge **\$100.00** to our Deposit Account No. 50-5394. In the event that a further fee is required, please charge the amount to the same Deposit Account.

The exact locations where the errors appear in the patent and patent application are as follows:

On Page 2, in Field (56), under “OTHER PUBLICATIONS”, in Column 2, Line 8, delete “eyet,” and insert - - eye,” - -, therefor.

(LIST OF REFERENCES CITED BY APPLICANT AND CONSIDERED BY EXAMINER DATED FEBRUARY 16, 2012, SHEET 4 OF 7 (PAGE 48 OF FW), UNDER “NON PATENT LITERATURE DOCUMENTS”, ENTRY 2, LINE 1)

On Page 2, in Field (56), under “OTHER PUBLICATIONS”, in Column 2, Line 62, delete “caputring” and insert - - capturing - -, therefor.

(LIST OF REFERENCES CITED BY APPLICANT AND CONSIDERED BY EXAMINER DATED FEBRUARY 16, 2012, SHEET 6 OF 7 (PAGE 50 OF FW), UNDER “NON PATENT LITERATURE DOCUMENTS”, ENTRY 8, LINE 1)

On Page 2, in Field (56), under “OTHER PUBLICATIONS”, in Column 2, Line 63, delete “idgital” and insert - - digital - -, therefor.

(LIST OF REFERENCES CITED BY APPLICANT AND CONSIDERED BY EXAMINER DATED FEBRUARY 16, 2012, SHEET 6 OF 7 (PAGE 50 OF FW), UNDER “NON PATENT LITERATURE DOCUMENTS”, ENTRY 8, LINE 1)

In Column 5, Line 49, delete “(t=T_{long}/T_{short})” and insert - - (t=T_{long}/T_{short}), - -, therefor.

(ORIGINALLY FILED SPECIFICATION DATED JULY 2, 2009, PAGE 8, PARAGRAPH [0041], LINE 3)

In Column 18, Line 62, delete “foe” and insert - - for - -, therefor.

(ORIGINALLY FILED SPECIFICATION DATED JULY 2, 2009, PAGE 28, PARAGRAPH [0124], LINE 2)

In Column 21, Line 59, delete “extreme” and insert - - extreme. - -, therefor.

(ORIGINALLY FILED SPECIFICATION DATED JULY 2, 2009, PAGE 32, PARAGRAPH [0139], LINE 11)

In Column 23, Line 9, delete “know” and insert - - known - -, therefor.

(ORIGINALLY FILED SPECIFICATION DATED JULY 2, 2009, PAGE 34, PARAGRAPH [0148], LINE 1)

In Column 26, Line 49, in Claim 18, delete “on or” and insert - - on one or - -, therefor.

(ORIGINALLY FILED SPECIFICATION, IN THE CLAIMS DATED JULY 2, 2009, PAGE 40, CLAIM 18, LINE 2)

The requested corrections are attached on Form PTO/SB/44.

Dated this 8th day of October, 2012.

Respectfully Submitted,

/R. Burns Israelsen/ Reg. # 42,685

R. BURNS ISRAELSEN

Acting in Representative Capacity

(37 CFR 1.34)

Registration No. 42,685

Telephone No. (435) 252-1360

Electronic Patent Application Fee Transmittal				
Application Number:		12496854		
Filing Date:		02-Jul-2009		
Title of Invention:		LARGE DYNAMIC RANGE CAMERAS		
First Named Inventor/Applicant Name:		Richard Ian Olsen		
Filer:		Robert Burns Israelsen/Tonya Kusitor		
Attorney Docket Number:		088245-6407		
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Certificate of correction	1811	1	100	100
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				100

Electronic Acknowledgement Receipt	
EFS ID:	13929576
Application Number:	12496854
International Application Number:	
Confirmation Number:	5298
Title of Invention:	LARGE DYNAMIC RANGE CAMERAS
First Named Inventor/Applicant Name:	Richard Ian Olsen
Customer Number:	23524
Filer:	Robert Burns Israelsen/Tonya Kusitor
Filer Authorized By:	Robert Burns Israelsen
Attorney Docket Number:	088245-6407
Receipt Date:	08-OCT-2012
Filing Date:	02-JUL-2009
Time Stamp:	13:45:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$100
RAM confirmation Number	17298
Deposit Account	505394
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Certificate of Correction	2253USCN164798_20121008_CoC.pdf	259118 e20c5ae2d30cc9f5e457b1bc18e67061f8fe820d	no	2
Warnings:					
Information:					
2	Request for Certificate of Correction	2253USCN164798_20121008_RequestLetter.pdf	150154 6bc2fd83bcd40b7d904d6cd22372f19135fa72f	no	3
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	29987 d598046ebe1bdf840dcfcc18f05dc65aa5621bf	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			439259		
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p>New Applications Under 35 U.S.C. 111 If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p>National Stage of an International Application under 35 U.S.C. 371 If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p>New International Application Filed with the USPTO as a Receiving Office If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					



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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/496,854	06/12/2012	8198574	088245-6407	5298

23524 7590 05/23/2012
FOLEY & LARDNER LLP
150 EAST GILMAN STREET
P.O. BOX 1497
MADISON, WI 53701-1497

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 513 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Richard Ian Olsen, Irvine, CA;
Darryl L. Sato, Irvine, CA;
Feng-Qing Sun, Irvine, CA;
James Gates, Irvine, CA;

Receipt date: 10/07/2010

12496854 - GAU: 2878

Approved for use through 03/31/2007. OMB 0651-0031

U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

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Substitute for form 1449/PTO		Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT		Application Number	12/496854
(Change(s) applied to document, Date Submitted: October 7, 2010		Filing Date	7/2/2009
Sheet 2 of 7 (use as many sheets as necessary)		First Named Inventor	Richard Ian Olsen
		Art Unit	2622
		Examiner Name	Lin Ye
		Attorney Docket Number	088245-6407

U.S. PATENT DOCUMENTS				
	Document Number			
	3,971,065	07-20-1976	BAYER, BRYCE E.	
	4,323,925	01-01-1980	ABELL ET AL. 4/1982	
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Examiner Signature	/Seung C Sohn/	Date Considered	02/11/2012
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. 3 Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). 4 For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 5 Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. 6 Applicant is to place a check mark here if English language Translation is attached. This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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MADI_2435326.1

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /SCS/

Receipt date: 10/07/2010

12496854 - GAU: 2878

Approved for use through 03/31/2007. OMB 0651-0031

U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT		Application Number	12/496854
		Filing Date	7/2/2009
Date Submitted: October 7, 2010		First Named Inventor	Richard Ian Olsen
		Art Unit	2622
Change (use primary sheets as necessary)		Examiner Name	Lin Ye
		Attorney Docket Number	088245-6407
Sheet 1	of 7		

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number Number-Kind Code ² (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		2002/0020845	02-21-2002	OGURA ET AL.	
		2002/0024606	02-28-2002	YUKI ET AL.	
		2002/0051071	05-02-2002	ITANO ET AL.	
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		2003/0234907	12-25-2003	KAWAI	
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		2004/0080638	04-29-2004	LEE, WON-HO	
		2004/0095495	05-20-2004	INOKUMA ET AL.	
		2004/0183918	09-23-2004	SQUILLA ET AL.	
		2005/0024731	02-03-2005	MITCHELL ET AL.	
		2005/0128335	06-16-2005	KOLEHMAINEN ET AL.	
		2005/0128509	06-16-2005	TOKKONEN ET AL.	
		2005/0134712	06-23-2005	GRUHLKE ET AL.	
		2005/0160112	07-21-2005	MAKELA ET AL.	
		2005/0248667	11-10-2005	SCHWENG ET AL.	
		2005/0285955	12-29-2005	UTZ ET AL.	
		2006/0087572	04-27-2006	SCHROEDER	
		2006/0108505	05-25-2006	GRUHLKE ET AL.	
		2006/0125936	06-15-2006	GRUHLKE ET AL.	
		2006/0187322	08-24-2006	JANSON, JR. ET AL.	
		2006/0187338	08-24-2006	MAY ET AL.	
		2007/0002159	01-04-2007	OLSEN ET AL.	
		3,609,367	09-28-1971	BARRON, DONALD ROBERT	

Examiner Signature	/Seung C Sohn/	Date Considered	02/11/2012
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. 3 Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). 4 For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 5 Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. 6 Applicant is to place a check mark here if English language Translation is attached. This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/496,854	07/02/2009	Richard Ian Olsen	088245-6407	5298
23524 7590 05/11/2012 FOLEY & LARDNER LLP 150 EAST GILMAN STREET P.O. BOX 1497 MADISON, WI 53701-1497			EXAMINER SOHN, SEUNG C	
			ART UNIT 2878	PAPER NUMBER
			MAIL DATE 05/11/2012	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Response to Rule 312 Communication	Application No. 12/496,854	Applicant(s) OLSEN ET AL.
	Examiner	Art Unit

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

1. ☒ The amendment filed on 09 May 2012 under 37 CFR 1.312 has been considered, and has been:

a) ☒ entered.

b) ☐ entered as directed to matters of form not affecting the scope of the invention.

c) ☐ disapproved because the amendment was filed after the payment of the issue fee.
Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue.

d) ☐ disapproved. See explanation below.

e) ☐ entered in part. See explanation below.


Publishing Division

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Olsen, et al.
Title: LARGE DYNAMIC RANGE CAMERAS
Appl. No.: 12/496,854
Filing Date: 7/2/2009
Examiner: Seung C. Sohn
Art Unit: 2878
Confirmation Number: 5298

ISSUE FEE TRANSMITTAL

Mail Stop Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

Enclosed herewith please find Issue Fee Transmittal Form PTOL-85(B).

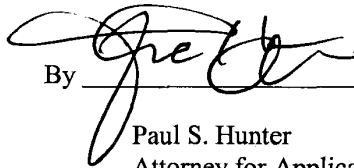
Fees in the amount of \$2,040.00 for payment of the Issue Fee and the Publication Fee are being paid by credit card via EFS-Web.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by the credit card payment instructions in EFS-Web being incorrect or absent, resulting in a rejected or incorrect credit card transaction, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741.

Respectfully submitted,

Date May 9, 2012

FOLEY & LARDNER LLP
Customer Number: 23524
Telephone: (608) 258-4292
Facsimile: (608) 258-4258

By 
Paul S. Hunter
Attorney for Applicant
Registration No. 44,787

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

23524 7590 02/16/2012
FOLEY & LARDNER LLP
150 EAST GILMAN STREET
P.O. BOX 1497
MADISON, WI 53701-1497

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/496,854	07/02/2009	Richard Ian Olsen	088245-6407	5298

TITLE OF INVENTION: LARGE DYNAMIC RANGE CAMERAS

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1740	\$300	\$0	\$2040	05/16/2012

EXAMINER	ART UNIT	CLASS-SUBCLASS
SOHN, SEUNG C	2878	250-208100

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.563).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list
 (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____
 (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____
 3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

Protarius Filo AG, L.L.C.

(B) RESIDENCE: (CITY AND STATE OR COUNTRY)

Dover, Delaware

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☒ Issue Fee
☒ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

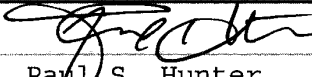
4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
☒ Payment by credit card ~~XXXXXXXXXXXXXXXXXXXX~~ EFS Web
☒ The Director is hereby authorized to charge the required fee(s), any deficiency or credit any overpayment, to Deposit Account Number ~~XXXXXXXXXXXX~~ 19 0741 (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature 
 Typed or printed name Paul S. Hunter

Date May 9, 2012
 Registration No. 44, 787

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Olsen, et al.
Title: LARGE DYNAMIC RANGE CAMERAS
Appl. No.: 12/496,854
Filing Date: 7/2/2009
Examiner: Seung C. Sohn
Art Unit: 2878
Confirmation Number: 5298

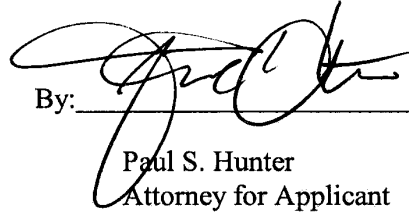
COMMENTS ON STATEMENT OF REASONS FOR ALLOWANCE

Mail Stop ISSUE FEE
Commissioner for Patents
PO Box 1450
Alexandria, Virginia 22313-1450

These Comments on Statement of Reasons for Allowance under 37 C.F.R. § 1.104 are intended to be responsive to the Notice of Allowance dated February 16, 2012. On page 2 of the Notice of Allowability under “Examiner’s Statement of Reasons for Allowance,” the Examiner provided a statement of reasons for allowance.

While Applicant agrees that the allowed claims recite a combination of subject matter that is patentable over the cited references, Applicant does not necessarily agree with or acquiesce in the statement of reasons for allowance given by the Examiner. Moreover, the Applicant notes that the recited subject matter as well as various other subject matter and/or combinations of subject matter may be patentable for other reasons than those given by the Examiner. Applicant expressly reserves the right to set forth additional and/or alternative reasons for patentability and/or allowance with the present Application or in any other future proceeding.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Paul S. Hunter", is written over a horizontal line.

By: _____

Paul S. Hunter
Attorney for Applicant
Registration No. 44,787

Date: May 9, 2012

FOLEY & LARDNER LLP
Customer Number: 23524
Telephone: (608) 258-4292
Facsimile: (608) 258-4258

Electronic Patent Application Fee Transmittal				
Application Number:		12496854		
Filing Date:		02-Jul-2009		
Title of Invention:		LARGE DYNAMIC RANGE CAMERAS		
First Named Inventor/Applicant Name:		Richard Ian Olsen		
Filer:		Paul S. Hunter/Linda Anderson		
Attorney Docket Number:		088245-6407		
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl issue fee	1501	1	1740	1740
Publ. Fee- early, voluntary, or normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				2040

Electronic Acknowledgement Receipt	
EFS ID:	12735597
Application Number:	12496854
International Application Number:	
Confirmation Number:	5298
Title of Invention:	LARGE DYNAMIC RANGE CAMERAS
First Named Inventor/Applicant Name:	Richard Ian Olsen
Customer Number:	23524
Filer:	Paul S. Hunter/Linda Anderson
Filer Authorized By:	Paul S. Hunter
Attorney Docket Number:	088245-6407
Receipt Date:	09-MAY-2012
Filing Date:	02-JUL-2009
Time Stamp:	13:18:56
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$2040
RAM confirmation Number	10820
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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1	Amendment after Notice of Allowance (Rule 312)	312amend.pdf	56849 f19bdd73c45aae5ace9d9dced5e0fdbb18053329	no	3
Warnings:					
Information:					
2		IssuefeeComments.pdf	244356 4db7d0fd855cbab4f7a0bd2c40b5770efeeaf3f1	yes	4
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Issue Fee Payment (PTO-85B)		1	2	
	Post Allowance Communication - Incoming		3	4	
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	31960 0c25621b643ff11250ed92928967f387ff403271	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			333165		
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Olsen, et al.
Title: LARGE DYNAMIC RANGE CAMERAS
Appl. No.: 12/496,854
Filing Date: 7/2/2009
Examiner: Seung C. Sohn
Art Unit: 2878
Confirmation Number: 5298

AMENDMENT UNDER 37 CFR 1.312

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

Applicant acknowledges receipt of a Notice of Allowance in the above-captioned application. In response to the Notice to File Corrected Application papers mailed March 26, 2012, and prior to payment of the issue fee, please amend the application as follows:

Amendments to the Specification begin on page 2 of this document.

Remarks/Arguments begin on page 3 of this document.

Please amend the application as follows:

Amendments to the Specification:

Please amend the specification by inserting the following two paragraphs after paragraph 0008:

FIG. 1 is a block diagram of a conventional digital camera.

FIG. 2 is a block diagram of a digital camera that includes multiple channels, under an embodiment.

REMARKS

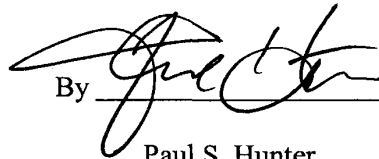
This amendment is being filed concurrently with the payment of the issue fee. The amendments are directed to the correction of errors found in the specification and noted in the Notice to File Corrected Application Papers mailed 3/26/2012. The amendments do not change the scope of the claims and no new matter has been added.

It is believed that no fees are due in connection with this Rule 312 amendment. In the event this is not correct, the undersigned authorizes the Commissioner to charge Deposit Account No. 19-0741.

Respectfully submitted,

Date May 9, 2012

FOLEY & LARDNER LLP
Customer Number: 23524
Telephone: (608) 258-4292
Facsimile: (608) 258-4258

By 

Paul S. Hunter
Attorney for Applicant
Registration No. 44,787



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/496,854	07/02/2009	Richard Ian Olsen	088245-6407	5298
23524 7590 03/26/2012 FOLEY & LARDNER LLP 150 EAST GILMAN STREET P.O. BOX 1497 MADISON, WI 53701-1497			EXAMINER SOHN, SEUNG C	
			ART UNIT 2878	PAPER NUMBER
			MAIL DATE 03/26/2012	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.



UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Application No. : 12496854
Applicant : Oslen
Filing Date : 07/02/2009
Date Mailed : 03/26/2012

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Notice of Allowance Mailed

This application has been accorded an Allowance Date and is being prepared for issuance. The application, however, is incomplete for the reasons below.

Applicant is given 2 month(s) from the mail date of this Notice, or the time remaining from the Notice of Allowance and Fee(s) Due, whichever is longer, within which to respond.

The informalities requiring correction are indicated in the attachment(s). If the informality pertains to the abstract, specification (including claims) or drawings, the informality must be corrected with an amendment in compliance with 37 CFR 1.121 (or, if the application is a reissue application, 37 CFR 1.173). Such an amendment may be filed after payment of the issue fee if limited to correction of informalities noted herein. See Waiver of 37 CFR 1.312 for Documents Required by the Office of Patent Publication, 1280 Off. Gaz. Patent Office 918 (March 23, 2004). In addition, if the informality is not corrected until after payment of the issue fee, for purposes of 35 U.S.C. 154(b)(1)(iv), "all outstanding requirements" will be considered to have been satisfied when the informality has been corrected. A failure to respond within the above-identified time period will result in the application being ABANDONED. **This period for reply is NOT extendable under 37 CFR 1.136(a).**

See attachment(s).

*A copy of this notice **MUST** be returned with the reply. Please address response to "Mail Stop Issue Fee, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450".*

/Carlota Erana/
Publication Branch
Office of Data Management
(571) 272-4200

Application No. 12496854

IDENTIFICATION OF SPECIFICATION/DRAWING INCONSISTENCIES

- ☐ On Page of the specification there is a brief description of FIG. , but the drawings filed do not include a drawing with that designation. Applicant must respond either by supplying the omitted drawing or by amending the specification to remove all references to that drawing.
- ☒ The drawings filed 07/02/2009 include FIG. 1 and 2, but the specification's brief description of the drawings does not describe a drawing with that designation. Applicant must respond either by amending the specification to add a brief description of that drawing or by correcting the drawings to remove the drawing in question.
- ☐ Drawings are present in the application and are referred to in the detailed description of the invention, but the specification does not contain a brief description of the drawings as required by 37 CFR 1.74 and 37 CFR 1.77(b)(8).
- ☐ Page of the specification refers to FIG. , but no drawing with that designation is described in the brief description of the drawings and no drawing with that designation is present in the application. Applicant must respond either by amending the specification to remove all references to that drawing, or by supplying that drawing and amending the specification to add a brief description of it.
- ☐ OTHER:
- ☐ COMMENTS:



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/496,854	07/02/2009	Richard Ian Olsen	088245-6407	5298
23524 7590 03/21/2012 FOLEY & LARDNER LLP 150 EAST GILMAN STREET P.O. BOX 1497 MADISON, WI 53701-1497			EXAMINER SOHN, SEUNG C	
			ART UNIT 2878	PAPER NUMBER
			MAIL DATE 03/21/2012	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.



UNITED STATES DEPARTMENT OF COMMERCE
U.S. Patent and Trademark Office
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Alexandria, Virginia 22313-1450

APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
12/496,854	02 July, 2009	OLSEN ET AL.	088245-6407

FOLEY & LARDNER LLP 150 EAST GILMAN STREET P.O. BOX 1497 MADISON, WI 53701-1497		EXAMINER	
		SEUNG C. SOHN	
		ART UNIT	PAPER
		2878	20120313

DATE MAILED:

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner for Patents

The information disclosure statement (IDS) submitted on March 6, 2012 was filed after the mailing date of the Notice of Allowance on February 16, 2012. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner. The signed IDS is attached.

/SEUNG C SOHN/
Primary Examiner, Art Unit 2878

Receipt date: 03/06/2012

12496854 - GAU: 2878

PTO/SB/08 (09-06)

Approved for use through 03/31/2007. OMB 0651-0031

U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

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Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT Date Submitted: March 6, 2012 <i>(use as many sheets as necessary)</i>				Complete if Known	
				Application Number	12/496,854
				Filing Date	7/2/2009
				First Named Inventor	Richard Ian Olsen
				Art Unit	2878
				Examiner Name	Seung C. Sohn
				Attorney Docket Number	088245-6407
Sheet	1	of	1		

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number Number-Kind Code ² (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. ¹	Foreign Patent Document Country Code ³ Number ⁴ Kind Code ⁵ (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T ⁶

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.) date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ⁶
/SCS/		Communication from the European Patent Office on European Patent Application 05793927.4, mailed 2/10/2012.	

Examiner Signature	/Seung C Sohn/	Date Considered	03/13/2012
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. 3 Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). 4 For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 5 Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. 6 Applicant is to place a check mark here if English language Translation is attached. This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

4822-9226-8302.1

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Substitute for form 1449/PTO		Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT		Application Number	12/496,854
Date Submitted: March 6, 2012		Filing Date	7/2/2009
(use as many sheets as necessary)		First Named Inventor	Richard Ian Olsen
		Art Unit	2878
		Examiner Name	Seung C. Sohn
		Attorney Docket Number	088245-6407
Sheet	1	of	1

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number Number-Kind Code ² (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. ¹	Foreign Patent Document Country Code ³ Number ⁴ Kind Code ⁵ (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T ⁶

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.) date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ⁶
		Communication from the European Patent Office on European Patent Application 05793927.4, mailed 2/10/2012.	

Examiner Signature		Date Considered	
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. 3 Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). 4 For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 5 Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. 6 Applicant is to place a check mark here if English language Translation is attached. This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

Electronic Patent Application Fee Transmittal				
Application Number:		12496854		
Filing Date:		02-Jul-2009		
Title of Invention:		LARGE DYNAMIC RANGE CAMERAS		
First Named Inventor/Applicant Name:		Richard Ian Olsen		
Filer:		Christopher L. Kalafut/Linda Anderson		
Attorney Docket Number:		088245-6407		
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description		Fee Code	Quantity	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
Total in USD (\$)				180

Electronic Acknowledgement Receipt	
EFS ID:	12230783
Application Number:	12496854
International Application Number:	
Confirmation Number:	5298
Title of Invention:	LARGE DYNAMIC RANGE CAMERAS
First Named Inventor/Applicant Name:	Richard Ian Olsen
Customer Number:	23524
Filer:	Christopher L. Kalafut/Linda Anderson
Filer Authorized By:	Christopher L. Kalafut
Attorney Docket Number:	088245-6407
Receipt Date:	06-MAR-2012
Filing Date:	02-JUL-2009
Time Stamp:	13:30:16
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$180
RAM confirmation Number	10960
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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1		SupplDS.pdf	339239 edcbf80deef5803f21b420d93e85395eeb32b411	yes	10
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Transmittal Letter		1	4	
	Information Disclosure Statement (IDS) Form (SB08)		5	5	
	Non Patent Literature		6	10	
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30214 3be1b983ff84d828efa1812233dea96f79e9bf3	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			369453		
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Olsen, et al.
Title: LARGE DYNAMIC RANGE
CAMERAS
Appl. No.: 12/496,854
Filing Date: 7/2/2009
Examiner: Seung C. Sohn
Art Unit: 2878
Confirmation Number: 5298

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT
UNDER 37 CFR §1.56

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

Submitted herewith on Form PTO/SB/08 is a listing of a document known to Applicants in order to comply with Applicants' duty of disclosure pursuant to 37 CFR §1.56.

A copy of each non-U.S. patent document and each non-patent document is being submitted to comply with the provisions of 37 CFR §1.97 and §1.98.

The submission of any document herewith, which is not a statutory bar, is not intended as an admission that such document constitutes prior art against the claims of the present application or that such document is considered material to patentability as defined in 37 CFR §1.56(b). Applicants do not waive any rights to take any action which would be appropriate to

antedate or otherwise remove as a competent reference any document which is determined to be a *prima facie* art reference against the claims of the present application.

TIMING OF THE DISCLOSURE

The listed document is being submitted in compliance with 37 CFR §1.97(d), before payment of the issue fee.

RELEVANCE OF EACH DOCUMENT

All of the documents are in English.

Applicants respectfully request that each listed document be considered by the Examiner and be made of record in the present application and that an initialed copy of Form PTO/SB/08 be returned in accordance with MPEP §609.

STATEMENT

The undersigned hereby states in accordance with 37 CFR §1.97(e)(1) that each item of information contained in this supplemental information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three (3) months prior to filing of this Statement.

The undersigned hereby states in accordance with 37 CFR §1.704(d) that each item of information contained in the information disclosure statement was first cited in any communication from a patent office in a counterpart foreign or international application or from the Office, and that this communication was not received by any individual designated in 37 CFR §1.56(c) more than thirty days prior to the filing of the information disclosure statement.

FEE

Fees in the amount of \$180.00 to cover the fee associated with an information disclosure statement under 37 CFR §1.97(d) are being paid by credit card via EFS-Web.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this submission under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by the credit card payment instructions in EFS-Web being incorrect or absent, resulting in a rejected or incorrect credit card transaction, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741.

Atty. Dkt. No. 088245-6407

Respectfully submitted,

Date March 6, 2012

By: /Christopher L. Kalafut/

FOLEY & LARDNER LLP
Customer Number: 23524
Telephone: (608) 258-4286
Facsimile: (608) 258-4258

Christopher L. Kalafut
Attorney for Applicant
Registration No. 57,946



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

23524 7590 02/16/2012
FOLEY & LARDNER LLP
150 EAST GILMAN STREET
P.O. BOX 1497
MADISON, WI 53701-1497

EXAMINER

SOHN, SEUNG C

ART UNIT

PAPER NUMBER

2878

DATE MAILED: 02/16/2012

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/496,854	07/02/2009	Richard Ian Olsen	088245-6407	5298
TITLE OF INVENTION: LARGE DYNAMIC RANGE CAMERAS				

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1740	\$300	\$0	\$2040	05/16/2012

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

- A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.
- B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

- A. Pay TOTAL FEE(S) DUE shown above, or
- B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

23524 7590 02/16/2012
FOLEY & LARDNER LLP
150 EAST GILMAN STREET
P.O. BOX 1497
MADISON, WI 53701-1497

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

12/496,854 07/02/2009 Richard Ian Olsen 088245-6407 5298

TITLE OF INVENTION: LARGE DYNAMIC RANGE CAMERAS

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1740	\$300	\$0	\$2040	05/16/2012

EXAMINER	ART UNIT	CLASS-SUBCLASS
SOHN, SEUNG C	2878	250-208100

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.111. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/496,854	07/02/2009	Richard Ian Olsen	088245-6407	5298
23524 7590 02/16/2012 FOLEY & LARDNER LLP 150 EAST GILMAN STREET P.O. BOX 1497 MADISON, WI 53701-1497			EXAMINER SOHN, SEUNG C	
			ART UNIT 2878	PAPER NUMBER

DATE MAILED: 02/16/2012

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 532 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 532 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No.	Applicant(s)	
	12/496,854	OLSEN ET AL.	
	Examiner	Art Unit	
	SEUNG C. SOHN	2878	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☐ This communication is responsive to ____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are 1-31.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some* c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
(a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
(b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892) 2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 3. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date <u>See Continuation Sheet</u> 4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material	5. ☐ Notice of Informal Patent Application 6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____. 7. ☐ Examiner's Amendment/Comment 8. ☒ Examiner's Statement of Reasons for Allowance 9. ☐ Other _____.
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Continuation of Attachment(s) 3. Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date: 10/7/2010; 12/9/2010; 3/30/2011; 7/14/2011; 7/26/2011; and 12/13/2011.

Allowable Subject Matter

1. **Claims 1-31** are allowed.
2. The following is an examiner's statement of reasons for allowance:

Claims 1-31 are not disclosed or made obvious by the prior art of record, specifically in combination with the limitation of "a processing component operatively coupled to the first channel and to the second channel, wherein the processing component is configured to separately control an integration time of each channel, wherein a first integration time of the first channel is less than a second integration time of the second channel, and wherein the processing component is configured to combine data captured by each of the first channel and the second channel to generate an image."

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SEUNG C. SOHN whose telephone number is (571)272-4123. The examiner can normally be reached on Mon-Thur, 7:30 AM -6 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, GEORGIA Y. EPPS can be reached on 571-272-2328. The fax phone

Art Unit: 2878

number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/SEUNG C SOHN/

Primary Examiner, Art Unit 2878



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
 United States Patent and Trademark Office
 Address: COMMISSIONER FOR PATENTS
 P.O. Box 1450
 Alexandria, Virginia 22313-1450
 www.uspto.gov

BIB DATA SHEET

CONFIRMATION NO. 5298

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.		
12/496,854	07/02/2009	250	2878	088245-6407		
RULE						
APPLICANTS Richard Ian Olsen, Irvine, CA; Darryl L. Sato, Irvine, CA; Feng-Qing Sun, Irvine, CA; James Gates, Irvine, CA;						
** CONTINUING DATA ***** This application is a CON of 11/788,122 04/19/2007 PAT 7,564,019 which claims benefit of 60/795,882 04/28/2006 and is a CIP of 11/212,803 08/25/2005 ABN which claims benefit of 60/604,854 08/25/2004 and claims benefit of 60/695,946 07/01/2005						
** FOREIGN APPLICATIONS *****						
** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 07/14/2009						
Foreign Priority claimed ☐ Yes ☒ No 35 USC 119(a-d) conditions met ☐ Yes ☐ No Verified and /SEUNG C SOHN/ Acknowledged Examiner's Signature		☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
			CA	24	31	4
ADDRESS FOLEY & LARDNER LLP 150 EAST GILMAN STREET P.O. BOX 1497 MADISON, WI 53701-1497 UNITED STATES						
TITLE LARGE DYNAMIC RANGE CAMERAS						
FILING FEE RECEIVED 1882	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:			☐ All Fees		
				☐ 1.16 Fees (Filing)		
				☐ 1.17 Fees (Processing Ext. of time)		
				☐ 1.18 Fees (Issue)		
				☐ Other _____		
			☐ Credit			

Receipt date: 03/30/2011

12496854 - GAU: 2878

PTO/SB/08 (09-06)

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U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

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Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT Date Submitted: March 30, 2011 <i>(use as many sheets as necessary)</i>				Application Number	12/496,854
				Filing Date	7/2/2009
				First Named Inventor	Richard Ian Olsen
				Art Unit	2622
				Examiner Name	Lin Ye
Sheet	1	of	1	Attorney Docket Number	088245-6407

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number Number-Kind Code ² (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. ¹	Foreign Patent Document Country Code ³ Number ⁴ Kind Code ⁵ (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T ⁶

NON PATENT LITERATURE DOCUMENTS			
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		Notice of Allowance on U.S. Application 11/810,623, mailed 2/2/2011.	
		Office Action on U.S. Application 11/729,132, mailed 2/3/2011.	

Examiner Signature	/Seung C Sohn/	Date Considered	02/11/2012
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ADI_2619045.1

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /SCS/

<i>Index of Claims</i> 	Application/Control No. 12496854	Applicant(s)/Patent Under Reexamination OLSEN ET AL.
	Examiner SEUNG C SOHN	Art Unit 2878

✓	Rejected
=	Allowed

-	Cancelled
÷	Restricted

N	Non-Elected
I	Interference

A	Appeal
O	Objected

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47										
CLAIM		DATE								
Final	Original	02/11/2012								
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Search Notes 	Application/Control No. 12496854	Applicant(s)/Patent Under Reexamination OLSEN ET AL.
	Examiner SEUNG C SOHN	Art Unit 2878

SEARCHED			
Class	Subclass	Date	Examiner
250	208.1	2/11/2012	SCS
348	273, 302, 308	2/11/2012	SCS

SEARCH NOTES		
Search Notes	Date	Examiner
EAST (US-PGPUB, USPAT, EPO, JPO, DERWENT)	2/11/2012	SCS
INVENTOR SEARCH	2/11/2012	SCS

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner
	TEXT SEARCH (EAST US-PGPUB)	2/12/2012	SCS

	/SEUNG C SOHN/ Primary Examiner.Art Unit 2878
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Issue Classification 	Application/Control No. 12496854	Applicant(s)/Patent Under Reexamination OLSEN ET AL.
	Examiner SEUNG C SOHN	Art Unit 2878

ORIGINAL						INTERNATIONAL CLASSIFICATION												
CLASS			SUBCLASS			CLAIMED					NON-CLAIMED							
250			208.1			H	O	1	L	27 / 00 (2006.01.01)								
CROSS REFERENCE(S)																		
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)																	

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Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		17												
	2		18												
	3		19												
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	14		30												
	15		31												
	16														

NONE		Total Claims Allowed:	
		31	
(Assistant Examiner)	(Date)		
/SEUNG C SOHN/ Primary Examiner.Art Unit 2878	2/11/2012	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	2

Receipt date: 10/07/2010

12496854 - GAU: 2878

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				First Named Inventor	Richard Ian Olsen
				Art Unit	2622
				Examiner Name	Lin Ye
Sheet	1	of	7	Attorney Docket Number	088245-6407

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		Number-Kind Code ² (if known)			
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Examiner Signature	/Seung C Sohn/	Date Considered	02/11/2012
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				First Named Inventor	Richard Ian Olsen	
				Art Unit	2622	
				Examiner Name	Lin Ye	
Attorney Docket Number	088245-6407					
Sheet	2	of	7			

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Examiner Signature	/Seung C Sohn/	Date Considered	02/11/2012
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Sheet	3	of	7	Attorney Docket Number	088245-6407

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	Document Number				
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	7,417,674	08-26-2008	GRUHLKE		
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		EP-1 032 045	08-30-2000	SANYO ELECTRIC CO.		
		EP-0 599 470	06-01-1994	PICKER INTERNATIONAL, INC.		
		JP-62-011264	01-20-1987	FUJI PHOTO FILM CO LTD		

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		Duparre et al., "Artificial apposition compound eye fabricated by micro-optics technology," Applied Optics, Vol. 43, No. 22, August 2004, pp. 4303-4310.	

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		Duparre et al., "Artificial compound eyes - different concepts and their application to ultra flat image acquisition sensors," Proceedings of SPIE, Vol. 5346 (SPIE, Bellingham, WA, 2004), pp. 89-100.	
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Examiner Signature	/Seung C Sohn/	Date Considered	02/11/2012
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Receipt date: 10/07/2010

12496854 - GAU: 2878

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Substitute for form 1449/PTO		Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT Date Submitted: October 7, 2010 <i>(use as many sheets as necessary)</i>		Application Number	12/496854
		Filing Date	7/2/2009
		First Named Inventor	Richard Ian Olsen
		Art Unit	2622
		Examiner Name	Lin Ye
		Attorney Docket Number	088245-6407
Sheet	5	of	7

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.) date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ⁶
		Norvell, Robin, " Shellcase Debuts Ultra-Thin Miniaturization for Optics," July 8, 2005, 1 page.	
		Notice of Allowance for U.S. Application 11/478,242, mailed December 30, 2009.	
		Notice of Allowance for U.S. Application 11/888,546, mailed December 14, 2009.	
		Notice of Allowance on U.S. Application 11/888,582, mailed August 6, 2010.	
		Office Action for U.S. Application 11/825,382, mailed October 29, 2009.	
		Office Action on U.S. Application 11/788,279, mailed January 21, 2010.	
		Office Action on U.S. Application 11/810,623, mailed 8/18/2010	
		Office Action on U.S. Application 11/478,242, mailed 9/16/2009	
		Office Action on U.S. Application 11/788,120, mailed 4/16/2010	
		Office Action on U.S. Application 11/788,120, mailed 5/19/2009	
		Office Action on U.S. Application 11/788,120, mailed 7/30/2010	
		Office Action on U.S. Application 11/788,120, mailed 9/18/2009	

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		Examiner Name	Lin Ye
Sheet	6	of	7
		Attorney Docket Number	088245-6407

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		Office Action on U.S. Application 11/788,279, mailed 8/4/2010	
		Office Action on U.S. Application 11/810,623 mailed February 4, 2010.	
		Office Action U.S. Application 11/888,582, mailed September 3, 2009.	
		Search Report for EP Application 05793927.4, dated February 26, 2010	
		Shogenji et al., "Bimodal fingerprint capturing system based on compound-eye imaging module," Applied Optics, Vol. 43, No. 6, February 2004, pp. 1355-1359.	
		Shogenji et al., "Multispectral imaging using compact compound optics," Optics Express, Vol. 12, No. 8, April 2004, pp. 1643-1655.	
		Stager et al., "Replicated Micro-Optics for Automotive Applications," SPIE European Workshop on Photonics in the Automobile, Geneva, 2004, (8 pages).	
		Tanida et al., "Compact image capturing system based on compound imaging and digital reconstruction," Proceedings of SPIE, Vol. 4455, 2001, pp. 34-41.	
		Tanida, "Color imaging with an integrated compound imaging system," Optics Express, Vol. 11, No. 18, September 2003, pp. 2109-2117.	
		Notice of Allowance on United States Application 11/888,546, mailed 6/3/2009	
		Volkel et al., "Miniaturization of Imaging Systems," mstnews, February 2003, pp. 36-38.	
		Volkel et al., "Miniaturized imaging systems," Elsevier Science B.V., Microelectronic Engineering 67-68 (2003), pp. 461-472.	

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		Wood et al., "Resolution Improvement for Compound Eye Images Through Lens Diversity," IEEE, Signal Processing Society, DSP/SPE Workshop, August 2, 2004 (5 pages).	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT Date Submitted: December 13, 2011 <i>(use as many sheets as necessary)</i>		Application Number	12/496,854
		Filing Date	7/2/2009
		First Named Inventor	Richard Ian Olsen
		Art Unit	2878
		Examiner Name	Seung C. Sohn
Sheet	1	of	1
		Attorney Docket Number	088245-6407

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number Number-Kind Code ² (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS					
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NON PATENT LITERATURE DOCUMENTS		
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		Notice of Allowance on U.S. Appl. 11/729,132, mailed 10/11/2011.

Examiner Signature	/Seung C Sohn/	Date Considered	02/11/2012
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4839-8922-0622.1

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EAST Search History**EAST Search History (Prior Art)**

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	4	"11788122"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/11 13:00
L2	139	olsen near2 richard	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/11 13:00
L3	31	olsen near2 richard near2 ian	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/11 13:00
L4	244192	digital adj camera	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/11 13:00
L5	5770	250/208.1.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/11 13:00
L6	22948	integration adj time	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/11 13:00
L7	1852	L4 and L6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/11 13:00
L8	111	L5 and L7	US-PGPUB;	OR	ON	2012/02/11

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			13:00
L9	1526	shorter same (integration adj time)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/11 13:00
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EAST Search History

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L17	3145	348/302,308.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/11 13:32

EAST Search History (Interference)

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2/ 11/ 2012 1:39:17 PM

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Receipt date: 12/09/2010

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				Art Unit	2622
				Examiner Name	Lin Ye
Sheet	1	of	2	Attorney Docket Number	088245-6407

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		Final Office Action on U.S. Application 11/212,803, mailed 9/20/2007.	
		Non-Final Office Action on U.S. Application 11/212,803, mailed 2/7/2007.	
		Non-Final Office Action on U.S. Application 11/265,669, mailed 2/28/2006.	
		Non-Final Office Action on U.S. Application 11/322,959, mailed 8/8/2007.	
		Non-Final Office Action on U.S. Application 11/788,122, mailed 6/27/2008.	
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		Notice of Allowance on U.S. Application 11/888,546, mailed 6/3/2009.	
		Notice of Allowance on U.S. Application 11/888,570, mailed 3/23/2009.	
		Second Office Action on Chinese Application 200580032374.0, issued September 9, 2010 (with English translation).	

Examiner Signature	/Seung C Sohn/	Date Considered	02/11/2012
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. 3 Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). 4 For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 5 Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. 6 Applicant is to place a check mark here if English language Translation is attached. This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

MADI_2493698.1

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /SCS/

Receipt date: 07/14/2011

12496854 - GAU: 2878

PTO/SB/08 (09-06)

Approved for use through 03/31/2007. OMB 0651-0031

U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT Date Submitted: July 14, 2011 <i>(use as many sheets as necessary)</i>				Application Number	12/496,854
				Filing Date	7/2/2009
				First Named Inventor	Richard Ian Olsen
				Art Unit	2622
				Examiner Name	Peter Chon
Sheet	1	of	1	Attorney Docket Number	088245-6407

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number Number-Kind Code ² (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		2002/0075481	06-20-2002	ROUSTAEI, ALEXANDER R.	
		2003/0095711	05-22-2003	MCGUINNESS ET AL.	
		2006/0222220	10-05-2006	YAMANO ET AL.	

