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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/586,221	09/18/2009	Neal Solomon	5311.001US2

CONFIRMATION NO. 8799

POA ACCEPTANCE LETTER

OC000000069696267

144524
The Law Office of Michael J. Scheer
5531 Murietta Avenue
Sherman Oaks, CA 91401

Date Mailed: 03/15/2024

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 02/08/2024.

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.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/sltorres/

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/586,221	09/18/2009	Neal Solomon	5311.001US2

CONFIRMATION NO. 8799

POWER OF ATTORNEY NOTICE

OC000000069696285

21186
SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

Date Mailed: 03/15/2024

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 02/08/2024.

- The Power of Attorney to you in this application has been revoked by the applicant.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

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/sltorres/

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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
12/586,221	**02/08/2024 04:05:55 PM Z ET**	**5311.001US2**

Title of Invention

DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	8451339
CONFIRMATION #	8799	FILED BY	Michael Scheer
PATENT CENTER #	64262655	FILING DATE	09/18/2009
CUSTOMER #	21186	FIRST NAMED INVENTOR	Neal Solomon
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	-

Documents

TOTAL DOCUMENTS: 3

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
1020-1001 Executed US84513339 Power of Attorney.pdf	2	Power of Attorney	165 KB
1020-1001 US8451339 Transmittal letter for Power of Attorney.pdf	1	Transmittal Letter	87 KB
1020-1001 Executed US84513339 Statement under 3.73.pdf	3	Assignee showing of ownership per 37 CFR 3.73	236 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)

1020-1001 Executed US84513339 Power of Attorney.pdf	5EFCDC7E8DDF6B6610E005570681E29CF143F829C8A2073F17CEDF84A30A0CDA7A5495CF2E2F66DA6CCCB664966DBB98729F5D73EA837925D287D9B504C3FF96
1020-1001 US8451339 Transmittal letter for Power of Attorney.pdf	8CACB5A186EAEB3DBB43F27ACC58B0CDECBE925C133F3C9F749964DE141CFD5FF83F05C1B98CE5B2582A832025DEF1A4D1DB411B287D7CEF43444CA724E145BC
1020-1001 Executed US84513339 Statement under 3.73.pdf	1D588B6DA81F3230EECED69EACB4872036B632920E983B273A094F01F617938CF369EDF656D404341F4026DD5DD88716E9230979B81CAF0E61EB87271A26D78D

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

If a new application is being filed and the application includes the necessary components for 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

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.

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.

PTO/AIA/81A (02-15)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT - POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

Patent Number	US 8,451,339
Issue Date	May 28, 2013
First Named Inventor	Neal Solomon
Title	DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE
Attorney Docket No.	1020-1001

I hereby revoke all previous powers of attorney given in the above-identified patent.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the Customer Number identified in the box at right as my/our attorney(s) or agent(s) with respect to the patent identified above, and to transact all business in the United States Patent and Trademark Office connected therewith: 144524

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) with respect to the patent identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number

Please recognize or change the correspondence address for the above-identified patent to:

☒ The address associated with the above-identified Customer Number.

OR

☐ The address associated with the Customer Number identified in the box at right:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the:

☐ Applicant.

OR

☒ Patent owner.

Statement under 37 CFR 3.73(c) (Form PTO/AIA/96) submitted herewith or filed on _____.

SIGNATURE of Applicant or Patent Owner

Signature	/ Neal E. Solomon /	Date	2/8/24
Name	Neal Solomon	Telephone	
Title and Company	Managing Member OPTIMUM IMAGING TECHNOLOGIES LLC		

NOTE: Signatures of all the applicants or patent owners of the entire interest or their representative(s) are required. If more than one signature is required, submit multiple forms, check the box below, and identify the total number of forms submitted in the blank below.

☐ A total of _____ forms are submitted.

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 update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 3 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.

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Neal SOLOMON	Patent No.: 8,451,339
Application No.: 11/825,521	Issue Date: November 3, 2009
Filing Date: September 18, 2009	Confirmation No.: 8799
For: DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS	Attorney Docket No.: 1020-1001

TRANSMITTAL OF POWER OF ATTORNEY

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

Sir:

Please find attached a Revocation of Power of Attorney With a New Power of Attorney and Change of Correspondence Address (PTO/AIA/81A). Please also find attached the associated Statement Under 37 CFR 3.73(c) (PTO/AIA/96).

All previous Powers of Attorney have been revoked. It is respectfully requested that the undersigned be recognized as the attorney of record and all future correspondence be directed to the undersigned.

Date: February 8, 2023,

Respectfully submitted,

/ Michael J. Scheer/

Michael J. Scheer, Reg. No. 34,425
The Law Office of Michael J. Scheer PC
Customer No. 144524
818- 616-3363

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.

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: OPTIMUM IMAGING TECHNOLOGIES LLC

Application No./Patent No.: US 8,451,339 Filed/Issue Date: May 28, 2013

Titled: DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS

OPTIMUM IMAGING TECHNOLOGIES, a Limited Liability Company

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

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

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.

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

1. From: Neal Solomon To: OPTIMUM IMAGING TECHNOLOGIES

The document was recorded in the United States Patent and Trademark Office at

Reel 049584, Frame 495, or for which a copy thereof is attached.

2. 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.

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 1.11 and 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.

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.

STATEMENT UNDER 37 CFR 3.73(c)

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.

4. 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.

5. 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.

6. 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(s).

☐ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment 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.

/ Neal E. Solomon /	2/8/24
Signature	Date
Neal Solomon	Managing Member
Printed or Typed Name	Title or Registration Number

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.

AO 120 (Rev. 08/10)

TO:	Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Eastern District of Texas, Marshall Division on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:19-cv-246	7/8/2019	Eastern District of Texas, Marshall Division

PLAINTIFF	DEFENDANT
Optimum Imaging Technologies LLC	Canon Inc.

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 7,612,805 B2	11/3/2009	Optimum Imaging Technologies LLC
2 8,451,339 B2	5/28/2013	Optimum Imaging Technologies LLC
3		
4		
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

All claims asserted by and between all parties as part of the above-captioned case are hereby DISMISSED WITH PREJUDICE with all attorneys' fees, expenses, and costs of court to be borne by the party incurring the same.

CLERK	(BY) DEPUTY CLERK	DATE
David A. O'Toole	nkl	4/29/21

Copy 1—Upon initiation of action, mail this copy to Director **Copy 3—Upon termination of action, mail this copy to Director**
Copy 2—Upon filing document adding patent(s), mail this copy to Director **Copy 4—Case file copy**

Trials@uspto.gov
571-272-7822

Paper 9
Date: March 1, 2021

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CANON INC.,
Petitioner,

v.

OPTIMUM IMAGING TECHNOLOGIES LLC,
Patent Owner.

IPR2020-01322
Patent 8,451,339 B2

Before LYNNE E. PETTIGREW, DANIEL J. GALLIGAN, and RUSSELL E. CASS, *Administrative Patent Judges.*

GALLIGAN, *Administrative Patent Judge.*

DECISION
Denying Institution of *Inter Partes* Review
`*35 U.S.C. § 314*

I. INTRODUCTION

A. Background and Summary

Petitioner Canon Inc. filed a Petition (Paper 1, "Pet.") requesting *inter partes* review of claims 1–5 and 14–18 of U.S. Patent No. 8,451,339 B2 (Ex. 1001, "the '339 patent"). Patent Owner Optimum Imaging Technologies LLC filed a Preliminary Response. Paper 6 ("Prelim. Resp."). With our authorization, Petitioner filed a Reply (Paper 7) and Patent Owner filed a Sur-reply (Paper 8) directed solely to whether we should exercise our discretion to deny the Petition under 35 U.S.C. § 314(a).

For the reasons that follow, we do not institute an *inter partes* review in this proceeding.

B. Related Matters

The parties indicate that the '339 patent is at issue in *Optimum Imaging Technologies LLC v. Canon Inc.*, No. 2:19-cv-246 (E.D. Tex.)[1] ("the Texas case"). Pet. 1; Paper 3, 2.

Petitioner also filed a petition challenging claims of related U.S. Patent No. 7,612,805 B2 ("the '805 patent"). IPR2020-01321, Paper 1.

C. Real Parties in Interest

The parties identify themselves as the real parties in interest. Pet. 1; Paper 3, 2.

---

[1] We refer to the United States District Court for the Eastern District of Texas as "the Texas court."

D. The '339 Patent

The '339 patent discloses a system "for the automated correction of optical and digital aberrations in a digital imaging system" that addresses issues "in still and video photography that are presented in the digital imaging environment." Ex. 1001, code (57).

E. Prior Art and Asserted Grounds

Petitioner asserts that claims 1–5 and 14–18 of the '339 patent are unpatentable on the following grounds:

Claims Challenged	35 U.S.C. §	Reference(s)/Basis
1, 5, 14, 17	103(a)[2]	Niikawa[3]
2, 4, 15, 16	103(a)	Niikawa, Kita[4]
3, 18	103(a)	Niikawa, Kishida[5]
1–3, 5, 14, 15, 17, 18	103(a)	Watanabe[6]
4, 16	103(a)	Watanabe, Kita

II. ANALYSIS

A. Discretionary Denial Under 35 U.S.C. § 314

Institution of *inter partes* review is discretionary. *See Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2140 (2016) ("[T]he agency's decision

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[2] The Leahy-Smith America Invents Act ("AIA") included revisions to 35 U.S.C. § 103 that became effective after the filing of the application for the '339 patent. Therefore, we apply the pre-AIA version of this section.

[3] Niikawa, US 2002/0135688 A1, published Sept. 26, 2002 (Ex. 1006).

[4] Kita, JP 2004-328506, published Nov. 18, 2004 (Ex. 1011).

[5] Kishida, JP 2004-343358, published Dec. 2, 2004 (Ex. 1009).

[6] Watanabe, US 2005/0280877 A1, published Dec. 22, 2005 (Ex. 1007).

to deny a petition is a matter committed to the Patent Office's discretion."); *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1367 (Fed. Cir. 2016) ("[T]he PTO is permitted, but never compelled, to institute an [*inter partes* review (IPR)] proceeding."); 35 U.S.C. § 314(a) ("The Director *may not* authorize an inter partes review to be instituted unless the Director determines that the information presented in the petition filed under section 311 and any response filed under section 313 shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." (emphasis added)).

The Board has held that the advanced state of a parallel district court action is a factor that may weigh in favor of denying a petition under § 314(a). *See NHK Spring Co. v. Intri-Plex Techs., Inc.*, IPR2018-00752, Paper 8 at 20 (PTAB Sept. 12, 2018) (precedential); Patent Trial and Appeal Board Consolidated Trial Practice Guide (Nov. 2019), 58 & n.2, *available at* https://www.uspto.gov/TrialPracticeGuideConsolidated ("Trial Practice Guide"). We consider the following factors to assess "whether efficiency, fairness, and the merits support the exercise of authority to deny institution in view of an earlier trial date in the parallel proceeding":

1. whether the court granted a stay or evidence exists that one may be granted if a proceeding is instituted;
2. proximity of the court's trial date to the Board's projected statutory deadline for a final written decision;
3. investment in the parallel proceeding by the court and the parties;
4. overlap between issues raised in the petition and in the parallel proceeding;
5. whether the petitioner and the defendant in the parallel proceeding are the same party; and

6. other circumstances that impact the Board's exercise of discretion, including the merits.

Apple Inc. v. Fintiv, Inc., IPR2020-00019, Paper 11 at 5–6 (PTAB Mar. 20, 2020) (precedential). In evaluating these factors, we "take[] a holistic view of whether efficiency and integrity of the system are best served by denying or instituting review." *Id.* at 6.

Analyzing the *Fintiv* factors, Patent Owner argues that we should deny institution based on the advanced state of the Texas case. Prelim. Resp. 1–21; Sur-reply 1–7. Petitioner disagrees. Pet. 4–6; Reply 1–7.

Based on our analysis of the *Fintiv* factors below, we determine that discretionary denial is warranted based on the circumstances presented.

1. Whether the Court Granted a Stay or Evidence Exists that One May Be Granted if a Proceeding Is Instituted

Patent Owner argues this factor favors denial because Petitioner, who is the defendant in the Texas case, represented to the Texas court that Petitioner would not seek a stay if this proceeding were instituted. Prelim. Resp. 4–5 (citing Ex. 2015 (transcript of telephonic status conference with the Texas court), 6:12–21). Based on Petitioner's representation that it will not seek a stay of the Texas case, we agree with Patent Owner that this factor favors denial.

2. Proximity of the Court's Trial Date to the Board's Projected Statutory Deadline for a Final Written Decision

Patent Owner argues that this factor favors denial because the trial in the Texas case is scheduled to begin May 10, 2021, and "is therefore only two months after the Board's deadline for an institution decision in March 2021 and ten months ***before*** the Board's deadline for a final written decision

in approximately March of 2022." Prelim. Resp. 5–6; *see* Ex. 2006, 3 (resetting jury selection in the Texas case from February 1, 2021, to May 10, 2021). Petitioner argues that the trial has already been delayed twice due to COVID-19 and "[t]here is no guarantee that there will not be further delays." Reply 1. Other than pointing to past delays in the district court trial setting, Petitioner offers no evidence showing a likely delay in the current trial setting, and we decline to speculate about whether there may be further delays in the district court.

Because the Texas case's trial date is just over two months from the date of this Decision and, therefore, approximately ten months before the deadline for a final written decision if we were to institute, this factor weighs in favor of exercising discretion to deny institution.

3. Investment in the Parallel Proceeding by the Court and the Parties

Patent Owner argues that the Texas court "and the parties have already made substantial investment in preparation for trial," noting that the Texas court has issued a *Markman* order construing various terms in the '339 patent, that fact and expert discovery have closed, and that the parties have fully briefed dispositive motions. Prelim. Resp. 6 (citing Exs. 1004, 2005, 2007).

Petitioner argues that "there has been no investment in the parallel proceeding with respect to the *prior art issues for the independent claims involved here*." Pet. 5 (emphasis added). The inquiry under the third *Fintiv* factor, however, is not limited to considering efforts in the district court concerning the patentability issues raised in a petition. Rather, under factor three, we "consider[] the amount and type of work already completed in the parallel litigation by the court and the parties at the time of the institution

decision." *Fintiv*, Paper 11 at 9. For example, *Fintiv* states that, "if, at the time of the institution decision, the district court has issued substantive orders related to the patent at issue in the petition, this fact favors denial." *Fintiv*, Paper 11 at 9–10. The Texas court has issued a 60-page claim construction order addressing terms in the '339 patent and in the related '805 patent. Ex. 1004. As Patent Owner correctly points out, the parties have also invested significantly in the Texas case in preparation for the upcoming trial. *See* Prelim. Resp. 6 (discussing the close of fact and expert discovery and the filing of dispositive motions).

In its discussion of factor three, *Fintiv* also addresses the impact of a petitioner's diligence or delay in filing a petition:

> If the evidence shows that the petitioner filed the petition expeditiously, such as promptly after becoming aware of the claims being asserted, this fact has weighed against exercising the authority to deny institution under *NHK*. If, however, the evidence shows that the petitioner did not file the petition expeditiously, such as at or around the same time that the patent owner responds to the petitioner's invalidity contentions, or even if the petitioner cannot explain the delay in filing its petition, these facts have favored denial.

Fintiv, Paper 11 at 11–12.

Petitioner argues that "the primary references [in the Petition] were only uncovered by Petitioner in the last 2 months (which is why the Petition was not filed earlier)." Pet. 4. Patent Owner counters that Petitioner filed the Petition on the last possible day permitted under 35 U.S.C. § 315(b) and that this "delay" is unfair to Patent Owner with the Texas case in its final stages. Prelim. Resp. 7–8. Patent Owner also argues that Petitioner could have found the asserted prior art references earlier with a "reasonably diligent search." Prelim. Resp. 11–16. In their Reply and Sur-reply,

Petitioner and Patent Owner dispute whether the prior art asserted in the Petition could have been found earlier with a diligent search. Reply 2–5; Sur-reply 2–5.

We need not speculate as to whether the prior art asserted in the Petition could have been found earlier because Petitioner's explanation as to petition timing misses the mark. As the above-quoted passage from *Fintiv* indicates, this inquiry is directed to ascertaining whether a petitioner acts promptly with respect to activities in the parallel litigation, such as filing a petition "promptly after becoming aware of the claims being asserted." *Fintiv*, Paper 11 at 11. Here, Petitioner did not file a petition "promptly after becoming aware of the claims being asserted" but instead waited until July 2020, over nine months after Patent Owner served infringement contentions in the Texas case on October 1, 2019. Ex. 2003. Petitioner's explanation for the timing of the filing is that the prior art asserted in the Petition "was found in additional analysis undertaken around May 2020." Reply 4. Petitioner may have acted promptly after discovering the asserted prior art, but using this as a justification would simply incentivize delaying searching for prior art. Petitioner's focus on the discovery of the particular prior art asserted in the Petition fails to explain why any petition could not have been filed earlier.

In its Reply, Petitioner does not dispute Patent Owner's contentions as to the parties' and the Texas court's investment in the Texas case. Rather, Petitioner focuses on justifying the timing of the Petition, which we address above. *See* Reply 1–6. As Patent Owner notes, fact and expert discovery in the Texas case have ended, claim construction has occurred, dispositive motions and motions *in limine* have been filed, and the Joint Pretrial Order has been filed. *See* Prelim. Resp. 6 (citing Exs. 1004, 2005, 2006, 2007).

Thus, the parties' and the Texas court's investment in the Texas case is substantial, as one would expect with trial scheduled to begin in just over two months.

Based on the foregoing, we determine that this factor weighs in favor of exercising discretion to deny institution.

4. Overlap Between Issues Raised in the Petition and in the Parallel Proceeding

"[I]f the petition includes the same or substantially the same claims, grounds, arguments, and evidence as presented in the parallel proceeding, this fact has favored denial." *Fintiv*, Paper 11 at 12. "Conversely, if the petition includes materially different grounds, arguments, and/or evidence than those presented in the district court, this fact has tended to weigh against exercising discretion to deny institution under *NHK*." *Id.* at 12–13.

Petitioner argues that trial in the Texas case "will not resolve the issues before the Board here inasmuch as neither the same nor similar invalidity challenges are at issue." Pet. 4. Patent Owner counters that, although "Petitioner does not assert the exact same primary references here, the asserted primary references in the Petition are substantially the same as those in the district court litigation." Prelim. Resp. 17. In particular, Patent Owner contends that Niikawa and Watanabe are similar to Kishida, on which Petitioner relies in the Texas case, and Patent Owner notes that Petitioner relies on Kita in the Texas case. Prelim. Resp. 17–19.

With its Reply, Petitioner submitted a stipulation that it filed in the Texas case stating that, "if the Patent Trial and Appeal Board institutes *inter partes* review on IPR2020-01322, then Canon will not assert invalidity in this litigation against any claim of the '339 Patent based on Kishida alone or

in combination with any other reference." Ex. 1050, 1. Based on the stipulation, Petitioner asserts that "neither the IPR grounds themselves nor any IPR primary reference is before the district court" and, therefore, that "[t]his fact alone causes factor 4 to weigh in favor of institution." Reply 6–7 (citing *Sand Revolution II, LLC v. Cont'l Intermodal Grp. – Trucking LLC*, IPR2019-01393, Paper 24 at 11–12 (PTAB June 16, 2020) (informative); *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 at 19 (PTAB Dec. 1, 2020) (precedential in part)).

Petitioner's stipulation, which only addresses invalidity defenses based on Kishida, is not as broad as the *Sotera* stipulation, in which the petitioner stated that it would not pursue any ground "that was raised or could have been reasonably raised in an IPR (i.e., any ground that could be raised under §§ 102 or 103 on the basis of prior art patents or printed publications)." *Sotera*, Paper 12 at 18–19 (emphasis omitted). Rather, Petitioner's stipulation is more similar in scope to the one in *Sand Revolution*, Paper 24 at 11–12. In that decision, a panel of the Board found that "this factor weighs marginally in favor of not exercising discretion to deny institution" and noted that a broader stipulation "might have tipped this factor more conclusively in [the petitioner's] favor." *Sand Revolution*, Paper 24 at 12 & n.5.

Petitioner's stipulation mitigates to some degree concerns about overlapping issues between this proceeding and the Texas case. Therefore, we find that this factor weighs marginally against exercising discretion to deny institution.

5. Whether the Petitioner and the Defendant in the Parallel Proceeding Are the Same Party

Petitioner is the defendant in the Texas case. Therefore, this factor favors exercising discretion to deny institution.

6. Other Circumstances that Impact the Board's Exercise of Discretion

Petitioner argues that "the merits weigh in favor of institution given the strength of the grounds presented and developed below" (Pet. 5), while Patent Owner argues that "the Petition Grounds are very weak" (Prelim. Resp. 20).

As discussed above, with the exception of factor 4, the other *Fintiv* factors favor denying institution. We have reviewed Petitioner's unpatentability arguments and Patent Owner's arguments in response, and based on the limited record before us, we do not view this as a case where this one factor would outweigh the other *Fintiv* factors favoring denial of institution.

7. Holistic Assessment of Fintiv *Factors*

We consider the above factors and take "a holistic view of whether efficiency and integrity of the system are best served by denying or instituting review." *Fintiv*, Paper 11 at 6. As discussed above, the Texas case is scheduled to go to trial in just over two months and approximately ten months before the deadline for a final written decision if we were to institute (factor 2), and the Texas court and the parties in the Texas case, which are the same parties in this proceeding (factor 5), have invested substantially in the Texas case in preparation for trial (factor 3). Furthermore, Petitioner has represented to the Texas court that it will not

request a stay of the Texas case (factor 1). These factors, taken together, outweigh the remaining considerations discussed in factors 4 and 6. Thus, we determine that the facts presented weigh in favor of exercising discretion to deny institution in this instance.

III. CONCLUSION

Taking into consideration the arguments in the Petition, the Preliminary Response, the Reply, the Sur-reply, and the evidence of record, we exercise our discretion to deny institution under 35 U.S.C. § 314(a).

IV. ORDER

In consideration of the foregoing, it is hereby

ORDERED that the Petition is denied and no *inter partes* review is instituted in this proceeding.

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AO 120 (Rev. 08/10)

TO:	Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Eastern District of Texas, Marshall Division on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:19-cv-246	7/8/2019	Eastern District of Texas, Marshall Division

PLAINTIFF	DEFENDANT
Optimum Imaging Technologies LLC	Canon Inc.

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 7,612,805 B2	11/3/2009	Optimum Imaging Technologies LLC
2 8,451,339 B2	5/28/2013	Optimum Imaging Technologies LLC
3		
4		
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director **Copy 3—Upon termination of action, mail this copy to Director**
Copy 2—Upon filing document adding patent(s), mail this copy to Director **Copy 4—Case file copy**

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 8,451,339 B2
APPLICATION NO. : 12/586221
DATED : May 28, 2013
INVENTOR(S) : Neal Solomon

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

Item (60) please add the following header and paragraph:
--PRIORITY APPLICATION
This application is a continuation of U.S. Patent Application Serial Number 11/825,521, filed Jul. 6, 2007, which claims the benefit of U.S. Provisional Patent Application Number 60/807,065, filed Jul. 11, 2006, the disclosure of both are incorporated herein in their entireties by reference.--

In the Specification

In Column 1, Lines 7-9, delete "claims the benefit of priority under 35 U.S.C. section 119 from U.S. patent application Ser. No. 11/825,521 filed on Jul. 11, 2007 and" and insert --is a continuation of U.S. Patent Application Serial Number 11/825,521, filed Jul. 6, 2007, which claims the benefit of U.S.-- therefor

Signed and Sealed this
Eighteenth Day of June, 2019

Andrei Iancu

Andrei Iancu
Director of the United States Patent and Trademark Office

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.
12/586,221	09/18/2009	Neal Solomon	5311.001US2	8799

21186 7590 05/07/2019
SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

EXAMINER
KHAN, USMAN A

ART UNIT	PAPER NUMBER
2662	

NOTIFICATION DATE	DELIVERY MODE
05/07/2019	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

SLW@blackhillsip.com
uspto@slwip.com

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

In re Application of	:	
Solomon, Neal	:	
Application No. 12/586,221	:	DECISION ON PETITION
Filed: 18 Sep 2009	:	
For: DIGITAL IMAGING SYSTEM FOR	:	
CORRECTING IMAGE ABERRATIONS	:	

This is a decision on the petition under 37 CFR 1.78(c) and 37 CFR 1.78(e) filed May 3, 2019, to accept unintentionally delayed claims under 35 U.S.C. 119(e) and 35 U.S.C. 120 for the benefit of prior-filed provisional and nonprovisional applications in above-identified issued patent by way of Certificate of Correction.

The petition under 37 CFR 1.78(c) and 37 CFR 1.78(e) is **GRANTED.**

A review of the record indicates petitioner did not make proper benefit claims to prior-filed provisional and nonprovisional applications as required by 35 U.S.C. 119(e) and 35 U.S.C. 120 and 37 CFR 1.78 in an application data sheet (ADS) within the time period provided by 37 CFR 1.78(a)(4) and 37 CFR 1.78(d)(3). The underlying application issued as Patent No. 8,451,339 on May 28, 2013. Therefore, the appropriate avenue of relief for adding or correcting benefit claims to prior-filed applications after issuance of the application into a patent is by way of a grantable petition under 37 CFR 1.78(c) and 37 CFR 1.78(e), accompanied by the petition fee as set forth in § 1.17(m), a corrected ADS in compliance § 1.76(c), a request for a Certificate of Correction, and a Certificate of Correction fee. *See* MPEP 1481.03(II).

With the present petition, petitioner submitted a $1000 petition fee, a corrected ADS in compliance with 37 CFR 1.76(c) containing proper benefit claims to prior-filed applications, an acceptable statement of unintentional delay, a completed Certificate of Correction form, and a $150 certificate of correction fee.

As the present petition satisfies the requirements to add or correct a reference to a prior applications in a patent via a Certificate of Correction, the Office accepts the benefit claims under 35 U.S.C. 119(e) and 35 U.S.C. 120 as unintentionally delayed. Therefore, it is appropriate for petitioner to add or correct claims under 35 U.S.C. 119(e) and 35 U.S.C. 120 for benefit of the prior-filed application via Certificate of Correction.

A corrected Filing Receipt, which includes the claim for benefit of the prior-filed applications, accompanies this decision on petition.

Petitioner is advised that this decision grants the petition to accept unintentionally delayed domestic benefit claims to the prior-filed applications because the petition requirements of 37 CFR 1.78 and the formal requirements for claiming domestic benefit (*see* MPEP 211.01 et. seq.) have been met. This acceptance should not be construed as meaning that any claim in this patent is entitled to the benefit of the prior-filed application(s). *See* MPEP 211.05 for more information regarding entitlement to domestic benefit.

This application is being referred to the Certificates of Correction Branch for processing the request for a Certificate of Correction in accordance with this decision.

Any inquiries concerning this decision may be directed to the undersigned at (571) 272-3211.

/Christina Tartera Donnell/

Christina Tartera Donnell
Attorney Advisor
Office of Petitions

Enclosure: Corrected Filing Receipt

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
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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
12/586,221	09/18/2009	2662	845	5311.001US2	15	3

CONFIRMATION NO. 8799

CORRECTED FILING RECEIPT

21186
SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

OC000000107930296

Date Mailed: 05/06/2019

Receipt is acknowledged of this non-provisional utility 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 FIRST INVENTOR, 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 corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction 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 provided that the request is grantable.

Inventor(s)

Neal Solomon, Oakland, CA;

Applicant(s)

Neal Solomon, Oakland, CA;

Power of Attorney: The patent practitioners associated with Customer Number 21186

Domestic Priority data as claimed by applicant

This application is a CON of 11/825,521 07/06/2007 PAT 7612805
which claims benefit of 60/807,065 07/11/2006

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: No

Permission to Access Search Results: No

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 10/29/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/586,221**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No
**** SMALL ENTITY ****
Title

DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS

Preliminary Class

348

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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 (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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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 AssetsControl, 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).

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The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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
12/586,221	09/18/2009	2662	845	5311.001US2	15	3

CONFIRMATION NO. 8799

CORRECTED FILING RECEIPT

21186
SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

OC000000107930296

Date Mailed: 05/06/2019

Receipt is acknowledged of this non-provisional utility 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 FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

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Inventor(s)

Neal Solomon, Oakland, CA;

Applicant(s)

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Power of Attorney: The patent practitioners associated with Customer Number 21186

Domestic Priority data as claimed by applicant

This application is a CON of 11/825,521 07/06/2007 PAT 7612805
which claims benefit of 60/807,065 07/11/2006

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: No

Permission to Access Search Results: No

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 10/29/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/586,221**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No
**** SMALL ENTITY ****
Title

DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS

Preliminary Class

348

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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 (1-866-999-4258).

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 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 AssetsControl, 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).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

Modified PTO/AIA/14 (12-13)
Approved for use through 04/30/2017. OMB 0651-0032
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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	5311.001US2
	Application Number	12/586,221
Title of Invention	DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor:

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix

Residence Information (Select One) ☐ US Residency ☐ Non US Residency ☐ Active US Military Service

City		State/Province		Country of Residence	

Mailing Address of Inventor:

Address 1			
Address 2			
City		State/Province	
Postal Code		Country	

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ An Address is being provided for the correspondence Information of this application.

Customer Number	
Email Address	

Application Information:

Title of the Invention			
Attorney Docket Number		Small Entity Status Claimed ☐	
Application Type			
Subject Matter			
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)		Suggested Figure for Publication (if any)	

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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	5311.001US2
	Application Number	12/586,221
Title of Invention	DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country Publication

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ Request Not to Publish. I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Enter either Customer Number or complete the Representative Name section below. If both sections are completed the Customer Number will be used for the Representative Information during processing.

Please Select One:	☐ Customer	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number			

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	5311.001US2
	Application Number	12/586,221
Title of Invention	DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status	Patented		
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
This application	continuation of	11/825,521	2007-07-06
Prior Application Status	Expired		
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
11/825,521	Claims benefit of provisional	60/807,065	2006-07-11

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(d). When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)i the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(h)(1) and (2). Under the POX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country	Parent Filing Date (YYYY-MM-DD)	Access Code (if applicable)

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	5311.001US2
	Application Number	12/586,221
Title of Invention	DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant must opt-out of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is ONLY reviewed and processed with the INITIAL filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby grants the USPTO authority to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant DOES NOT authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant DOES NOT authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	5311.001US2
	Application Number	12/586,221
Title of Invention	DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

☐ Assignee	☐ Legal Representative under 35 U.S.C. 117	☐ Joint Inventor
☐ Person to whom the inventor is obligated to assign	☐ Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

☐ Deceased	☐ Legally incapacitated

Name of the Deceased or Legally Incapacitated Inventor :

If the Applicant is an Organization check here: ☐

Organization Name:

Prefix	Given Name	Middle Name	Family Name	Suffix

Mailing Address Information:

Address 1			
Address 2			
City		State/Province	
Country		Postal Code	
Phone Number			
Email Address			

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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	5311.001US2
	Application Number	12/586,221
Title of Invention	DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	Given Name	Middle Name	Family Name	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		State/Province	
Country		Postal Code	
Phone Number		Fax Number	
Email Address			

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is **a juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, all joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of all joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Ryan J. Connell/			Date (YYYY-MM-DD)	2019-05-03
First Name	Ryan	Last Name	Connell	Registration Number	74,611

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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 22313-14**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Neal Solomon

Title: DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS

Docket No:	5311.001US2	Serial No.:	12/586,221
Filed:	September 18, 2009	Group Art Unit:	2662
Examiner:	Usman A. Khan	Patent No.:	8,451,339
Customer No.:	21186	Confirmation No.:	8799

Certificate of Corrections Branch
ATTN: Christina Tartera Donnell
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

We are transmitting herewith the attached:

X Updated Application Data Sheet (6 pgs).
X Petition to Expedite Consideration Under 37 C.F.R. § 1.182 (2 pgs).
X Petition under 37 CFR 1.78(c) and 1.78(e) to Accept an Unintentionally Delayed Claim of Priority (3 pgs).
X Patentee Certification Of Petition Under 37 Cfr 1.78(C) And 1.78(E) To Accept An Unintentionally Delayed Priority Claim (1 pg).
X Request for Certificate of Correction. (1 pg).
X Certificate of Correction Form – PTO/SB/44 (PTO-1050) (1pg.).
X **Authorization to Charge Deposit Account 19-0743 in the amount of $200.00 to cover the Petition to Expedite Consideration fee.**
X **Authorization to Charge Deposit Account 19-0743 in the amount of $1000.00 to cover the Petition to Accept an Unintentionally Delayed Claim of Priority fee.**
X **Authorization to charge Desposit Account 19-0743 in the amount of $150.00 to cover the Certificate of Correction fee.**

If necessary please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
Customer No: 21186

By: /Ryan J. Connell/
Ryan J. Connell
Reg. No. 74,611

Electronic Patent Application Fee Transmittal

Application Number:	12586221
Filing Date:	18-Sep-2009
Title of Invention:	DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS
First Named Inventor/Applicant Name:	Neal Solomon
Filer:	Joseph P. Mehrle/Amanda Latzke
Attorney Docket Number:	5311.001US2

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
PETITION FEE - 37 CFR 1.17(F)(GROUP I)	2462	1	200	200
PET. DELAY SUB OR RESTORE PRIORITY-CLAIM	2454	1	1000	1000
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
CERTIFICATE OF CORRECTION	2811	1	150	150
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1350**

Electronic Acknowledgement Receipt

EFS ID:	35915350
Application Number:	12586221
International Application Number:	
Confirmation Number:	8799
Title of Invention:	DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS
First Named Inventor/Applicant Name:	Neal Solomon
Customer Number:	21186
Filer:	Joseph P. Mehrle/Amanda Latzke
Filer Authorized By:	Joseph P. Mehrle
Attorney Docket Number:	5311.001US2
Receipt Date:	03-MAY-2019
Filing Date:	18-SEP-2009
Time Stamp:	16:07:41
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1350
RAM confirmation Number	050619INTEFSW00003062190743
Deposit Account	190743
Authorized User	Robyn Miller

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		5311001US2_DocsforFiling.pdf	291410 a243568d3df52045e645e3f06802086d864cde43	yes	15

Multipart Description/PDF files in .zip description

Document Description	Start	End
Miscellaneous Incoming Letter	15	15
Request for Certificate of Correction	14	14
Miscellaneous Incoming Letter	13	13
Miscellaneous Incoming Letter	10	12
Miscellaneous Incoming Letter	8	9
Application Data Sheet	2	7
Transmittal Letter	1	1

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	33559 dd4522c2c7451e2ff719ad629d515d4cb045a5ec	no	2

Warnings:

Information:

Total Files Size (in bytes):	324969

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
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.
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.
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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Neal Solomon	Examiner: Usman A. Khan	
Serial No.:	12/586,221	Group Art Unit: 2662	
Filed:	September 18, 2009	Docket No.: 5311.001US2	
Customer No.: 21186		Confirmation No.: 8799	
Title:	DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS		

PETITION TO EXPEDITE CONSIDERATION UNDER 37 C.F.R. § 1.182

Director, Office of Petitions
Attention: Christina Tartera Donnell
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Patentee respectfully requests accelerated consideration of Patentee's Petition under 37 CFR §1.78(c) and 1.78(e) and all accompanying documents that outline accurate claims of priority. The delayed claims of priority were unintentional and Patentee submits this Petition requesting expedited review.

The Commissioner is hereby authorized to charge Deposit Account 19-0743 in the amount of $200.00, which is the required fee due under 37 C.F.R. § 1.17(f). Please charge any additional fees deemed necessary for the consideration of this Petition to Deposit Account 19-0743.

CONCLUSION

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's representative at (612) 373-6912 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account 19-0743.

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 373-6912

/Ryan J. Connell/

Date May 3, 2019 By _____
Ryan J. Connell
Reg. No. 74,611

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Neal Solomon	Examiner: Usman A. Khan	
Serial No.:	12/586,221	Group Art Unit: 2662	
Filed:	September 18, 2009	Docket No.: 5311.001US2	
Customer No.: 21186		Confirmation No.: 8799	
Title:	DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS		

PETITION UNDER 37 CFR 1.78(c) AND 1.78(e) TO ACCEPT AN UNINTENTIONALLY DELAYED PRIORITY CLAIM

Director, Office of Petitions
Attention: Christina Tartera Donnell
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Patentee respectfully requests that the priority claim for the above-identified patent be corrected to clarify that it is a continuation of U.S. Patent Application Ser. No. 11/825,521 filed on Jul. 11, 2007 now issued as U.S. Patent 7,612,805, which claims the benefit of Provisional Patent Application Ser. No. 60/807,065 filed on July 11, 2006.

Patentee has submitted herewith a Supplemental Application Data Sheet to reflect the correction of the priority claim.

Therefore, Patentee respectfully requests that the priority claim under 35 U.S.C. §120 be corrected for the above-referenced patent to clearly show that it (U.S. Application Serial No. 12/586,211) is a continuation of U.S. Patent Application Ser. No. 11/825,521 filed on Jul. 11, 2007 now issued as U.S. Patent 7,612,805. Patentee further requests that priority under 35 U.S.C. § 119(e) be corrected to clearly show that the above-referenced patent (U.S. Application Serial No. 12/586,211) further claims the benefit of priority of U.S. Provisional Patent Application Ser. No. 60/807,065 filed on July 11, 2006.

Accordingly, it is respectfully requested that this Petition be granted to accept Patentee's delayed claims of priority. Patentee certifies that the entire delay between the date the claims of priority were first made and the date of correction was unintentional.

The Commissioner is authorized to charge Deposit Account No. 19-0743 in the amount of $1000.00, which is the fee set forth under 37 C.F.R. § 1.17(m). Patentee submits herewith a Certificate of Correction and a Petition to Expedite Consideration Under 37 C.F.R. § 1.182

with authorizations to pay the requisite fees for each, respectively. The Commissioner is further authorized to charge any fees deemed necessary for the consideration and grant of this Petition and its supporting documents to Deposit Account 19-0743.

CONCLUSION

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's representative at (612) 373-6912 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account 19-0743.

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 373-6912

Date May 3, 2019

By /Ryan J. Connell/
Ryan J. Connell
Reg. No. 74,611

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Neal Solomon	Examiner: Usman A. Khan	
Serial No.:	12/586,221	Group Art Unit: 2662	
Filed:	September 18, 2009	Docket No.: 5311.001US2	
Customer No.:	21186	Confirmation No.: 8799	
Title:	DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS		

PATENTEE CERTIFICATION OF PETITION UNDER 37 CFR 1.78(c) AND 1.78(e) TO ACCEPT AN UNINTENTIONALLY DELAYED PRIORITY CLAIM

Director, Office of Petitions
Attention: Christina Tartera Donnell
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Patentee has respectfully submitted a Petition under 37 CFR 1.78(c) and 37 CFR 1.78(e) to accept an unintentionally delayed priority claim. Patentee certifies that the entire delay between the date the claims of priority were first made and the date of correction was unintentional.

Respectfully submitted,

Date April 29, 2019 By /Neal Solomon/
Neal Solomon

S/N 12/586,221 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent No.:	8,451,339	Docket:	5311.001US2
Issue Date:	May 28, 2013	Patentee:	Neal Solomon
Customer No.:	21186	Confirmation No.:	8799
Title	DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS		

REQUEST FOR CERTIFICATE OF CORRECTION

Certificate of Corrections Branch
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

It is requested that a Certificate of Correction be issued correcting printing errors appearing in the above-identified United States patent. A copy of the text of the Certificate in the suggested form is attached.

Pursuant to 37 CFR 1.323, authorization is hereby given to charge Deposit Account 19-0743 in the amount of $150.00 to cover the fee required under 37 CFR 1.20(a).

Issuance of the Certificate of Correction would neither expand nor contract the scope of the claims as properly allowed, and re-examination is not required.

The Examiner is authorized to charge any additional fees or credit overpayment to Deposit Account 19-0743.

