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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/152,157	08/30/2011	8009290		4036

7590 08/10/2011

ROGER L. UNGER
5449 PASSERO AVENUE
RIVERSIDE, CA 92505

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 414 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):

Roger L. Unger, Riverside, CA;

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 04/29/2011

ROGER L. UNGER
5449 PASSERO AVENUE
RIVERSIDE, CA 92505

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.

ROGER UNGER	(Depositor's name)
	(Signature)
07/20/11	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/152,157	05/12/2008	Roger L. Unger		4036

TITLE OF INVENTION: COMPACT, LOW COST PARTICLE SENSOR

07/21/2011 EHAILU1 00000018 12152157

01 FC:2501 755.00 OP
02 FC:1504 300.00 OP

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$755	$300	$0	$1055	07/29/2011

EXAMINER	ART UNIT	CLASS-SUBCLASS
PUNNOOSE, ROY M	2886	356-336000

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 07/20/11

Typed or printed name Roger Unger 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.

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NOTICE OF ALLOWANCE AND FEE(S) DUE

7590 04/29/2011

ROGER L. UNGER
5449 PASSERO AVENUE
RIVERSIDE, CA 92505

EXAMINER
PUNNOOSE, ROY M

ART UNIT	PAPER NUMBER
2886	

DATE MAILED: 04/29/2011

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/152,157	05/12/2008	Roger L. Unger		4036

TITLE OF INVENTION: COMPACT, LOW COST PARTICLE SENSOR

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$755	$300	$0	$1055	07/29/2011

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

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7590 04/29/2011

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RIVERSIDE, CA 92505

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/152,157	05/12/2008	Roger L. Unger		4036

TITLE OF INVENTION: COMPACT, LOW COST PARTICLE SENSOR

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
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EXAMINER	ART UNIT	CLASS-SUBCLASS
PUNNOOSE, ROY M	2886	356-336000

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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)

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

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Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/152,157	05/12/2008	Roger L. Unger		4036

7590 04/29/2011

ROGER L. UNGER
5449 PASSERO AVENUE
RIVERSIDE, CA 92505

EXAMINER	
PUNNOOSE, ROY M	

ART UNIT	PAPER NUMBER
2886	

DATE MAILED: 04/29/2011

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 304 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 304 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)
	12/152,157	UNGER, ROGER L.
	Examiner	Art Unit
	ROY PUNNOOSE	2886

-- 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 *amendment filed on 02/10/2011*.
2. ☒ The allowed claim(s) is/are *1-18*.
3. ☐ 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.

4. ☐ 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.
5. ☐ 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).
6. ☐ 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)	5. ☐ Notice of Informal Patent Application
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)	6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____	7. ☐ Examiner's Amendment/Comment
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material	8. ☒ Examiner's Statement of Reasons for Allowance
	9. ☐ Other _____.

DETAILED ACTION

Response to Amendment

1. Applicant's amendment filed on 02/10/2011 is acknowledged and has been accepted by the Examiner. Claims 1-18 are currently pending in the application.

Allowability

2. Claims 1-18 are allowable in view of the applicants amendment and because prior art does not teach of a particle sensor in which only a portion of the airflow intersects a beam of light in proximity to a detector, in combination with the rest of the limitations of the respective claims.

Contact/Status Information

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Roy M. Punnoose** whose telephone number is **(571)272-2427**. The examiner can normally be reached on 9:30 AM - 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Tarifur R. Chowdhury** can be reached on **571-272-2287**. The **Fax** 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.

/Roy M. Punnoose/
Primary Examiner
Art Unit 2886

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12152157	UNGER, ROGER L.
	Examiner	**Art Unit**
	ROY M. PUNNOOSE	2886

SEARCHED

Class	Subclass	Date	Examiner
356	336	11/5/2010	RMP
	Search Updated	4/25/2011	RMP

SEARCH NOTES

Search Notes	Date	Examiner
EAST	05/05/2010	TN
356/335-343, 246, 432-444, 73, 39	05/05/2010	TN
250/222.2, 458.1, 288, 290, 293, 299, 423 R	05/05/2010	TN
SEARCH UPDATED	11/5/2010	RMP
INVENTOR SEARCH	11/7/2010	RMP
DOUBLE PATENTING SEARCH	11/7/2010	RMP
SEARCH UPDATED	4/25/2011	RMP

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner
	SEE SEARCH HISTORY	11/7/2010	RMP
	SEARCH UPDATED	4/25/2011	RMP

	/R. P./ Primary Examiner.Art Unit 2886

Issue Classification

Application/Control No.	Applicant(s)/Patent Under Reexamination
12152157	UNGER, ROGER L.
Examiner	**Art Unit**
ROY PUNNOOSE	2886

ORIGINAL		INTERNATIONAL CLASSIFICATION	
CLASS	SUBCLASS	CLAIMED	NON-CLAIMED
356	336	G 0 1 N 15 / 02 (2006.01.01)	

CROSS REFERENCE(S)

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				

☒ 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		17												
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	13														
	14														
	15														
	16														

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	18	
/ROY PUNNOOSE/ Primary Examiner.Art Unit 2886	04/25/2011	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	6

UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
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BIB DATA SHEET

CONFIRMATION NO. 4036

SERIAL NUMBER	FILING or 371(c) DATE / RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/152,157	05/12/2008	356	2886	

APPLICANTS
Roger L. Unger, Riverside, CA;

**** CONTINUING DATA ***************************
This appln claims benefit of 60/928,870 05/12/2007

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

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **** ** SMALL ENTITY **
06/02/2008

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /ROY M PUNNOOSE/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		CA	5	18	3

ADDRESS

ROGER L. UNGER
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RIVERSIDE, CA 92505
UNITED STATES

TITLE

Compact, low cost particle sensor

FILING FEE RECEIVED		
515	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

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	2778	356/335-343.ccls.	US-PGPUB; USPAT	OR	ON	2011/04/25 07:48
L2	7844	356/246,432-444,73.ccls.	US-PGPUB; USPAT	OR	ON	2011/04/25 07:48
L3	7674	250/222.2,458.1,288,290,293,299,423R.ccls.	US-PGPUB; USPAT	OR	ON	2011/04/25 07:48
L4	17501	L1 or L2 or L3	US-PGPUB; USPAT	OR	ON	2011/04/25 07:48
L5	2575	L4 and (particle$1 near2 (count$3 or size))	US-PGPUB; USPAT	OR	ON	2011/04/25 07:48
L6	27	L5 and ((scatter$2 near2 light) and (beam with light) and (area with (air near2 flow$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/04/25 07:48
L7	1551	(beam with (proxim$3 or adjacent or "near") with (detect$3 or photodetect$3 or CCD)) and particles and beam and scatter$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/04/25 07:49
L8	0	L7 and ((beam near (proxim$3 or adjacent or "near") near (detect$3 or photodetect$3 or CCD)) and particles and beam and scatter$3).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/04/25 07:49
S1	15	"6087947"	US-PGPUB; USPAT	OR	ON	2010/11/04 19:00
S2	2	(("6087947") or ("7499809")).PN.	US-PGPUB; USPAT	OR	OFF	2010/11/04 19:01
S3	1	("20080278725").PN.	US-PGPUB; USPAT	OR	OFF	2010/11/04 22:19
S4	3	(("5870190") or ("5085500") or ("20070229825")).PN.	US-PGPUB; USPAT	OR	OFF	2010/11/04 22:25
S5	36	("2682613" | "3614231" | "3770351" | "3835315" | "3851169" | "3989381" | "4178103" | "4188121" | "4189236" | "4783599" | "4804853" | "4871249").PN. OR ("5085500").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2010/11/04 22:45
S6	690	356/336.ccls.	US-PGPUB; USPAT	OR	ON	2010/11/04 23:08
S7	9	("2920525" | "3535531" | "3677650").PN. OR ("3819269").URPN.	US-PGPUB; USPAT;	OR	ON	2010/11/04 23:28

			USOCR			
S8	7	("3535531").URPN.	USPAT	OR	ON	2010/11/04 23:29
S9	5	((particle$1 with (scatter$2 near2 light)) and (beam with light) and (area with (air near2 flow$3)) and (detector or photodetector)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/11/04 23:36
S10	56	((particle$1 with (scatter$2 near2 light)) and (beam with light) and (area with (air near2 flow$3)) and (detector or photodetector))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/11/04 23:37
S11	51	S10 not S9	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/11/04 23:38
S12	2690	356/335-343.ccls.	US-PGPUB; USPAT	OR	ON	2010/11/04 23:39
S13	7638	356/246,432-444,73.ccls.	US-PGPUB; USPAT	OR	ON	2010/11/04 23:39
S14	7342	250/222.2,458.1,288,290,293,299,423R.ccls.	US-PGPUB; USPAT	OR	ON	2010/11/04 23:41
S15	16894	S12 or S13 or S14	US-PGPUB; USPAT	OR	ON	2010/11/04 23:41
S16	5	S9 and S15	US-PGPUB; USPAT	OR	ON	2010/11/04 23:41
S17	2470	S15 and (particle$1 near2 (count$3 or size))	US-PGPUB; USPAT	OR	ON	2010/11/04 23:45
S18	27	S17 and ((scatter$2 near2 light) and (beam with light) and (area with (air near2 flow$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/11/04 23:46
S20	0	(beam adj close adj3 (detect$3 or photodetect$3 or CCD)) and particles and scatter$3 and beam and (airflow or (air adj flow))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/11/07 05:46
S21	3	(beam adj close adj3 (detect$3 or photodetect$3 or CCD)) and particles and scatter$3 and beam	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/11/07 05:47
S22	3	(beam adj close adj3 (detect$3 or photodetect$3 or CCD)) and particles and	US-PGPUB; USPAT;	OR	ON	2010/11/07 05:49

		beam	USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S23	1499	(beam with (proxim$3 or adjacent or "near") with (detect$3 or photodetect$3 or CCD)) and particles and beam and scatter$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/11/07 05:51
S24	9	S23 and (beam near (proxim$3 or adjacent or "near") near (detect$3 or photodetect$3 or CCD)) and particles and beam and scatter$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/11/07 05:52
S25	9	(UNGER with ROGER).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/11/07 06:31
S26	0	((beam adj close adj3 (detect$3 or photodetect$3 or CCD)) and particles and scatter$3 and area).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/11/07 06:34
S29	1	("20050079635").PN.	US-PGPUB; USPAT	OR	OFF	2011/02/04 15:08
S30	1	S29 and position	US-PGPUB; USPAT	OR	ON	2011/02/04 15:14

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L9	0	((beam near (proxim$3 or adjacent or "near") near (detect$3 or photodetect$3 or CCD)) and particles and beam and scatter$3).clm.	US-PGPUB; USPAT	OR	ON	2011/04/25 07:50
S19	5	((particle$1 with (scatter$2 near2 light)) and (beam with light) and (area with (air near2 flow$3)) and (detector or photodetector)).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2010/11/04 23:37
S27	5	(UNGER with ROGER).in.	US-PGPUB; USPAT; UPAD	OR	ON	2010/11/07 06:32
S28	0	((beam adj close adj3 (detect$3 or photodetect$3 or CCD)) and particles and scatter$3 and area).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2010/11/07 06:35

4/25/2011 8:32:12 AM

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FEB 10 2011

Appl. No. : 12/152,157

Confirmation No. 4036

Applicant : Roger L. Unger

Filed : 05/12/2008

TC/A.U. : 2886

Examiner : Roy Punnoose

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

AMENDMENT

Sir:

In response to the Non-Final Office action of November 11, 2010, please amend the above identified application as follows:

Amendments to the Specification: Amendments to the specification begin on page 2 of this amendment.

Amendments to the Claims: Amendments to the claims begin on page 5 of this amendment.

Amendments to the Drawings: A statement explaining the drawing amendments begins on page 8 of this amendment.

Remarks/Arguments begin on page 9 of this amendment.