FOREIGN PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Foreign Patent Document Country Code ³ Number ⁴ Kind Code ⁵ (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.) date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ⁶
		Notice of Allowance on U.S. Application 13/006,351, mailed 5/17/2011.	

Examiner Signature	/Seung C Sohn/	Date Considered	02/11/2012
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If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

MADI_2741232.1

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /SCS/

Receipt date: 07/26/2011

12496854 - GAU: 2878

PTO/SB/08 (09-06)

Approved for use through 03/31/2007. OMB 0651-0031

U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

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Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT Date Submitted: July 26, 2011 <i>(use as many sheets as necessary)</i>				Application Number	12/496,854
				Filing Date	7/2/2009
				First Named Inventor	Richard Ian Olsen
				Art Unit	2622
				Examiner Name	Peter Chon
Sheet	1	of	1	Attorney Docket Number	088245-6407

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number Number-Kind Code ² (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.) date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ⁶
		Third Office Action issued on Chinese Application 200580032374.0, mailed 5/24/2011 (with English translation)	

Examiner Signature	/Seung C Sohn/	Date Considered	02/11/2012
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If you need assistance in completing the form, call 1-800-PTO-9195 (1-800-786-9199) and select option 2.

MADI_2752795.1

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Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT Date Submitted: December 13, 2011 (use as many sheets as necessary)			Complete if Known		
			Application Number	12/496,854	
			Filing Date	7/2/2009	
			First Named Inventor	Richard Ian Olsen	
			Art Unit	2878	
			Examiner Name	Seung C. Sohn	
			Attorney Docket Number	088245-6407	
Sheet	1	of	1		

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number Number-Kind Code ² (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. ¹	Foreign Patent Document Country Code ³ Number ⁴ Kind Code ⁵ (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T ⁶

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.) date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ⁶
		Notice of Allowance on U.S. Appl. 11/729,132, mailed 10/11/2011.	

Examiner Signature		Date Considered	
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4839-8922-0622.1

Electronic Acknowledgement Receipt	
EFS ID:	11601969
Application Number:	12496854
International Application Number:	
Confirmation Number:	5298
Title of Invention:	LARGE DYNAMIC RANGE CAMERAS
First Named Inventor/Applicant Name:	Richard Ian Olsen
Customer Number:	23524
Filer:	Christopher L. Kalafut/Linda Anderson
Filer Authorized By:	Christopher L. Kalafut
Attorney Docket Number:	088245-6407
Receipt Date:	13-DEC-2011
Filing Date:	02-JUL-2009
Time Stamp:	14:41:43
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		SuppIDS.pdf	125635	yes	3
			2d38eb3cdaf0b60395a49a4c8ad0becfb8d82b47		

	Multipart Description/PDF files in .zip description								
	Document Description		Start	End					
	Transmittal Letter		1	2					
	Information Disclosure Statement (IDS) Form (SB08)		3	3					
Warnings:									
Information:									
2	Non Patent Literature	NPL.pdf	438981	no	8				
			3b8193cccf1913d07049c013888bf6ba55e4ac15						
Warnings:									
Information:									
Total Files Size (in bytes):			564616						
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>									

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Olsen, et al.
Title: LARGE DYNAMIC RANGE CAMERAS
Appl. No.: 12/496,854
Filing Date: 7/2/2009
Examiner: Seung C. Sohn
Art Unit: 2878
Confirmation Number: 5298

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT
UNDER 37 CFR §1.56

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Submitted herewith on Form PTO/SB/08 is a listing of a document known to Applicants in order to comply with Applicants' duty of disclosure pursuant to 37 CFR §1.56.

A copy of each non-U.S. patent document and each non-patent document is being submitted to comply with the provisions of 37 CFR §1.97 and §1.98.

The submission of any document herewith, which is not a statutory bar, is not intended as an admission that such document constitutes prior art against the claims of the present application or that such document is considered material to patentability as defined in 37 CFR §1.56(b). Applicants do not waive any rights to take any action which would be appropriate to

antedate or otherwise remove as a competent reference any document which is determined to be a *prima facie* art reference against the claims of the present application.

TIMING OF THE DISCLOSURE

The listed document is being submitted in compliance with 37 CFR §1.97(b), before the mailing date of the first Office Action on the merits.

RELEVANCE OF EACH DOCUMENT

All of the documents are in English.

Applicants respectfully request that each listed document be considered by the Examiner and be made of record in the present application and that an initialed copy of Form PTO/SB/08 be returned in accordance with MPEP §609.

Although Applicant believes that no fee is required, the Commissioner is hereby authorized to charge any additional fees which may be due to Deposit Account No. 19-0741.

Respectfully submitted,

Date December 13, 2011

By: /Christopher L. Kalafut/

FOLEY & LARDNER LLP
Customer Number: 23524
Telephone: (608) 258-4286
Facsimile: (608) 258-4258

Christopher L. Kalafut
Attorney for Applicant
Registration No. 57,946

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Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT Date Submitted: July 26, 2011 <i>(use as many sheets as necessary)</i>				Application Number	12/496,854
				Filing Date	7/2/2009
				First Named Inventor	Richard Ian Olsen
				Art Unit	2622
				Examiner Name	Peter Chon
Sheet	1	of	1	Attorney Docket Number	088245-6407

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number Number-Kind Code ² (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.) date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ⁶
		Third Office Action issued on Chinese Application 200580032374.0, mailed 5/24/2011 (with English translation)	

Examiner Signature		Date Considered	
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MADI_2752795.1

Electronic Acknowledgement Receipt	
EFS ID:	10596191
Application Number:	12496854
International Application Number:	
Confirmation Number:	5298
Title of Invention:	LARGE DYNAMIC RANGE CAMERAS
First Named Inventor/Applicant Name:	Richard Ian Olsen
Customer Number:	23524
Filer:	Christopher L. Kalafut/Linda Anderson
Filer Authorized By:	Christopher L. Kalafut
Attorney Docket Number:	088245-6407
Receipt Date:	26-JUL-2011
Filing Date:	02-JUL-2009
Time Stamp:	12:20:50
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		SupplDS.pdf	333072 f89b606216a79ebf4f1f707b7bf5ac4faee03726	yes	7

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Transmittal Letter	1	2
	Information Disclosure Statement (IDS) Form (SB08)	3	3
	Non Patent Literature	4	7
Warnings:			
Information:			
Total Files Size (in bytes):		333072	
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>			

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Olsen, et al.
Title: LARGE DYNAMIC RANGE CAMERAS
Appl. No.: 12/496,854
Filing Date: 7/2/2009
Examiner: Peter Chon
Art Unit: 2622
Confirmation Number: 5298

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT
UNDER 37 CFR §1.56

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Submitted herewith on Form PTO/SB/08 is a listing of a document known to Applicants in order to comply with Applicants' duty of disclosure pursuant to 37 CFR §1.56.

A copy of each non-U.S. patent document and each non-patent document is being submitted to comply with the provisions of 37 CFR §1.97 and §1.98.

The submission of any document herewith, which is not a statutory bar, is not intended as an admission that such document constitutes prior art against the claims of the present application or that such document is considered material to patentability as defined in 37 CFR §1.56(b). Applicants do not waive any rights to take any action which would be appropriate to

antedate or otherwise remove as a competent reference any document which is determined to be a *prima facie* art reference against the claims of the present application.

TIMING OF THE DISCLOSURE

The listed document is being submitted in compliance with 37 CFR §1.97(b), before the mailing date of the first Office Action on the merits.

RELEVANCE OF EACH DOCUMENT

Any document listed on the attached PTO/SB/08 was cited as being relevant during the prosecution of the corresponding Chinese application. A copy of the Chinese Office Action is attached. An English-language counterpart of the foreign-language document has been provided.

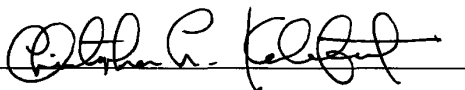
Applicants respectfully request that each listed document be considered by the Examiner and be made of record in the present application and that an initialed copy of Form PTO/SB/08 be returned in accordance with MPEP §609.

Although Applicant believes that no fee is required, the Commissioner is hereby authorized to charge any additional fees which may be due to Deposit Account No. 19-0741.

Respectfully submitted,

Date July 26, 2011

FOLEY & LARDNER LLP
Customer Number: 23524
Telephone: (608) 258-4286
Facsimile: (608) 258-4258

By 

Christopher L. Kalafut
Attorney for Applicant
Registration No. 57,946

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Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT Date Submitted: July 14, 2011 <i>(use as many sheets as necessary)</i>				Application Number	12/496,854
				Filing Date	7/2/2009
				First Named Inventor	Richard Ian Olsen
				Art Unit	2622
				Examiner Name	Peter Chon
Sheet	1	of	1	Attorney Docket Number	088245-6407

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number Number-Kind Code ² (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		2002/0075481	06-20-2002	ROUSTAEI, ALEXANDER R.	
		2003/0095711	05-22-2003	MCGUINNESS ET AL.	
		2006/0222220	10-05-2006	YAMANO ET AL.	

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		Notice of Allowance on U.S. Application 13/006,351, mailed 5/17/2011.	

Examiner Signature		Date Considered	
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If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

MADI_2741232.1

Electronic Acknowledgement Receipt	
EFS ID:	10517315
Application Number:	12496854
International Application Number:	
Confirmation Number:	5298
Title of Invention:	LARGE DYNAMIC RANGE CAMERAS
First Named Inventor/Applicant Name:	Richard Ian Olsen
Customer Number:	23524
Filer:	Christopher L. Kalafut/Linda Anderson
Filer Authorized By:	Christopher L. Kalafut
Attorney Docket Number:	088245-6407
Receipt Date:	14-JUL-2011
Filing Date:	02-JUL-2009
Time Stamp:	14:51:08
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		SupplDS.pdf	574604 b7c6670ebd2ad77af20b1f9f9223383f6f73b701	yes	11

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Transmittal Letter	1	2
	Information Disclosure Statement (IDS) Form (SB08)	3	3
	Non Patent Literature	4	11
Warnings:			
Information:			
Total Files Size (in bytes):		574604	
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>			

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Olsen, et al.
Title: LARGE DYNAMIC RANGE CAMERAS
Appl. No.: 12/496,854
Filing Date: 7/2/2009
Examiner: Peter Chon
Art Unit: 2622
Confirmation Number: 5298

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT
UNDER 37 CFR §1.56

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Submitted herewith on Form PTO/SB/08 is a listing of documents known to Applicants in order to comply with Applicants' duty of disclosure pursuant to 37 CFR §1.56.

A copy of each non-U.S. patent document and each non-patent document is being submitted to comply with the provisions of 37 CFR §1.97 and §1.98.

The submission of any document herewith, which is not a statutory bar, is not intended as an admission that such document constitutes prior art against the claims of the present application or that such document is considered material to patentability as defined in 37 CFR §1.56(b). Applicants do not waive any rights to take any action which would be appropriate to

antedate or otherwise remove as a competent reference any document which is determined to be a *prima facie* art reference against the claims of the present application.

TIMING OF THE DISCLOSURE

The listed documents are being submitted in compliance with 37 CFR §1.97(b), before the mailing date of the first Office Action on the merits.

RELEVANCE OF EACH DOCUMENT

All of the documents are in English.

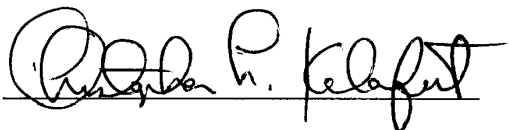
Applicants respectfully request that each listed document be considered by the Examiner and be made of record in the present application and that an initialed copy of Form PTO/SB/08 be returned in accordance with MPEP §609.

Although Applicant believes that no fee is required, the Commissioner is hereby authorized to charge any additional fees which may be due to Deposit Account No. 19-0741.

Respectfully submitted,

Date July 14, 2011

FOLEY & LARDNER LLP
Customer Number: 23524
Telephone: (608) 258-4286
Facsimile: (608) 258-4258

By 

Christopher L. Kalafut
Attorney for Applicant
Registration No. 57,946

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT Date Submitted: March 30, 2011 <i>(use as many sheets as necessary)</i>				Application Number	12/496,854
				Filing Date	7/2/2009
				First Named Inventor	Richard Ian Olsen
				Art Unit	2622
				Examiner Name	Lin Ye
Sheet	1	of	1	Attorney Docket Number	088245-6407

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number Number-Kind Code ² (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. ¹	Foreign Patent Document Country Code ³ Number ⁴ Kind Code ⁵ (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T ⁶

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.) date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ⁶
		Notice of Allowance on U.S. Application 11/810,623, mailed 2/2/2011.	
		Office Action on U.S. Application 11/729,132, mailed 2/3/2011.	

Examiner Signature		Date Considered	
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If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

ADI_2619045.1

Electronic Acknowledgement Receipt	
EFS ID:	9770812
Application Number:	12496854
International Application Number:	
Confirmation Number:	5298
Title of Invention:	LARGE DYNAMIC RANGE CAMERAS
First Named Inventor/Applicant Name:	Richard Ian Olsen
Customer Number:	23524
Filer:	Christopher L. Kalafut/Charmaine Teuschler
Filer Authorized By:	Christopher L. Kalafut
Attorney Docket Number:	088245-6407
Receipt Date:	30-MAR-2011
Filing Date:	02-JUL-2009
Time Stamp:	13:56:53
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Transmittal Letter	1	2
	Information Disclosure Statement (IDS) Filed (SB/08)	3	3
	NPL Documents	4	11
	NPL Documents	12	20
Warnings:			
Information:			
Total Files Size (in bytes):		802799	
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Olsen, et al.
Title: LARGE DYNAMIC RANGE CAMERAS
Appl. No.: 12/496,854
Filing Date: 7/2/2009
Examiner: Lin Ye
Art Unit: 2622
Confirmation Number: 5298

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT
UNDER 37 CFR §1.56

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

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RELEVANCE OF EACH DOCUMENT

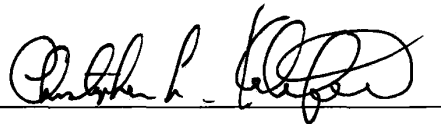
All of the documents are in English.

Applicants respectfully request that each listed document be considered by the Examiner and be made of record in the present application and that an initialed copy of Form PTO/SB/08 be returned in accordance with MPEP §609.

Although Applicant believes that no fee is required, the Commissioner is hereby authorized to charge any additional fees which may be due to Deposit Account No. 19-0741.

Respectfully submitted,

Date March 30, 2011

By 

FOLEY & LARDNER LLP
Customer Number: 23524
Telephone: (608) 258-4286
Facsimile: (608) 258-4258

Christopher L. Kalafut
Attorney for Applicant
Registration No. 57,946

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT Date Submitted: December 9, 2010 <i>(use as many sheets as necessary)</i>				Application Number	12/496,854
				Filing Date	7/2/2009
				First Named Inventor	Richard Ian Olsen
				Art Unit	2622
				Examiner Name	Lin Ye
Sheet	1	of	2	Attorney Docket Number	088245-6407

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number Number-Kind Code ² (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. ¹	Foreign Patent Document Country Code ³ -Number ⁴ - Kind Code ⁵ (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T ⁶

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.) date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ⁶
		Final Office Action on U.S. Application 11/212,803, mailed 9/20/2007.	
		Non-Final Office Action on U.S. Application 11/212,803, mailed 2/7/2007.	
		Non-Final Office Action on U.S. Application 11/265,669, mailed 2/28/2006.	
		Non-Final Office Action on U.S. Application 11/322,959, mailed 8/8/2007.	
		Non-Final Office Action on U.S. Application 11/788,122, mailed 6/27/2008.	
		Non-Final Office Action on U.S. Application 11/888,546, mailed 5/1/2008.	

Examiner Signature		Date Considered	
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MADI_2493698.1

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT Date Submitted: December 9, 2010 <i>(use as many sheets as necessary)</i>				Application Number	12/496,854
				Filing Date	7/2/2009
				First Named Inventor	Richard Ian Olsen
				Art Unit	2622
				Examiner Name	Lin Ye
Sheet	2	of	2	Attorney Docket Number	088245-6407

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.) date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ⁶
		Non-Final Office Action on U.S. Application 11/888,570, mailed 5/28/2008.	
		Notice of Allowance on U.S. Application 11/265,669, mailed 10/27/2006.	
		Notice of Allowance on U.S. Application 11/788,122, mailed 3/9/2009.	
		Notice of Allowance on U.S. Application 11/788,279, mailed October 28, 2010.	
		Notice of Allowance on U.S. Application 11/888,546, mailed 12/2/2008.	
		Notice of Allowance on U.S. Application 11/888,546, mailed 6/3/2009.	
		Notice of Allowance on U.S. Application 11/888,570, mailed 3/23/2009.	
		Second Office Action on Chinese Application 200580032374.0, issued September 9, 2010 (with English translation).	

Examiner Signature		Date Considered	
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MADI_2493698.1

Electronic Acknowledgement Receipt	
EFS ID:	8999848
Application Number:	12496854
International Application Number:	
Confirmation Number:	5298
Title of Invention:	LARGE DYNAMIC RANGE CAMERAS
First Named Inventor/Applicant Name:	Richard Ian Olsen
Customer Number:	23524
Filer:	Christopher L. Kalafut/Linda Anderson
Filer Authorized By:	Christopher L. Kalafut
Attorney Docket Number:	088245-6407
Receipt Date:	09-DEC-2010
Filing Date:	02-JUL-2009
Time Stamp:	15:37:08
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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			19dfb2958ac52092ccbd7b19a8a5486b17a34fbf		

	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Transmittal Letter		1	2	
	Information Disclosure Statement (IDS) Filed (SB/08)		3	4	
Warnings:					
Information:					
2	NPL Documents	6118FOA09202007.pdf	912835	no	25
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Information:					
3	NPL Documents	6118NFOA02072007.pdf	1256001	no	34
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Warnings:					
Information:					
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Warnings:					
Information:					
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Information:					
7	NPL Documents	6128NFOA05012008.pdf	265796	no	8
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Warnings:					
Information:					

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Information:					
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Information:					
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Warnings:					
Information:					
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Warnings:					
Information:					
Total Files Size (in bytes):			6576326		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

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National Stage of an International Application under 35 U.S.C. 371

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New International Application Filed with the USPTO as a Receiving Office

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Olsen, et al.
Title: LARGE DYNAMIC RANGE
CAMERAS
Appl. No.: 12/496,854
Filing Date: 7/2/2009
Examiner: Lin Ye
Art Unit: 2622
Confirmation Number: 5298

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT
UNDER 37 CFR §1.56

Mail Stop Amendment
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Submitted herewith on Form PTO/SB/08 is a listing of documents known to Applicants in order to comply with Applicants' duty of disclosure pursuant to 37 CFR §1.56.

A copy of each non-U.S. patent document and each non-patent document is being submitted to comply with the provisions of 37 CFR §1.97 and §1.98.

The submission of any document herewith, which is not a statutory bar, is not intended as an admission that such document constitutes prior art against the claims of the present application or that such document is considered material to patentability as defined in 37 CFR §1.56(b). Applicants do not waive any rights to take any action which would be appropriate to

antedate or otherwise remove as a competent reference any document which is determined to be a *prima facie* art reference against the claims of the present application.

TIMING OF THE DISCLOSURE

The listed documents are being submitted in compliance with 37 CFR §1.97(b), before the mailing date of the first Office Action on the merits.

RELEVANCE OF EACH DOCUMENT

All of the documents are in English.

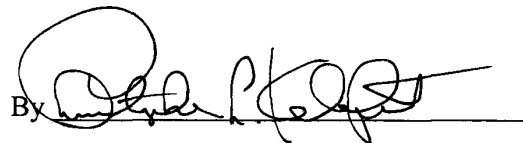
Applicants respectfully request that each listed document be considered by the Examiner and be made of record in the present application and that an initialed copy of Form PTO/SB/08 be returned in accordance with MPEP §609.

Although Applicant believes that no fee is required, the Commissioner is hereby authorized to charge any additional fees which may be due to Deposit Account No. 19-0741.

Respectfully submitted,

Date December 9, 2010

FOLEY & LARDNER LLP
Customer Number: 23524
Telephone: (608) 258-4286
Facsimile: (608) 258-4258

By 

Christopher L. Kalafut
Attorney for Applicant
Registration No. 57,946

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				First Named Inventor	Richard Ian Olsen
				Art Unit	2622
				Examiner Name	Lin Ye
Sheet	1	of	7	Attorney Docket Number	088245-6407

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number Number-Kind Code ² (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		2002/0020845	02-21-2002	OGURA ET AL.	
		2002/0024606	02-28-2002	YUKI ET AL.	
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Examiner Signature		Date Considered	
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				Art Unit	2622
				Examiner Name	Lin Ye
Sheet	2	of	7	Attorney Docket Number	088245-6407

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				First Named Inventor	Richard Ian Olsen	
				Art Unit	2622	
				Examiner Name	Lin Ye	
Attorney Docket Number	088245-6407					
Sheet	3	of	7			

U.S. PATENT DOCUMENTS					
	Document Number				
	7,095,159	08-22-2006	MACHIDA, AKIHIRO		
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Examiner Initials*	Cite No. ¹	Foreign Patent Document Country Code ² -Number ⁴ - Kind Code ⁵ (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T ⁶
		EP-1 032 045	08-30-2000	SANYO ELECTRIC CO.		
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NON PATENT LITERATURE DOCUMENTS			
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		Duparre et al., "Artificial apposition compound eye fabricated by micro-optics technology," Applied Optics, Vol. 43, No. 22, August 2004, pp. 4303-4310.	

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		Duparre et al., "Artificial compound eyes - different concepts and their application to ultra flat image acquisition sensors," Proceedings of SPIE, Vol. 5346 (SPIE, Bellingham, WA, 2004), pp. 89-100.	
		Duparre et al., "Microoptical telescope compound eyet," Optics Express, Vol. 13, No. 3, February 2005, pp. 889-903.	
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		Norvell, Robin, " Shellcase Debuts Ultra-Thin Miniaturization for Optics," July 8, 2005, 1 page.	
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		Office Action on U.S. Application 11/788,120, mailed 5/19/2009	
		Office Action on U.S. Application 11/788,120, mailed 7/30/2010	
		Office Action on U.S. Application 11/788,120, mailed 9/18/2009	

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		Office Action on U.S. Application 11/788,279, mailed 8/4/2010	
		Office Action on U.S. Application 11/810,623 mailed February 4, 2010.	
		Office Action U.S. Application 11/888,582, mailed September 3, 2009.	
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		Shogenji et al., "Bimodal fingerprint capturing system based on compound-eye imaging module," Applied Optics, Vol. 43, No. 6, February 2004, pp. 1355-1359.	
		Shogenji et al., "Multispectral imaging using compact compound optics," Optics Express, Vol. 12, No. 8, April 2004, pp. 1643-1655.	
		Stager et al., "Replicated Micro-Optics for Automotive Applications," SPIE European Workshop on Photonics in the Automobile, Geneva, 2004, (8 pages).	
		Tanida et al., "Compact image capturing system based on compound imaging and digital reconstruction," Proceedings of SPIE, Vol. 4455, 2001, pp. 34-41.	
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		Notice of Allowance on United States Application 11/888,546, mailed 6/3/2009	
		Volkel et al., "Miniaturization of Imaging Systems," mstnews, February 2003, pp. 36-38.	
		Volkel et al., "Miniaturized imaging systems," Elsevier Science B.V., Microelectronic Engineering 67-68 (2003), pp. 461-472.	

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(72) Inventor: **Yamada, Tsutomu**
Motosu-gun, Gifu (JP)

(74) Representative:
Cross, Rupert Edward Blount et al
BOULT WADE TENNANT,
27 Furnival Street
London EC4A 1PQ (GB)

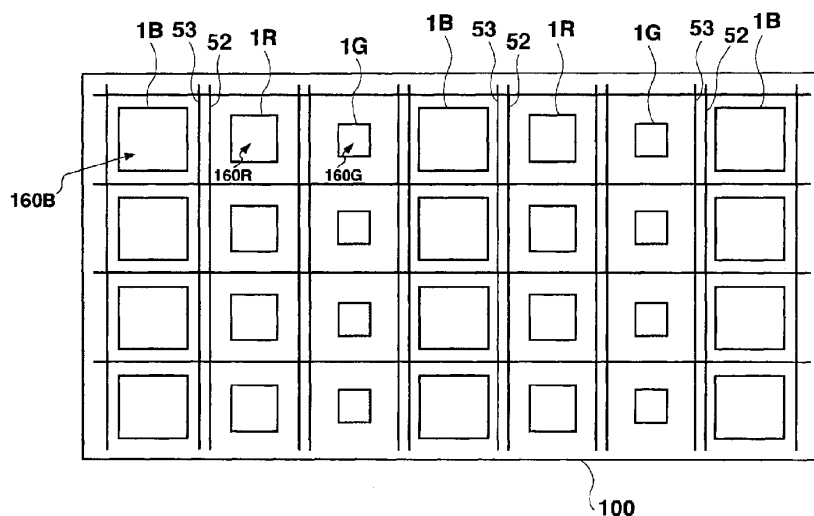
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(71) Applicant: **SANYO ELECTRIC Co., Ltd.**
Moriguchi-shi, Osaka 570 (JP)

(54) Electroluminescence display apparatus

(57) A color display device having an organic EL element for each display pixel. The element emissive area in the display pixel of any color among the R, G, and B display pixels has a size that is different from the element emissive area of the display pixel of another color. Furthermore, the element emissive areas in the display pixels for R, G, and B are designed to take into consideration not only the emission efficiency of the emissive

elements of the display pixels but also the luminance ratio of red to green to blue in accordance with the chromaticity of the target display white of the display device and with the chromaticity of each red, green, and blue color emitted by the emissive elements of the respective display pixels. This prevents the organic EL elements of colors for which the emission efficiency is low from selectively deteriorating, and facilitates the control of white balance in the color display.

**Fig. 4****EP 1 032 045 A2**

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Description**BACKGROUND OF THE INVENTION**

1. Field of the Invention

[0001] The present invention relates to an electroluminescence display apparatus comprising an electroluminescence (hereinafter also referred to as EL) element and a thin film transistor (hereinafter referred to as TFT) element.

2. Description of the Related Art

[0002] In recent years, the EL display apparatus employing EL elements has attracted attention as being the display apparatus to replace CRTs and LCDs.

[0003] Furthermore, research and development have been conducted on display apparatuses having TFTs as the switching elements to drive the EL elements.

[0004] Fig. 1 is a top plan view showing a display pixel and periphery in an organic EL display apparatus of the related art, Fig. 2A shows a cross-sectional view along line A-A of Fig. 1, and Fig. 2B shows a cross-sectional view along line B-B of Fig. 1.

[0005] As shown in Fig. 1, a display pixel is formed in a region surrounded by gate signal lines 51 and drain signal lines 52. A first TFT 30 is provided in proximity to an intersection of both signal lines, and a source 13s of the TFT 30 serves as a capacitance electrode 55, which forms a capacitor with a holding capacitance electrode line 54 to be described later, and is connected to a gate 41 of a second TFT 40. A source 43s of the second TFT 40 is connected to an anode 61 of an organic EL element 60, and a drain 43d at the other end is connected to a power source line 53, which is a current source that is supplied to the organic EL element 60.

[0006] Furthermore, in the proximity of the TFTs, the holding capacitance electrode line 54 is positioned in parallel with the gate signal lines 51. The holding capacitance electrode line 54 is formed from a material such as chromium, and the capacitance electrode 55 is connected to the source 13s of the TFT 30. The electric charge is stored between the holding capacitance electrode line 54 and the capacitance electrode 55, via a gate insulating film 12, thus forming a capacitor. This holding capacitor is provided to hold a voltage that is applied to the gate electrode 41 of the second TFT 40.

[0007] As shown in Figs. 2A and 2B, the organic EL display apparatus is formed by laminating in sequence the TFT and the organic EL element onto a substrate 10, such as a substrate formed from glass or synthetic resin, a conductive substrate, or a semiconductor substrate. However, when a conductive substrate or a semiconductor substrate is used for the substrate 10, an insulating film is formed, such as from SiO₂ or SiN, on which the TFT and organic EL display element are formed.

[0008] The first TFT 30, which is a switching TFT, will be described first.

[0009] As shown in Fig. 2A, gate signal lines 51 also serving as gate electrodes 11 and formed from a refractory metal, such as chromium or molybdenum, and the holding capacitance electrode 54 are formed on the insulating substrate 10, such as of quartz glass or no-alkali glass. Next, the gate insulating film 12 and an active layer 13, which is formed from a polysilicon (p-Si) film, are formed in sequence.

[0010] On the entire surface of the gate insulating film 12, the active layer 13 and stopper insulating films 14, is formed an interlayer insulating film 15 in which a SiO₂ film, a SiN film, and a SiO₂ film are laminated in sequence. A drain electrode 16, which is filled with a metal, such as Al, is provided at a contact hole formed at a position corresponding to a drain 13d of the interlayer insulating film 15. Furthermore, a planarization insulating film 17, which is formed from an organic resin, is formed on the entire surface of the substrate so as to planarize the surface.

[0011] The second TFT 40, which is a TFT for driving the organic EL element, will be described next.

[0012] As shown in Fig. 2B, the gate electrodes 41, which is formed from a refractory metal, such as Cr or Mo, the gate insulating film 12, and the active layer 43 which is formed from a p-Si film, are formed in sequence on the insulating substrate 10 which is made of quartz glass or no-alkali glass. In the active layer 43 are provided channels 43c, and on both sides of the channels 43c, the source 43s and the drain 43d. On the entire surface of the gate insulating film 12 and the active layer 43 is formed the interlayer insulating film 15 in which a SiO₂ film, a SiN film, and a SiO₂ film are laminated in sequence. A power source line 53 connected to a power source (not shown) and filled with a metal, such as Al, is provided at a contact hole formed to correspond to the drain 43d. Furthermore, the planarization insulating film 17, which is formed from an organic resin or the like, is formed on the entire surface so as to planarize the surface. A contact hole is formed at a position corresponding to the source 43s of the planarization insulating film 17 and the interlayer insulating film 15, and a transparent electrode, namely, the anode 61 of the organic EL element, which is formed from ITO (indium tin oxide) and contacting the source 43s via this contact hole, is provided on the planarization insulating film 17.

[0013] The organic EL element 60, provided at each pixel so as to enable light emission at each pixel, has a structure in which are formed in sequence the anode 61 made of a transparent electrode, such as ITO, a hole transport layer 62 having a first hole transport layer formed such as from MTDATA (4,4',4''-tris(3-methylphenylphenylamino)triphenylamine) and a second hole transport layer formed such as from TPD (N,N'-diphenyl-N,N'-di(3-methylphenyl)-1,1'-biphenyl-4,4'-diamine), an emissive layer 63 formed such as from Beq₂ (bis(10-hydroxybenzo[h]quinolino) beryllium)

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including a Quinacridon derivative, an electron transport layer 64 formed such as from Beq₂, and a cathode 66 formed from an alloy, such as magnesium-indium. The hole transport layer 62, the emissive layer 63, and the electron layer 64 form an emissive element layer 65.

[0014] In this organic EL element, holes injected from the anode and electrons injected from the cathode recombine, and organic molecules forming the emissive layer are excited and yield excitons. Light is released from the emissive layer in the process where the excitons undergo radiation deactivation, and this light is released to the outside from the transparent anode via the transparent insulating substrate.

[0015] However, the emission efficiency of the emissive layer for emitting light of various colors differs with each color.

[0016] However, in the EL display apparatus of the related art shown in Fig. 3, emissive regions 1B, 1R, and 1G for the display pixel of the respective color are arranged in a matrix configuration at every intersection of a plurality of the gate signal lines 51 and a plurality of the drain signal lines 53 and all have identical emissive areas in size. Thus, in order to obtain the same luminance at the display pixels having a low emission efficiency, a current larger than that supplied to the other display pixels having a high emission efficiency must be supplied. This causes the life of those display pixels having a low emission efficiency, in particular, to shorten, and also possibly causes the life of the EL display apparatus to shorten.

[0017] Furthermore, when the emissive areas of the display pixels of various colors, each having a different emission efficiency, are set to be identical, color balance (white balance) is difficult to achieve, and higher currents must be supplied to certain emissive layers to achieve such a balance. Thus, a drawback is that deterioration occurs at the EL elements in the display pixels supplied with the higher currents.

SUMMARY OF THE INVENTION

[0018] It is therefore an object of the present invention, which takes into consideration the above-mentioned disadvantage of the related art, to provide a display apparatus having emissive elements, such as EL elements, in which the control of white balance is simple and the service life is long.

[0019] In order to achieve the above-mentioned object, the present invention is characterized by a color display device, in which a display pixel having an emissive element is provided for every color, wherein the emissive area of the display pixel of any one color, among the display pixels of various colors, is different in size from the emissive area of the display pixel of another color.

[0020] In another aspect of the present invention in the above-mentioned color display device, the emissive area of the display pixel is set in accordance with the

emission efficiency of the emissive element provided at the display pixel.

[0021] In another aspect of the present invention, the emissive area of a display pixel of the various colors is respectively set larger for lower emission efficiency of the emissive element provided at the display pixel.

[0022] In another aspect of the present invention in the above-mentioned color display device, the emissive area of a display pixel of one color is set larger than the emissive area of a display pixel of another color having emissive element with emission efficiency higher than the emissive element provided at the display pixel of the one color.

[0023] In another aspect of the present invention, the emissive area of the display pixel having the emissive element of a color with the highest emission efficiency, among emissive elements respectively emitting different colors of light for color display, is set smaller than the emissive area of the display pixel having the emissive element of another color.

[0024] In another aspect of the present invention in the above-mentioned color display device, the emissive area of a display pixel of one color is set smaller than the emissive area of a display pixel of another color having emissive element with emission efficiency lower than the emissive element provided at the display pixel of the one color.

[0025] In another aspect of the present invention in the above-mentioned color display device, the emissive area of the display pixel having the emissive element of a color with the lowest emission efficiency, among emissive elements respectively emitting different colors of light for color display, is set larger than the emissive area of the display pixel having the emissive element of another color.

[0026] In another aspect of the present invention in the above-mentioned color display device, the emissive element is an electroluminescence element having an emissive layer between a first electrode and a second electrode.

[0027] In the present invention in the color display apparatus in which each display pixel comprises an emissive element, the emissive area of the display pixel corresponds to the emissive area of the emissive element. By setting the emissive area of the display pixel, namely, the emissive area of the emissive element, in accordance with the emission efficiency of the emissive element as in the foregoing, and by supplying, for example, the same power to the emissive elements of colors having different emission efficiencies, it becomes possible to have the same emission luminance at the various display pixels. In other words, in order to obtain a target display luminance for the respective colors, it is not necessary to supply only the emissive element of a particular color, having low emission efficiency, with a power higher than the other elements. Therefore, even for an emissive element for which deterioration accelerates as the amount of the supplied power increases, it is possi-

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ble to prevent the deterioration from accelerating when a load is selectively placed on the emissive element having low emission efficiency and extend the life of the display device.

[0028] In another aspect of the present invention as in one of the above-mentioned color display devices, the emissive element is an organic electroluminescence element comprising the emissive layer using an organic compound between first electrode and second electrode.

[0029] In this sort of organic EL element, in particular, when used in a color display device, where the emission efficiency differs according to the type of organic compound used as the emissive material in the emissive layer, and a different emissive material is to be used for every color, the above-mentioned problem of deterioration of the organic EL element having a low emission efficiency is liable to occur. However, this type of problem can be prevented according to the present invention.

[0030] In another aspect of the present invention, in a color display device in which a display pixel having an emissive element is provided for every color, the emissive area of the display pixel is set for every color in accordance with the emission efficiency of the emissive element provided at the display pixel, the chromaticity of each color emitted by respective emissive element, and the chromaticity of target display white of the display device.

[0031] In another aspect of the present invention, the emissive area of the display pixel of any one color, among the display pixel of various colors, is different in size from the emissive area of the display pixel of another color.

[0032] In another aspect of the present invention in a color display device having display pixel for red, for green, and for blue, respectively having emissive element, the emissive area of said display pixel for red, for green, and for blue is set on the basis of the emission efficiency of the emissive element of each display pixel, and a luminance ratio of red to green to blue in accordance with each chromaticity of red, green, and blue emitted by respective emissive element of the display pixel, and with the chromaticity of target display white of the display device.

[0033] In another aspect of the present invention in the above-mentioned color display device, the emissive area of the display pixel of any one color among the display pixel for red, for green, and for blue is different in size from the emissive area of the display pixel of another color.

[0034] In the color display device having emissive elements, the target white that is set can be represented, for example, by the addition of the lights of R, G, and B. In this sort of device, by setting the emissive area of each display pixel in accordance with the emission efficiency of the emissive element of each color R, G, and B as described above, with the chromaticity of the R, G,

and B emitted by the respective emissive element, and with the chromaticity of target display white, for example, the display of a target white is simplified with the supply of the same amount of power to each emissive element of R, G, and B. In other words, the white balance is controlled by the emissive area of each emissive element so that the white balance, while these emissive elements are driven, becomes extremely easy to control. Furthermore, since the emission efficiency of the element is taken into consideration in the emissive area of each emissive element, it is possible to prevent the emissive element having low emission efficiency from deteriorating faster than the element having high emission efficiency.

[0035] In another aspect of the present invention in the above-mentioned color display device, the emissive area of the display pixel is set by smaller one of direct contact areas between an emissive element layer including the emissive layer of the organic electroluminescence element and the first electrode, and between the emissive element layer and the second electrode.

[0036] In another aspect of the present invention in the above-mentioned color display device, the emissive element is an organic electroluminescence element composed by forming in sequence a first electrode, an emissive element layer including at least an emissive layer using an organic compound, and a second electrode, the element is separated by an insulating film between layers of the first electrode and the emissive element layer in the proximity of an edge of the first electrode, and the emissive area of each display pixel in the organic electroluminescence element of the display pixel is set in accordance with the area of the insulating film covering the edge of the first electrode.

[0037] In another aspect of the present invention in the above-mentioned color display device, the insulating film, at the edge of the first electrode, is decreased thickness toward the center of the first electrode.

[0038] When the organic EL element is used as the emissive element in this manner, the organic compound is used for the emissive layer so that there is a wide selection range of materials and variation of emission colors (chromaticity and color purity), which are extremely advantageous in the color display apparatus and so forth.

[0039] On the other hand, along with the difference in emission efficiency due to the organic compound that is used in the emissive layer, the chromaticity (for example, the chromaticity of red, green, and blue) of the emitted light differs. Therefore, when the emissive area of the organic EL element is adjusted in accordance with the emission efficiency of the element as described above, a large load can be prevented from being imposed on the organic EL element having low emission efficiency. Furthermore, the emissive area of the organic EL element can be easily set by changing the electrode area or direct contact area between the emissive element layer and the first or second electrode.

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[0040] Furthermore, covering the proximity of the edge of the first electrode with the insulating film as described above enables the emissive area of the organic EL element to be set to a desired area also by adjusting the contact area of the first electrode and the emissive element layer, which includes the emissive layer. In this case, when the thickness of the insulating film in the proximity of the edge of the first electrode is made thinner toward the center of the electrode, it is possible to prevent, at the emissive element layer that is formed on the first electrode and the insulating film, a disconnection from occurring at the proximity of the boundary between the first electrode and the insulating film. Furthermore, using the planarization film for the insulating film makes it possible to reliably prevent a disconnection at the second electrode that is formed on the insulating film and the emissive element layer.

[0041] In another aspect of the present invention in the above-mentioned color display device, the display pixel with the smallest emissive area is the display pixel comprising the emissive element for emitting green light, among colors red, green, and blue.

[0042] In another aspect of the present invention in the above-mentioned color display device, the display pixel with the largest emission area is the display pixel comprising the emissive element for emitting either red or blue light, among colors red, green, and blue, or the display pixel comprising the emissive element for emitting red light and the display pixel comprising the emissive element for emitting blue light.

BRIEF DESCRIPTION OF THE DRAWINGS

[0043] Fig. 1 is a top plan view of the EL display apparatus relating to the related art.

[0044] Fig. 2A is a cross-sectional view along line A-A of Fig. 1.

[0045] Fig. 2B is a cross-sectional view along line B-B of Fig. 1.

[0046] Fig. 3 is a conceptual diagram showing a layout of emissive regions of the EL display apparatus relating to the related art.

[0047] Fig. 4 is a conceptual diagram showing emissive region areas of the EL display apparatus relating to an embodiment of the present invention.

[0048] Fig. 5 is a schematic top plan view of one display pixel of the EL display apparatus relating to the embodiment of the present invention.

[0049] Figs. 6A and 6B respectively show example cross-sectional configurations of one display pixel of the EL display apparatus relating to the embodiment of the present invention along line B-B of Fig. 5.

[0050] Fig. 7 shows a mask for anodes of the organic EL elements relating to the embodiment of the present invention.

[0051] Fig. 8 shows a mask for emissive layers of the organic EL elements relating to the embodiment of the present invention.

[0052] Fig. 9 illustrates a method for obtaining the emission luminance ratio of R, G, and B for a white display.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0053] An EL display apparatus of the present invention will be described below.

[0054] Fig. 4 is a top plan view of an EL display apparatus 100 of the present invention.

[0055] The same figure represents a case where the respective display pixels emit red (R), green (G), and blue (B) light. The basic cross-sectional configuration of each R, G, and B display pixel is shown in Fig. 5.