Respectfully Submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 373-6912

/Ryan J. Connell/

Date :May 3, 2019 By: _____

Ryan J. Connell
Reg. No. 74,611

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO.: 8,451,339

APPLICATION NO.: 12/586,221

ISSUE DATE: May 28, 2013

INVENTOR(S): Neal Solomon

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:

Please add the following header and paragraph on face page of the patent:

--PRIORITY APPLICATION

This application is a continuation of U.S. Patent Application Serial Number 11/825,521, filed Jul. 6, 2007, which claims the benefit of U.S. Provisional Patent Application Number 60/807,065, filed Jul. 11, 2006, the disclosures of both are incorporated herein in their entireties by reference.--

In column 1, lines 7-9, delete "claims the benefit of priority under 35 U.S.C. section 119 from U.S. patent application Ser. No. 11/825,521 filed on Jul. 11, 2007 and" and insert --is a continuation of U.S. Patent Application Serial Number 11/825,521, filed Jul. 6, 2007, which claims the benefit of U.S.-- therefor

MAILING ADDRESS OF SENDER (Please do not use customer number below): Atty Docket No: 5311.001US2

Schwegman Lundberg & Woessner, P.A.
P.O. BOX 2938
Minneapolis, MN 55402

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. 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 1.0 hour 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: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/586,221	09/18/2009	Neal Solomon	5311.001US2

CONFIRMATION NO. 8799

POA ACCEPTANCE LETTER

21186
SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

OC000000107828696

Date Mailed: 05/02/2019

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 04/29/2019.

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.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/atesfai/

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Neal Solomon	Patent No.: 8,451,339
Serial No.:	12/586,221	Issue Date: May 28, 2013
Filed:	September 18, 2009	Docket: 5311.001US2
Customer No.	21186	Confirmation No.: 8799
Title:	DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS	

REVOCATION AND POWER OF ATTORNEY & CHANGE OF CORRESPONDENCE ADDRESS

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

In accordance with 37 C.F.R. Section 1.36, M.P.E.P. Section 402.05 and 402.07, please revoke any existing Powers of Attorney, if any, and appoint the following attorneys and/or patent agents to prosecute this application and to transact all business in the Patent and Trademark Office in connection therewith:

Customer Number: 21186

Please direct all correspondence in this case to:

Schwegman Lundberg & Woessner, P.A.
Customer No. 21186

Date 4/24/19

By Neal J. Solomon
Name: Neal Solomon
Title: Applicant/Inventor

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Neal Solomon
Title: DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS

Docket No.:	5311.001US2	Serial No.:	12/586,221
Filed:	September 18, 2009	Due Date:	N/A
Examiner:	Unknown	Group Art Unit:	2662
Customer No.:	21186	Confirmation No.:	8799

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

We are transmitting herewith the following attached items (as indicated with an "X"):

X Revocation and Power of Attorney & Change of Correspondence Address (1 pg.)

If not provided for in a separate paper filed herewith, please consider this a PETITION FOR EXTENSION OF TIME for sufficient number of months to enter these papers and please charge any additional fees or credit overpayment to Deposit Account No. 19-0743. If applicable, any papers or fees supplied herewith are considered to be timely filed pursuant to 37 C.F.R. § 1.7(a), the response period falling on a Federal Holiday, Saturday or Sunday being extended to the next succeeding business day.

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
Customer No.: 21186

By: /Timothy E. Bianchi/
Timothy E. Bianchi
Reg. No. 39,610

Electronic Acknowledgement Receipt

EFS ID:	35861914
Application Number:	12586221
International Application Number:	
Confirmation Number:	8799
Title of Invention:	DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS
First Named Inventor/Applicant Name:	Neal Solomon
Correspondence Address:	Neal Solomon - P.O. Box 21297 - Oakland CA 94620 US - -
Filer:	Timothy J. Christman/Mandy Brown
Filer Authorized By:	Timothy J. Christman
Attorney Docket Number:	
Receipt Date:	29-APR-2019
Filing Date:	18-SEP-2009
Time Stamp:	16:01:18
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		5311_001US2_RPOA_signed.pdf	162237 7074c0e3bd3cee5564cbc5ec9c46169146dbe075	yes	2

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Power of Attorney	2	2
Miscellaneous Incoming Letter	1	1

Warnings:

Information:

Total Files Size (in bytes):	162237

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
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.
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.
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.

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.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/586,221	05/28/2013	8451339		8799

7590 05/08/2013

Neal Solomon
P.O. Box 21297
Oakland, CA 94620

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 655 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):

Neal Solomon, Oakland, CA;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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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
12/586,221	09/18/2009	2662	845		15	3

CONFIRMATION NO. 8799

CORRECTED FILING RECEIPT

Neal Solomon
P.O. Box 21297
Oakland, CA 94620

OC000000060710894

Date Mailed: 04/25/2013

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**

Inventor(s)

Neal Solomon, Oakland, CA;

Applicant(s)

Neal Solomon, Oakland, CA;

Power of Attorney: None

Domestic Applications for which benefit is claimed - None.
A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

If Required, Foreign Filing License Granted: 10/29/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/586,221**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No
**** SMALL ENTITY ****

Title

DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS

Preliminary Class

348

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:

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

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 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 AssetsControl, 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).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

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.
12/586,221	09/18/2009	Neal Solomon		8799

7590 04/25/2013

Neal Solomon
P.O. Box 21297
Oakland, CA 94620

EXAMINER
KHAN, USMAN A

ART UNIT	PAPER NUMBER
2662	

MAIL DATE	DELIVERY MODE
04/25/2013	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. 12/586 221	Applicant(s)
	Examiner	Art Unit

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

1. ☒ The amendment filed on *23 April 2013* 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.

/Rahel Tekle/

Publishing Division

April 23, 2013

U.S. Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313

Re: 12/586,221

To Whom It May Concern:

This is a response to the "Notice to File Corrected Application Papers" dated March 29, 2013. The notice refers to a request to correct a reference in an application data sheet or the first sentence of the specification regarding the relationship to the prior U.S. nonprovisional application. Enclosed is a copy of the notice.

Paragraph 0001 of the application states:

"CROSS-REFERENCES TO RELATED APPLICATIONS

"The present application claims the benefit of priority under 35 U.S.C. section 119 from U.S. Patent Application Serial No. 11/825,521 filed on July 11, 2007 and Provisional Patent Application Serial No. 60/807,065 filed on July 11, 2006, the disclosures of which are hereby incorporated by reference in their entirely for all purposes."

This statement is correct and accurate. The notice was therefore erroneous.

The applicant requests an extension of time on the patent to accommodate this error on the part of the Patent Office.

Please respond to this letter with the notice of the issuance of the patent.

Sincerely,

/Neal E. Solomon/

Neal Solomon

[Customer #: 103468; Address: P.O. Box 21297, Oakland, CA 94620; Phone: (415) 334-5600]

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/586,221	09/18/2009	Neal Solomon		8799

7590 03/29/2013

Neal Solomon
P.O. Box 21297
Oakland, CA 94620

EXAMINER
KHAN, USMAN A

ART UNIT	PAPER NUMBER
2662	

MAIL DATE	DELIVERY MODE
03/29/2013	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.

PTOL-90A (Rev. 04/07)

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. : 12586221
Applicant : Solomon
Filing Date : 09/18/2009
Date Mailed : 03/29/2013

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 1 month 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 application is not in compliance with 37 CFR 1.78, as indicated in the attachment. The consequences of failure to respond within the above-identified time period are set forth in the attachment.

Even if the Office has recognized a benefit claim and has entered it into the Office's database and included it on applicant's filing receipt, the benefit claim is not a proper benefit claim unless the reference in compliance with 37 CFR 1.78 is included, depending upon the application's filing date and as indicated in the attachment, in an application data sheet or in the first sentence(s) of the specification and all other requirements are met.

This period for reply is NOT extendable under 37 CFR 1.136(a).

See attachment.

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".

Jonathan Robbins
Publication Branch
Office of Data Management
(571) 272-4200

571-
272-

Application No. 12586221

APPLICATION FILED PRIOR TO SEPTEMBER 16, 2012, NOT IN COMPLIANCE WITH 37 CFR 1.78

☒ The 37 CFR 1.78(a)(2) reference on the application data sheet or in the first sentence(s) of the specification does not indicate the relationship (continuation, division, continuation-in-part) to the prior U.S. nonprovisional application or international application designating the U.S. See document coded SPEC dated 09-18-2009, listing application number(s) 11/825,521.

☐ The 37 CFR 1.78(a)(2) reference on the application data sheet or in the first sentence(s) of the specification following the title does not provide the U.S. nonprovisional application number (series code and serial number) or, with respect to an international PCT application designating the U.S., it provides the international application number or international filing date but not both. See document coded ____ dated _____, in which the following is missing:_____.

☐ The 37 CFR 1.78(a)(2) reference on the application data sheet or in the first sentence(s) of the specification following the title shows an incorrect, incomplete, or illegible U.S. nonprovisional application number, international PCT application number, or international PCT filing date. See document coded ____ dated _____, in which the following error was made:_____.

☐ The 37 CFR 1.78(a)(2) reference to the prior U.S. nonprovisional application or international application designating the U.S. is not present on an application data sheet or in the first sentence(s) of the specification following the title, thus removing the validating link under 35 U.S.C. 119(a)-(d) to a prior foreign application or under 35 U.S.C. 119(e) to a prior U.S. provisional application.

☐ The 37 CFR 1.78(a)(2) reference to the prior U.S. nonprovisional application or international application designating the U.S. is not present on an application data sheet or in the first sentence(s) of the specification following the title.

☐ The 37 CFR 1.78(a)(5) reference to the prior U.S. provisional application is not present on an application data sheet or in first sentence(s) of the specification following the title.

☐ The 37 CFR 1.78(a)(5) reference to the prior U.S. provisional application on an application data sheet or in first sentence(s) of the specification following the title does not provide the provisional application number (series code and serial number). See document coded ____ dated _____, in which the following is missing:_____.

☐ The 37 CFR 1.78(a)(5) reference to the prior U.S. provisional application on an application data sheet or in first sentence(s) of the specification following the title shows an incorrect, incomplete, or illegible U.S. provisional application number. See document coded ____ dated _____, in which the following error was made:_____.

☐ Other: _____.

HOW TO RESPOND

A proper response to this notice would include any one of: (1) a supplemental Application Data Sheet (ADS) pursuant to 37 CFR 1.76(c) which provides benefit information that complies with 37 CFR 1.78(a)(2) or 37 CFR 1.78(a)(5); (2) an amendment to the first sentence(s) of the specification which provides benefit information that complies with 37 CFR 1.78(a)(2) or 37 CFR 1.78(a)(5); or (3) a petition filed pursuant to the provisions of 37 CFR 1.78(a)(3) or 37 CFR 1.78(a)(6) if the benefit information from the document identified above by code and date does not accurately reflect the benefits under 35 U.S.C. 119(e), 120, 121 or 365(c) as claimed by applicant (a grantable petition would include either a supplemental ADS or an amendment to the first sentence(s) of the specification as required by 37 CFR 1.78(a)(3)(i) or 37 CFR 1.78(a)(6)(i)). Such amendments to the specification or supplemental ADS submission may be filed after payment of the issue fee if limited to informalities noted herein. See Waiver of 37 CFR 1.312 for Document Required by Office of Patent Publication, 1280 Off. Gaz. Patent Office 918 (March 23, 2004).

WARNING: If Applicant fails to timely submit a proper response, the benefit information will be deleted and the patent will be printed without the benefit information present.

Electronic Acknowledgement Receipt

EFS ID:	15594699
Application Number:	12586221
International Application Number:	
Confirmation Number:	8799
Title of Invention:	DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS
First Named Inventor/Applicant Name:	Neal Solomon
Correspondence Address:	Neal Solomon - P.O. Box 21297 - Oakland CA 94620 US - -
Filer:	Neal Edward Solomon
Filer Authorized By:	
Attorney Docket Number:	
Receipt Date:	23-APR-2013
Filing Date:	18-SEP-2009
Time Stamp:	18:22:44
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	Amendment after Notice of Allowance (Rule 312)	SPP_X_221_response_to_notice.pdf	129393 ea563d6f0a847c2b2ba08a30874e771470beeaff	no	1
Warnings:					
Information:					
2	Other Reference-Patent/App/Search documents	SPP_X_221_Notice.pdf	2394700 1530726c9f0e71471c8136e3f39293a001f88f96	no	3
Warnings:					
Information:					
		Total Files Size (in bytes):	2524093		

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.

<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.

<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.

<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.

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.
12/586,221	09/18/2009	Neal Solomon		8799

7590 03/29/2013

Neal Solomon
P.O. Box 21297
Oakland, CA 94620

EXAMINER
KHAN, USMAN A

ART UNIT	PAPER NUMBER
2662	

MAIL DATE	DELIVERY MODE
03/29/2013	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. : 12586221
Applicant : Solomon
Filing Date : 09/18/2009
Date Mailed : 03/29/2013

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 1 month 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 application is not in compliance with 37 CFR 1.78, as indicated in the attachment. The consequences of failure to respond within the above-identified time period are set forth in the attachment.

Even if the Office has recognized a benefit claim and has entered it into the Office's database and included it on applicant's filing receipt, the benefit claim is not a proper benefit claim unless the reference in compliance with 37 CFR 1.78 is included, depending upon the application's filing date and as indicated in the attachment, in an application data sheet or in the first sentence(s) of the specification and all other requirements are met.

This period for reply is NOT extendable under 37 CFR 1.136(a).

See attachment.

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".

Jonathan Robbins
Publication Branch
Office of Data Management
(571) 272-4200

Application No. 12586221

APPLICATION FILED PRIOR TO SEPTEMBER 16, 2012, NOT IN COMPLIANCE WITH 37 CFR 1.78

☒ The 37 CFR 1.78(a)(2) reference on the application data sheet or in the first sentence(s) of the specification does not indicate the relationship (continuation, division, continuation-in-part) to the prior U.S. nonprovisional application or international application designating the U.S. See document coded SPEC dated 09-18-2009, listing application number(s) 11/825,521.

☐ The 37 CFR 1.78(a)(2) reference on the application data sheet or in the first sentence(s) of the specification following the title does not provide the U.S. nonprovisional application number (series code and serial number) or, with respect to an international PCT application designating the U.S., it provides the international application number or international filing date but not both. See document coded ____ dated _____, in which the following is missing:_____.

☐ The 37 CFR 1.78(a)(2) reference on the application data sheet or in the first sentence(s) of the specification following the title shows an incorrect, incomplete, or illegible U.S. nonprovisional application number, international PCT application number, or international PCT filing date. See document coded ____ dated _____, in which the following error was made:_____.

☐ The 37 CFR 1.78(a)(2) reference to the prior U.S. nonprovisional application or international application designating the U.S. is not present on an application data sheet or in the first sentence(s) of the specification following the title, thus removing the validating link under 35 U.S.C. 119(a)-(d) to a prior foreign application or under 35 U.S.C. 119(e) to a prior U.S. provisional application.

☐ The 37 CFR 1.78(a)(2) reference to the prior U.S. nonprovisional application or international application designating the U.S. is not present on an application data sheet or in the first sentence(s) of the specification following the title.

☐ The 37 CFR 1.78(a)(5) reference to the prior U.S. provisional application is not present on an application data sheet or in first sentence(s) of the specification following the title.

☐ The 37 CFR 1.78(a)(5) reference to the prior U.S. provisional application on an application data sheet or in first sentence(s) of the specification following the title does not provide the provisional application number (series code and serial number). See document coded ____ dated _____, in which the following is missing:_____.

☐ The 37 CFR 1.78(a)(5) reference to the prior U.S. provisional application on an application data sheet or in first sentence(s) of the specification following the title shows an incorrect, incomplete, or illegible U.S. provisional application number. See document coded ____ dated _____, in which the following error was made:_____.

☐ Other: _____.

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WARNING: If Applicant fails to timely submit a proper response, the benefit information will be deleted and the patent will be printed without the benefit information present.

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.
12/586,221	09/18/2009	Neal Solomon		8799

7590 01/14/2013

Neal Solomon
P.O. Box 21297
Oakland, CA 94620

EXAMINER
KHAN, USMAN A

ART UNIT	PAPER NUMBER
2662	

MAIL DATE	DELIVERY MODE
01/14/2013	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

Neal Solomon
P.O. Box 21297
Oakland CA 94620

Application No.: **12586221**
Date Mailed: **1/12/2013**

NOTICE TO PAY BALANCE OF ISSUE FEE

The issue fee payment filed on **12/10/12** has been received. Although the fee was paid in response to the Notice of Allowance and Fees Due, new patent fees went into effect on October 5, 2012, after the mailing date of the Notice. See CPI Adjustment of Patent Fees for Fiscal Year 2013, 77 Fed. Reg. 54360, which adjusts certain patent fees, including the issue fee, to reflect fluctuations in the Consumer Price Index (CPI). Because the issue fee was paid on or after October 5, 2012, the new issue fee was due instead of the amount specified in the Notice of Allowance and Fees Due.

Applicant is given a time period of **THREE (3) MONTHS** from the mailing date of this notice during which to pay the **BALANCE DUE** indicated below. The balance due is the difference between the issue fee required on the date that the correct issue fee is paid and the amount that was previously paid. This three-month time period may not be extended. If the balance due is not paid before the expiration of the three-month period, the application will become abandoned (if not issued) or the patent will lapse (if issued) at the termination of the three-month period.

Application Type	Column A Issue Fee Required Small Entity	Column A Issue Fee Required Large Entity	Column B Issue Fee Paid	Balance Due Column A - Column B
UTILITY	$885.00	$1,770.00	$870.00	$15.00
REISSUE	$885.00	$1,770.00		
DESIGN	$505.00	$1,010.00		
PLANT	$695.00	$1,390.00		

/Kimberly Terrell/
Office of Data Management
571-272-4100

How to Pay:

Currently payments cannot be made via the Electronic Filing System

Submit payment by fax at 571-273-8300 – Include a copy of the letter and authorization to charge a deposit account or credit card on file.
Submit payment by mail – Include a copy of the letter, and either authorization to charge a deposit account/credit card or submit a check/ money order.

Document code: WFEE

United States Patent and Trademark Office
Sales Receipt for Accounting Date: 02/07/2013

DTERRY SALE #00000007 Mailroom Dt: 12/11/2012 12586221
01 FC : 2501 885.00 OP

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)

7590 09/06/2012

Neal Solomon
P.O. Box 21297
Oakland, CA 94620

12/11/2012 EEKUBAY2 00000040 12586221

01 FC:1504 300.00 OP
02 FC:1506 870.00 OP

OPAP DEC 10 2012 IAP11 PATENT & TRADEMARK OFFICE

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.

Neal Solomon	(Depositor's name)
Neal Solomon	(Signature)
12/6/12	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/586,221	09/18/2009	Neal Solomon		8799

TITLE OF INVENTION: DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$870	$300	$0	$1170	12/06/2012

EXAMINER	ART UNIT	CLASS-SUBCLASS
KHAN, USMAN A	2622	348-222100

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,
   (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.
   1 _____
   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 (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 Neal Solomon Date 12/6/12

Typed or printed name Neal Solomon 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

NOTICE OF ALLOWANCE AND FEE(S) DUE

7590 09/06/2012

Neal Solomon
P.O. Box 21297
Oakland, CA 94620

OPAP
DEC 10 2012
IAP11
PATENT & TRADEMARK OFFICE

EXAMINER
KHAN, USMAN A

ART UNIT	PAPER NUMBER
2622	

DATE MAILED: 09/06/2012

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/586,221	09/18/2009	Neal Solomon		8799

TITLE OF INVENTION: DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$870	$300	$0	$1170	12/06/2012

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.

Document Code: IMIS

Notice of Fee Due

Date: 12-10-12

Application Number: 12586221

A fee is due for the attached document for the reason indicated below. Please check the application for the appropriate authorization to charge a deposit account. If an authorization is present, please charge the appropriate fee*. If an authorization is not present, notify the applicant of the fee deficiency.

***If the fee due is for any of the filing fees, check for authorization to charge the surcharge. If authorization is present, charge the surcharge for late payment of the filing fees as well.**

- [x] Insufficient payment by check or money order.
- [ ] Insufficient funds in deposit account _____ at _____:_____ (time).
- [ ] Insufficient payment by credit card.
- [ ] Declined credit card _____:_____ (time).
- [x] No authorization to charge a deposit account.

Fee code(s) to be applied:	2501	385.00
Amount in holding fee code:	1506	870.00
	1622/2622	
	1999	
Total remaining due from applicant:		915.00

RAM Operator E-E

Rev. 12/27/07

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

7590 09/06/2012

Neal Solomon
P.O. Box 21297
Oakland, CA 94620

EXAMINER
KHAN, USMAN A

ART UNIT	PAPER NUMBER
2622	

DATE MAILED: 09/06/2012

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/586,221	09/18/2009	Neal Solomon		8799

TITLE OF INVENTION: DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$870	$300	$0	$1170	12/06/2012

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)

7590 09/06/2012

Neal Solomon
P.O. Box 21297
Oakland, CA 94620

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.
12/586,221	09/18/2009	Neal Solomon		8799

TITLE OF INVENTION: DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$870	$300	$0	$1170	12/06/2012

EXAMINER	ART UNIT	CLASS-SUBCLASS
KHAN, USMAN A	2622	348-222100

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,

(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.

1_____
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 (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.
12/586,221	09/18/2009	Neal Solomon		8799

7590 09/06/2012

Neal Solomon
P.O. Box 21297
Oakland, CA 94620

EXAMINER
KHAN, USMAN A

ART UNIT	PAPER NUMBER
2622	

DATE MAILED: 09/06/2012

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 406 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 406 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)	
	12/586,221	SOLOMON, NEAL	
	Examiner	Art Unit	
	USMAN KHAN	2622	

-- 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 *08/23/2012*.

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 *1-2,16-27,29-32 renumbered as allowed claims 1-12,14-18, and 13*.

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 Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
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 _____.

/Usman Khan/
Primary Examiner, Art Unit 2622

PETITIONERS EX1015

DETAILED ACTION

Terminal Disclaimer

The terminal disclaimer filed on 08/23/2012 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of 7,612,805 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Applicant has amended claims 17, 19, 22, and 29 to overcome the objection to the specification provided in the previous office action.

Allowable Subject Matter

Claims 1 - 2, 16 - 27, 29 - 32 are allowed.

The following is an examiner's statement of reasons for allowance:

Regarding independent **claim 1**, the prior art of record fails to teach or fairly suggest a digital camera mechanism, an optical lens mechanism, a digital sensor, a microprocessor, a digital signal processor, system software, a database management system and a memory storage sub-system; wherein the optical lens mechanism is a fixed focal length lens; wherein a microprocessor uses system software organized to identify at least one optical aberration by accessing the database; wherein the microprocessor uses the database to identify at least one algorithm to use to correct the at least one optical aberration; wherein when the image file is captured by the digital sensor the digital file is forwarded to the digital signal processor; wherein the image file

with the at least one optical aberration is corrected by applying digital filtration by using at least one algorithm in the digital signal processor; and wherein the modified digital file consisting of the digital data optimized from the at least one optical aberration that are corrected from the original optical image is stored in memory; in combination with other elements of the claim.

Regarding **claims 2 and 16 - 18**, these claims are allowed as being dependent from allowed independent claim 1.

Regarding independent **claim 19**, the prior art of record fails to teach or fairly suggest a digital camera mechanism, an optical lens mechanism, a digital sensor, an integrated circuit, a digital signal processor, system software, a database management system and a memory storage sub-system; wherein the optical lens mechanism is a zoom lens or a fixed focal length lens; wherein the image data file is forwarded from the digital sensor to storage in memory; wherein at least one optical and/or digital aberration in the image file are identified by comparing image files in the database management system by using the system software and the integrated circuit; wherein the at least one filtration algorithms required to correct the at least one optical and/or digital aberration are sent from the integrated circuit to the digital signal processor; wherein the at least one optical and/or digital aberration from the optical lens mechanism are corrected by using the digital signal processor to apply digital filtration algorithm; and wherein the modified digital file consisting of the digital data optimized

from the at least one aberration that are corrected from the original optical image is stored in memory; in combination with other elements of the claim.

Regarding **claims 20 - 25 and 32**, these claims are allowed as being dependent from allowed independent claim 19.

Regarding independent **claim 26**, the prior art of record fails to teach or fairly suggest a digital camera mechanism, an optical lens mechanism, a digital sensor, a microprocessor, a digital signal processor, system software, a database management system and a memory storage sub-system; wherein the optical lens mechanism is a zoom lens; wherein the zoom lens changes focal length positions; wherein when the image file is captured by the digital sensor the file is forwarded to the digital signal processor and to memory; wherein the microprocessor uses system software to access the database to identify at least one optical aberration in the image file at any focal length of a zoom lens configuration; wherein the microprocessor accesses the database to obtain at least one filtration correction algorithm to the optical aberrations and forwards the at least one filtration algorithms to the digital signal processor; wherein the image file is forwarded to the digital signal processor which applies a at least one filtration algorithm to optimize the image and corrects the at least one optical aberration at the specific focal length in the zoom lens configuration; and wherein the modified image file consisting of the digital data optimized from the at least one optical aberration

of a specific focal length of the zoom lens that are corrected from the original optical image is stored in memory; in combination with other elements of the claim.

Regarding **claims 27 and 29 - 31**, these claims are allowed as being dependent from allowed independent claim 26.

Conclusion

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 Usman Khan whose telephone number is (571) 270-1131. The examiner can normally be reached on Mon-Fri 6:45-3:15.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jason Chan can be reached on (571) 272-3022. The fax phone 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.

/Usman Khan/
Usman Khan
08/29/2012
Primary Examiner, Art Unit 2622

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. 8799

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/586,221	09/18/2009 **RULE**	348 UK	2622	

APPLICANTS
Neal Solomon, Oakland, CA; UK

**** CONTINUING DATA ***************************
This application is a CON of 11/825,521 07/06/2007 PAT 7,612,805 UK
which claims benefit of 60/807,065 07/11/2006 UK

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **** ** SMALL ENTITY **
10/29/2009

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /USMAN A KHAN/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		CA	19 UK	~~15~~ 18	3 UK

ADDRESS
Neal Solomon
P.O. Box 21297
Oakland, CA 94620
UNITED STATES

TITLE
Digital imaging system for correcting image aberrations UK

FILING FEE RECEIVED		
545	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

BIB (Rev. 05/07).

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12586221	SOLOMON, NEAL
	Examiner	**Art Unit**
	USMAN KHAN	2622

SEARCHED

Class	Subclass	Date	Examiner
348	222.1,231.99,224.1,273,342,208.11,333.08,335,340,241	05/17/2012,05/18/2012; 08/28/2012	UK

SEARCH NOTES

Search Notes	Date	Examiner
EAST (Including databases: US-PGPUB, USPAT, USOCR, FPRS, EPO, JPO, DERWENT, IBM_TDB): See attached EAST search history	05/17/2012; 08/28/2012	UK
Inventor name search	05/17/2012; 08/28/2012	UK
Patent case (7,612,805) review	05/17/2012; 08/28/2012	UK

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner
	PgPub text search, see interference search history printout	08/29/2012	UK

	/USMAN KHAN/ Primary Examiner.Art Unit 2622

PETITIONERS EX1015

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12586221	SOLOMON, NEAL
	Examiner	**Art Unit**
	USMAN KHAN	2622

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☒ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	05/18/2012	08/28/2012							
1	1	✓	=							
2	2	✓	=							
	3	-	-							
	4	-	-							
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	11	-	-							
	12	-	-							
	13	-	-							
	14	-	-							
	15	-	-							
3	16	✓	=							
4	17	✓	=							
5	18	✓	=							
6	19	✓	=							
7	20	✓	=							
8	21	✓	=							
9	22	✓	=							
10	23	✓	=							
11	24	✓	=							
12	25	✓	=							
14	26	✓	=							
15	27	✓	=							
	28	✓	-							
16	29	✓	=							
17	30	✓	=							
18	31		=							
13	32		=							

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	75	((NEAL) near2 (SOLOMON)).INV.	US-PGPUB; USPAT; USOCR	WITH	ON	2012/05/17 11:22
S2	4	S1 AND aberration	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2012/05/17 11:23
S3	1970	(348/241).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/05/17 11:25
S4	38	aberration NEAR5 correct$4 NEAR20 database	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2012/05/17 11:29
S9	27	aberration With digital NEAR2 (filter$4 OR filtration) AND camera	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2012/05/17 12:35
S10	5	"20070236574"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2012/05/17 12:37
S11	1319	(348/231.99).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/05/17 12:51
S12	1	("7612805").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/05/17 12:52
S13	275	(348/224.1).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/05/17 14:42
S14	4611	(348/222.1).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2012/05/17 17:00
S15	827	(348/273).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/05/18 08:23
S16	295	(348/208.11).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/05/18 09:29
S17	2747	(348/333.08,335,340).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/05/18 09:29
S18	75	((NEAL) near2 (SOLOMON)).INV.	US-PGPUB; USPAT; USOCR	WITH	ON	2012/08/28 15:20
S19	2061	(348/241).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/08/28 15:20
S20	1372	(348/231.99).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/08/28 15:44
S21	4874	(348/222.1).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2012/08/28 15:47

S22	314	(348/208.11).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/08/28 15:53
S23	2871	(348/333.08,335,340).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/08/28 16:00

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S24	3	aberration With digital NEAR2 (filter$4 OR filtration).CLM. AND (image NEAR2 (pickup OR pick$1up OR pick ADJ up) NEAR2 (device OR apparatus OR unit) OR image ADJ sensing ADJ (device OR apparatus OR unit) OR camera OR imager OR recording NEAR2 (device OR apparatus OR unit) OR taking NEAR2 (device OR apparatus OR unit) OR capturing NEAR2 (device OR apparatus OR unit)).CLM.	US-PGPUB; UPAD	WITH	ON	2012/08/29 10:12
S25	8	aberration.CLM. AND digital NEAR2 (filter$4 OR filtration).CLM. AND (image NEAR2 (pickup OR pick$1up OR pick ADJ up) NEAR2 (device OR apparatus OR unit) OR image ADJ sensing ADJ (device OR apparatus OR unit) OR camera OR imager OR recording NEAR2 (device OR apparatus OR unit) OR taking NEAR2 (device OR apparatus OR unit) OR capturing NEAR2 (device OR apparatus OR unit)).CLM.	US-PGPUB; UPAD	WITH	ON	2012/08/29 10:13

8/29/2012 11:47:56 AM
C:\Users\ukhan\Documents\EAST\Workspaces\12586221 aberration correction using database.wsp

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12586221	SOLOMON, NEAL
	Examiner	**Art Unit**
	USMAN KHAN	2622

ORIGINAL		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
348	222.1	H	0	4	N	5 / 228 (2006.01.01)						

CROSS REFERENCE(S)

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
348	231.99	224.1	273	208.11	333.08
348	335	340	241		

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☒ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	4	17												
2	2	5	18												
	3	6	19												
	4	7	20												
	5	8	21												
	6	9	22												
	7	10	23												
	8	11	24												
	9	12	25												
	10	14	26												
	11	15	27												
	12		28												
	13	16	29												
	14	17	30												
	15	18	31												
3	16	13	32												

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 18	
/USMAN KHAN/ Primary Examiner.Art Unit 2622 (Primary Examiner)	08/29/2012 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 1

Doc Code: DIST.E.FILE Document Description: Electronic Terminal Disclaimer - Filed	PTO/SB/25 PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	**TERMINAL DISCLAIMER TO OBVIATE A PROVISIONAL DOUBLE PATENTING REJECTION OVER A PENDING "REFERENCE" APPLICATION AND TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT**
Application Number	12586221
Filing Date	18-Sep-2009
First Named Inventor	Neal Solomon
Attorney Docket Number	
Title of Invention	Digital imaging system for correcting image aberrations

☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action

☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.

Owner	Percent Interest
Neal Solomon	100 %

The owner(s) of percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of any patent granted on pending reference Application Number(s)

12586221 filed on 09/18/2009

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The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s)

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- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
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- has all claims canceled by a reexamination certificate;
- is reissued; or
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(●) Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.

( ) I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.

( ) Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

( ) Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

(●) Applicant(s) status remains as SMALL ENTITY.

( ) Applicant(s) status remains as other than SMALL ENTITY.

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.

THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES

I certify, in accordance with 37 CFR 1.4(d)(4) that I am:

( ) An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application

Registration Number _____

(●) A sole inventor

( ) A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors

( ) A joint inventor; all of whom are signing this request

( ) The assignee of record of the entire interest that has properly made itself of record pursuant to 37 CFR 3.71

Signature	/Neal Solomon/
Name	Neal Solomon

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal

Application Number:	12586221
Filing Date:	18-Sep-2009
Title of Invention:	Digital imaging system for correcting image aberrations
First Named Inventor/Applicant Name:	Neal Solomon
Filer:	Neal Edward Solomon
Attorney Docket Number:	

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Statutory or terminal disclaimer	2814	1	80	80
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($)
Miscellaneous:				
			Total in USD ($)	**80**

Doc Code: DISQ.E.FILE
Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 12586221

Filing Date: 18-Sep-2009

Applicant/Patent under Reexamination: Solomon et al.

Electronic Terminal Disclaimer filed on August 23, 2012

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

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Electronic Acknowledgement Receipt

EFS ID:	13575753
Application Number:	12586221
International Application Number:	
Confirmation Number:	8799
Title of Invention:	Digital imaging system for correcting image aberrations
First Named Inventor/Applicant Name:	Neal Solomon
Correspondence Address:	Neal Solomon - P.O. Box 21297 - Oakland CA 94620 - - -
Filer:	Neal Edward Solomon
Filer Authorized By:	
Attorney Docket Number:	
Receipt Date:	23-AUG-2012
Filing Date:	18-SEP-2009
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Deposit Account	
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Electronic Terminal Disclaimer-Filed	eTerminal-Disclaimer.pdf	35866 7a5ed8c15c6154fd4c925f9c235c595e537c1cd8	no	3
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	29301 0bb0a69cdf46a40d2995a7d4e3caaa1cc3431aad	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	65167	

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<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.

<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.

<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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT:	Neal E. Solomon
APPLICATION NO.:	12/586,221
CONFIRMATION NO.:	8799
FILING DATE:	SEPTEMBER 18, 2009
TITLE:	DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS
EXAMINER:	USMAN KHAN
GROUP ART UNIT:	2622

MAIL STOP AMENDMENT
COMMISSIONER FOR PATENTS
P.O. BOX 1450
ALEXANDRIA, VA 22313-1450

AMENDMENT A

This amendment is a response to the office action dated May 24, 2012.

PETITIONERS EX1015
Page 106

I CLAIM:

1. [Amended claim] A digital imaging system for correcting optical image aberrations comprising:

a digital camera mechanism, an optical lens mechanism, a digital sensor, a microprocessor, a digital signal processor, system software, a database management system and a memory storage sub-system;

wherein the optical lens mechanism is a fixed focal length lens;

~~wherein a microprocessor is used to provide digital and optical data to the digital signal processor;~~

wherein a microprocessor uses ~~the~~ system software ~~is organized~~ to identify at least one optical aberration ~~and to access~~ by accessing the database; ~~to identify at least one correction to the optical aberration;~~

wherein the microprocessor uses the database to identify at least one algorithm to use to correct the at least one optical aberration;

wherein when the image file is captured by the digital sensor the digital file is forwarded to the digital signal processor;

wherein the image file with the at least one optical aberration ~~from the optical lens mechanism~~ is corrected by applying digital filtration by using at least one algorithm in the digital signal processor; and

wherein the modified digital file consisting of the digital data optimized from the at least one optical aberration that are corrected from the original optical image is stored in memory.

2. [Previously amended] The system of claim 1:

wherein the optical aberrations include at least one of spherical, comatic, lens distortion, astigmatism, curvature of field, pin cushion, barrel distortion, chromatic aberrations, scattered light, red eye, dust and/or flare types of optical aberrations.

3. [Cancelled]

4. [Cancelled].

5. [Cancelled]

6. [Cancelled]

7. [Cancelled]

8. [Cancelled]

9. [Cancelled]

10. [Cancelled]

11. [Cancelled]

12. [Cancelled]

13. [Cancelled]

14. [Cancelled]

15. [Cancelled]

16. [Amended claim] The system of claim 1:

wherein the optical aberration is vignetting;

wherein the digital signal processor applies neutral density filtration from one third of a stop to three stops in the center of the image and/or wherein the digital signal processor applies an algorithm to lighten the ~~perimeter~~ corners of the image or the digital signal processor applies both neutral density filtration in the image center and/or an algorithm to lighten the ~~perimeter~~ corners of the image; and

wherein the image exposure is optimized to correct the vignetting.

17. [Amended claim] The system of claim 1:

wherein the digital signal processor applies at least one ~~FFT~~ fast Fourier transform (FFT) algorithm to correct the at least one optical aberration.

18. [Amended claim] The system of claim 1:

wherein each lens ~~specimen~~ type is registered in the camera database;

wherein the multiple optical aberrations of each lens is listed in the database;

wherein the filtration solutions to the lens optical aberrations are listed in the database;

wherein the filtration of each lens optical aberration is applied by the digital signal processor; and

wherein after the digital signal processor applies the filtration to correct the optical aberrations the corrected digital file is forwarded to storage in memory.

19. [Amended claim] A digital imaging system for correcting ~~optical~~ image aberrations comprising:

a digital camera mechanism, an optical lens mechanism, a digital sensor, an integrated circuit, a digital signal processor, system software, a database management system and a memory storage sub-system;

wherein the optical lens mechanism is a zoom lens or a fixed focal length lens;

wherein the image data file is forwarded from the digital sensor to storage in memory;

wherein at least one optical and/or digital aberration in the image file are identified by comparing image files in the database management system by using the system software and the ~~the~~ integrated circuit;

wherein the <u>at least one</u> filtration ~~procedures~~ algorithm<u>s</u> required to correct the at least one ~~the~~ optical and/or digital aberration are sent from the integrated circuit to the digital signal processor;

wherein the at least one optical and/or digital aberration from the optical lens mechanism are corrected by using the digital signal processor to apply digital filtration <u>algorithm</u>; and

wherein the modified digital file consisting of the digital data optimized from the at least one aberration that are corrected from the original optical image is stored in memory.

20. [Amended claim] The system of claim 19:

wherein the optical aberrations include ~~vignetting,~~ spherical, comatic, lens distortion, astigmatism, chromatic aberrations, curvature of field, pin cushion, barrel distortion, scattered light, red eye, dust and/or flare types of optical aberrations.

21. [Previously presented] The system of claim 19:

wherein the digital aberrations include moiré and/or aliasing.

22. [Amended claim] The system of claim 19:

wherein the digital signal processor applies ~~an FFT~~ a fast Fourier transform (FFT) algorithm to correct optical and/or digital aberrations.

23. [Previously presented] The system of claim 19:

wherein the digital signal processor applies color filtration to the image file.

24. [Previously presented] The system of claim 19:

wherein the digital image file are filtered to correct at least one optical and/or digital aberrations after initial capture and before the image file is initially sent to storage.

25. [Previously presented] The system of claim 19:

wherein the integrated circuit may be a microprocessor, an application specific integrated circuit or a system on a chip.

26. [Amended claim] A digital imaging system for correcting ~~optical~~ image aberrations comprising:

a digital camera mechanism, an optical lens mechanism, a digital sensor, a microprocessor, a digital signal processor, system software, a database management system and a memory storage sub-system;

wherein the optical lens mechanism is a zoom lens;

wherein the zoom lens changes focal length positions ~~on a continuous scale~~;

~~wherein a microprocessor is used to provide digital and optical data to the digital signal processor;~~

wherein when the image file is captured by the digital sensor the file is forwarded to the digital signal processor and to memory;

wherein the microprocessor uses system software ~~is organized~~ to access the database to identify at least one optical aberration in the image file at any focal length of a zoom lens configuration;

~~and to access the database to identify at least one correction to the at least one optical aberration;~~

wherein the microprocessor accesses the database to obtain at least one filtration correction ~~algorithms~~ algorithm to the optical aberrations and forwards the at least one filtration algorithms to the digital signal processor;

~~wherein when the image file is captured by the digital sensor the file is forwarded to the digital signal processor;~~

wherein the image file is forwarded to the digital signal processor which applies ~~a specific~~ at least one filtration algorithm ~~procedure~~ to optimize the image and corrects the at least one optical aberration at ~~any~~ the specific focal length in the zoom lens configuration; and

wherein the modified ~~digital~~ image file consisting of the digital data optimized from the at least one optical aberration of a specific focal length of the zoom lens that are corrected from the original optical image is stored in memory.