SPECIFICATION

Page 2, second to last paragraph, replace with the following new paragraph:

The invention is an improvement in a light scattering particle sensor or optical particle counter. In accordance with one embodiment, the cross-sectional area of the flow passage through the sensor is larger than the area of the beam of light which it intersects. Thus, only a portion of the air flow is illuminated by the beam of light and only a portion of the air flow is sampled for particles. Also in the improvement, the beam of light passes in close proximity to a photodetector such that a sufficiently large percentage of the light scattered off the particles will directly strike the photodetector so as to enable particle detection without ~~eliminating~~ the need for a light collection system utilizing mirrors, lenses, or other light collection techniques.

Page 2, last paragraph (extends to page 3), replace with the following new paragraph:

The large flow passage through the sensor allows the sensor to ~~be operated~~ operate at very low ~~vacuum (< 0.2 inches H2O)~~ vacuums of less than 0.2 inches of H2O (1 inch of H2O, or water, is defined as a differential pressure of 248.84 pascals at 60 degrees Fahrenheit and a vacuum of 1 inch of H2O is a differential pressure of 248.84 pascals from ambient pressure at 60 degrees Fahrenheit). It further allows loose tolerances on the sealing of the sensor because minor leaks will not appreciably affect the flow rate through the sensor. In contrast, current particle sensors typically contain a block with an inlet and exit, but otherwise tightly sealed, referred to as a "flow cell", "sensor chamber", "detector housing", "sensor assembly", or other such name. The approach of this invention allows this block to be eliminated and the entire

enclosure for the particle counter to be made of two plastic pieces injection molded to standard tolerances. Operation at low vacuum also permits the use of a low cost axial fan or blower to generate the air flow. The large flow passage also permits the elimination of a nozzle or inlet jet which typically require precise alignment to the beam of light.

Page 4, third paragraph, replace with the following new paragraph:

FIG. 3 is a section view illustrating the positioning of the light source **30** and photodetector **31** relative to the baffles **15**,**16**, and **17**. These baffles are molded into the rear enclosure **12** and serve to control stray light and direct air flow within the particle sensor (arrows show the direction of flow). The control of stray light, as is known to those skilled in the art, is important to reduce unwanted output from the photodetector **31**. The baffles **15**,**16**, and **17** function to reduce stray light reaching the photodetector **31** from outside the particle sensor. In addition, baffles **16** and **17** reduce stray light from the light source **30** by forming what is known to those skilled in the art as a "light trap", "light stop", "beam dump", "beam stop", etc. FIG. 3 also illustrates the relationship between air flow passage **34**, the beam of light **32**, the photodetector **31**, and the air flow. The air flow passage **34** is located upstream ("upsteam" is defined as the direction from which the air flow is coming) of the beam of light **32**. Thus, the air first flows through the air flow passage **34** and then through the beam of light **32**.

Page 4, last paragraph (extends to page 5), replace with the following new paragraph:

FIG. 5. is a diagram (not to scale) which shows the positioning of the light source **30**, the light beam **32**, the photodetector **31**, and the air flow passage **34**. Also shown are particles **33** entrained in the air flow. In the diagram, the direction of air flow

is into the page through air flow passage **34**. The area of air flow passage **34** is greater than the area of the light beam **32** under the air flow passage **34** such that only a portion of the particles **33** passing through the particle sensor will traverse the light beam **32**. By way of example, the cross sectional area of the flow passage **34** could be 75 square millimeters, the width of the beam of light **32** could be 0.5 millimeters, and the height of the beam above the photodetector could be 1.0 millimeters, although other geometries are possible. Again, by way of example, with the above geometry, many typical low cost axial fans (60 mm x 60 mm) will produce less than 0.1 inches of pressure drop across the flow passage. As can be seen from the example dimensions and the small size ~~fan~~ of the axial fan, this embodiment permits a compact particle sensor to be constructed.

CLAIMS

Please amend the claims according to the status designations in the following list, which contains all claims that were ever in the application, with the text of all active claims.

1. (CURRENTLY AMENDED) A particle sensor using scattered light to detect and size particles entrained in air drawn from an environment into the particle sensor, said particle sensor comprising; a beam of light; a photodetector in ~~close~~ proximity to said beam of light; an air flow passage located ~~above~~ upstream of said beam of light; an air flow means for generating air flow through the particle sensor; wherein ~~the area of said air flow passage is greater than the area of that portion of said beam of light located under said air flow passage~~ said beam of light intersects only a portion of said air flow.
2. (ORIGINAL) The particle sensor of claim 1 wherein said air flow means includes an axial fan.
3. (ORIGINAL) The particle sensor of claim 1 wherein the pressure drop across said air flow passage is less than 0.2 inches of H20.
4. (ORIGINAL) The particle sensor of claim 1, further comprising a light baffle located between said beam of light and said photodetector.
5. (ORIGINAL) The particle sensor of claim 4 wherein said air flow means includes an axial fan.
6. (ORIGINAL) The particle sensor of claim 4 wherein the pressure drop across said air flow passage is less than 0.2 inches of H20.
7. (CURRENTLY AMENDED) A particle sensor using scattered light to detect and size particles entrained in air drawn from an environment into the particle sensor, said particle sensor comprising; a light source generating a beam of light; a photodetector in ~~close~~ proximity to said beam of light; an air flow passage located ~~above~~ upstream of said beam of

light; an air flow means for generating air flow through the particle sensor; an electronic means for converting the output of said photodetector into pulses and analyzing those pulses for count and size information; wherein ~~the area of said air flow passage is greater than the area of that portion of said beam of light located under said air flow passage~~ said beam of light intersects only a portion of said air flow.

8. (ORIGINAL) The particle sensor of claim 7 wherein said electronic means calculates the effective flow rate of the particle sensor.

9. (ORIGINAL) The particle sensor of claim 8 wherein said electronic means controls the flow means to regulate the effective flow rate.

10. (ORIGINAL) The particle sensor of claim 7 wherein the entire particle sensor is enclosed in a two piece molded plastic enclosure.

11. (CURRENTLY AMENDED) A method using scattered light for detecting and sizing particles entrained in an air flow, the method comprising steps of; generating a beam of light; directing said beam of light to pass above a photodetector in ~~close~~ proximity to said photodetector; directing the air flow above the photodetector so that a portion of said air flow intersects ~~a portion of~~ said beam of light in ~~close~~ proximity to said photodetector; analyzing the output of the photodetector to count and size particles in the air [flow;]flow.

12. (CURRENTLY AMENDED) The method of claim 11 further comprising the step of calibrating the output of the photodetector by sampling calibration particles of known [size;]size.

13. (CURRENTLY AMENDED) The method of claim 12 further comprising the step of calculating the effective flow rate by comparing the count rate of a calibrated particle sensor with a reference particle [counter;]counter.

14. (CURRENTLY AMENDED) The method of claim 11 further comprising the step of measuring [the]a pulse width of the photodetector output and computing the effective flow rate of the particle [sensor;]sensor.

15. (CURRENTLY AMENDED) The method of claim 12 further comprising the step of measuring [the]a pulse width of the photodetector output and computing the effective flow rate

being sampled for [particles.;]particles.

16. (CURRENTLY AMENDED) The method of claim 13 further comprising the step of measuring [the]a pulse width of the photodetector output and computing the effective flow rate being sampled for [particles.;]particles.

17. (ORIGINAL) The method of claim 11 wherein the analysis of the photodetector output involves digitizing the photodetector output and summing the values within a pulse to obtain size information on the particle.

18. (ORIGINAL) The method of claim 11 wherein the analysis of the photodetector output involves digitizing the photodetector output and monitoring the values for a transition through a count threshold.

DRAWINGS

The attached sheet (sheet 3/5) of drawings includes a change to FIG. 3. In FIG. 3 the reference number 34 has been added to show the location of the air flow passage. In addition, in FIG. 3 the beam of light 32 has been added to clarify the relationship between the air flow passage 34, the photodetector 31, the beam of light 32, and the air flow. The attached sheet (sheet 5/5) of drawings includes changes to FIGs. 5 and 6. In FIGs. 5 and 6 the arrow from reference number 33 is removed and a line is added which connects directly to one of the particles.

REMARKS/ARGUMENTS

I want to thank Examiner Punnoose for his input and helpful suggestions during our phone conversation on February 9, 2011. I believe I have addressed the issues concerning the drawings by amending the drawings. In paragraph 3 of the office action the objection was raised to the wording "airflow passage located above the beam of light." FIG. 3 has been amended to clearly show the relationship of the air flow passage, the beam of light, and the air flow. The specification and claims have also been amended to use the more accurate term "upstream" to describe the location of the air flow passage.

The objection raised in paragraph 9 of the office action has been addressed by providing a definition in the specification of a vacuum of 1 inch of H2O. The objection raised in paragraph 10 of the office action has been addressed by changing claims 14-16 so that they read "a pulse width" instead of "the pulse width." Also, claims 11 through 16 are amended to end in a period instead of a semicolon – this was a typo.

For the objection in paragraph 7 of the office action, I amended the specification to provide a definition of "close proximity." Also, per our phone conversation I have amended claims 1, 7, and 11 to delete the word "close" and just use "proximity" as this will eliminate vagueness from the claims.

For the objection in paragraph 8 of the office action, and as per my phone conversation with Examiner Punnoose, I have modified the claims so that the "wherein clause" in claims 7 and 11 reads "wherein said beam of light intersects only a portion of said air flow." This is a much simpler and direct way of describing the structure of the invention.

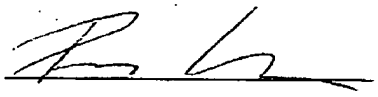
I also decided to use the word "upstream" in claims 1 and 7 as opposed to "above" as "upstream" is more descriptive and unambiguous. I have also modified the specification to further make the term "upstream" unambiguous by defining it in terms of the direction of air flow. The changes to FIG. 3 and the changes to the description of FIG. 3 in the specification also make "upstream" unambiguous.

Finally, for simplicity I deleted the extra wording of "a portion of" in claim 11 concerning the beam as this is not necessary. Also, a typo in the specification was corrected by removing the extra word "fan" from the paragraph describing FIG.5.

I believe that these amendments bring this application into condition for allowance, which action I respectfully solicit.

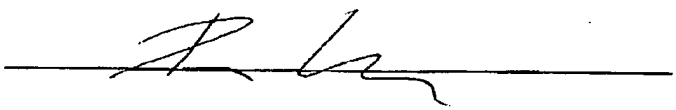
Respectfully submitted,

Dated: February 10, 2011

By: 

Roger L. Unger
(951) 351-2730
(951) 351-1765 (fax)

Certificate of Facsimile Transmission. I certify that on the date below I will fax this paper (including 2 attached drawings sheets) to the U.S. Patent Office at 571-273-8300.