[0056] In the EL display apparatus 100, the gate signal lines 51 are arranged in the row direction, and the drain signal lines 52 and the power lines 53 supplying power to the EL elements from a power source are arranged in the column direction. The signal lines 51 intersect with the lines 52 and the lines 53.

[0057] In the proximity of their intersections are formed the first TFT 30 connected to both signal lines 51 and 52, the second TFT 40 supplying current from power line 53 to an organic EL element 160, and the organic EL element 160 emitting either a red, green, or blue light. The emissive region of Fig. 5 among the various display pixels 1 for emitting light of red, green, or blue, namely, the emissive region defined by the organic EL element 160, is conceptually shown in Fig. 4. (1R, 1B, and 1G are added in Fig. 4.)

[0058] As shown in Fig. 4, the display pixels for the various colors are arranged in a matrix configuration on the substrate. The emissive areas of the display pixels differ among 1R, 1B, and 1G. Specifically, in the case of Fig. 4, the emissive area of the green display pixel 1G is provided as the smallest. Emissive regions 1R and 1B of the other colors are formed with a larger area than that of emissive region 1G. More specifically in this case: Area of green emissive region 1G < area of red emissive region 1R < area of blue emissive region 1B.

[0059] The order in size of the areas of the green, red, and blue emission regions 1G, 1R, and 1B is dependent on the emission efficiency of the emissive materials of the organic EL element 160. Therefore, the order in size of the emission region areas is not fixed at the above-mentioned green < red < blue, but is determined by the emission efficiency of the emissive materials that are used.

[0060] Figs. 6A and 6B respectively show examples of a cross-sectional configuration of one display pixel of the organic EL display apparatus relating to the present embodiment along line B-B of Fig. 5. In the present embodiment, one display pixel comprises the organic EL element 160 of one of the assigned R, G, or B, the first TFT 30 for receiving a data signal in accordance with the gate signal on gate signal line 51, a holding capacitor SC for holding the data signal supplied from the data

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line 52 via the first TFT 30, and the second TFT 40 for supplying current via the power source line 53 to the organic EL element 160 in accordance with the held data signal. It should be noted that since the cross-sectional configurations of the first TFT 30 and the holding capacitor SC along line A-A of Fig. 5 are the same as those of the above-mentioned Fig. 2A, their descriptions will be omitted. Furthermore, the configuration of the second TFT 40 in Figs. 6A and 6B is the same as that of the above-mentioned Fig. 2B.

[0061] The organic EL element 160 is configured by forming an anode 161 connected to the source 43s of the second TFT 40, a cathode 166 formed as a common electrode on the substrate, and an emissive element layer 165 using an organic compound between the two electrodes. The emissive element layer 165 includes at least an emissive layer, which can be formed in a single layer or multiple layers, and as an example is shown configured in the order from the anode: the hole transport layer 162, the emissive layer 163, and the electron transport layer 164.

[0062] Furthermore, in the present embodiment, in order to perform the display of colors by emitting lights of R, G, and B at the display pixels arranged in a matrix configuration on the substrate as shown in Fig. 4, different materials, in particular, different materials for organic compounds having an emissive function, are used in the organic EL elements 160 for R, for G, and for B.

[0063] As an example, the organic EL element 160R for R employs ITO for the anode 161, MTDATA (first hole transport layer) and TPD (second hole transport layer) for the hole transport layer 162, BeBq₂ doped at 2% with ZnPr for the emissive layer 163, and an MgIn alloy for the cathode 166.

[0064] The organic EL element 160G for G employs ITO for the anode 161, MTDATA (first hole transport layer) and TPD (second hole transport layer) for the hole transport layer 162, BeBq₂ for the emissive layer 163, and an MgIn alloy for the cathode 166.

[0065] The organic EL element 160B for B employs ITO for the anode 161, MTDATA (first hole transport layer) and TPD (second hole transport layer) for the hole transport layer 162, 1AZM-Hex for the emissive layer 163, and an MgIn alloy for the cathode 166. Furthermore, besides the above-mentioned materials for B, a combination of ITO (anode), MTDATA (first hole transport layer), TPD (second hole transport layer), OXD-8 (emissive layer), and MgIn (cathode) may also be used.

[0066] The above-mentioned compound abbreviations have the standard chemical names given below.

ZnPr: 5,10,15,20-tetraphenylporphyrinato zinc
 MTDATA: 4,4',4''-tris(3-methylphenylphenylamino)triphenylamine
 TPD: N,N'-diphenyl-N,N'-di(3-methylphenyl)-1,1'-biphenyl-4,4'-diamine
 BeBq₂: bis(10-hydroxybenzo[h]quinolinato)beryllium

1AZM-Hex: (N,N'-disalicylidene-1,6-hexanediaminato)zinc

OXD-8: 3-bis[5-(p-dimethylaminophenyl)-1,3,4-oxadiazol-2-yl]benzene

[0067] When these materials are adopted as the R, G, and B organic EL elements 160 (160R, 160G, 160B), the emission efficiencies at the present result in element 160G > element 160R > element 160B. In the organic EL element 160, the emission luminance exhibits a dependency on the current (current density). Therefore, it is sufficient to set the element emissive region areas (element sizes) as described above to region 1G < region 1R < region 1B so that each color has the same luminance when the same current is supplied to each display pixel.

[0068] Described next are display pixel formation methods for forming the emissive areas in the display pixels at different optimum sizes for R, G, and B. Existing methods include (i) changing the size of the area of the anodes 161 of the organic EL elements for R, G, and B, (ii) forming the anodes 161 with areas having identical sizes, and then covering the end of anodes 161 with a planarization insulating film 167 that is formed prior to the emissive element layer so as to change the size of the contact area between the anode and the emissive element layer for R, G, and B.

[0069] The method of (i) for forming the display pixels while changing the size of the anode areas will be described first and further with reference to Fig. 7. Fig. 7 represents a mask for forming the anodes 161 of the organic EL elements 160 for R, G, and B.

[0070] A mask 200A is used so that the emissive region areas shown in Fig. 4 realize 1G < 1R < 1B, and openings 201 are formed in accordance with the size of the intended anode. The largest openings shown are the openings 201B for the anodes of the blue EL elements, which have the lowest emission efficiency among the R, G, and B EL elements, and the smallest openings are the openings 201G for the anodes of the green EL elements, which have the highest emission efficiency. The openings having a size between the sizes of openings 201B and 201G are openings 201R for the anodes of the red EL elements, which have an emission efficiency lower than that of the green EL elements and higher than that of the blue EL elements.

[0071] The method of (i) will be described hereinafter in detail with reference to Fig. 6A. The process up until forming the second TFT 40, forming the interlayer insulating film 15 to cover the TFT 40, the power line 53 connected to the drain 43d of the TFT 40, and the planarization insulating film 17 to cover the entire surface of the substrate, forming a contact hole in the region corresponding to the source 43s of the TFT 40 so as to penetrate the planarization insulating film 17 and the interlayer insulating film 15, and forming ITO into a transparent electrode (anode) through sputtering so as to cover the contact hole and the entire surface of the

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planarization insulating film 17, is the same as for the configuration shown in Fig. 2B described above.

[0072] In the present embodiment, after ITO is formed, resist is applied, and using the mask 200A shown in the above-mentioned Fig. 7, exposure and development are performed. The resist pattern then remains only at the positions corresponding to the openings 201R, 201G, and 201B, and using this resist pattern as an etching mask, the ITO is etched with a predetermined etchant. This causes ITO patterns to be formed at the positions and sizes corresponding to the openings 201R, 201G, and 201B of the mask 200A, resulting in different sizes of the anodes 161 for R, G, and B.

[0073] After the anodes 161 of the organic EL elements are formed at the respective display pixel regions, the above-mentioned organic compound materials, which differ for R, G, and B, are used next to form the emissive element layer 165 for R, G, and B. For the organic EL elements, the materials used in the emissive element layer have a relatively high resistance and the emissive region is limited to the region that is sandwiched between the anode and cathode layers in the emissive element layer. Therefore, the emissive element layer may be the same as the anode formation region or larger than the anode formation region. However, to prevent a short circuit at the anode end between the anode and cathode formed on the emissive element layer, the emissive element layer for R, G, and B in the present embodiment shown in Fig. 6A are set to be larger than the respective anode area so as to cover the anode. Of course, if another countermeasure is adopted so that a short circuit does not occur between the anode and cathode (for example, forming the planarization insulating film 167 as shown in Fig. 6B to be described later), it is not absolutely necessary for the emissive element layer 165 to be larger than the anode.

[0074] If a configuration is employed as described above where the organic EL element for R is ITO, MTDATA, TPD, BeBq₂+ZnPr2%, and MgIn, the organic EL element for G is ITO, MTDATA, TPD, BeBq₂, and MgIn, and the organic EL element for B is either ITO, MTDATA, TPD, 1AZM-Hex, and MgIn or ITO, MTDATA, TPD, OXD-8, and MgIn, the same materials are used for R, G, and B in the hole transport layers 162, which are composed from the first and second hole transport layers, and when forming the hole transport layers 162, the hole transport layers 162 are formed on the corresponding anodes 161 and the entire surface of the planarization insulating film 17 regardless of distinction of R, G, and B as shown in Fig. 6A.

[0075] Regarding the formation of the emissive layers 163, in the present embodiment as described above, different emissive materials are used for R, G, and B so that the emissive layers 163 for the various colors are formed in sequence by changing the material. A mask 200L, as shown in Fig. 8, is used in the formation of the emissive layers 163 for the various colors. The mask

200L employs a metal, such as tungsten (W), or a material, such as silicon.

[0076] As shown in the same figure, the mask 200L has openings 202 for forming the emissive layers on the substrate of the same color, and the openings 202 are provided so as to overlap with the anodes of the various colors formed using the mask 200A shown in Fig. 7 by shifting the position of the mask 200L. At this time, the area of the emissive layers may be the same as the anodes, or larger than the anodes so as to cover the anodes, and in the present embodiment, as shown in Fig. 6A, is set to be larger than any of the anodes for R, G, and B.

[0077] For example, in the process of sputtering the emissive layers for emitting blue light, the mask 200L is aligned prior to sputtering so that the openings 202 of the mask 200L are positioned at the regions where the emissive layers for blue light are to be formed and in contact over the hole transport layers 162. Thereafter, the island-shaped blue emissive layers are formed corresponding to the openings 202 by sputtering the blue emissive material.

[0078] For the sputtering of the red emissive layers, the mask 200L is shifted horizontally so that the openings 202 in the mask 200L are positioned on the regions where the red emissive layers are to be formed. In the same manner, for the sputtering of the green emissive layers, the openings in the mask 200L are positioned on the regions where the green emissive layers are to be formed. This procedure sequentially forms island-shaped emissive layers having the same area size on the hole transport layers 162 with different materials for R, G, and B. This enables the emissive layers 163 to be formed for the various colors.

[0079] After formation of the emissive layers 163, for the EL element 160 requiring the electron transport layers 164, an electron transport material is sputtered on the emissive layers 163 and the hole transport layers 162 to form the electron transport layers 164.

[0080] The cathodes 166 are formed from the accumulation of a magnesium indium alloy or the like through sputtering so as to cover the emissive element layer obtained from the above-mentioned process. Thus, this yields a display apparatus employing organic EL elements having anodes of different area sizes for R, G, and B and having element emissive areas of the desired sizes for R, G, and B.

[0081] The method of (ii) for forming anodes of identical area sizes and forming different sizes of the contact areas between anodes and emissive element layers with the planarization insulating film formed between the anodes and emissive layers will be described next.

[0082] As shown in Fig. 6B, to prevent the emissive element layer 165 provided on the anode 161 from disconnecting due to the step of the anode 161, it is preferable for the planarization insulating film 167 to cover the peripheral part of the anode 161. In the case of an EL element having this configuration, the region actually

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emitting light, namely, the emissive area, is in contact with the emissive element layer 165 and the anode 161, and the peripheral part of the anode 161 covered by the planarization insulating film 167 is actually an area not emitting light.

[0083] Therefore, by varying for each color only the area of the peripheral part of the anode 161 covered by the planarization insulating film 167, the emissive area of the display pixel of each color can be varied.

[0084] Varying the emissive area of the display pixel of each color in this manner serves to extend the life of the EL elements.

[0085] In the above-mentioned embodiment, when the emission efficiency is green > red > blue, an example was described where the emissive area of the display pixels was green < red < blue so that the size of the emissive area for the various colors differed in this order. However, an embodiment need not be limited to this example. For example, with the emission efficiency at the same green > red > blue, the emissive areas may be set to green = red < blue or to green < red = blue.

[0086] In the organic EL element, which exhibits a tendency toward accelerated deterioration at higher currents as described in the foregoing, when the lights of the various colors are emitted at the same luminance by supplying a larger current to the EL element emissive layers of the display pixels having a low emission efficiency than to the emissive layers for the other color, it is possible to prevent a shortcoming in which the elements having a low emission efficiency selectively deteriorate. As a result, the life for the overall display apparatus can be extended.

[0087] The following is given as an example of an area ratio. For example, when the supply currents are identical in the case where the luminance ratio of the green, red, and blue lights that are emitted is 1:1:1, the emission efficiency ratio becomes 10:3.8:1.8. The ratio of emissive areas of the colors required to achieve a luminance of "1" among all the colors is set to 1/10:1/3.8:1/1.8 = 1:2.6:5.6.

[0088] Setting the emissive area ratio in this manner enables the R, G, and B lights to be emitted at the same luminance without a large current being supplied only to the blue EL elements, which have the lowest emission efficiency, thus enabling the life of the emissive layers to be extended.

[0089] Another example of the area ratio will be described next. This example takes into consideration the prevention of deterioration of the organic EL elements of a color for which the emission efficiency is low and the control of white balance in a full-color display.

[0090] When a color display is performed using the self-emissive organic EL elements for display pixels, white is displayed by adding the emitted light from the organic EL elements of the colors R, G, and B.

[0091] When the target white is expressed as chromaticity coordinates (x,y: 0.31, 0, 32) of a reference white light source (C light source) of the NTSC format,

and when the chromaticity of the R, G, and B colors of light emitted by the respective organic EL elements is expressed by the coordinates shown at the top of fig 9, the luminance required for R, G, and B to achieve a white luminance of 100% is set, for example, at 25%: 46%:29%. Expressed as a luminance ratio, this becomes R:G:B = 0.54:1:0.63.

[0092] Furthermore, when the emission efficiency ratio of the various colors of the organic EL elements is 10:3.8:1.8 for green, red, and blue as described above, the emissive area ratio becomes G:R:B = 1/10:0.54/3.8:0.63/1.8 = 1:14.2:35 to achieve a G, R, and B luminance ratio of G:R:B = 1:0.54:0.63.

[0093] In this manner, when the chromaticity of R, G, and B and the chromaticity of the target white, as well as the emission efficiency of the various colors are taken into consideration and the emissive layers for R, G, and B are set, for example, so that the area ratio of the emissive regions assumes the above-mentioned values, a white luminance of 100% can be achieved with the same amount of current supplied to the organic EL elements of the various display pixels.

[0094] Therefore, in an EL display apparatus in which the area ratio has been determined by this method, the luminance balance of the various colors is adjusted by the emissive areas so that control of the white balance is extremely simple and the need for supplying large currents only to the EL elements of a particular color is obviated, thereby enabling the service life of the overall display apparatus to be extended.

[0095] If the materials to be used are different, the chromaticity coordinate values of the R, G, and B lights emitted from the organic EL elements are also different. The luminance ratio of R to G to B also changes accordingly, and the emission efficiency values also change. The emissive area ratio is determined accordingly and is therefore not limited to the values given above.

[0096] Furthermore, in the present invention, when the same current is respectively supplied to the R, G, and B organic EL elements, the configuration is not limited to having the emissive areas of the elements set so that 100% white is always achieved. For example, taking into further consideration the characteristics of the driver circuit (not shown) for driving the display pixels, the emissive areas of the R, G, and B organic EL elements can be set so as to simplify the control of the white balance for the overall apparatus and to prevent selective loading on the elements with a low emission efficiency.

[0097] Furthermore, in the above-mentioned embodiment, although the organic EL display apparatus was described as an example, the present invention is not limited to organic EL display apparatuses. Instead using the organic EL elements as the emissive elements, an inorganic EL display apparatus using inorganic EL elements or a vacuum fluorescent display (VFD) comprising a fluorescent layer as the emissive layer between two electrodes yields a similar effect as the organic EL

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display apparatus.

[0098] The emissive area of a display pixel in the present invention refers to the area of the region at which the emissive element of the display pixel actually emits light.

[0099] Namely, as shown in Fig. 6B, when the planarization insulating film, provided to prevent the emissive layer from creating a step and short circuiting with the cathode caused by the step from the thickness of the anode, covers the periphery of the anode, the anode and emissive element layer are in direct contact and form the area of the region actually emitting light.

[0100] Furthermore, although an example was given for the present embodiment in which the display pixels were arranged in 4 rows by 7 columns, the present invention is not limited to such a size and is applicable to an arbitrary number of display pixels, such as VGA (640x480), SVGA (800x600), XGA (1024x768), and SXGA (1280x1024).

[0101] Furthermore, although the display pixels assumed the form of a square in the example (Fig. 4), the present invention is not limited to such a form, and is applicable to a rectangular shape or an "L" shape, or any shape that does not hinder the emission of light from the emissive layer.

[0102] Furthermore, although the arrangement of the display pixels of various colors in the embodiment was shown in a stripe layout, the same effect is also obtained in a delta layout and a diagonal layout. Still furthermore, although the TFTs were shown in a so-called bottom gate configuration, the present invention is also applicable to TFTs in a so-called top gate configuration.

[0103] While there has been described what are at present considered to be preferred embodiments of the invention, it will be understood that various modifications may be made thereto, and it is intended that the appended claims cover all such modifications as fall within the true spirit and scope of the invention.

Claims

1. A color display device, in which a display pixel having an emissive element is disposed for every color, wherein the emissive area of the display pixel of any one color, among the display pixels of various colors, is different in size from the emissive area of the display pixel of another color.
2. A color display device according to claim 1 wherein the emissive area of said display pixel is set in accordance with the emission efficiency of said emissive element disposed at said display pixel.
3. A color display device according to claim 2 wherein the emissive area of a display pixel of said various colors is respectively set larger for lower emission efficiency of said emissive element disposed at said

display pixel.

4. A color display device according to claim 1 wherein the emissive area of a display pixel of one color is set larger than the emissive area of a display pixel of another color having emissive element with emission efficiency higher than the emissive element disposed at the display pixel of said one color.
5. A color display device according to claim 1 wherein the emissive area of the display pixel having the emissive element of a color with the highest emission efficiency, among emissive elements respectively emitting different colors of light for color display, is set smaller than the emissive area of the display pixel having the emissive element of another color.
6. A color display device according to claim 1 wherein the emissive area of a display pixel of one color is set smaller than the emissive area of a display pixel of another color having emissive element with emission efficiency lower than the emissive element disposed at the display pixel of said one color.
7. A color display device according to claim 1 wherein the emissive area of the display pixel having the emissive element of a color with the lowest emission efficiency, among emissive elements respectively emitting different colors of light for color display, is set larger than the emissive area of the display pixel having the emissive element of another color.
8. A color display device according to claim 1 wherein the display pixel with the smallest emissive area is the display pixel comprising the emissive element for emitting green light, among colors red, green, and blue.
9. A color display device according to claim 1 wherein the display pixel with the largest emission area is:
 - the display pixel comprising the emissive element for emitting either red or blue light, among colors red, green, and blue; or
 - the display pixel comprising the emissive element for emitting red light and the display pixel comprising the emissive element for emitting blue light.
10. A color display device according to claim 1 wherein said emissive element is an electroluminescence element having an emissive layer between a first electrode and a second electrode.
11. A color display device, in which a display pixel having an emissive element is disposed for every color,

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wherein the emissive area of said display pixel is set for every color in accordance with:

the emission efficiency of said emissive element disposed at said display pixel;
the chromaticity of each color emitted by respective emissive element; and
the chromaticity of target display white of the display device.

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12. A color display device according to claim 11 wherein the emissive area of the display pixel of any one color, among the display pixel of various colors, is different in size from the emissive area of the display pixel of another color.

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13. A color display device having display pixel for red, for green, and for blue, respectively having emissive element wherein the emissive area of said display pixel for red, for green, and for blue is set on the basis of:

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the emission efficiency of the emissive element of each display pixel; and
a luminance ratio of red to green to blue in accordance with each chromaticity of red, green, and blue emitted by respective emissive element of the display pixel, and with the chromaticity of target display white of the display device.

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14. A color display device according to claim 13 wherein the emissive area of the display pixel of any one color among said display pixel for red, for green, and for blue is different in size from the emissive area of the display pixel of another color.

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15. A color display device as in any one of claims 1-14 wherein said emissive element is an organic electroluminescence element comprising the emissive layer using an organic compound between first electrode and second electrode.

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16. A color display device according to claim 15 wherein the emissive area of said display pixel is set by smaller one of direct contact areas between an emissive element layer including said emissive layer of said organic electroluminescence element and said first electrode, and between said emissive element layer and said second electrode.

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17. A color display device as in any one of claims 1-14 wherein:

said emissive element is an organic electroluminescence element composed by forming in sequence a first electrode, an emissive element layer including at least an emissive layer

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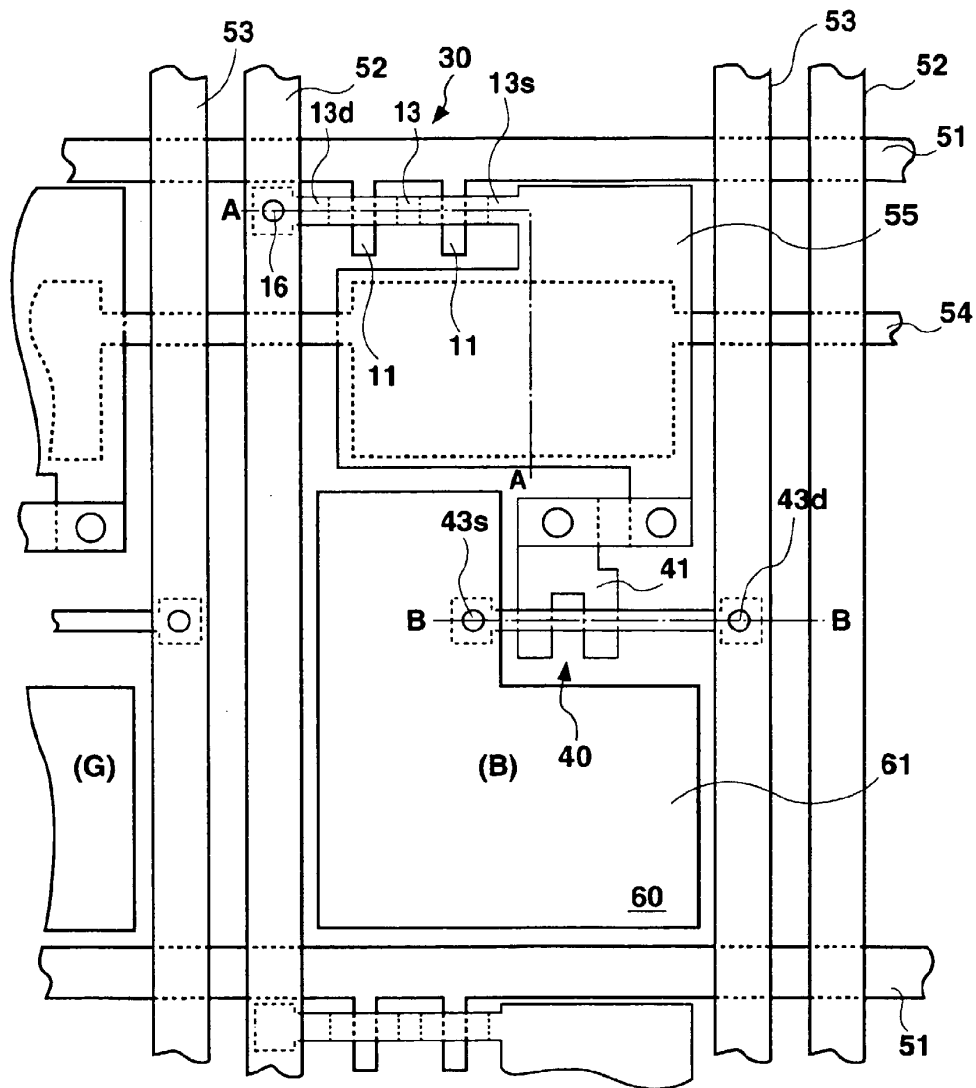
using an organic compound, and a second electrode;

the element is separated by an insulating film between layers of said first electrode and said emissive element layer in the proximity of edge of said first electrode; and

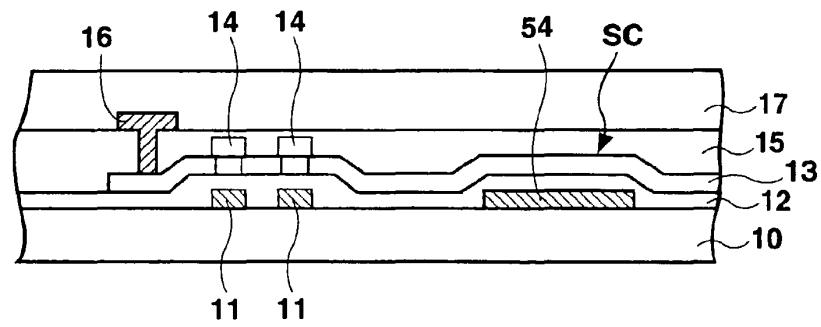
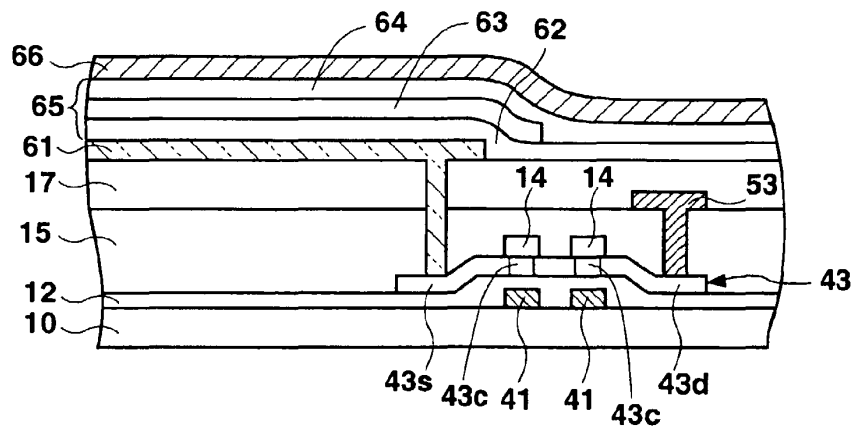
the emissive area of each display pixel in the organic electroluminescence element of the display pixel is set in accordance with the area of said insulating film covering the edge of said first electrode.

18. A color display device according to claim 17 wherein said insulating film, in the proximity of the edge of said first electrode, is decreased thickness toward the center of said first electrode.

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**Fig. 1**

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**Fig. 2A****Fig. 2B**

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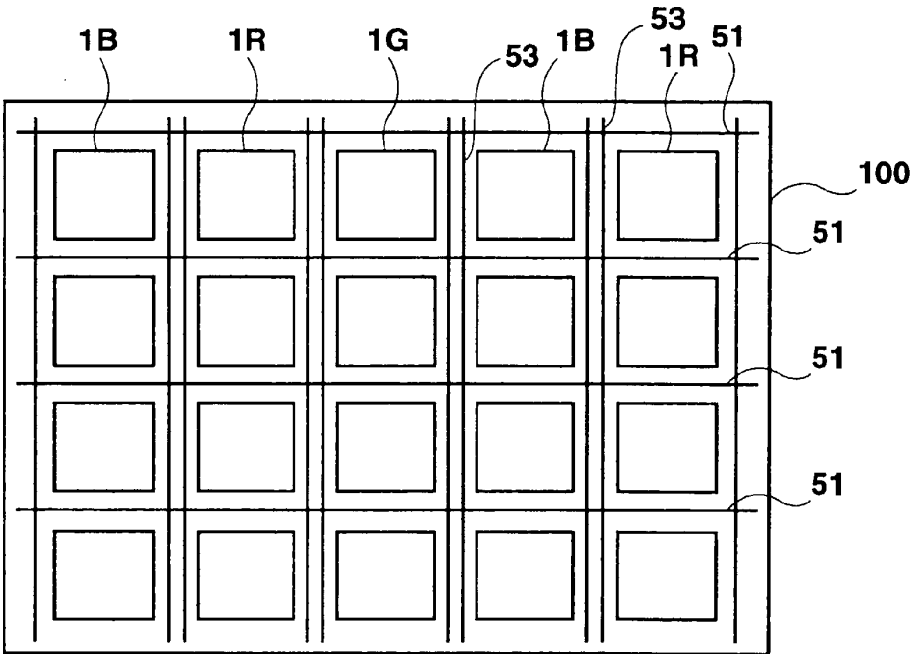


Fig. 3

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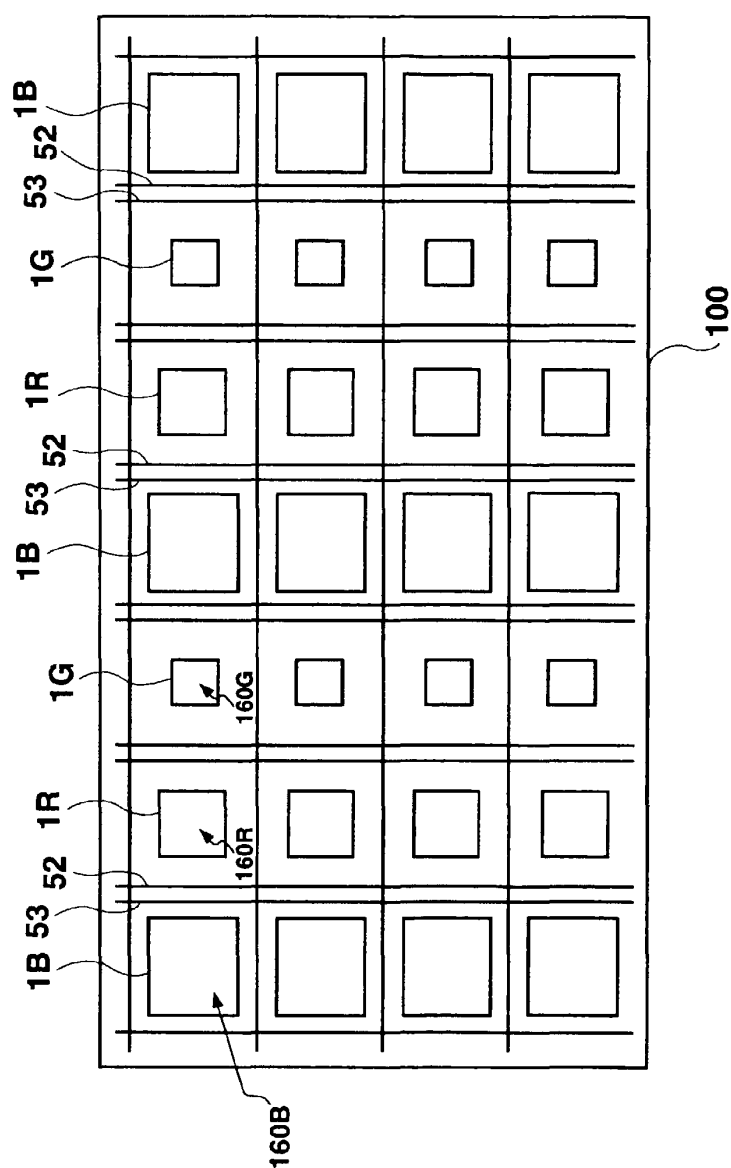


Fig. 4

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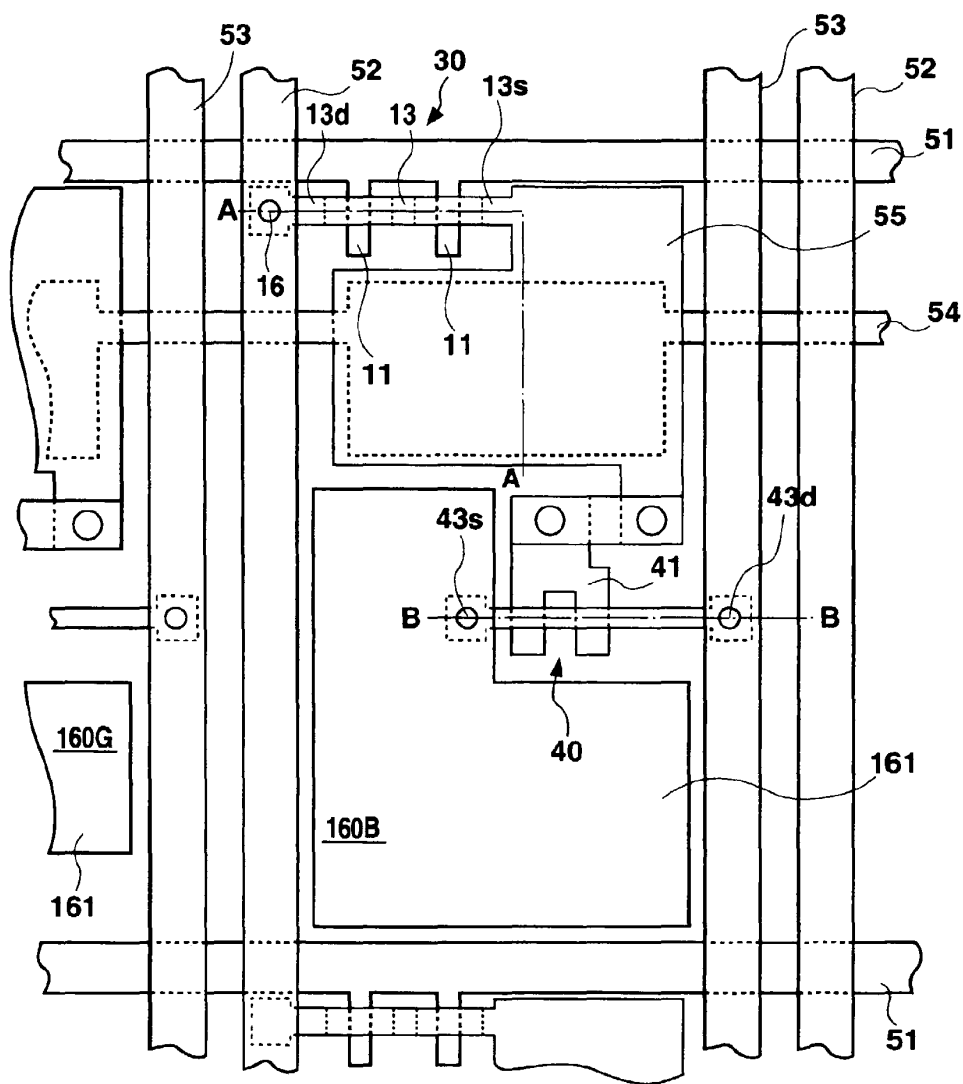


Fig. 5

Fig. 6A

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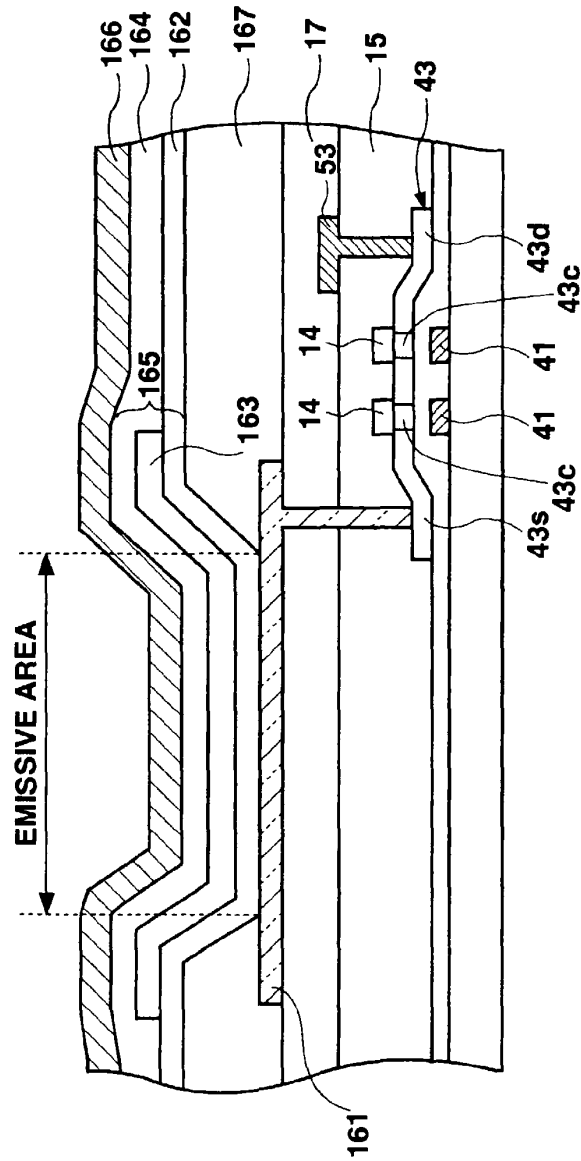


Fig. 6B

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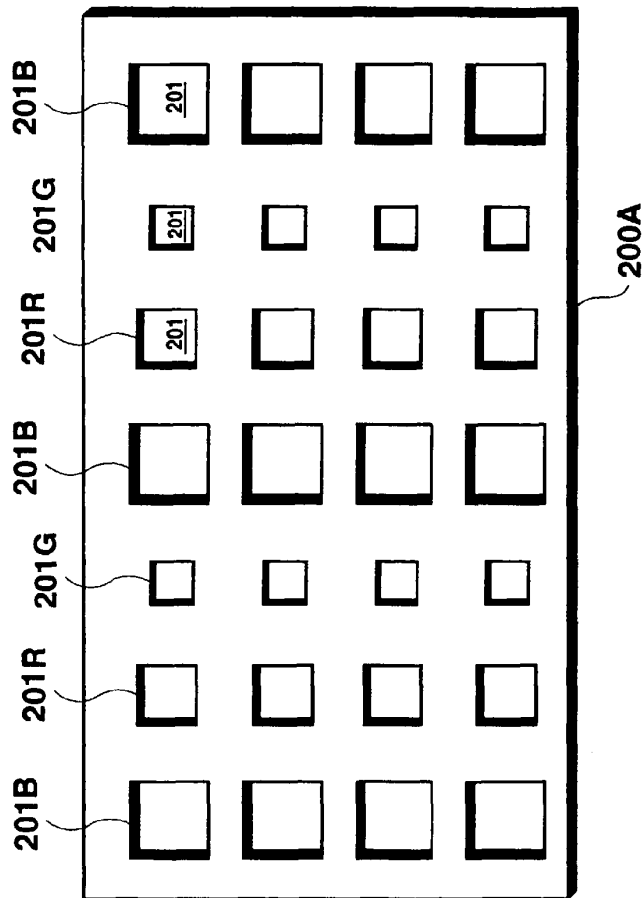


Fig. 7

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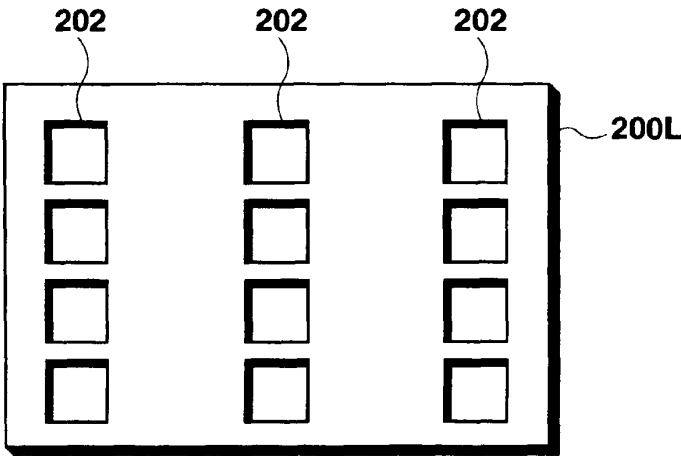


Fig. 8

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	R		G		B		W	
CHROMAT- ICITY COORDI- NATE	x	y	x	y	x	y	x	y
	0.65	0.34	0.30	0.63	0.17	0.17	0.31	0.32
LUMINANCE PERCENTAGE (WITH W AT 100%)	25(%)		46(%)		29(%)		100(%)	
LUMINANCE RATIO (G)	0.54		1		0.63		—	

Fig. 9

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference 300.001-PCT	FOR FURTHER ACTION See item 4 below	
International application No. PCT/US2005/030256	International filing date (<i>day/month/year</i>) 25 August 2005 (25.08.2005)	Priority date (<i>day/month/year</i>) 25 August 2004 (25.08.2004)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant NEWPORT IMAGING CORPORATION		

<p>1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).</p> <p>2. This REPORT consists of a total of 9 sheets, including this cover sheet.</p> <p>In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.</p>																
<p>3. This report contains indications relating to the following items:</p> <table> <tr> <td>☒ Box No. I</td> <td>Basis of the report</td> </tr> <tr> <td>☐ Box No. II</td> <td>Priority</td> </tr> <tr> <td>☐ Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td>☐ Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td>☒ Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td>☐ Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td>☒ Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td>☐ Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table> <p>4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).</p>	☒ Box No. I	Basis of the report	☐ Box No. II	Priority	☐ Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	☐ Box No. IV	Lack of unity of invention	☒ Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	☐ Box No. VI	Certain documents cited	☒ Box No. VII	Certain defects in the international application	☐ Box No. VIII	Certain observations on the international application
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The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Date of issuance of this report 17 March 2009 (17.03.2009)
	Authorized officer Masashi Honda e-mail: pt08.pct@wipo.int

Form PCT/IB/373 (January 2004)

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference 300.002-PCT	FOR FURTHER ACTION		See item 4 below
International application No. PCT/US2006/025781	International filing date (<i>day/month/year</i>) 29 June 2006 (29.06.2006)	Priority date (<i>day/month/year</i>) 01 July 2005 (01.07.2005)	
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237			
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☒	Box No. VII	Certain defects in the international application																							
☐	Box No. VIII	Certain observations on the international application																							
4.	The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).																								