27. [Previously presented] The system of claim 26:

wherein the optical aberrations include vignetting, spherical, comatic, lens distortion, chromatic aberrations, curvature of field, pin cushion, barrel distortion, scattered light, red eye, dust and/or flare types of optical aberrations.

28. [Cancelled]

29. [Previously presented] The system of claim 26:

wherein the digital signal processor applies ~~an FFT~~ a fast Fourier transform (FFT) algorithm to correct optical and/or digital aberrations.

30. [Previously presented] The system of claim 26:

wherein each focal length of a zoom lens is analyzed for a different set of optical aberrations.

31. [New claim] The system of claim 26:

wherein the optical aberration is vignetting;

wherein the digital signal processor applies neutral density filtration from one third of a stop to three stops in the center of the image and/or wherein the digital signal processor applies an algorithm to lighten the corners of the image or the digital signal processor applies both neutral density filtration in the image center and/or an algorithm to lighten the corners of the image; and

wherein the image exposure is optimized to correct the vignetting.

32. [New claim] The system of claim 19:

wherein the optical aberration is vignetting;

wherein the digital signal processor applies neutral density filtration from one third of a stop to three stops in the center of the image and/or wherein the digital signal processor applies an algorithm to lighten the corners of the image or the digital signal processor applies both neutral density filtration in the image center and/or an algorithm to lighten the corners of the image; and

wherein the image exposure is optimized to correct the vignetting.

Remarks:

This is a response to the Examiner's office action of May 24, 2012.

Claims 1, 16, 17, 18, 19, 22, 26 and 29 are amended. Claim 28 is cancelled. Claims 31 and 32 are new. Claim 19 is corrected for typographical error. Claims 17, 22 and 29 are clarified by addition of "fast Fourier transform (FFT)." Claim 16 is amended to change the word "perimeter" to "corners" in order to comply with § 112 requirements. Please refer to pages 14, 15 (paragraphs 2 and 3 of section 1), 21 and 22 (section 4) for a clear discussion of the elements of this claim. In claim 18, the word "specimen" is changed to the word "type" in order to define with clarity the main idea of using each lens type as a basis for identifying classes of common aberrations. Claims 1, 19 and 26 are amended for clarity and updated in light of the Examiner's questions.

The applicant acknowledges the telephone interview with the Examiner on August 21, 2012.

The Examiner requests a terminal disclaimer in order to correct a double patenting objection regarding Solomon (U.S. Patent 7,612,805). Please refer to the terminal disclaimer with the '805 patent and the accompanying completed form and fee.

The Examiner objected to claims 1 and 2 because of 35 USC § 102 relating Alon (U.S. Patent Application 2007/0236574). The Alon patent application refers to digital filtration of a specific class of optical aberration with a specific type of digital filter and to the design process of optical elements in a lens apparatus.

The Alon patent application, however, refers to an apparatus and system that reduces the invention to a set of claims that are very narrow. Alon is solving a completely different set of problems, viz., a process for designers to design camera optics to control image blur, that are

unrelated to the present invention. Consequently, the present invention is not anticipated by Alon.

Alon is concerned with a method of producing a camera, including optics. As claim 1 states:

> "A method for producing a camera, which includes objective optics for forming an image on an electronic image sensor and a digital filter for filtering an output of the image sensor, the method comprising: defining a maximum permissible value of a noise gain; determining one or more aberrations due to the objective optics; calculating coefficients of the digital filter so as to compensate for the one or more aberrations while preventing the noise gain of the digital filter from exceeding the maximum permissible value; and filtering the output of the image sensor using the computed coefficients so as to generate an enhanced output image."

The invention is concerned with "methods for designing digital cameras" [paragraph 2] and, particularly, with developing improved optics. The main concern of Alon is with the optical aberration category of image blur. For example, Alon discusses in the background of the invention, "[i]t is also possible to add a special-purpose blur to an image . . . Signal processing is then used to remove the blur. . . A special aspheric optical element is used to create the blur in the image." [paragraph 5] A related Alon patent application "describes an electronic imaging camera . . . which applies a deblurring function – typically in the form of a deconvolution filter . . . to generate an output image with reduced blur." [paragraph 6] The summary of the invention describes the main idea as providing "improved methods and tools for design of digital cameras with digital deblurring capabilities . . . [comprising] a digital filter, such as a deconvolution filter (DCF), which is used to reduce blur in the digital output image." [paragraph 7] The effort in the

invention is to find a way to develop a tool to design objective optics, in which "[a] design tool computes the output image quality based on the parameters of the optical design and the filter. . . . [t]he tool may compute and display a simulated image based on these parameters, in order to enable the designer to see the effect of the chosen parameters." [paragraph 9]

The purpose of the invention, then, is to develop design tools with which to improve lens performance, particularly involving image blur, by using a DCF filter to counter the optical blur effects within the limits of digital sharpening. The effort is to design a camera, with an improved lens design, so as to correct image blur with a specific (DCF) filter, not to filter a range of optical aberrations.

The generation, development and improvement of a camera device and optical lens components is completely different than the operation and optimization of the camera as specified in the present invention. The lens designers use a software system for application to improving lens components in order to solve the narrow problem of image blur.

Alon is a system used to design lenses to limit optical blur; it is focused on optical lens design and on a specific type of optical aberration. In order to repair the optical lens blur aberration, a DCF filter is applied within the constraints of image noise. In order to control the image noise, a low pass filter is applied. The trade-off of the lens designer is between blur and noise.

Interestingly, the Alon patent application is assigned to a company called D-Blur Technologies Ltd.

Claim 1 of the present invention states:

"A digital imaging system for correcting optical image aberrations comprising:

a digital camera mechanism, an optical lens mechanism, a digital sensor, a microprocessor, a digital signal processor, system software, a database management system and a memory storage sub-system;

wherein the optical lens mechanism is a fixed focal length lens;

wherein a microprocessor uses system software to identify at least one optical aberration by accessing the database;

wherein the microprocessor uses the database to identify at least one algorithm to use to correct the at least one optical aberration;

wherein when the image file is captured by the digital sensor the digital file is forwarded to the digital signal processor;

wherein the image file with the at least one optical aberration is corrected by applying digital filtration by using at least one algorithm in the digital signal processor; and

wherein the modified digital file consisting of the digital data optimized from the at least one optical aberration that are corrected from the original optical image is stored in memory."

Alon does not refer to the use of a microprocessor and system software to analyze optical aberrations in a digital camera system. Alon is concerned with a specific narrow set of aberration, i.e., image blur, that the present application is not concerned with. The present invention identifies the optical aberrations by using a database to compare image aberration to reference images. Alon does not use a database. In addition, the present invention uses the database (and a microprocessor and software) to identify specific *solutions* to specific optical aberrations. Once identified, the present invention selects a digital filtration algorithm to apply to the image file by using a DSP. Alon does not use a DSP to apply a filtration algorithm to correct specific optical aberrations.

Regarding claim 2, Alon does not specify any additional aberrations other than blur that are corrected by his system. Paragraph 71 of Alon refers to a set of image parameters that are "expressed in a list of desired parameter values" that are weighted and scored in order to design a camera specification. The list of image parameters include "modulation transfer function (MTF), geometrical distortion, field of view, chromatic aberrations, chief ray angle, F-number, relative illumination, artifact level, glare, back focal length, manufacturing tolerances, depth of field, noise level and total length of optics." This is a laundry list of camera specifications, not a list of aberrations to which the invention is directed to solve problems. These lens design specifications balance several image variables for each parameter. The invention does not seek to correct any of these attributes and is not directed to this problem. However, only the chromatic aberrations are overlapping the present invention.

The Examiner objected to claims 17 and 26-30 because of 35 USC § 103 relating Alon (U.S. Patent Application 2007/0236574) in view of Havens (U.S. Patent Application 2007/0080280). As observed above, the Alon patent application refers to digital filtration of a specific class of optical aberration with a specific type of digital filter and to the design process of optical elements in a lens apparatus.

Havens refers to a system for controlling a fluid lens. A "fluid lens comprises an interface between two fluids having dissimilar optical indices." [Paragraph 4] Claim 1 refers to "[a]n imager for use in a data collective device, said imager comprising a fluid lens system for focusing light received by a said data collective device from a target image" that includes a front surface and a rear surface and a pump that forms a sealed system. It does not appear that the Havens patent is in the field of invention of a mechanical camera system that includes a mechanical optical component (mechanical lens) and a digital camera processing system. For

example, the present invention does not involve any fluid or the processing of light signals using any sort of fluid lens system.

However, the Examiner's intention to use the Haven's patent application is to illustrate two things. First, the Examiner shows in paragraph 63 of Havens that "fluid lenses may have aberrations, such as spherical aberration and/or color aberration." However, the correction of these aberrations is performed by applying "additional lenses, such as positive or negative lenses, [that] can be used in conjunction with a fluid lens . . . to correct one or more of spherical, color, or higher order aberrations." To further clarify, "the materials of construction of the additional lenses can be chosen so as to compensate for optical imperfections and aberrations introduced by the fluid lens." In other words, the invention uses *optical* lens corrections to filter fluid lens aberrations. This is similar to using optical filters, such as a polarizer filter, to the front (or rear) of a lens to modify the optics. None of this relates to the present invention, which uses digital filtration of optical lens aberrations.

Second, the Examiner refers to the control system of the Havens patent application to indicate that a microprocessor and an ASIC may work together. In this approach, it is argued that it is "obvious" that if one uses the microprocessor and ASIC of the fluid lens control system in conjunction with the Alon lens design system, then the present invention is anticipated.

It is acknowledged that microprocessors and ASICs are used in digital cameras, however. These mechanisms have evolved to be applied to embedded computing devices including digital cameras. The microprocessor is a CPU that controls the computing functions of the camera. The CPU may use memory circuits (DRAM, EPROM, EEPROM, Flash memory) in order to store and access data to perform a set of control functions. For example, the camera microprocessor is used to identify the correct exposure of an image by using the exposure meter in the camera. In

addition, the microprocessor is used in conjunction with a lens CPU in order to autofocus the image. Further, the microprocessor is used in conjunction with a flash CPU in order to automatically illuminate an image based on user preferences. Moreover, it is recognized that a digital signal processor (DSP), typically an application specific integrated circuit (ASIC), is used to process a digital image file. In general, the general exposure data of the image file is processed using the DSP. For example, most digital sensors use a Bayer filter (to add color to a gray scale CCD or CMOS sensor) and an anti-aliasing filter to correct for the artifacts of the Bayer filter. A DSP may be used to process these digital filter components in order to eliminate digital or color artifacts related to specific image sensor pixels.

However, these digital circuitry components are generally accepted to be used in a digital camera. Havens did not invent them and they are only applied to a fluid optical system in Havens. They are thus not useful to direct to a 103 objection against the present invention.

Rather, the Examiner may intend to continue to refer to an objection to claims 17 and 26-30 based on 102 regarding putative anticipation by Alon. However, this objection has arguments against it.

First, regarding claim 26, Alon is narrowed only to a very specific aberration type, viz., blur. Alon uses neither a microprocessor nor a database management system in order to perform his operations to correct the blur aberration. Rather, Alon only uses a "convolution engine" (paragraph 47) and "DCF tables" (paragraph 92) to process the blur correction.

Furthermore, Alon does not refer to a zoom lens in any embodiment. A zoom lens presents a set of optimization problems that create different optical aberrations at different ends of the focal length spectrum. One must conceive of the problem of optical aberrations of a zoom lens as a set of different types of fixed focal length lenses. This set of problems is not intuitive.

Whereas the identification of the multiple optical aberrations of a zoom lens is complex, it is far from clear how to solve the multiple and differentiated optical aberration problems associated with different zoom lens types. For this reason, the present system, which uses a database to access specific lens types, including zoom lens types at different focal positions, in order to identify the specific aberrations of each type and then identify the specific solutions for each set of aberrations by accessing, and comparing to, the database, is a substantial advance. Particularly because of the quality trade-offs of zoom lenses that require optical aberration filtration in software, the present invention allows manufacturers to save money by improving the inexpensive software (algorithms that correct the optical aberrations) and not the expensive glass and optical mechanism.

This argument on zoom lenses also applies to claim 30.

The reference to claims 19-20 and 24-25 should not include a reference to Havens under 103, since Havens applies to a different field of art, but rather to a generally accepted approach of using digital circuits in a camera. While the microprocessor is used to process image files from a digital image sensor to a DSP and to memory, this approach has hitherto been passive and deterministic. The user provides settings in the camera, for instance, regarding exposure data, and captures the image, which image file is processed by the DSP and sent to memory. But how is it processed? Off-the-shelf software algorithms are applied at the factory to process the image files according to the simple exposure dimensions. This limitation, however, is the beginning of the problem to which the present patent application is directed.

In the present invention, the microprocessor (CPU or system-on-a-chip) is used to analyze a problem involving optical and digital aberrations. The way that the microprocessor does this is to access a database management system in the camera system memory. The

database may be periodically updated with data of new aberrations associated with different types of lenses. Specific lenses have different types of optical aberrations that require identification in the database. In addition to merely identifying the different optical aberrations associated with each lens type, the microprocessor uses the database to identify the specific solutions to solve the optical aberrations. These solutions take the shape of the software algorithms. Once the algorithms are identified to solve the specific optical aberrations, then the microprocessor sends the algorithms to the DSP to apply the aberrations to the image file in order to correct the aberrations. Once corrected, the image files are forwarded to memory. The operation is performed after (or before) the image files are in memory, thereby allowing the user to perform the operation in order to perfect the image in the camera.

While the Examiner refers to the use of a FFT algorithm as well-known in the industry, the present invention uses the FFT as one class of algorithm to apply to specific optical or digital aberrations in image files in order to provide solutions. There is no reason not to include a powerful class of algorithm to the toolbox in order to solve the aberrations. However, the emphasis is not on the FFT algorithm, which the applicant does not claim to invent. Rather, the emphasis is on the use of the microprocessor and system software to access the database to identify the problem, to identify the solution (software algorithm) and to apply the algorithm to correct the aberration in the DSP.

Alon does not do any of these things since the present invention is a substantial advance of the art. Havens is not relevant to any aspect of this process of solving image aberrations in the camera and does not render any aspect of the present invention obvious.

The present invention, however, is not focused on image blur or on image noise. The present invention does not use a DCF filter. Because the Alon patent is concerned with

developing ways for a lens and camera designer to construct a lens with minimal lens blur, it is not related to the area of the present invention or to the '805 patent. If it is related at all, the problems that Alon seek to solve are very narrow and the ways that are employed to solve them do not anticipate the present invention.

The present invention provides an original view of solving image aberration problems in a camera. The new claims clarify this novel system and process.

The present invention is novel and useful. The arguments on overcoming the Examiner's objection to the claims of 102 and 103 are substantial and compelling.

The present invention specification is complete. The revised claims put the application in a state of grant.

Favorable action is requested.

If the Examiner has any questions regarding the present application, please feel free to contact the applicant at the number below.

Respectfully submitted,

/Neal Solomon/

Neal Solomon

(415) 334-5600

Electronic Acknowledgement Receipt

EFS ID:	13575920
Application Number:	12586221
International Application Number:	
Confirmation Number:	8799
Title of Invention:	Digital imaging system for correcting image aberrations
First Named Inventor/Applicant Name:	Neal Solomon
Correspondence Address:	Neal Solomon - P.O. Box 21297 - Oakland CA 94620 US - -
Filer:	Neal Edward Solomon
Filer Authorized By:	
Attorney Docket Number:	
Receipt Date:	23-AUG-2012
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Application Type:	Utility under 35 USC 111(a)

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Arguments/Remarks Made in an Amendment	SPP_X_221_continatuion_response_embedded.pdf	3014791 c138eade543721da30b7d049ee462d8075e6188b	no	19
Warnings:					
Information:					
		Total Files Size (in bytes):	3014791		

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.

<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.

<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.

<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.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
12/586,221	09/18/2009	

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY ☒ RATE ($)	FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ 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))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 08/23/2012	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 18	Minus	** 20	= 0	X $30 =	0	OR	X $ =	
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $125 =	0	OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

AMENDMENT	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/LINDA BADIE/

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.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/586,221	09/18/2009	Neal Solomon		8799

7590 05/24/2012

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EXAMINER
KHAN, USMAN A

ART UNIT	PAPER NUMBER
2622	

MAIL DATE	DELIVERY MODE
05/24/2012	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.

Office Action Summary	Application No.	Applicant(s)	
	12/586,221	SOLOMON, NEAL	
	Examiner	Art Unit	
	USMAN KHAN	2622	

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09/18/2009, 03/02/2012*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ 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.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *1,2 and 16-30* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1,2 and 16-30* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *18 September 2009* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13)☐ 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:

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)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Election/Restrictions

2. Claims 3 – 15 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 03/02/2012. Note claims 3 – 15 were canceled by the applicant and new claims 16 – 30 relating to claims 1 – 2 were added by the applicant.

Information Disclosure Statement

3. The information disclosure statement (IDS) submitted on 03/10/2011 has been considered by the examiner. The submission is in compliance with the provisions of 37 CFR 1.97.

Claim Objection

4. **Claim 19** is objected to because of the following informalities: in lines 9 – 10 “the the” should be amended to read –the--. Appropriate correction is required.

5. **Claims 17, 22, and 29** is objected to because of the following informalities: applicant does not specifically define what FFT stands for in the claims. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

6. **Claim 16** is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. "wherein the digital signal processor applies neutral density filtration from one third of a stop to three stops in the center of the image and/or wherein the digital signal processor applies an algorithm to lighten the perimeter of the image or the digital signal processor applies both neutral density filtration in the image center and/or an algorithm to lighten the perimeter of the image'" is not disclosed in the application as filed. If applicant believes that this portion of the claim is present in the application as filed the applicant is requested to specifically point to each section of the spec where there is a disclosure of the claimed subject matter.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. **Claim 18** is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Applicant does not define what is a lens specimen in the application as filed.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

8. Claims 1 - 2, 19 - 20, and 26 - 27 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 4, 9, 11, 15, 18, 21, 24, 26, and 30 of U.S. Patent No. 7,612,805. Although the conflicting claims are not identical, they are not patentably distinct from each other because pending claims 1 - 2, 19, and 26 are broader representations of the claims in the parent case.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

9. Claims 1 – 2 are rejected under 35 U.S.C. 102(e) as being anticipated by Alon et al. (US PgPub 2007/0236574).

Regarding **claim 1,** Alon et al. teaches a digital imaging system for correcting optical image aberrations (paragraph 0007 and 0025 *et seq.*) comprising: a digital camera mechanism (paragraph 0007 *et seq.* and 0025 *et seq.*), an optical lens mechanism (paragraphs 0008, 0039, and 0051 *et seq.*), a digital sensor (paragraphs 0011 and 0020 *et seq.*), a microprocessor (paragraph 0047), a digital signal processor (paragraphs 0048 and 0092), system software (paragraphs 0020 and 0054), a database management system (paragraphs 0089, 0092, and 0095 - 0096) and a memory storage sub-system (paragraphs 0089, 0092, and 0095 - 0096); wherein the optical lens mechanism is a fixed focal length lens (paragraphs 0008, 0039, and 0051 *et seq.*); wherein a microprocessor is used to provide digital and optical data to the digital signal processor (paragraph 0047); wherein the system software is organized to identify at least one optical aberration and to access the database to identify at least one correction to the optical aberrations (paragraphs 0020 and 0054); wherein the image file is captured by the digital sensor the digital file is forwarded to the digital signal processor (paragraphs 0020 and 0054); wherein the at least one optical aberration from the optical lens mechanism is corrected by applying digital filtration by using the digital signal processor (paragraphs 0007 0011 – 00209, 0047 and 0097); wherein the modified digital file consisting of the digital data optimized from the at least one optical aberration that are corrected from the original optical image is stored in memory (paragraphs 0089, 0092, and 0095 - 0096).

Regarding **claim 2**, as mentioned above in the discussion of claim 1 Alon et al. teaches all of the limitations of the parent claim. Additionally, Alon et al. teaches wherein the optical aberrations include at least one of spherical, comatic, lens distortion, astigmatism, curvature of field, pin cushion, barrel distortion, chromatic aberrations, scattered light, red eye, dust and/or flare types of optical aberrations (paragraph 0050, 0055 - 0056, 0071, 0096).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 17 and 26 - 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Alon et al. (US PgPub 2007/0236574) in view of official notice.

Regarding **claim 17,** as mentioned above in the discussion of claim 1, Alon et al. teaches all of the limitations of the parent claim.

However, Alon et al. fails to teach wherein the digital signal processor applies at least one FFT algorithm to correct the at least one optical aberration.

The examiner takes Official Notice that it is old and well known in the art to have a system wherein the digital signal processor applies at least one FFT algorithm to correct the at least one optical aberration.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have a system wherein the digital signal processor applies at least one FFT algorithm to correct the at least one optical aberration so as to improve image quality.

Regarding **claim 26,** Alon et al. teaches a digital imaging system for correcting optical image aberrations (paragraph 0007 and 0025 *et seq.*) comprising: a digital camera mechanism (paragraph 0007 *et seq.* and 0025 *et seq.*), an optical lens mechanism (paragraphs 0008, 0039, and 0051 *et seq.*), a digital sensor (paragraphs 0011 and 0020 *et seq.*), a microprocessor (paragraph 0047), a digital signal processor (paragraphs 0048 and 0092), system software (paragraphs 0020 and 0054), a database management system (paragraphs 0089, 0092, and 0095 - 0096) and a memory storage sub-system (paragraphs 0089, 0092, and 0095 - 0096); wherein a microprocessor is used to provide digital and optical data to the digital signal processor (paragraph 0047); wherein the system software is organized to identify at least one optical aberration at any focal length of lens configuration and to access the database to identify at least one correction to the at least one optical aberration (paragraphs 0020 and 0054); wherein the microprocessor accesses the database to obtain filtration correction algorithms to

the optical aberrations and forward the filtration algorithms to the digital signal processor wherein when the image file is captured by the digital sensor the file is forwarded to the digital signal processor (paragraphs 0020 and 0054); wherein the digital signal processor applies a specific filtration procedure to optimize the image and corrects the at least one optical aberration at any specific focal length in the zoom lens configuration (paragraphs 0007 0011 – 00209, 0047 and 0097); and wherein the modified digital file consisting of the digital data optimized from the at least one optical aberration of a specific focal length of the zoom lens that are corrected from the original optical image is stored in memory (paragraphs 0089, 0092, and 0095 - 0096).

However, Alon et al. fails to teach wherein the optical lens mechanism is a zoom lens; wherein the zoom lens changes focal length positions on a continuous scale.

The examiner takes Official Notice that it is old and well known in the art to have a system wherein the optical lens mechanism is a zoom lens; wherein the zoom lens changes focal length positions on a continuous scale.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have a system wherein the optical lens mechanism is a zoom lens; wherein the zoom lens changes focal length positions on a continuous scale so as to easily zoom in and capture a required area of a scene thereby improving functionality.

Regarding **claim 27**, as mentioned above in the discussion of claim 26 Alon et al. in view of official notice teach all of the limitations of the parent claim. Additionally, Alon

et al. teaches wherein the optical aberrations include at least one of spherical, comatic, lens distortion, astigmatism, curvature of field, pin cushion, barrel distortion, chromatic aberrations, scattered light, red eye, dust and/or flare types of optical aberrations (paragraph 0050, 0055 - 0056, 0071, 0096).

Regarding **claim 28,** as mentioned above in the discussion of claim 26, Alon et al. in view of official notice teach all of the limitations of the parent claim.

However, Alon et al. fails to teach wherein the digital aberrations include moire and/or aliasing.

The examiner takes Official Notice that it is old and well known in the art to have a system wherein the digital aberrations include moire and/or aliasing.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have a system wherein the digital aberrations include moire and/or aliasing so as to improve image quality.

Regarding **claim 29,** as mentioned above in the discussion of claim 26, Alon et al. in view of official notice teach all of the limitations of the parent claim.

However, Alon et al. fails to teach wherein the digital signal processor applies at least one FFT algorithm to correct the at least one optical aberration.

The examiner takes Official Notice that it is old and well known in the art to have a system wherein the digital signal processor applies at least one FFT algorithm to correct the at least one optical aberration.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have a system wherein the digital signal processor applies at least one FFT algorithm to correct the at least one optical aberration so as to improve image quality.

Regarding **claim 30,** as mentioned above in the discussion of claim 26, Alon et al. in view of official notice teach all of the limitations of the parent claim.

However, Alon et al. fails to teach wherein each focal length of a zoom lens is analyzed for a different set of optical aberrations.

The examiner takes Official Notice that it is old and well known in the art to have wherein each focal length of a zoom lens is analyzed for a different set of optical aberrations.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have wherein each focal length of a zoom lens is analyzed for a different set of optical aberrations so as to improving the image quality under various situations.

11. Claims 19 – 20 and 24 - 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Alon et al. (US PgPub 2007/0236574) in view of over Havens (US PgPub 2007/0080280).

Regarding **claim 19,** Alon et al. teaches a digital imaging system for correcting optical image aberrations (paragraph 0007 and 0025 *et seq.*) comprising: a digital

camera mechanism (paragraph 0007 *et seq.* and 0025 *et seq.*), an optical lens mechanism (paragraphs 0008, 0039, and 0051 *et seq.*), a digital sensor (paragraphs 0011 and 0020 *et seq.*), a digital signal processor (paragraphs 0048 and 0092), system software (paragraphs 0020 and 0054), a database management system (paragraphs 0089, 0092, and 0095 - 0096) and a memory storage sub-system (paragraphs 0089, 0092, and 0095 - 0096); wherein the optical lens mechanism is a zoom lens or a fixed focal length lens (paragraphs 0008, 0039, and 0051 *et seq.*); wherein the image data file is forwarded from the digital sensor to storage in memory (paragraphs 0089, 0092, and 0095 - 0096); wherein at least one optical and/or digital aberration in the image file are identified by comparing image files in the database management system by using the system software (paragraphs 0020 and 0054); wherein the filtration procedures required to correct the at least one the optical and/or digital aberration are sent to the digital signal processor (paragraphs 0007 0011 – 00209, 0047 and 0097); wherein the at least one optical and/or digital aberration from the optical lens mechanism are corrected by using the digital signal processor to apply digital filtration (paragraphs 0007 0011 – 00209, 0047 and 0097); and wherein the modified digital file consisting of the digital data optimized from the at least one aberration that are corrected from the original optical image is stored in memory (paragraphs 0089, 0092, and 0095 - 0096).

However, Alon et al. fails to teach an integrated circuit used for correcting aberrations. Havens, on the other hand teaches an integrated circuit along with a microprocessor can be used for processing data.

More specifically, Havens teaches an integrated circuit along with a microprocessor can be used for processing data (paragraphs 0045 – 0046, 0063).

Therefore, one of ordinary skill in the art at the time the invention was made would have been motivated to incorporate the teachings of Havens with the teachings of Alon et al. since the use of both an integrated circuit and a microprocessor in a system will increase the system speed.

Regarding **claim 20**, as mentioned above in the discussion of claim 19 Alon et al. in view of over Havens teach all of the limitations of the parent claim. Additionally, Alon et al. teaches wherein the optical aberrations include at least one of spherical, comatic, lens distortion, astigmatism, curvature of field, pin cushion, barrel distortion, chromatic aberrations, scattered light, red eye, dust and/or flare types of optical aberrations (paragraph 0050, 0055 - 0056, 0071, 0096).

Regarding **claim 24**, as mentioned above in the discussion of claim 19 Alon et al. in view of over Havens teach all of the limitations of the parent claim. Additionally, Alon et al. teaches wherein the digital image file are filtered to correct at least one optical and/or digital aberrations after initial capture and before the image file is initially sent to storage (paragraph 0007 and 0025 *et seq.*).

Regarding **claim 25**, as mentioned above in the discussion of claim 19 Alon et al. in view of Havens teach all of the limitations of the parent claim. Additionally, Havens teaches wherein the integrated circuit may be a microprocessor, an application specific integrated circuit or a system on a chip (paragraphs 0045 – 0046, 0063).

12. Claims 21 - 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Alon et al. (US PgPub 2007/0236574) in view of over Havens (US PgPub 2007/0080280) in view of official notice.

Regarding **claim 21,** as mentioned above in the discussion of claim 19, Alon et al. in view of Havens teach all of the limitations of the parent claim.

However, Alon et al. fails to teach wherein the digital aberrations include moire and/or aliasing.

The examiner takes Official Notice that it is old and well known in the art to have a system wherein the digital aberrations include moire and/or aliasing.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have a system wherein the digital aberrations include moire and/or aliasing so as to improve image quality.

Regarding **claim 22,** as mentioned above in the discussion of claim 19, Alon et al. in view of Havens teach all of the limitations of the parent claim.

However, Alon et al. fails to teach wherein the digital signal processor applies at least one FFT algorithm to correct the at least one optical aberration.

The examiner takes Official Notice that it is old and well known in the art to have a system wherein the digital signal processor applies at least one FFT algorithm to correct the at least one optical aberration.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have a system wherein the digital signal processor applies at least one FFT algorithm to correct the at least one optical aberration so as to improve image quality.

Regarding **claim 23,** as mentioned above in the discussion of claim 19, Alon et al. in view of Havens teach all of the limitations of the parent claim.

However, Alon et al. fails to teach wherein the digital signal processor applies color filtration to the image file.

The examiner takes Official Notice that it is old and well known in the art to have a system wherein the digital signal processor applies color filtration to the image file.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have a system wherein the digital signal processor applies color filtration to the image file so as to improve image quality.

Conclusion

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to USMAN KHAN whose telephone number is (571)270-1131. The examiner can normally be reached on Mon-Fri 6:45-3:15.

14. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jason Chan can be reached on (571) 272-3022. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

15. 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.

/Usman Khan/
Usman Khan
05/18/2012
Primary Examiner, Art Unit 2622

Notice of References Cited	Application/Control No. 12/586,221	Applicant(s)/Patent Under Reexamination SOLOMON, NEAL	
	Examiner USMAN KHAN	Art Unit 2622	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2007/0236574	10-2007	Alon et al.	348/207.99
*	B	US-2007/0080280	04-2007	Havens, William H.	250/201.1
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

UNITED STATES PATENT AND TRADEMARK OFFICE

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BIB DATA SHEET

CONFIRMATION NO. 8799

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/586,221	09/18/2009 **RULE**	348 UK	2622	

APPLICANTS
Neal Solomon, Oakland, CA; UK

**** CONTINUING DATA ***************************
This application is a CON of 11/825,521 07/06/2007 PAT 7,612,805 UK
which claims benefit of 60/807,065 07/11/2006 UK

**** FOREIGN APPLICATIONS ****************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **** ** SMALL ENTITY ** UK
10/29/2009

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /USMAN A KHAN/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		CA	19 UK	~~18~~ 17	3 UK

ADDRESS
Neal Solomon
P.O. Box 21297
Oakland, CA 94620
UNITED STATES

TITLE
Digital imaging system for correcting image aberrations UK

FILING FEE RECEIVED		
545	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

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12586221	SOLOMON, NEAL
	Examiner	**Art Unit**
	USMAN KHAN	2622

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	05/18/2012								
	1	✓								
	2	✓								
	3	-								
	4	-								
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	6	-								
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	27	✓								
	28	✓								
	29	✓								
	30	✓								

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	75	((NEAL) near2 (SOLOMON)).INV.	US-PGPUB; USPAT; USOCR	WITH	ON	2012/05/17 11:22
S2	4	S1 AND aberration	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2012/05/17 11:23
S3	1970	(348/241).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/05/17 11:25
S4	38	aberration NEAR5 correct$4 NEAR20 database	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2012/05/17 11:29
S9	27	aberration With digital NEAR2 (filter$4 OR filtration) AND camera	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2012/05/17 12:35
S10	5	"20070236574"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2012/05/17 12:37
S11	1319	(348/231.99).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/05/17 12:51
S12	1	("7612805").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/05/17 12:52
S13	275	(348/224.1).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/05/17 14:42
S14	4611	(348/222.1).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2012/05/17 17:00
S15	827	(348/273).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/05/18 08:23
S16	295	(348/208.11).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/05/18 09:29
S17	2747	(348/333.08,335,340).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/05/18 09:29

EAST Search History (Interference)

<This search history is empty>

5/18/2012 9:43:14 AM
C:\Users\ukhan\Documents\EAST\Workspaces\12586221 aberration correction using database.wsp

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12586221	SOLOMON, NEAL
	Examiner	**Art Unit**
	USMAN KHAN	2622

SEARCHED

Class	Subclass	Date	Examiner
348	222.1,231.99,224.1,273,342,208.11,333.08,335,340,241	05/17/2012,05/18/2012	UK

SEARCH NOTES

Search Notes	Date	Examiner
EAST (Including databases: US-PGPUB, USPAT, USOCR, FPRS, EPO, JPO, DERWENT, IBM_TDB): See attached EAST search history	05/17/2012	UK
Inventor name search	05/17/2012	UK
Patent case (7,612,805) review	05/17/2012	UK

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner

	/USMAN KHAN/ Primary Examiner.Art Unit 2622

O.P.A.P. IAP8
MAR 0 2 2012
PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT:	Neal E. Solomon
APPLICATION NO.:	12/586,221
CONFIRMATION NO.:	8799
FILING DATE:	SEPTEMBER 18, 2009
TITLE:	DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS
EXAMINER:	USMAN KHAN
GROUP ART UNIT:	2622

MAIL STOP AMENDMENT
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PRELIMINARY AMENDMENT

This amendment is a response to the claim restriction dated December 29, 2011.

03/05/2012 CCHAU1 00000005 12586221
01 FC:2251 75.00 OP

I CLAIM:

1. [Amended claim] A digital imaging system for correcting optical image aberrations comprising:

~~A~~ a digital camera mechanism, an optical lens mechanism, a digital sensor, a microprocessor, ~~an application specific integrated circuit,~~ a digital signal processor, system software, a database management system and a memory storage sub-system;

wherein the optical lens mechanism is a fixed focal length lens;

~~wherein the optical aberrations from the optical lens mechanism are corrected by applying digital filtration by using the application specific integrated circuit and digital signal processor;~~

wherein a microprocessor is used to provide digital and optical data to the digital signal processor;

wherein the system software is organized to identify at least one ~~specific~~ optical ~~aberrations~~ aberration and to access the database to identify at least one ~~specific~~ corrections to the optical ~~aberrations~~ aberration;

~~wherein the system software forwards the data file from the digital sensor to the digital signal processor;~~

wherein when the image file is captured by the digital sensor the digital file is forwarded to the digital signal processor;

wherein the at least one optical aberration from the optical lens mechanism is corrected by applying digital filtration by using the digital signal processor; and

~~wherein the digital signal processor selects a specific procedure to optimize the image and corrects the aberrations and;~~

wherein the modified digital file consisting of the digital data optimized from the at least one optical ~~aberrations~~ aberration that are corrected from the original optical image is stored in memory.

2. [Amended claim] The system of claim 1: ~~wherein:~~

wherein the optical aberrations ~~are~~ include at least one of spherical, comatic, lens distortion, astigmatism, curvature of field, pin cushion, barrel distortion, chromatic aberrations, scattered light, red eye, dust and/or flare types of optical aberrations.

3. [Cancelled]

4. [Cancelled].

5. [Cancelled]

6. [Cancelled]

7. [Cancelled]

8. [Cancelled]

9. [Cancelled]

10. [Cancelled]

11. [Cancelled]

12. [Cancelled]

13. [Cancelled]

14. [Cancelled]

15. [Cancelled]

16. [New claim] The system of claim 1:

wherein the optical aberration is vignetting;

wherein the digital signal processor applies neutral density filtration from one third of a stop to three stops in the center of the image and/or wherein the digital signal processor applies an algorithm to lighten the perimeter of the image or the digital signal processor applies both neutral density filtration in the image center and/or an algorithm to lighten the perimeter of the image; and

wherein the image exposure is optimized to correct the vignetting.

17. [New claim] The system of claim 1:

wherein the digital signal processor applies at least one FFT algorithm to correct the at least one optical aberration.

18. [New claim] The system of claim 1:

wherein each lens specimen is registered in the camera database;

wherein the multiple optical aberrations of each lens is listed in the database;

wherein the filtration solutions to the lens optical aberrations are listed in the database;

wherein the filtration of each lens optical aberration is applied by the digital signal processor; and

wherein after the digital signal processor applies the filtration to correct the optical aberrations the corrected digital file is forwarded to storage in memory.

19. [New claim] A digital imaging system for correcting optical image aberrations comprising:

a digital camera mechanism, an optical lens mechanism, a digital sensor, an integrated circuit, a digital signal processor, system software, a database management system and a memory storage sub-system;

wherein the optical lens mechanism is a zoom lens or a fixed focal length lens;

wherein the image data file is forwarded from the digital sensor to storage in memory;

wherein at least one optical and/or digital aberration in the image file are identified by comparing image files in the database management system by using the system software and the the integrated circuit;

wherein the filtration procedures required to correct the at least one the optical and/or digital aberration are sent from the integrated circuit to the digital signal processor;

wherein the at least one optical and/or digital aberration from the optical lens mechanism are corrected by using the digital signal processor to apply digital filtration; and

wherein the modified digital file consisting of the digital data optimized from the at least one aberration that are corrected from the original optical image is stored in memory.

20. [New claim] The system of claim 19:

wherein the optical aberrations include vignetting, spherical, comatic, lens distortion, astigmatism, chromatic aberrations, curvature of field, pin cushion, barrel distortion, scattered light, red eye, dust and/or flare types of optical aberrations.

21. [New claim] The system of claim 19:

wherein the digital aberrations include moiré and/or aliasing.

22. [New claim] The system of claim 19:

wherein the digital signal processor applies an FFT algorithm to correct optical and/or digital aberrations.

23. [New claim] The system of claim 19:

wherein the digital signal processor applies color filtration to the image file.

24. [New claim] The system of claim 19:

wherein the digital image file are filtered to correct at least one optical and/or digital aberrations after initial capture and before the image file is initially sent to storage.

25. [New claim] The system of claim 19:

wherein the integrated circuit may be a microprocessor, an application specific integrated circuit or a system on a chip.

26. [New claim] A digital imaging system for correcting optical image aberrations comprising:

a digital camera mechanism, an optical lens mechanism, a digital sensor, a microprocessor, a digital signal processor, system software, a database management system and a memory storage sub-system;

wherein the optical lens mechanism is a zoom lens;

wherein the zoom lens changes focal length positions on a continuous scale;

wherein a microprocessor is used to provide digital and optical data to the digital signal processor;

wherein the system software is organized to identify at least one optical aberration at any focal length of a zoom lens configuration and to access the database to identify at least one correction to the at least one optical aberration;

wherein the microprocessor accesses the database to obtain filtration correction algorithms to the optical aberrations and forward the filtration algorithms to the digital signal processor;

wherein when the image file is captured by the digital sensor the file is forwarded to the digital signal processor;

wherein the digital signal processor applies a specific filtration procedure to optimize the image and corrects the at least one optical aberration at any specific focal length in the zoom lens configuration; and

wherein the modified digital file consisting of the digital data optimized from the at least one optical aberration of a specific focal length of the zoom lens that are corrected from the original optical image is stored in memory.

27. [New claim] The system of claim 26:

wherein the optical aberrations include vignetting, spherical, comatic, lens distortion, chromatic aberrations, curvature of field, pin cushion, barrel distortion, scattered light, red eye, dust and/or flare types of optical aberrations.

28. [New claim] The system of claim 26:

wherein the digital aberrations include moiré and/or aliasing.

29. [New claim] The system of claim 26:

wherein the digital signal processor applies an FFT algorithm to correct optical and/or digital aberrations.