February 10, 2011 

Replacement Sheet

3/5

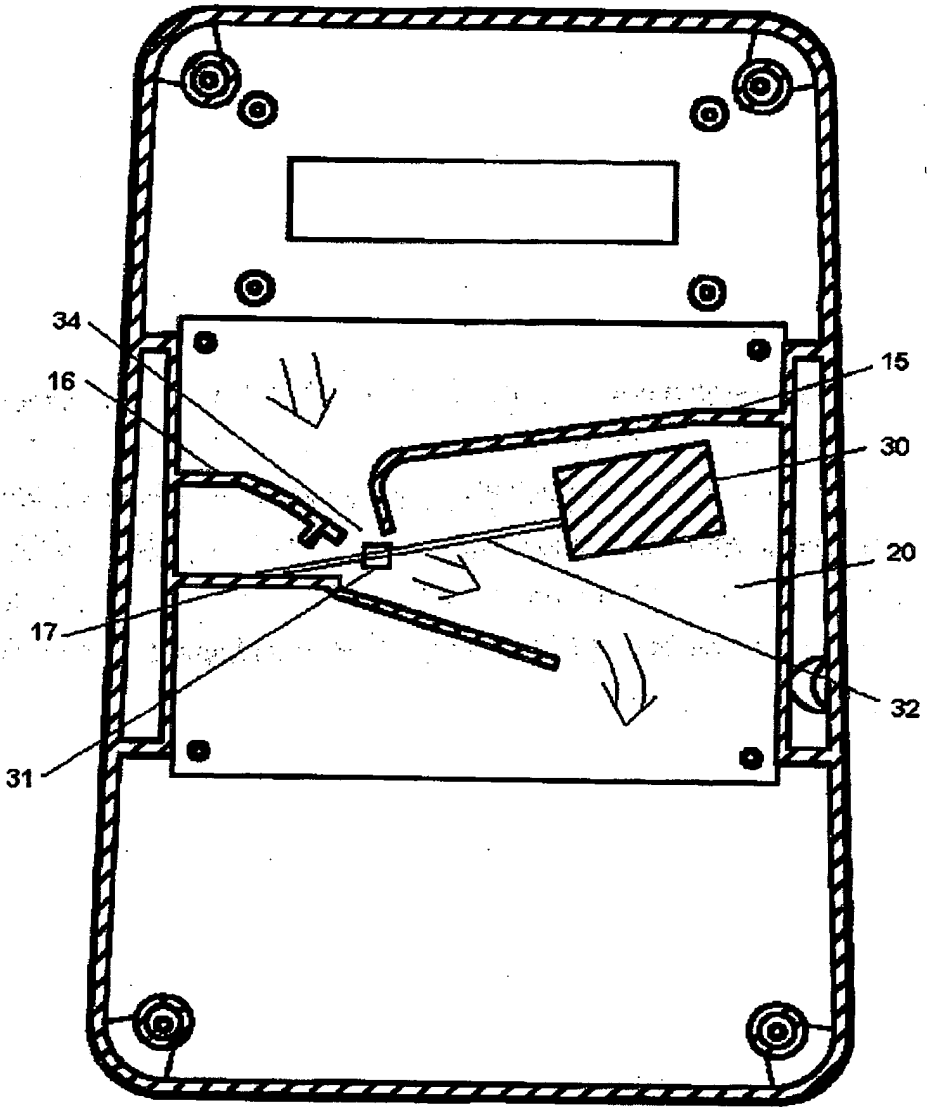


FIG. 3

Replacement Sheet

5/5

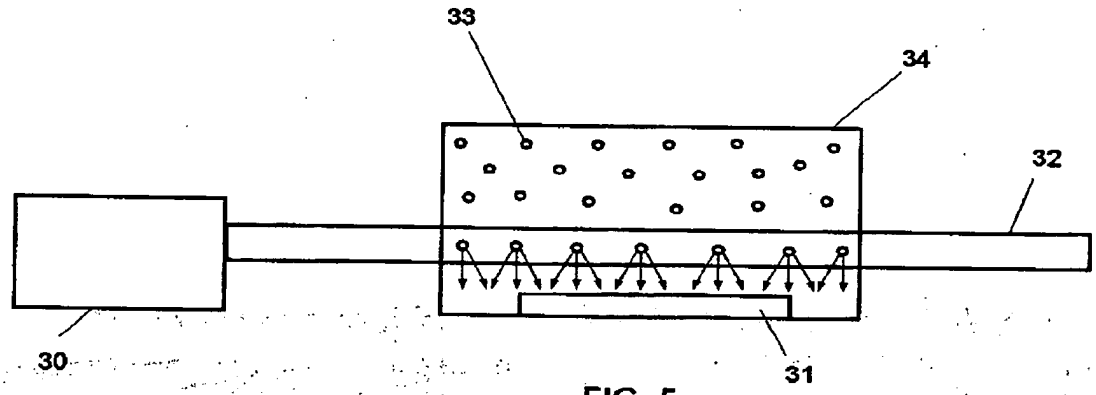


FIG. 5

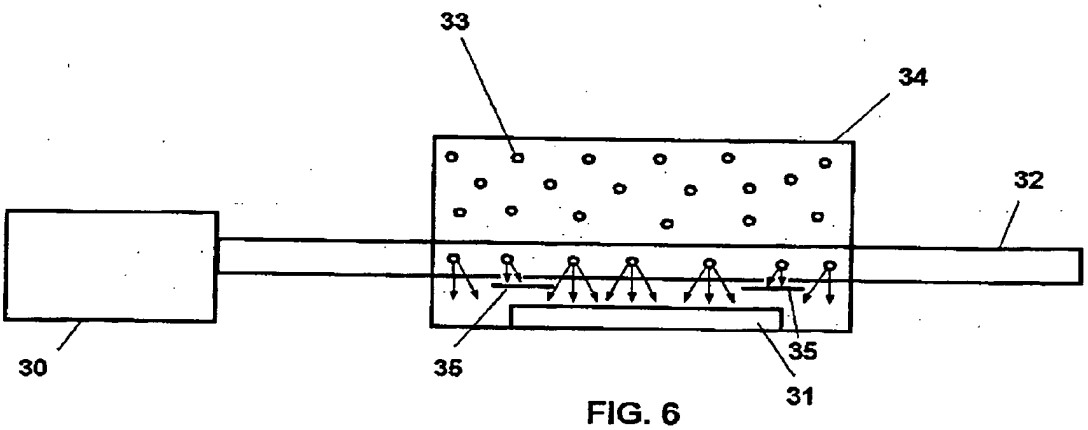


FIG. 6

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.
12/152,157	05/12/2008	Roger L. Unger		4036

7590 11/10/2010

ROGER L. UNGER
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EXAMINER	
PUNNOOSE, ROY M	
ART UNIT	PAPER NUMBER
2886	

MAIL DATE	DELIVERY MODE
11/10/2010	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)	
	12/152,157	UNGER, ROGER L.	
	Examiner	Art Unit	
	ROY PUNNOOSE	2886	

-- 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 August 2010*.

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

3)☐ 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

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-18* is/are rejected.

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

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

Application Papers

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

10)☒ The drawing(s) filed on *12 May 2008* 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).

11)☐ 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

12)☐ 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

Response to Arguments

1. Applicant's argument filed on 07/14/2010 in response to the office action mailed on 05/12/2010 is acknowledged. Claims 1-20 are currently pending in the application.

2. During a review of the claims and a final prior art search, deficiencies in certain claims and documents relevant to the applicant's claimed invention have been discovered. In view of the above, the rejections of the claims as stated in the office action of 05/12/2010 have been withdrawn. A new rejection based on the above mentioned findings are detailed below.

Drawings

3. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the "airflow passage **located above** the beam of light" must be shown or the feature(s) canceled from the claim(s). No new matter should be entered. Figures 5 and 6 currently show the beam of light going through the airflow passage.

4. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference characters **"33"** and **"34"** have both been used to designate the particles and the airflow passage (see Figures 5 and 6). Reference characters "33" and "34" points to the same object in the figures.

5. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing

should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

6. 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. Claims 1, 7 and 11 are 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. In claims 1, 7 and 11, it's not clear what "close proximity" represents. "Close" is a subjective term and could represent a wide range of distances depending on the circumstances. A definition of "close" is not provided in the specification. This lack of clarity has made the claim vague and indefinite. Appropriate correction is required.

8. Claims 1 and 7 are further 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. In claims 1 and 7, the limitation "area of that portion of said

beam of light located under said air flow passage" is ambiguous. It's not clear if the "area" is located under the air flow passage, or if the "beam" is located under the air flow passage.

Further, with regard to the "area of … the beam" it's not clear if reference is being made to the area of vertical or horizontal cross-section of the beam. The specification only refers to the "width" of the beam. This lack of clarity has made the claim vague and indefinite. Appropriate corrections are required.

9. Claims 3 and 6 are 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. Claims 3 and 6 are rejected because it's not clear what H2O (ending with the letter O), or H20 (ending with numeral 0) represents. It is not defined in the specification. This lack of clarity has made the claim vague and indefinite. Appropriate correction is required.

10. Claims 14-16 recites the limitation "**the** pulse width" in line 1. There is insufficient antecedent basis for this limitation in the claims. There is no reference of any pulse width in the base/parent claims.

11. Claims 2-6, 8-10 and 12-18 are rejected because they are dependent on a rejected base/parent claim with all the deficiencies of the base/parent claim inherent in them.

Allowable Subject Matter

12. Prior art does not show or teach of a beam in close proximity or adjacent to a photodetector, and without the use of any optical elements between the beam and the photodetector, in a particle sensor using scattered light. However, the invention has to claimed using proper claim language and be specific about the distance between the beam and the

photodetector. Claims 1-18 would be allowable if the 35 USC 112 rejections and the drawing deficiencies detailed above can be overcome.

Abstract

13. An abstract without any reference numerals is preferred over the current abstract on record in the file.

Contact/Status Information

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Roy M. Punnoose** whose telephone number is **(571)272-2427**. The examiner can normally be reached on 9:30 AM - 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Tarifur R. Chowdhury** can be reached on **571-272-2287**. The **Fax** 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.

/Roy M. Punnoose/
Primary Examiner
Art Unit 2886

Notice of References Cited	Application/Control No. 12/152,157	Applicant(s)/Patent Under Reexamination UNGER, ROGER L.	
	Examiner ROY PUNNOOSE	Art Unit 2886	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-3,819,269 A	06-1974	Duvall et al.	356/36
*	B	US-4,783,599 A	11-1988	Borden, Peter G.	250/574
*	C	US-5,534,999 A	07-1996	Koshizuka et al.	356/338
*	D	US-7,088,447 B1	08-2006	Bates et al.	356/338
	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.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12152157	UNGER, ROGER L.
	Examiner	Art Unit
	TU T NGUYEN	2886

✓	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	05/09/2010	11/07/2010							
	1	✓	✓							
	2	✓	✓							
	3	✓	✓							
	4	✓	✓							
	5	✓	✓							
	6	✓	✓							
	7	✓	✓							
	8	✓	✓							
	9	✓	✓							
	10	✓	✓							
	11	✓	✓							
	12	✓	✓							
	13	✓	✓							
	14	✓	✓							
	15	✓	✓							
	16	✓	✓							
	17	✓	✓							
	18	✓	✓							

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12152157	UNGER, ROGER L.
	Examiner	Art Unit
	TU T NGUYEN	2886

SEARCHED

Class	Subclass	Date	Examiner
356	336	11/5/2010	RMP

SEARCH NOTES

Search Notes	Date	Examiner
East	05/05/2010	TN
356/335-343, 246, 432-444, 73, 39	05/05/2010	TN
250/222.2, 458.1, 288, 290, 293, 299, 423 R	05/05/2010	TN
SEARCH UPDATED	11/5/2010	RMP
INVENTOR SEARCH	11/7/2010	RMP
DOUBLE PATENTING SEARCH	11/7/2010	RMP

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner
	SEE SEARCH HISTORY	11/7/2010	RMP

	/R. P./ Primary Examiner.Art Unit 2886

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BIB DATA SHEET

CONFIRMATION NO. 4036

SERIAL NUMBER	FILING or 371(c) DATE / RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/152,157	05/12/2008	356	2886	

APPLICANTS
Roger L. Unger, Riverside, CA;

**** CONTINUING DATA ***************************
This appln claims benefit of 60/928,870 05/12/2007

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

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **** ** SMALL ENTITY **
06/02/2008

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /ROY M PUNNOOSE/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		CA	5	18	3

ADDRESS

ROGER L. UNGER
5449 PASSERO AVENUE
RIVERSIDE, CA 92505
UNITED STATES

TITLE

Compact, low cost particle sensor

FILING FEE RECEIVED		
515	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

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	0	(beam adj close adj3 (detect$3 or photodetect$3 or CCD)) and particles and scatter$3 and beam and (airflow or (air adj flow))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/11/07 05:46
L3	3	(beam adj close adj3 (detect$3 or photodetect$3 or CCD)) and particles and scatter$3 and beam	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/11/07 05:47
L4	3	(beam adj close adj3 (detect$3 or photodetect$3 or CCD)) and particles and beam	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/11/07 05:49
L5	1499	(beam with (proxim$3 or adjacent or "near") with (detect$3 or photodetect$3 or CCD)) and particles and beam and scatter$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/11/07 05:51