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Date of issuance of this report 10 March 2009 (10.03.2009)</td> <td style="width: 50%;">Authorized officer</td> </tr> <tr> <td></td> <td style="text-align: center; font-weight: bold;">Nora Lindner</td> </tr> <tr> <td></td> <td>e-mail: pt11.pct@wipo.int</td> </tr> </table>	Date of issuance of this report 10 March 2009 (10.03.2009)	Authorized officer		Nora Lindner		e-mail: pt11.pct@wipo.int
Date of issuance of this report 10 March 2009 (10.03.2009)	Authorized officer						
	Nora Lindner						
	e-mail: pt11.pct@wipo.int						

Form PCT/IB/373 (January 2004)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US05/30256

A. CLASSIFICATION OF SUBJECT MATTER

IPC: H01L 27/00
(2006.01)

USPC: 250/208.1;257/432;348/336

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)
U.S. : 250/208.1; 257/432; 348/265, 336

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X — Y	US 2002/0020845 A1 (OGURA et al) 21 Feb 2002 (21.02.2002), Fig. 1, 2A, Paragraphs 0042-0057	1-10,12-17,19-23,30-46,48-52,58-62,64-67 11,18,24-29,47,53-57,63
Y	US 6,727,521 B2 (MERRILL et al) 16 May 2002 (16.05.2002), Fig. 1, Paragraphs 0013-0015	11,18,47
Y	US 2002/0067416 A1 (YONEDA et al) 6 June 2002 (06.06.2002), Fig. 7, 23	24-49,53-57,63
A	US 2002/0051071 A1 (TANO et al) 2 May 2002 (02.05.2002), entire document	1-67
A	US 2002/0089596 A1 (SUDA) 11 July 2002 (11.07.2002), entire documents	1-67

☒ 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	"I" 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
"E" earlier application or patent published on or after the international filing date	"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
"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)	"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
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 07 June 2008 (07.06.2008)	Date of mailing of the international search report 07 JUL 2008
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	Authorized officer Stephen Yam <i>Stephen Yam</i> Telephone No. (571)272-2445

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORTInternational application No.
PCT/US05/30256**C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2002/0122124 A1 (SUDA) 5 Sept 2002 (05.09.2002), entire document	1-67
A	US 6,611,289 B1 (YU et al) 26 Aug 2003 (26.08.2003), entire document	1-67

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
NEIL A. STEINBERG
2665 MARINE WAY, SUITE 1150
MOUNTAIN VIEW, CA 94043

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing (day/month/year) 07 JUL 2008		
Applicant's or agent's file reference 300.001-PCT	FOR FURTHER ACTION See paragraph 2 below	
International application No. PCT/US05/30256	International filing date (day/month/year) 25 August 2005 (25.08.2005)	Priority date (day/month/year) 25 August 2004 (25.08.2004)
International Patent Classification (IPC) or both national classification and IPC IPC: H01L 27/00(2006.01) USPC: 250/208.1;257/432;348/336		
Applicant NEWPORT IMAGING CORPORATION		

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

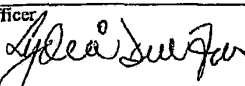
2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/ US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	Date of completion of this opinion 07 June 2008 (07.06.2008)	Authorized officer Stephen Yam  Telephone No. (571) 272-2449
--	---	---

Form PCT/ISA/237 (cover sheet) (April 2007)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US05/30256

Box No. I Basis of this opinion

1. With regard to the language, this opinion has been established on the basis of:

- ☒ the international application in the language in which it was filed
☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the rectification of an obvious mistake authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, this opinion has been established on the basis of:

a. type of material

- ☐ a sequence listing
☐ table(s) related to the sequence listing

b. format of material

- ☐ on paper
☐ in electronic form

c. time of filing/furnishing

- ☐ contained in the international application as filed.
☐ filed together with the international application in electronic form.
☐ furnished subsequently to this Authority for the purposes of search.

4. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US05/30256

Box No. V Reasoned statement under Rule 43 bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims <u>1-67</u>	YES
	Claims <u>NONE</u>	NO
Inventive step (IS)	Claims <u>NONE</u>	YES
	Claims <u>1-67</u>	NO
Industrial applicability (IA)	Claims <u>1-67</u>	YES
	Claims <u>NONE</u>	NO

2. Citations and explanations:

Please See Continuation Sheet

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US05/30256

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

Please See Continuation Sheet

Form PCT/ISA/237 (Box No. VII) (April 2007)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US05/30256

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

V. 2. Citations and Explanations:

Claims 1-10, 12-17, 19-23, 30-46, 48-52, 58-62 and 64-67 lack an inventive step under PCT Article 33(3) as being obvious over Ogura et al. US 2002/0020845 A1.

Regarding Claim 1, Ogura et al. teach (see Fig. 1, 2A) a digital camera comprising: a plurality of arrays (2-5) of photo detectors, including: a first array (2) of photo detectors to sample an intensity of light; and a second array (3) of photo detectors to sample an intensity of light; signal processing circuitry (for performing the compound-eye imaging- see Paragraph 0004, 0005, 0054), coupled to the first and second arrays of photo detectors, to generate a composite image using (i) data which is representative of the intensity of light sampled by the first array of photo detectors, and (ii) data which is representative of the intensity of light sampled by the second array of photo detectors (see Paragraph 0004, 0005); and wherein the first array of photo detectors and the second array of photo detectors are integrated on or in the same semiconductor substrate (see Fig. 2A, Paragraph 0042). Ogura et al. does not disclose the signal processing circuitry integrated on the semiconductor substrate. It is well known in the art to integrate all the electronic semiconductor components on a single semiconductor substrate, to form a single chip to perform all the desired functions. It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the signal processing circuitry integrated on the semiconductor substrate, in the digital camera of Ogura et al., to integrate all the components for a unified component in the digital camera.

Regarding Claim 34, Ogura et al. teach (see Fig. 1, 2A) the first lens includes a predetermined optical response to the light of the first wavelength; a second lens disposed in with an optical path of the second array of photo detectors wherein the second lens includes a predetermined optical response to the light of the second wavelength (see Fig. 1).

Regarding Claim 37, Ogura et al. teach a third array (5) of photo detectors to sample the intensity of light of a third wavelength; a third lens (9) disposed in with an optical path of the third array of photo detectors wherein the third lens includes a predetermined optical response to the light of the third wavelength; and wherein the signal processing circuitry is coupled to the third array of photo detectors and generates a composite image using (i) data which is representative of the intensity of light sampled by the first array of photo detectors, (ii) data which is representative of the intensity of light sampled by the second array of photo detectors, and (iii) data which is representative of the intensity of light sampled by the third array of photo detectors.

Regarding Claim 2, Ogura et al. teach the first array of photo detectors sample an intensity of light of a first wavelength (red); and the second array of photo detectors sample an intensity of light of a second wavelength (green).

Form PCT/ISA/237 (Supplemental Box) (April 2007)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US05/30256

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Regarding Claim 3, Ogura et al. teach a third array (5) of photo detectors to sample the intensity of light of a third wavelength (blue), and wherein the signal processing circuitry is coupled to the third array of photo detectors and generates a composite image using (i) data which is representative of the intensity of light sampled by the first array of photo detectors, (ii) data which is representative of the intensity of light sampled by the second array of photo detectors, and (iii) data which is representative of the intensity of light sampled by the third array of photo detectors (see explanation of Claim 1).

Regarding Claims 4 and 39, Ogura et al. teach the first (2), second (3) and third (5) arrays of photo detectors are relatively arranged in a triangular configuration (see Fig. 1).

Regarding Claims 5 and 40, Ogura et al. teach the first array of photo detectors, the second array of photo detectors, the third array of photo detectors, and the signal processing circuitry are integrated on the same semiconductor substrate (see explanation of Claim 1).

Regarding Claims 6 and 41, Ogura et al. teach the first wavelength is associated with a first color, the second wavelength is associated with a second color and the third wavelength is associated with a third color (see Fig. 2A).

Regarding Claims 7 and 42, Ogura et al. teach the first array of photo detectors sample the intensity of light of the first wavelength for a first integration time; the second array of photo detectors sample the intensity of light of the second wavelength for a second integration time; and the third array of photo detectors sample the intensity of light of the third wavelength for a third integration time (since integration is used for capturing an image, the first, second, and third integration times in the claim do not necessarily have to be different).

Regarding Claim 8, Ogura et al. teach the first, second and third arrays of photo detectors are relatively arranged in an isosceles, obtuse, acute or a right triangular configuration (see Fig. 2A).

Regarding Claims 9 and 43, Ogura et al. teach the first wavelength is associated with a first color and the second wavelength is associated with a second color (see Paragraph 0043).

Regarding Claims 10 and 44, Ogura et al. teach the first array of photo detectors sample the intensity of light for a first integration time; and the second array of photo detectors sample the intensity of light for a second integration time (since integration is used for capturing an image, the first, second, and third integration times in the claim do not necessarily have to be different).

Regarding Claim 12, Ogura et al. teach the first array of photo detectors and the second array of photo detectors are disposed in the same image plane (see Fig. 1, 2A).

Regarding Claim 13, Ogura et al. teach (see Fig. 1) a first lens (6) disposed in and associated with an optical path of the first array of photo detectors and a second lens (7) disposed in and associated with an optical path of the second array of photo detectors.

Regarding Claim 14, Ogura et al. teach a substantially uniform color filter sheet disposed in the optical path of the first array of photo detectors (see Paragraph 0052).

Regarding Claims 15, 16, 19, 36, 38, and 48, it is known in the art to combine filter functionality into a lens using a film or materials within the lens and to select an appropriate filter range according to the desired detection spectrum characteristics of the device. It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the lenses as colored with an appropriate optical filter range, in the device of Ogura et al. to integrate the filter and lens functions into a single component.

Regarding Claims 17 and 46, Ogura et al. teach the first array of photo detectors sample an intensity of light of a first wavelength and an intensity of light of a second wavelength; the second array of photo detectors sample an intensity of light of a third wavelength; and the first wavelength is associated with a first color, the second wavelength is associated with a second color and the third wavelength is associated with a third color (see Paragraph 0052).

Regarding Claims 20 and 49, Ogura et al. teach an optical filter (see Paragraph 0052) disposed in and associated with an optical path of the first array of photo detectors, and it is known in the art to select an appropriate filter range according to the desired detection spectrum characteristics of the device.

Regarding Claims 21 and 50, Ogura et al. teach the first array of photo detectors sample the intensity of light of the first wavelength for a first integration time; the first array of photo detectors sample the intensity of light of the second wavelength for a second integration time; and the second array of photo detectors sample the intensity of light of the third wavelength for a third integration time (since integration is used for capturing an image, the first, second, and third integration times in the claim do not necessarily have to be different).

Regarding Claims 22 and 51, Ogura et al. teach (see Paragraph 0004) the signal processing circuitry generates: a first image using data which is representative of the intensity of light sampled by the first array of photo detectors, and a second image using data which is representative of the intensity of light sampled by the second array of photo detectors.

Form PCT/ISA/237 (Supplemental Box) (April 2007)

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US05/30256

Supplemental Box
In case the space in any of the preceding boxes is not sufficient.

Regarding Claims 23 and 52, Ogura et al. teach (see Paragraph 0004) the signal processing circuitry generates the composite image using the first image and the second image.

Regarding Claims 30-33 and 64-67, it would have been obvious to provide any appropriate surface area for the arrays of photo detectors according to the design of the arrays, depending on the particular sensitivity of the photo detectors, to provide uniform sensitivity for the camera

Regarding Claim 35, Ogura et al. teach the first lens passes light of the first wavelength onto an image plane of the photo detectors of the first array; and the second lens passes light of the second wavelength onto an image plane of the photo detectors of the second array (See Fig. 1).

Regarding Claim 45, Ogura et al. teach a housing (since the device is used within a camera system), wherein the first and second lenses, first and second arrays of photo detectors, and the signal processing circuitry are attached to the housing (since they cannot be suspended as seen in Fig. 1), and wherein the first and second lenses are independently positionable relative to the associated array of photo detectors (see Fig. 1).

Regarding Claims 58-61, it is known to provide multiple signal processing circuitry, analog signal logic, black level logic, and exposure control circuitry for image sensors in a digital camera system, and it would have been obvious to combine them into the Ogura et al. digital camera to provide the basic functionality of capturing a digital image.

Regarding Claim 62, it is known to fix components in a camera system to a frame of the device, to maintain the configuration and alignment of components in the system. It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide a frame, wherein the first and second arrays of photo detectors, the signal processing circuitry, and the first and second lenses are fixed to the frame, in the camera of Ogura et al., to maintain alignment of the components for capturing an optimal image.

Claims 11, 18, and 47 lack an inventive step under PCT Article 33(3) as being obvious over Ogura et al. US 2002/0020845 A1 in view of in view of Merrill US 6,727,521 B2.

Ogura et al. teaches the device of the parent claims but does not teach different semiconductor depths for each color/wavelength. Merrill teaches (see Fig. 1) using different semiconductor depths for optimal detection of each color/wavelength. It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide different semiconductor depths for each color/wavelength as taught by Merrill, in the device of Ogura et al., to improve detection sensitivity at each color/wavelength for a more complete image.

Claims 24-29, 53-57, 63 lack an inventive step under PCT Article 33(3) as being obvious over Ogura et al. US 2002/0020845 A1 in view of Yoneda et al. US 2002/0067416 A1.

Ogura et al. teaches the device of the parent claims but does not teach a memory, timing and logic control, wireless/wired/optical communication circuitry or the components integrated on the same semiconductor substrate. Yoneda et al. teach (see Fig. 7, 23) a similar device with a memory (10), timing and logic control (8), and wireless/wired/optical communication circuitry (13). As previously discussed, it is well known in the art to integrate all the electronic semiconductor components on a single semiconductor substrate, to form a single chip to perform all the desired functions. It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide a memory, timing and logic control, wireless/wired/optical communication circuitry and the components integrated on the semiconductor substrate, in the digital camera of Ogura et al., to enable full camera functionality for the digital camera and to integrate all the components for a unified component in the digital camera.

Claims 1-67 meet the criteria set out in PCT Article 33(4), and thus meet industrial applicability because the subject matter claimed can be made or used in industry.

Continuation of Section VII. Certain defects:

The description is objected to as containing the following defect(s) under PCT Rule 66.2(a)(iii) in the form or contents thereof:

In the "Brief Description of the Drawings" section, the following figures do not have a description: Figures 10I-10N, 50G-50H, 54G-54H, 57G-57H, 78Q-78Q, 81D, 83D-83E, 97D, 98A-98B, and 110G-110H.

The following figures are not described in the "Detailed Description" section: Figures 17J-17K, 33K, and 127-138.

Form PCT/ISA/237 (Supplemental Box) (April 2007)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US05/30256

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Page 30: "Figures 87A-8B" should read "Figures 87A-87B"
Page 30: Reference is made to Figure 90B, which does not appear in the Drawings.
Page 51: "370A" should read "330A"
Page 53: "10I" should read "10G"
Page 57, line 14: "476" should read "474"
Page 57: "pixel pixels" should read "pixel"
Page 60: "to in order" should read "in order"
Page 63: "circles XX" should read "circles 502"
Page 67: "support320" should read "support 320"
Page 69: "630A-630D" should read "600A-600D"
Page 74: "support 520" should read "support 320"
Page 74: "circuit board 732" should read "circuit board 720"
Page 75, line 3-7 is identical to lines 12-16 and should be deleted.
Page 80: "330S" should read "330D"
Page 81: "supports 32" should read "supports 320"
Page 81: "Figures 41B-41D" should read "Figures 41B, 41D, and 41C"
Page 81: "456A-456C, 458A-458C, shown in Figures 15B-15D" should read "458A-458C, 456A-456C, shown in Figures 15B, 15E, and 15D"
Page 81 contains duplicate paragraph starting with "In that regard, Figures 42-44...".
Page 82: "Figure 41C" should read "Figure 41D"
Page 83: "Figure 41D" should read "Figure 41C"
Page 86: "pads on the circuit board 732" should read "pads 732 on the circuit board 720"
Page 86: "pads on the image device 792" should read "pads 742 on the image device 520" and "pads on the second device 794" should read "pads 794 on the second device 780"
Page 87: "apertures 804" should read "apertures 804A-804D"
Page 87: "spacer 500" should read "spacer 800"
Page 96 makes reference to a "Figure", but no number is given.
Page 99: "Figure 78R" should read "Figure 78Q"
Page 101: "Bayer patter" should read "Bayer pattern"
Page 102: The heading "Four Camera Channels" should appear on a separate line.
Page 102: "In some embodiments," should read "In some embodiments (see for example Figure 8)."
Page 117: "four support portions" should read "three support portions"
Page 117: "Support portion 600D...310D" should be deleted.
Page 127: "support portions 600A-600D" should read "support portions 600A-600C"
Page 119: "330D" should read "330C" and "310D" should read "310C"
Page 119, line 21: "616D" should read "616C" and "600D" should read "600C"
Page 120: "Figures 89A" should read "Figure 99A"
Page 126: "Figures 103B-103E" should read "Figures 103C-103E"
Page 135, line 10: "109D" should read "109E"
Pages 168-169: the first mention of "115R" should read "115T", "115P" should read "115U", "115Q" should read "115V", and the second mention of "115R" should read "115X"
Page 173: "Figures 121A-121B" should read "Figures 121-122"

Claims 26, 29, 50, 57, and 63 are objected to under PCT Rule 66.2(a)(iii) as containing the following defect(s) in the form or contents thereof:

- Claim 26, line 1: "logic that to provide" should read "logic to provide"
Claim 29, line 1 recites the limitation "the communication circuitry," which lacks antecedent basis when dependent on claim 24. The claim should be dependent on claim 27 or 28.
Claim 50, line 4: "the third wavelength" should read "the second wavelength"
Claim 57, line 1 recites the limitation "the communication circuitry," which lacks antecedent basis when dependent on claim 53. The claim should be dependent on claim 55 or 56.
Claim 63, line 1: "logic that to provide" should read "logic to provide"

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US06/25781

A. CLASSIFICATION OF SUBJECT MATTER IPC: H04N 5/247(2006.01),5/228(2006.01),5/225(2006.01),9/09(2006.01),9/097(2006.01) USPC: 348/208.99,208.4,208.7,208.8,208.11,262,264,265 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) U.S. : 348/208.99,208.4,208.7,208.8,208.11,262,264,265 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) East Search		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,654,752 A (YAMAZAKI) 5 August 1997 (05.08.1997)	1-63
Y	US 2005/0128509 A1 (TOKKENEN et al) 16 June 2005 (16.6.2005), column 2, lines 1-60.	1-63
T	US 7,123,298 B2 (SCHROEDER et al) 17 October 2006 (17.10.2006)	1-63
Y	US 2003/0086013 A1 (ARATANI) 8 May 2003 (08.05.2003), column 3, lines 1-60.	1-63
Y	US 2002/0113888 A1 (SONDA et al) 22 August 2002 (22.08.2002), column 3, lines 9-62.	1-63
Y	US 6,381,072 B1 (BURGER) 30 April 2002 (30.04.2002), column 3, lines 60-67 and column 4, lines 1-21.	1-63
Y	US 2004/0017620 A1 (KANEKO et al) 29 January 2004 (29.01.2004), column 7, Lines 1-60.	1-63
☒ 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	"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
"E"	earlier application or patent published on or after the international filing date	"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
"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)	"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
"O"	document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed	
Date of the actual completion of the international search 19 June 2008 (19.06.2008)		Date of mailing of the international search report 22 JUL 2008
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201		Authorized officer /James Hannett/ Telephone No. 571-272-7309

Form PCT/ISA/210 (second sheet) (April 2007)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US06/25781

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 4,385,373 (HOWE) 24 May 1983 (24.05.1983), column 1, lines 1-30.	1-63
T	US 7,280,290 B2 (ARAKI et al) 9 October 2007 (09.10.2007).	1-63

Form PCT/ISA/210 (continuation of second sheet) (April 2007)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
NEIL A. STEINBERG
2665 MARINE WAY, SUITE 1150
MOUNTAIN VIEW, CA 94043

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing (day/month/year) 22 JUL 2008	
Applicant's or agent's file reference 300.002-PCT	
FOR FURTHER ACTION See paragraph 2 below	
International application No. PCT/US06/25781	International filing date (day/month/year) 29 June 2006 (29.06.2006)
Priority date (day/month/year) 01 July 2005 (01.07.2005)	
International Patent Classification (IPC) or both national classification and IPC IPC: H04N 5/247(2006.01), 5/228(2006.01), 5/225(2006.01), 9/09(2006.01), 9/097(2006.01) USPC: 348/208.99, 208.4, 208.7, 208.8, 208.11, 262, 264, 265	
Applicant NEWPORT IMAGING CORPORATION	

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/ US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	Date of completion of this opinion 19 June 2008 (19.06.2008)	Authorized officer /James Hannett/ Telephone No. 703-308-6789
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Form PCT/ISA/237 (cover sheet) (April 2007)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US06/25781

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:
 - ☒ the international application in the language in which it was filed
 - ☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of:
 - a. type of material
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material
 - ☐ on paper
 - ☐ in electronic form
 - c. time of filing/furnishing
 - ☐ contained in the international application as filed.
 - ☐ filed together with the international application in electronic form.
 - ☐ furnished subsequently to this Authority for the purposes of search.
4. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US06/25781

Box No. V Reasoned statement under Rule 43 bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims <u>NONE</u>	YES
	Claims <u>1-63</u>	NO
Inventive step (IS)	Claims <u>None</u>	YES
	Claims <u>1-63</u>	NO
Industrial applicability (IA)	Claims <u>1-63</u>	YES
	Claims <u>NONE</u>	NO

2. Citations and explanations:

Please See Continuation Sheet

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US06/25781

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

Claims 55 and 56 are objected to under PCT Rule 66.2(a)(iii) as containing the following defect(s) in the form or contents thereof:
Claims 55 and 56 are duplicated and have different subject matter, the claim numbering is incorrect.

Form PCT/ISA/237 (Box No. VII) (April 2007)

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US06/25781

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

V. 2. Citations and Explanations:

Claims 1-63 are an inventive step under PCT Article 33(3) as being obvious over US 2005/0128509 A1 Tokkonen et al in view of USPN 7,123,298 B2 Schroeder et al. in view of US 2004/0017620 A1 Kaneko et al.

In regards to Claims 1-63, Tokkonen et al. discloses a digital camera comprising a plurality of arrays of photo detectors, including: two separate CCD or CMOS sensor arrays (234,236) that are responsive the amount of light incident on them, reading on the claimed "first array of photo detectors" and "second array of photo detectors to sample an intensity of light" (Figure 2B, paragraphs 19-20); a lens assembly (200) with lenses (210, 212) disposed in front of sensors (234,236) to focus an image on the sensors, reading on the claimed "first lens disposed in and associated with an optical path of the first array" and "second lens..., with..., the second array" (paragraph 19); a color filter arrangement (206) with color filters (226,228) disposed in front of sensors (234,236) to allow only a single color to reach each of the sensor, reading on the claimed "first array..., sample an intensity of light of a first wavelength," "second array..., sample..., a second wavelength," and "a substantially uniform color filter sheet disposed in the optical path of the first array" (paragraphs 19, 23); and a signal processor that produces two sub-images from the signals of the sensors (234,236) and combines them into a final image, reading on the claimed "signal processing circuitry, coupled to the first and second arrays of photo detectors, to generate a composite image using (i) data..., of the intensity..., sampled by the first array and (ii) data..., of the intensity..., sampled by the second array" (paragraph 28). However, Tokkonen et al, does not disclose that the first and second arrays and the signal processing circuitry are integrated in the same semiconductor substrate, with the image.

In the same field of endeavor, Schroeder et al. teaches a color image sensor (100) with three light sensor regions (131-133) fabricated on the same silicon substrate, and an auxiliary circuit (128), including signal processing circuits, that occupies a portion of the substrate outside of the sensor regions, reading on the claimed "first array..., second array..., and the signal processing circuitry are integrated on or in the same semiconductor substrate" (figure 2; column 4, lines 53-62; column 8, lines 15-21 ; column 10, lines 39-41). The color image sensor (100) also comprises color filters (141- 143), which only transmit a single color of light and filter out other colors, supported by lenses (101-103), which focus an image on a respective sensor region, and the color filters may be located on a surface of the respective lens, thereby integrated the color filter into the lens, reading on the claimed "first lens passes light of a first wavelength and filters light of a second wavelength," "first lens disposed in an optical path of the first array of photo detectors wherein the first lens includes a predetermined optical response to the light of the first wavelength," and "second lens..., includes a predetermined optical response to the light of the second wavelength" (column 5, lines 42-66). Schroeder et al. teaches by integrating the components into a single substrate and integrating the filter and lens

Form PCT/ISA/237 (Supplemental Box) (April 2007)

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US06/25781

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

reduces the number of components and decrease the size of the image sensor.

Tokkonen et al in view of Schroeder et al teaches the use of an imaging system that has multiple image sensors on a single chip and have lens systems including filters etc, over each of the individual sensors wherein the light paths from the different lens systems are designed to not allow light to pass to the other image sensor regions. However, Tokkonen et al in view of Schroeder et al only teaches the use of stationary lens arrays that do not move and does not teach using lens systems actuated by MEMS in order to allow the lens systems to move in a parallel, perpendicular, oblique and angular fashion.

Kaneko et al depicts in Figures 1 and 14 and teaches on Paragraphs [0004, 0101, 0123-0129] a compact lens system that is connected to the front of an image capture device to allow the lens to be moved in all directions to allow the lens to compensate for changes in temperature, humidity and camera shake. Kaneko et al teaches that the lens system will receive a signal from a controller to change the position of the lens based on data sensed from several different sensors. Kaneko et al teaches that it is advantageous to use this lens system instead of a stationary lens system because it provides the lens system and camera with the ability to compensate for camera shake, temperature and humidity fluctuations and therefore, improves image quality.

Therefore, the claims lack the inventive step.

Electronic Acknowledgement Receipt	
EFS ID:	8578795
Application Number:	12496854
International Application Number:	
Confirmation Number:	5298
Title of Invention:	LARGE DYNAMIC RANGE CAMERAS
First Named Inventor/Applicant Name:	Richard Ian Olsen
Customer Number:	23524
Filer:	Christopher L. Kalafut/Linda Anderson
Filer Authorized By:	Christopher L. Kalafut
Attorney Docket Number:	088245-6407
Receipt Date:	07-OCT-2010
Filing Date:	02-JUL-2009
Time Stamp:	15:15:16
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		IDS.pdf	298240	yes	9
			c597ede30fb47a2f9c9146e0c8e33e436ace788		

	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Transmittal Letter		1	2	
	Information Disclosure Statement (IDS) Filed (SB/08)		3	9	
Warnings:					
Information:					
2	Foreign Reference	EP1032045.pdf	965608	no	20
			b3e475a07805ea32976b0b5fe9181b19c82aec8a		
Warnings:					
Information:					
3	NPL Documents	CNOA.pdf	322902	no	10
			cb5e9248f4f23736d81da8a4d61361f6568bdcd9d		
Warnings:					
Information:					
4		PCTref.pdf	441244	yes	20
			42831a0833982c7d5c59ca2596f6b151152a71fa		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	NPL Documents		1	1	
	NPL Documents		2	2	
	NPL Documents		3	12	
	NPL Documents		13	20	
Warnings:					
Information:					
5		NOAS.pdf	452814	yes	20
			a4675f55f598f62d92ceabaf948d98e03adeddab		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	NPL Documents		1	6	
	NPL Documents		7	13	

	NPL Documents		14	20	
Warnings:					
Information:					
6		OAspt1.pdf	426596 f5232f87432a2c65cb9a85219bc4834dfeae b1e5	yes	41
	Multipart Description/PDF files in .zip description				
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	NPL Documents		1	11	
	NPL Documents		12	20	
	NPL Documents		21	34	
	NPL Documents		35	41	
Warnings:					
Information:					
7	NPL Documents	6121NFOA04162010.pdf	556174 9a212085a304ca32c5568c2248262b43658 f219c	no	13
Warnings:					
Information:					
8	NPL Documents	6121NFOA5192009.pdf	213661 53d0e18bb2db9a5b921a95a880996f44a6 ce10e	no	6
Warnings:					
Information:					
9		OAspt2.pdf	214703 60f26b9b92274ce3bb3077f4da6048563e2 53d05	yes	15
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	NPL Documents		1	8	
	NPL Documents		9	15	
Warnings:					
Information:					
10	NPL Documents	6123FOA080410.pdf	357518 30400c1d409a34777f9492c3285b9525661 d50d1	no	11

Warnings:					
Information:					
11	NPL Documents	OAspt3.pdf	110428	no	11
			42c32f6db0cbbec374be769a7245683942b75c5		
Warnings:					
Information:					
12	NPL Documents	6130NFOA09032009.pdf	164954	no	5
			891abf16a7036a60c3a3bd7f1825716744bf4831		
Warnings:					
Information:					
13	NPL Documents	EPOsearchreport.pdf	345436	no	6
			7aebaf275b399e8706d77f212af7a12d499ce2f2		
Warnings:					
Information:					
14	NPL Documents	6128NOA06032009.pdf	300824	no	6
			95469a462d679e51a2e7b6fb70c57e47746370df		
Warnings:					
Information:					
Total Files Size (in bytes):			5171102		
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Olsen, et al.
Title: LARGE DYNAMIC RANGE
CAMERAS
Appl. No.: 12/496854
Filing Date: 7/2/2009
Examiner: Lin Ye
Art Unit: 2622
Confirmation Number: 5298

INFORMATION DISCLOSURE STATEMENT
UNDER 37 CFR §1.56

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Submitted herewith on Form PTO/SB/08 is a listing of the documents cited by or submitted to the United States Patent and Trademark Office in parent applications Serial No. 11/788,122, filed 4/19/2007 and Serial No. 11/212,803, filed 8/25/2005. As provided in 37 CFR §1.98(d), copies of most of the documents are not being provided since they were previously submitted to the United States Patent & Trademark Office in the above-identified parent application.

The submission of any document herewith, which is not a statutory bar, is not intended as an admission that such document constitutes prior art against the claims of the present application or that such document is considered material to patentability as defined in 37 CFR

§1.56(b). Applicants do not waive any rights to take any action which would be appropriate to antedate or otherwise remove as a competent reference any document which is determined to be a *prima facie* art reference against the claims of the present application.

TIMING OF THE DISCLOSURE

The listed documents are being submitted in compliance with 37 CFR §1.97(b), before the mailing date of the first Office Action on the merits.

RELEVANCE OF EACH DOCUMENT

All of the documents are in English.

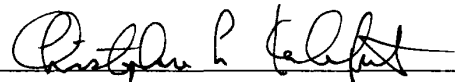
Applicants respectfully request that each listed document be considered by the Examiner and be made of record in the present application and that an initialed copy of Form PTO/SB/08 be returned in accordance with MPEP §609.

Although Applicant believes that no fee is required, the Commissioner is hereby authorized to charge any additional fees which may be due to Deposit Account No. 19-0741.

Respectfully submitted,

Date October 7, 2010

FOLEY & LARDNER LLP
Customer Number: 23524
Telephone: (608) 258-4286
Facsimile: (608) 258-4258

By 

Christopher L. Kalafut
Attorney for Applicant
Registration No. 57,946



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/496,854	07/02/2009	Richard Ian Olsen	088245-6407

CONFIRMATION NO. 5298

PUBLICATION NOTICE



OC000000038517035

23524
FOLEY & LARDNER LLP
150 EAST GILMAN STREET
P.O. BOX 1497
MADISON, WI 53701-1497

Title: LARGE DYNAMIC RANGE CAMERAS

Publication No. US-2009-0268043-A1

Publication Date: 10/29/2009

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <http://pair.uspto.gov/>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/496,854	07/02/2009	Richard Ian Olsen	088245-6407

23524
FOLEY & LARDNER LLP
150 EAST GILMAN STREET
P.O. BOX 1497
MADISON, WI 53701-1497

CONFIRMATION NO. 5298
POWER OF ATTORNEY NOTICE



Date Mailed: 10/02/2009

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/22/2009.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

/snguyen/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/496,854	07/02/2009	Richard Ian Olsen	088245-6122

CONFIRMATION NO. 5298

POA ACCEPTANCE LETTER



23524
FOLEY & LARDNER LLP
150 EAST GILMAN STREET
P.O. BOX 1497
MADISON, WI 53701-1497

Date Mailed: 10/02/2009

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/22/2009.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/snguyen/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
12/496,854	07/02/2009	2622	1882	088245-6122	31	4

CONFIRMATION NO. 5298

CORRECTED FILING RECEIPT



OC000000038001785

23524
FOLEY & LARDNER LLP
150 EAST GILMAN STREET
P.O. BOX 1497
MADISON, WI 53701-1497

Date Mailed: 09/29/2009

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Richard Ian Olsen, Irvine, CA;
Darryl L. Sato, Irvine, CA;
Feng-Qing Sun, Irvine, CA;
James Gates, Irvine, CA;

Power of Attorney: The patent practitioners associated with Customer Number 23524

Domestic Priority data as claimed by applicant

This application is a CON of 11/788,122 04/19/2007 PAT 7,564,019
which claims benefit of 60/795,882 04/28/2006
and is a CIP of 11/212,803 08/25/2005 ABN
which claims benefit of 60/604,854 08/25/2004
and claims benefit of 60/695,946 07/01/2005

Foreign Applications

If Required, Foreign Filing License Granted: 07/14/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/496,854**

Projected Publication Date: 10/29/2009

Non-Publication Request: No

Early Publication Request: No

Title

LARGE DYNAMIC RANGE CAMERAS

Preliminary Class

348

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER**Title 35, United States Code, Section 184****Title 37, Code of Federal Regulations, 5.11 & 5.15****GRANTED**

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set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Olsen, et al.
Title: LARGE DYNAMIC RANGE CAMERAS
Appl. No.: 12/496,854
Filing Date: 07/02/2009
Examiner: Unknown
Art Unit: 2878
Confirmation Number: 5298

REQUEST FOR CORRECTED FILING RECEIPT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Attn: Appl. Processing Division, Customer Correction Branch

Sir:

Attached is a copy of the official Filing Receipt received from the PTO in the above-referenced application.

There is an error with respect to the Power of Attorney information. The Power of Attorney information should read as follows:

The patent practitioners associated with Customer Number 23524.

Enclosed herewith is the executed Power of Attorney PTO/SB/80 form accompanied by a signed Statement Under 37 CFR 3.73(b) showing the correct power of attorney information. The correction is not due to any error by Applicant and, accordingly, no fee is due. Issuance of a corrected Filing Receipt is respectfully requested.

Respectfully submitted,

Date September 22, 2009

FOLEY & LARDNER LLP
Customer Number: 23524
Telephone: (608) 258-4286
Facsimile: (608) 258-4258

By Christopher L. Kalafut

Christopher L. Kalafut
Attorney for Applicant
Registration No. 57,946



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY DOCKET NO	TOT CLAIMS	IND CLAIMS
12/496,854	07/02/2009	2622	1882	088245-6407	31	4

CONFIRMATION NO. 5298

23524
FOLEY & LARDNER LLP
150 EAST GILMAN STREET
P.O. BOX 1497
MADISON, WI 53701-1497

FILING RECEIPT



Date Mailed: 07/20/2009

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Richard Ian Olsen, Irvine, CA;
Darryl L. Sato, Irvine, CA;
Feng-Qing Sun, Irvine, CA;
James Gates, Irvine, CA;

Power of Attorney: The patent practitioners associated with Customer Number ~~53186~~ 23524

Domestic Priority data as claimed by applicant

This application is a CON of 11/788,122 04/19/2007 PAT 7,564,019
which claims benefit of 60/795,882 04/28/2006
and is a CIP of 11/212,803 08/25/2005 ABN
which claims benefit of 60/604,854 08/25/2004
and claims benefit of 60/695,946 07/01/2005

Foreign Applications

If Required, Foreign Filing License Granted: 07/14/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/496,854**

Projected Publication Date: 10/29/2009

Non-Publication Request: No

Early Publication Request: No

Title

LARGE DYNAMIC RANGE CAMERAS

Preliminary Class

348

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

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For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER**Title 35, United States Code, Section 184****Title 37, Code of Federal Regulations, 5.11 & 5.15****GRANTED**

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as

page 2 of 3

set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

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STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: OLSEN, Richard Ian et al. Confirmation No. 5081
Application No.: 11/788,122 Filed: 4/19/2007
Patent No.: _____ Issue Date: _____
Docket Number: 088245-6122
Entitled: LARGE DYNAMIC RANGE CAMERAS

PROTARIUS FILO AG, L.L.C.
(Name of Assignee)

LLC
(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. ☒ the assignee of the entire right, title, and interest; or
2. ☐ an assignee of less than the entire right, title, and interest
The extent (by percentage) of its ownership interest is %

in the patent application/patent identified above by virtue of either:

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel/Frame _____ or for which a copy thereof is attached.

OR

B. ☒ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as shown below:

1. From: OLSEN, RICHARD IAN To: NEWPORT IMAGING CORPORATION
The document was recorded in the United States Patent and Trademark Office at
Reel 019576, Frame 0976, or for which a copy thereof is attached.

2. From: NEWPORT IMAGING CORPORATION To: PROTARIUS FILO AG, L.L.C.
The document was recorded in the United States Patent and Trademark Office at
Reel 022046, Frame 0464, or for which a copy thereof is attached.

3. From: _____ To: _____
The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet.

☐ Copies of assignments or other documents in the chain of title are attached.

[NOTE: A separate copy (i.e., a true copy of the original document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, if the assignment is to be recorded in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

Christopher L. Kalafut
Signature

01/05/09
Date

Christopher L. Kalafut (Reg. No. 57,946)

(608) 258-4286

Printed or Typed Name

Telephone Number

Attorney for Applicant

Title

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

MADI_1770262.1

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:



Practitioners associated with the Customer Number:

23524

OR



Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:



The address associated with Customer Number:

23524

OR



Firm or Individual Name

Address

City

State

Zip

Country

Telephone

Email

Assignee Name and Address:

PROTARIUS FILO AG, L.L.C.
160 Greentree Drive, Suite 101
Dover, DE 19904
USA

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature		Date	12/26/08
Name	Jeremiah Miller	Telephone	
Title	Authorized Person for Protarius Filo AG, L.L.C.		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes: complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

MADI_1764079.1

Electronic Acknowledgement Receipt	
EFS ID:	6116702
Application Number:	12496854
International Application Number:	
Confirmation Number:	5298
Title of Invention:	LARGE DYNAMIC RANGE CAMERAS
First Named Inventor/Applicant Name:	Richard Ian Olsen
Customer Number:	23524
Filer:	Christopher L. Kalafut/Lee Jankoski
Filer Authorized By:	Christopher L. Kalafut
Attorney Docket Number:	088245-6407
Receipt Date:	22-SEP-2009
Filing Date:	02-JUL-2009
Time Stamp:	11:14:21
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment		no			
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		6407ReqforCorrFR92209.pdf	288802	yes	7
			e704194eb4aa16c5bb98e2231248954bc26d9934		

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Request for Corrected Filing Receipt	1	5
	Assignee showing of ownership per 37 CFR 3.73(b).	6	6
	Power of Attorney	7	7
Warnings:			
Information:			
Total Files Size (in bytes):		288802	
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>			



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
12/496,854	07/02/2009	2622	1882	088245-6407	31	4

CONFIRMATION NO. 5298

23524
FOLEY & LARDNER LLP
150 EAST GILMAN STREET
P.O. BOX 1497
MADISON, WI 53701-1497

FILING RECEIPT



Date Mailed: 07/20/2009

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Richard Ian Olsen, Irvine, CA;
Darryl L. Sato, Irvine, CA;
Feng-Qing Sun, Irvine, CA;
James Gates, Irvine, CA;

Power of Attorney: The patent practitioners associated with Customer Number 53186

Domestic Priority data as claimed by applicant

This application is a CON of 11/788,122 04/19/2007 PAT 7,564,019
which claims benefit of 60/795,882 04/28/2006
and is a CIP of 11/212,803 08/25/2005 ABN
which claims benefit of 60/604,854 08/25/2004
and claims benefit of 60/695,946 07/01/2005

Foreign Applications

If Required, Foreign Filing License Granted: 07/14/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/496,854**

Projected Publication Date: 10/29/2009

Non-Publication Request: No

Early Publication Request: No

Title

LARGE DYNAMIC RANGE CAMERAS

Preliminary Class

348

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

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LICENSE FOR FOREIGN FILING UNDER**Title 35, United States Code, Section 184****Title 37, Code of Federal Regulations, 5.11 & 5.15****GRANTED**

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Olsen, et al.
Title: LARGE DYNAMIC RANGE CAMERAS
Prior Appl. No.: 11/788,122
Prior Appl.
Filing Date: 4/19/2007
Examiner: Unknown
Art Unit: Unknown

CONTINUING PATENT APPLICATION
TRANSMITTAL LETTER

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Transmitted herewith for filing under 37 C.F.R. § 1.53(b) is a:

☒ Continuation ☐ Division ☐ Continuation-In-Part (CIP)

of the above-identified copending prior application in which no patenting, abandonment, or termination of proceedings has occurred. Priority to the above-identified prior application is hereby claimed under 35 U.S.C. § 120 for this continuing application. The entire disclosure of the above-identified prior application is considered as being part of the disclosure of the accompanying continuing application and is hereby incorporated by reference therein.