30. [New claim] The system of claim 26:

wherein each focal length of a zoom lens is analyzed for a different set of optical aberrations.

Comments:

This is a response to the Examiner's office action of December 29, 2011. The Examiner requested a restriction of claims. Claims 1-2 are selected and amended. Claims 3-15 are cancelled. Claims 16 to 30 are new. The new claims are closely related to the substance of the first claim and no traverse is required. There is no new material.

The invention pertains to an in-camera filtration system to digitally correct optical image aberrations. The present invention is a continuation of U.S. Patent No. 7,612,805. The present invention is substantially different from '805 and focuses on a system and procedures to digitally correct and filter the optical aberrations of fixed focal length and zoom lenses.

The disclosure lays out in substantial detail the substance of the claims. All of the claimed material lies in the highly detailed disclosure.

Claim 1 pertains to fixed focal length lenses. Please refer to section 1 of the specification, pages 14 to 17, for a detailed description of the approach used. Please also refer to figures 1 to 7 and the detailed description of the drawings on pages 44-47 of the disclosure.

Claim 19 pertains to fixed focal length or zoom lens types. In this embodiment of the invention, an image is captured, sent to storage and then the image file is corrected for both optical and digital aberrations. Please refer to section 2 of the specification, pages 18 to 20, for a detailed description of the approach used. In addition to figures 1-7, please also refer to figure 8 and the detailed description of figure 8 on pages 46-47.

Claim 26 pertains to a zoom lens type of lens mechanism and the optical aberrations and filtration corrections of this lens type. Please refer to section 19 of the specification, pages 37-

39, for a detailed description of the approach used. Please also refer to figure 29 and page 52 for the detailed description.

If the Examiner has questions, he is encouraged to contact the applicant at the number below.

Respectfully submitted,

Neal Solomon

Neal Solomon

(415) 334-5600

PETITIONERS EX1015
Page 160

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IAP8
PATENT & TRADEMARK OFFICE

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PTO/SB/21 (01-09)
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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	12/586,221
Filing Date	9/18/09
First Named Inventor	Neal Solomon
Art Unit	2622
Examiner Name	Usman Khan
Attorney Docket Number	
Total Number of Pages in This Submission	11

ENCLOSURES *(Check all that apply)*

- [ ] Fee Transmittal Form
  - [✓] Fee Attached
- [ ] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
  - [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) _____
  - [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- [ ] Proprietary Information
- [ ] Status Letter
- [X] Other Enclosure(s) (please identify below): preliminary amendment

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	Neal Solomon		
Signature	Neal J Solomon		
Printed name	Neal Solomon		
Date	2/27/12	Reg. No.	

CERTIFICATE OF TRANSMISSION/MAILING

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Signature	Neal J Solomon		
Typed or printed name	Neal Solomon	Date	2/29/12

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Effective on 12/08/2004.
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2009

☒ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 75

Complete if Known	
Application Number	12/586,271
Filing Date	9/18/09
First Named Inventor	Neal Solomon
Examiner Name	Usman Khan
Art Unit	2622
Attorney Docket No.	

METHOD OF PAYMENT (check all that apply)

☒ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

☐ Deposit Account Deposit Account Number: _____ Deposit Account Name: _____

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☐ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**

☐ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☐ Credit any overpayments

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FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

	FILING FEES		SEARCH FEES		EXAMINATION FEES		
Application Type	Fee ($)	Small Entity Fee ($)	Fee ($)	Small Entity Fee ($)	Fee ($)	Small Entity Fee ($)	Fees Paid ($)
Utility	330	165	540	270	220	110	
Design	220	110	100	50	140	70	
Plant	220	110	330	165	170	85	
Reissue	330	165	540	270	650	325	
Provisional	220	110	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 (including Reissues)	52	26
Each independent claim over 3 (including Reissues)	220	110
Multiple dependent claims	390	195

Total Claims _____ - 20 or HP = _____ x Extra Claims _____ Fee ($) _____ = Fee Paid ($) _____

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims _____ - 3 or HP = _____ x Extra Claims _____ Fee ($) _____ = Fee Paid ($) _____

HP = highest number of independent claims paid for, if greater than 3.

Multiple Dependent Claims Fee ($) _____ Fee Paid ($) _____

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), 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 1.16(s).

Total Sheets _____ - 100 = Extra Sheets _____ / 50 = Number of each additional 50 or fraction thereof _____ (round up to a whole number) x Fee ($) _____ = Fee Paid ($) _____

4. OTHER FEE(S) Fees Paid ($)

Non-English Specification, $130 fee (no small entity discount) _____

Other (e.g., late filing surcharge): late filing fee for office action response 75

SUBMITTED BY

Signature	Neal J Solomon	Registration No. (Attorney/Agent)	Telephone
Name (Print/Type)	Neal Solomon		Date 2/27/12

This collection of information is required by 37 CFR 1.136. 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 30 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.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
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 displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
12/586,221	09/18/2009	

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY ☒ RATE ($)	FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ 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))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 03/02/2012	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 17	Minus	** 20	= 0	X $30 =	0	OR	X $ =	
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $125 =	0	OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

AMENDMENT	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)	OR	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/YUVANNA CHAPHIV/

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.

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 NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/586,221	09/18/2009	Neal Solomon		8799

7590 12/29/2011

Neal Solomon
P.O. Box 21297
Oakland, CA 94620

EXAMINER
KHAN, USMAN A

ART UNIT	PAPER NUMBER
2622	

MAIL DATE	DELIVERY MODE
12/29/2011	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.

Office Action Summary	Application No.	Applicant(s)	
	12/586,221	SOLOMON, NEAL	
	Examiner	Art Unit	
	USMAN KHAN	2622	

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 1 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 18 September 2009.

2a)☐ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ 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.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) 1-15 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☐ Claim(s) _____ is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☒ Claim(s) 1-15 are subject to restriction and/or election requirement.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13)☐ 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:

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)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. This application contains claims directed to the following patentably distinct species:

Species 1: Figures 5 – 6, and 8

Species 2: Figure 9

Species 3: Figures 18 - 20

Species 4: Figure 21

2. The species are independent or distinct because claims to the different species recite the mutually exclusive characteristics of such species. In addition, these species are not obvious variants of each other based on the current record. The species are mutually exclusive because each species teaches a different process of operating the camera.

3. Applicant is required under 35 U.S.C. 121 to elect a single disclosed species for prosecution on the merits to which the claims shall be restricted if no generic claim is finally held to be allowable. Currently, there are no generic claims.

4. There is an examination and search burden for these patentably distinct species due to their mutually exclusive characteristics. The species require a different field of search (e.g., searching different classes/subclasses or electronic resources, or employing different search queries); and/or the prior art applicable to one species would

not likely be applicable to another species; and/or the species are likely to raise different non-prior art issues under 35 U.S.C. 101 and/or 35 U.S.C. 112, first paragraph.

5. **Applicant is advised that the reply to this requirement to be complete must include (i) an election of a species to be examined** even though the requirement may be traversed (37 CFR 1.143) **and (ii) identification of the claims encompassing the elected species**, including any claims subsequently added. An argument that a claim is allowable or that all claims are generic is considered nonresponsive unless accompanied by an election.

6. The election of the species may be made with or without traverse. To preserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the election of species requirement, the election shall be treated as an election without traverse. Traversal must be presented at the time of election in order to be considered timely. Failure to timely traverse the requirement will result in the loss of right to petition under 37 CFR 1.144. If claims are added after the election, applicant must indicate which of these claims are readable on the elected species.

7. Should applicant traverse on the ground that the species are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the species to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the species unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other species.

8. Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which depend from or otherwise require all the limitations of an allowable generic claim as provided by 37 CFR 1.141.

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Usman Khan whose telephone number is (571) 270-1131. The examiner can normally be reached on Mon-Fri 6:45-3:15.

10. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jason Chan can be reached on (571) 272-3022. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

11. 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.

/Usman Khan/
Usman Khan

12/28/2011

Primary Examiner, Art Unit 2622

UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/586,221	09/18/2009	Neal Solomon	

CONFIRMATION NO. 8799

PUBLICATION NOTICE

Neal Solomon
P.O. Box 21297
Oakland, CA 94620

OC000000040075049

Title: Digital imaging system for correcting image aberrations

Publication No.US-2010-0033604-A1
Publication Date:02/11/2010

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 Managment, 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	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
12/586,221	09/18/2009	2622	545		15	3

CONFIRMATION NO. 8799

Neal Solomon
P.O. Box 21297
Oakland, CA 94620

FILING RECEIPT

OC000000038536408

Date Mailed: 11/04/2009

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)

Neal Solomon, Oakland, CA;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 11/825,521 07/06/2007 PAT 7,612,805
which claims benefit of 60/807,065 07/11/2006

Foreign Applications

If Required, Foreign Filing License Granted: 10/29/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/586,221**

Projected Publication Date: 02/11/2010

Non-Publication Request: No

Early Publication Request: No
**** SMALL ENTITY ****

Title

Digital imaging system for correcting image aberrations

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).

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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16310 U.S. PTO
091809

PTO/SB/05 (08-08)
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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	
First Inventor	Neal Solomon
Title	Digital Imaging System for correction image aberration
Express Mail Label No.	EB 884977815 US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: **Commissioner for Patents**
P.O. Box 1450
Alexandria VA 22313-1450

1. ☐ **Fee Transmittal Form** (e.g., PTO/SB/17)
2. ☑ **Applicant claims small entity status.** See 37 CFR 1.27.
3. ☑ **Specification** [*Total Pages* 62]
   Both the claims and abstract must start on a new page
   (For information on the preferred arrangement, see MPEP 608.01(a))
4. ☑ **Drawing(s)** (*35 U.S.C. 113*) [*Total Sheets* 19]
5. **Oath or Declaration** [*Total Sheets* _____]
   a. ☐ Newly executed (original or copy)
   b. ☐ A copy from a prior application (37 CFR 1.63(d))
   (for continuation/divisional with Box 18 completed)
   i. ☐ DELETION OF INVENTOR(S)
   Signed statement attached deleting inventor(s) name in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
6. ☐ **Application Data Sheet.** See 37 CFR 1.76
7. ☐ **CD-ROM or CD-R** in duplicate, large table or Computer Program *(Appendix)*
   ☐ Landscape Table on CD
8. **Nucleotide and/or Amino Acid Sequence Submission**
   (if applicable, items a. – c. are required)
   a. ☐ Computer Readable Form (CRF)
   b. Specification Sequence Listing on:
   i. ☐ CD-ROM or CD-R (2 copies); or
   ii. ☐ Paper
   c. ☐ Statements verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

9. ☐ **Assignment Papers** (cover sheet (PTO-1595) & document(s))
   Name of Assignee _____
10. ☐ **37 CFR 3.73(b) Statement** *(when there is an assignee)* ☐ **Power of Attorney**
11. ☐ **English Translation Document** *(if applicable)*
12. ☐ **Information Disclosure Statement** (PTO/SB/08 or PTO-1449)
    ☐ Copies of foreign patent documents, publications, & other information
13. ☐ **Preliminary Amendment**
14. ☐ **Return Receipt Postcard** (MPEP 503)
    (Should be specifically itemized)
15. ☐ **Certified Copy of Priority Document(s)**
    (if foreign priority is claimed)
16. ☐ **Nonpublication Request** under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.
17. ☐ Other: _____

18. If a CONTINUING APPLICATION, *check appropriate box, and supply the requisite information below and in the first sentence of the specification following the title, or in an Application Data Sheet under 37 CFR 1.76:*

☑ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: 11/825,521

Prior application information: *Examiner* Usman Khan *Art Unit:* 2622

19. CORRESPONDENCE ADDRESS

☐ The address associated with Customer Number: [ ] **OR** ☐ Correspondence address below

Name	Neal Solomon				
Address	PO Box 21297				
City	Oakland	State	CA	Zip Code	94620
Country	USA	Telephone		Email	

Signature	Neal Solomon	Date	7/27/09
Name (Print/Type)	Neal Solomon	Registration No. (Attorney/Agent)	

This collection of information is required by 37 CFR 1.53(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 1.11 and 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.**
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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)

☑ Declaration Submitted With Initial Filing OR ☐ Declaration Submitted After Initial Filing (surcharge (37 CFR 1.16(f)) required)

Attorney Docket Number	
First Named Inventor	Neal Solomon
COMPLETE IF KNOWN	
Application Number	
Filing Date	9/21/09
Art Unit	2622
Examiner Name	Usman Khan

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Digital Imaging System for Correcting Image Aberrations

(Title of the Invention)

the application of which

☑ is attached hereto

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NAME OF SOLE OR FIRST INVENTOR:		☐ A petition has been filed for this unsigned inventor	
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PATENT APPLICATION

DIGITAL IMAGING SYSTEM

FOR CORRECTING IMAGE ABERRATIONS

Inventor(s): Neal Solomon

Entity: Small Entity

DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS

CROSS-REFERENCES TO RELATED APPLICATIONS

The present application claims the benefit of priority under 35 U.S.C. section 119 from U.S. Patent Application Serial No. 11/825,521 filed on July 11, 2007 and Provisional Patent Application Serial No. 60/807,065 filed on July 11, 2006, the disclosures of which are hereby incorporated by reference in their entirety for all purposes.

FIELD OF THE INVENTION

The present invention pertains to imaging systems. The invention presents electronic methods to optimize optical processing, the digital capture of light and post-capture image organization of digital data sets. The system may be used in any device that captures, records, replicates, scans, reproduces, accesses, organizes, modifies, edits or stores images digitally. The invention applies to any imaging system that includes interaction between optics, digital image sensors, post-capture integrated circuits and digital storage components. The system includes self-organizing apparatus for optical image collection, electronic organization and optimization of digital data using integrated circuits and software applications. The system applies to consumer and professional still and video photography, including cinematography, to the processing of images with digital sensors, and to copying and scanning technologies. The system also applies to complex grids of multiple video cameras and satellites for surveillance and reconnaissance.

BACKGROUND OF THE INVENTION

The history of photography in the twentieth century is a story of finding solutions for optimizing optical problems. The main challenges have involved improving lens configurations to optimize image quality for film capture. As an example of this, lens aberrations have been reliably corrected by creating aspherical lens elements in wide-angle lenses and by creating apochromatic lens elements in telephoto lenses. The use of lens element coatings has also improved optical quality. Similarly, the evolution of zoom lenses has included improvement in

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optical quality via the combining of complex optical element configurations; as the optical quality of zoom lenses improved dramatically, their simplicity and utility led them to dominate lens sales. Complex computer-aided design (CAD) software has been used to test a broad range of possible lens configurations so as to optimize the optical performance in terms of clarity and contrast of each lens type, as much as optically possible within economic constraints.

In the last twenty-five years, an additional revolution has occurred with the advent of auto-focus (AF) technology in still photographic and video cameras. Invented by Minolta in the early 1980s, AF technology was a photographic application of technology developed for the U.S. military. The AF system used an infrared light sensor to reflect light onto an object that allowed a camera's lens to focus on the object by employing a motor in the camera. Canon eventually developed improved methods of auto focus by using electronic means (viz., micro ultrasonic motors) to increase speed and accuracy. This AF technology was integrated with automatic exposure (AE) technology which developed complex algorithms in a "program" mode to combine shutter and aperture data to match each lens with particular subject matter, as well as an aperture-priority exposure mode and a shutter-priority exposure mode. Of course, the photographer could use manual focus and manual exposure at any time, but these improvements increased the creative process and the competitive advantages of camera makers and photographers that employed them. Ultimately, the combination of these developments allowed ordinary photographers to achieve high quality standards.

AE was improved by Nikon, particularly with the use of a "3D color matrix" system, which included a library of pre-programmed image types. The combination of the improved AF and AE subsystems allowed a dramatic simplification of photographic imaging because the photographer no longer labored over the time-consuming focus and the exposure variables. Automated film advance, in the form of built in motor drives, increased the working speeds of camera operation as well. Nearly all consumer and professional cameras became automated to some degree by the mid-1990s, including formats beyond the 35mm film standard.

In the last decade, a new technology of image stabilization (IS) has emerged to help correct the problem of vibrations caused camera shake that lead to image blur. This technology is implemented in lenses by the use of gyros to reorient the light plane to compensate for camera shake; when combined with the earlier automated camera technologies such as AF and AE, IS further improves the photographic experience, particularly for larger lenses.

In addition to these advances in camera automation, technologies improved in the category of artificial flash as well. With microprocessors and sensors employed to measure minute variances, the development of photographic flash systems allowed the photographer to control the lighting in an environment to some degree. Nikon's use of distance information in its flash system advanced the state of the art in flash photography. The combination of AF and AE with automated flash mechanisms provided increased efficiency and simplicity in image capture processes.

The last several years have witnessed a revolution in digital photography. Because of its simplicity, potential quality improvement, immediate feedback and cost savings, digital photography has captured an increasing market share relative to film-based cameras. Kodak holds a number of patents involving the charge coupled device (CCD) for converting and recording light into electronic format. A competing technology for digital capture is complementary metal-oxide semiconductor (CMOS) which, though developed by Fairchild Semiconductor over forty years ago, is predominantly used in photographic cameras by Canon. Although there are trade-offs in the application of CCD and CMOS digital sensors for image capture, they both find wide acceptance in the market.

In order to correct for digital artifacts in image capture mechanisms, anti-aliasing filters are placed in front of digital sensors. Despite this improvement, digital imaging still has some challenges to overcome in competing with the image quality of film.

At the present time, the most recent advances in digital imaging for professional still photography have come from Hasselblad, which offers a Phase One camera back with a 39 MP digital sensor from Kodak. This system uses software that automatically corrects for digital capture limitations to produce a quality image. Their "digital APO correction" (DAC) technology performs an analysis of meta-data to color-correct the digital capture resulting in moiré-free images.

At the limits of current technology, a Canadian company, Dalsa, has produced a 111MP (10,560 by 10,560 pixels) CCD digital sensor that measures four inches square. This technology must be mated with large format-type lenses with large image area, and may be used for satellite surveillance applications and for other astronomical applications.

With both the larger sensor surface area of a medium format camera system and the high-quality fixed focal-length lenses of Zeiss, Schneider and Rodenstock, the quality of even the top

optics will be a limiting barrier to advanced digital sensors' ability to perceive maximum resolution. Without new improvements in optical and digital technologies, further progression of photographic camera systems will be limited.

Photographic Problems

Though every major advance in photography has solved an important problem, there are still remaining photographic problems to be solved in order to meet the goals of optimizing optical imaging quality while increasing simplicity and efficiency and lowering cost. Despite the advent and evolution of digital imaging, a number of problems have emerged in the digital realm in addition to earlier problems involving optics. Nevertheless, an opportunity exists to solve some of these problems via digital approaches. These problems are generally categorized as optical or digital.

Optical Problems

In the case of optics, lens aberrations are characterized according to lens type, with wide-angle lens problems differentiated from telephoto lens problems. Some of the problems affecting wide-angle lenses arose from the creation of the single lens reflex (SLR) camera. Before the SLR, the rear element of a lens could be placed in a rangefinder to protrude to a point immediately in front of the film plane in order to correct for aberrations. While the advantages of the mirror mechanism include ability to see exactly what one is photographing, because the mirror of the SLR flips up during exposure, the rear element of the lens must be placed in front of the mirror's plane of movement. This mechanical fact limits lens designs in most 35mm and medium-format camera systems and particularly affects wide-angle lens configurations.

It is very difficult to control the five aberrations of Seidel – spherical aberration, distortion (barrel distortion and pin cushion distortion), comatic aberration, astigmatism and curvature of field. In wide-angle SLR lenses as they are currently designed, these aberrations are particularly prominent.

For wide-angle lenses, optical vignetting affects peripheral illumination. Though optical vignetting will affect even retrofocus wide-angle lenses in rangefinders, it is particularly prominent in SLR cameras. According to the Cosine law, light fall-off in peripheral areas of an image increases as the angle-of-view increases. While optical vignetting can be reduced by

stopping down the lens, the aberrations in rectilinear wide-angle lenses generally exhibit more distortion the wider the lens.

In the case of wide-angle lenses, the depth of field range is much broader, with close focusing causing aberrations without stopping down the aperture. To solve this problem, close-distance focusing is improved by the creation of floating groups of lens elements. The rear lens group elements float to correct close-distance aberrations. With wide-angle lenses that have wide apertures, floating lens elements improve lens aberrations in focusing on distance points also.

Modulation transfer function (MTF) curves represent a quantitative methodology used to assess the resolution and contrast of lens performance at specific apertures. Each lens type has a specific lens element composition, formula and behavior as measured by MTF. In general, MTF measures lens sharpness to 30 lines/mm and contrast to 10 lines/mm.

Because different colors of the visible light spectrum behave uniquely, the goal of lens design is to have all colors accurately hit a film plane or digital sensor plane. The particular challenge for telephoto lenses is that the red and green light colors strike the film plane at different times than blue light colors; thus a compensation must be made in the lens configuration to adjust for chromatic aberrations. Camera lens manufacturers have used extra low dispersion glass and fluorite glass elements in telephoto lenses primarily to adjust the red color light spectra to the film plane. In addition, telephoto lenses use carefully designed lens coatings to limit light diffraction-based aberrations.

Due to their construction, super-telephoto lenses are very large and heavy. While modifying the materials used in the lens barrels could reduce size and weight problems, a technological improvement in telephoto lens design was developed by Canon with the addition of diffractive optical (DO) elements, which behave as a sort of highly-refined fresnel lens magnifier. Though the MTF analyses of wide-angle lenses show dramatic latitude in performance of even high quality SLR lenses, with particular loss in resolution and contrast toward the edges of the image, high quality telephoto lenses show control of aberrations. However, the price of these lenses is prohibitively high.

In the case of zoom lenses, as many as four distinct groups of lens elements correct various optical aberrations. These lens element groups include (a) a focusing group, (b) a magnification variation group, (c) a correction group and (d) an image formation group.

Modulating the focal length range of a zoom lens enables the lens to perform within the scope of operation, yet the zoom lens architecture has limits. In particular, the zoom lens configuration sacrifices resolution and wide potential aperture. Generally, the degree of resolution and contrast at the smaller angle of view is traded away in favor of competence at a wider angle of view, or vice-versa. This explains why MTF analyses of zoom lenses generally show a dramatic lowering in resolution and contrast relative to excellent fixed focal length lenses.

Digital Problems

Digital photography has built on the edifice of *film* camera systems. For instance, the size of the sensor is generally limited to the size of the optical circumference of a lens system. In the case of 35mm lenses that are designed for a specific angle of view, the largest that a digital sensor in a 35mm lens system could be, is 24mm by 36mm, with a corresponding maximum image circle of 43mm. In the case of medium format lenses, the largest digital sensors would duplicate the corresponding film plane size, whether 6x4.5 cm, 6x6 cm, 6x7 cm, 6x8 cm, 6x9 cm, 6x12 cm or 6x17 cm (which results in an effective image circle as large as 7 inches).

Digital sensors that are smaller than the limits of a corresponding lens system have been introduced. For example, Nikon digital sensors are smaller than 24mm x 36mm, or advanced photo system (APS) size. Efficient stacking of pixels allows a smaller sensor to eventually match the performance of a corresponding film system, while using the smaller circumference of the same lenses. Since the outside edges of the lens typically degrade resolution and contrast, this model using the smaller digital sensor can have an advantage of using primarily the centralized "sweet spot" of the image area. However, this smaller sensor size sacrifices the peripheral effects of a wide-angle lens, so a 14mm becomes a 21mm in a 1.5x conversion-sized sensor in a 35mm lens system. On the other hand, with telephoto lenses, the angle of view is limited to the center 65% of the image. This gives the appearance of upconverting a telephoto lens by 1.5x and thus provides an impression of increased magnification; a 400mm f/2.8 lens appears as a 600mm f/2.8 lens on a camera with a cropped digital sensor. Ultra-wide-angle lenses have been introduced with smaller image areas than 35mm to compensate for smaller sensor size.

Though invented over thirty years ago by Dr. Bayer, the charge coupled device (CCD) that is used in many digital cameras generally emulates the behavior of film. Specifically, since

most photographic film has three layers of green, red and blue, with green representing fifty percent of the emulsion and red and blue twenty-five percent each, the CCD architecture also configured pixels to capture fifty percent of the green photonic visible light spectrum and twenty-five percent each for pixels recording red and blue light. Human eyes see more green than red and blue, so both film and digital sensors seek to emulate the way that we see. Each light color is captured by a different pixel in the CCD, just as there are three emulsion layers of film. In recent years, Foveon has developed a digital sensor for image capture that further seeks to emulate film by structuring the pixels into three *layers*, again with fifty percent capturing green light and twenty-five percent each capturing red and blue light.

Unfortunately, unwanted artifacts are also captured by the digital image capture process. These include banding and moiré effects that present false patterns and colors. Moiré patterns are created because the dot pattern of a sensor will intermittently overlap with the pattern of a subject to create a third pattern; these effects are optically-generated digital distortions that represent the effect of light hitting a pixel without correction. In order to compensate for these effects, digital sensors have employed low pass filters consisting of liquid crystal structures; however, these filters tend to have the effect of softening image resolution. Additionally, RGB or CMYG color filters are placed in front of digital sensors to ensure the accurate capture of colors.

CMOS digital sensors present an alternative to CCDs. By employing alternating positive and negative transistor networks, the CMOS sensors use less power. While they do not have the low noise ratio of the CCD, they do have greater light exposure latitude, in both range of ISO and dynamic range of detail in highlight and shadow. More importantly, CMOS sensors contain the circuitry, including analog to digital converter (ADC) and digital to analog converter (DAC), for post-processing digital images on the chip itself and enabling increased micro-miniaturization of the digital imaging process. An increase in the bit rate of the CMOS chip up to 32-bit makes possible a much richer color palate and level of detail than with earlier generation CCDs.

CMOS sensors can be full-frame, matching the lens specifications for the camera systems for which they are designed. A relatively bigger sensor has a wider depth of field capability, so the background can appear as a blur to set apart the main subject. Given these capabilities, one problem that emerges is that a digital sensor's enhanced capabilities to capture details may exceed the maximum optical resolution capabilities of many lenses. Nevertheless, CMOS

sensors still require an anti-aliasing filter to be used in front of the sensor, which marginally degrades resolution.

Over the years, cameras have gotten smaller. While in the 19th century cameras were 11x14 or 8x10, literally capturing images on large emulsion plates, cameras of today are smaller and more automated. Yet the larger the film size, the bigger the enlargement potential and the increase in relative detail in the overall image. Similarly in digital photography, the larger the sensor, the more detail available and the bigger the output print can be enlarged. Because of this correspondence of digital sensor to film, the evolution of digital photography has been restricted to respective film camera systems, with 35mm and medium format systems dominating the field because well-developed lens systems have already been organized for these camera formats. The potential exists, however, to develop 35mm camera system digital sensors that rival film-based medium format or large format camera system quality or to surpass the limits of 35mm camera systems with medium format camera system digital sensors. The relative size, cost and automation advantages of 35mm camera systems generally show that these systems not only are competitive, but that these markets are increasingly accelerated relative to larger format systems. For example, the development of large aperture lenses, super-telephotos, rapid auto-focus, refined automated exposure and image stabilization systems in 35mm systems has solved various problems that have emerged in the last century and has improved image quality and camera system efficiency.

However, in the digital imaging realm additional problems have emerged, including the need to improve color (hue and saturation) quality, exposure highlight range, contrast range and other tonal adjustments. In addition, digital image capture brings its own set of aberrations, including moiré and banding effects and noise and ISO range limits. Additional aberrations are linked to the unique design of each type of digital sensor, with trade-offs presented between types of CCDs or CMOS chips. Moreover, there are still optical problems in the digital realm, namely, a range of optical aberrations created particularly by wide-angle and zoom lenses as well as the limits of very large, costly and heavy super-telephoto lenses.

In order to transcend the optical and digital limits of present camera systems, software systems have been developed that deal with the problems in post-production. While the most notable of these post-production digital editing software programs is Adobe Photoshop, each camera manufacturer has its own proprietary program. In the main, these post-production

software programs are limited to color correction and sharpening/softening of images. Additionally, some of these software programs are able to emulate specific artificial filter techniques to produce creative modifications of an original image. Nevertheless, manipulating unfiltered RAW image files in post-production processes is time-consuming and expensive and requires considerable skill.

One unintended effect of using digital sensors to capture images in digital photography is that dust accumulates on the sensor surface and thereby obstructs a clear optical image. The vacuum behavior of increasingly ubiquitous zoom lenses moves dust in lenses that are not internally sealed and the existence of dust is a prevalent feature of digital photography. Dust on the sensor is a non-trivial problem that requires tedious post-production correction for each image. The existence of dust on a digital sensor is an inconvenient impediment to achievement of optical imaging quality.

What is needed to correct these various optical and digital aberrations and unfiltered image files is in-camera modification capability for each specific image problem. The present invention describes a digital imaging system to optimize optical results.

Applications of the Present Invention

The present invention has several practical applications. The digital imaging system applies to consumer and professional still and video camera technologies, to cellular telephones and to personal digital assistants (PDAs). Since video technologies are evolving into digital formats, including HDTV and its successors, the present invention would be applicable to these technologies. The present invention also applies to networks of remote camera sensors for surveillance. The system also applies to native digital cinematography and telecine conversion from analogue to digital media. The system may be applied to image scanning and image copying technologies. Finally, the present system may be applied to any optical digital capture, processing and storage sub-system technologies, including groups of sensors or satellites.

Advantages of the Present Invention

There are several important advantages of the present invention. The present system dramatically improves image quality. This digital imaging system eliminates, or minimizes, post-production processes. In addition, the system presents substantial cost savings as well as

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time savings relative to existing digital imaging systems because of the automation of integrated in-camera optical and digital corrections of aberrations.

With the present system, in-camera digital filters will largely replace optical filters. With less distortion, cost and weight/size than current optical filters and with far more control and quality results, the present system demonstrates that in-camera digital filtration out-performs better than external filters. The in-camera filter system is also an improvement over post-production digital filter systems which require substantial time, cost and skill to implement.

By using the present invention, users will be able to use lens apertures that are wider open, because lens aberrations will be corrected. In turn, this increased latitude will allow more efficient (2+ stops) use of available light and will allow slower lenses to achieve quality images that have traditionally been in the domain of expensive fast lenses. The process of photography will be made generally more efficient.

The present system allows camera manufacturers to design different, predominantly smaller, lenses. Moreover, with providing a system for digital corrections, camera lenses may use less expensive optics and still obtain good results. This process will, in turn, accelerate the adoption of low-cost digital photographic systems and, in the aggregate, increase the overall size of the digital photographic market. Similarly, there will be an increase in the effectiveness of zoom lenses, which are already becoming popular. With the present system, 35mm optics may obtain the quality typically recognized by 4x5 film camera systems. The present system will thus facilitate photographic digital imaging to supplant the film era.

Its application to digital scanning and copying will allow the present system to become ubiquitous as a system to improve imaging.

Because the system presents an integration of several critical subsystems that are centered on digital imaging processes, the system has applications to video photography, satellite systems and surveillance systems. The dynamics of the operation of the subsystems of the present digital imaging system reveal the refinement, efficiency and optimization of the digital photographic paradigm.

Importantly, since the present system uses apparatus and methods that are implemented with software processes, in-camera software can be constantly upgraded and remotely downloaded, while image files can be automatically uploaded, organized and published.

If the goal of the evolution of photographic technology is to increase the number and quality of excellent images, the present system will revolutionize photography.

Solutions to Digital Imaging Problems that the Present System Presents

The present system provides in-camera digital corrections to both optical and digital aberrations. In the case of optical aberrations, distinct lens-specific imperfections are caused by wide-angle, telephoto and zoom lens types. In the case of digital aberrations, specific digital artifacts, such as aliasing and dust, must be corrected.

The present invention also designs specific improvements to digital sensor design. These hardware architecture modifications allow digital imaging to maximize both optical resolution and image exposure range.

Post-capture in-camera filtration is only part of the solution. There is also a need to modify the digital sensor, whether CCD or CMOS, with specific filtration in some cases, including a low pass anti-aliasing filter and a polarizing filter. This post-optic pre-sensor filtration works with post-sensor in-camera filtration processes.

In the context of specific complex processes, such as in zoom lens modifications of focal length and in full-motion video processing, additional corrections are performed using the digital imaging system which continuously optimizes performance.

Finally, the present system reveals approaches to improve network coordination and wireless external storage and publication capabilities for digital imaging systems.

BRIEF SUMMARY OF THE INVENTION

The present invention is divided into several main sub-systems: (1) digital filters to correct optical and digital aberrations; (2) digital sensor improvements and nano-grids; (3) digital system improvements that link multiple digital corrections; (4) dynamic digital imaging system improvements that apply to zoom lenses and video imaging; and (5) digital image network improvements. There are several distinct improvements for each category of sub-system listed.

DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic drawing of a digital imaging system.

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Fig. 2 is a flow chart of an analog to digital signal process.

Fig. 3 is an image of the vignetting corrective filter in an optical lens.

Fig. 4 is a list of wide angle 35mm lens types.

Fig. 5 is a flow chart of the digital corrective process.

Fig. 6 is a schematic diagram of different types of optical aberrations in different configurations of the same lens.

Fig. 7 is a flow chart of the process of digital image capture, processing and storage.

Fig. 8 is a flow chart illustrating the process of selecting filtration settings.

Fig. 9 is a pair of diagrams showing the varied depth of field optimization at different apertures.

Fig. 10 is a flow chart showing exposure optimization using digital correction in camera.

Fig. 11 is a flow chart illustrating the use of in-camera special effects filtration.

Fig. 12 is a flow chart showing the selective in-camera filtration of specific objects.

Fig. 13 is a flow chart describing the exposure adjustment of an image using in-camera filtration.

Fig. 14 is a flow chart showing the process of in-camera special effects filtration.

Fig. 15 is a flow chart showing the process of in-camera digital correction for sensor dust.

Fig. 16 is a diagram showing a digital camera with an ASIC array.

Fig. 17 is a diagram illustrating a digital camera with interchangeable CCD and CMOS sensors.

Fig. 18 is a diagram of a digital camera with a nano-grid before the sensor.

Fig. 19 is a diagram of a nano-grid.

Fig. 20 is a diagram showing the feedback loop connecting the processor and the nano-grid.

Fig. 21 is a diagram illustrating the tri-pixel architecture in a digital sensor.

Fig. 22 is a flow chart showing the pre-programmed modules for in-camera functionality.

Fig. 23 is a diagram showing the pre-sensor modification process in a digital camera.

Fig. 24 is a flow chart showing the integration of optical and digital corrections with feedback.

Fig. 25 is a flow chart showing the interactive feedback mechanism of integrated corrections.

Fig. 26 is a flow chart describing the adaptive user pattern learning process to process images.

Fig. 27 is a flow chart describing the feedback process in filtering images.

Fig. 28 is a flow chart showing software privacy function in a digital imaging system.

Fig. 29 is a flow chart showing the dynamics of zoom lens corrections in digital imaging.

Fig. 30 is a diagram illustrating object tracking in dynamic changes in video corrections.

Fig. 31 is a flow chart showing object tracking of a digital imaging system.

Fig. 32 is a flow chart showing the caching process of an object in motion in a stationary scene.

Fig. 33 is a diagram showing network coordination of fixed sensor grid tracking multiple objects.

Fig. 34 is a diagram showing the wireless communication features of the digital imaging system.

Fig. 35 is a flow chart showing an image organization system.

DETAILED DESCRIPTION OF THE INVENTION

(I) Digital Filters to Correct Optical and Digital Aberrations

(1) Lens-specific digital correction of fixed focal-length lens for specific optical aberrations in camera.

Each lens has some sort of aberrations because of the trade-offs involved in producing lenses of usable size and practical commercial cost. The challenge of building lenses for SLR camera systems lies in accounting for particular restrictions and compromises, particularly for wide-angle and zoom lenses. In the case of wide-angle fixed focal length lenses, several main kinds of aberrations occur, including spherical aberration, distortion (pin cushion distortion and barrel distortion), astigmatism, curvature of field (manifesting as the reduced corner exposure of vignetting) and comatic aberration (a distortion evident with long exposures). The extremes of each of these aberrations have to be corrected in post-production.

In the case of vignetting, a type of aberration in which the corners of an image are exposed a stop less than the image's center area, software can digitally emulate a center-neutral density filter to compensate for the light fall-off on the edges. This operation identifies the

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degree of light fall-off for each specific lens and adjusts the brighter areas in the center of the lens by appropriate exposure compensation. A consequence of this digital equivalent of the traditional optical solution to vignetting is that the image will require exposure metering of the subject at a level consistent with the outside edges of the image rather than the typical inner section. In the present system, the camera will use pre-set calculations compensating (generally one stop) for the specific gradations of the curvature of the field for each lens, with an increasing compensation correlated to an increased angle of view. Similarly, barrel distortion and pin-cushion distortion, which also manifest in image corners, are corrected using processes of employing pre-set calculations, to compensate for optical distortion, particularly in wide-angle and zoom lenses.

In addition to integrating into the camera the traditional process of image correction for exposure gradations of vignetting, the present invention offers two further embodiments. First, instead of darkening the center to match the darker corners, the in-camera digital compensation system will lighten the corners to match the exposure of the center of the image. In the second embodiment, the in-camera digital compensation system will both lighten the corners somewhat and darken the center of the image somewhat, to produce a more pleasing and realistic effect. The in-camera digital corrections of the vignetting problem dramatically improve the traditional optical solution of a center-weighted neutral density filter, which typically degrades image quality as it evenly illuminates the full image.

Since each lens has specific aberrations, depending on manufacturer and even differences in the specimens themselves, the camera software system will have preprogrammed general corrections for each specific lens type. For instance, while a 20mm f2.8 lens varies among manufacturers, the general optical aberrations will be similar. An effective software solution is one which brings the optical image quality to a level consistent with a benchmark as measured by low MTF curves for each lens in its class in terms of both resolution and contrast throughout the image. To exemplify this benchmark, retrofocus rangefinder lens performance results of wide-angle lenses, which lack a shutter mechanism to design around, can be used for comparison. To accommodate the mirror in the SLR design type, the rear nodal point in SLR lenses are shifted forward, creating distortion. In contrast, the present system suggests applying a digital solution to compensate for this problem.

In a general sense, this process of correction is similar to correcting an ocular astigmatism with reading glasses. However, rather than using an optical solution to an ocular problem, the present system reveals a digital solution to an optical problem.

In the process, the camera identifies a specific lens and refers to a database that matches the lens type with the specific aberrations. The aberrations are consistent throughout all images for each formula of a specific prime lens type and are thus corrected by adjusting for each specific aberration category. Generally, the larger the angle of view of a lens, the greater the distortion and the greater the need for in-camera digital corrections.

In addition to the kinds of distortions created in wide-angle lenses, other types of distortion occur primarily in large aperture telephoto lenses, most notably chromatic aberrations that require apochromatic corrections. Rather than employing large, heavy and expensive extra dispersion glass, such as fluorite elements, the present system allows each lens type to be digitally corrected for these types of aberrations. The in-camera digital process works by identifying a specific lens and comparing the lens pattern to an internal database. Mathematical calculations compensate for the shift in red and green light that apochromatic corrections require for very low MTF curves registering high standards of resolution and contrast by emulating the optical benefits of extra low dispersion glass elements.

Since lenses of the same focal length but with different maximum apertures represent completely different lens designs, modifications of their aberrations will vary relative to each specific lens type. For example, a 24mm f/2.8 lens will have a different optical formula than a 24mm f1.4 lens in a 35mm camera system. Similarly, a 28mm f/2.8 will differ from both a 28mm f/2 lens and a 28mm f1.4 lens and will thus each require different adjustments for vignetting, spherical aberration, pin cushion distortion, barrel distortion and coma. In other words, each lens with a unique optical formula will have specific aberrations, the corrections for which will be accessible in a database.

Another type of optical aberration that affects lenses involves flare, which is a sort of specific reflection of light sources. While improvements in lens coatings have been used to correct for flare, high refractive glass also eliminates flare. The present system uses digital processes to emulate these flare reduction functions on lenses even at maximum apertures.