L6	9	5 and (beam near (proxim$3 or adjacent or "near") near (detect$3 or photodetect$3 or CCD)) and particles and beam and scatter$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/11/07 05:52
L7	9	(UNGER with ROGER).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/11/07 06:31
L9	0	((beam adj close adj3 (detect$3 or photodetect$3 or CCD)) and particles and scatter$3 and area).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/11/07 06:34
S1	15	"6087947"	US-PGPUB; USPAT	OR	ON	2010/11/04 19:00
S2	2	(("6087947") or ("7499809")).PN.	US-PGPUB; USPAT	OR	OFF	2010/11/04 19:01
S3	1	("20080278725").PN.	US-PGPUB; USPAT	OR	OFF	2010/11/04 22:19
S4	3	(("5870190") or ("5085500") or ("20070229825")).PN.	US-PGPUB; USPAT	OR	OFF	2010/11/04 22:25
S5	36	("2682613" | "3614231" | "3770351" | "3835315" | "3851169" | "3989381" | "4178103" | "4188121" | "4189236" | "4783599" | "4804853" | "4871249").PN. OR ("5085500").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2010/11/04 22:45
S6	690	356/336.ccls.	US-PGPUB; USPAT	OR	ON	2010/11/04 23:08
S7	9	("2920525" | "3535531" | "3677650").PN. OR ("3819269").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2010/11/04 23:28

S8	7	("3535531").URPN.	USPAT	OR	ON	2010/11/04 23:29
S9	5	((particle$1 with (scatter$2 near2 light)) and (beam with light) and (area with (air near2 flow$3)) and (detector or photodetector)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/11/04 23:36
S10	56	((particle$1 with (scatter$2 near2 light)) and (beam with light) and (area with (air near2 flow$3)) and (detector or photodetector))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/11/04 23:37
S11	51	S10 not S9	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/11/04 23:38
S12	2690	356/335-343.ccls.	US-PGPUB; USPAT	OR	ON	2010/11/04 23:39
S13	7638	356/246,432-444,73.ccls.	US-PGPUB; USPAT	OR	ON	2010/11/04 23:39
S14	7342	250/222.2,458.1,288,290,293,299,423R.ccls.	US-PGPUB; USPAT	OR	ON	2010/11/04 23:41
S15	16894	S12 or S13 or S14	US-PGPUB; USPAT	OR	ON	2010/11/04 23:41
S16	5	S9 and S15	US-PGPUB; USPAT	OR	ON	2010/11/04 23:41
S17	2470	S15 and (particle$1 near2 (count$3 or size))	US-PGPUB; USPAT	OR	ON	2010/11/04 23:45

S18	27	S17 and ((scatter$2 near2 light) and (beam with light) and (area with (air near2 flow$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/11/04 23:46

11/7/2010 6:43:34 AM
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08-11-10

IFW

Appl. No. : 12/152,157

Applicant : Roger L. Unger

Filed : 05/12/2008

TC/A.U. : 2886

Examiner : Tu T Nguyen

Confirmation No. 4036

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

AMENDMENT

Sir:

In response to the Non-Final Office action of May 12, 2010, please amend the above identified application as follows:

Amendments to the Specification: there are no amendments to the specification.

Amendments to the Claims: there are no amendments to the claims.

Amendments to the Drawings: there are no amendments to the drawings.

Remarks/Arguments begin on page 2 of this paper.

REMARKS/ARGUMENTS

In regards to the patentability of the present invention, there are several secondary factors that the Applicant would like to point out for consideration which indicate the unobviousness of the present invention. First, the high cost of particle counters, typically in the several thousands of dollars, has placed market pressure on the industry to reduce costs, but no previous manufacturers have been able to come close to the cost reductions found in this invention. Second, this cost reduction has led to commercial success with instruments based on this patent application selling for as little as under $200. Third, this invention allows elimination of several elements found in previous particle counters. Fourth, many customers have stated that they have waited for years for someone to come up with a low cost particle counter or monitor. Others have stated that this invention has made many projects possible, such as those involving particle monitoring at multiple locations, which previously would have been impossible due to cost. This has led to this invention being used and suggested in various large scale studies by major research institutions that otherwise would not have been economically feasible. In general, the reaction to this invention within the environmental monitoring community has been one of amazement at the cost reduction.

The Applicant provides the following brief descriptions of the 2 inventions cited in the initial rejection of claims. These are Hamburger (6,087,947) and Nagura (7,499,809).

As way of background, the Applicant makes the following observations concerning Hamburger (6,087,947). This invention is described in the abstract as an "allergen particle detecting apparatus." This is a simple invention which is based on the assertions that allergen particles fall into a certain size range and that particles within that size range will scatter light within certain angular limits. Hamburger never acknowledges that scattering

angle is a relatively poor indicator of particle size. The Applicant has been unable to find any instrument which actually uses these principles and functions as a practical allergen detector. It should be noted that laser particle counters (or particle counters in general) as well as aerodynamic particle sizers have much better particle size resolution than is possible by using scattering angle as an indication of size. These are the types of instruments used in applications requiring particle size concentration measurements such as filter validation (e.g. ASHRAE 52.2)

Further, the Hamburger invention is not a particle counter. It does not size particles nor does it count particles. The invention is also not capable of deriving the concentration of allergen sized particles in the air. The invention will collect the light scattered by the particles between predetermined angles to a detector and produce an electrical signal. In claim 2 this is described as "an output signal proportional to the amount of light scattered in said predetermined range." In column 5 lines 62-63 of the specification Hamburger further states that "The amount of scattered light will be proportional to the number of particles 42 present." In column 5 line 50 the function of the invention is described as monitoring "the level of allergen particulates." It should be noted that this is not the same as determining the concentration of particles in the air as the Hamburger invention might scatter identical quantities of light from relatively many small particles as from relatively few large particles. In addition, the determination of a level of particulates would require that a reasonable statistical sample of particles is present in the light beam at any given time. In contrast, a particle counter is designed such that only one particle would be in the beam at any given time so that the light scattered from that single particle could be used to determine its size. The Hamburger invention, in contrast to a particle counter, determines the particulate level independent of the flow rate of air through the sensor. A particle counter, on the other hand, must know the flow rate through the sensor in order to determine the concentration of particles in the air from the number of particles counted and the volume of air sampled.

As way of background, the Applicant makes the following observations concerning Nagura (7,499,809). This invention is described as a "Particle Size Distribution Analyzer." It belongs to a class of extremely expensive and complex laboratory instruments marketed by the Assignee (Horiba Ltd.) as "Laser Scattering Particle Size Distribution Analyzers" such as the LA-950V2 which weighs 123lb according to their literature. These instruments are not particle counters and do not sample from the environment. Instead, they do precise measurements of particle size and distribution on samples contained in "a transparent cell which stores a particles dispersed in a dispersion medium" (claim 1). Also, in the abstract Nagura states "multiple detectors 5 scattered and arranged to detect the intensity of diffracted/scattered light" are used in the invention. Further, in the specification in column 9 line 1 he states "The total number of light detectors 5 is between 9-100" and in a second embodiment he states in column 17 lines 52-53 "The total number of light detectors 5 is, for example, between 90-100 units." The need for multiple detectors gives an indication of the expense and complexity of this invention.

The Applicant respectively offers the following responses to the rejection of specific claims by the Examiner.

In respect to claims 1,11,17, Hamburger does not disclose a particle sensor in the same sense as the present invention for the reasons mentioned above. In addition, the beam of light in Hamburger is not in close proximity to the photodetector. Fig. 2 of Hamburger illustrates that there is a space between the particles 42 and the beam blocking device 24 in which the light spreads out at various scattering angles. After the blocking device 24 there are two mirrors 28, 30 followed by a lens 32 followed by a pinhole device 34 before the photodetector. In contrast, the Applicant illustrates in Fig. 5 nothing between the beam 32 and the photodetector 31. In Fig. 6 the Applicant illustrates only a baffle 35. In the specification, the Applicant states that by way of example the distance between the beam 32 and the photodetector 31 could be 1.0mm.

Although Nagura does disclose a system for sizing particles, it is for a system which does analysis of batch samples as opposed to real time sampling from an environment. Further, it is neither obvious nor desirable to modify Hamburger with Nagura. Hamburger detects light scattered within a fixed scattering angle range and collects that light to a single photodetector. Hamburger assumes that all such scattered light is from particles within a certain size range. In contrast, Nagura uses multiple light detectors and then analyzes the signals from these detectors to determine the particle size distribution within the transparent cell 2. Although Nagura does not discuss the time required to compute this distribution, typical laser scattering particle size distribution analyzers, such as the LA-950V2, require approximately one minute.

With respect to claims 2,5 of the present invention, Hamburger does not disclose using an axial fan because the means of air flow is not critical to his invention. A particle counter, as in the Applicant's invention, must use the air flow rate to compute the particle concentration (as in particles per cubic foot) from the number of particles counted in a given time. It should be noted, as stated above, that the Hamburger invention is not capable of determining the particle concentration in an environment, but rather, generates a signal which reflects total light scattered. Since the output signal of Hamburger is based on the particles 42 within the beam at any given time it is only necessary to ensure enough air flow such that the particles within the beam reflect the current environment. Therefore, any flow system used by the Hamburger invention is not under the performance requirements of a flow system for a particle counter.

With respect to claims 3,6 of the present invention, in the Hamburger invention pressure drop is not of significance because his invention is not under the performance requirements of a particle counter.

With respect to claim 4 of the present invention, the parts 12 and 19 of Fig 1 of Hamburger

form a portion of the air passageway and are not relevant to the light baffle 35 of the present invention.

With respect to claim 7 of the present invention, the pulsing of the laser by Hamburger would produce pulses at the photodetector, but these pulses would reflect overall particulate levels whereas in the present invention, and in typical particle counters, the pulses represent the light scattered by a single particle at a time. In the present invention, each pulse will be used to size the particle which produced it and to count that particle if it is of sufficient size.

With respect to claims 8-9 of the present invention, the flow rate or effective flow rate is not meaningful to the Hamburger invention. The Hamburger invention does nct use flow rate in any way to derive the particulate level output.

With respect to claim 10 of the present invention, the Hamburger invention shows two parts 10,12 (Fig. 1) but these are not the same as the 2 pieces of the present invention. From inspection, it can be seen that passageway 12 (Fig. 1) cannot be composed of a single molded piece of plastic. Further, the outer housing 10 which contains the laser, optics, and electronics must itself be composed of at least 2 pieces. Therefore, the Hamburger enclosure must contain more than 2 molded pieces of plastic.

With respect to claims 12-13 of the present invention, the Hamburger invention cannot be calibrated as it is not designed to detect single particles as in a particle counter. Further, the effective flow rate has no meaning to the Hamburger invention as the flow rate does not enter into the determination of particulate levels in the Hamburger invention as discussed previously. Therefore, it is neither desirable nor possible to modify Hamburger with the claimed calibration steps.

With respect to claims 14-16 of the present invention, as discussed previously, the effective

flow rate is not relevant to the Hamburger invention as the flow rate does not enter into the determination of particulate levels. Further, as discussed previously, the Hamburger invention is not designed to detect single particles. Therefore, it is neither desirable nor possible to modify Hamburger with the claimed steps to calculate the effective flow rate.

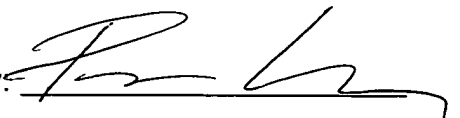
With respect to claim 18 of the present invention, Hamburger does not disclose digitizing of the photodetector output. In one embodiment, Hamburger illustrates in Fig. 3 of the specification a completely analog threshold detection circuit where the threshold is set by adjustable resistor 52. In a second embodiment, Hamburger discusses on column 7 lines 15-16 of the specification that "The output of the detector 122 is connected via amplifier 124 to a threshold and timer circuit 126," but does not disclose digitizing of the detector output.

Finally, it was suggested in a phone conversation on July 23,2010 by the Examiner, Tu Nguyen, that he schedule an interview after reviewing this response. He offered to help assist as necessary to propose changes and create patentable claims for the present invention.