Enclosed are:

- ☒ Description, Claim(s), and Abstract (42 pages).
- ☒ Formal drawings (24 sheets, Figures 1-24).
- ☒ Declaration and Power of Attorney (3 pages).
- ☒ Application Data Sheet (37 CFR 1.76).

The adjustment to the number of sheets for EFS-Web filing follows:

Number of Sheets		EFS-Web Adjustment	Number of Sheets for EFS-Web
66	x	75%	50

The filing fee is calculated below:

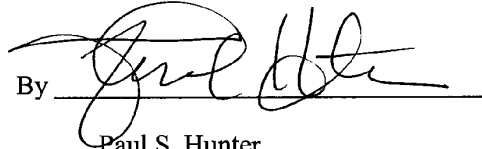
	Number Filed	Included in Basic Fee	Extra	Rate	Fee Totals
Basic Filing Fee				\$330.00 =	\$330.00
Search Fee				\$540.00	\$540.00
Examination Fee				\$220.00	\$220.00
Size Fee	50	- 100	= 0	x \$270.00	\$0.00
Total Claims:	31	- 20	= 11	x \$52.00	\$572.00
Independents:	4	- 3	= 1	x \$220.00	\$220.00
If any Multiple Dependent Claim(s) present:			+	\$390.00	\$0.00
Surcharge under 37 CFR 1.16(e) for late filing of Executed Declaration or late payment of filing fee			+	\$130.00	\$0.00
				SUBTOTAL:	\$1882.00
[] Small Entity Fees Apply (subtract ½ of above):					0
Basic Filing Fee Reduction for Filing via EFS-Web					\$0.00
				TOTAL FILING FEE:	\$1882.00
Assignment Recordation Fee:			+	\$40.00	\$0.00
Processing Fee under 37 CFR 1.17(i) for Late Filing of English Translation of Application:			+	\$130.00	\$0.00
TOTAL FEE					\$1882.00

The above-identified fees of \$1882.00 are being paid by credit card via EFS-Web.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by the credit card payment instructions in EFS-Web being incorrect or absent, resulting in a rejected or incorrect credit card transaction, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741.

Please direct all correspondence to the undersigned attorney or agent indicated below.

Respectfully submitted,

By 

Paul S. Hunter
Attorney for Applicant
Registration No. 44,787

Date July 2, 2009

FOLEY & LARDNER LLP
Customer Number: 23524
Telephone: (608) 258-4292
Facsimile: (608) 258-4258

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Olsen, et al.
Title: LARGE DYNAMIC RANGE CAMERAS
Prior Appl. No.: 11/788,122
Prior Appl.
Filing Date: 4/19/2007
Examiner: Unknown
Art Unit: Unknown

CONTINUING PATENT APPLICATION
TRANSMITTAL LETTER

Commissioner for Patents
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☒ Continuation ☐ Division ☐ Continuation-In-Part (CIP)

of the above-identified copending prior application in which no patenting, abandonment, or termination of proceedings has occurred. Priority to the above-identified prior application is hereby claimed under 35 U.S.C. § 120 for this continuing application. The entire disclosure of the above-identified prior application is considered as being part of the disclosure of the accompanying continuing application and is hereby incorporated by reference therein.

Enclosed are:

- ☒ Description, Claim(s), and Abstract (42 pages).
- ☒ Formal drawings (24 sheets, Figures 1-24).
- ☒ Declaration and Power of Attorney (3 pages).
- ☒ Application Data Sheet (37 CFR 1.76).

The adjustment to the number of sheets for EFS-Web filing follows:

Number of Sheets		EFS-Web Adjustment	Number of Sheets for EFS-Web
66	x	75%	50

The filing fee is calculated below:

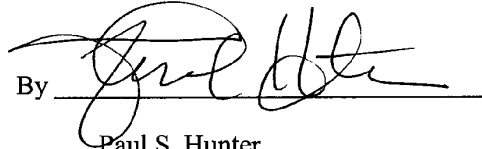
	Number Filed	Included in Basic Fee	Extra	Rate	Fee Totals
Basic Filing Fee				\$330.00 =	\$330.00
Search Fee				\$540.00	\$540.00
Examination Fee				\$220.00	\$220.00
Size Fee	50	- 100	= 0 x	\$270.00	\$0.00
Total Claims:	31	- 20	= 11 x	\$52.00 =	\$572.00
Independents:	4	- 3	= 1 x	\$220.00 =	\$220.00
If any Multiple Dependent Claim(s) present:			+	\$390.00 =	\$0.00
Surcharge under 37 CFR 1.16(e) for late filing of Executed Declaration or late payment of filing fee			+	\$130.00 =	\$0.00
				SUBTOTAL:	\$1882.00
[] Small Entity Fees Apply (subtract ½ of above):				=	0
Basic Filing Fee Reduction for Filing via EFS-Web					\$0.00
				TOTAL FILING FEE:	\$1882.00
Assignment Recordation Fee:			+	\$40.00 =	\$0.00
Processing Fee under 37 CFR 1.17(i) for Late Filing of English Translation of Application:			+	\$130.00 =	\$0.00
TOTAL FEE				=	\$1882.00

The above-identified fees of \$1882.00 are being paid by credit card via EFS-Web.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by the credit card payment instructions in EFS-Web being incorrect or absent, resulting in a rejected or incorrect credit card transaction, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741.

Please direct all correspondence to the undersigned attorney or agent indicated below.

Respectfully submitted,

By 

Paul S. Hunter
Attorney for Applicant
Registration No. 44,787

Date July 2, 2009

FOLEY & LARDNER LLP
Customer Number: 23524
Telephone: (608) 258-4292
Facsimile: (608) 258-4258

LARGE DYNAMIC RANGE CAMERAS

CROSS-REFERENCE TO RELATED PATENT APPLICATIONS

[0001] This application is a Continuation of U.S. Patent Application No. 11/788,122, filed 4/19/2007, which is a Continuation-In-Part of U.S. Patent Application No. 11/212,803, filed 8/25/2005, which claims priority to U.S. Provisional Patent Application No. 60/695,946 filed on 07/01/05 and to U.S. Provisional Patent Application No. 60/604,854 filed on 08/25/04; U.S. Patent Application No. 11/788,122 also claims priority to U.S. Provisional Patent App. No. 60/795,882 filed 04/28/06. Each of the above-referenced patent applications is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The following disclosure relates generally to optical devices and more particularly to expanding the dynamic exposure range in digital cameras.

BACKGROUND

[0003] Image sensors can be realized with semiconductors based on their capability to convert locally impinging light energy into a proportional amount of electronic charge. This electronic charge "Q" is often referred to as photo-charge, and can be integrated within the pixel on a storage device such as a reverse biased diode or as a pre-charged metal-oxide-semiconductor capacitance. The finite charge storage capacitance within each pixel limits the amount of integrated photo-charge. Dynamic range is measured as the ratio of the maximum photo-charge that can be meaningfully integrated in a pixel of the imager to the pixel noise level.

[0004] Intrascene dynamic range refers to the range of incident light that can be accommodated by an image sensor in a single frame of pixel data. Examples of high dynamic scenes range scenes include an indoor room with a window view of the outdoors, an outdoor scene with mixed shadows and bright sunshine, and evening or night scenes combining

artificial lighting and shadows. In a typical charge coupled device (CCD) or CMOS active pixel sensor (APS), the available dynamic range is in a range of 1,000:1 to about 4,000:1. Unfortunately, many outdoor and indoor scenes with highly varying illumination have a dynamic range significantly greater than 4,000:1. Image sensors with intrascene dynamic range significantly greater than 4,000:1 are required to meet many imaging requirements.

[0005] The dynamic range of an image sensor can be increased by using multiple exposure times and/or integration times. For example, U.S. Pat. No. 4,647,975 describes a method based on the acquisition of two or more images, each having an exposure time. Once numerous images have been taken at different exposure times, the images have to be fused or merged to form one single piece of pixel information having a wide dynamic range. U.S. Pat. Nos. 4,647,975, 5,168,532, and 5,671,013 disclose the use of a selection rule to combine information from the most suitable of the multiple images. The merged pixel information or value is then multiplied by a suitable factor that corrects for the respective exposure times. This method however exhibits undesirable temporal aliasing if the scene or camera is moving because the two or more images having different exposure times are captured using the same image sensor and thus are not captured concurrently.

[0006] Despite improvements in solid-state image sensor and digital camera technology, the light signal or brightness range of scenes often exceeds the dynamic range of the sensor. For this reason, numerous methods have been described in the art of image sensors to extend the dynamic or signal range. A summary of some methods is presented in: "Wide dynamic range sensors", Optical Engineering, Vol. 38, No. 10, pp. 1650-1660, October 1999. Methods to provide wide dynamic range imaging capability with a single image sensor include: (a) logarithmic or compressed response photo-detection; (b) multiple integration and charge storage capability within each pixel; (c) frequency based sensors, where the sensor output is converted to pulse frequency; (d) local integration time control, where different areas within the sensor can have different exposure times; (e) signal charge versus integration time rate (signal slope) measurement; (f) analog to digital conversion per pixel; and (g) autonomous pixel control. These methods require complex pixel circuitry and are difficult to implement in small pixel areas without taking up area required for the photo-detection mechanism (such as a photodiode).

[0007] Typical scenes imaged by digital cameras have light levels that span a range including low light (1-100 lux), moderate light (100-1000 lux), and bright light (1000-1,000,000 lux) under outdoor conditions. To accommodate lighting changes from scene to scene (the interscene dynamic range) an electronic shutter is used to change the integration time of all pixels in an array from frame to frame. To cover a single scene that might involve indoor lighting (100 lux) and outdoor lighting (100,000 lux), the required intrascene dynamic range is approximately 10,000:1, corresponding to 80 dB (14-bits). This exceeds the dynamic range of a single image sensor using a single integration time (typically 3,100:1 corresponding to 70 dB (12-bits)). Therefore, there is a need for a digital camera in which the effective single-frame dynamic exposure range is expanded.

INCORPORATION BY REFERENCE

[0008] Each patent, patent application, and/or publication mentioned in this specification is herein incorporated by reference in its entirety to the same extent as if each individual patent, patent application, and/or publication was specifically and individually indicated to be incorporated by reference. diagram of a digital camera that includes multiple channels, under an embodiment.

[0009] FIG. 3 is a block diagram of a digital camera subsystem, under an embodiment.

[0010] FIG. 4 is a digital camera subsystem, under an alternative embodiment.

[0011] FIG. 5 is a digital camera subsystem, under another alternative embodiment.

[0012] FIG. 6 is a digital camera subsystem, under still another alternative embodiment.

[0013] FIG. 7 is a block diagram of a method for forming images having a large dynamic range, under an embodiment.

[0014] FIG. 8 is a block diagram of a digital camera, under an embodiment.

[0015] FIG. 9 is an exploded view of a digital camera subsystem, under an embodiment.

[0016] FIG. 10 is a block diagram of a digital camera having a three array/lens configuration, under an embodiment.

[0017] FIG. 11 is a block diagram of a digital camera subsystem that employs separate arrays on one image sensor, under an embodiment.

[0018] FIG. 12 is a block diagram of arrays, each of which receives a respective color as passed by a respective lens, under an embodiment.

[0019] FIG. 13 is a block diagram of processing circuitry of a digital camera subsystem, under an embodiment.

[0020] FIG. 14 is a block diagram of signal processing circuitry, under an embodiment.

[0021] FIG. 15 is an exploded perspective view of a digital camera, under an embodiment.

[0022] FIGS. 16A-16D are schematic exploded representations of one embodiment of an optics portion, under an embodiment.

[0023] FIGS. 17A-17C are schematic representations of a sensor array, under an embodiment.

[0024] FIG. 18 is a schematic cross-sectional view of a digital camera apparatus, under an embodiment.

[0025] FIG. 19 is a schematic perspective view of a digital camera apparatus having one or more optics portions with the capability to provide color separation, under an embodiment.

[0026] [0028] FIG. 20A is a block diagram of a processor of a digital camera subsystem, under an embodiment.

[0027] FIG. 20B is a block diagram of a channel processor of a digital camera subsystem, under an embodiment.

[0028] FIG. 20C is a block diagram of an image pipeline of a digital camera subsystem, under an embodiment.

[0029] FIG. 20D is a block diagram of an image post processor of a digital camera subsystem, under an embodiment.

[0030] FIG. 21 is a block diagram of digital camera system, including system control components, under an embodiment.

DETAILED DESCRIPTION

[0031] Digital camera systems and methods are described below that provide an expanded effective single-frame dynamic exposure range. The digital camera systems and methods, collectively referred to herein as digital camera systems, generally include two or more camera channels. Each channel includes an optics component and an image sensor having an active area including multiple picture elements (pixels). Each sensor is controlled under or with an independent signal integration time as described in detail below. Image capture by the camera is performed using the multiple camera channels, and each camera channel is controlled during a frame under an independent integration time. The integration time for each channel can be automatically controlled and/or controlled in response to a user input. A wide range of integration times are available for use in an embodiment. The images obtained in each channel under the different integration times are obtained simultaneously or nearly simultaneously, so undesirable temporal aliasing from moving scenes or camera motion is minimized.

[0032] The digital camera systems, through the use of multiple integration times, enable formation of an image having a wide dynamic range by combining the data from all camera channels to form a composite single frame. The wide dynamic range of an embodiment is generally greater than the dynamic range obtained by a conventional digital camera with a single image sensor channel and one integration time.

[0033] Conventional digital cameras may have a maximum photo-signal storage capacity that limits the dynamic range of the particular system. The photo-signal charge is stored on a capacitor within the pixel area. The charge handling capacity is limited by the maximum voltage swing in the integrated circuitry and the storage capacitance within the pixel. The amount of integrated photo-charge is directly related to the time the image sensor collects and integrates signal from the scene. This is known as integration time. A long integration time is

desired for weak signals since more photo-charge is integrated within the pixel and the signal-to-noise of the digital camera is improved. Once a maximum charge capacity is reached, the sensor no longer senses image brightness resulting in data loss. Therefore, the use of a single integration time for the entire field of view creates an imaging dilemma in conventional cameras. The digital camera integration time can be set to image low light levels and saturate bright signals or image high light levels and not detect low light levels (since the integrated photo-charge from low light levels is below the signal-to-noise of the sensor).

[0034] The digital cameras described herein overcome this dynamic range limitation through the use of multiple camera channels, including multiple optics and image sensors on a single integrated circuit (IC) or semiconductor substrate. The multiple camera channels are configured to image the same field of view simultaneously, and each operates independently under a different integration time. The digital camera can include, for example, a 3 by 3 assembly of image sensors, perhaps three sensor of each color (e.g., red (R), green (G), and blue (B)) and the integration time of the sensors associated with each color can be varied, for example, each color can have three distinct values (e.g., 0.1 msec, 1 msec, and 10 msec integration time, respectively). The data from all sensors can be digitally combined to provide a much greater dynamic range within one frame of digital camera data. The raw digital camera data could be used by digital signal processing of the scene. The digital data can also be stored and displayed to exhibit low light or bright light characteristics as desired.

[0035] Exposure is the total amount of light allowed to fall on a sensor during the process of taking a photograph. Exposure control is control of the total amount of light incident on a sensor during the process of taking a photograph.

[0036] In contrast to exposure control, which is used by conventional digital cameras to manage dynamic range, the digital camera systems of an embodiment use integration time control to control the time the electrical signal is integrated on a charge storage device (capacitance) within a sensor (pixel), as described herein. Integration time control, also referred to as "focal plane shutter" control, controls the time the electrical signal is integrated or accumulated by controlling a switch (e.g., charge integration switch) coupled or connected to the sensor or a photo-detection mechanism of a sensor. For example, the charge integration switch is placed in a state to allow charge to accumulate within the sensor for a period of time

approximately equal to the integration time corresponding to that sensor; upon completion of the integration period, the switch is placed in a state to transfer the accumulated charge as a photo-signal to a processing component. Digital camera components or circuitry are configured to allow independent control of the charge integration switch associated with each sensor, thereby making possible dynamic range control for each sensor. The integration time control can be executed (depending on readout configuration) according to a number of techniques, for example, rolling mode and/or snap-shot mode to name a few.

[0037] Generally, the digital camera systems of an embodiment provide digital cameras with large effective single-frame dynamic exposure ranges. The digital camera systems include multiple channels. Each channel includes an optics component and sensor comprising an array of photo-detectors. The sensors of the camera channels are integrated on a semiconductor substrate. The camera systems include a processing component coupled to the channels. The processing component is configured to separately and simultaneously control an integration time of each channel. The integration time of at least one channel is controlled relative to the integration time of at least one other channel so that an image formed by combining data of a frame received simultaneously from the channels has a relatively large dynamic range.

[0038] A digital camera according to an embodiment includes multiple (e.g., two or more) closely spaced image sensor camera channels integrated on or in a common semiconductor substrate. Each sensor camera channel has its own optics, photo-detection and readout mechanism that includes a plurality of picture elements (pixels) with independent signal integration time control. The pixel area, including photo-detector and circuitry, can be as small as 2 μm by 2 μm but is not so limited. The individual camera channels of an embodiment look at the same field of view.

[0039] Each image sensor camera channel for example includes a plurality of pixels, wherein at least two channels may be individually interrogated, for example, the channels can independently be reset, integrate charge for a predetermined and unique time period, and read out. The digital camera further comprises circuitry and/or algorithms for individually interrogating the camera image sensor camera channels, for combining output values of said subsets into combined output values to form a high dynamic range composite image within a single frame of data, and for electrically outputting said composite image.

[0040] The digital camera systems and methods of an embodiment use a range of integration times, T_{long} to T_{short} , for each channel to increase significantly the dynamic range of the digital camera, while insuring a signal overlap between the images. For example, the dynamic range of a digital camera using the methods described herein can be increased from approximately 70 dB to 90 dB using a ratio of $T_{\text{long}}/T_{\text{short}}$ equal to 25. The use of a long integration time in one camera channel allows dark objects to be detected, whereas very bright objects are not, due to saturation of the corresponding pixels storage capacity. In contrast, the use of a short integration time in another channel enables detection of bright objects, whereas very dark objects are not detected due to a weak signal below the noise floor of the pixel. The digital camera systems and methods described below suitably combine the output signals of both exposures to increase the dynamic range of the digital camera.

[0041] The sensor camera channel output values P_{short} to P_{long} , measured with different exposure times, of the camera system described below may not be related ideally through the ratio ($t=T_{\text{long}}/T_{\text{short}}$), for example, P_{long} may be close to but not identical with $t \cdot P_{\text{short}}$ due to non-linear photo-response. For this reason the methods of an embodiment include algorithms that combine the two values to form a large dynamic range composite image in a manner that does not lead to image artifacts and pattern noise.

[0042] FIG. 1 is a block diagram of a conventional digital camera 100. The digital camera 100 includes a lens assembly 110, a color filter array layer 112, an image sensor 116, and an electronic image storage media 120. The camera 100 also includes a power supply 124, a peripheral user interface (represented as a shutter button) 132, a circuit board 136 (which supports and electrically interconnects the aforementioned components), a housing 140 (including housing portions 141, 142, 143, 144, 145 and 146) and a shutter assembly (not shown), which controls an aperture 150 and passage of light into the digital camera 100. A mechanical frame 164 is used to hold the various parts of the lens assembly 110 together. The lens assembly 110 includes lenses 161 and 162 and one or more electro-mechanical devices 163 to move the lenses 161 and 162 along a center axis 165. The lenses 161 and 162 can be made up of multiple elements arranged together to in any combination to form an integral optical component. Additional lenses can be used if necessary. The electromechanical device 163 portion of the lens assembly 110 and the mechanical frame 164 portion of the lens assembly 110 can include numerous components and/or complex assemblies.

[0043] The color filter array layer 112 has an array of color filters arranged in a Bayer pattern (e.g., a 2 by 2 matrix of colors with alternating red and green in one row and alternating green and blue in the other row, although other colors may be used). The Bayer pattern is repeated throughout the color filter array. In some imaging applications, such as broadband visible imaging color filter layers 112 are not required. In other color imaging applications different color filters are used or color separation capability is built into the image sensor detection mechanism.

[0044] The image sensor 116 contains a plurality of identical photo detectors (alternatively referred to as "picture elements" or "pixels") arranged in a matrix. The number of photo detectors is usually in a range of hundreds of thousands to millions. The lens assembly 110 spans the diagonal of the array.

[0045] Each of the color filters in the color filter array 112 is disposed above a respective one of the photo detectors in the image sensor 116, such that each photo detector in the image sensor receives a specific band of visible light (e.g., red, green or blue) and provides a signal indicative of the color intensity of the respective band. Signal processing circuitry (not shown) receives signals from the photo detectors, processes the signals, and ultimately outputs a color image.

[0046] The peripheral user interface 132, which includes the shutter button, can further include one or more additional input devices (e.g., for settings, controls and/or input of other information), one or more output devices, (e.g., a display for output of images or other information) and associated electronics.

[0047] FIG. 2 is a block diagram of a digital camera 200 that includes multiple channels, under an embodiment. The digital camera 200 includes a digital camera subsystem 210 and an electronic image storage media 220. The digital camera 200 also includes a power supply 224, a peripheral user interface (represented as a shutter button) 232, a circuit board 236 (which electrically interconnects and/or supports one or more components), a housing 240 (including housing portions 241, 242, 243, 244, 245 and 246) and a shutter assembly (not shown), which controls an aperture 250 and passage of light into the digital camera 200.

[0048] The digital camera subsystem 210, also referred to herein as the "DCS" 210, includes one or more camera channels (e.g., four camera channels 260A-260D) and replaces (and/or fulfills one, some or all of the roles fulfilled by) the lens assembly 110, the color filter

112 and the image sensor 116 of the digital camera 100 described above. The four camera channels 260A-260D have a configurable or selectable signal integration time control that can be made optimal for a range of incident optical signal levels. The combination of signals from the four camera channels representing the varying integration times allow a greater range of incident photo-signal levels to be detected. Each camera channel, working in conjunction with a selected or programmed integration time, can be optimized to collect an incident light range; for example the optical f-number, photo-detector design, in-pixel circuitry and readout circuitry can be selected for low, medium or high light levels.

[0049] The peripheral user interface 232, which includes the shutter button, may further include one or more additional input devices (e.g., for settings, controls and/or input of other information), one or more output devices, (e.g., a display for output of images or other information) and associated electronics.

[0050] The electronic image storage media 220, power supply 224, peripheral user interface 232, circuit board 236, housing 240, shutter assembly (not shown), and aperture 250, may be, for example, similar to the electronic image storage media 120, power supply 124, peripheral user interface 132, circuit board 136, housing 140, shutter assembly (not shown), and aperture 150 of the digital camera 100 described above.

[0051] FIG. 3 is a block diagram of a digital camera subsystem 210, under an embodiment. As described above, the subsystem 210 includes one or more camera channels. The digital camera subsystem 210 for example is a four channel signal integration time control system (e.g., four camera channels 260A-260D), but the embodiment is not limited to four channels and can include any number of camera channels. Each of the camera channels 260A-260D includes an optics component or portion and a sensor component or portion. The optics component can have different optical f-number among the included camera channels but is not so limited. For example, camera channel 260A includes an optics portion 290A and a sensor portion 292A. Camera channel B includes an optics portion 290B and a sensor portion 292B. Camera channel C includes an optics portion 290C and a sensor portion 292C. Camera channel D includes an optics portion 290D and a sensor portion 292D. The optics portions of the one or more camera channels are collectively referred to herein as an optics subsystem. The sensor portions of the one or more camera channels are collectively referred to herein as a sensor subsystem. Each camera channel has a selectable integration, and the integration

time setting between channels is selected to cover a range of incident light level onto the digital camera.

[0052] In the digital camera subsystem 210, each channel can have the same configuration or a different configuration relative to at least one other channel of the subsystem 210. For example, in some embodiments, the camera channels are all identical to one another. In some other embodiments, one or more of the camera channels are different, in one or more respects, from one or more of the other camera channels. In some of the latter embodiments, each camera channel may be used to detect a different color (or band of colors) and/or band of light than that detected by the other camera channels. For example, in some embodiments, one of the camera channels (e.g., camera channel 260A) detects red light, one of the camera channels (e.g., camera channel 260B) detects green light, and one of the camera channels (e.g., camera channel 260C) detects blue light; any other color combinations can also be used. The color detection capability can be provided by optical materials, color filter layers over the detector, and/or color separation mechanisms built into the photo-detector structure.

[0053] Thus, the optics portions can each be the same or different relative to other optics portions. In some embodiments, all optics portions are identical. In some other embodiments, one or more of the optics portions are different, in one or more respects, from one or more of the other optics portions. For example, in some embodiments, one or more of the characteristics (for example, but not limited to, its type of element(s), size, and/or performance) of one or more of the optics portions is tailored to the respective sensor portion and/or to help achieve a desired result. For example, if a particular camera channel is dedicated to a particular color (or band of colors) or wavelength (or band of wavelengths) then the optics portion for that camera channel may be adapted to transmit only that particular color (or band of colors) or wavelength (or band of wavelengths) to the sensor portion of the particular camera channel and/or to filter out one or more other colors or wavelengths.

[0054] Similar to the optics portion, if the digital camera subsystem 210 includes more than one sensor portion, configurations of the sensor portions can be the same or different relative to one or more other sensor portions. In some embodiments, the sensor portions are similar or identical to the other sensor portions. In some other embodiments, one or more of the sensor portions are different, in one or more respects, from one or more of the other sensor portions. In some embodiments, for example, one or more of the characteristics (for example, but not

limited to, its type of element(s), size, and/or performance) of one or more of the sensor portions is tailored to the respective optics portion and/or to help achieve a desired result. For example, if a particular camera channel is dedicated to a particular color (or band of colors) or wavelength (or band of wavelengths) then the sensor portion for that camera channel may be adapted to have a sensitivity that is higher to that particular color (or band of colors) or wavelength (or band of wavelengths) than other colors or wavelengths and/or to sense only that particular color (or band of colors) or wavelength (or band of wavelengths). The sensor portion for that camera may be adapted for optimized operation by features such as array size, pixel size, pixel design, image sensor design, image sensor integrated circuit process and electrical circuit operation.

[0055] The digital camera subsystem 210 further includes a processor. The processor includes an image processor portion 270 (referred to as image processor 270) and an integration time controller portion 300 (referred to as controller 300). The controller is a component of the variable integration time that provides integration time control for each of the camera channels. The processor 270 is coupled or connected to the one or more sensor portions (e.g., sensor portions 292A-292D) via one or more communication couplings or links, represented by a signal line 330. A communication link may be any kind of communication link including but not limited to, for example, wired (e.g., conductors, fiber optic cables) links, wireless links (e.g., acoustic links, electromagnetic links, and/or any combination of links including but not limited to microwave links, satellite links, infrared links), and/or combinations of wired and/or wireless links.

[0056] The operation of the digital camera subsystem 210 is described below. For example, the user selects a desired incident light range and the camera automatically adjusts the integration time setting between the camera channels to give an optimal dynamic range result. Alternatively the user can select an integration time for each camera channel. An optics portion of a camera channel receives light from within a field of view and transmits one or more portions of such light. The sensor portion receives one or more portions of the light transmitted by the optics portion and, in response, generates an output signal representative or indicative of information of the received light. The output signal from the sensor portion is coupled to the image processor 270 which, as is further described below, can generate an image based at least in part on the output signal from the sensor.

[0057] When the digital camera subsystem 210 includes more than one camera channel, the image processor 270 generates a combined image based at least in part on the images from two or more of the camera channels. For example, in an embodiment, each of the camera channels is dedicated to a different color (or band of colors) or wavelength (or band of wavelengths) relative to the other camera channels, and the image processor 270 combines the images from the two or more camera channels to provide a full-color large dynamic range image. In other embodiments, all camera channels provide the same color capability (such as RGB Bayer patterns on each color channel) and the image processor 270 combines the camera channels to create a large dynamic range image.

[0058] The image processor 270 can also combine sensor channels and analyze the resultant image on a frame by frame basis. The image processor 270 can send a signal to the integration time controller 300 for real-time, or near real-time, dynamic range management by adjustment of each channel's integration time control. This same method can be used to optimize a subsequent single field exposure for optimal picture taking.

[0059] In the digital camera subsystem 210 of an embodiment, the four camera channels 260A-260D are configured to detect RGB light. Each of the camera channels can be identical in configuration or optimized for a specified light level as described above; for example if camera channel 260A is intended to detect dim light the optics f-number in that channel could be reduced. The pixel photo-detector can be configured for low dark current and the pixel circuitry configured for low noise. The integration time control on camera channel 260A is increased to allow increased signal collection. Some pixels in channel 260A would saturate due to incident light levels; this would be determined electrically and data from those pixels would not be used in creating a composite image. Channels 260B-260D would be configured and operated in a similar fashion to sense larger incident light levels.

[0060] In the digital camera subsystem 210 of another alternative embodiment, the four camera channels 260A-260D are configured to provide different imaging capability; for example channel 260A is configured to detect red and blue light, while channel 260B is configured to detect green light. The combined response from channels 260A and 260B of this embodiment thus comprises a RGB color camera. The integration time settings for channels 260A and 260B are configured or set for low incident light levels. Camera channel 260C is configured to collect red and blue light and channel 260D is configured to collect

green light. The combined images of channels 260C and 260D generate a second RGB imaging capability and the integration time of channels 260C and 260D is configured for high incident light levels.

[0061] In the digital camera subsystem 210 of yet another alternative embodiment, camera channel 260A is configured for red light, camera channel 260B is configured for green light, and camera channel 260C is configured for blue light. Camera channels of a single color can provide superior low light response since the color transmission with each channel is high (high transmission color filters within the optical path) and the photo-detection mechanism in each camera channel is configured or set for a specific color for high responsivity. The combined response from channels 260A, 260B and 260C thus comprises a RGB color camera. The integration time settings for channels 260A, 260B and 260C are configured for low incident light levels. Camera channel 260D is configured for RGB light detection and the integration time of that channel configured or set for high incident light levels. Various other combinations of integration times among the channels are possible under the description herein.

[0062] FIG. 4 is a digital camera subsystem 410, under an alternative embodiment. The digital camera subsystem 410 for example is a three channel signal integration time control system (e.g., three camera channels 260A-260C), but the embodiment is not limited to three channels and can include any number of camera channels. The digital camera subsystem 410 includes camera channel 260A configured for RGB light, camera channel 260B configured for RGB light, and camera channel 260C configured for RGB light. The integration time of camera channel 260A is configured for low light, the integration time of camera channel 260B is configured for medium high, and the integration time of camera channel 260C is configured for high incident light levels. The combined response from camera channels 260A, 260B and 260C provides a large dynamic range imaging capability.

[0063] The digital camera subsystem 410 of one alternative configuration is a three channel system in which camera channel 260A is configured for RGB light, camera channel 260B is configured for RGB light, and camera channel 260C is configured for RGB light. The integration time of camera channel 260A is configured for medium light, the integration time of camera channel 260B is configured for medium high, and the integration time of camera channel 260C is configured for high incident light levels. The combined response from

camera channels 260A, 260B and 260C provides a large dynamic range imaging capability. Various other combinations of integration times among the channels are possible under the description herein.

[0064] While the triangular layout configuration of the three camera channels 260A-260C can provide area reduction advantages in imager layout and processing on semiconductor wafers, and can provide optical symmetry between the channels, alternative layout configurations are possible using the three camera channels. For example, one alternative layout includes a 1 by 3 vertical configuration. Another alternative layout includes a 1 by 3 horizontal configuration.

[0065] FIG. 5 is a digital camera subsystem 510, under another alternative embodiment. The digital camera subsystem 510 for example is a two channel signal integration time control system (e.g., two camera channels 260A-260B), but the embodiment is not limited to two channels and can include any number of camera channels. The digital camera subsystem 510 includes camera channel 260A configured for RGB light and camera channel 260B configured for RGB light. The integration time of camera channel 260A is configured or set for low light and camera channel 260B is configured for high incident light levels. The combined response from camera channels 260A and 260B provides a large dynamic range imaging capability. Alternative configurations of the two camera channels include a 1 by 2 vertical layout and a 1 by 2 diagonal layout of camera channels.

[0066] The digital camera subsystem 510 of one alternative configuration is a two channel system in which camera channel 260A is configured for RGB light and camera channel 260B is configured for RGB light. The integration time of camera channel 260A is configured or set for low light and camera channel 260B is configured for medium incident light levels. The combined response from camera channels 260A and 260B provides a large dynamic range imaging capability.

[0067] The digital camera subsystem 510 of another alternative configuration is a two channel system in which camera channel 260A is configured for RGB light and camera channel 260B is configured for RGB light. The integration time of camera channel 260A is configured or set for medium light and camera channel 260B is configured for high incident light levels. The combined response from camera channels 260A and 260B provides a large

dynamic range imaging capability. Various other combinations of integration times among the channels are possible under the description herein.

[0068] FIG. 6 is a digital camera subsystem 610, under still another alternative embodiment. The digital camera subsystem 610 is a six channel signal integration time control system (e.g., six camera channels 260A-260F), but the embodiment is not limited to six channels and can include any number of camera channels. The digital camera subsystem 610 includes camera channel 260A configured for incident red light, camera channel 260B configured for green light, and camera channel 260C configured for blue light. The combined response from camera channels 260A, 260B and 260C provides a first RGB color camera. The integration time settings for camera channels 260A, 260B and 260C are configured for low incident light levels.

[0069] The digital camera subsystem 610 also includes camera channel 260D configured for incident red light, camera channel 260E configured for green light, and camera channel 260F configured for blue light. The combined response from camera channels 260D, 260E and 260F provides a second RGB color camera. The integration time settings for camera channels 260D, 260E and 260F are configured for high incident light levels.

[0070] The digital camera system described above includes a method for forming images having a large dynamic range. FIG. 7 is a block diagram for forming images 700 having a large dynamic range, under an embodiment. The method for forming images 700 can be implemented using the image processor 270 and/or the 300 integration time controller as described above with reference to FIGS. 3-6. The method of an embodiment includes selecting 702 an integration time for each image sensor camera channel from a range of integration times. The photo-signal from each camera channel is integrated 704 within a single frame of data, and the resultant photo-charge for each pixel is stored within that pixel. The photo-signal is read from each pixel and each pixel response is corrected 706 for one or more of non-linearity, gain and offset as appropriate and/or required. The method combines 708 data of the multiple camera channels, and thus provides a continuous monotonic representation of the combined pixel response from low to high incident light levels. The method of an embodiment includes processing (e.g. post-processing), storing, displaying and/or outputting the resultant large dynamic range image from the combined camera channels. Information of the resultant image and/or any post-processing operations is used to

determine integration time control settings 710 that provide optimum dynamic range on subsequent frames of data but is not so limited.

[0071] FIGS. 8-21 illustrate further examples of apparatus and systems in which the imaging module and focusing method embodiments disclosed above can be implemented. FIG. 8 is a block diagram of a digital camera 800, under an embodiment. The digital camera includes a digital camera subsystem 802, a circuit board 812, a peripheral user interface electronics 810 (here represented as a shutter button, but could also include display and/or one or more other output devices, setting controls and/or one or more additional input devices etc), a power supply 806, and electronic image storage media 804. The digital camera 800 may further include a housing and a shutter assembly (not shown), which controls an aperture 814 and passage of light into the digital camera 800.

[0072] FIG. 9 is an exploded view of the digital camera subsystem 802, under an embodiment. In this embodiment, the digital camera subsystem includes an image sensor 904, an optics frame (also referred to as a frame) 902, and lenses 912A-912D. The frame 902 is used to mount the lenses 912A-912D to the image sensor 904. The image sensor, or imager die 904 generally includes a semiconductor integrated circuit or "chip" having several higher order features including multiple arrays 904A-904D and signal processing circuits 908 and 910. Each of the arrays 904A-904D captures photons and outputs electronic signals. The signal processing circuit 908, in certain embodiments, processes signals for each of the individual arrays 904. The signal processing circuit 910 may combine the output from signal processing 908 into output data (usually in the form of a recombined full color image). Each array and the related signal processing circuitry may be tailored to address a specific band of visible spectrum.

[0073] Each of lenses 912A-912D may be tailored for the respective wavelength of the respective array. Lenses are approximately the same size as the underlying array 904, and will differ from one another in size and shape depending upon the dimensions of the underlying array. In alternative embodiments a lens could cover only a portion of an array, and could extend beyond the array. Lenses can comprise any suitable material or materials, including for example, glass and plastic. Lenses can be doped in any suitable manner, such as to impart a color filtering, polarization, or other property. Lenses can be rigid or flexible.

[0074] In the example of FIG. 9, each lens, array, and signal processing circuit constitutes an image generating subsystem for a band of visible spectrum (e.g., red, blue, green, etc). These individual images are then combined with additional signal processing circuitry within the semiconductor chip to form a full image for output.

[0075] Although the digital camera subsystem 904 is depicted in a four array/lens configuration, the digital camera subsystem can be employed in a configuration having any number of arrays/lenses and any combination of shapes of arrays/lenses. FIG. 10 is a block diagram of a digital camera 1000 having a three array/lens configuration, under an embodiment. The digital camera 1000 includes a digital camera subsystem 1002 that includes three lenses. The digital camera 1000 further includes a circuit board 1012, a peripheral user interface electronics 1010 (here represented as a shutter button, but could also include display and/or one or more other output devices, setting controls and/or one or more additional input devices etc), a power supply 1006, and electronic image storage media 1004. The digital camera 1000 may further include a housing and a shutter assembly (not shown), which controls an aperture 1014 and passage of light into the digital camera 1000.

[0076] FIG. 11 is a block diagram of a digital camera subsystem that employs separate arrays, e.g., arrays 1104A-1104D, on one image sensor, in contrast to the prior art. For example, typical prior art approaches employ a Bayer pattern (or variations thereof), perform operations across the array (a pixel at a time), and integrate each set of four pixels (for example, red/green/blue/green or variation thereof) from the array into a single full color pixel.

[0077] Each of the arrays 1104 focuses on a specific band of visible spectrum. Each lens only needs to pass a respective color (1106A-1106D) on to the image sensor. The traditional color filter sheet is eliminated. Each array 1104 outputs signals to signal processing circuitry. Signal processing circuitry for each of these arrays is also tailored for each of the bands of visible spectrum. In effect, individual images are created for each of these arrays. Following this process, the individual images are combined or to form one full color or black/white image. By tailoring each array and the associated signal processing circuitry, a higher quality image can be generated than the image resulting from traditional image sensors of like pixel count.

[0078] As such, each array may be tuned to be more efficient in capturing and processing the image in that particular color. Individual lenses (1112A-D) can be tailored for the array's band of spectrum.

[0079] FIG. 12 is a block diagram of arrays 1204A-1204D. Each array 1204 receives a respective color as passed by a respective lens. The traditional color filter sheet is eliminated. Each array 1204 outputs signals to signal processing circuitry. Signal processing circuitry for each of these arrays is also tailored for each of the bands of visible spectrum. In effect, individual images are created for each of these arrays. Following this process, the individual images are combined or to form one full color or black/white image. By tailoring each array and the associated signal processing circuitry, a higher quality image can be generated than the image resulting from traditional image sensors of like pixel count.

[0080] FIG. 13 is a block diagram of processing circuitry of a digital camera subsystem, under an embodiment. FIG. 13 includes an array 1304, including arrays 1304A-1304D, and signal processing circuitry (also referred to as image processing circuitry) 1414 and 1416. Each array outputs signals to signal processing circuitry.

[0081] FIG. 14 is a block diagram of image processing circuitry 1414 and 1416. Within the image processing circuitry 1414, each array can be processed separately to tailor the processing to the respective bands of spectrum.

[0082] Column logic 1414.1A-1414.1D is the portion of the signal processing circuitry that reads the signals from the pixels. For example, the column logic 1414.1A reads signals from the pixels in array 1404A. Column logic 1414.1B reads signals from the pixels in array 1404B. Column logic 1414.1C reads signals from the pixels in array 1404C. Column logic 1414.1D reads signals from the pixels in array 1404D.

[0083] Since an array is targeting a specific wavelength, wavelengths, band of wavelength, or band of wavelengths, the column logic may have different integration times for each array enhancing dynamic range and/or color specificity. Signal processing circuitry complexity for each array can be substantially reduced since logic may not have to switch between extreme color shifts.