In addition to the lens-specific types of corrections that are supplied by in-camera software, a function that optimizes contrast provided by limited reflected light is required. In

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general, lens hoods reduce reflected light. However, in the absence of a lens hood, scattered light will adversely affect contrast in all lenses. Thus, a general digital solution will optimize contrast from reflected light by emulating the effects of a lens hood.

Because the pixels on a digital sensor behave as neutral intermediaries to record light, the aberrations on specific fixed focal length lenses will be prominent. It is therefore necessary to filter out various optical impurities. In all cases, the digital in-camera software program emulates specific filters to effectively correct specific optical aberrations.

By digitally adjusting for optical distortions, the present system advances the state of the art for fixed focal length lens optics, beyond any opportunities available in film cameras. The following chart illustrates a list of optical distortions that are corrected by in-camera digital solutions.

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	Fixed Focal Length Lens Type		Zoom Lens Type		
Specific Aberrations	**Wide-angle**	**Telephoto**	**Wide-angle**	**Wide-to-Tele**	**Telephoto**
Spherical	X		X	X	
Comatic	X	X	X	X	X
Astigmatism	X		X		
Distortion (Pin Cushion and Barrel Distortion	X		X		
Curvature of Field	X		X		
Chromatic		X		X	X
Flare	X	X	X	X	X
Scattered light (Unpolarized)	X	X	X	X	X
Color Accuracy	X	X	X	X	X
No Lens Coatings	X	X	X	X	X

(2) Multivariate digital correction using matrix filter system in camera

Since typically several distinct aberrations exist in a lens, it is necessary to correct each of the aberrations. For this multi-dimensional problem there is a multivariate digital in-camera software correction solution. The problem of correcting multiple aberrations presents the additional challenge of requiring acceleration to complete multiple tasks rapidly. In most cases, the hardware employed in a camera's chip set will include an application specific integrated circuit (ASIC) which processes a particular program rapidly. It is appropriate to facilitate the combination of corrections to multiple simultaneous aberrations with an ASIC or multiple ASICs.

There is a need to optimize both resolution and contrast across the image area for accurate light reproduction. One way to do this is to stop down the lens to an optimum aperture of about f/8. However, this solution sacrifices the advantages of a fast lens design and capability, namely, limited depth of field and bokeh (smooth out-of-focus area). Though

resolution is typically improved by stopping down a lens, digital sensors are generally still restricted in their latitude of contrast. Therefore, regarding both resolution and contrast, it is necessary to provide multiple adjustments of the native image with in-camera digital corrections.

While it is possible to produce mathematical algorithms for automatic correction of optical aberrations, it is also useful to have manually adjustable variables. Therefore, the present system includes a function whereby one may omit a specific correction in an image by using a lens with multiple aberrations in order to induce a particular creative effect. This factor may involve a lack of exposure compensation, a lack of correction for spherical aberration or an improperly or partially corrected apochromatic modification.

In one example of the use of multiple corrections, simultaneous application of multiple digital filters concurrently corrects multiple aberrations. In effect, this is like adding layers of different eye glasses to repair multiple types of astigmatisms for each specific ocular condition. The dynamics of correcting multiple simultaneous aberrations may be complex, but since the number and type of aberrations are constrained to a specific lens type, a centralized database may be accessed with specific corrections for each respective aberration. For example, lenses with multiple complex aberrations, such as in very wide-angle lenses, will require multiple corrections. These combinations of corrections become complex as focal length modes change in zoom lenses and as aperture changes.

The following is a list of filter types that provide digital methods of correcting image problems or creating specific effects. The list is not intended to be comprehensive or systematic.

Filter Type in Digital App.	**Most Common Uses**	**Other Filter Types**
UV (and Sky)	General Use	Polarizer
Color-enhancing (and warming)	17mm-200mm (in 35mm)	Close-up
Contrast	17mm-200mm (in 35mm)	Special effects filters
Black and White (Red, Orange, Yellow, Green)	17mm-200mm (in 35mm)	
Infrared	17mm-200mm (in 35mm)	
Color Graduated (Neutral Density)	17mm-200mm (in 35mm)	
Diffusion (Soft, mist/fog, star, streak)	24mm-135mm (in 35mm)	
Combinations (Neutral density and enhancing, Polarizer and UV)	17mm-200mm (in 35mm)	

In the past, these optical filtration processes were added after the production process via editing software such as Photoshop. However, in the present system, these combinations of processes are performed in-camera by user-adjusted settings. In the case of artificial color changes to an image, digital processes emulate specific optical filters by adding a specific color or a combination of colors. On the other hand, in the case of diffusion filtration, the in-camera digital process creates an emulation of optical filters. The classic example of this diffusion approach is the soft filter, which is used for portraiture. In this case, various user-adjustable settings in the camera digitally manipulate soft filtration.

(3) Depth-of-field optimization using digital correction in camera

In addition to correcting optically-generated aberrations with in-camera digital processes, the present system allows in-camera depth-of-field (DOF) optimization by affecting the aperture of the lens that is used.

DOF in an image is dependent on the aperture setting in a lens, in which a moderate DOF range – allowing a subject to be isolated in an image – can be manipulated, that is, extended or narrowed, by the camera's digital processing capability. In the film paradigm, one obtains a specific aperture, and thus the corresponding DOF, that is preset by the photographer. However, in the digital paradigm, by contrast, one can *narrow* an image's surplus DOF range in-camera by manipulating the aperture. This process can only be done in the camera, because once the digital file is sent to post-production editing, the aperture and DOF is already set and incapable of being changed. The aperture is narrowed in camera by isolating the subject and shifting the field of view (forward from the rear range of DOF and backward from the front range of the DOF). Distance information is used to recalculate an optimal DOF. In another embodiment, the camera provides feedback from an internal computational analysis that results in a specification of less DOF and takes another image (or images) with a larger aperture to accomplish reduced DOF at a specific focus point.

The camera will effectively identify a type of subject and provide an optimal aperture for this subject. For instance, for a portrait, the camera will select a shallow DOF around the subject. In the case of a distant landscape, the camera will focus on a distance at infinity and provide a nominal aperture to correspond to shutter speed that will fit the available light as matched to a specific lens. A near landscape photographed with a wide-angle lens will, on the other hand, have a near focus and a maximum DOF; specific subjects will be highlighted with

ample DOF. The camera will also have the capability to bracket exposures in several successive images based on DOF variations.

The DOF manipulation thus depends on a combination of data sets including the particular lens used (wide-angle lenses have greater DOF at moderate distances than telephoto lenses), the distance information and the unique combinations of aperture and shutter speed. DOF will narrow with less distance, with use of a telephoto lens and a fast aperture; contrarily, DOF will expand with a further distance, with use of a wide-angle lens and a slower aperture.

In another embodiment of this process, test images are taken and analyzed, then later images taken with new settings optimize DOF for each image type.

(4) Exposure optimization using digital correction in camera

One phenomenon that film currently records better than digital photo technology is exposure latitude. Film is capable of greater exposure latitude than either CCD or CMOS digital sensors, though each digital sensor type has strengths and weaknesses. For the crucial detail recorded in a scene, film provides far more depth of tonal range. Yet some of this problem – caused by the limits of digital sensors themselves and the way that photons are recorded by electrically charged pixels – can be digitally corrected and optimized in-camera.

The problem derives equally from the method of measuring exposure as well as the method of image capture by a digital sensor. In general, since there is less exposure latitude in digital sensors, as compared to film, the maximum scope is two or three stops in the image tonal range. Consequently, the camera must meter the image within constraints of the tonal range of the digital sensor, with the sacrifice of either shadow detail or highlight detail. In an image with broad exposure range, then, the image will generally be either too light or too dark because metering for one area sacrifices the other tonal category.

One way to solve this problem is to manipulate the lens aperture, because increased aperture within an optimal limit generally increases detail. An optimal aperture of f/8 provides more detail and clarity than at f/2 or at f/32. The in-camera processor may thus seek out more detail in the image by manipulating the aperture to the optimal range of f/5.6 to f/11, depending on the type of subject and the availability of light. With more detail in the original image, it is possible to interpolate the digital data in the image file by increasing both shadow and highlight detail and to gain an additional stop or two of tonal range.

In another embodiment, the tonal range of an image data set is enhanced in-camera by using meta-data to sample the range of shadow and highlight detail. The data sets are interpolated to add requested shadow detail and/or highlight detail. Obviously, some subjects require more or less shadow or highlight (or both), which the camera can correspondingly adjust. These tonal range corrections are user-adjustable.

In an additional embodiment of in-camera tonal range corrections, exposure data are bracketed by manipulating the aperture and shutter speed to lower or raise the overall exposure in one-third to one-half stop increments. This bracketing method may be correspondingly limited to a specific image type. For instance, in a portrait, the extraneous background, which ought to be out of focus, is not emphasized in the exposure data, while the main subject is carefully nuanced for balancing an optimum of both highlight and shadow, or for an exclusive emphasis on either highlight or shadow.

The overall problem of limited tonal range in digital photography stems from mismatched exposure-metering mechanisms of digital sensors with substantially restricted tonal range capabilities. One interesting example of this problem occurs in scenes with two or more stops of difference, such as a landscape with sky on top and earth on bottom. A filtration process will operate on the key parts of such an image, as described above regarding the vignetting phenomenon; the overexposed top half of the scene will be gradually underexposed while the lower half of the scene will be gradually overexposed. This scene-specific adjustment of exposure greatly increases the tonal range of digital images and is made possible via analysis of the scene and comparison to a database of typical scenes categorized by the in-camera digital processor which effects correction using the methods described herein. In this example, the corrective process emulates the use of neutral-density optical filters.

(5) Special effects digital filtration of specific objects

Though there are several main categories of special effects optical filters, including color enhancing, infrared and diffusion, the use of diffusion filters appears to elicit the most dramatic effect. Diffusion filters are categorized as soft effect, mist/fog, black mist, gold diffusion, and star and streak, with various degrees of diffusion producing lesser or greater distortions. In effect, rather than removing optically-generated distortions, we are deliberately creating photographically desirable distortions. It is possible to reproduce these special effects by using

the digital post-capture production processes in the camera. In this case, the camera digitally emulates the special effect by applying user-adjustable filter settings.

Portraits have traditionally used some sort of soft effect filtration approach which is producible in the camera using the methods described here. After the image is captured, the camera analyzes the image's meta-data and applies a correction by interpolating the data with specific filter emulation. In the past, specific camera lenses, such as the 135mm soft effects (also called "defocus control") lenses performed this function optically with an included adjustable lens element. This defocus control lens type will focus on the main subject and a lens element setting of the telephoto lens to produce a soft filter effect. In addition, because this lens type uses a nine blade aperture, the background that is out of focus has a pleasing bokeh in which the gradations of tone are evenly smooth. Nevertheless, a sophisticated digital camera is able to produce the same results with more information provided by a normal telephoto lens, using the method of emulating special effects in-camera.

Another novel special effect that is a further embodiment of the system is the ability of the in-camera digital corrective system to use complex data sets contained and analyzed in an image to create a three dimensional (3-D) representation of the image. The camera creates a 3-D image by arranging the DOF in a way that optimizes the aperture by using distance information and autofocus data to isolate a subject. By removing the foreground and background of the image as a center of subject focus, the DOF will emphasize the subject only as 3-D. The key to this effect is the application of specific exposure data as indicated above, because it is in the increased extension of the range of highlight and shadow that the subject in the image will attain a 3-D quality in contrast to its out of focus foreground and background.

An additional embodiment of the present system would extend the still photography in-camera special effects to video with full-motion ranges of filtration actions.

Finally, it is possible to *combine* different user-programmable special effects in-camera by adding the various types of diffusion methods for a specific image.

(6) Selective in-camera filtration of specific objects

The combination of sophisticated auto-focus technologies and in-camera auto-exposure systems provides the opportunity to isolate a subject by focusing on the subject and narrowing the DOF range by manipulating the aperture. In a further extension of the subject-isolating capabilities of these technologies, it is possible to digitally filter out specific objects in a scene

in-camera while focusing on other selected objects that are in a specific range of DOF. In other words, one may apply filtration to correct aspects of a single object or only the background of a scene to the exclusion of an isolated object, rather than correcting a whole scene. Selective filtering of specific objects in an image by in-camera digital processing affords greater creative flexibility.

Because the camera uses distance information to isolate a specific object by focusing on the object within a range of DOF, it is possible to isolate a particular object for the purposes of applying a specific filtration preference, such as manipulating the color, correcting the optical aberration (say, if the object is in a corner of the image of a wide-angle lens), providing a special effect (such as a soft effect only on a specific object rather than the scene as a whole) or using some combination of these corrections. Once the camera isolates the selected object (using auto-focus mechanisms and distance information), the user selects programmable correction features to perform a corrective function only on the specific object (or only on the parts of the scene that are exclusive of the object). In a further embodiment, contrastively, once the object is isolated, only the background may be selectively manipulated with filtration, achieving pleasing effects. This in-camera corrective feature provides a powerful tool to rapidly manipulate an image without using post-production editing software tools.

These object-specific in-camera selective filtration capabilities are particularly dramatic with fast-moving action photography in which split-second timing produces the preferred complex effects. Selectively identifying a particular object for intensive combinations of filtration is a highlight of the present system.

(7) Digital correction in-camera of intermittent aberrations caused by dust on digital sensor

Dust on a digital sensor is a major concern for photographers. The use of zoom lenses compounds this condition, because as the zoom lens changes focal-length positions, air is transmitted, which results in the proliferation and diffusion of sensor dust. Unless photography is isolated to a clean room, the problem of dust on a digital sensor will remain prevalent. The present system provides a method to correct for this phenomenon.

In the case of dust on a sensor, a specific consistent pattern emerges on each image captured by the digital sensor. Consequently, information from various images is analyzed, and the pixels affected by dust are identified. Information from the consistent fixed pixel positions that are affected by the dust are then isolated. The specific positions with the dust are then

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analyzed by comparing the immediate areas surrounding the dust that are not affected by it. These unaffected areas are analyzed, and the affected areas are interpolated to provide a continuous tone. In effect, the images identify the locations with dust by using caching technology. The continuity of the location of the dust between multiple images provides information to the in-camera image processor to detect the specific pixel locations. The camera will then apply a corrective process to the isolated dust locations with adjoining exposures by interpolating these distinct locations for each specific image configuration.

In another embodiment of the present system, "hot" (too bright) or "dead" (too dark) pixels are interpolated out of the scene using the method described above. Unlike hot or dead pixels, dust is a similar but temporary version of the same problem of an artifact that requires in-camera modification. In effect, a map is built to discover, isolate and interpolate bad pixels, which are a permanent problem revealing a key limit in digital sensor technology. Separate maps are constructed for permanent pixel dysfunctions and temporary pixel aberrations (viz., dust). In both cases, the camera works from these maps to correct the aberrations on a pixel-level.

In a further embodiment of the present system, Monte Carlo analysis is applied to the problem of identifying the location of dust on specific pixels (or partial pixels) by randomly creating an initial map from information of at least two contaminated images.

In still another embodiment of the present system, the process of modifying pixel aberrations (either permanent or temporary) uses a sequence of operation which begins by correcting the major aberrations first, then repairing the minor aberrations, thereby maximizing efficiency. This is done by starting the corrective process in a specific location of the image and moving to other positions in an efficient pattern.

(8) Sequence of corrections for multiple (optical and digital) types of aberrations in camera

Since it is evident that multiple digital filtration approaches may be used for specific types of problems or aberrations or to achieve specific effects, it is clear that a combination of the techniques may be employed simultaneously on specific images. The present invention allows the various optical and digital corrections to be performed in camera in a sequence of actions. The user selects the various combinations of functions required to be performed, inspects the effects, and chooses the most effective combination of effects. Thus the invention offers a combinatorial optimization of the totality of corrective filtration approaches.

After the images have been taken, it is possible to inspect them in the camera using the camera's image read-out. This makes it possible to create new files, or to adapt a RAW file, in real time, by manipulating the various corrections in sequence. This post-image-capture in-camera editing process allows multiple corrections to be applied to a range of optical and digital aberrations by combining various specific corrective techniques.

In some cases, the user can pre-set specific corrections. For instance, to correct for optical aberrations, a user may leave this function on permanently. In other cases, such as selective filtration of a specific object or optimization for DOF or exposure, there may be discriminating use of specific corrective functions. In the case of selective user choice, it is possible, by using the present invention, to select a priority sequence of corrections in layers. While specific select layers may be permanently activated, for example to automatically adjust specific optical aberrations, additional sets of layers may be manually selected in order to modify the specific aspects of each image, particularly to adjust or correct digital aberrations. This process can be performed with a single microprocessor, multiple microprocessors, multiple ASICs or a combination of microprocessors and ASICs.

An additional embodiment of the system provides multiple combinations of corrections and effects via multiple independent ASICs, which only perform specific functions, working in parallel. The various tasks are divided into specific-function ASICs for rapid processing. The advantage of this approach is accelerated processing speed in performing multiple simultaneous functions.

(II) Digital Sensor Improvement and Nano-grids

(9) Interchangeable digital sensor system using both CCD and CMOS to optimize best results

Because the main digital sensor types of CCD and CMOS, like film types, each have benefits and detriments, it is sometimes advantageous to provide the utility of both sensor types in a camera system. With the exception of a video camera, which employs three CCDs, the use of multiple sensors has not been adopted. Two generations ago, however, the idea of using a twin reflex camera for medium format photography was implemented. In this case, though focus was coupled between the lenses, one lens was used to see the subject, while the other lens took the picture. This method was used to obtain the benefits of a rangefinder camera with a single lens reflex camera.

The use of two types of sensors in a camera is compelling, because the user benefits from the strengths of both. In the present invention, one sensor is selected from among at least two different types of sensors that are rotated to an active position by the user. One advantage of this approach is that if one sensor experiences a problem, there is a reserve sensor available at the push of a button.

This capability usefully exploits the strengths of each particular sensor. For instance, in situations in which high resolution is required, a CCD may be preferable, while in cases in which increased tonal range or low noise is preferable, a CMOS sensor may be preferable. With this approach, a customer does not need to choose between different types of sensors.

The process of interchanging the two chips is performed by placing the two chips on either façade of a plane that "flips" over (i.e., rotates 180 degrees) upon demand to obtain the requirements of the chosen chip type. This mechanism would fit behind an SLR's mirror and could easily be performed as long as the mirror is in the "up" position. In another embodiment, the chip exchange process can occur by sliding alternating chips into a sleeve from a single location and replacing the non-utilized chip(s) into the reserve compartment. In either event, the camera will detect the chip exchange and will automatically reprogram software functions and settings for the usable chip.

(10) Nano-grids for selected pixels on CCD or CMOS integrated circuits to optimize selective modifications of exposure, ISO and aberrations in digital photography

Digital sensors consist of arrays of pixels, arranged in rows, which behave as tiny buckets for converting photons to electrons. As the pixels fill up with light, they are able to discern slight differences in color and exposure and transfer the energy, in the form of electrons, to storage. Charge coupled devices (CCDs) have been the predominant form of digital sensor because they use a form of electronic charge which creates the behavior of a bucket brigade of transferring data, once the buckets in a row are filled up, to successive rows for digital data storage of the electronic charge sets. CMOS digital sensors may be structured with larger bucket pixels, which can increase the depth of the light captured and thus the latitude of light exposure that is stored. However, for the relatively larger buckets to provide increased photon capture capacity, it is necessary to control the width of the opening in the top and the width of the buckets so that the amount of light captured may be modulated.

The present invention introduces a key advance in the ability of digital sensors, particularly CMOS sensors, to modulate the size of the openings of the pixels. Specifically, the present system provides for a nano-grid, or a very small matrix of filaments, which fits over the sensor. The nano-grid is carefully calibrated to match the rows of pixels on the sensor so as to limit the amount of light that each of the buckets may receive. Use of the nano-grid allows a selective closing of the large buckets in order for photons to be restricted. Selective modification of specific pixels on the neutral grid makes it possible to identify specific sets of pixels to correct for various exposure or lens aberrations.

In this embodiment of the present system, data about a specific lens are provided to the camera in order to correct specific lens aberrations, while exposure data is used to modify image capture using nano-grids for optimum image performance.

Nano-grids may be selectively switched at different pixel sites, akin to continuously programmable field programmable gate array (CP-FPGA) semiconductors, which modify architecture in order to optimize effective operation by constantly manipulating the chip's gates.

Nano-grids may be used for specific image modes, for example, nocturnal imaging, which requires more time to read a sufficient amount of light. In this case, a specific software module may provide lens and exposure data to the camera, which then determine the precise composition of nano-grid correction to provide to specific sets of pixels on the digital sensor. In effect, nano-filaments move to positions to effectively block out the full capacity of the pixel buckets and thus change the pixel effects. With use of preset nano-grid positions for particular applications, the identification of specific vectors of nano-filaments is performed, and exposure adjustments are made on specific images in hardware.

The nano-grid is overlaid over the surface of the pixel architecture. The nano-grid is used not only in specific pre-set positions, but it also provides feedback to the post-capture system for analysis and repositioning to achieve the desired effects. One effect of the nano-grid is to manually expand or narrow the range of a set of pixel buckets; this process in turn effectively modifies not only the exposure range but also sharpness at high ISO, thereby dramatically reducing noise. Consequently, it becomes possible, by modifying the pixel bucket width and height, to obtain extremely sharp images with excellent contrast and tonal range even in poor lighting, a feat heretofore impossible.

The nano-grid performs these mechanical functions by moving the nano-filaments in an arc, like expandable windshield wipers. Though nano-grids are particularly useful in CMOS chips, they are also useful with CCDs. In fact, with the advent of nano-grids, CCD pixel size (and density in pixel-rows which will affect the overall sensor size) may be expanded and thus made substantially more versatile.

In a further embodiment of the present invention, multiple screens, or grids, would be placed over the digital sensor. The use of multiple nano-grids provides increased capacity to perform the function of closing off the pixel buckets and, in fact, to completely close off selected pixels to make the image effect completely dark. The combinations of nano-grids behave as multiple screens that move left and right to achieve the desired effect. Although there is a need to periodically calibrate the screens to effect their precise positions, this system will employ an electric charge to push the nano-filaments to the desired locations.

Nano-filaments move to block the space allowing photons to hit the pixel in order to limit the amount of light capacity available to the pixel. The complete darkening of the pixel will result in a total black color in the resulting image.

Exposure data feedback is provided to the digital sensor to effect the precise positioning of the nano-grid(s). In a further aspect of the present system, the camera's computer will anticipate the exposure data by statistically extrapolating from the pattern created by at least three data sets. A microprocessor (or ASIC) controlled nano-grid mechanism will use the feedback to anticipate specific nano-grid positions in order to optimize the exposure and corrective functions.

In one application of the nano-grid, the problem of vignetting in wide-angle lenses may be solved by activating nano-filaments in nano-grid(s) primarily in the corners to correct for the darkening from the limits of the optical aberrations, while still maintaining very low noise in a high ISO (low light) photographic situation. The use of the nano-grid would thus contribute to solving multiple problems.

Nano-grids will also be useful in accurately correcting for both color and exposure detail. In fact, with nano-grids, the capacity of digital sensors' range should be substantially increased, because the chips' pixel bucket sizes can be modulated. Therefore, not only will the lighting and color be accurate, but sharpness and optical aberrations will also be optimized, in ways not possible before.

(11) Integrated nano-grids in digital sensor

In a further embodiment of the system, nano-grids may be integrated into the digital sensor. In this form of the nano-grid, the nano-filaments are constructed *within* the pixel buckets in order to increase their accuracy and responsiveness. The nano-filaments mechanically move in various directions to perform the main operation of modulating light into their respective pixels. This method of organizing nano-grids and nano-filaments increases the rapidity of response to feedback. In effect, each pixel has a mask, or flexible lid, contained in it, which may open and close, to allow more or less light into the pixel bucket.

The integrated nano-filaments are activated by oscillation between positive and negative charges. In the context of a CMOS sensor, the transistor networks oscillate between positive and negative charges. This architecture allows a "push-pull" design of nano-filaments in which the negative charge "pulls" and the positive charge "pushes" the activation of the nano-filaments. This charge-enabled nano-grid (CENG) advantageously allows modulating gates (i.e., filaments) integrated into the pixel to reduce spaces between pixels, thereby allowing more pixels to be packed on the same surface area. The net benefit of the use of integrated CENG filaments is that specific sets of nano-filaments will produce specific effects on-demand and allow far more tonal detail than has been possible before.

In a further embodiment of the present system, sophisticated digital sensors may contain combinations of nano-grids that appear on top of the sensor as well as nano-grids that are integrated into the digital sensor. This combination will provide maximum latitude for processing the greatest effect available.

(12) Combinations of nano-grids and digital corrections applied to digital imaging system

Whereas it is possible to exclusively implement nano-grids to control the amount of light penetrating specific pixels, and it is possible to exclusively provide digital corrections as specified above regarding correcting optical or digital aberrations, a further embodiment of the present invention combines the two processes in order to optimize imaging.

Combining these two complex processes makes it possible to modify pixel capacity to maximize exposure latitude, to expand exposure modification and to apply digital correctives for optical and digital aberrations. Hence selective exposure far beyond the limits of present film or digital photography is made possible. The restrictions of film can thus be transcended by using

the present system, whereas use of a static and limited digital system would not be sufficient to facilitate these complex corrections.

The unique combinations of these processes also illustrate a complex system that provides feedback from both the environment and the photographer. The photographer may select preset exposure settings that will activate a range of options in both the nano-grids and the digital corrective system, while the lens aberration corrective system is automatically implemented. Once the camera detects specific conditions, such as a broad range of exposure latitude, from very bright to very dark, in the scene, it computes the precise number and location of nano-grids needed to modulate the pixels for optimum exposure with highlight and shadow detail and extreme sharpness, even in relatively low light. The dynamics of these multiple processes present trade-offs in selecting the best available set of selected modifications.

(13) Tri-well pixels

As indicated above, one of the key problems with current digital sensors involves dynamic range. There is a need to limit the scope of the space in the pixel well, into which light is captured, then converted into electrons. The challenge with current technologies is to balance details in shadow and highlight areas, particularly to acheive low noise at relatively high ISO speeds.

In addition to the concept of nano-grids, both in surface screen and integrated embodiments, as specified in (10) to (11) above, the present system introduces the notion of three side-by-side differentially-sized buckets within each pixel intended to optimize dynamic range for increased sensitivity. In the most common configuration, the three different-sized buckets are arranged with the largest bucket (in both width and height) in the center, with the second and third largest buckets on either side. The buckets are elliptical and concave in architecture to increase efficiency of fitting together in a round pixel structure. Their structures are semi-circular and elongated. The largest and tallest bucket will be tasked with maintaining the details in highlights, and the smallest will be tasked with maximizing the details in shadows, while the mid-sized bucket will be tasked with maintaining the middle range of exposure details. The pixel will have data from all three buckets available, but will select the data from one or more buckets depending on the exposure details.

The system is analogous to the high fidelity sound technology in speakers with crossovers, whose several frequencies are used by the tweeters, mid-range(s) and woofers; the

crossover point at which the frequency changes from one component to another can be modified based on the specific mechanics of each component.

In the case of the multiple buckets in a single pixel, the buckets are connected by filaments to a central grid which captures and stores the electrons. When the photographic scene displays increased light, image data from the larger buckets are selected to be recorded by the processor, while in cases of darkness and increased need for sensitivity, the smaller buckets are selected to be recorded; the mid-sized bucket is used in normal light situations of most cases. Further, this multi-aspect architecture can use pixels in varying positions on the sensor differently, particularly to facilitate processing far more dynamic range and to produce uniform tonal range in scenes that vary more than two or three stops. This novel multi-aspect model solves a number of key problems involving exposure dynamics in digital photography.

In another embodiment of the system, there may be more than three buckets in a pixel, so as to divide out the functions further and create even finer tonal continuity. In a further embodiment of the system, several pixels in a super-pixel allow red, green and blue colors to be segregated by each sub-pixel. This approach will be useful particularly in CCD semiconductors because of limits of this architecture, which require coupling circuitry between pixels to pass a charge between rows of pixels. In this case, outputs will vary between the micro-pixels to facilitate the differential processing required.

While cases of two side-by-side pixels might solve these exposure latitude problems, they represent an inadequate solution, much as a speaker with only two components limits the dynamic range output dramatically in contrast with a speaker with five components. This is similar to comparing a diode and a transistor.

(III) Digital System Improvements that Link Multiple Digital Corrections

(14) Auto pre-programmed modules for specific functions in digital imaging system

To process the functions specified in this integrated digital imaging system, it is necessary for automated pre-programmed modules to detect the specific lens type and the specific digital sensor(s) used to assess the appropriate corrections or alterations. The purpose of the pre-programmed modules is to access a preset library of (a) typical corrections of lenses, (b) typical scene types with appropriate exposure modes, (c) specific effects that may be selected and (d) specific sensor functions. It is important to match a particular lens to a particular sensor

type so that adjustments are calibrated to this pairing. The processing software is stored in either a microprocessor or an ASIC in order to process the images after they are captured by the sensor but before they are transferred to storage on a memory device.

In another embodiment, the system processes image corrections after the digital data is stored and constantly accesses the original stored data file in the production of a corrected file. This process allows for immediate data processing and storage which affords more time to accomplish specific corrective functions. There are thus cases when real-time correctives are neither necessary nor possible. Such increased processing capability may also facilitate a more complete corrective task.

In an additional embodiment, because similar correctives and effects may be provided to images that share the specific combination of lens and sensor, in order to accelerate the process of optimizing the images, batches of similar images may be processed together. This batch processing method may include the creation of duplicate images for each image captured, including a RAW image that contains no changes to the native image capture and a simultaneous auto-corrected image. The optimized image may be simultaneously compressed, to maximize storage capabilities, while the RAW image may be left uncompressed so as to maintain original detail.

(15) Apparatus and process for affecting pre-sensor optical and digital corrections in digital imaging system

Given the nature of light transmission, not all optical corrections are optimized by modification after the image is captured by the sensor. Though a range of important corrections and effects may be made after image capture, such as correction for optical or digital aberrations, there are several types of corrections that are required to be made before the light reaches the sensor. One example of this pre-sensor digital correction involves the use of a low-pass or anti-aliasing filter that resides in front of the digital sensor to minimize moiré and aliasing digital problems (although the use of this filter adversely affects image sharpness).

In the case of optical corrections, one class of filter that requires use before the digital sensor is the polarizing filter, because once light is captured on the digital sensor, the polarizing effect will not be available. Another type of correction that involves use of a filter or lens before the digital sensor is the close-up filter. This latter solution allows a lens's closest focusing plane to be closer to the front of a lens and has the effect of diminishing the rear plane of the depth of

field. The close-up filter may be optimized for use with floating rear-element group lenses which allow increasingly close focusing. In one embodiment of the system, specific pre-sensor optical filters may be used to provide polarization and close up corrections. The use of in-camera optical (circular) polarization would help standardize this valuable process and eliminate the need to maintain several external polarizer filters for each lens mount.

Since the present system entails an embodiment which uses nano-grids to perform specific exposure modifications before the light hits the digital sensor, it is possible to use these nano-grids for the applications of polarization and close-up filter. These filtration capabilities occur between the lens and the digital sensor.

In order to optimize the use of pre-sensor filtration, an image is initially tested and analyzed before the optimized corrections are activated and the pre-sensor changes are made. This process is analogous to the use of automated flash photography in which a feedback mechanism is provided; a scene is evaluated, and the initial flash data analyzed and modified to correspond to the correct exposure before a final flash is produced.

Because the camera system processes post-capture data, in order to optimize images for optical and digital problems, as well as continuously makes changes to pre-sensor filtration, multiple ASICs work in parallel to make the conversion of the image after capture. The use of parallel ASICs to perform specific correction processes solves the problem of capturing images and making post-capture corrections while simultaneously adapting the pre-sensor filtration system.

As an alternative embodiment of the system, a microprocessor (and software) may perform specific pre-sensor adjustments while the ASIC(s) performs specific corrective functions. In another embodiment, the ASIC(s) may perform the specific pre-sensor adjustments while a microprocessor (and software) will perform the specific corrective functions.

(16) Integrated digital imaging system for optical and digital corrections with feedback dynamics

Because the present system consists of, and uses, complex sub-systems, including an auto-focus mechanism, an auto-exposure mechanism, a shutter mechanism, an automatic flash mechanism, a digital sensor mechanism, a digital processing mechanism and a digital storage mechanism, it is possible to realize interaction dynamics that contain feedback. The interactive process of operating these sub-systems involves a learning progression. The image is analyzed,

solutions are tested and an optimal solution is selected and implemented, all in real time. By choosing a specific logic vector in a decision tree involving an initial variable, the process begins again with another key variable in real-time until the final image is captured and optimized.

In order to accomplish these complex processes, specific variables, such as aperture data, shutter speed data, lens data, digital sensor data and subject type are registered and analyzed by the camera. As environmental data changes, the camera mechanisms adapt to the environmental and the photographer's situation.

In order to accelerate these processes, the camera learns to anticipate the user's behaviors, the user's preferences and the subject's behaviors. By providing user-adjusted setting modifications for optical and digital corrections, the camera establishes a reference point for processing rapid image changes. In particular, the camera's software will analyze trends in the user's pattern of behaviors and preferences as well as pattern changes in the subject's behaviors. Anticipation processes are programmed into the autofocus and automated flash systems because of the extremely rapid reaction-time requirements of these specific mechanisms.

In one embodiment of the system, a method of processing a chain of rapid image captures is to employ computer-caching techniques in which a first image is processed in a normal way while later images are processed in an accelerated way. This is possible because the first image provides data to the system to analyze; these data then allow the system to anticipate further similar images and to use similar auto-focus and auto-exposure data. The optical and digital corrections are performed in a batch fashion by applying similar changes to near-identical image problems in order to dramatically accelerate the processing speed of a chain of images. This caching and anticipation approach is very useful in fast-paced action photography.

Another embodiment of the process of rapidly capturing a chain of images in sequence employs multi-threading techniques. Dividing the functions between specific subsystem ASICs allows multiple corrections to be performed in a parallel cascade for efficient task completion. One advantage of breaking down functions to specific processors is the acquired ability to start on one function and, while the system is in the process of completing a task, to begin other tasks. This process eliminates the lag between the specific subsystems.

(17) Adaptive user pattern learning with user-programmable functions in digital imaging system

In order to optimize its functions, the camera needs to learn about the user's preferences. When the user uses the camera, the camera evaluates the use patterns. Since the camera is programmed with a database of common user patterns, it can identify common uses and anticipate common uses of similar users by employing a "collaborative filtering" mechanism (i.e., if you like this camera setting, you should like this other setting because similar users who have liked the first setting have also liked the second setting). By anticipating common uses of each camera user, the camera optimizes its functions for each use and for each user. In effect, the camera's learning of user preferences is a sort of guided process of experimentation. Evolving algorithms learn about the user from actual use patterns.

One positive effect of this learning process of the camera about the user's patterns of behavior is that the filtration process becomes adaptive. The camera builds an initial map of the user's preferences from the user's actual selections. From the starting point of common types of personal selections, the camera uses standard templates of main types of uses that are fulfilled for each user's applications. For instance, if a photographer typically takes portraits with a traditional portrait lens, the camera will be aware of this and will activate filtration processes that are optimal for this type of portraiture photography, such as instilling limited depth of field on a subject and out-of-focus foreground and background. Contrarily, if landscape images are selected, depth of field will be increased substantially and the lens focused on either infinity or a medium point depending on the specific type of subject matter. The camera builds a model for each user based on the accumulation of experience.

In order for the camera to learn about the preferences of a specific user, the camera must adjust to each particular user, much as each individual identity must log onto a computer network privately.

Since the dynamics of the combined subsystems are complex, and adaptive, it is necessary that automated adjustments be interactive. Once detection of the lens type, the sensor type, the exposure settings, the user and the subject is made, optical and digital distortions are identified and specific combinations of corrections are applied both before and after the digital sensor in order to optimize the image. All of this is accomplished in less time than the blink of an eye.

(18) Software privacy function in digital imaging system

Because digital camera systems are able to use software and wireless mechanisms for their operation, it is possible to activate aspects of the camera remotely. Conversely, it is possible to disable operations of the camera remotely.

The present invention embodies a capability to externally disable the camera remotely in specific locations that require privacy, such as secret government areas (courthouses), private homes or businesses that are image-free zones. In these cases, a signal from an external source is provided to disable the shutter from firing. This black-out capability will allow external control of access to specific sites. As a condition of access, only a camera with this feature may be admitted to public buildings, so that even if the camera is permitted to operate, permission is only conditional. For instance, the owner of the building may allow the camera to function only in a specific set of rooms but not in others. Cameras without this feature may not be allowed in private spaces where control must be externally restricted.

This blocking feature will require the addition of specific blocking software, which may be automatically downloaded as one enters specific buildings. Similarly, in order to be granted permission to access the camera, or specific functions of the camera, the downloading of a "key" may be required.

Moreover, a further embodiment of the system may make it necessary to download software keys to get access to filtration capabilities in the camera in order to obtain optimum images. For example, the user may be required to pay a fee to download software in real time that will permit her to access a particular function in the camera to obtain a critical image. A spectrum of quality and complexity in filtration capabilities may be made obtainable for a range of fees on-demand. Therefore, the external downloading of software for the camera need not be limited to a black out function.

(IV) Dynamic Digital Imaging System Improvements that Apply to Zoom Lenses and Video Imaging

(19) Dynamics of zoom lens corrections in digital imaging system

Whereas the optical aberrations of prime (fixed focal length) lenses were discussed above, the modulation of optical aberrations of zoom lenses is another problem to consider. As a wholly different species of lens, zoom lenses have become extremely complex optical mechanisms consisting of multiple groups of lens elements. The general problem with zoom

lenses is the trade-off that must be made: To minimize the distortions of the widest possible focal length, distortions become maximized at the longest possible focal length, and vice-versa. Consequently, zoom lens architecture is inherently compromised on image quality. Over the years, lens designers have developed lens formulas that have dramatically improved image quality and that compete with typical prime lenses. As an example of this evolution in quality, the class of 70-200 f/2.8 35mm zoom lenses, now in their sixth generation, has supplied substantial improvements over earlier telephoto zooms. However, in general, zoom lenses have more aberrations than primes and thus require increased optical corrections. The need to solve the problem of zoom lens aberration correction is accentuated by their increased use in photography because of their simplicity and versatility.

The dynamics of the zooming process present specific difficulties for the purposes of correcting optical aberrations in digital imaging systems. With fixed-focal length lenses, the camera can detect the lens and provide an immediate consistent modification for a varying range of apertures. In the case of zooms, however, where the focal-length is not fixed, the adjustments must correlate to the changes in the focal length. In effect, this condition presents a continuous resampling process. When combined with changing scenes, the zooming process requires far faster responses to changing inputs by the camera system. This process resembles the tracking of a kaleidoscope's changing image structures as the wheel on the device is constantly turned.

In order to solve the problem of distortion at the wide-angle part of select zoom lenses, manufacturers have been using aspherical elements which are complex shapes that require special production techniques. On the other hand, in order to solve the problem of chromatic aberration in select telephoto lenses, manufacturers have used extra low dispersion glass elements, particularly at the front of the zoom lens. Since there are generally three main classes of zoom lenses – wide-angle to wide-angle, wide-angle to telephoto and telephoto to telephoto – aspherical elements have been used in wide-angle zoom lenses, while extra low dispersion glass has been used in the telephoto zoom lenses and both kinds of lens elements have been included in the wide-angle to telephoto zoom lenses.

The changing focal lengths of zoom lenses add a variable to the complex set of variables of the interacting sub-systems in the digital imaging system. The digital camera system must therefore track the movement of the changes in the focal lengths in zoom lenses and continuously make modifications to the varied optical aberrations in these types of lenses.

Unlike in fixed focal length lenses, the aberrations change at different focal lengths in zoom lenses, and the camera must track these changes.