In view of the above remarks, Applicant believes the pending application is in condition for allowance. Applicant believes no fee is due with this response.

Respectfully submitted,

Dated: August 9, 2010

By: 

Roger L. Unger
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/152,157	05/12/2008	Roger L. Unger		4036

7590 05/12/2010

ROGER L. UNGER
5449 PASSERO AVENUE
RIVERSIDE, CA 92505

EXAMINER	
NGUYEN, TU T	

ART UNIT	PAPER NUMBER
2886	

MAIL DATE	DELIVERY MODE
05/12/2010	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)	
	12/152,157	UNGER, ROGER L.	
	Examiner	Art Unit	
	TU T. NGUYEN	2886	

-- 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 _____.

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

3)☐ 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

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-18* is/are rejected.

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

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

Application Papers

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

10)☒ The drawing(s) filed on *12 May 2008* 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).

11)☐ 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

12)☐ 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 *08/11/2008*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

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.

Claims 1-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hamburger et al (6,087,947) in view of Nagura et al (7,499,809).

With respect to claims 1,11,17, Hamburger discloses a particle sensor using scattered light to detect particles entrained in air drawn from an environment into the particle sensor (abstract). The particle sensor comprising; a beam of light 22 (fig 2); a photodetector 16 (fig 1) in close proximity to said beam of light; an air flow passage 12 (fig 1) located above said beam of light; an air flow means for generating air flow through the particle sensor 16 (fig 1); wherein the area of said air flow passage is greater than the area of that portion of said beam of light located under said air flow passage (see chamber 12, fig 2).

Hamburger does not disclose sizing the particles. Nagura discloses a system for sizing the particles (abstract). It would have been obvious to modify Hamburger with Nagura for analyzing the size distribution of the air flow to determine the quality of an environment.

With respect to claims 2,5, Hamburger discloses using the system with the ventilation system (column 5, lines 28-29) and flowing the air to the sampling passage (column 5, lines 49-55). Hamburger does not explicitly disclose using an axial fan for the air flow. Using a fan to circulate or flow the air would have been known. It would have been obvious to modify Hamburger with the fan as claimed to flow the air to reduce the cost of the system.

With respect to claims 3,6, Hamburger does not disclose the pressure drop of the across air flow. However, it would have been obvious a design choice to modify Hamburger with claimed pressure for measuring different type of particles.

With respect to claim 4, the chamber 12 (fig 1) or the element 19 (fig 1) of Hamburger could be considered as the claimed light baffle which is located between said beam of light and said photodetector.

With respect to claim 7, refer to discussion in claim 1 above for the system. Since Hamburger discloses using a pulse generator 136 (fig 6) for controlling the laser 110 (fig 6), the photodetector 122 (fig 6) outputting pulse signals would have been obvious.

With respect to claims 8-9, Hamburger does not disclose calculating the effective flow rate of the particle sensor. However, it would have been obvious a design choice to

modify Hamburger by calculating and controlling the flow rate of the particle to facilitate the measurement.

With respect to claim 10, Hamburger discloses the entire particle sensor is enclosed in a two piece enclosure 10, 12 (fig 1). Hamburger does not disclose the material of the enclosure. However, it would have been obvious to modify Hamburger with different material for different intended uses.

With respect to claims 12-13, Hamburger does not disclose calculating the output of the photodetector by sampling calibration particles of known size or calculating the effective flow rate by comparing the count rate of a calibrated particle sensor with a reference particle counter. It would have been obvious to modify Hamburger with the claimed calibrated steps to facilitate the measurement.

With respect to claims 14-16, Hamburger does not explicitly disclose measuring the pulse width of the photodetector output and computing the effective flow rate of the particles. However, the claimed measuring steps would have been known. It would have been obvious to modify Hamburger with the claimed steps to control the flow rate of the particles to facilitate the measurement.

With respect to claim 18, Hamburger discloses the analysis of the photodetector output involves digitizing the photodetector output and monitoring the values for a transition through a count threshold 124, 126 (“threshold", fig 6).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to TU T. NGUYEN whose telephone number is (571)272-2424. The examiner can normally be reached on T-F 7:30-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Tarifur Chowdhury can be reached on (571) 272-2800 Ext. 86. 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.

/Tu T. Nguyen/
Primary Examiner, Art Unit 2886

05/09/2010

Notice of References Cited	Application/Control No. 12/152,157	Applicant(s)/Patent Under Reexamination UNGER, ROGER L.	
	Examiner TU T. NGUYEN	Art Unit 2886	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,087,947	07-2000	Hamburger et al.	340/627
*	B	US-7,499,809	03-2009	Nagura et al.	702/29
	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.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	343	((determin$5 or detect$5 or measur$5 or obtain$5 or calculat$5 or analyz$5) near8 (size near4 particle)) with (air near2 flow$4)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/05/05 08:27
L2	3176114	$5detector or $sensor	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/05/05 08:33
L3	63903	(determin$5 or detect$5 or measur$5 or obtain$5 or calculat$5 or analyz$5) near8 (scatter$5 near2 light)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/05/05 08:34
L4	24	1 and 2 and 3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/05/05 08:35

L5	1	((determin$5 or detect$5 or measur$5 or obtain$5 or calculat$5 or analyz$5) near8 (size near4 particle)) with (air near2 flow$4) with portable	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/05/05 08:50
L6	284167	air near5 passage	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/05/05 08:51
L7	127340	(determin$5 or detect$5 or measur$5 or obtain$5 or calculat$5 or analyz$5) near8 (size near4 particle)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/05/05 08:52
L8	905690	portable	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/05/05 08:53
L9	18	7 and 8 and 6 and 2 and 3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/05/05 08:53
L11	39	((determin$5 or detect$5 or measur$5 or obtain$5 or calculat$5 or analyz$5) near8 (size near4 particle)) with portable	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/05/05 09:12

L12	133591	(air near3 flow$5) near7 (passage or chamber)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/05/05 09:14
L13	4	11 and 12 and 3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/05/05 09:14
L14	111	7 and 12 and 2 and 3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/05/05 09:16
L15	94	14 and @ad<="20070512"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/05/05 09:17
L16	4	(("5671046") or ("5319575")).PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/05/05 09:50
L17	71317	(air near3 flow$5) with fan	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/05/05 10:01

L18	15	7 and 17 and 2 and 3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/05/05 10:01
L20	14588	(356/335-343,246,432-444,73,39).CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/05/05 10:18
L21	8568	(250/222.2,458.1,288,290,299,423R).CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/05/05 10:19
L22	22915	20 or 21	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/05/05 10:19
L23	48	22 and 7 and 12 and 2 and 3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/05/05 10:20

5/5/10 10:21:22 AM

PTO/SB/08a (08-08)
Approved for use through 08/31/2008. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	12/152,157
Filing Date	05/12/2008
First Named Inventor	R. UNGER
Art Unit	2877
Examiner Name	
Attorney Docket Number	

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	A	US- 5,870,190	2-9-1999	UNGER	
	B	US- 5,085,500	2-4-1992	BLESENER	
	C	US- 2007/0229825 A1	10-4-2007	BATES	
		US-			
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FOREIGN PATENT DOCUMENTS

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

Examiner Signature	/Tu Nguyen/	Date Considered	05/09/2010

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /T.N./

PTO/SB/08b (08-08)
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NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]

Examiner Signature	/Tu Nguyen/	Date Considered	05/09/2010

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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12152157	UNGER, ROGER L.
	Examiner	Art Unit
	TU T NGUYEN	2886

✓	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	05/09/2010								
	1	✓								
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	4	✓								
	5	✓								
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	14	✓								
	15	✓								
	16	✓								
	17	✓								
	18	✓								

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12152157	UNGER, ROGER L.
	Examiner	Art Unit
	TU T NGUYEN	2886

SEARCHED

Class	Subclass	Date	Examiner

SEARCH NOTES

Search Notes	Date	Examiner
East	05/05/2010	TN
356/335-343, 246, 432-444, 73, 39	05/05/2010	TN
250/222.2, 458.1, 288, 290, 293, 299, 423 R	05/05/2010	TN

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner

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	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/152,157	05/12/2008	Roger L. Unger	

CONFIRMATION NO. 4036

ROGER L. UNGER
5449 PASSERO AVENUE
RIVERSIDE, CA 92505

PUBLICATION NOTICE

Title: Compact, low cost particle sensor

Publication No.US-2008-0278725-A1
Publication Date:11/13/2008

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

PTO/SB/08a (08-08)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

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First Named Inventor	R. UNGER
Art Unit	2877
Examiner Name	
Attorney Docket Number	

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	A	US- 5,870,190	2-9-1999	UNGER	
	B	US- 5,085,500	2-4-1992	BLESENER	
	C	US- 2007/0229825 A1	10-4-2007	BATES	
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FOREIGN PATENT DOCUMENTS

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

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

PTO/SB/08b (08-08)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 2

Complete if Known	
Application Number	12/152,157
Filing Date	05/08/2008
First Named Inventor	R. UNGER
Art Unit	2877
Examiner Name	
Attorney Docket Number	

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]

Examiner Signature		Date Considered	

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1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

1 fw

PTO/SB/21 (08-08)
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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	12/152,157
Filing Date	05/12/2008
First Named Inventor	R. UNGER
Art Unit	2877
Examiner Name	
Attorney Docket Number	

Total Number of Pages in This Submission: 3

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
- ☐ Other Enclosure(s) (please Identify below):

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	ROGER UNGER		
Signature			
Printed name	ROGER UNGER		
Date	08/08/2008	Reg. No.	

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature			
Typed or printed name	ROGER UNGER	Date	08/08/2008

UNITED STATES PATENT AND TRADEMARK OFFICE

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Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
12/152,157	05/12/2008	2877	515		18	3

CONFIRMATION NO. 4036

ROGER L. UNGER
5449 PASSERO AVENUE
RIVERSIDE, CA 92505

FILING RECEIPT

Date Mailed: 06/09/2008

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)

Roger L. Unger, Riverside, CA;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This appln claims benefit of 60/928,870 05/12/2007

Foreign Applications

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

If Required, Foreign Filing License Granted: 06/02/2008

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/152,157**

Projected Publication Date: 11/13/2008

Non-Publication Request: No

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

Title

Compact, low cost particle sensor

Preliminary Class

356

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

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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U.S. PTO
12/152157
05/12/2008

22713 U.S. PTO
051208

PTO/SB/05 (07-07)
Approved for use through 06/30/2010. OMB 0651-0032
U.S. Patent and Trademark Office. U.S. DEPARTMENT OF COMMERCE
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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	
First Inventor	ROGER L. UNGER
Title	Compact, Low Cost Particle Sensor
Express Mail Label No.	EB011010293325

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. ☑ **Fee Transmittal Form** (e.g., PTO/SB/17)
   (Submit an original and a duplicate for fee processing)
2. ☑ **Applicant claims small entity status.** See 37 CFR 1.27.
3. ☑ **Specification** [*Total Pages* 10]
   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* 5]
5. **Oath or Declaration** [*Total Sheets* 3]
   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

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Alexandria VA 22313-1450

ACCOMPANYING APPLICATION PARTS

9. ☐ **Assignment Papers** (cover sheet & 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 citations attached
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: REQUEST UNDER MPEP 707.07 (j)

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.: .....