[0084] Analog Signal Logic (ASL) 1414.2A-1414.2D for each array may be color specific. As such, the ASL processes a single color and therefore can be optimized for gain, noise, dynamic range, linearity, etc. Due to color signal separation, dramatic shifts in the logic and

settling time are not required as the amplifiers and logic do not change on a pixel by pixel (color to color) basis as in traditional Bayer patterned designs.

[0085] Black level control 1414.3A-1414.3D assesses the level of noise within the signal, and filters it out. With each array focused upon a narrower band of visible spectrum than traditional image sensors, the black level control can be more finely tuned to eliminate noise.

[0086] Exposure control 1414.4A-1414.4D measures the overall volume of light being captured by the array and adjusts the capture time for image quality. Traditional cameras must make this determination on a global basis (for all colors). The embodiments describe herein allow for exposure control to occur differently for each array and targeted band of wavelengths.

[0087] These processed images are then passed to a second group of signal processing circuitry 1416. First, image processing logic 1416.1 integrates the multiple color planes into a single color image. The image is adjusted for saturation, sharpness, intensity, hue, artifact removal, and defective pixel correction.

[0088] In an embodiment, the final two operations include encoding the signal into standard protocols such as MPEG, JPEG, etc. in an encoder 1416.2 before passing the result to a standard output interface 1416.3, such as USB.

[0089] Although the signal processing circuitries 1414 and 1416 are shown at specific areas of the image sensor, the signal processing circuitries 1414 and 1416 can be placed anywhere on the chip and subdivided in any fashion. The signal processing circuitries are often placed in multiple locations.

[0090] As previously stated, the image sensor 1404 generally includes a semiconductor chip having several higher order features including multiple arrays (1404A-1404D), and signal processing circuitry 1414, in which each array and the related signal processing circuitry is preferably tailored to address a specific band of visible spectrum. As noted above, the image sensor array can be configured using any multiple numbers and shapes of arrays.

[0091] The image sensor 1404 can be constructed using any suitable technology, including silicon and germanium technologies. The pixels can be formed in any suitable manner, can be sized and dimensioned as desired, and can be distributed in any desired pattern. Pixels that are distributed without any regular pattern may also be used.

[0092] Any range of visible spectrum can be applied to each array depending on the specific interest of the customer. Further, an infrared array could also be employed as one of the array/lens combinations giving low light capabilities to the sensor.

[0093] As previously described, arrays 1404A-1404D may be of any size or shape. While some figures referenced herein show the arrays as individual, discrete sections of the image sensor, these arrays may also be touching. There may also be one large array configured such that the array is subdivided into sections, and each section is focused upon one band of spectrum, creating the same effect as separate arrays on the same chip.

[0094] Although the well depth of the photo detectors across each individual array 1404 may be the same, the well depth of any given array may be different from that of other arrays of the sensor subsystem. A photo detector includes an area or portion of the photo detector that captures, collects, is responsive to, detects and/or senses the intensity illumination of incident light. In some embodiments, the well depth is the distance from the surface of the photo detector to a doped region.

[0095] Selection of an appropriate well depth depends on many factors, including the targeted band of visible spectrum. Since each entire array is likely to be targeted at one band of visible spectrum (e.g., red) the well depth can be configured to capture that wavelength and ignore others (e.g., blue, green). Doping of the semiconductor material in the color specific arrays can further be used to enhance the selectivity of the photon absorption for color-specific wavelengths.

[0096] In various embodiments, a digital camera subsystem can have multiple separate arrays on a single image sensor, each with its own lens. The simple geometry of smaller, multiple arrays allows for a smaller lenses (e.g., smaller diameter, thickness and focal length), which allows for reduced stack height in the digital camera.

[0097] The lens and frame concept is applicable to traditional image sensors (without the traditional color filter sheet) to gain physical size, cost and performance advantages.

[0098] Each array can advantageously be focused on one band of visible and/or detectable spectrum. Among other things, each lens may be tuned for passage of one specific band of wavelength. Since each lens would therefore not need to pass the entire light spectrum, the number of elements may be reduced, for example, to one or two.

[0099] Further, due to the focused bandwidth for each lens, each of the lenses may be dyed during the manufacturing process for its respective bandwidth (e.g., red for the array targeting the red band of visible spectrum). Alternatively, a single color filter may be applied across each lens. This process eliminates the traditional color filters (such as the sheet of individual pixel filters) thereby reducing cost, improving signal strength and eliminating the pixel reduction barrier.

[0100] The above-described devices can include any suitable number of combinations, including as few as two arrays/lenses, and many more than two arrays/lenses. Examples include: two arrays/lenses configured as red/green and blue; two arrays/lenses configured as red and blue/green; two arrays/lenses configured as red, green, blue; four arrays/lenses configured as red, blue, green, emerald (for color enhancement); four arrays/lenses configured as red, blue, green, infrared (for low light conditions); and eight arrays/lenses configured as double the above configurations for additional pixel count and image quality.

[0101] The cameras or camera subsystems described herein are intended to be emblematic of a generic appliance containing the digital camera subsystem. Thus, the description herein should be interpreted as being emblematic of still and video cameras, cell phones, other personal communications devices, surveillance equipment, automotive applications, computers, manufacturing and inspection devices, toys, plus a wide range of other and continuously expanding applications. Of course these alternative interpretations may or may not include the specific components as depicted herein. For example, the circuit board may not be unique to the camera function but rather the digital camera subsystem may be an add-on to an existing circuit board, such as in a cell phone.

[0102] Any or all of the methods and/or apparatus disclosed herein may be employed in any type of apparatus or process including, but not limited to still and video cameras, cell phones, other personal communications devices, surveillance equipment, automotive applications, computers, manufacturing and inspection devices, toys, plus a wide range of other and continuously expanding applications.

[0103] Although each array and the related signal processing circuitry is can be tailored to address a specific band of visible spectrum, and each lens may be tuned for passage of that one specific band of wavelength, there is no requirement that each such array and the related signal processing circuitry be tailored to address a specific band of the visible spectrum. Nor

is there any requirement that each lens be tuned for passage of a specific band of wavelength or that each of the arrays be located on the same semiconductor device. Indeed, the embodiments described and illustrated herein, including the specific components thereof, need not employ wavelength-specific features. For example, the arrays and/or signal processing circuitry need not be tailored to address a specific wavelength or band of wavelengths.

[0104] FIG. 15 is an exploded perspective view of a digital camera 1500, under an embodiment. The digital camera apparatus 1500 includes one or more sensor arrays, e.g., four sensor arrays 1504A-1504D, and one or more optics portions, e.g., four optics portions 1512A-1512D. Each of the optics portions 1504A-1504D may include a lens, and may be associated with a respective one of the sensor arrays sensor arrays 1504A-1504D. In some embodiments a support 1502, for example a frame, is provided to support the one or more optics portions 1512A-1512D, at least in part. Each sensor array and the respective optics portion may define an optical channel. For example, an optical channel 1506A may be defined by the optics portion 1512A and the sensor array 1504A. An optical channel 1506B may be defined by the optics portion 1512B and the sensor array 1504B. An optical channel 1506C may be defined by optics portion 1512C and the sensor array 1504C. An optical channel 1506D may be defined by optics portion 1512D and a sensor array 1504D. The optics portions of the one or more optical channels are also collectively referred to as an optics subsystem.

[0105] The sensor arrays of the one or more optical channels are collectively referred as a sensor subsystem. The two or more sensor arrays may be integrated in or disposed on a common substrate, referred to as an image device, on separate substrates, or any combination thereof. For example, where the system includes three or more sensor arrays, two or more sensor arrays may be integrated in a first substrate, and one or more other sensor arrays may be integrated in or disposed on a second substrate.

[0106] In that regard, the one or more sensor arrays 1504A-1504D, may or may not be disposed on a common substrate. For example, in some embodiments two or more of the sensor arrays are disposed on a common substrate. In some embodiments, however, one or more of the sensor arrays is not disposed on the same substrate as one or more of the other sensor arrays. The one or more optical channels may or may not be identical to one another.

[0107] In some embodiments, one of the optical channels 1506 detects red light, one of the optical channels 1506 detects green light, and one of the optical channels 1506 detects blue light. In some of such embodiments, one of the optical channels 1506 detects infrared light, cyan light, or emerald light. In some other embodiments, one of the optical channels 1506 detects cyan light, one of the optical channels 1506 detects yellow light, one of the optical channels 1506 detects magenta light and one of the optical channels 1506 detects clear light (black and white). Any other wavelength or band of wavelengths (whether visible or invisible) combinations can also be used.

[0108] A processor 1514 is coupled to the one or more sensor arrays 1504A-1504D, via one or more communication links, e.g., communication links 1508A-1508D, respectively. A communication link may be any kind of communication link including but not limited to, for example, wired (e.g., conductors, fiber optic cables) or wireless (e.g., acoustic links, electromagnetic links or any combination thereof including but not limited to microwave links, satellite links, infrared links), and combinations thereof, each of which may be public or private, dedicated and/or shared (e.g., a network). A communication link may include for example circuit switching or packet switching or combinations thereof. Other examples of communication links include dedicated point-to-point systems, wired networks, and cellular telephone systems. A communication link may employ any protocol or combination of protocols including but not limited to the Internet Protocol.

[0109] The communication link may transmit any type of information. The information may have any form, including, for example, but not limited to, analog and/or digital) e.g., a sequence of binary values, or a bit string). The information may or may not be divided into blocks. If divided into blocks, the amount of information in a block may be predetermined or determined dynamically, and/or may be fixed (e.g., uniform) or variable.

[0110] As will be further described hereinafter, the processor may include one or more channel processors, each of which is coupled to a respective one (or more) of the optical channels and generates an image based at least in part on the signal(s) received from the respective optical channel, although this is not required. In some embodiments, one or more of the channel processors is tailored to its respective optical channel, for example, as described herein. For example, when one of the optical channels is dedicated to a specific wavelength or color (or band of wavelengths or colors) the respective channel processor may

be adapted or tailored to such wavelength or color (or band of wavelengths or colors).

Further, the gain, noise reduction, dynamic range, linearity and/or any other characteristic of the processor, or combinations of such characteristics, may be adapted to improve and/or optimize the processor to such wavelength or color (or band of wavelengths or colors).

Tailoring the channel processing to the respective optical channel may facilitate generating an image of a quality that is higher than the quality of images resulting from traditional image sensors of like pixel count. In addition, providing each optical channel with a dedicated channel processor may help to reduce or simplify the amount of logic in the channel processors as the channel processor may not need to accommodate extreme shifts in color or wavelength, e.g., from a color (or band of colors) or wavelength (or band of wavelengths) at one extreme to a color (or band of colors) or wavelength (or band of wavelengths) at another extreme.

[0111] In operation, an optics portion of a optical channel receives light from within a field of view and transmits one or more portions of such light, e.g., in the form of an image at an image plane. The sensor array receives one or more portions of the light transmitted by the optics portion and provides one or more output signals indicative thereof. The one or more output signals from the sensor array are supplied to the processor. In some embodiments, the processor generates one or more output signals based, at least in part, on the one or more signals from the sensor array. In some other embodiments, the processor may generate a combined image based, at least in part, on the images from two or more of such optical channels.

[0112] Although the processor 1514 is shown separate from the one or more sensor arrays 1504A-1504D, the processor 1514, or portions thereof, may have any configuration and may be disposed in one or more locations. For example, certain operations of the processor may be distributed to or performed by circuitry that is integrated in or disposed on the same substrate or substrates as one or more of the one or more of the sensor arrays and certain operations of the processor are distributed to or performed by circuitry that is integrated in or disposed on one or more substrates that are different from (whether such one or more different substrates are physically located within the camera or not) the substrates the one or more of the sensor arrays are integrated in or disposed on.

[0113] The digital camera apparatus 1500 may or may not include a shutter, a flash and/or a frame to hold the components together.

[0114] FIGS. 16A-16D are schematic exploded representations of one embodiment of an optics portion, such as optic portion 1512A, under an embodiment. In FIG. 16A, the optics portion 1512A includes one or more lenses, e.g., a complex aspherical lens module 1680, one or more color coatings, e.g., a color coating 1682, one or more masks, e.g., an auto focus mask 1684, and one or more IR coatings, e.g., an IR coating 1686.

[0115] Lenses can comprise any suitable material or materials, including for example, glass and plastic. Lenses can be doped in any suitable manner, such as to impart a color filtering, polarization, or other property. Lenses can be rigid or flexible. In this regard, some embodiments employ a lens (or lenses) having a dye coating, a dye diffused in an optical medium (e.g., a lens or lenses), a substantially uniform color filter and/or any other filtering technique through which light passes to the underlying array.

[0116] The color coating 1682 helps the optics portion filter (or substantially attenuate) one or more wavelengths or bands of wavelengths. The auto focus mask 1684 may define one or more interference patterns that help the digital camera apparatus perform one or more auto focus functions. The IR coating 1686 helps the optics portion 1512A filter a wavelength or band of wavelength in the IR portion of the spectrum.

[0117] The one or more color coatings, e.g., color coating 1682, one or more masks, e.g., mask 1684, and one or more IR coatings, e.g., IR coating 1686 may have any size, shape and/or configuration.

[0118] In some embodiments, as shown in FIG. 16B, one or more of the one or more color coatings, e.g., the color coating 1682, are disposed at the top of the optics portion. Some embodiments of the optics portion (and/or components thereof) may or may not include the one or more color coatings, one or more masks and one or more IR coatings and may or may not include features in addition thereto or in place thereof.

[0119] In some embodiments, as shown in FIG. 16C, one or more of the one or more color coatings, e.g., the color coating 1682, are replaced by one or more filters 1688 disposed in the optics portion, e.g., disposed below the lens. In other embodiments, as shown in FIG. 16D, one or more of the color coatings are replaced by one or more dyes diffused in the lens.

[0120] The one or more optics portions, e.g., optics portions 1512A-1512D of FIG. 15, may or may not be identical to one another. In some embodiments, for example, the optics portions are identical to one another. In some other embodiments, one or more of the optics portions are different, in one or more respects, from one or more of the other optics portions. For example, in some embodiments, one or more of the characteristics (for example, but not limited to, its type of element(s), size, response, and/or performance) of one or more of the optics portions is tailored to the respective sensor array and/or to help achieve a desired result. For example, if a particular optical channel is dedicated to a particular color (or band of colors) or wavelength (or band of wavelengths) then the optics portion for that optical channel may be adapted to transmit only that particular color (or band of colors) or wavelength (or band of wavelengths) to the sensor array of the particular optical channel and/or to filter out one or more other colors or wavelengths. In some of such embodiments, the design of an optical portion is optimized for the respective wavelength or bands of wavelengths to which the respective optical channel is dedicated. It should be understood, however, that any other configurations may also be employed. Each of the one or more optics portions may have any configuration.

[0121] In some embodiments, each of the optics portions, e.g., optics portions 1512A-1512D of FIG. 15, comprises a single lens element or a stack of lens elements (or lenslets), although, as stated above. For example, in some embodiments, a single lens element, multiple lens elements and/or compound lenses, with or without one or more filters, prisms and/or masks are employed.

[0122] An optical portion can also contain other optical features that are desired for digital camera functionality and/or performance. For example, these features can include electronically tunable filters, polarizers, wavefront coding, spatial filters (masks), and other features not yet anticipated. Some of the features (in addition to the lenses) are electrically operated (such as a tunable filter), or are mechanically movable with MEMs mechanisms.

[0123] In some embodiments, one or more photochromic (or photochromatic) materials are employed in one or more of the optical portions. The one or more materials may be incorporated into an optical lens element or as another feature in the optical path, for example, above one or more of the sensor arrays. In some embodiments, photochromatic materials may be incorporated into a cover glass at the camera entrance (common aperture) to

all optics (common to all optical channels), or put into the lenses of one or more optical channels, or into one or more of the other optical features included into the optical path of an optics portion over any sensor array.

[0124] FIGS. 17A-17C are schematic representations of one embodiment of a sensor array 1704. The sensor array is similar to one of the sensor arrays 1504A-1504D of FIG. 15, for example. As shown in FIG. 17A, the sensor array 1704 is coupled to circuits 1770, 1772, and 1774. The sensor array 1704 captures light and converts it into one or more signals, such as electrical signals, which are supplied to one or more of the circuits 1770, 1772, and 1774. The sensor array 1704 includes a plurality of sensor elements such as for example, a plurality of identical photo detectors (sometimes referred to as "picture elements" or "pixels"), e.g., pixels 1780_{1,1}-1780_{n,m}. The photo detectors 1780_{1,1}-1780_{n,m}, are arranged in an array, for example a matrix-type array. The number of pixels in the array may be, for example, in a range from hundreds of thousands to millions. The pixels may be arranged for example, in a two-dimensional array configuration, for example, having a plurality of rows and a plurality of columns, e.g., 640 by 480, 1280 by 1024, etc. However, the pixels can be sized and dimensioned as desired, and can be distributed in any desired pattern. Pixels that are distributed without any regular pattern can also be used. Referring to FIG. 17B, a pixel, for example pixel 1780_{1,1}, may be viewed as having x and y dimensions, although the photon capturing portion of a pixel may or may not occupy the entire area of the pixel and may or may not have a regular shape. In some embodiments, the sensor elements are disposed in a plane, referred to herein as a sensor plane. The sensor may have orthogonal sensor reference axes, including for example, an x-axis, a y-axis, and a z-axis, and may be configured so as to have the sensor plane parallel to the x-y plane XY and directed toward the optics portion of the optical channel. Each optical channel has a field of view corresponding to an expanse viewable by the sensor array. Each of the sensor elements may be associated with a respective portion of the field of view.

[0125] The sensor array may employ any type of technology, for example, but not limited to MOS pixel technologies (e.g., one or more portions of the sensor are implemented in "Metal Oxide Semiconductor" technology), charge coupled device (CCD) pixel technologies, or combination of both. The sensor array may comprise any suitable material or materials,

including, but not limited to, silicon, germanium and/or combinations thereof. The sensor elements or pixels may be formed in any suitable manner.

[0126] In operation, the sensor array 1704A, is exposed to light on a sequential line per line basis (similar to a scanner, for example) or globally (similar to conventional film camera exposure, for example). After being exposed to light for certain period of time (exposure time), the pixels $1780_{1,1}$ - $1780_{n,m}$, are read out, e.g., on a sequential line per line basis.

[0127] In some embodiments, circuitry 1770, also referred to as column logic 1770, is used to read the signals from the pixels $1780_{1,1}$ - $1780_{n,m}$. FIG. 17C is a schematic representation of a pixel circuit. The pixels $1780_{1,1}$ - $1780_{n,m}$, also referred to as sensor elements, may be accessed one row at a time by asserting one of the word lines 1782, which run horizontally through the sensor array 1704A. A single pixel $1780_{1,1}$ is shown. Data is passed into and/or out of the pixel $1780_{1,1}$ via bit lines (such as bit line 1784) which run vertically through the sensor array 1704A.

[0128] The pixels are not limited to the configurations shown in FIGS. 17A-17C. As stated above, each of the one or more sensor arrays may have any configuration (e.g., size, shape, pixel design).

[0129] The sensor arrays 1502A-1502D of FIG. 15 may or may not be identical to one another. In some embodiments, for example, the sensor arrays are identical to one another. In some other embodiments, one or more of the sensor arrays are different, in one or more respects, from one or more of the other sensor arrays. For example, in some embodiments, one or more of the characteristics (for example, but not limited to, its type of element(s), size (for example, surface area), and/or performance) of one or more of the sensor arrays is tailored to the respective optics portion and/or to help achieve a desired result.

[0130] FIG. 18 is a schematic cross-sectional view of a digital camera apparatus 1800 including a printed circuit board 1820 of a digital camera on which the digital camera elements are mounted, under an embodiment. In this embodiment, the one or more optics portions, e.g., optics portions 1812A and 1812B are seated in and/or affixed to a support 1814. The support 1814 (for example a frame) is disposed superjacent a first bond layer 1822, which is disposed superjacent an image device 1820, in or on which sensor portions 1812A-1812D (sensor portions 1812C and 1812D are not shown), are disposed and/or integrated.

The image device 1820 is disposed superjacent a second bond layer 1824 which is disposed superjacent the printed circuit board 1821.

[0131] The printed circuit board 1821 includes a major outer surface 1830 that defines a mounting region on which the image device 1820 is mounted. The major outer surface 1830 may further define and one or more additional mounting regions (not shown) on which one or more additional devices used in the digital camera may be mounted. One or more pads 1832 are provided on the major outer surface 1830 of the printed circuit board to connect to one or more of the devices mounted thereon.

[0132] The image device 1820 includes the one or more sensor arrays (not shown), and one or more electrically conductive layers. In some embodiments, the image device 1820 further includes one, some or all portions of a processor for the digital camera apparatus 1800. The image device 1820 further includes a major outer surface 1840 that defines a mounting region on which the support 1814 is mounted.

[0133] The one or more electrically conductive layers may be patterned to define one or more pads 1842 and one or more traces (not shown) that connect the one or more pads to one or more of the one or more sensor arrays. The pads 1842 are disposed, for example, in the vicinity of the perimeter of the image device 1820, for example along one, two, three or four sides of the image device 1820. The one or more conductive layers may comprise, for example, copper, copper foil, and/or any other suitably conductive material(s).

[0134] A plurality of electrical conductors 1850 may connect one or more of the pads 1842 on the image device 1820 to one or more of the pads 1832 on the circuit board 1821. The conductors 1850 may be used, for example, to connect one or more circuits on the image device 1820 to one or more circuits on the printed circuit board 1821.

[0135] The first and second bond layers 1822 and 1824 may comprise any suitable material(s), including but not limited to adhesive, and may comprise any suitable configuration. The first and second bond layers 1822, 1824 may comprise the same material(s) although this is not required. As used herein, a bond layer may be continuous or discontinuous. For example, a conductive layer may be an etched printed circuit layer. Moreover, a bond layer may or may not be planar or even substantially planar. For example, a conformal bond layer on a non-planar surface will be non-planar.

[0136] FIG. 19 is a schematic perspective view of a digital camera apparatus having one or more optics portions with the capability to provide color separation in accordance with one embodiment of the present invention. In some of such embodiments, one or more of the optics portions, e.g., optics portion 1912C includes an array of color filters, for example, but not limited to a Bayer pattern. In some of such embodiments, one or more of the optics portions, e.g., optics portion 1912C has the capability to provide color separation similar to that which is provided by a color filter array.

[0137] In some embodiments, the lens and/or filter of the optical channel may transmit both of such colors or bands of colors, and the optical channel may include one or more mechanisms elsewhere in the optical channel to separate the two colors or two bands of colors. For example, a color filter array may be disposed between the lens and the sensor array, and/or the optical channel may employ a sensor capable of separating the colors or bands of colors. In some of the latter embodiments, the sensor array may be provided with pixels that have multiband capability, e.g., two or three colors. For example, each pixel may comprise two or three photodiodes, wherein a first photodiode is adapted to detect a first color or first band of colors, a second photodiode is adapted to detect a second color or band of colors and a third photodiode is adapted to detect a third color or band of colors. One way to accomplish this is to provide the photodiodes with different structures and/or characteristics that make them selective, such that the first photodiode has a higher sensitivity to the first color or first band of colors than to the second color or band of colors, and the second photodiode has a higher sensitivity to the second color or second band of colors than to the first color or first band of colors. Alternatively, the photodiodes are disposed at different depths in the pixel, taking advantage of the different penetration and absorption characteristics of the different colors or bands of colors. For example, blue and blue bands of colors penetrate less (and are thus absorbed at a lesser depth) than green and green bands of colors, which in turn penetrate less (and are thus absorbed at a lesser depth) than red and red bands of colors. In some embodiments, such a sensor array is employed, even though the pixels may see only one particular color or band of colors, for example, to in order to adapt such sensor array to the particular color or band of colors.

[0138] FIG. 20A is a block diagram of a processor 2002 of a digital camera subsystem 2000, under an embodiment. In this embodiment, the processor 2002 includes one or more

channel processors, one or more image pipelines, and/or one or more image post processors. Each of the channel processors is coupled to a respective one of the optical channels (not shown) and generates an image based at least in part on the signal(s) received from the respective optical channel. In some embodiments the processor 2002 generates a combined image based at least in part on the images from two or more of the optical channels. In some embodiments, one or more of the channel processors are tailored to its respective optical channel, as previously described.

[0139] In various embodiments, the gain, noise reduction, dynamic range, linearity and/or any other characteristic of the processor, or combinations of such characteristics, may be adapted to improve and/or optimize the processor to a wavelength or color (or band of wavelengths or colors). Tailoring the channel processing to the respective optical channel makes it possible to generate an image of a quality that is higher than the quality of images resulting from traditional image sensors of like pixel count. In such embodiments, providing each optical channel with a dedicated channel processor helps to reduce or simplify the amount of logic in the channel processors, as the channel processor may not need to accommodate extreme shifts in color or wavelength, e.g., from a color (or band of colors) or wavelength (or band of wavelengths) at one extreme to a color (or band of colors) or wavelength (or band of wavelengths) at another extreme

[0140] The images (and/or data which is representative thereof) generated by the channel processors are supplied to the image pipeline, which may combine the images to form a full color or black/white image. The output of the image pipeline is supplied to the post processor, which generates output data in accordance with one or more output formats.

[0141] FIG. 20B shows one embodiment of a channel processor. In this embodiment, the channel processor includes column logic, analog signal logic, and black level control and exposure control. The column logic is coupled to the sensor and reads the signals from the pixels. Each of the column logic, analog signal logic, black level control and exposure control can be configured for processing as appropriate to the corresponding optical channel configuration (e.g., specific wavelength or color, etc.). For example, the analog signal logic is optimized, if desired, for processing. Therefore, gain, noise, dynamic range and/or linearity, etc., are optimized as appropriate to the corresponding optical channel configuration (e.g., a specific wavelength or color, etc.). As another example, the column logic may employ an

integration time or integration times adapted to provide a particular dynamic range as appropriate to the corresponding optical channel.

[0142] The output of the analog signal logic is supplied to the black level control, which determines the level of noise within the signal, and filters out some or all of such noise. If the sensor coupled to the channel processor is focused upon a narrower band of visible spectrum than traditional image sensors, the black level control can be more finely tuned to eliminate noise.

[0143] The output of the black level control is supplied to the exposure control, which measures the overall volume of light being captured by the array and adjusts the capture time for image quality. Traditional cameras must make this determination on a global basis (for all colors). In the camera of an embodiment, however, the exposure control can be specifically adapted to the wavelength (or band of wavelengths) to which the sensor is configured. Each channel processor is thus able to provide a capture time that is specifically adapted to the sensor and/or specific color (or band of colors) targeted, and which may be different than the capture time provided by another channel processor for another optical channel.

[0144] FIG. 20C is a block diagram of the image pipeline, under an embodiment. In this embodiment, the image pipeline includes two portions. The first portion includes a color plane integrator and an image adjustor. The color plane integrator receives an output from each of the channel processors and integrates the multiple color planes into a single color image. The output of the color plane integrator, which is indicative of the single color image, is supplied to the image adjustor, which adjusts the single color image for saturation, sharpness, intensity and hue. The adjustor also adjusts the image to remove artifacts and any undesired effects related to bad pixels in the one or more color channels. The output of the image adjustor is supplied to the second portion of the pipeline, which provides auto focus, zoom, windowing, pixel binning and camera functions.

[0145] FIG. 20D is a block diagram of the image post processor, under an embodiment. In this embodiment, the image post processor includes an encoder and an output interface. The encoder receives the output signal from the image pipeline and provides encoding to supply an output signal in accordance with one or more standard protocols (e.g., MPEG and/or JPEG). The output of the encoder is supplied to the output interface, which provides encoding

to supply an output signal in accordance with a standard output interface, e.g., universal serial bus (USB) interface.

[0146] FIG. 21 is a block diagram of digital camera system, including system control components, under an embodiment. The system control portion includes a serial interface, configuration registers, power management, voltage regulation and control, timing and control, a camera control interface and a serial interface, but is not so limited. In some embodiments, the camera interface comprises an interface that processes signals that are in the form of high level language (HLL) instructions. In some embodiments the camera interface comprises an interface that processes control signals that are in the form of low level language (LLL) instructions and/or of any other form now known or later developed. Some embodiments may process both HLL instructions and LLL instructions.

[0147] As used herein, the following terms are interpreted as described below, unless the context requires a different interpretation.

[0148] "Array" means a group of photodetectors, also know as pixels, which operate in concert to create one image. The array captures photons and converts the data to an electronic signal. The array outputs this raw data to signal processing circuitry that generates the image sensor image output.

[0149] "Digital Camera" means a single assembly that receives photons, converts them to electrical signals on a semiconductor device ("image sensor"), and processes those signals into an output that yields a photographic image. The digital camera would included any necessary lenses, image sensor, shutter, flash, signal processing circuitry, memory device, user interface features, power supply and any mechanical structure (e.g. circuit board, housing, etc) to house these components. A digital camera may be a stand-alone product or may be imbedded in other appliances, such as cell phones, computers or the myriad of other imaging platforms now available or to be created in the future, such as those that become feasible as a result of this invention.

[0150] "Digital Camera Subsystem" (DCS) means a single assembly that receives photons, converts them to electrical signals on a semiconductor device ("image sensor") and processes those signals into an output that yields a photographic image. The Digital Camera Subsystem includes any necessary lenses, image sensor, signal processing circuitry, shutter, flash and

any frame to hold the components as may be required. The power supply, memory devices and any mechanical structure are not necessarily included.

[0151] "Electronic media" means that images are captured, processed and stored electronically as opposed to the use of film.

[0152] "Frame" or "thin plate" means the component of the DCS that is used to hold the lenses and mount to the image sensor.

[0153] "Image sensor" means the semiconductor device that includes the photon detectors ("pixels"), processing circuitry and output channels. The inputs are the photons and the output is the image data.

[0154] "Lens" means a single lens or series of stacked lenses (a column one above the other) that shape light rays above an individual array. When multiple stacks of lenses are employed over different arrays, they are called "lenses."

[0155] "Package" means a case or frame that an image sensor (or any semiconductor chip) is mounted in or on, which protects the imager and provides a hermetic seal.

[0156] "Packageless" refers to those semiconductor chips that can be mounted directly to a circuit board without need of a package.

[0157] The terms "Photo-detector" and "pixels" mean an electronic device that senses and captures photons and converts them to electronic signals. These extremely small devices are used in large quantities (hundreds of thousands to millions) in a matrix to capture an image.

[0158] "Semiconductor Chip" means a discrete electronic device fabricated on a silicon or similar substrate, which is commonly used in virtually all electronic equipment.

[0159] "Signal Processing Circuitry" means the hardware and software within the image sensor that translates the photon input information into electronic signals and ultimately into an image output signal.

[0160] Aspects of the digital camera systems and methods described herein may be implemented as functionality programmed into any of a variety of circuitry, including programmable logic devices (PLDs), such as field programmable gate arrays (FPGAs), programmable array logic (PAL) devices, electrically programmable logic and memory devices and standard cell-based devices, as well as application specific integrated circuits (ASICs). Some other possibilities for implementing aspects of the digital camera systems and methods include: microcontrollers with memory (such as electronically erasable

programmable read only memory (EEPROM)), embedded microprocessors, firmware, software, etc. Furthermore, aspects of the digital camera systems and methods may be embodied in microprocessors having software-based circuit emulation, discrete logic (sequential and combinatorial), custom devices, fuzzy (neural) logic, quantum devices, and hybrids of any of the above device types. Of course the underlying device technologies may be provided in a variety of component types, e.g., metal-oxide semiconductor field-effect transistor (MOSFET) technologies like complementary metal-oxide semiconductor (CMOS), bipolar technologies like emitter-coupled logic (ECL), polymer technologies (e.g., silicon-conjugated polymer and metal-conjugated polymer-metal structures), mixed analog and digital, etc.

[0161] It should be noted that components of the various systems and methods disclosed herein may be described using computer aided design tools and expressed (or represented), as data and/or instructions embodied in various computer-readable media, in terms of their behavioral, register transfer, logic component, transistor, layout geometries, and/or other characteristics. Computer-readable media in which such formatted data and/or instructions may be embodied include, but are not limited to, non-volatile storage media in various forms (e.g., optical, magnetic or semiconductor storage media).

[0162] Examples of transfers of such formatted data and/or instructions by carrier waves include, but are not limited to, transfers (uploads, downloads, e-mail, etc.) over the Internet and/or other computer networks via one or more data transfer protocols (e.g., HTTP, FTP, SMTP, etc.). When received within a computer system via one or more computer-readable media, such data and/or instruction-based expressions of the above described systems and methods may be processed by a processing entity (e.g., one or more processors) within the computer system in conjunction with execution of one or more other computer programs.

[0163] Unless the context clearly requires otherwise, throughout the description and the claims, the words "comprise," "comprising," and the like are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in a sense of "including, but not limited to." Words using the singular or plural number also include the plural or singular number respectively. Additionally, the words "herein," "hereunder," "above," "below," and words of similar import refer to this application as a whole and not to any particular portions of this application. When the word "or" is used in reference to a list of two

or more items, that word covers all of the following interpretations of the word: any of the items in the list, all of the items in the list and any combination of the items in the list.

[0164] The above description of illustrated embodiments of the digital camera systems and methods is not intended to be exhaustive or to limit the digital camera systems and methods to the precise form disclosed. While specific embodiments of, and examples for, the digital camera systems and methods are described herein for illustrative purposes, various equivalent modifications are possible within the scope of the digital camera systems and methods, as those skilled in the relevant art will recognize. The teachings of the digital camera systems and methods provided herein can be applied to other processing systems and methods, not only for the systems and methods described above.

[0165] The elements and acts of the various embodiments described above can be combined to provide further embodiments. These and other changes can be made to the digital camera systems and methods in light of the above detailed description.

[0166] In general, in the following claims, the terms used should not be construed to limit the digital camera systems and methods to the specific embodiments disclosed in the specification and the claims, but should be construed to include all systems that operate under the claims. Accordingly, the digital camera systems and methods are not limited by the disclosure, but instead the scope of the digital camera systems and methods is to be determined entirely by the claims.

[0167] While certain aspects of the digital camera systems and methods are presented below in certain claim forms, the inventors contemplate the various aspects of the digital camera systems and methods in any number of claim forms. Accordingly, the inventors reserve the right to add additional claims after filing the application to pursue such additional claim forms for other aspects of the digital camera systems and methods.

WHAT IS CLAIMED IS:

1. A digital camera comprising:
a first channel and a second channel, wherein the first channel includes a first optics component and a first sensor, wherein the second channel includes a second optics component and a second sensor, and wherein the first sensor includes a first array of photo-detectors and the second sensor includes a second array of photo-detectors; and
a processing component operatively coupled to the first channel and to the second channel, wherein the processing component is configured to separately control an integration time of each channel, wherein a first integration time of the first channel is less than a second integration time of the second channel, and wherein the processing component is configured to combine data captured by each of the first channel and the second channel to generate an image.
2. The digital camera of claim 1, further comprising an interface operatively coupled to the processing component, wherein the interface is configured to receive the first integration time as an input to the digital camera.
3. The digital camera of claim 1, further comprising an interface operatively coupled to the processing component, wherein the interface is configured to receive an indication of an amount of incident light as an input.
4. The digital camera of claim 3, wherein processing component is further configured to determine at least the first integration time based at least in part on the indication of the amount of incident light.
5. The digital camera of claim 1, wherein the first integration time is used to control an amount of electrical charge placed on one or more storage devices associated with the first sensor of the first channel.
6. The digital camera of claim 5, wherein the one or more storage devices comprise one or more capacitors, and wherein each photo-detector in the first array of photo-detectors includes a capacitor.
7. The digital camera of claim 1, further comprising a semiconductor substrate on which the first channel and the second channel are integrated.

8. The digital camera of claim 1, wherein the first integration time falls within a range of integration times, and wherein the range of integration times has a minimum integration time and a maximum integration time.

9. The digital camera of claim 8, wherein a ratio of the maximum integration time to the minimum integration time is 25.

10. The digital camera of claim 8, further comprising a third channel operatively coupled to the processing component, wherein the first channel, the second channel, and the third channel each have a distinct integration time within the range of integration times so that one or more bright objects and one or more dark objects are captured in the image.

11. The digital camera of claim 1, wherein the first sensor and the second sensor are configured to image a same field of view.

12. The digital camera of claim 1, wherein the image corresponds to a first frame, and wherein the processing component is further configured to determine one or more integration times for a second frame based at least in part on the image.

13. A tangible computer-readable medium having stored thereon, computer-executable instructions that, upon execution, cause a digital camera to perform a method comprising:

identifying an integration time for each of a plurality of channels of the digital camera, wherein each of the plurality of channels includes a sensor;

controlling each sensor based at least in part on the integration time corresponding to a channel that includes the sensor, wherein a first integration time of a first channel is less than a second integration time of a second channel; and

generating an image by combining data captured with each sensor.

14. The tangible computer-readable medium of claim 13, wherein identifying the integration time for each of the plurality of channels comprises receiving an input through an interface of the digital camera.

15. The tangible computer-readable medium of claim 14, wherein the input specifies at least one integration time.

16. The tangible computer-readable medium of claim 14, wherein the input comprises an indication of an amount of light incident on a subject of the image.

17. The tangible computer-readable medium of claim 13, wherein controlling each sensor comprises providing an electrical charge to each sensor for a period of time, wherein the period of time comprises the integration time corresponding to the sensor.

18. The tangible computer-readable medium of claim 17, wherein the electrical charge is stored on or more capacitors of the sensor.

19. The tangible computer-readable medium of claim 13, further comprising determining a subsequent integration time for each channel to use during a subsequent frame, wherein each subsequent integration time is determined based at least in part on the image.

20. The tangible computer-readable medium of claim 13, wherein identifying the integration time for each of the plurality of channels includes accessing predetermined integration times from a memory.

21. A method comprising:
identifying an integration time for each of a plurality of sensors of a digital camera, wherein each of the plurality of sensors comprises a plurality of photo-detectors;
controlling each sensor based at least in part on the integration time corresponding to the sensor, wherein a first integration time of a first sensor is less than a second integration time of a second sensor;
capturing data with each of the plurality of sensors, wherein the data captured by each sensor is based at least in part on the integration time of the sensor; and
generating an image by combining the data captured by each of the plurality of sensors.

22. The method of claim 21, wherein identifying the integration time for each of the plurality of sensors comprises receiving an input through an interface of the digital camera, wherein the input includes at least one of a specific integration time or an amount of light incident on a subject of the image.

23. The method of claim 21, wherein controlling each sensor comprises providing an electrical charge to each sensor for a period of time, wherein the period of time comprises the integration time corresponding to the sensor.

24. The method of claim 23, wherein at least a portion of the electrical charge is provided to each of the plurality of photo-detectors of the sensor.

25. The method of claim 24, further comprising storing at least the portion of the electrical charge on a capacitor associated with each of the plurality of photo-detectors of the sensor.

26. The method of claim 21, further comprising determining a subsequent integration time for each of the plurality of sensors based at least in part on the image.

27. The method of claim 21, further comprising analyzing a previous image generated by the digital camera, wherein the identifying of the integration time for each of the plurality of sensors is based at least in part on the analysis.

28. A digital camera comprising:

means for identifying an integration time for each of a plurality of channels of the digital camera, wherein each of the plurality of channels includes a sensor;

means for controlling each sensor based at least in part on the integration time corresponding to a channel that includes the sensor, wherein a first integration time of a first channel is less than a second integration time of a second channel; and

means for generating an image by combining data captured with each sensor.

29. The digital camera of claim 28, further comprising means for capturing the data with each sensor based at least in part on the integration time corresponding to the channel that includes the sensor.

30. The digital camera of claim 28, further comprising means for storing an electrical charge at each sensor, wherein an amount of the electrical charge is based at least in part on the integration time corresponding to the channel that includes the sensor.

31. The digital camera of claim 28, further comprising means for receiving an input, wherein the input is used by the means for identifying to identify the integration time for each of the plurality of channels.

ABSTRACT OF THE DISCLOSURE

A digital camera includes a plurality of channels and a processing component operatively coupled to the plurality of channels. Each channel of the plurality of channels includes an optics component and a sensor that includes an array of photo-detectors. The processing component is configured to separately control an integration time of each channel, where a first integration time of a first channel is less than a second integration time of a second channel. The processing component is also configured to combine data from the plurality of channels to generate an image.