The present system is designed to make the corrections to these changing aberrations in zoom lenses by noting the changed focal length at specific times of each lens. For a fixed focal length lens, the camera refers to a database of information to provide information to correct specific types of aberrations; for a zoom lens, the camera's database contains multiplex information for each focal length in each respective zoom lens type. This is as if each zoom lens contains a combination of multiple lenses of specific focal lengths. When the zoom is moved to a new focal position, the camera reads the lens as a specific focal length and makes corrections to aberrations based on this specific setting. Although the camera reads the zoom lens at a specific moment in time and adjusts the necessary modifications to correct for aberrations at that specific focal length at that time, overall the zoom lens requires the camera to rapidly make these adjustments.

Since zoom lenses employ dynamic processes of change, it is possible to track a moving subject in real-time by changing focal length from a stationary vantage. These changed focal length positions are tracked by the auto-focus system, but also by the auto-exposure system in the camera. The present system thus allows for zoom tracking in order to anticipate the direction of zoom lens changes, much as the focus on the moving subject involves focus tracking mechanisms. These systems use fuzzy logic and evolutionary algorithms to anticipate the movement of the subject and thus of the focal length change of zoom lens. In this way it is possible to accelerate the lens aberration correction process using zoom lenses.

Because the zoom lenses typically increase aberrations precisely because of the lens design compromises, these types of lenses are ideally suited to the present digital imaging system. The present system allows the zoom lens to be used at high quality without needing to stop down the aperture, thereby resulting in superior photographic opportunities.

(20) Dynamic changes in video corrections of digital imaging system

While the zoom lens presents the need to provide a dynamic solution to the process of making corrections to optical aberrations, video photography provides another case of a process that requires dynamic solutions. The same principles that apply to still photography apply to video; auto-focus variability, aperture and depth-of-field variability aspects, shutter speed variability aspects, differences in lens focal length and artificial lighting variability suggest that

video be viewed as merely a very rapid (30 to 60 frames per second) application of still photography. Nonetheless, video presents new classes of dynamic problems, most notably regarding the matter of tracking changing subjects in real time.

The process of shifting subject positions, even if the camera is stationary, presents a change of multiple variables that require the automated subsystems (auto-focus, auto-exposure, auto-flash, etc.) to be integrated. Feedback is presented by subjects in the external environment with changing focus and exposure variables. In these cases, even with a modulating shutter speed, the three main variables of change are a zoom lens to continuously change the focal length, auto-focus to track a subject and aperture modifications to continuously change depth-of-field.

The unique dynamics of these complex sub-systems presents particular challenges for a digital imaging system to produce rapid results with the use of advanced ASICs and microprocessors. By incorporating techniques that track objects with advanced auto-focus mechanisms, anticipate zoom lens changes and predict optimal exposures as well as make automatic corrections to both optical and digital aberrations in real time, the present system continuously optimizes the video imaging process.

(21) "Stationary-scene object-motion" caching process, with application to video, in digital imaging system

Because video imaging processes employ full motion activity, particularly of subjects in the environment, tracking a subject in a video system is problematic. Once a subject is identified and selected, the subject is automatically tracked with auto-focus and auto-exposure mechanisms by a zoom lens apparatus. There is a particular need to identify and track a subject within a broad stationary scene.

The present system accomplishes this task by using anticipatory object-trajectory tracking. The parts of the stationary scene that are not being tracked are cached. In other words, precisely because the background of the scene is stationary, this part of the scene is not tracked for focus or exposure. On the other hand, the object in motion is identified and tracked by subtracting the extraneous data of the stationary scene. Multiple objects are tracked by comparing data about these combinations of objects and their relations and determining the appropriate exposure and focus settings.

While Monte Carlo processes use random settings to self-organize an initial map, which are useful as a baseline for the purpose of anticipating tracking data sets, the present system subtracts the known information about the specific object(s) being tracked from the stationary background in the environment. In other words, the background data is "blanked out" in a caching process while the main subject(s) are tracked. By so using these techniques, the camera system can efficiently calculate the modifications needed to optimize the video scene.

In a further embodiment of the system, a chip-set is enabled in video display devices (i.e., video monitors) to implement select corrections for optical and digital distortions. The user may modify settings for automating the process of achieving optimum video images.

(V) Digital Image Networking

(22) Network coordination of fixed sensor grid to track multiple objects in digital video imaging system

While the previous discussion has focused on employing a single camera to capture images, the present system is also useful for networking sensors in a sensor grid in order to track multiple objects. Specifically, the present system may be used in surveillance and reconnaissance situations to track objects over time. Using a grid of image sensors with overlapping range parameters makes it possible to organize a complex network of sensors for surveillance activities.

After selecting specific objects to track, the system follows the objects as they move from location to location, appropriately modulating the focus, the lens focal length, the ISO and the exposure settings. As the subject moves from one section of a grid to another, the sensors are coordinated to "hand off" the object to other sensors on the grid, much like a cellular phone network hands off calls between cells.

In another embodiment of the present system, the cameras in the network may be mobile instead of stationary in a fixed sensor grid. In this case, self-organizing aspects of the mobile sensor grid track mobile objects in real time. One application of this complex system, which draws on earlier work in collective robotics, is in cinematography, which requires multiple transportable perspectives of mobile subjects. The complex dynamics of a mobile sensor network provides complex feedback in this manifestation of the present system.

(23) Automatic wireless off-porting of back-up images to external data bank

Because the present system uses digital files, it is possible to move these files to an external site for storage. The present system has capabilities to off-port images to an external data bank automatically. This feature is valuable in order to preserve on-board storage capability.

Whether implemented in a local area network (LAN) or a wide area network (WAN), by using a built-in wireless router, the present digital imaging system may be set to send data files directly and automatically to hard-drive storage either in a device in the same room or uploaded to the Internet for storage around the world. This capability is critical for managing massive files of large sensor data sets and preserving valuable in-camera storage space. When automatically sending data files to a nearby computer, the computer may act as a data-port relay to automatically resend the images to an Internet site for storage. The system will maintain the option of keeping some images in the camera and sending duplicate copies of digital files of images to another site for storage as a backup. This automatic back-up process provides insurance for the photographer.

In another embodiment of the system, just as image files are off-loaded to external storage, software files are periodically downloaded to the camera in order to update the camera settings and the database system. For example, as the camera manufacturer provides new lenses for the camera, it becomes necessary to load new updated settings to accommodate corrections for the new lenses. Similarly, as the camera requires new software updates with improved algorithms to further optimize the corrective functions of both the optical and digital mechanisms, the camera will automatically accept these. This feature is particularly important to both manufacturer and user because the ability to update software capability periodically will protect a user from needing to upgrade major hardware such as with a lens replacement.

(24) Image organization system

The present digital imaging system does not merely allow for the storage of image data files on external storage. Because of the problems of protecting storage and the need to make multiple back-ups in the digital sphere, it is also necessary to store digital image files in multiple database locations. The images are organized in a main database by various criteria, such as time, location, subject-type, etc., and then rerouted to various locations around the world for safe storage. While specific sets of images may be stored together, the need to identify the locations is less important than the need to have control of the main database list which identifies the

locations.

In order to maintain security, the digital imaging files may periodically be rotated randomly between locations. Only the main database list, which is constantly updated, maintains information on their location. In fact, specific digital bits of a single image may be maintained at different locations in order to maintain further security. Thus, on many computers around the world bits of each image may be stored, and continuously rotated, with constantly updated registries maintaining their complex hybrid whereabouts. These rotation storage functions are performed by a randomizer logic engine.

In a further embodiment of the present system, once the digital files are off-loaded from the camera system to external storage, specific images may be automatically identified and further specific corrections automatically provided.

In yet another embodiment of the system, the images that are off-loaded from the camera to the external storage system are organized according to various criteria, such as accuracy of focus or exposure or quality of image type, in order to be automatically prioritized. The camera, with the assistance of an initial setting of user priorities, will automatically order new images with a higher or lower priority relative to other images and camera settings. Thus, at the end of a day, the images may be displayed in an order preferred by the user. Lesser images will be automatically routed to a lower position as they do not meet specific criteria, and better images will be routed to a relatively higher position in the organization of files. This feature of automatically assisting in the organization of the digital image files is a very useful one which will save photographers time.

(25) Wireless digital image system automatically generating prints from image capture

The present digital imaging system not only automatically off-loads digital image files to remote locations for storage; the system also will allow one to photograph an image (or sequence of images) in one location (i.e., Paris) and instantly print it in another location (i.e., Los Angeles) for publication in real time. In addition, an image may be captured by the camera and instantly uploaded to a pre-programmed Web site for publication by using wireless technologies. In addition, it is possible to automatically print the digital image file anywhere in the world virtually the moment the image is taken. This system makes this instantaneity particularly possible precisely because the image corrections are automated in-camera. Since there is no

need in most cases to further edit the image files, they are thus generally ready for immediate release.

Description of the Drawings

Fig. 1 is a schematic drawing of a digital imaging system.

Fig. 2 is a flow chart of an analog to digital signal process.

Fig. 3 is an image of the vignetting corrective filter in an optical lens.

Fig. 4 is a list of wide angle 35mm lens types.

Fig. 5 is a flow chart of the digital corrective process.

Fig. 6 is a schematic diagram of different types of optical aberrations in different configurations of the same lens.

Fig. 7 is a flow chart of the process of digital image capture, processing and storage.

Fig. 8 is a flow chart illustrating the process of selecting filtration settings.

Fig. 9 is a pair of diagrams showing the varied depth of field optimization at different apertures.

Fig. 10 is a flow chart showing exposure optimization using digital correction in camera.

Fig. 11 is a flow chart illustrating the use of in-camera special effects filtration.

Fig. 12 is a flow chart showing the selective in-camera filtration of specific objects.

Fig. 13 is a flow chart describing the exposure adjustment of an image using in-camera filtration.

Fig. 14 is a flow chart showing the process of in-camera special effects filtration.

Fig. 15 is a flow chart showing the process of in-camera digital correction for sensor dust.

Fig. 16 is a diagram showing a digital camera with an ASIC array.

Fig. 17 is a diagram illustrating a digital camera with interchangeable CCD and CMOS sensors.

Fig. 18 is a diagram of a digital camera with a nano-grid before the sensor.

Fig. 19 is a diagram of a nano-grid.

Fig. 20 is a diagram showing the feedback loop connecting the processor and the nano-grid.

Fig. 21 is a diagram illustrating the tri-pixel architecture in a digital sensor.

Fig. 22 is a flow chart showing the pre-programmed modules for in-camera functionality.

Fig. 23 is a diagram showing the pre-sensor modification process in a digital camera.

Fig. 24 is a flow chart showing the integration of optical and digital corrections with feedback.

Fig. 25 is a flow chart showing the interactive feedback mechanism of integrated corrections.

Fig. 26 is a flow chart describing the adaptive user pattern learning process to process images.

Fig. 27 is a flow chart describing the feedback process in filtering images.

Fig. 28 is a flow chart showing software privacy function in a digital imaging system.

Fig. 29 is a flow chart showing the dynamics of zoom lens corrections in digital imaging.

Fig. 30 is a diagram illustrating object tracking in dynamic changes in video corrections.

Fig. 31 is a flow chart showing objecting tracking of a digital imaging system.

Fig. 32 is a flow chart showing the caching process of an object in motion in a stationary scene.

Fig. 33 is a diagram showing network coordination of fixed sensor grid tracking multiple objects.

Fig. 34 is a diagram showing the wireless communication features of the digital imaging system.

Fig. 35 is a flow chart showing an image organization system.

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Detailed Description of the Drawings

Fig. 1 illustrates the overall structure of the system. Object data (100) in the domain of objects being photographed by the camera constantly change. In some cases, the lighting changes, while in other cases, the positions of the objects change. At 120 the flash will artificially light the objects. Flashes may be either on the camera or remote from the camera. A camera sensor (130) will detect external data changes. An optical lens (110) feeds analogue imaging data to the digital sensor(s) (175 and 180). In some cases, a mirror (170) will swivel in order to directly input imaging data to the digital sensor after the shutter (150) is fired. In some cases, a filter (160) stands between the lens and the digital sensor(s). A digital signal processor (DSP) (195) is connected to at least one sensor (A or B). A database (190) is connected to at least one sensor (A or B) as well. The digital sensors are connected to an ASIC (195) and/or a microprocessor (193) in order to process the image and control the camera. The digital image data is passed from the digital sensor to either the ASIC or microprocessor and then stored in memory (197). The presence or absence of specific elements of this mechanism is not required for the correct functioning of this system. Consequently, a number of the drawings contained herein will focus only on specific sub-assemblies of the overall digital imaging system mechanism.

The present invention is intended to operate with a spectrum of camera types. These camera categories include digital still cameras without a mirror mechanism or without an optical interface. The present system applies to cameras with single lens reflex mechanisms. In addition, the present system applies to video cameras, both with or without mirror mechanisms, including camcorders. Finally, many of the functions disclosed in the present system are integrated into specific imaging sensors. The system applies to image sensors that are integrated with complex system functions, including those described herein, with "system on a chip" (SoC) capabilities in a single microelectronic integrated circuit. The invention also applies to networks of sensors, networks of cameras or integrated networks of both sensors and cameras.

Fig. 2 describes digital image signal processing. After an analog signal (200) is captured, it is converted to a digital signal by an analog-to-digital converter (210). The signal is then forwarded to the digital signal processor (220) and filtered (230). The digital signal is then stored in memory (240).

In fig. 3, the correction to the optical vignetting problem is shown. In vignetting, the lens (300) makes the edges of the image significantly darker as the light falls off, a phenomenon particularly prominent on wide angle lenses. As represented here, the concentric circles of filtration correction are darker in the middle (310) of the image in order to counteract the vignetting effect. The overall image aperture is reduced from one half to two stops in order to compensate for the maximum light fall off depending on the amount of vignetting effect from each lens type.

Fig. 4 shows a list of several different wide angle lenses in a database. In the 35mm domain, the 14mm (400), 20mm (410), 24mm (420), 28mm (430) and 35mm (440) lenses, each with f/2.8 apertures are listed in the database. Each lens type presents a distinct formulation involving different sets of optical data that require different aberration corrections.

The digital corrective process is described in fig. 5. After a specific lens type is identified (500) and a database is referenced (510), the lens type is matched with the specific optical aberrations (520). The digital filter then applies a correction to specific optical aberrations (530). As an example, the vignetting effect is corrected by gradually darkening the center of the image in concentric rings (540).

Fig. 6 shows the database configuration of several different types of 24mm f/2.8 lenses (600 to 630) with different optical configurations. Each lens type has a different set of manifestations of optical aberrations including vignetting (640), spherical aberration (650), pin cushion distortion (660), barrel distortion (670) and comatic aberration (680). For each lens, there will be a unique combination of optical aberrations compared to each lens type from different optical configurations. The database is accessed to provide the multi-objective optimization solution for correcting several different optical aberrations for each specific lens formula.

In fig. 7, after a camera captures an image (700) and uses a digital sensor to create a digital file (710), the digital file is forwarded to the digital signal processor semiconductor (720). The DSP applies the filtration (730) to correct the optical aberrations from the lenses. The revised digital file is then sent to storage (740).

Digital filtration is performed by employing the DSP hardware as well as specific software in order to attain specific aberration corrections. In an optical filter, which typically sits at the front of a lens and performs a single function of modifying the optical characteristics of the

lens, the electronic filter will process the image after it is converted from an analogue representation to a digital signal. Common digital filters include a low pass filter or anti-aliasing filter. In most cases digital imaging filtration is a discrete time application and is processed in a time-signal sequence.

One example of a digital filtration process is a fast Fourier transform (FFT). The digital signal is modified by applying an algorithm to extract the frequency spectrum. The original function is then reconstructed by an inverse transformation of the original signal. The signal can be manipulated to perform various conversions. This process is used to sharpen or soften an image. For instance, by differentiating the frequency spectrum, the high frequency can be emphasized by limiting the low frequency, as in a high pass filter. Digital filtration is typically performed by the DSP after the image is captured and before the image file is stored. However, in the present system, there is some filtration before the digital sensor that captures the image as well as some filtration processing after the sensor sends the file to the DSP.

In order to accelerate the filtration process, the digital file will be broken into parts, with each part processed simultaneously. Filtering a one-dimensional image will treat data from each column of a digital sensor separately. When the data is treated like a two dimensional image, the data file may be treated with different techniques. For instance, different quadrants of the image may be analyzed and filtered separately. In addition, the highlights and the shadows in the varied frequency range may be analyzed and filtered separately as well. Similarly, a two dimensional image file may be analyzed by starting in a corner and working in each contiguous quadrant in a circular (clockwise or counterclockwise) order. Further, the filtration process may begin in the corners and work inwards or begin in the center of the image and work outwards. For instance, in wide angle lens filtration to correct optical aberrations, the outer edges will be the most prominent distortions that will require the most corrections; therefore, the filtration process will work by starting on the corners first.

The present invention also addresses the multi-functional corrections in an image by applying multiple simultaneous techniques. This is done either by performing a sequential filtration process or a simultaneous filtration process. In either case, the image is re-filtered to make more than one pass in order to correct different types of aberrations.

Different types of aberrations require different types of filtration. In the case of pin cushion distortion and barrel distortion, which are inverse appearing aberrations, the filtration

process will adjust the edges of affected digital files captured with wide-angle lenses. The optimized images will be accessed by the database and compared to the actual image files. The filtration will be applied to each image file to closely correct the distortions bit by bit. In effect, the corrected digital images will be reverse engineered to discover the unique distortions as they establish a pattern by comparing the input digital images and the database of optimized images. The digital image correction will be applied once the aberration is assessed.

Each lens provides data to the camera microprocessor and DSP about its unique characteristics. The lens is pre-programmed with aberration data pertaining to that lens type and even to each particular lens (ascertained through a testing process). The lens then provides this specific data to the camera for processing of optical aberrations. In one additional embodiment, the lens will also contain software to correct its aberrations that will also be sent to the camera processors in order to be applied to specific digital file filtration. As information and techniques are made available, new software to ascertain and correct each lens's unique optical aberrations will be forwarded to the camera and stored in the lens, thereby providing an upgrade path to continuously improve the optical qualities of lenses by employing a sort of after-manufacture digital correction.

Fig. 8 shows the process of selecting filtration settings. After the user selects the specific filtration settings (800), the user marks the specific filtration setting and accepts the setting (810). The user may continue to select multiple settings. When the user has selected all preferences (820) and accepts the settings the user returns to the main menu.

In Fig. 9 varied depth of field optimization at different apertures is described. In the first drawing, the object (930) has a depth of field (940) that has a broad range of clarity around the object. The camera (900) evaluates the distance data (920) and the object to establish an optimal depth of field range between f/8 and f/11. In the second drawing, the object (980) has a narrower depth of field range (990) based on distance data (970) and object data from the camera (950) to determine an optimal depth of field range between f/2.8 and f/5.6. The camera's automatic alteration of the aperture to narrow the depth of field is based on a range of factors, including the focus on the object, the object's motion, the distance to the camera, shutter speed constraints and the light on the object. Modulating aperture automatically in the camera provides a blurring of the background and the foreground so that the object can stand out without distraction.

Exposure optimization using digital correction is shown in fig. 10. After the camera assesses an object's distance from the camera (1000) and identifies the optimal aperture of the image to maximize the dynamic range (1010), the aperture is either increased (1020) or decreased (1030) and the correction applied (1040).

In-camera special effects filtration is illustrated in fig. 11. Once the image exposure is assessed by using the camera exposure meter (1100), the camera corrects the image by either underexposing the image by one third stops to one stop if the image is overexposed (1110) or overexposing the image by one third stops to one stop if the image is underexposed (1120). The camera finally takes a picture and stores the image (1130).

Fig. 12 shows the selective in-camera filtration of specific objects. After the camera identifies specific objects (1200), the camera assesses distance to the objects (1210). This is done by sending out an infrared light signal, bouncing it off the object, and measuring the distance data from the camera to the object. The camera isolates the objects on a one-dimensional Euclidian plane (1220) and then selects the optimum aperture to isolate objects and to blur the background and foreground (1230). The camera tracks the motion of objects (1240) and activates a digital sensor (1250) thereby capturing the image. The image data is sent to a post-sensor processor (1260) where the camera applies specific filtration only to the designated objects (1265) and stores the file in memory (1270). Alternatively, the camera will apply specific filtration only to the background (not to the objects) (1275) and then stores the file in memory (1280). The effect of only applying filtration to an object or to its background is to isolate the subject. The type and degree of special effects, which are selected by user-adjustable in-camera software, will be determined by the user's palate of filtration choices.

Image exposure adjustment using in-camera filtration is described in fig. 13. Once the camera assesses a two stop difference in parts of the image (1300), the camera's microprocessor accesses the database of similar scenes (1310) and then selects the optimal metering for the image and the user activates the digital sensor (1320), capturing an image. The camera provides the filtration to part of the image by adjusting the exposure in the processor (1330) and then stores the image (1340). In scenes such as sky on top, a neutral density filter is often required to remove the two stop difference between the bright top of the image and the darker bottom of the image. By reducing the brightness at the top, the exposure is evened out. By using the present system, this process is accomplished in the camera.

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In-camera special effects filtration is described in fig. 14. After a user selects a special effects filtration technique (1400), the camera assesses image meta-data (1410), analyzes image data (1420) and the user captures the image (1430). The camera's post-capture processor applies special effects filtration technique to part of the image (1440) and the camera stores the image in memory (1450).

Digital correction for sensor dust is described in fig. 15. The pattern of dust on the pixels of a digital sensor (1500) is assessed. The specific pixels that are obscured by the dust are identified (1510) and a map is built of a digital sensor pixel frame by comparing information from at least two image samples to identify obscured pixels (1520) and the camera takes an image (1530). Information from pixels that are adjacent to dust-affected pixels are used to interpolate data on affected pixels (1540) and image data is processed and stored in memory (1550).

Fig. 16 shows an ASIC array in a digital imaging system. Once the digital sensor (1620) captures an image, the digital file is sent to multiple application specific integrated circuits (1630, 1640, 1650 and 1660) for processing of several digital signals simultaneously. In one embodiment of the invention, each ASIC corrects a single optical aberration. In another embodiment, the ASICs will divide the digital file and perform specific functions on parts of the image file and reunite the file before storing the completed image in memory (1670).

In fig. 17, the camera is illustrated with multiple interchangeable digital sensors. The CCD (1720) is shown in the forward position capturing the digital image in this drawing. However, the CMOS (1730) digital imaging sensor may swivel around (1740) to replace the position of the CCD in order to be used to capture the image. The image is then processed (1750) and stored in memory (1760). The advantages of interchanging the digital sensors are to have the opportunity to benefit from the strengths of each sensor type without sacrificing the weaknesses of either. In some cases, the scene will be optimized for the exposure range of a CMOS digital sensor, while at other times, the scene will be optimized for the detail of the CCD.

In fig. 18, the nano-grid (1820) appears in front of the digital sensor (1830). The lens will send analog image data to the sensor through the nano-grid. Once the digital data from the sensor is processed (1840) it is sent to memory (1850). Fig. 19 shows a nano-grid (1900). Nanofilaments are shown at 1920. The modulation effects of the nanofilaments are shown at 1910. Nanofilaments will change their position in order to allow more or less light through the

system. Nano-grids fit before, or in some cases, adjacent to and on top of the digital sensor. Nano-grids behave as adjustable screens and may be used to polarize light between the lens and the digital sensor. Nano-grids are activated by electrical charge pulses sent to nanofilaments.

In fig. 20, the feedback loop connecting the processor and the nano-grid is shown. Analog optical data passes through the nano-grid (2020) to the digital sensor (2030) to the processor (DSP) (2040). A feedback loop (2050) is created by analyzing the data at the processor and modulating the performance of the nano-grid. For example, the image may be very bright initially, but the DSP will require that the image needs to be darker in order to be properly exposed. In this case, it will activate the nano-grid to modulate its grid structure in order to darken the image so as to let less light through the filaments by adjusting the filament structure. Once properly exposed, the camera will capture a digital image and send the file to memory (2060) for storage.

In fig. 21, a tri-pixel architecture is described. The large (deeper) oval bucket in the center (2110) will capture highlight exposure, the medium sized oval bucket at the right (2120) will capture a normal exposure range and the small (shallower) oval bucket at the left (2130) will capture the shadow exposure range. These three separate wells are contained within each pixel. In most cases, a pixel well is like a bucket, capturing light data and passing the data sets to the digital processor. By splitting the exposure range into three distinct wells within each pixel, the data is more accurately captured and organized in order to accommodate the broader range of exposure data. This system will be able to increase the range of digital imaging up to four stops, from the typical two stops. By maximizing the range of exposure data, the image collection will display more tonal range that is more associated with films' broader exposure range.

Fig. 22 shows the pre-programmed module for in-camera functionality. After the camera detects the lens type and the sensor type (2200), the camera focuses on an object (2210) and the processor accesses the library of scene and filter types (2220). The user pre-selects specific in-camera modifications (2230) and activates the camera to capture an image (2240). The processor makes filtration adjustments after the sensor takes the image (2250) and the image file is stored (2260) in memory.

Much like the nano-grid that is present before the digital image sensor, the pre-sensor modification to an image is shown in fig. 23. An optical filter (2320) such as a polarizer filter is shown in a position between the lens and the digital sensor (2340). The image is captured and

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the optical filter is activated by the processor (2350), which determines whether to activate the filter after analyzing a particular scene. Other filtration (2330), such as the use of the nano-grid, is also interchangeable with the optical filter in a position before the digital sensor. In another embodiment of the present invention, the filter assembly is sequential, with both, or multiple, filters being activated in order so as to obtain the maximum filtration effect. The DSP will compute the optimal combination of filtration resources based on the available resources in the camera. In another embodiment, the optical filter assembly will fit out of the line of sight between the lens and the digital sensor and will be activated by the DSP on-demand to swing into the optical image path much like a mirror mechanism.

Fig. 24 shows the integration of optical and digital corrections with feedback. Once the camera meters a scene (2400), the camera auto-focuses and obtains distance data to the object (2410), analyzes the lens data, the aperture data and the shutter speed data and accesses the library of images (2420). The camera assesses the optical aberrations (2430), activates the digital filters to correct aberrations (2440) and takes the picture (2450). The camera analyzes the image and optimizes the image using the processor (2460). This is performed by comparing the image data to the library of images and assessing the needed filtration required to optimize the image. The image is then stored in memory (2470).

The interactive feedback mechanism of integrated correction is described in fig. 25. After an analysis of the initial image (2500), the identification of optical aberrations (2510) is made. The camera's database is accessed to retrieve the corrections (2520) and the interactive feedback mechanism is activated (2530). Corrections to filters are applied before the sensor captures the next image (2540). In addition, correction to the image signal via the DSP is made after the sensor data is captured (2550) and the image is stored in memory (2560).

The adaptive user pattern learning process is shown as images are processed in fig. 26. A batch of images (2600, 2610, 2620 and 2630) is shown. The first image is processed (2640) and data from image 1 is analyzed and metadata is mapped (2650). Image 2 is then analyzed and its metadata is compared to the image 1 metadata (2660). Similar metadata in images 1 and 2 programmed in the processor (2670) and image 2 is rapidly processed by using similar metadata from image 1 (2680). Images 3 and 4 are analyzed and their metadata are compared to image 1 and rapidly processed (2690).

In fig. 27, the feedback process of filtering images is shown. After the camera analyzes the user behaviors, user preferences and subject behaviors (2700), the camera's processor analyzes trends in the pattern of user behavior and preferences and creates a map (2710). The camera's processor anticipates the user behavior and subject behavior (2720) by applying evolutionary computation and fuzzy logic algorithms. The camera's processor then applies a collaborative filtering process to a new image (2730) and the user takes and optimizes the image (2740).

Fig. 28 shows a software privacy function in a digital imaging system. The camera automatically downloads software as it enters a building or specified area (2800). The camera's features are deactivated in specific locations by the software (2810) while allowing the camera to perform specific camera functions by accessing software keys (2820). The camera then performs specific functions (2830) that are available in the restricted area while other specific functions are disabled (2850).

In fig. 29, the dynamics of zoom lens corrections are described. After a lens detects a zoom lens type (2900), the camera detects a particular focal length setting of the zoom lens (2910) and accesses a data library in the database to modify aberrations to optimize the zoom lens at a specific focal setting (2920). The camera applies a correction to a lens setting (2930) and continuously tracks the lens changes in the lens focal length (2940). The camera then applies the changed corrections to the changed focal lengths in the zoom lens (2950) and analyzes patterns of the user and subject behaviors (2960). Using fuzzy logic and evolutionary computation, the camera anticipates behaviors and rapidly optimizes image corrections by applying digital filtration (2970).

Fig. 30 shows object tracking in the dynamic changes of video corrections. An object moves from position 1 (3010) to position 6 (3060) in sequence. The camera (3000) is stationary, yet it records the object's motion as it is moving within the field of vision.

In fig. 31, object tracking is described. Once the camera tracks an object with auto-focus mechanisms and supplies distance information (3100), it tracks the user's zoom lens use patterns, anticipates the focal length changes (3110) and, using evolutionary computation and fuzzy logic algorithms, predicts optimal exposures (3120) and captures images in real time, continuously tracking the object (3130).

Fig. 32 shows the caching process of a moving object in a stationary scene. After the main objects are tracked by the camera (3200), the background of a stationary scene is cached in the camera (3210). The camera subtracts the data about objects from the background of the scene (3220). The background scene is then "blanked out" and cached in memory (3230) and the main objects are optimized by applying digital filters.

Fig. 33 describes the network coordination of a fixed sensor grid tracking multiple objects. The object in motion is represented in positions A through D (3370, 3380, 3390 and 3395). The fixed sensors are at positions 1-6 (3300, 3310, 3320, 3330, 3340 and 3350). The image data is fed remotely into the central imager (3360). The sensors track the object by taking image data at each fixed sensor position in the network. As the object moves through the field of the network, each sensor records the object.

In fig. 34, wireless communication features of the digital imaging system are described. The camera (3400) sends digital image data files wirelessly to a computer (3410). Files are also uploaded from the camera to the Internet in accessible locations (3450), while software files are downloaded from the Internet to the camera, both automatically and through manual intervention. Files are automatically downloaded if the user sets the camera to receive automated software updates. One advantage of loading files automatically to the Internet is that the images are then automatically published (3460) at a remote location, or locations, for viewing.

Fig. 35 describes an image organization system. After images are captured by the camera (3500), the image files are organized according to metadata in an external computer database (3510). The image files are then sorted by category and sent to the database of a distributed network (3520) for off-site storage.

Reference to the remaining portions of the specification, including the drawings and claims, will realize other features and advantages of the present invention. Further features and advantages of the present invention, as well as the structure and operation of various embodiments of the present invention, are described in detail below with respect to accompanying drawings.

It is understood that the examples and embodiments described herein are for illustrative purposes only and that various modifications or changes in light thereof will be suggested to

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persons skilled in the art and are to be included within the spirit and purview of this application and scope of the appended claims. All publications, patents, and patent applications cited herein are hereby incorporated by reference for all purposes in their entirety.

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WHAT IS CLAIMED IS:

1. A digital imaging system for correcting optical image aberrations comprising:

A digital camera mechanism, an optical lens mechanism, a digital sensor, a microprocessor, an application specific integrated circuit, a digital signal processor, system software, a database management system and a memory storage sub-system;

wherein the optical lens mechanism is a fixed focal length;

wherein the aberrations from the optical lens mechanism are corrected by applying digital filtration by using the application specific integrated circuit and digital signal processor;

wherein a microprocessor is used to provide digital and optical data to the digital signal processor;

wherein the system software is organized to identify specific optical aberrations and to access the database to identify specific corrections to the aberrations;

wherein the system software forwards the data file from the digital sensor to the digital signal processor;

wherein the digital signal processor selects a specific procedure to optimize the image and corrects the aberrations and;

wherein the modified digital file consisting of the digital data optimized from the aberrations that are corrected from the original optical image is stored in memory.

2. The system of claim 1 wherein:

the optical aberrations are spherical.

3. The system of claim 1 wherein:

the optical aberrations are comatic.

4. The system of claim 1 wherein:

the optical aberrations are lens distortion.

5. The system of claim 1 wherein:

the optical aberrations are curvature of field.

6. The system of claim 1 wherein:

the optical aberrations are chromatic.

7. The system of claim 1 wherein:

the optical aberrations are scattered light.

8. The system of claim 1 wherein:

the optical aberrations are flare.

9. A digital imaging system for correcting optical image aberrations comprising:

A digital camera mechanism, an optical lens mechanism, a digital sensor, a microprocessor, a digital signal processor, an application specific integrated circuit, system software, a database management system and a memory storage sub-system;

wherein the optical lens mechanism is a fixed focal length;

wherein image depth-of-field is optimized by forwarding the digital file from the digital sensor to the microprocessor;

wherein system software accesses a database to determine the optimal aperture by comparing the distance data to similar images in the database;

wherein a microprocessor is used to provide digital image data to the digital signal processor;

wherein the digital signal processor optimizes the digital file aperture setting by comparing it to the database data;

wherein the microprocessor adjusts the camera's aperture setting;

wherein the digital sensor captures the image and the application specific integrated circuit forwards the image data file to the digital signal processor to make modifications to the digital file and;

wherein the digital file is stored in memory.

10. The system of claim 9 wherein:

the subject's depth of field is narrowed by a preset user setting; and

the aperture information is modulated to accommodate the narrower depth of field.

11. The system of claim 9 wherein:

the subject's depth of field is widened by a preset user setting; and

the aperture information is modulated to accommodate the wider depth of field.

12. A digital imaging system for correcting digital image aberrations comprising:

A digital camera mechanism, an optical lens mechanism, a digital sensor, a microprocessor, a nano-grid mechanism, a digital signal processor, system software and a memory storage sub-system;

wherein the nano-grid mechanism is between the optical lens mechanism and the digital sensor;

wherein the nano-grid mechanism is comprised of an array of nano-filaments;

wherein the nano-grid mechanism receives an electrical signal from the microprocessor and modifies its filament structure by modulating the filaments;

wherein the nano-grid mechanism performs a function to provide filtration to the image before the digital sensor captures the image;

wherein the image is captured by the digital sensor and the digital image file forwarded to the digital signal processor and;

wherein the digital file is stored in memory.

13. The system of claim 12 wherein:

the nano-filaments are selectively switched at different pixel sites; and

the modified architecture optimizes the effective operation by manipulating the position of the nano-grid mechanism.

14. The system of claim 12 wherein:

the nano-grid mechanism modulates the image after the image information is analyzed by the microprocessor;

the microprocessor activates a function in the nano-filaments to change physical position;

the nano-grid mechanism modulates the image settings;

the optical data is forwarded to the digital sensor.

15. The system of claim 1 comprising:

wherein the digital sensor contains a tri-pixel configuration;

wherein three differentiated sub-pixels in each pixel in which one of the sub-pixels is in the center of the pixel and is the largest and deepest of the sub-pixels;

wherein the other two sub-pixels are smaller than the center sub-pixel and are on the sides of the center sub-pixel;

wherein the sub-pixels forward image data to the filament on each row and;

wherein each row forwards the image data to the digital signal processor.

DIGITAL IMAGING SYSTEM FOR CORRECTING IMAGE ABERRATIONS

ABSTRACT OF THE DISCLOSURE

A system is disclosed for the automated correction of optical and digital aberrations in a digital imaging system. The system includes (a) digital filters, (b) hardware modifications and (c) digital system corrections. The system solves numerous problems in still and video photography that are presented in the digital imaging environment.