Prior application information: *Examiner* _____ *Art Unit:* _____

19. CORRESPONDENCE ADDRESS

☐ The address associated with Customer Number: ☐ ***OR*** ☐ Correspondence address below

Name	ROGER L. UNGER				
Address	5449 PASSERO AVENUE				
City	RIVERSIDE	State	CA	Zip Code	92505
Country	USA	Telephone	951-351-2730	Email	engineering@dylosproducts.com

Signature		Date	5/12/08
Name (Print/Type)	ROGER L. UNGER	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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PTO/SB/17 (10-07)
Approved for use through 06/30/2010. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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

FEE TRANSMITTAL
For FY 2008

☑ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 515

Complete if Known	
Application Number	
Filing Date	
First Named Inventor	ROGER L. UNGER
Examiner Name	
Art Unit	
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

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

Application Type	FILING FEES Fee ($)	FILING FEES Small Entity Fee ($)	SEARCH FEES Fee ($)	SEARCH FEES Small Entity Fee ($)	EXAMINATION FEES Fee ($)	EXAMINATION FEES Small Entity Fee ($)	Fees Paid ($)
Utility	310	155	510	255	210	105	515
Design	210	105	100	50	130	65	
Plant	210	105	310	155	160	80	
Reissue	310	155	510	255	620	310	
Provisional	210	105	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	210	105
Multiple dependent claims	370	185

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

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

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

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

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

3. APPLICATION SIZE FEE

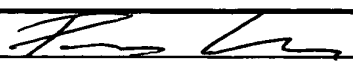
If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $260 ($130 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

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

4. OTHER FEE(S)

	Fees Paid ($)
Non-English Specification, $130 fee (no small entity discount)	
Other (e.g., late filing surcharge): _____	

SUBMITTED BY

Signature		Registration No. (Attorney/Agent)	Telephone 951-351-2730
Name (Print/Type)	ROGER L. UNGER		Date 5-12-08

In the United States Patent and Trademark Office

Serial Number: _____

Appn. Filed: _____

Applicant(s): R. UNGER

Appn. Title: COMPACT, LOW COST PARTICLE SENSOR

Examiner/GAU: _____

Mailed: 5/12/08

At: RIVERSIDE, CA

Request Under MPEP 707.07(j)

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

Sir:

The undersigned, pro se applicant(s), respectfully requests that if the Examiner finds patentable subject matter disclosed in this application, but feels that Applicant's present claims are not entirely suitable, the Examiner draft one or more allowable claims for applicant, pursuant to MPEP 707.07(j).

Very respectfully,

Signature of Inventor # 1	Signature of Inventor # 2
5449 PASSERO AVE Address	Address
RIVERSIDE, CA 92505	
951-351-4059 Telephone	Telephone

Patent Application of

Roger L. Unger

for

TITLE: COMPACT, LOW COST PARTICLE SENSOR

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of provisional patent application Ser. No. 60/928,870 filed May 12,2007 by the present inventor.

FEDERALLY SPONSORED RESEARCH Not Applicable

SEQUENCE LISTING OR PROGRAM Not Applicable

BACKGROUND-FIELD OF INVENTION

This invention relates generally to systems that use light scattering techniques for the detection of particles in a fluid (e.g. liquid or gas), which systems are generally referred to in the art as particle sensors or particle counters.

BACKGROUND-PRIOR ART

Typically, a particle counter works by drawing a sample of air through a beam of light and detecting the light scattered off the particles entrained in the air flow. These particles scatter light in proportion to their size, composition, shape and other physical properties. Lenses, mirrors, or other light collection techniques are used to increase the portion of the scattered light which is focused onto a photoelectric device (hereinafter referred to as a photodetector). The photodetector converts this scattered light into an electrical signal. This electrical signal is typically a pulse whose amplitude is related to the amount of scattered light reaching the photodetector and whose duration is typically related to the transit time of the particle through the beam of light. Thus, from the photodetector output and associated circuitry information about the number and size of particles in a sampled volume of air can be

determined.

At the present time particle counters typically cost several thousand dollars or more. Particle counters typically contain a number of expensive components or assemblies. Typically, a blower or pump is used to generate the necessary vacuum to draw the fluid flow through a sensor assembly/chamber. The sensor assembly is typically sealed except for an inlet and exhaust opening. The inlet typically has a "nozzle" or "inlet jet" which may be a machined or formed component through which the air to be sampled passes before entering the beam of light. As particle counters typically assume the total flow of air through the instrument is being sampled for particles, care must be taken in the alignment of the nozzle over the beam of light so that all air leaving the nozzle passes through the beam. The sensor will also typically contain collection optics to gather a large percentage of the light scattered off particles passing through the beam. These can consist of expensive components such as mirrors or lenses. In addition, particle counters typically use pressure sensors and/or mass flow sensors to determine the volumetric flow through the beam of light. The above components add significant cost to a particle counter.

There are many applications in which monitoring the concentration of airborne particles would be useful, such as testing indoor air quality, but a cost of several thousand dollars is a deterrent. Therefore, a need exists for a light scattering device which eliminates many of the above expensive components to provide low cost particle monitoring.

SUMMARY

The invention is an improvement in a light scattering particle sensor or optical particle counter. In accordance with one embodiment, the cross-sectional area of the flow passage through the sensor is larger than the area of the beam of light which it intersects. Thus, only a portion of the air flow is illuminated by the beam of light and only a portion of the air flow is sampled for particles. Also in the improvement, the beam of light passes in close proximity to a photodetector eliminating the need for a light collection system utilizing mirrors, lenses, or other light collection techniques.

The large flow passage through the sensor allows the sensor to be operated at very low vacuum (< 0.2 inches H2O). It further allows loose tolerances on the sealing of the sensor

because minor leaks will not appreciably affect the flow rate through the sensor. In contrast, current particle sensors typically contain a block with an inlet and exit, but otherwise tightly sealed, referred to as a "flow cell", "sensor chamber", "detector housing", "sensor assembly", or other such name. The approach of this invention allows this block to be eliminated and the entire enclosure for the particle counter to be made of two plastic pieces injection molded to standard tolerances. Operation at low vacuum also permits the use of a low cost axial fan or blower to generate the air flow. The large flow passage also permits the elimination of a nozzle or inlet jet which typically require precise alignment to the beam of light.

In another embodiment of the invention the need to measure the flow via a pressure and/or flow sensor is eliminated by measuring the pulse width of the photo detector output to determine the transit time of the particles through the beam of light and calculate the flow rate.

In another embodiment of the invention a light baffle is placed between the beam of light and the photodetector to improve the particle size resolution.

In another embodiment of the invention a lens is placed between the beam of light and the photodetector to improve the particle size resolution.

Other details of the invention are set forth in the following detailed description and in the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective drawing of a particle sensor constructed according to the principles of the present invention.

FIG. 2 is an exploded view of the apparatus of FIG. 1.

FIG. 3 is a cross section view of the apparatus of FIG. 1 taken through line 3--3 of FIG. 1.

FIG. 4 is a cross section view of the apparatus of FIG. 1 taken through line 4--4 of FIG. 1.

FIG. 5 is a diagrammatic view of the arrangement of the light source, light beam, photodetector, air flow opening and particle scattering.

FIG. 6 is a diagrammatic view of the arrangement of the light source, light beam,

photodetector, air flow opening, light baffle and particle scattering.

DETAILED DESCRIPTION OF THE INVENTION

One embodiment of the invention is illustrated in FIG. 1 which shows a perspective view of particle sensor **10**. FIG. 2 illustrates an exploded view of particle sensor **10** showing that the enclosure is made up of two pieces, an enclosure front **11** and an enclosure back **12** which are held together with screws. Also, a circuit board **20** is attached to the enclosure front **11**. Circuit board **20** has attached to it photodetector **31** and light source **30**. In this embodiment, the light source **30** is a collimated/focused laser beam. In this embodiment, the photodetector **31** is a Silicon PIN photodiode. In this embodiment, circuit board **20** contains circuitry familiar to those skilled in the art which will power the light source **30**, convert the photodetector **31** output to electrical pulses, process those pulses to obtain size and count information, control the fan **50** (shown in FIG. 4), output data for display on the LCD **14** (shown in FIG. 1), monitor switch **13** inputs, and perform all other control and input/output functions for the particle sensor.

FIG. 3 is a section view illustrating the positioning of the light source **30** and photodetector 31 relative to the baffles **15,16**, and **17**. These baffles are molded into the rear enclosure **12** and serve to control stray light and direct air flow within the particle sensor (arrows show the direction of flow). The control of stray light, as is known to those skilled in the art, is important to reduce unwanted output from the photodetector **31**. The baffles **15,16**, and **17** function to reduce stray light reaching the photodetector **31** from outside the particle sensor. In addition, baffles **16** and **17** reduce stray light from the light source **30** by forming what is known to those skilled in the art as a "light trap", "light stop", "beam dump", "beam stop", etc.

FIG 4. is a section view which further illustrates the air flow (shown by arrows) within the particle sensor. The air is drawn in through openings **18** at the top of the enclosure back **12** and exhausted out through openings **19** at the bottom of the enclosure back **12**. In this embodiment, the air flow is created by axial fan **50**. FIG. 4 also illustrates how the baffles **15**, **16** (not shown), and **17** are part of the enclosure back **12** and contact the circuit board **20**.

FIG. 5. is a diagram (not to scale) which shows the positioning of the light source **30**,

the light beam **32**, the photodetector **31**, and the air flow passage **34**. Also shown are particles **33** entrained in the air flow. In the diagram, the direction of air flow is into the page through air flow passage **34**. The area of air flow passage **34** is greater than the area of the light beam **32** under the air flow passage **34** such that only a portion of the particles **33** passing through the particle sensor will traverse the light beam **32**. By way of example, the cross sectional area of the flow passage **34** could be 75 square millimeters, the width of the beam of light **32** could be 0.5 millimeters, and the height of the beam above the photodetector could be 1.0 millimeters, although other geometries are possible. Again, by way of example, with the above geometry, many typical low cost axial fans (60 mm x 60 mm) will produce less than 0.1 inches of pressure drop across the flow passage. As can be seen from the example dimensions and the small size fan of the axial fan, this embodiment permits a compact particle sensor to be constructed.

Continuing with FIG. 5, that portion of particles **33** which traverse the light beam **32** will scatter light as they pass through the beam. A portion of this scattered light is illustrated in FIG. 5 by arrows. As can be seen in FIG. 5, particles near the center of the photodetector **31** will scatter more light onto the photodetector **31** than particles near the edge of the photodetector. The pulse output of the photodetector for a given size particle will tend to be relatively uniform for particles near the center and will drop off rapidly for particles near or beyond the edge of the photodetector **31**.

The rate at which air passing through the particle sensor is sampled for particles is the "effective flow rate" and is less than the actual flow rate of air through the air flow passage **34**. To a first approximation, the effective flow rate is the flow of air through the light beam **32** directly over the photodetector **31**. A more accurate calculation of the effective flow rate can be made by those skilled in the art by using Mie scattering theory, the light beam width, the geometry of the photodetector **31** relative to the light beam **32**, the velocity of the air passing through the light beam, and the sensitivity of the photodetector as a function of the angle of incidence of the scattered light. Alternatively, those skilled in the art may determine the effective flow rate by 1) calibrating the count threshold of the photodetector output to its median response to uniform sized calibration particles, 2) measuring the count rate of the

calibration particles, 3) determining the true concentration per unit volume of air of the calibration particles using a reference particle counter such as a Condensation Nucleus Counter, 4) calculating the effective flow rate by dividing the count rate by the true concentration and multiplying by 2. In this embodiment, the circuit board **20** contains a microprocessor and associated circuitry which, using techniques known to those skilled in the art, determines the count rate by monitoring the output of photodetector **31**. This can be done using either analog, digital, or a mix of methods. The microprocessor then calculates the concentration of particles per unit volume by using the count rate and the effective flow rate. If the speed of the particles through the light beam **32** changes then the effective flow rate will change accordingly. The microprocessor can compensate for any change in flow rate by monitoring the pulse width of the photodetector response pulse and adjusting the value used for the effective flow rate when calculating the particle concentration.

In another embodiment, the particle sensor can control the axial fan or other flow generating device, using techniques known to those skilled in the art, to maintain a nominal pulse width and thus maintain a nominal effective flow rate.

Another embodiment is shown in FIG. 6 which has a light baffle **35** between the light beam **32** and the photodetector **31**. As known by those skilled in the art, the light baffle **35** improves the ability of the particle sensor to resolve particle size by blocking light from the more distant particles.

In another embodiment, a lens (not shown), with or without a light baffle, can be added between the light beam and the photodetector to further improve the particle size resolution.

Although the air flow passage is shown as rectangular in FIG. 5 and FIG. 6 and in a particular size relationship to the light beam **32** and the photodetector **31**, other arrangements are possible including a non-rectangular shape for the air flow passage **34**, an air flow passage **34** narrower than the photodetector **31**, and other geometric configurations.