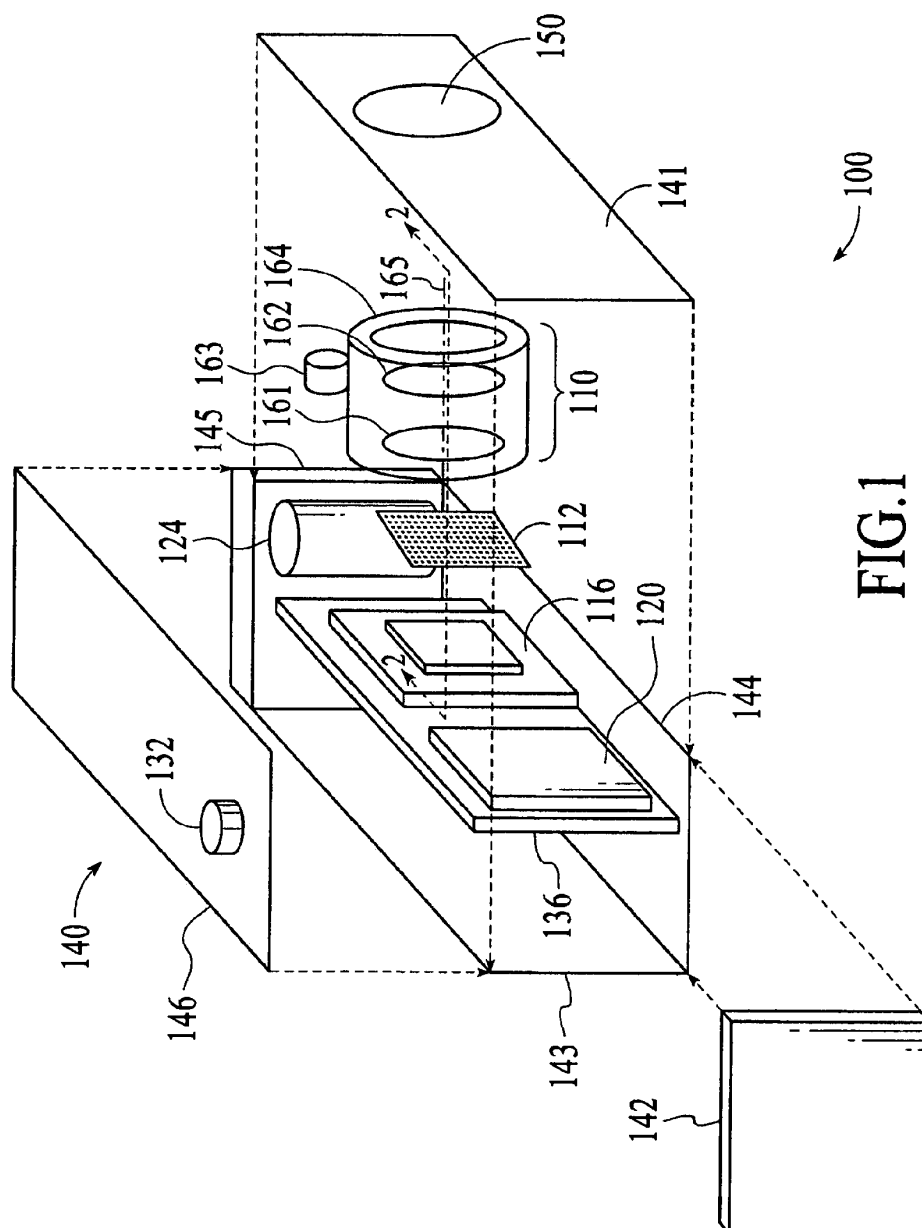


FIG. 1

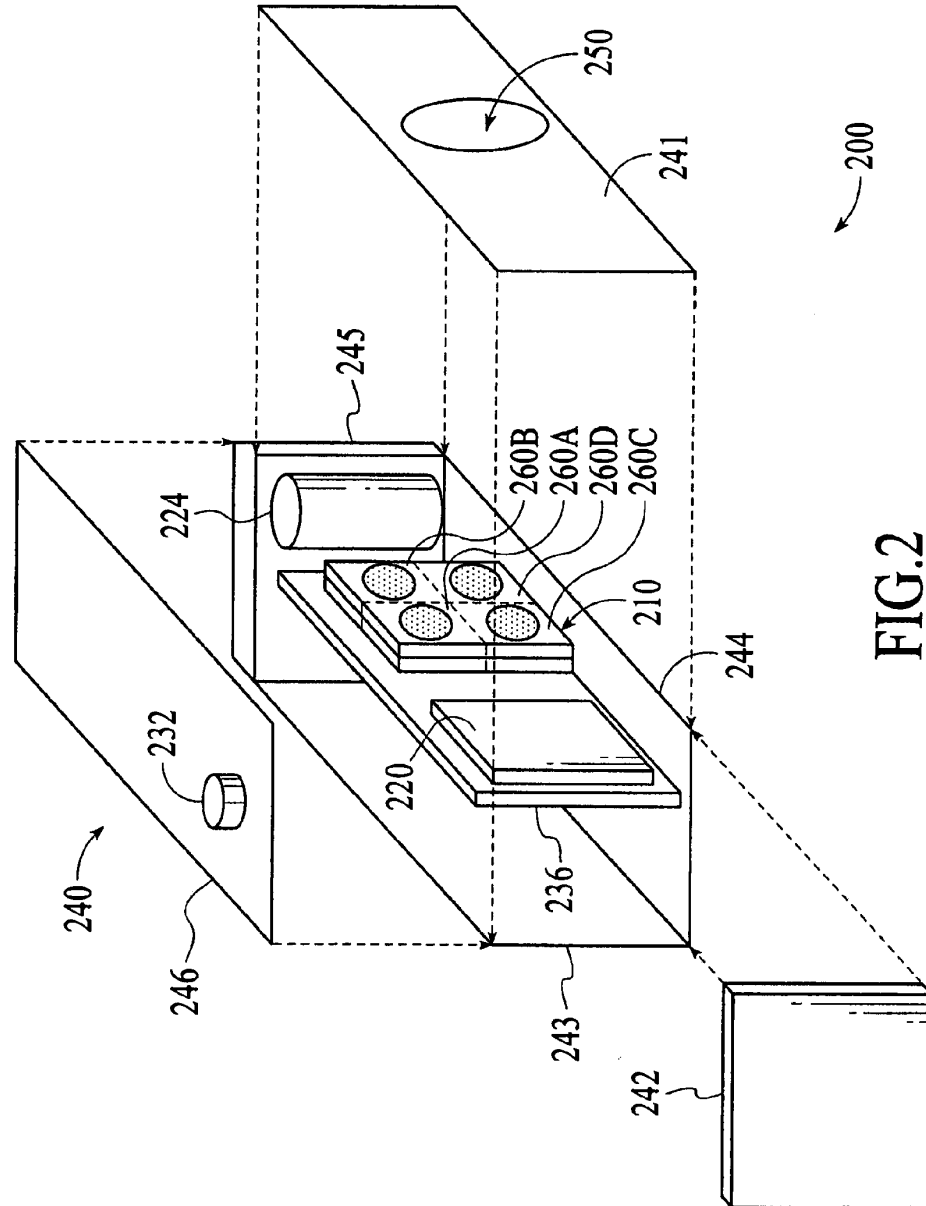
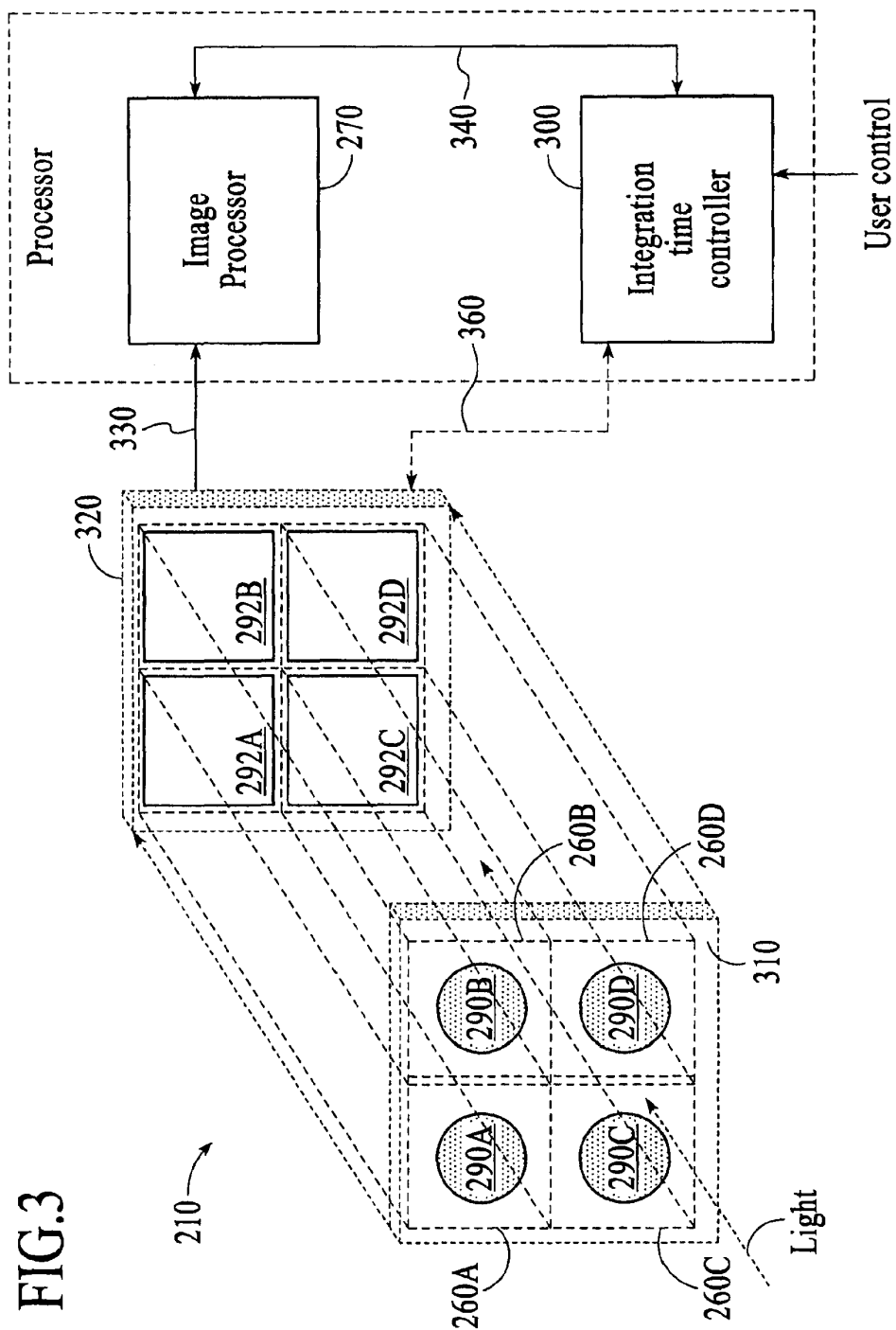
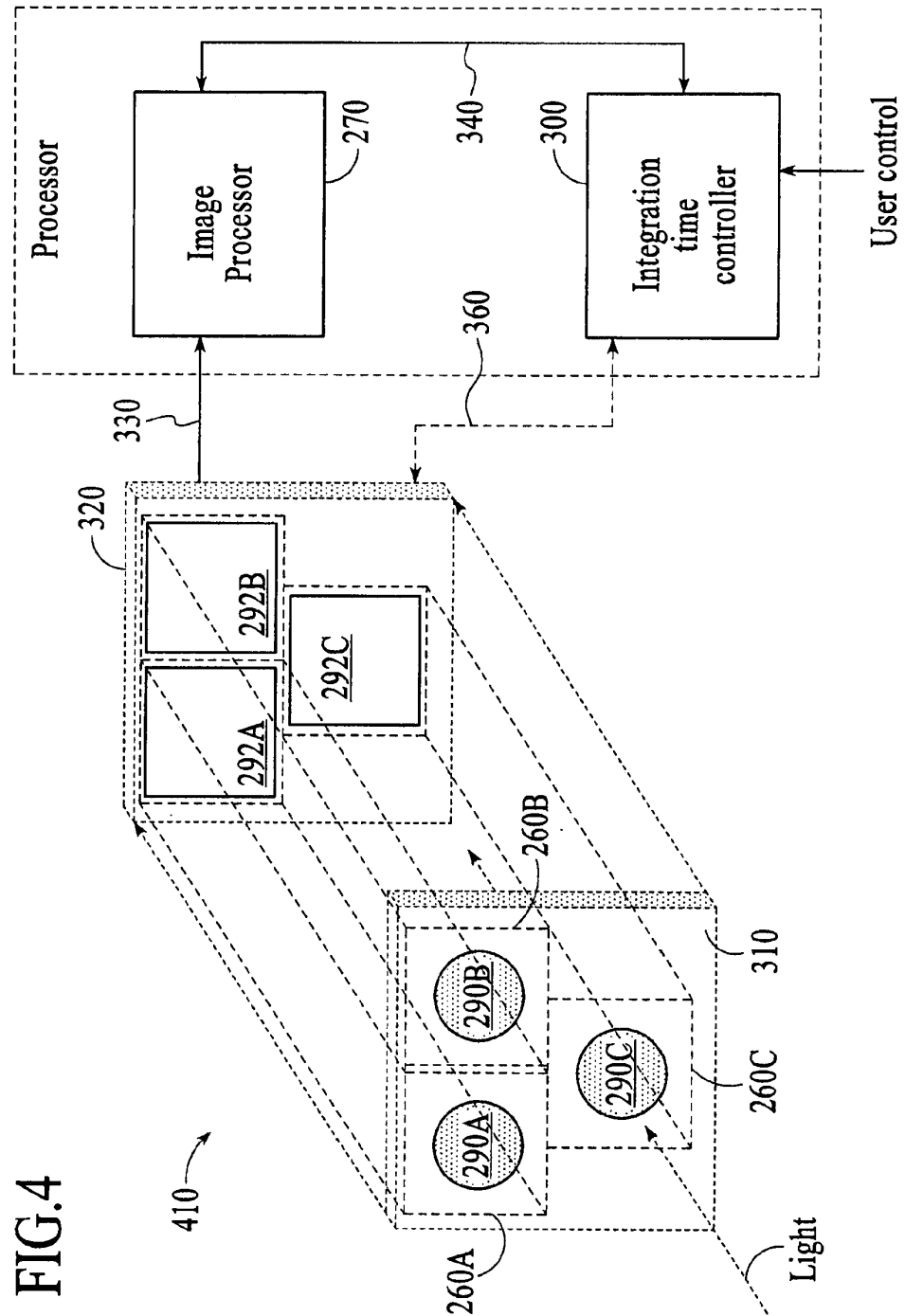
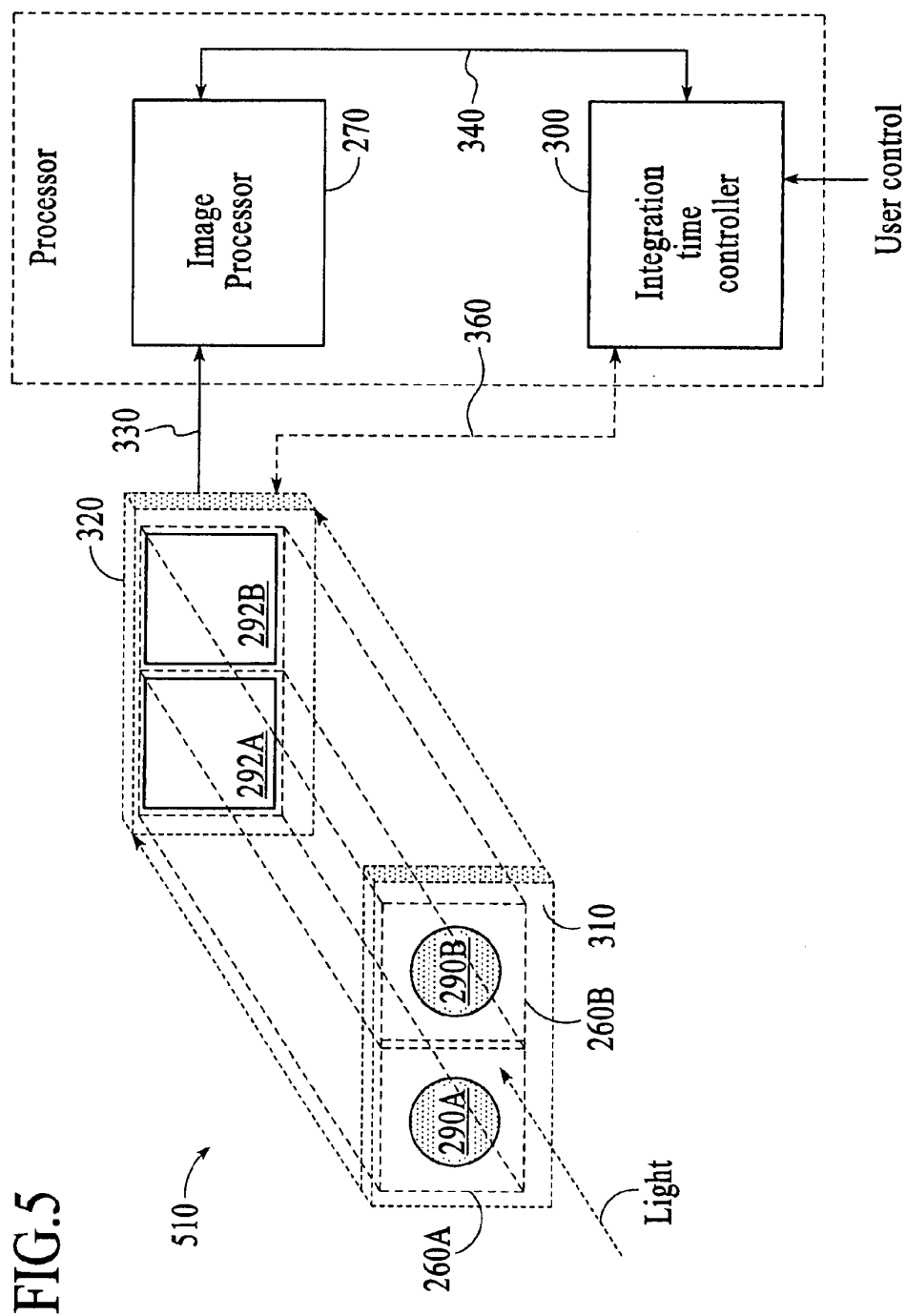


FIG. 2







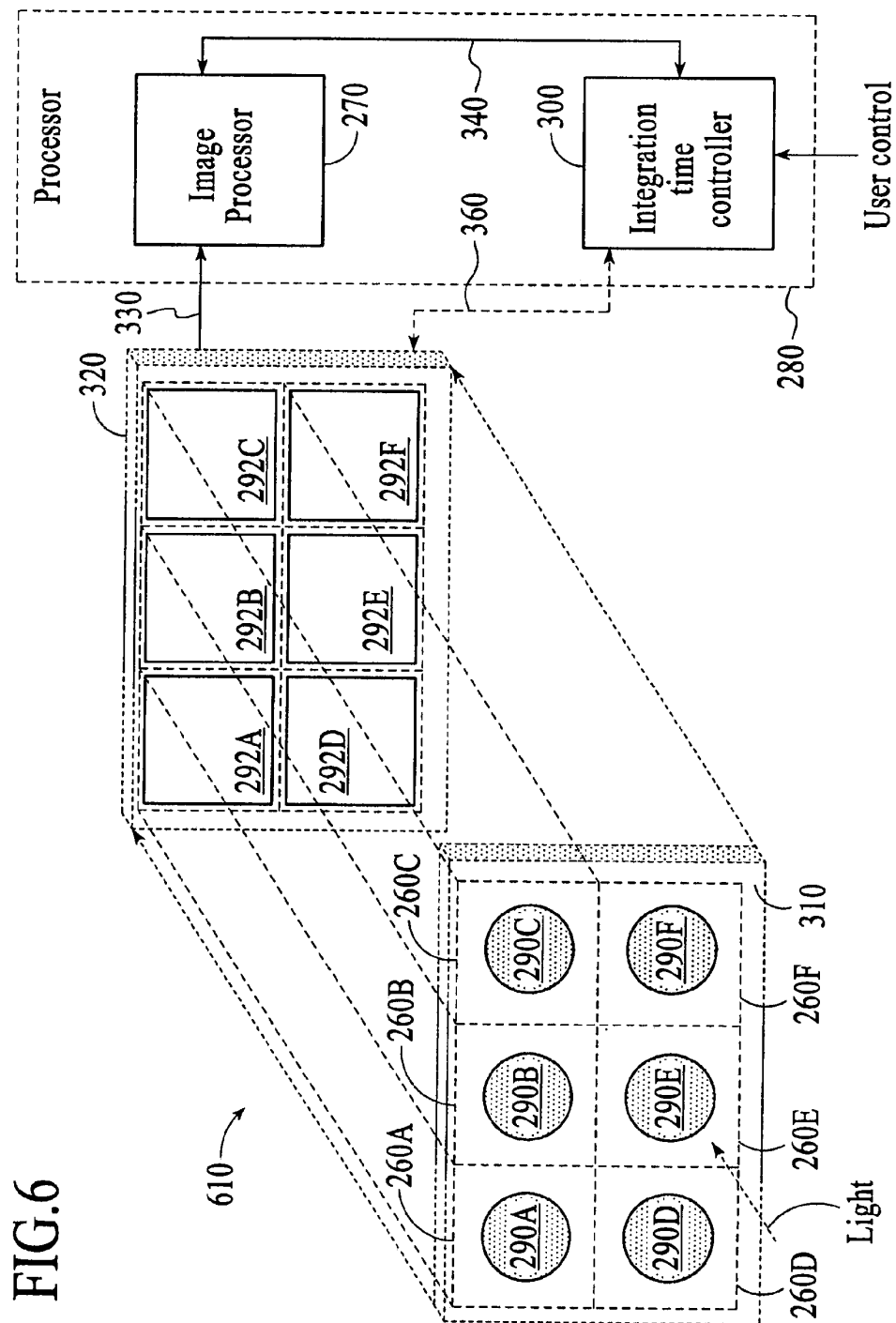
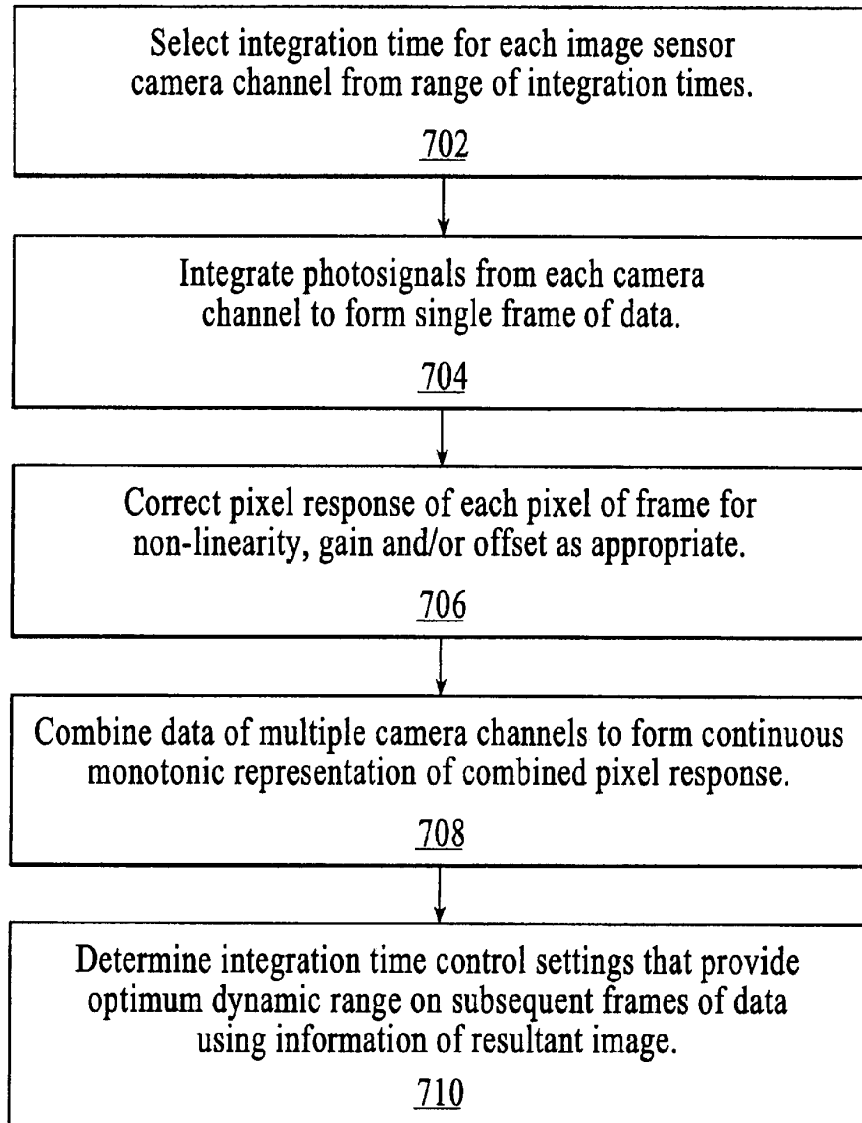
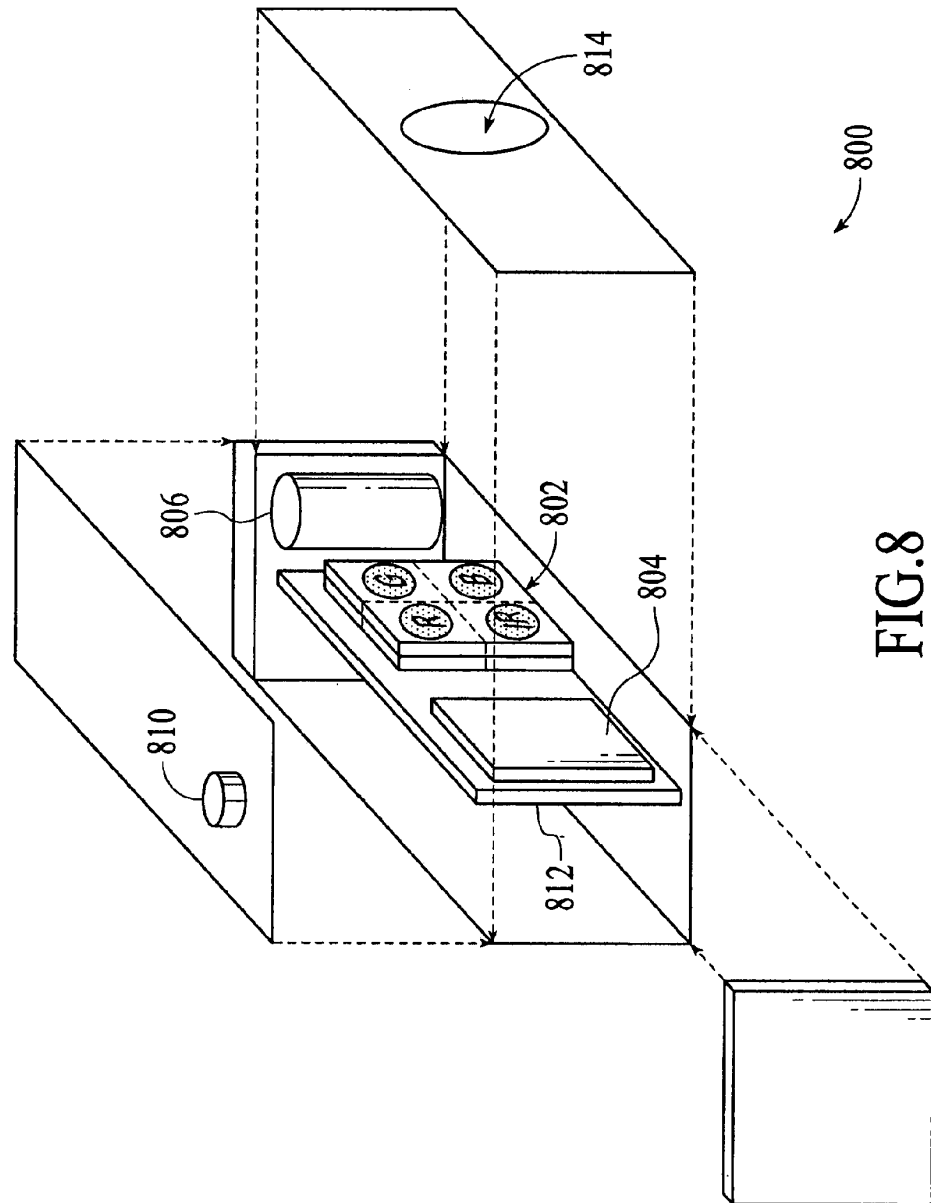


FIG. 6



700

FIG.7



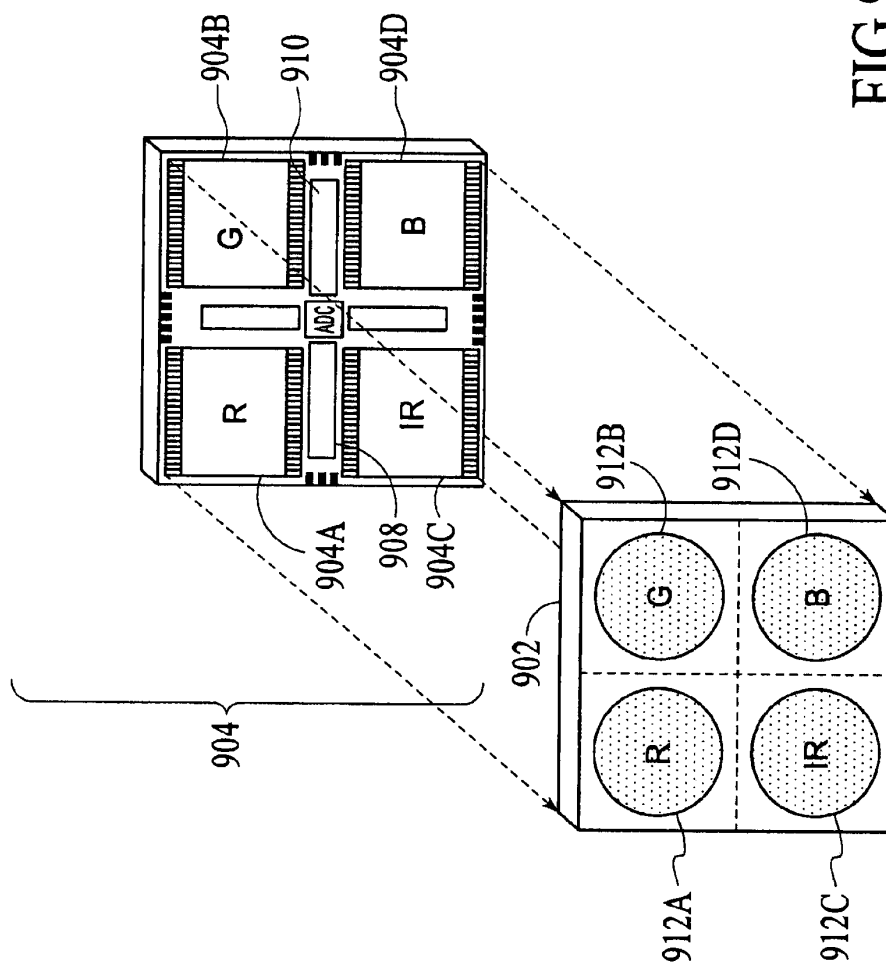
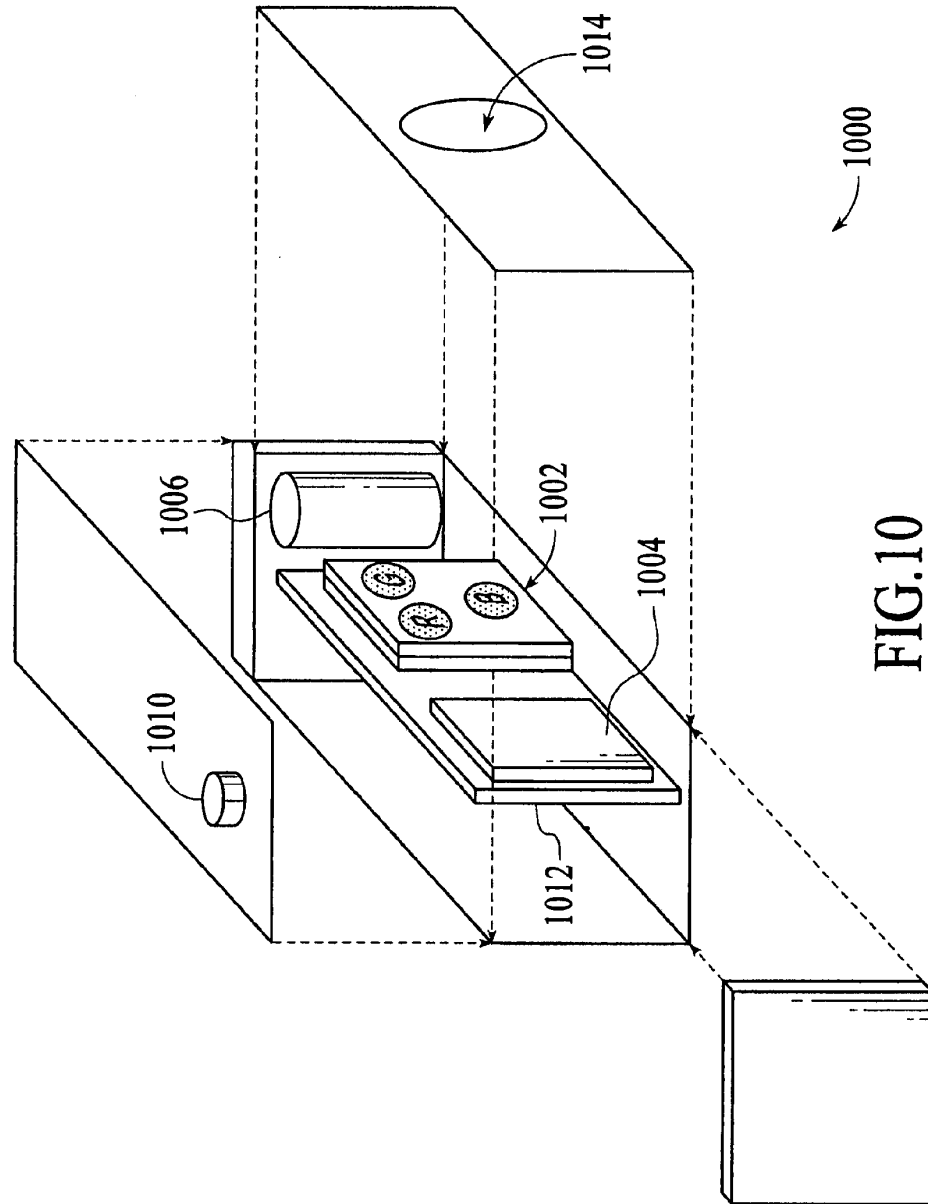
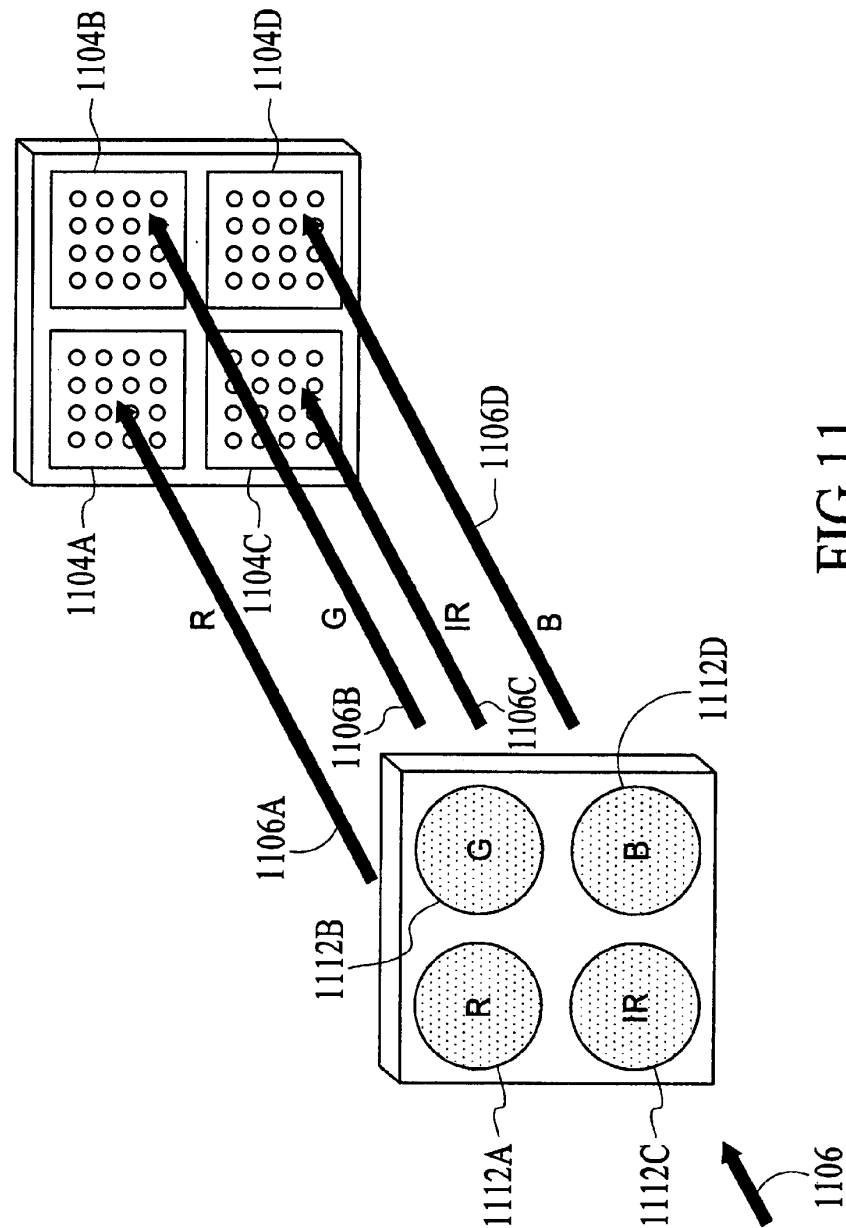