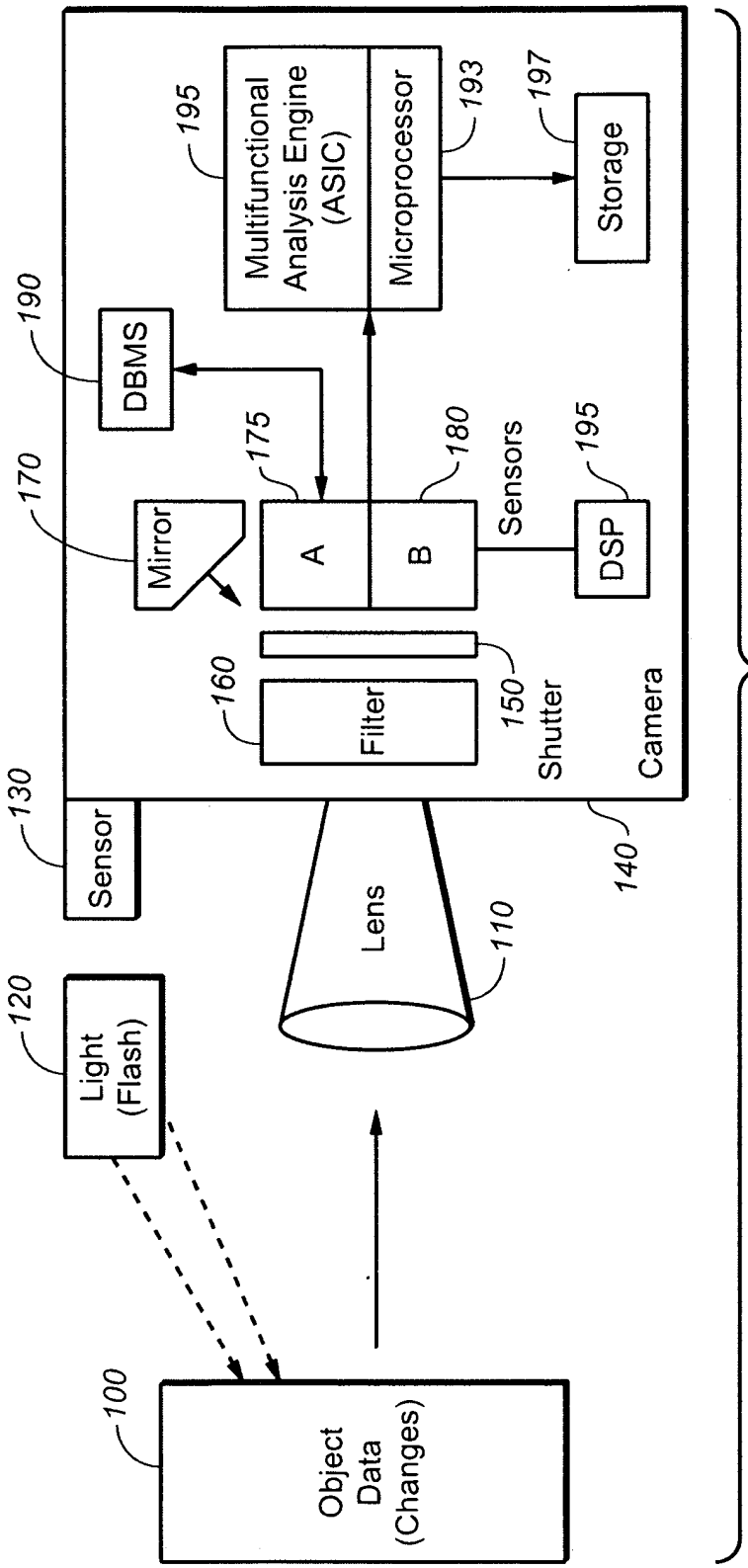
Object Data (Changes)
100
Light (Flash)
120
Sensor
130
Lens
110
Filter
160
Mirror
170
DBMS
190
Multifunctional Analysis Engine (ASIC)
195
Microprocessor
193
Storage
197
A
175
B
180
Sensors
DSP
195
Shutter
150
Camera
140

FIG. 1

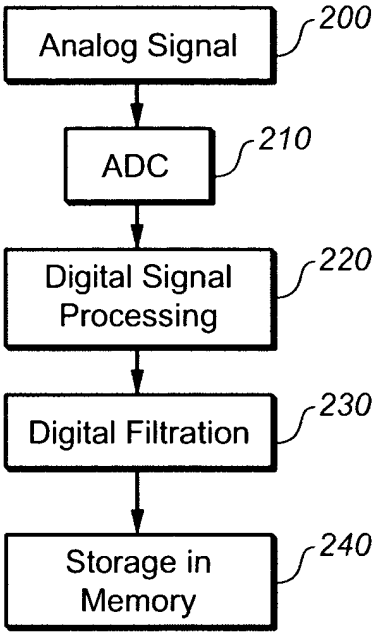

FIG. 2

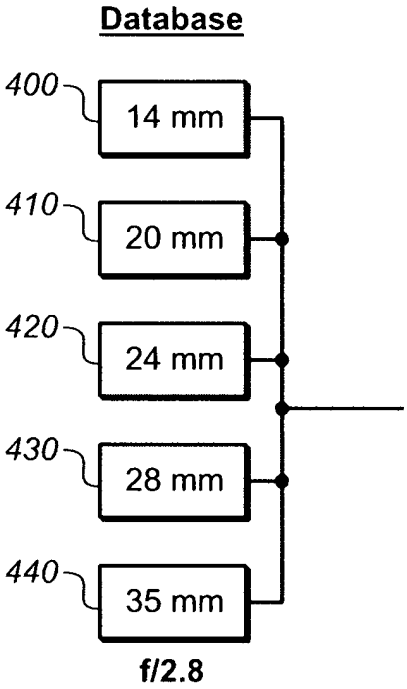

FIG. 4

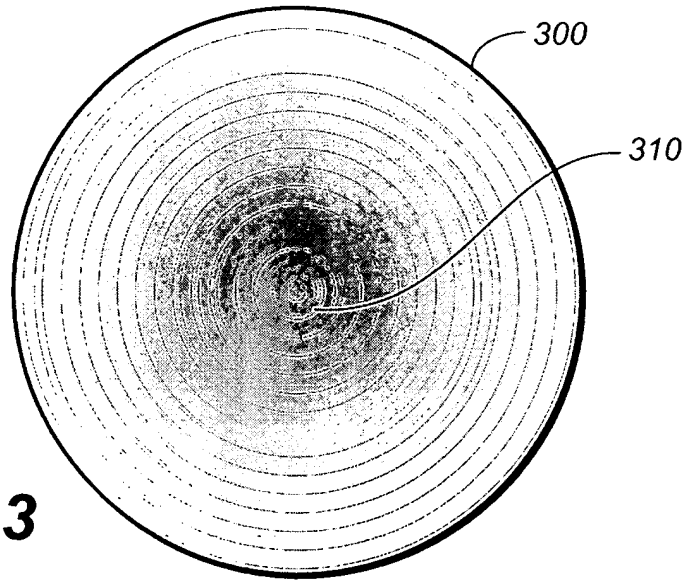

FIG. 3

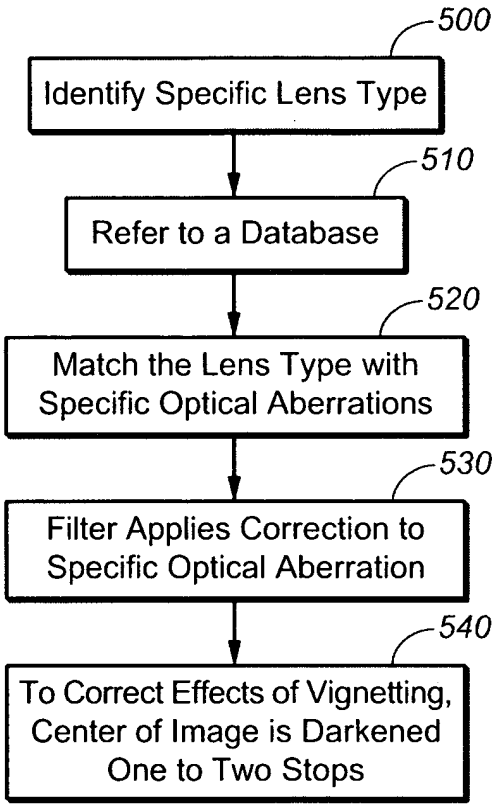

FIG. 5

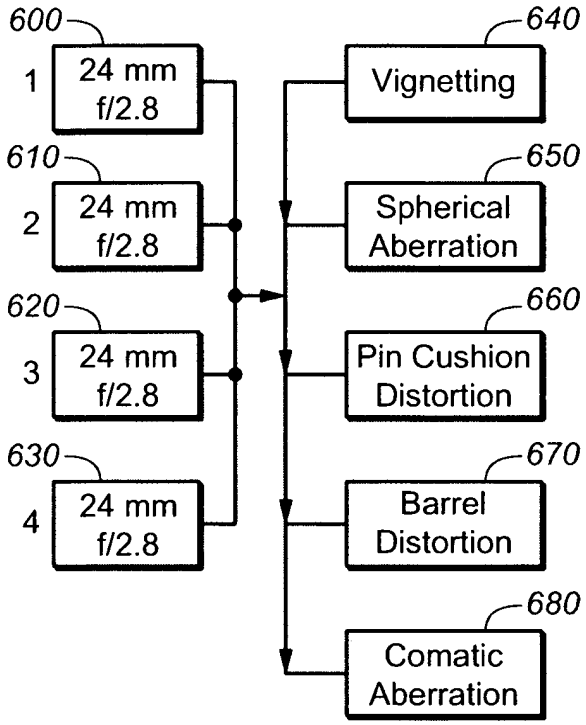

FIG. 6

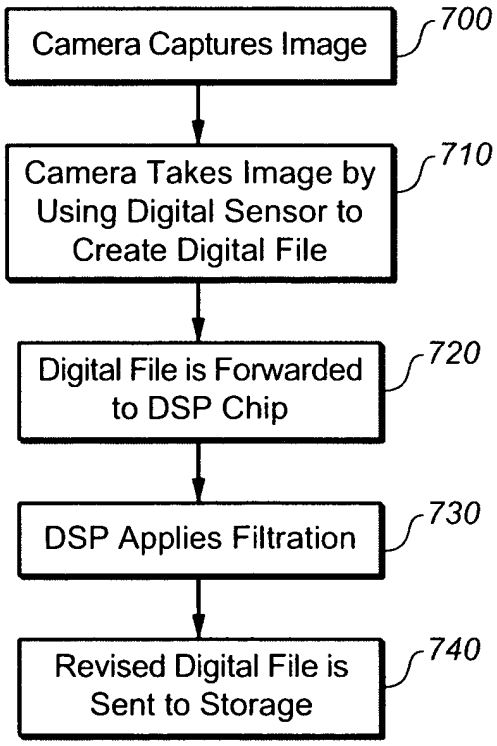

FIG. 7

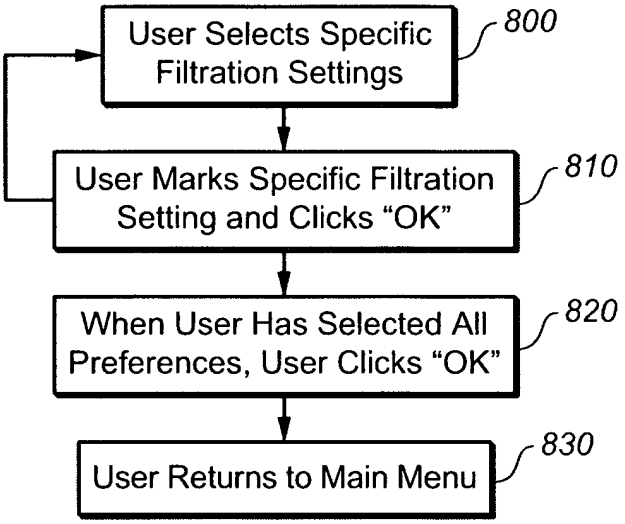
User Selects Specific Filtration Settings
800
User Marks Specific Filtration Setting and Clicks "OK"
810
When User Has Selected All Preferences, User Clicks "OK"
820
User Returns to Main Menu
830

FIG. 8

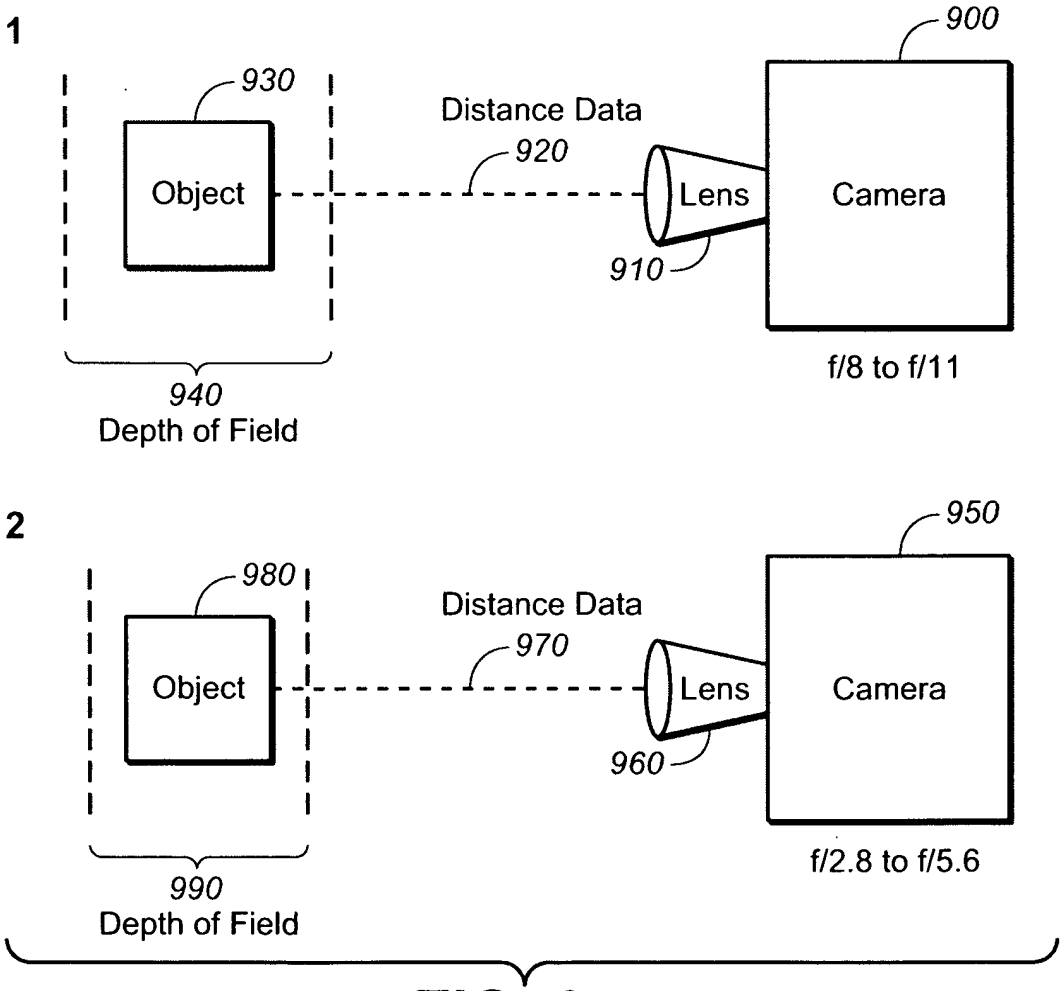
1
900
930
Distance Data
920
Object
Lens
Camera
910
f/8 to f/11
940
Depth of Field
2
950
980
Distance Data
970
Object
Lens
Camera
960
f/2.8 to f/5.6
990
Depth of Field

FIG. 9

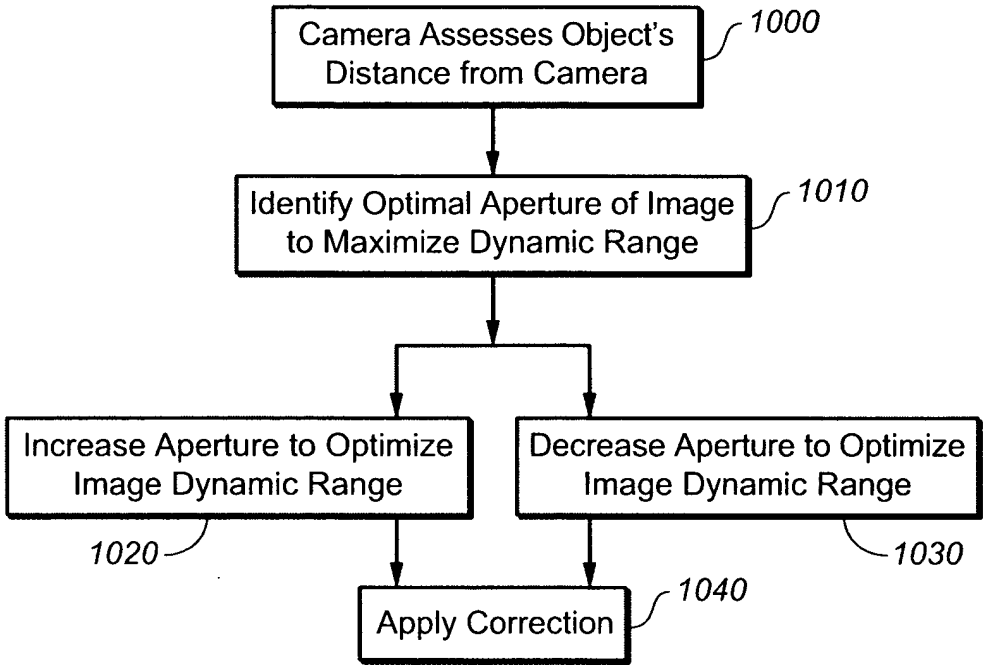
Camera Assesses Object's Distance from Camera
1000
Identify Optimal Aperture of Image to Maximize Dynamic Range
1010
Increase Aperture to Optimize Image Dynamic Range
Decrease Aperture to Optimize Image Dynamic Range
1020
1030
Apply Correction
1040

FIG. 10

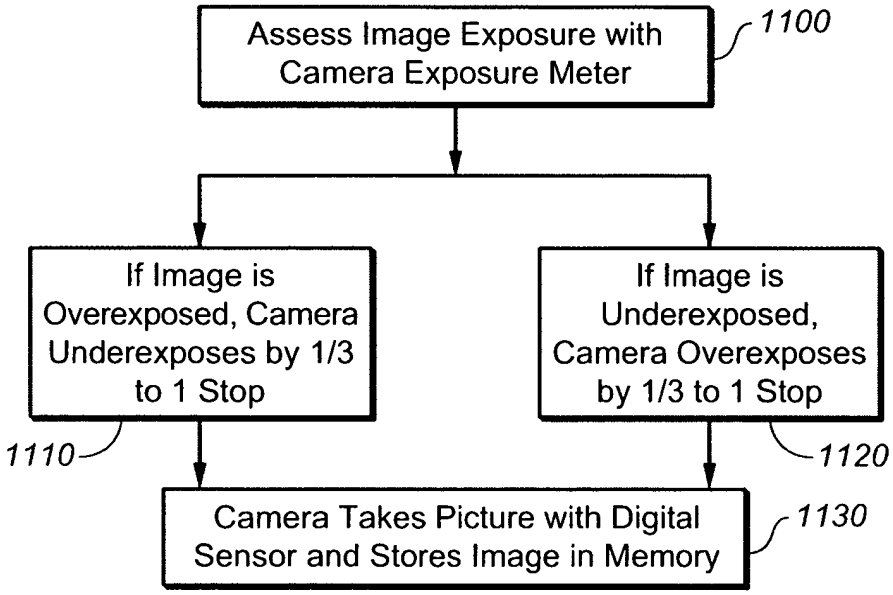
Assess Image Exposure with Camera Exposure Meter
1100
If Image is Overexposed, Camera Underexposes by 1/3 to 1 Stop
If Image is Underexposed, Camera Overexposes by 1/3 to 1 Stop
1110
1120
Camera Takes Picture with Digital Sensor and Stores Image in Memory
1130

FIG. 11

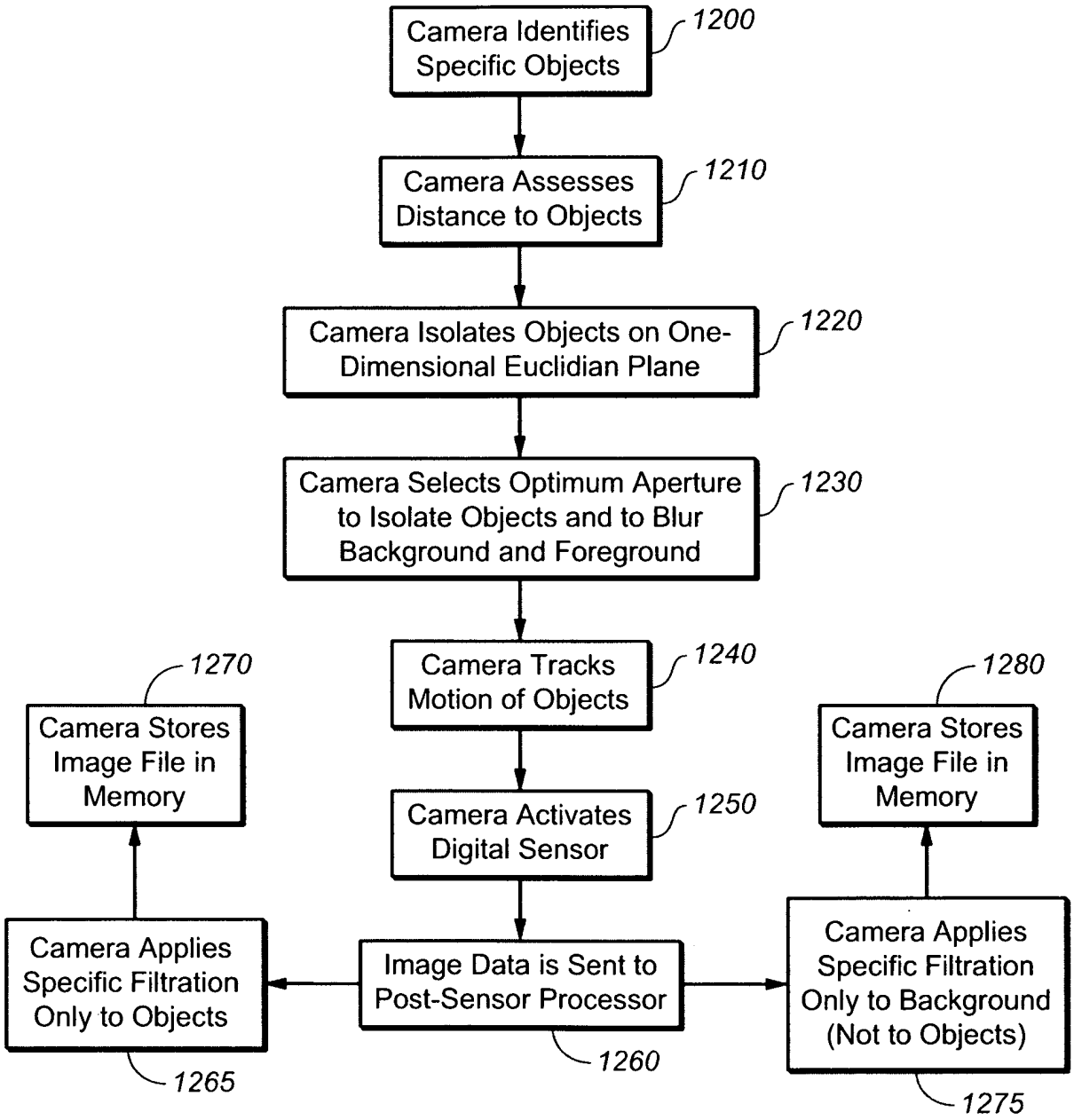
Camera Identifies Specific Objects
1200
Camera Assesses Distance to Objects
1210
Camera Isolates Objects on One-Dimensional Euclidian Plane
1220
Camera Selects Optimum Aperture to Isolate Objects and to Blur Background and Foreground
1230
Camera Tracks Motion of Objects
1240
Camera Activates Digital Sensor
1250
Image Data is Sent to Post-Sensor Processor
1260
Camera Applies Specific Filtration Only to Objects
1265
Camera Stores Image File in Memory
1270
Camera Applies Specific Filtration Only to Background (Not to Objects)
1275
Camera Stores Image File in Memory
1280

FIG. 12

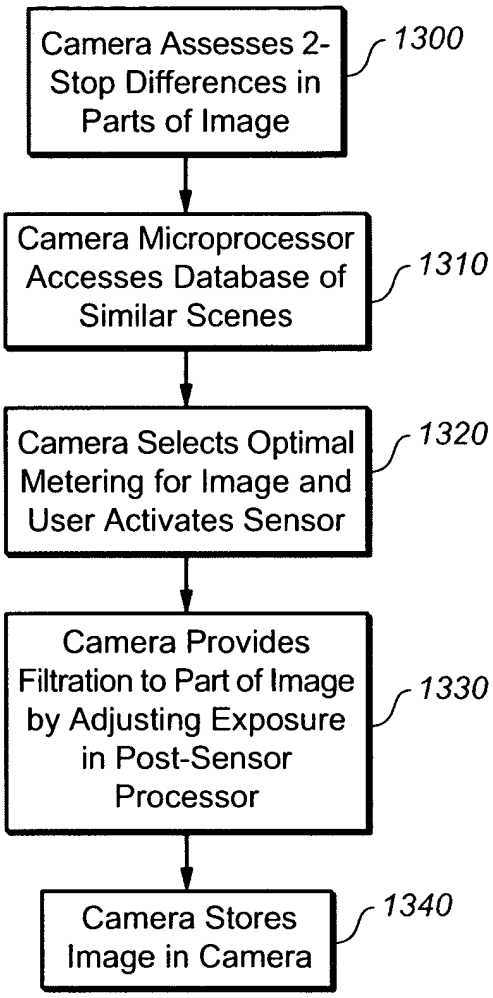
Camera Assesses 2-Stop Differences in Parts of Image
1300
Camera Microprocessor Accesses Database of Similar Scenes
1310
Camera Selects Optimal Metering for Image and User Activates Sensor
1320
Camera Provides Filtration to Part of Image by Adjusting Exposure in Post-Sensor Processor
1330
Camera Stores Image in Camera
1340

FIG. 13

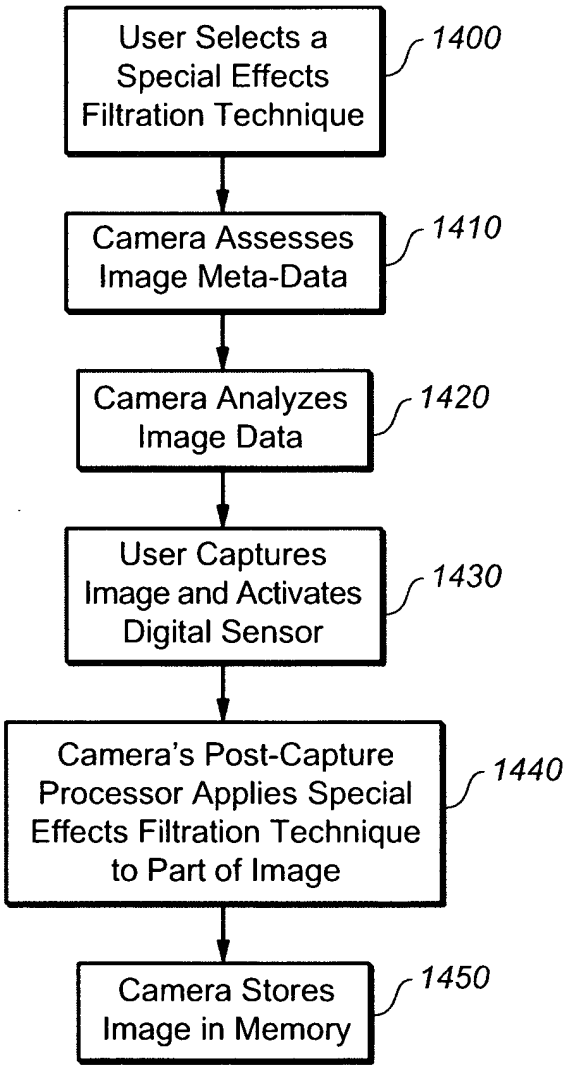
User Selects a Special Effects Filtration Technique
1400
Camera Assesses Image Meta-Data
1410
Camera Analyzes Image Data
1420
User Captures Image and Activates Digital Sensor
1430
Camera's Post-Capture Processor Applies Special Effects Filtration Technique to Part of Image
1440
Camera Stores Image in Memory
1450

FIG. 14

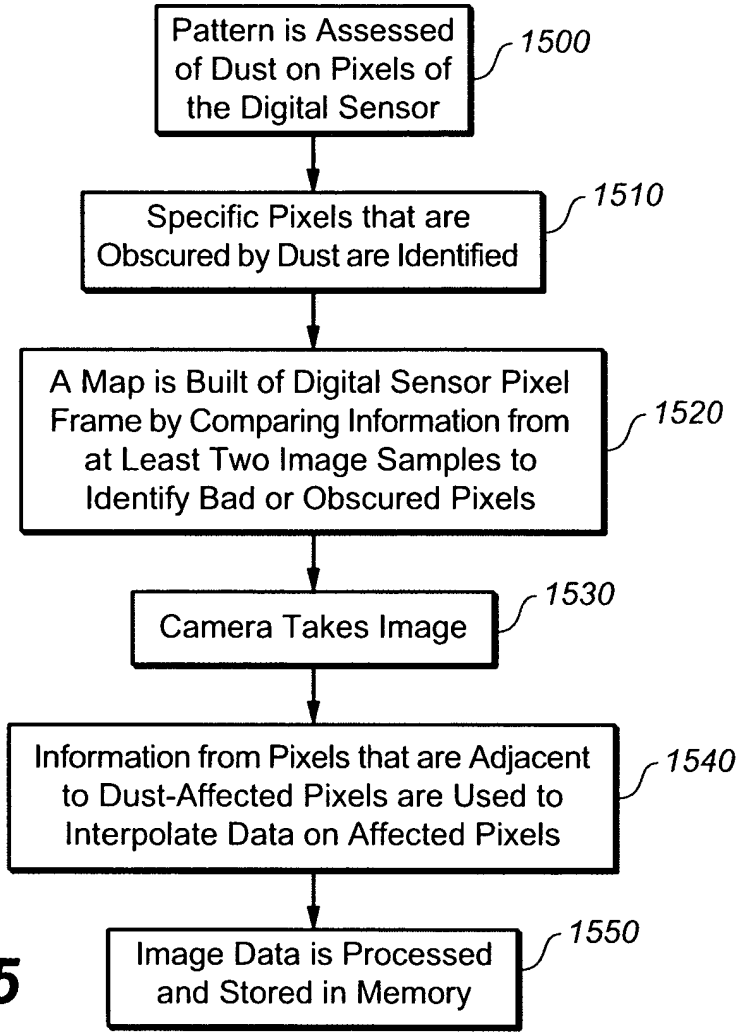
Pattern is Assessed of Dust on Pixels of the Digital Sensor
1500
Specific Pixels that are Obscured by Dust are Identified
1510
A Map is Built of Digital Sensor Pixel Frame by Comparing Information from at Least Two Image Samples to Identify Bad or Obscured Pixels
1520
Camera Takes Image
1530
Information from Pixels that are Adjacent to Dust-Affected Pixels are Used to Interpolate Data on Affected Pixels
1540
Image Data is Processed and Stored in Memory
1550

FIG. 15

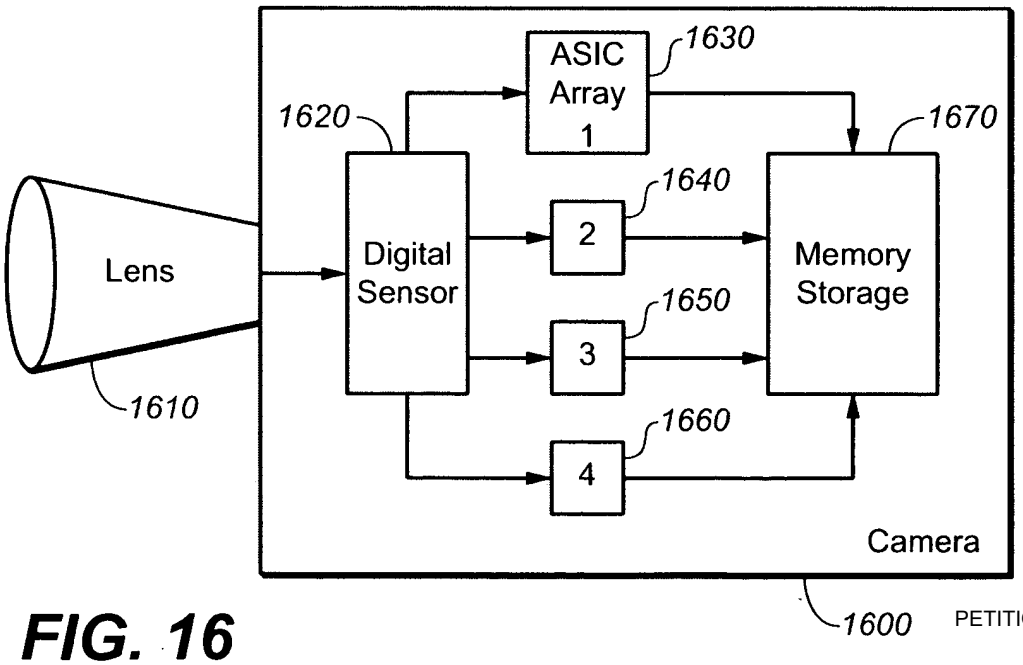
ASIC Array 1
1630
1620
1670
Lens
Digital Sensor
2
1640
3
1650
4
1660
Memory Storage
1610
Camera
1600

FIG. 16

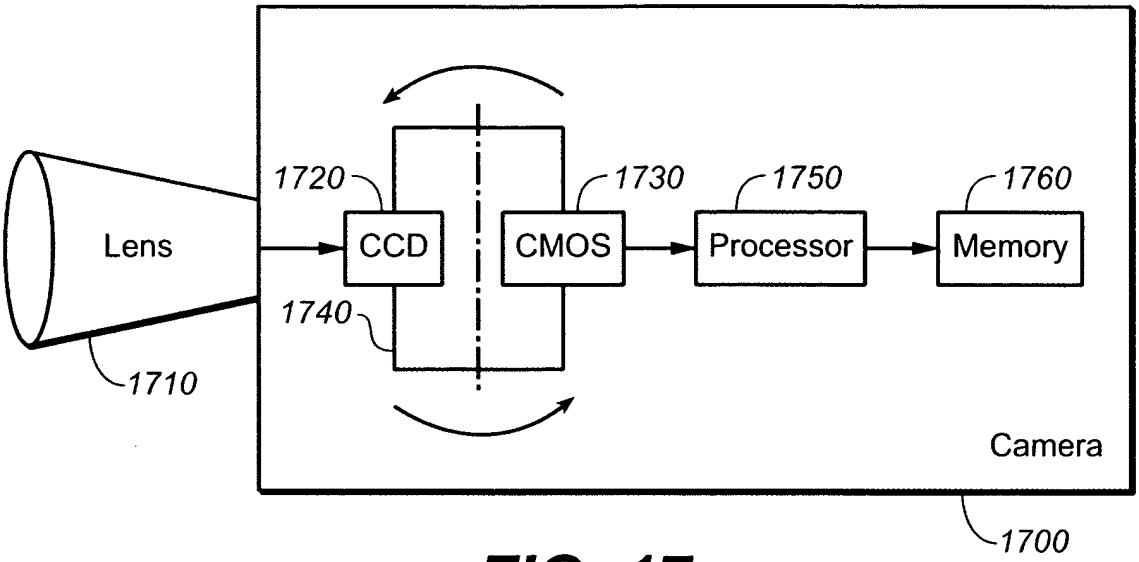
1720
1730
1750
1760
Lens
CCD
CMOS
Processor
Memory
1740
1710
Camera
1700

FIG. 17

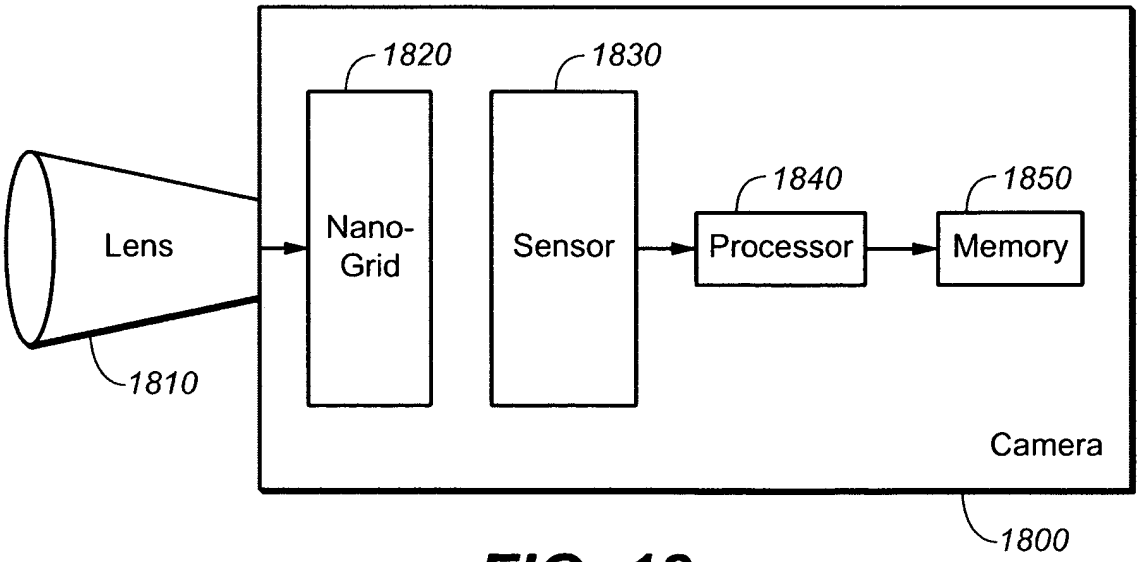
1820
1830
1840
1850
Lens
Nano-
Grid
Sensor
Processor
Memory
1810
Camera
1800

FIG. 18

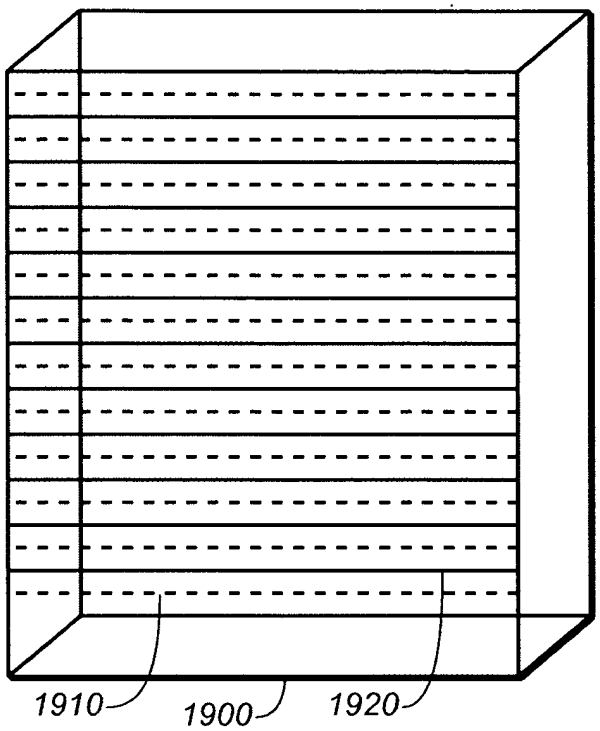
1910
1900
1920

FIG. 19

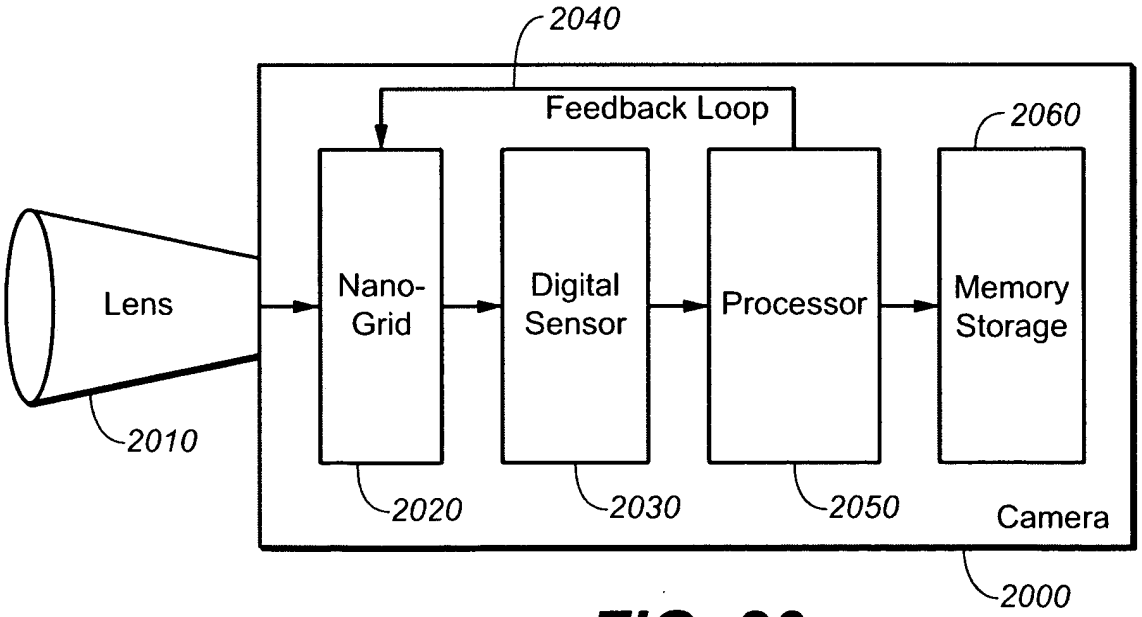
2040
Feedback Loop
2060
Lens
Nano-Grid
Digital Sensor
Processor
Memory Storage
2010
2020
2030
2050
Camera
2000

FIG. 20

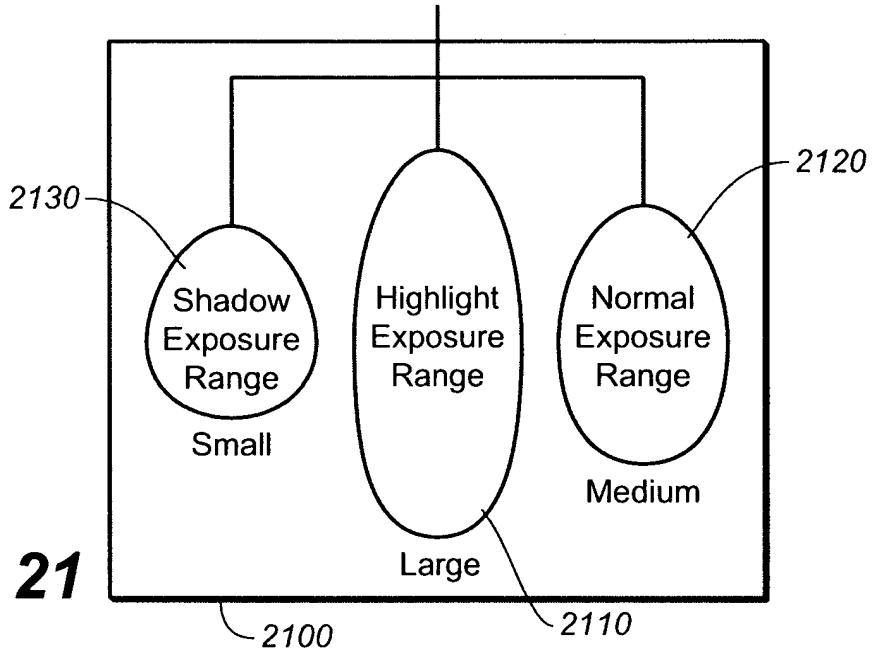
2130
2120
Shadow Exposure Range
Small
Highlight Exposure Range
Large
Normal Exposure Range
Medium
2100
2110