In an alternate embodiment, which is not described in the prior art, the photodetector output is digitally processed in a manner distinct from that described in patent #5,870,190. In this new method the pulses will be digitized in a manner similar to that described in patent

#5,870,190 but peak detection will not be used to size the particles. Rather, the digitized pulses will essentially be integrated by summing the digital values obtained for each distinct pulse. This summation will be related to the total amount of light scattered by the particle and will be used to determine the particle size.

In an alternate embodiment, the photodetector output is digitally processed in a manner distinct from that described in patent #5,870,190. In this new method the pulses will be digitized in a manner similar to that described in patent #5,870,190 but peak detection will not be used to size the particles. Rather, the digitized output of the photodetector will be continuously monitored to check for a transition through the count threshold and if so a particle will be counted for the size corresponding to that threshold..

Although the description above contains many specificities, these should not be construed as limiting the scope of the embodiment but as merely providing illustrations of some of the presently preferred embodiments. Thus the scope of the embodiments should be determined by the appended claims and their legal equivalents, rather than by the examples given.

CLAIMS: I claim:

1. A particle sensor using scattered light to detect and size particles entrained in air drawn from an environment into the particle sensor, said particle sensor comprising; a beam of light; a photodetector in close proximity to said beam of light; an air flow passage located above said beam of light; an air flow means for generating air flow through the particle sensor; wherein the area of said air flow passage is greater than the area of that portion of said beam of light located under said air flow passage.

2. The particle sensor of claim 1 wherein said air flow means includes an axial fan.

3. The particle sensor of claim 1 wherein the pressure drop across said air flow passage is less than 0.2 inches of H20.

4. The particle sensor of claim 1, further comprising a light baffle located between said beam of light and said photodetector.

5. The particle sensor of claim 4 wherein said air flow means includes an axial fan.

6. The particle sensor of claim 4 wherein the pressure drop across said air flow passage is less than 0.2 inches of H20.

7. A particle sensor using scattered light to detect and size particles entrained in air drawn from an environment into the particle sensor, said particle sensor comprising; a light source generating a beam of light; a photodetector in close proximity to said beam of light; an air flow passage located above said beam of light; an air flow means for generating air flow through the particle sensor; an electronic means for converting the output of said photodetector into pulses and analyzing those pulses for count and size information; wherein the area of said air flow passage is greater than the area of that portion of said beam of light located under said air flow passage.

8. The particle sensor of claim 7 wherein said electronic means calculates the effective flow rate of the particle sensor.

9. The particle sensor of claim 8 wherein said electronic means controls the flow means to regulate the effective flow rate.

10. The particle sensor of claim 7 wherein the entire particle sensor is enclosed in a two piece molded plastic enclosure.

11. A method using scattered light for detecting and sizing particles entrained in an air flow, the method comprising steps of; generating a beam of light; directing said beam of light to pass above a photodetector in close proximity to said photodetector; directing the air flow above the photodetector so that a portion of said air flow intersects a portion of said beam of light in close proximity to said photodetector; analyzing the output of the photodetector to count and size particles in the air flow;

12. The method of claim 11 further comprising the step of calibrating the output of the photodetector by sampling calibration particles of known size;

13. The method of claim 12 further comprising the step of calculating the effective flow rate by comparing the count rate of a calibrated particle sensor with a reference particle counter;

14. The method of claim 11 further comprising the step of measuring the pulse width of the photodetector output and computing the effective flow rate of the particle sensor;

15. The method of claim 12 further comprising the step of measuring the pulse width of the photodetector output and computing the effective flow rate being sampled for particles.;

16. The method of claim 13 further comprising the step of measuring the pulse width of the photodetector output and computing the effective flow rate being sampled for particles;

17. The method of claim 11 wherein the analysis of the photodetector output involves digitizing the photodetector output and summing the values within a pulse to obtain size information on the particle.

18. The method of claim 11 wherein the analysis of the photodetector output involves digitizing the photodetector output and monitoring the values for a transition through a count threshold.

ABSTRACT: A compact, low cost particle sensor utilizing a photodetector (**31**) which directly collects light scattered by particles (**33**) entrained in a fluid traversing a beam of light (**32**). The beam of light (**32**) is aligned such that it is in close proximity to the photo detector (**31**). The beam of light (**32**) is typically provided by a laser and associated focusing/collimating optics. The beam of light (**32**) intersects a portion of the fluid flow permitting a low pressure drop system and fluid flow generated by a low cost, low pressure device such as an axial fan (**50**).