FIG. 9





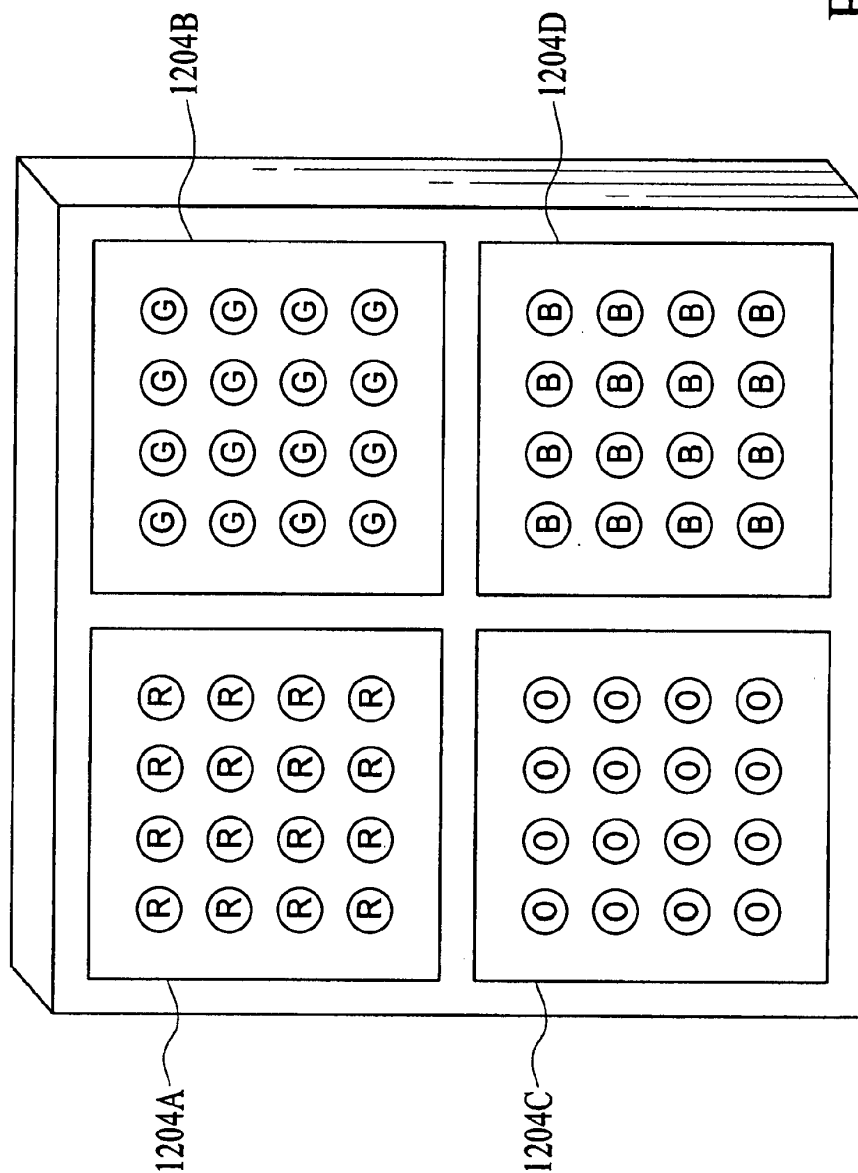


FIG.12

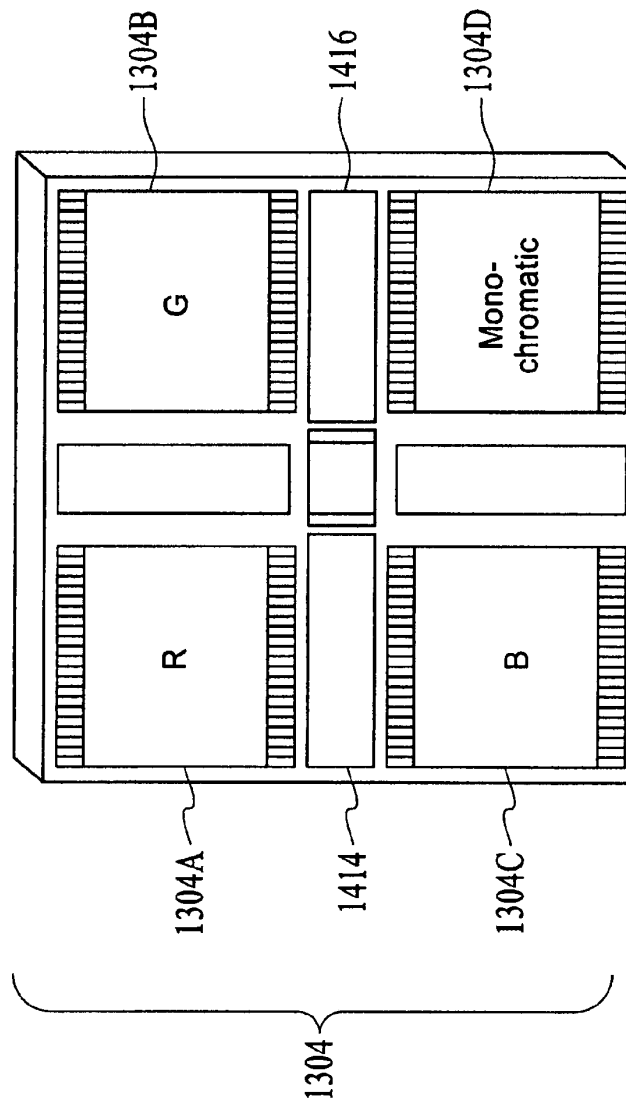
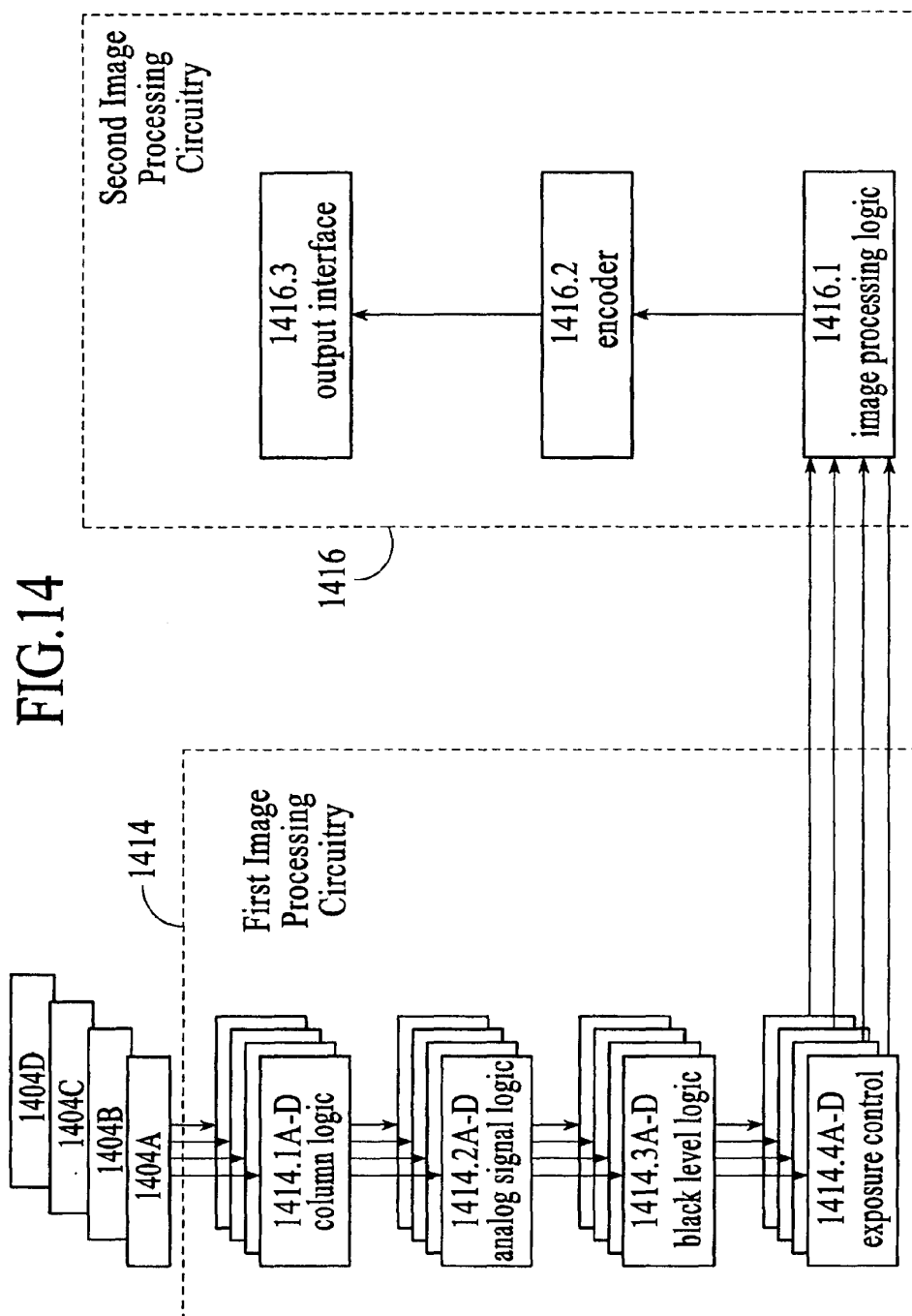


FIG.13



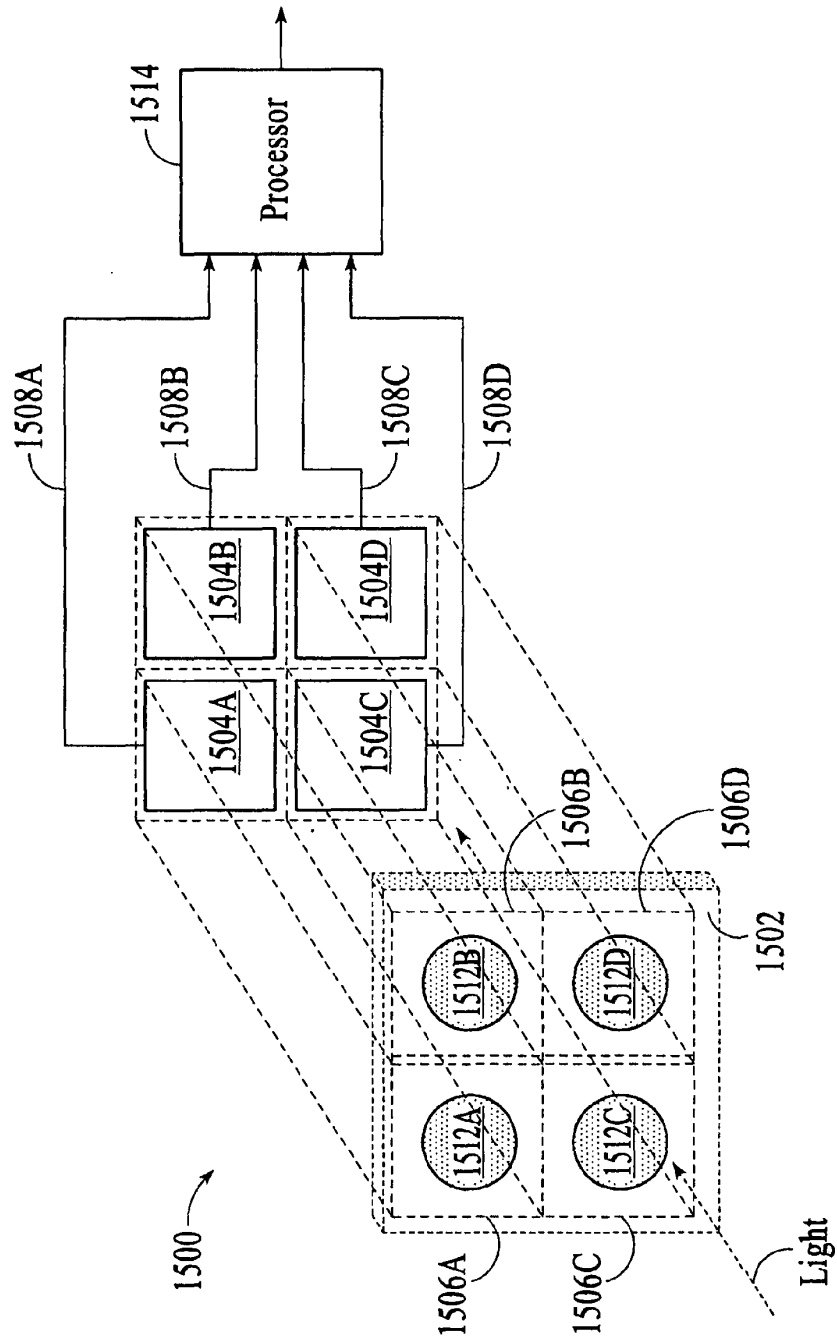
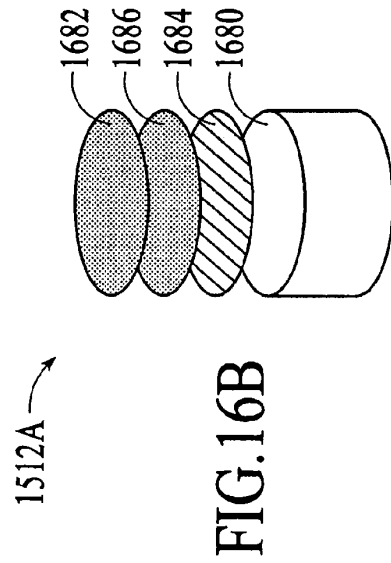
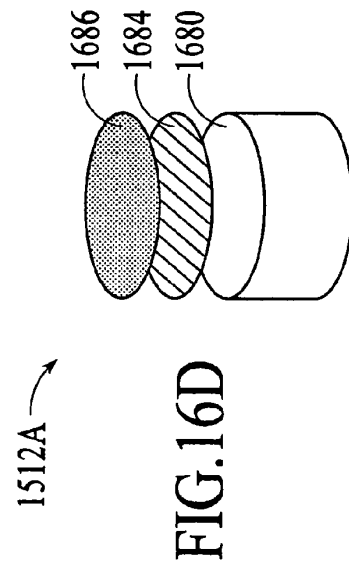
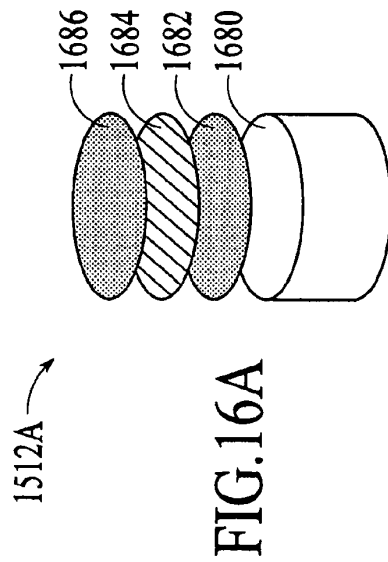
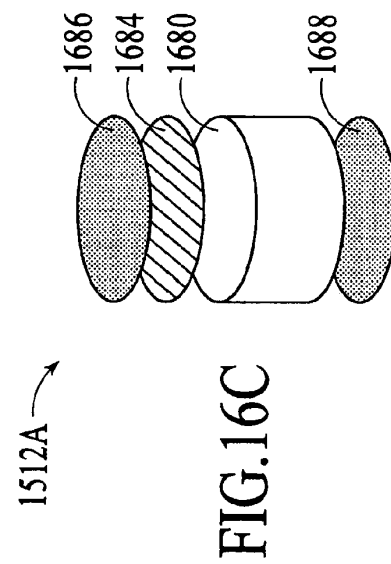


FIG.15



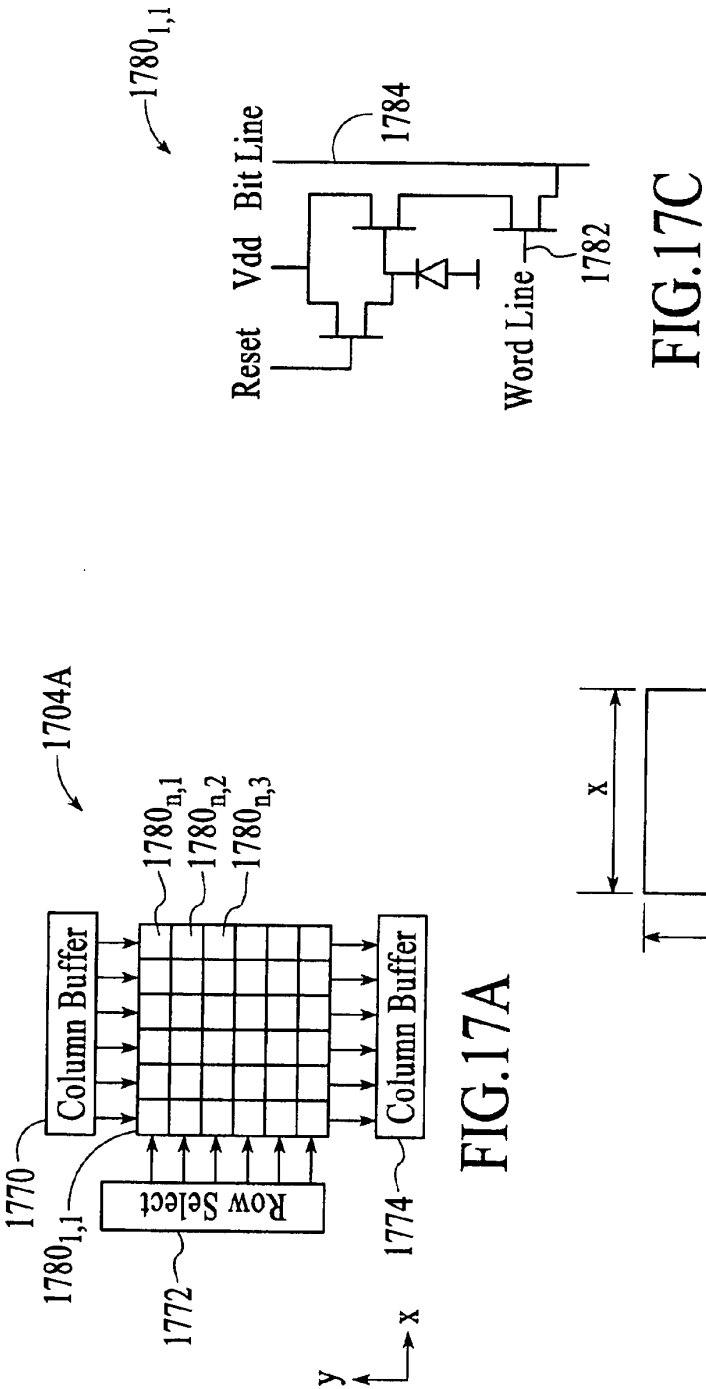


FIG. 17A

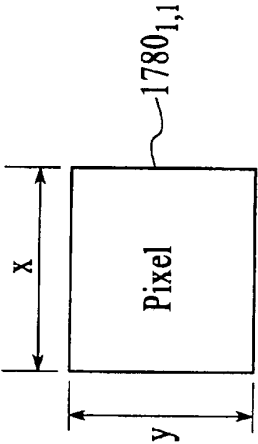


FIG. 17B

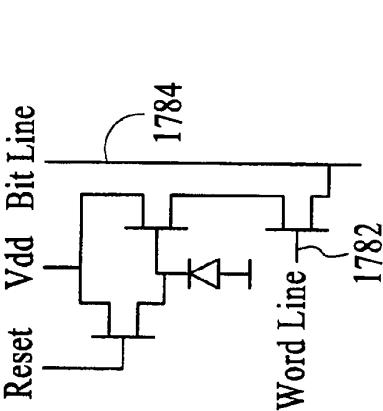


FIG. 17C

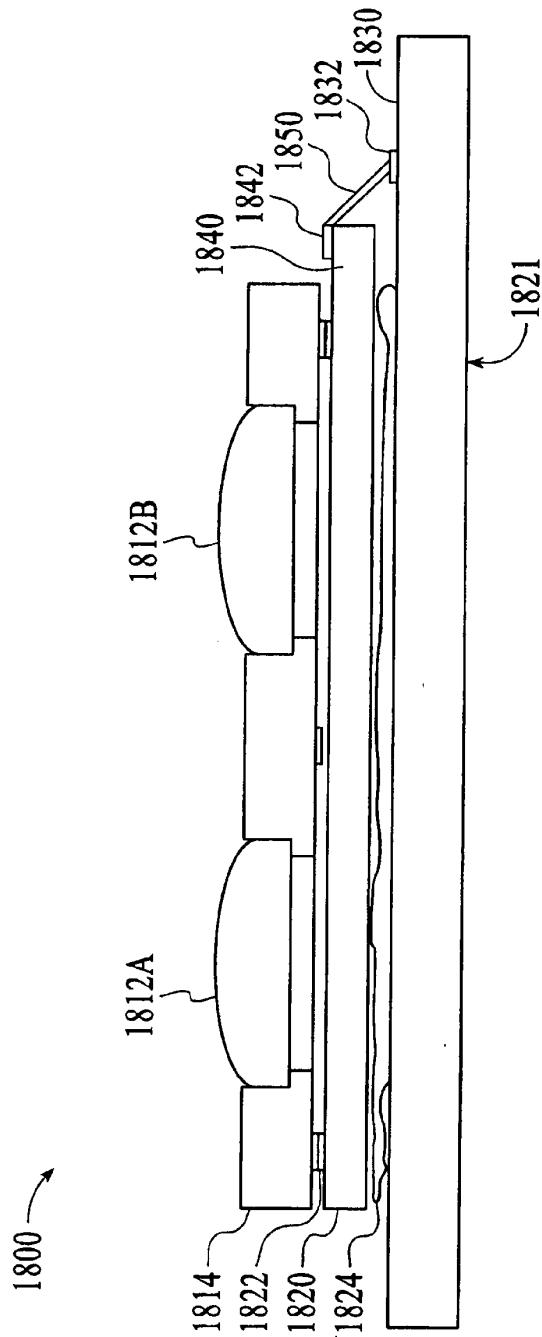


FIG. 18

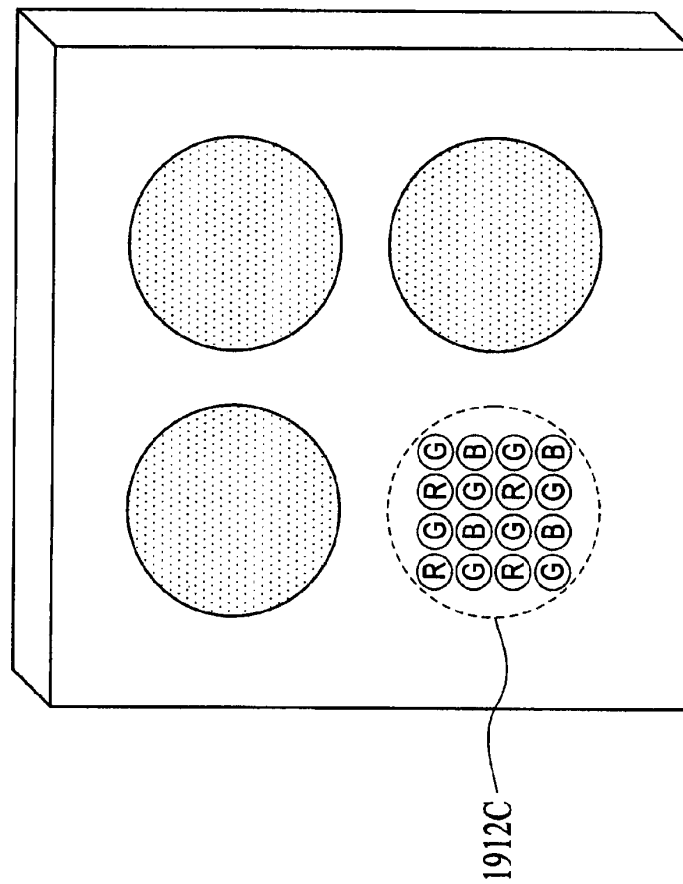


FIG.19

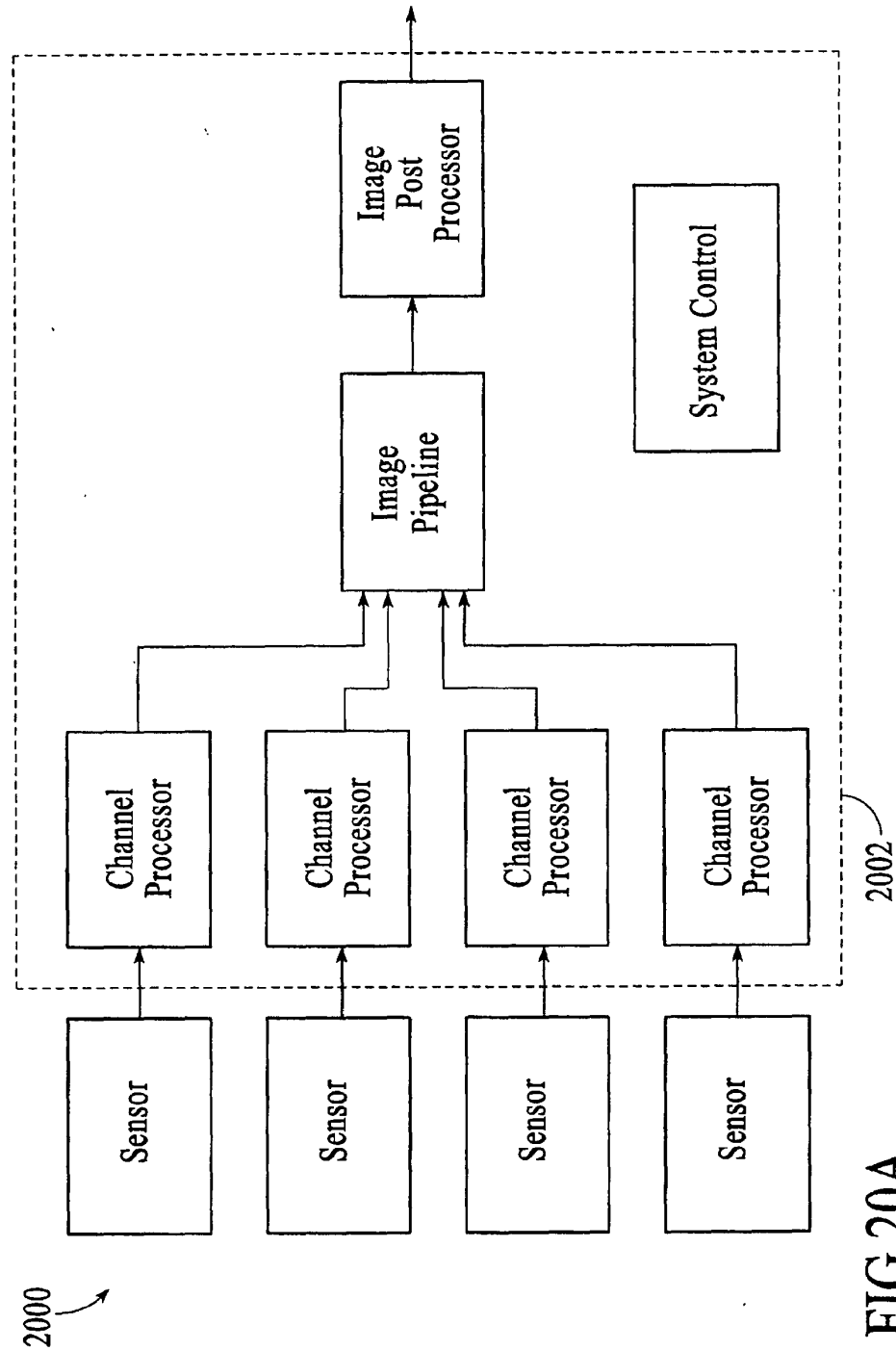


FIG.20A

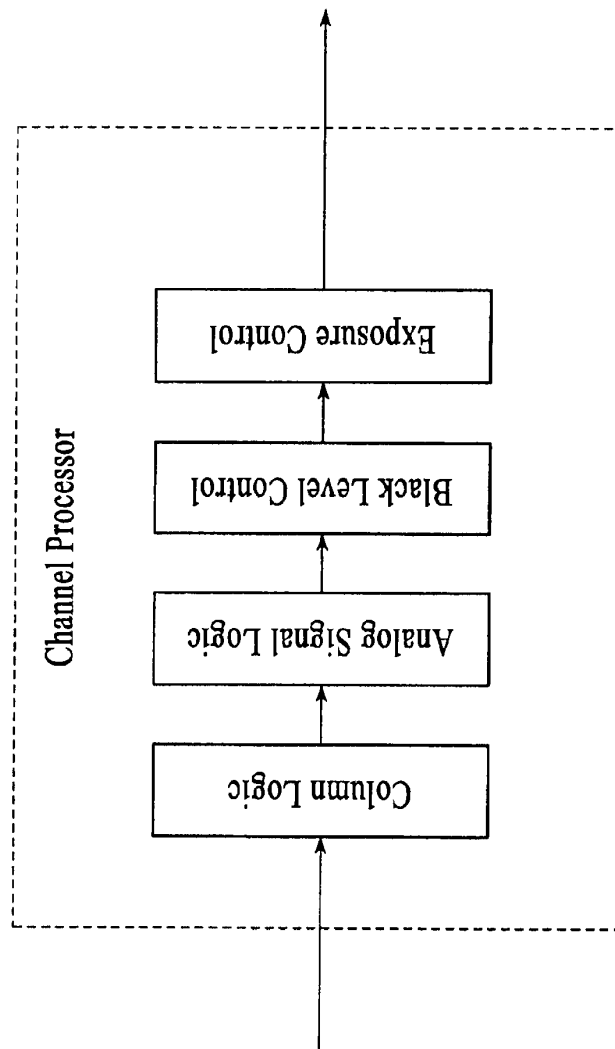


FIG.20B

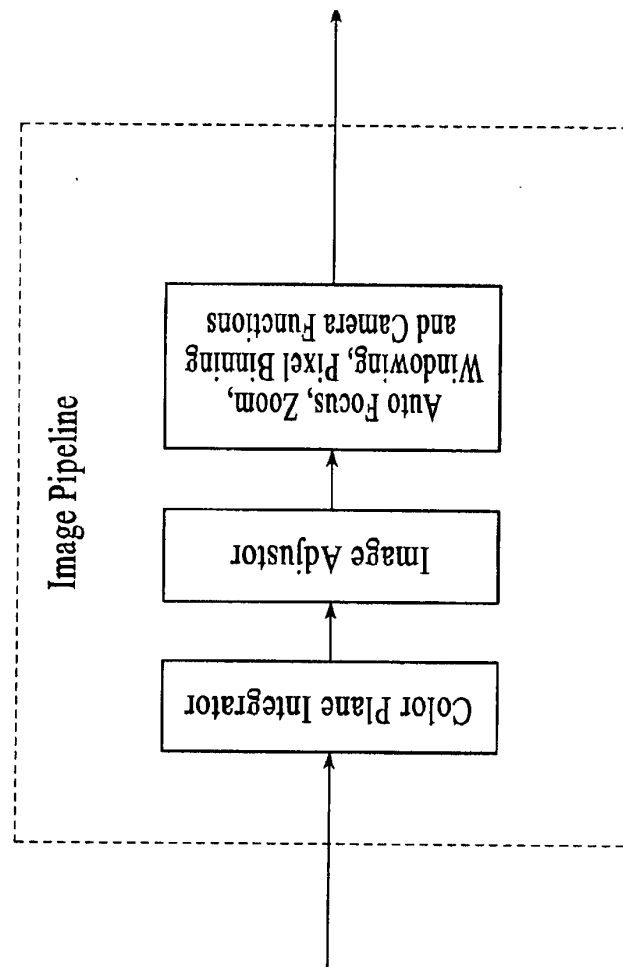


FIG.20C

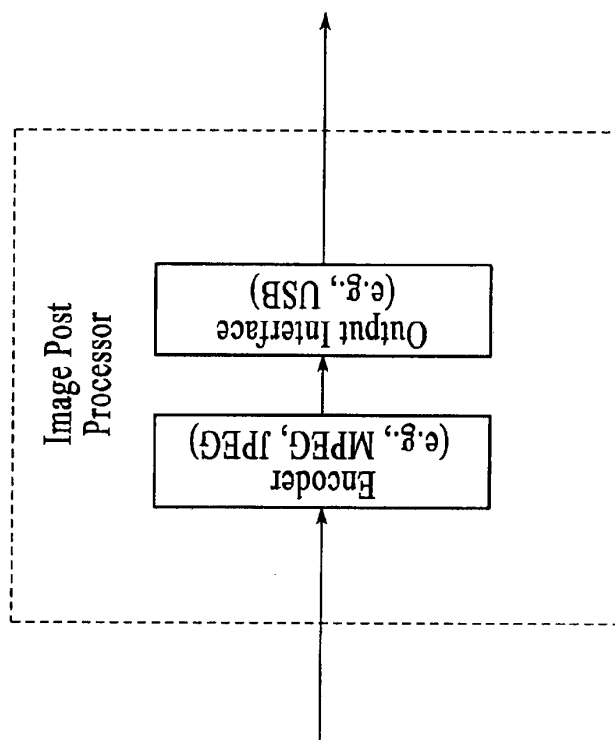
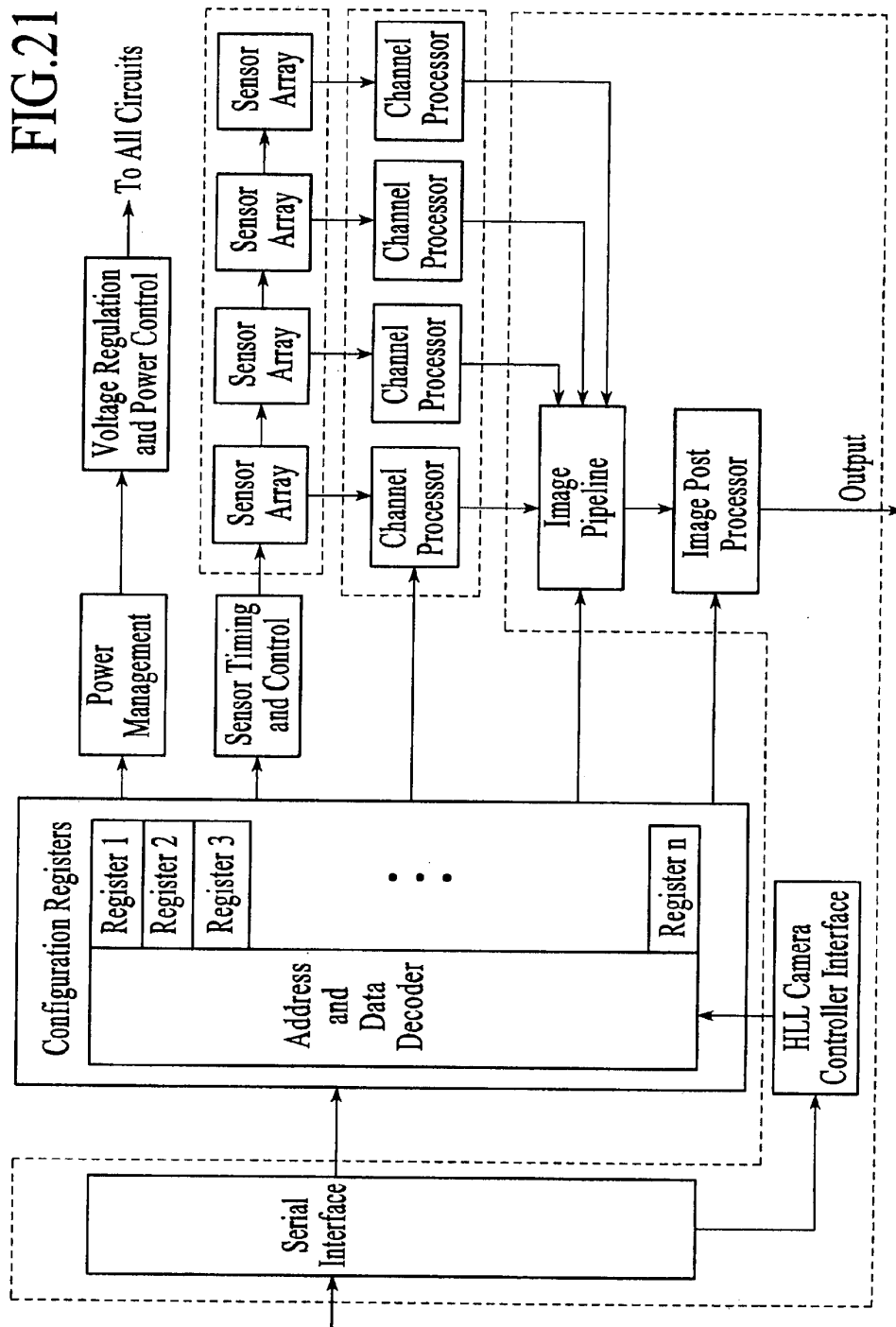


FIG. 20D





DECLARATION AND POWER OF ATTORNEY
(Docket No. NICO.P007)

As a below-named inventor, I hereby declare that:

My residence, mailing address, and citizenship are as stated below next to my name.

I believe I am an original, first and joint inventor of the inventions described and claimed in the specification filed:

_____ HEREWITH,
X on April 19, 2007, Application Number 11/788,122,
and entitled:

LARGE DYNAMIC RANGE CAMERAS

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to herein.

I acknowledge the duty to disclose information that is material to the examination of this application in accordance with 37 CFR § 1.56.

I hereby appoint the **registered patent practitioners associated with Customer Number 53186** with full power of substitution and revocation, to prosecute this application and transact all business in the U.S. Patent and Trademark Office connected therewith. The current mailing address and telephone and facsimile numbers are:

P.O. Box 9686
San Jose, California 95157

Tel: (408) 342-1900
Fax: (408) 342-1909

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Inventor: Richard Ian OLSEN
Address: 101 Academy Drive, Suite 100
Irvine, CA 92617

Citizenship: US

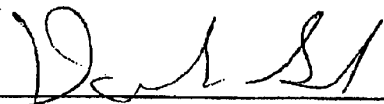
Date: 5-25-07


Richard Ian OLSEN

Inventor: Darryl L. SATO
Address: 101 Academy Drive, Suite 100
Irvine, CA 92617

Citizenship: US

Date: 5-25-07


Darryl L. SATO

Inventor: Feng-Qing SUN
Address: 101 Academy Drive, Suite 100
Irvine, CA 92617

Citizenship: CN

Date: 5/25/07


Feng-Qing SUN

Inventor: James GATES
Address: 101 Academy Drive, Suite 100
Irvine, CA 92617

Citizenship: US

Date: 24 MAY, 2007

James Gates
James GATES

Application Data Sheet

Application Information

Application Type::	Continuation
Subject Matter::	Utility
Suggested classification::	
Suggested Group Art Unit::	
CD-ROM or CD-R?::	None
Computer Readable Form (CRF)?::	No
Title::	LARGE DYNAMIC RANGE CAMERAS
Attorney Docket Number::	088245-6407
Request for Early Publication?::	No
Request for Non-Publication?::	No
Suggested Drawing Figure::	1
Total Drawing Sheets::	24
Small Entity?::	No
Petition included?::	No
Secrecy Order in Parent Appl.?::	No

Applicant Information

Applicant Authority Type::	Inventor
Primary Citizenship Country::	US
Status::	Full Capacity
Given Name::	Richard Ian
Family Name::	Olsen
City of Residence::	Irvine
State or Province of Residence::	CA
Country of Residence::	US
Street of mailing address::	101 Academy Drive, Suite 100

City of mailing address:: Irvine
State or Province of mailing address:: CA
Postal or Zip Code of mailing address:: 92617

Applicant Authority Type:: Inventor
Primary Citizenship Country:: US
Status:: Full Capacity
Given Name:: Darryl L.
Family Name:: Sato
City of Residence:: Irvine
State or Province of Residence:: CA
Country of Residence:: US
Street of mailing address:: 101 Academy Drive, Suite 100
City of mailing address:: Irvine
State or Province of mailing address:: CA
Postal or Zip Code of mailing address:: 92617

Applicant Authority Type:: Inventor
Primary Citizenship Country:: China
Status:: Full Capacity
Given Name:: Feng-Qing
Family Name:: Sun
City of Residence:: Irvine
State or Province of Residence:: CA
Country of Residence:: US
Street of mailing address:: 101 Academy Drive, Suite 100
City of mailing address:: Irvine

State or Province of mailing address:: CA
Postal or Zip Code of mailing address:: 92617

Applicant Authority Type:: Inventor
Primary Citizenship Country:: US
Status:: Full Capacity
Given Name:: James
Family Name:: Gates
City of Residence:: Irvine
State or Province of Residence:: CA
Country of Residence:: US
Street of mailing address:: 101 Academy Drive, Suite 100
City of mailing address:: Irvine
State or Province of mailing address:: CA
Postal or Zip Code of mailing address:: 92617

Correspondence Information

Correspondence Customer Number:: 23524
E-Mail address:: PTOMailMadison@foley.com

Representative Information

Representative Customer Number::	23524	
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Domestic Priority Information

Application::	Continuity Type::	Parent Application::	Parent Filing Date::
This Application	Continuation of	11/788,122	4/19/2007
11/788,122	An application claiming the benefit under 35 USC 119(e)	60/795,882	4/28/2006
11/788,122	Continuation in part of	11/212,803	8/25/2005
11/212,803	An application claiming the benefit under 35 USC 119(e)	60/604,854	8/25/2004
11/212,803	An application claiming the benefit under 35 USC 119(e)	60/695,946	7/1/2005

Foreign Priority Information

Country::	Application number::	Filing Date::	Priority Claimed::

Assignee Information

Assignee Name::

Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		LARGE DYNAMIC RANGE CAMERAS		
First Named Inventor/Applicant Name:		Richard Ian Olsen		
Filer:		Paul S. Hunter/Lee Jankoski		
Attorney Docket Number:		088245-6407		
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Utility application filing	1011	1	330	330
Utility Search Fee	1111	1	540	540
Utility Examination Fee	1311	1	220	220
Pages:				
Claims:				
Claims in excess of 20	1202	11	52	572
Independent claims in excess of 3	1201	1	220	220
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1882

Electronic Acknowledgement Receipt	
EFS ID:	5633265
Application Number:	12496854
International Application Number:	
Confirmation Number:	5298
Title of Invention:	LARGE DYNAMIC RANGE CAMERAS
First Named Inventor/Applicant Name:	Richard Ian Olsen
Customer Number:	23524
Filer:	Paul S. Hunter/Lee Jankoski
Filer Authorized By:	Paul S. Hunter
Attorney Docket Number:	088245-6407
Receipt Date:	02-JUL-2009
Filing Date:	
Time Stamp:	12:54:46
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$1882
RAM confirmation Number	10558
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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1		6407Appfiled7309.pdf	893967 a2088bd847637ccce60dab2a22bcf27792375f38	yes	76
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Transmittal of New Application		1	3	
	Specification		4	40	
	Claims		41	44	
	Abstract		45	45	
	Drawings-only black and white line drawings		46	69	
	Oath or Declaration filed		70	72	
	Application Data Sheet		73	76	
Warnings:					
Information:					
2	Fee Worksheet (PTO-875)	fee-info.pdf	37905 23e5035939337ddb6d22d70505b871248cc2d21f	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			931872		
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

Filing Date: 07/02/09

Approved for use through 7/31/2006. OMB 0651-0032

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 12/496,854	
APPLICATION AS FILED – PART I						
(Column 1)		(Column 2)		SMALL ENTITY		OR
FOR	NUMBER FILED	NUMBER EXTRA		RATE (\$)	FEE (\$)	OTHER THAN SMALL ENTITY
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A		RATE (\$)
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A		N/A		FEE (\$)
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A		N/A
TOTAL CLAIMS (37 CFR 1.16(i))	31	minus 20	=	x\$26		x\$52
INDEPENDENT CLAIMS (37 CFR 1.16(h))	4	minus 3	=	x\$110		x\$220
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$270 (\$135 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR					
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				195		390
				TOTAL		TOTAL
						1882
APPLICATION AS AMENDED – PART II						
(Column 1)		(Column 2)		SMALL ENTITY		OR
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OTHER THAN SMALL ENTITY
Total (37 CFR 1.16(i))	*	Minus **	=	X =		X =
Independent (37 CFR 1.16(h))	*	Minus ***	=	X =		X =
Application Size Fee (37 CFR 1.16(s))						
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))				N/A		N/A
				TOTAL ADD'T FEE		TOTAL ADD'T FEE
(Column 1)		(Column 2)		SMALL ENTITY		OR
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OTHER THAN SMALL ENTITY
Total (37 CFR 1.16(i))	*	Minus **	=	X =		X =
Independent (37 CFR 1.16(h))	*	Minus ***	=	X =		X =
Application Size Fee (37 CFR 1.16(s))						
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))				N/A		N/A
				TOTAL ADD'T FEE		TOTAL ADD'T FEE
<p>* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.</p> <p>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".</p> <p>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".</p> <p>The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.</p>						

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.