FIG. 21

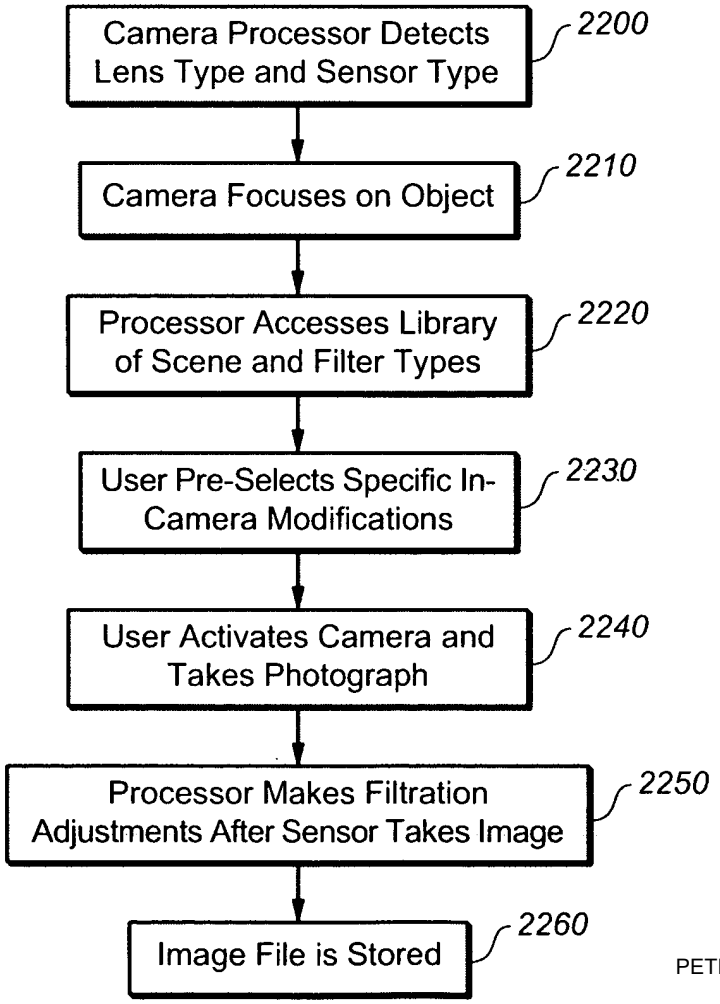
Camera Processor Detects Lens Type and Sensor Type
2200
Camera Focuses on Object
2210
Processor Accesses Library of Scene and Filter Types
2220
User Pre-Selects Specific In-Camera Modifications
2230
User Activates Camera and Takes Photograph
2240
Processor Makes Filtration Adjustments After Sensor Takes Image
2250
Image File is Stored
2260

FIG. 22

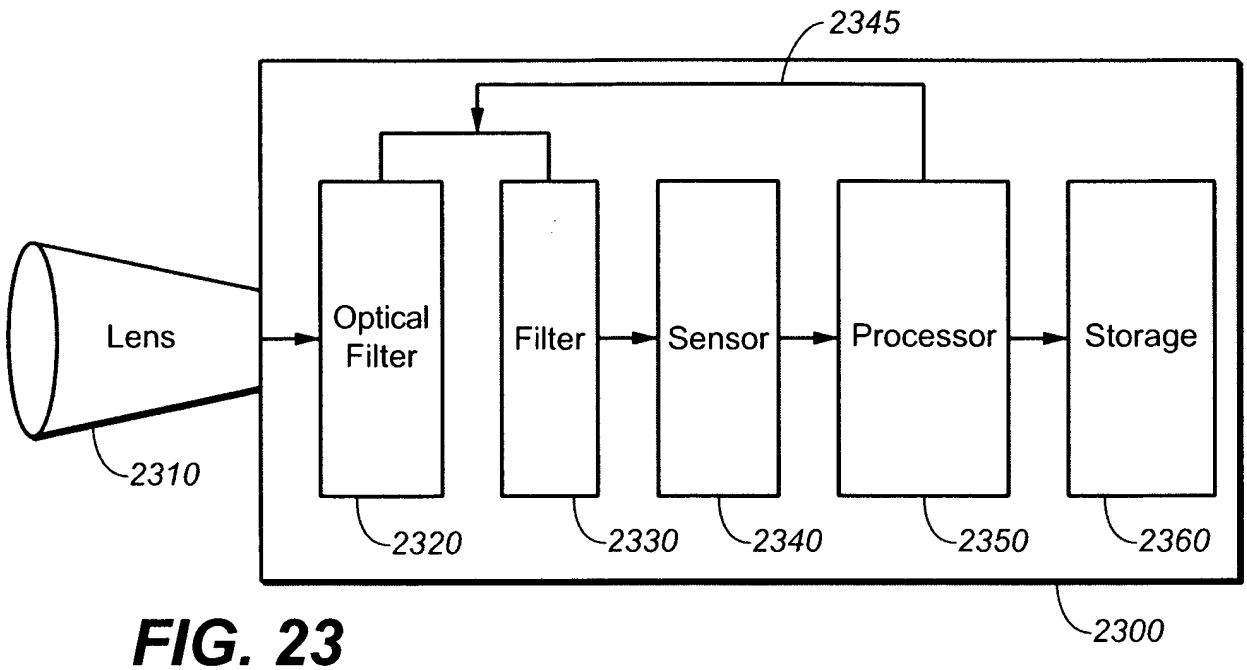
2345
Lens
Optical Filter
Filter
Sensor
Processor
Storage
2310
2320
2330
2340
2350
2360
2300

FIG. 23

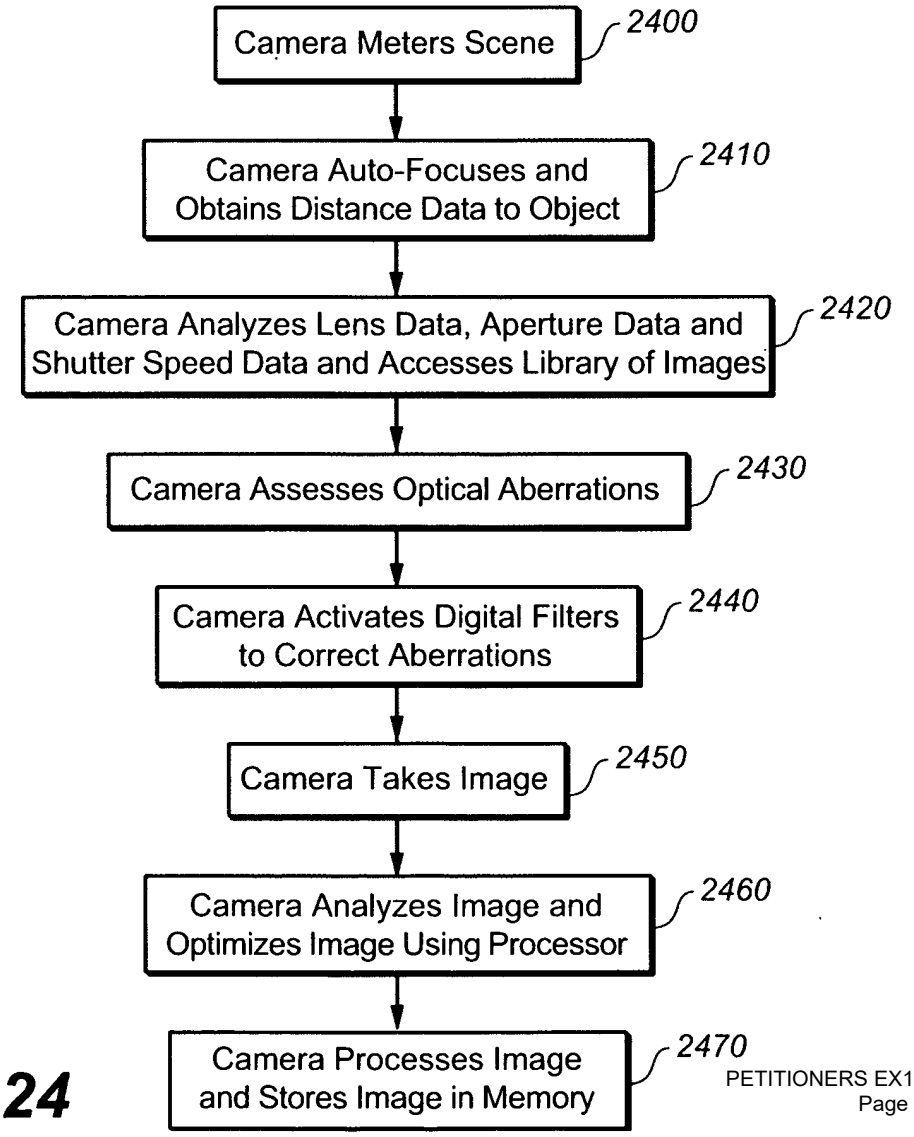
Camera Meters Scene
2400
Camera Auto-Focuses and Obtains Distance Data to Object
2410
Camera Analyzes Lens Data, Aperture Data and Shutter Speed Data and Accesses Library of Images
2420
Camera Assesses Optical Aberrations
2430
Camera Activates Digital Filters to Correct Aberrations
2440
Camera Takes Image
2450
Camera Analyzes Image and Optimizes Image Using Processor
2460
Camera Processes Image and Stores Image in Memory
2470

FIG. 24

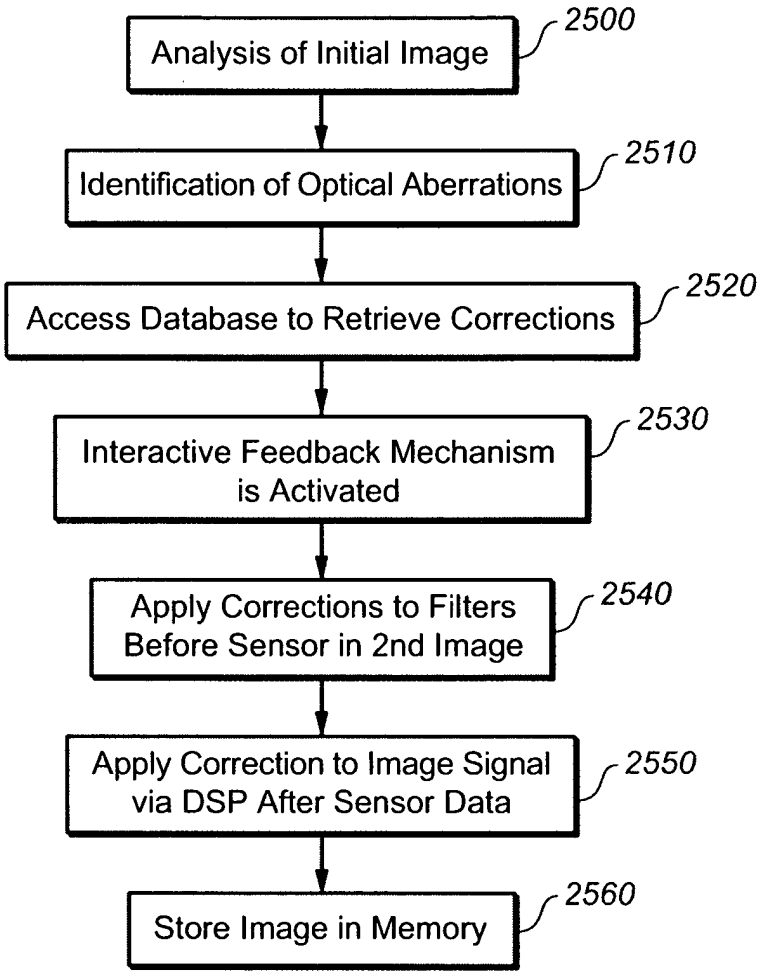
Analysis of Initial Image
2500
Identification of Optical Aberrations
2510
Access Database to Retrieve Corrections
2520
Interactive Feedback Mechanism is Activated
2530
Apply Corrections to Filters Before Sensor in 2nd Image
2540
Apply Correction to Image Signal via DSP After Sensor Data
2550
Store Image in Memory
2560

FIG. 25

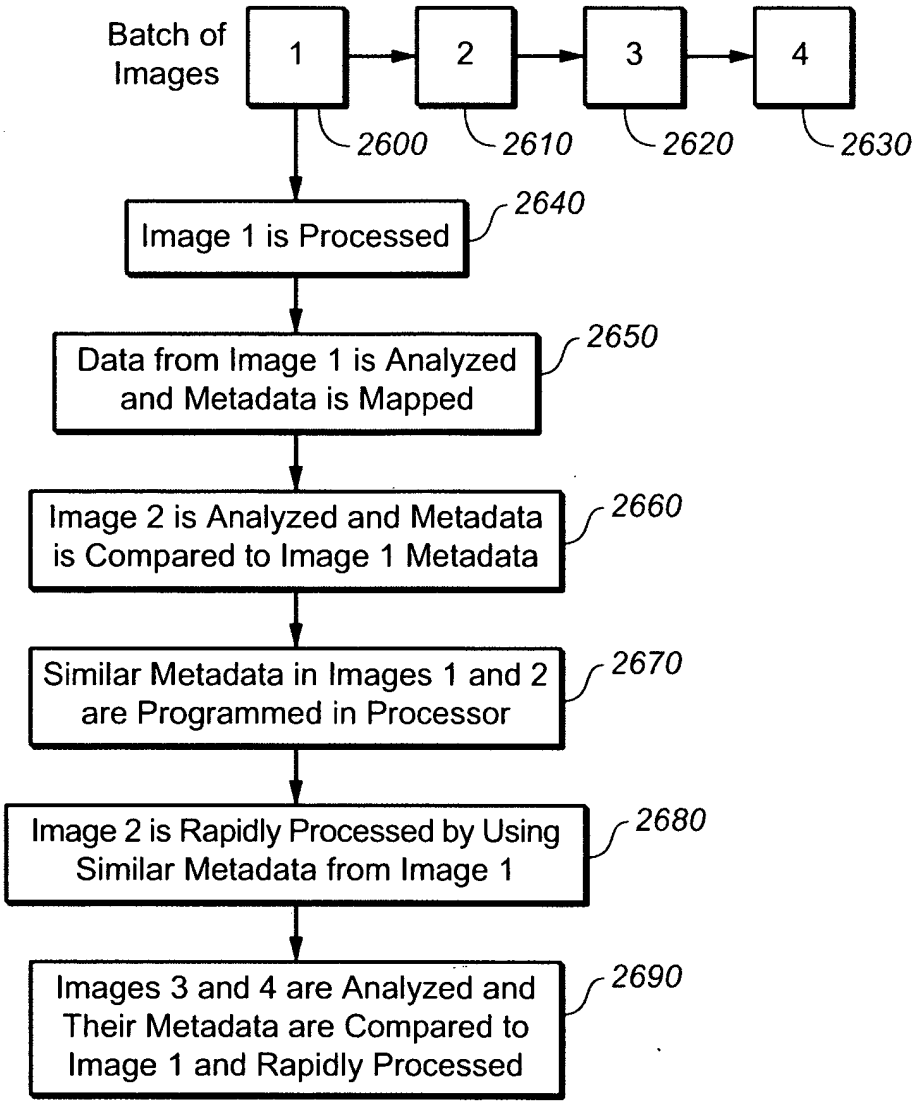
Batch of Images
1
2
3
4
2600
2610
2620
2630
Image 1 is Processed
2640
Data from Image 1 is Analyzed and Metadata is Mapped
2650
Image 2 is Analyzed and Metadata is Compared to Image 1 Metadata
2660
Similar Metadata in Images 1 and 2 are Programmed in Processor
2670
Image 2 is Rapidly Processed by Using Similar Metadata from Image 1
2680
Images 3 and 4 are Analyzed and Their Metadata are Compared to Image 1 and Rapidly Processed
2690

FIG. 26

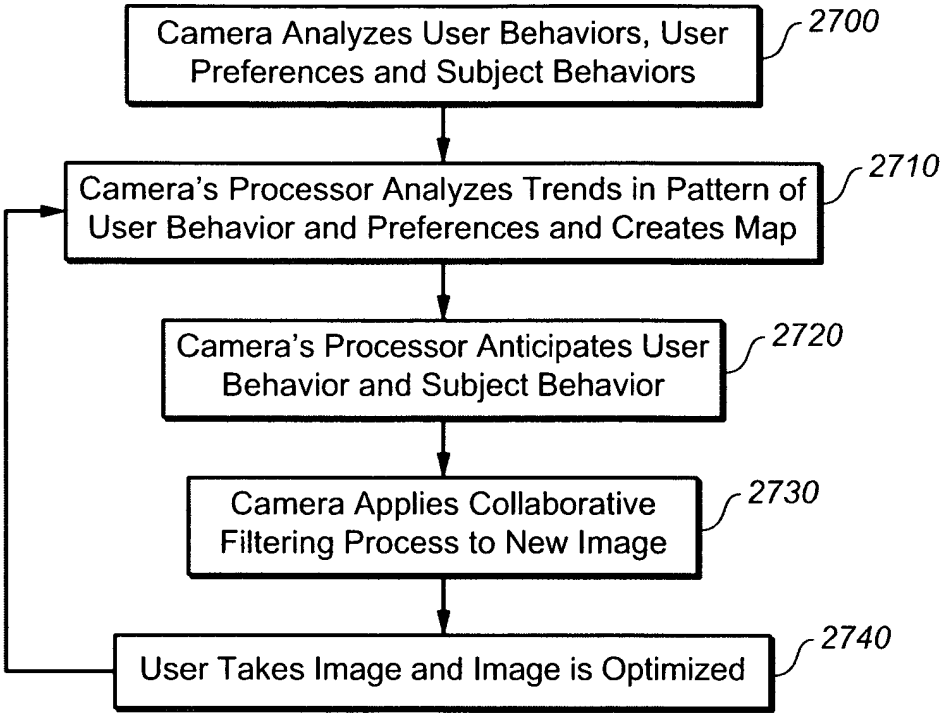
Camera Analyzes User Behaviors, User Preferences and Subject Behaviors
2700
Camera's Processor Analyzes Trends in Pattern of User Behavior and Preferences and Creates Map
2710
Camera's Processor Anticipates User Behavior and Subject Behavior
2720
Camera Applies Collaborative Filtering Process to New Image
2730
User Takes Image and Image is Optimized
2740

FIG. 27

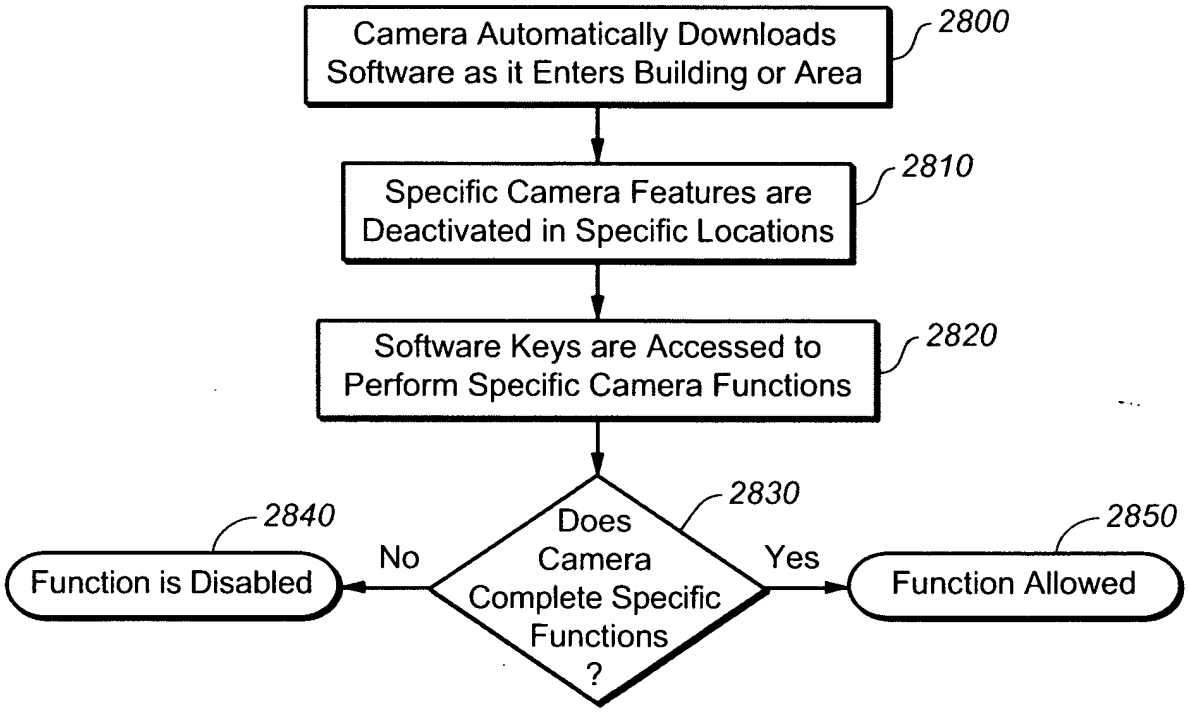
Camera Automatically Downloads Software as it Enters Building or Area
2800
Specific Camera Features are Deactivated in Specific Locations
2810
Software Keys are Accessed to Perform Specific Camera Functions
2820
Does Camera Complete Specific Functions ?
2830
No
Yes
Function is Disabled
2840
Function Allowed
2850

FIG. 28

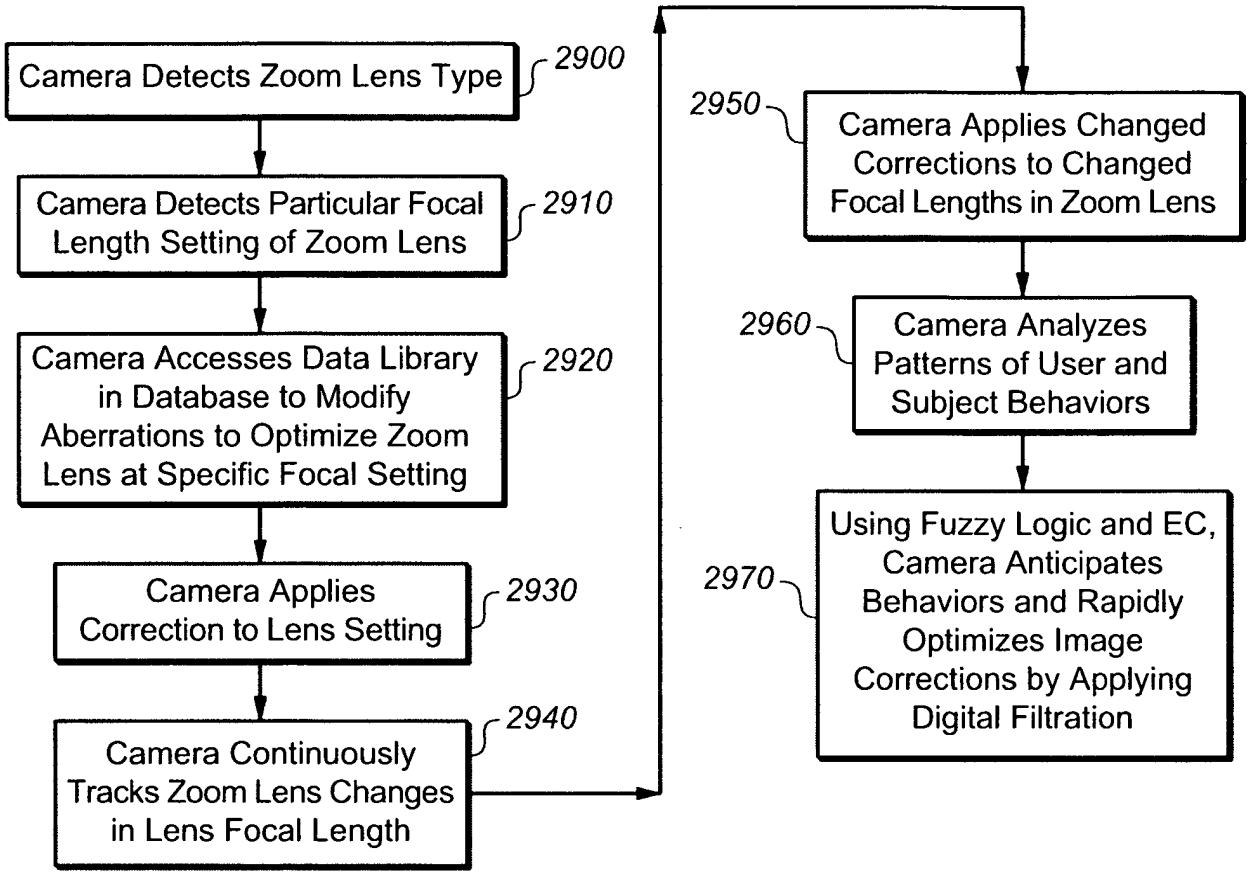
Camera Detects Zoom Lens Type
2900
Camera Detects Particular Focal Length Setting of Zoom Lens
2910
Camera Accesses Data Library in Database to Modify Aberrations to Optimize Zoom Lens at Specific Focal Setting
2920
Camera Applies Correction to Lens Setting
2930
Camera Continuously Tracks Zoom Lens Changes in Lens Focal Length
2940
2950
Camera Applies Changed Corrections to Changed Focal Lengths in Zoom Lens
2960
Camera Analyzes Patterns of User and Subject Behaviors
2970
Using Fuzzy Logic and EC, Camera Anticipates Behaviors and Rapidly Optimizes Image Corrections by Applying Digital Filtration

FIG. 29

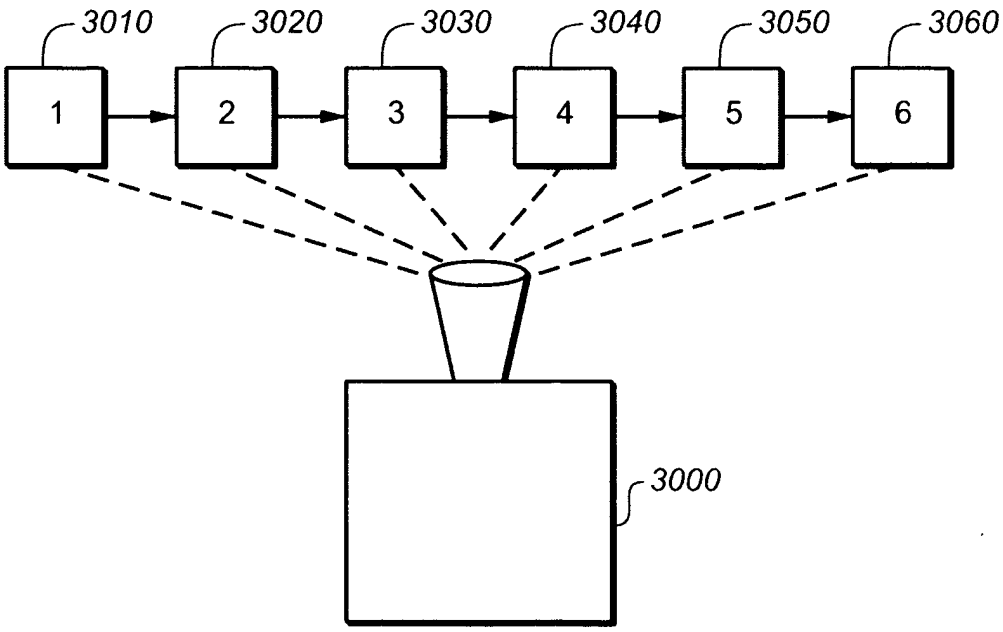
3010
3020
3030
3040
3050
3060
1
2
3
4
5
6
3000

FIG. 30

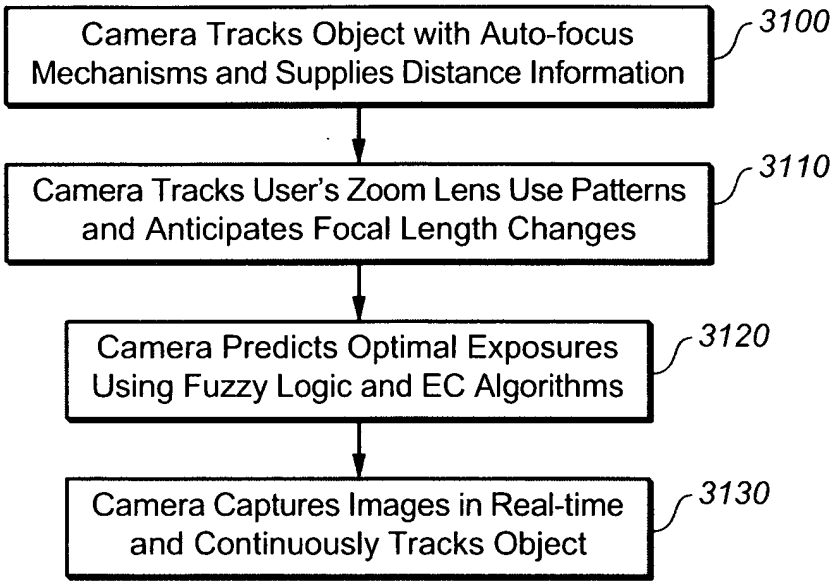
Camera Tracks Object with Auto-focus Mechanisms and Supplies Distance Information
3100
Camera Tracks User's Zoom Lens Use Patterns and Anticipates Focal Length Changes
3110
Camera Predicts Optimal Exposures Using Fuzzy Logic and EC Algorithms
3120
Camera Captures Images in Real-time and Continuously Tracks Object
3130

FIG. 31

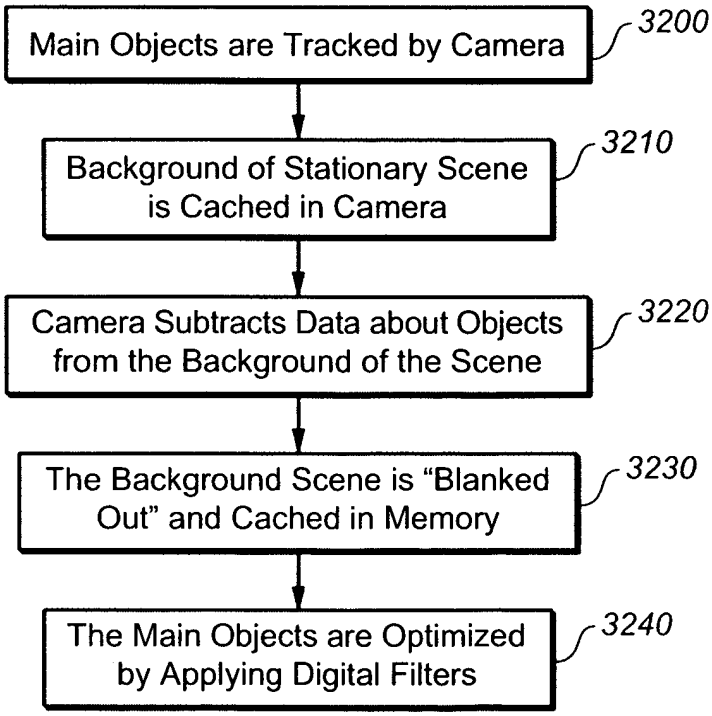
Main Objects are Tracked by Camera
3200
Background of Stationary Scene is Cached in Camera
3210
Camera Subtracts Data about Objects from the Background of the Scene
3220
The Background Scene is "Blanked Out" and Cached in Memory
3230
The Main Objects are Optimized by Applying Digital Filters
3240

FIG. 32

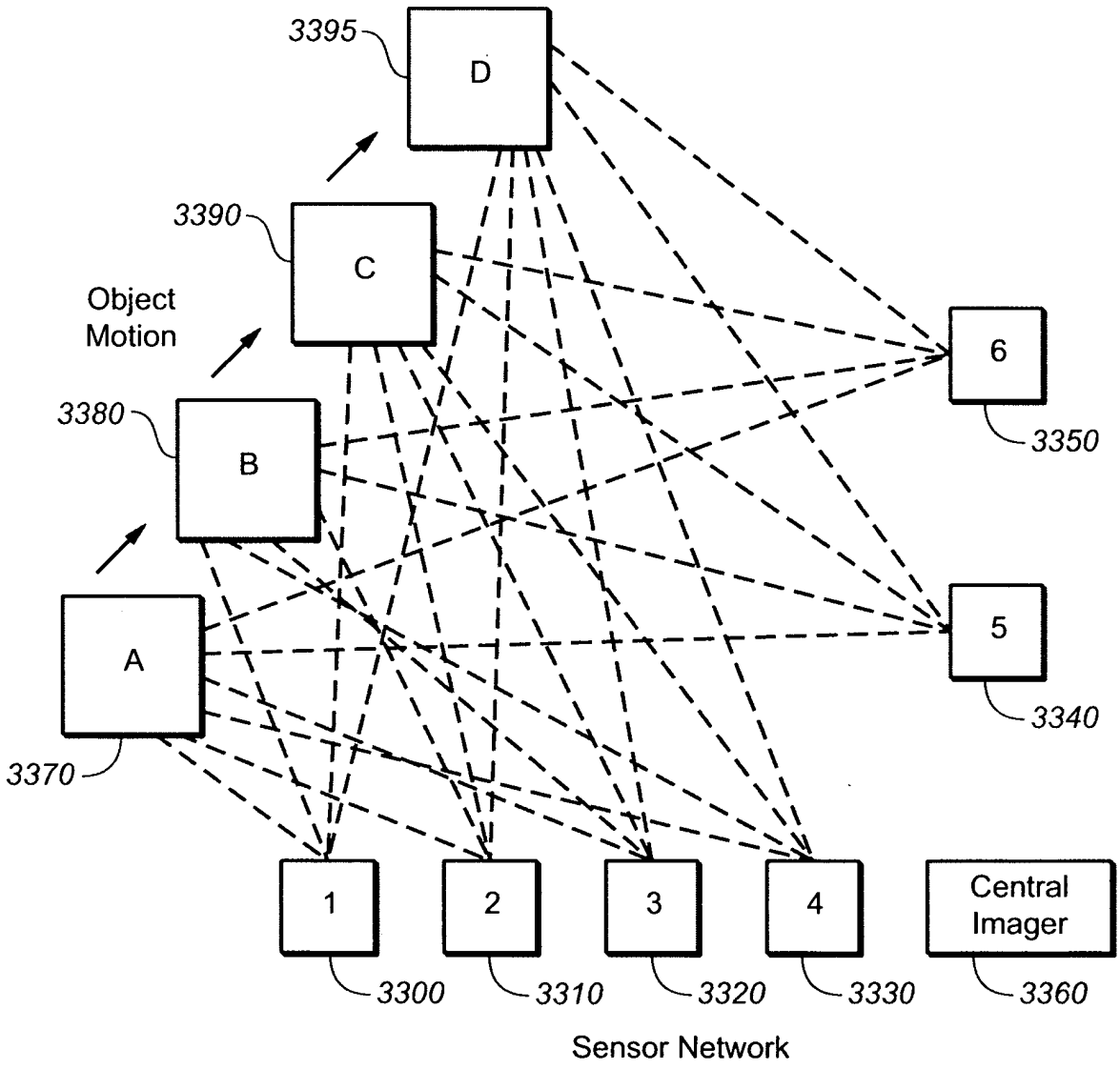
3395
D
3390
C
Object
Motion
3380
B
A
3370
6
3350
5
3340
1
2
3
4
Central
Imager
3300
3310
3320
3330
3360
Sensor Network

FIG. 33

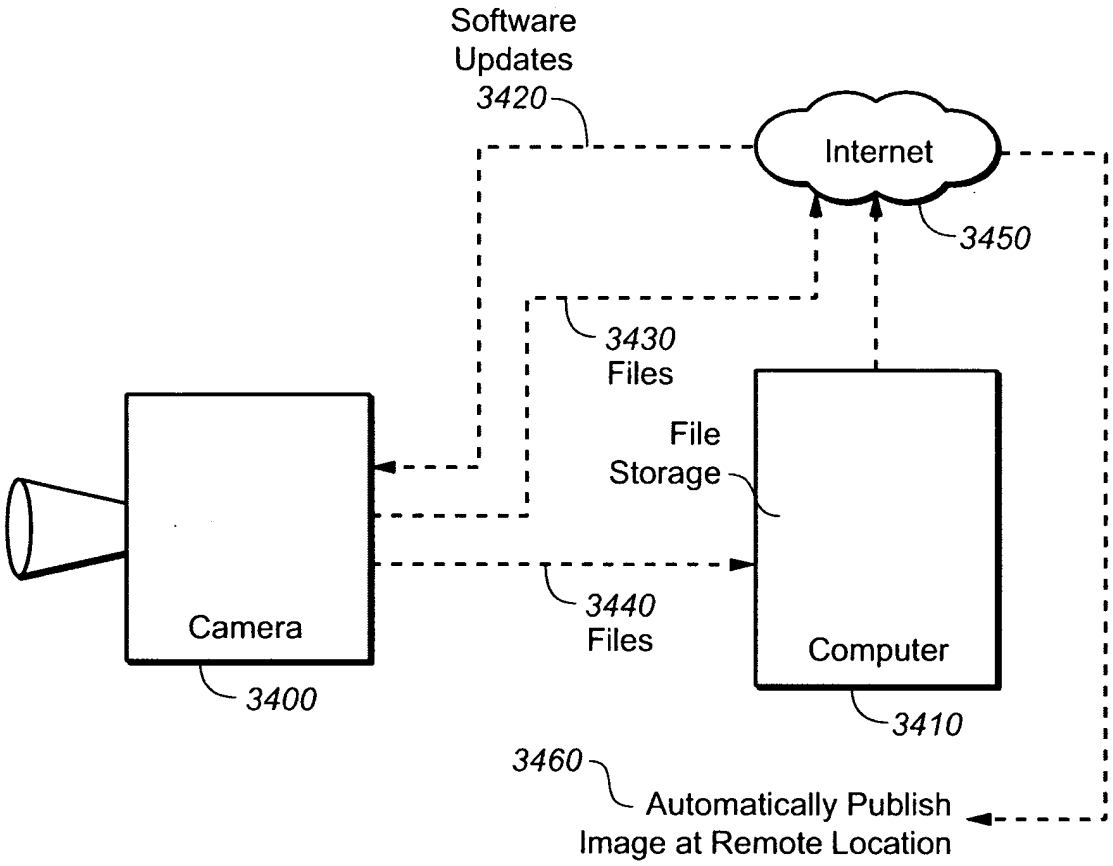
Software
Updates
3420
Internet
3450
3430
Files
File
Storage
Camera
3400
3440
Files
Computer
3410
3460
Automatically Publish
Image at Remote Location

FIG. 34

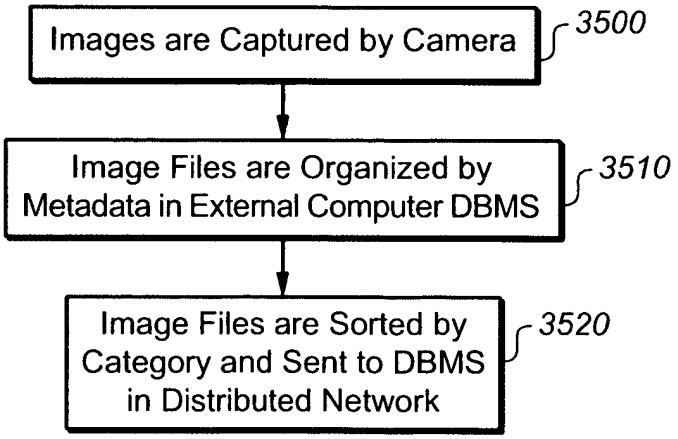
Images are Captured by Camera
3500
Image Files are Organized by
Metadata in External Computer DBMS
3510
Image Files are Sorted by
Category and Sent to DBMS
in Distributed Network
3520

FIG. 35

PATENT APPLICATION SERIAL NO._____

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

09/22/2009 CNGUYEN2 00000001 12586221

01 FC:2011	165.00 OP
02 FC:2111	270.00 OP
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Substitute for Form PTO-875

Application or Docket Number: 12586221

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	$165		N/A	$330
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	$270		N/A	$540
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	$110		N/A	$220
TOTAL CLAIMS (37 CFR 1.16(i))	15 minus 20 =	*	X $26 =	—	OR	X $52 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 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 $260 ($130 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).		$135			$270	
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))			$195			$390	
			TOTAL	545		TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED – PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDI-TIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDI-TIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $26 =		OR	X $52 =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $110 =		OR	X $220 =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					$195		OR	$390	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDI-TIONAL FEE ($)	OR	RATE ($)	ADDI-TIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $26 =		OR	X $52 =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $110 =		OR	X $220 =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					$195		OR	$390	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

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.**

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