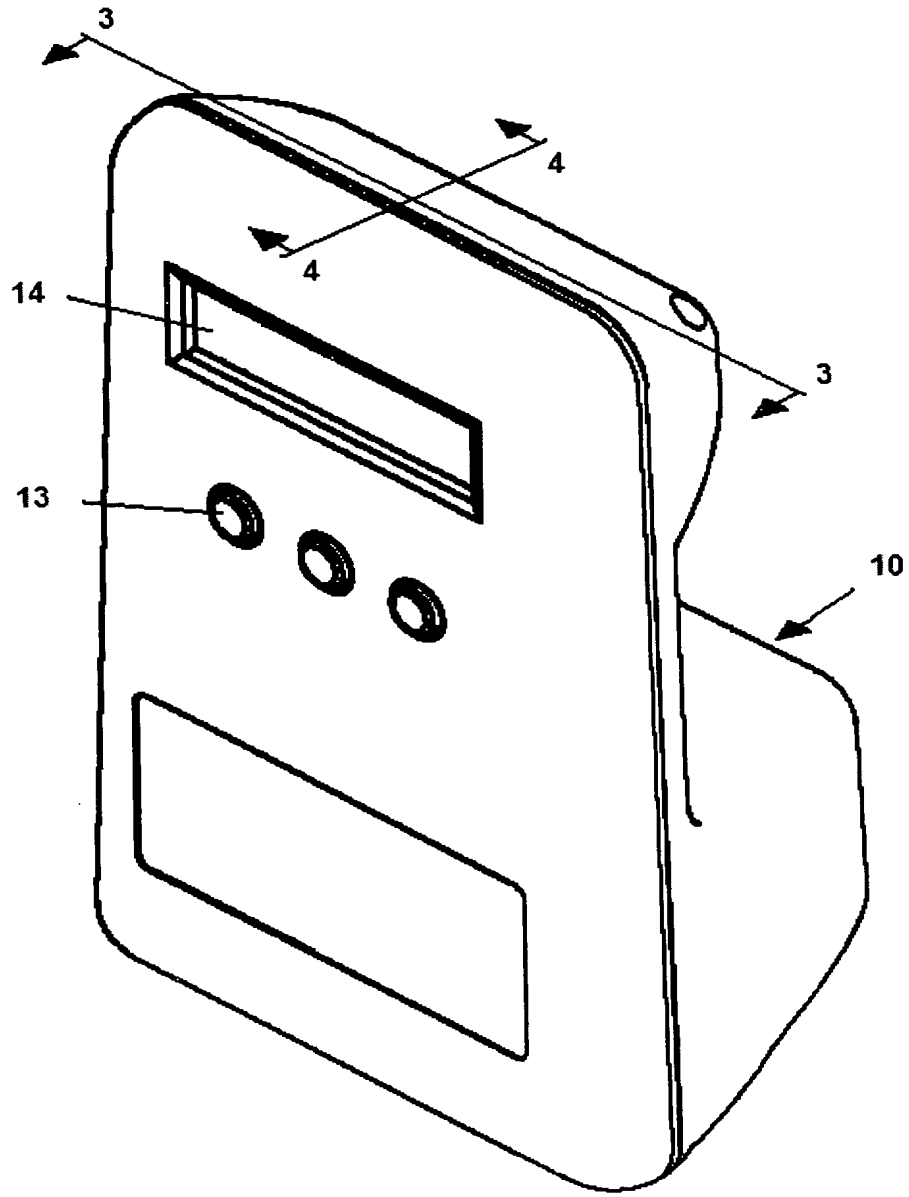


FIG. 1

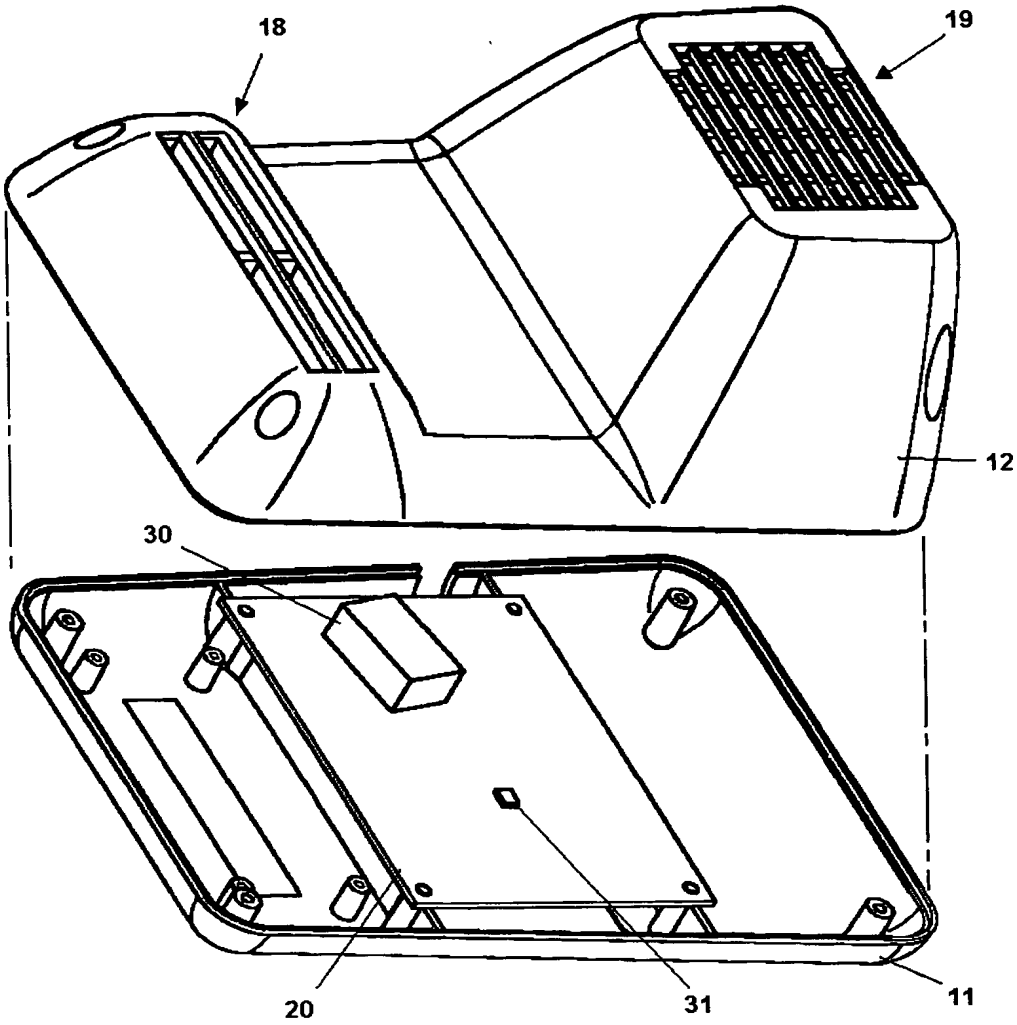


FIG. 2

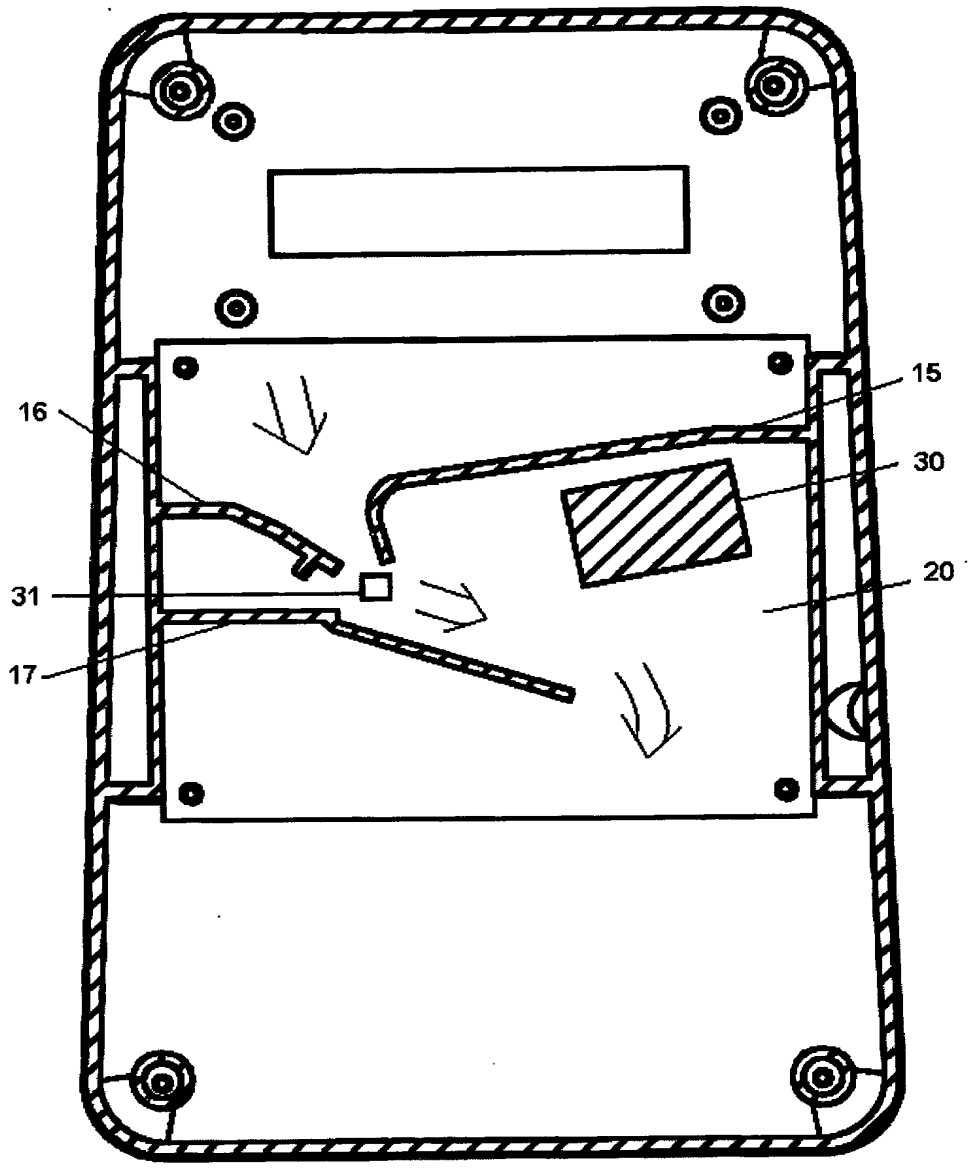


FIG. 3

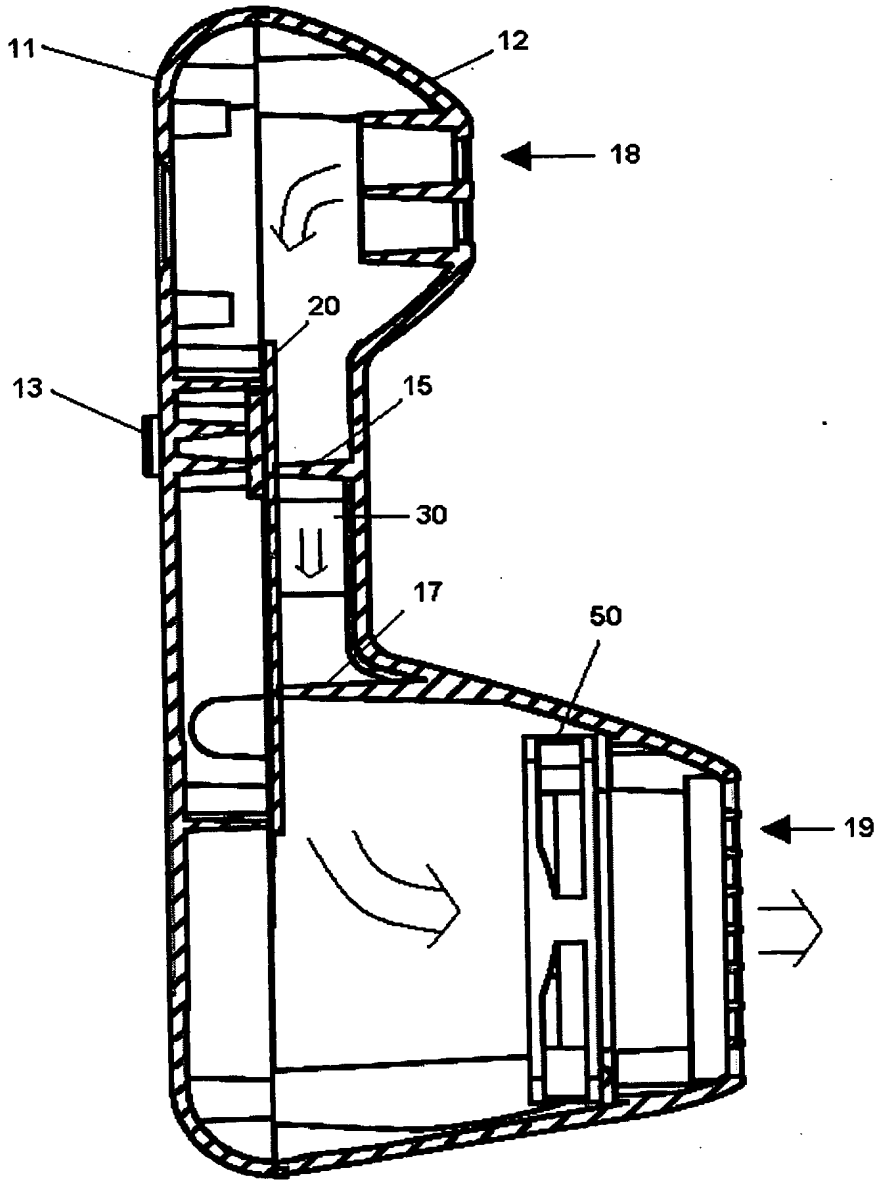


FIG. 4

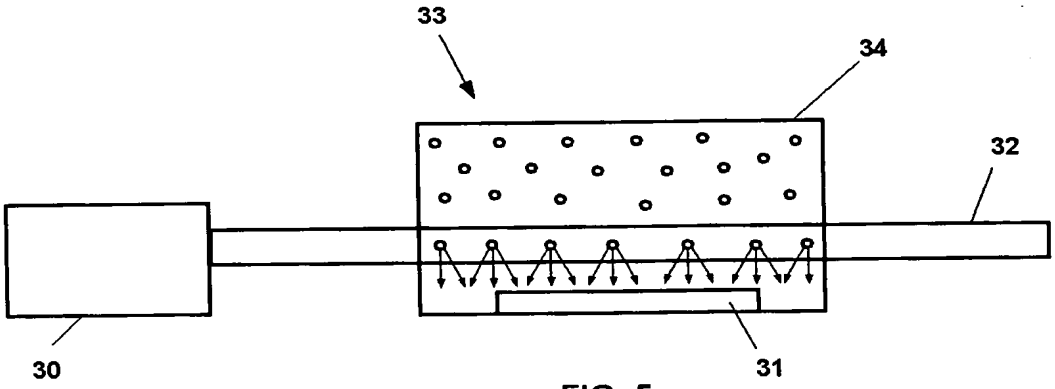


FIG. 5

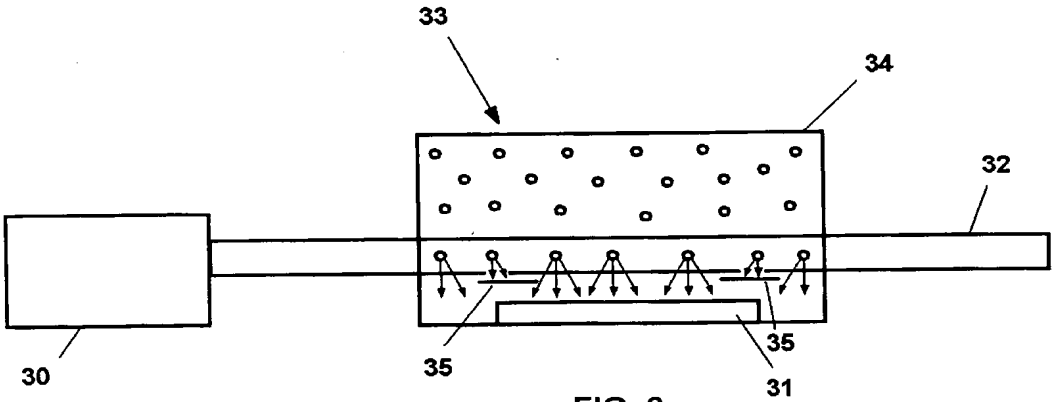


FIG. 6

Doc Code: OATH

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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	ROGER L. UNGER
COMPLETE IF KNOWN	
Application Number	
Filing Date	
Art Unit	
Examiner Name	

I hereby declare that: (1) Each inventor's residence, mailing address, and citizenship are as stated below next to their name; and (2) I believe the inventor(s) named below to be the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

COMPACT, LOW COST PARTICLE SENSOR

(Title of the Invention)

the specification of which

☑ is attached hereto

OR

☐ was filed on (MM/DD/YYYY) _____ as United States Application Number or PCT International Application Number _____ and was amended on (MM/DD/YYYY) _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

Authorization To Permit Access To Application by Participating Offices

☑ If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), and any other intellectual property offices in which a foreign application claiming priority to the above-identified application is filed access to the above-identified patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, or other intellectual property office in which a foreign application claming priority to the above-identified application is filed to have access to the application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the application-as-filed with respect to: 1) the above-identified application, 2) any foreign application to which the above-identified application claims priority under 35 USC 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the above-identified US application, and 3) any U.S. application from which benefit is sought in the above-identified application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing the Authorization to Permit Access to Application by Participating Offices.

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DECLARATION — Utility or Design Patent Application

Claim of Foreign Priority Benefits

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	NO
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

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DECLARATION — Utility or Design Patent Application

Direct all correspondence to: ☐ The address associated with Customer Number: _____ OR ☑ Correspondence address below

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Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available. Petitioner/applicant is advised that documents which form the record of a patent application (such as the PTO/SB/01) are placed into the Privacy Act system of records DEPARTMENT OF COMMERCE, COMMERCE-PAT-7, System name: *Patent Application Files*. Documents not retained in an application file (such as the PTO-2038) are placed into the Privacy Act system of COMMERCE/PAT-TM-10, System name: *Deposit Accounts and Electronic Funds Transfer Profiles*.

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 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

NAME OF SOLE OR FIRST INVENTOR: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])	Family Name or Surname
ROGER L.	UNGER

Inventor's Signature _____ Date 5/12/08

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Mailing Address
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City	State	Zip	Country
RIVERSIDE	CA	92505	USA

☐ Additional inventors or a legal representative are being named on the _____ supplemental sheet(s) PTO/SB/02A or 02LR attached hereto.

PATENT APPLICATION SERIAL NO._____

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

05/14/2008 CNGUYEN2 00000066 12152157

01 FC:2011		155.00 OP
02 FC:2111		255.00 OP
03 FC:2311		105.00 OP

PTO-1556
(5/87)

*U.S. Government Printing Office: 2002- 489-267/69033

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 12152-157

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	$155		N/A	$310
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	$255		N/A	$510
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	$105		N/A	$210
TOTAL CLAIMS (37 CFR 1.16(i))	18 minus 20 =	*	X $25 =		OR	X $50 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*	X $105 =			X $210 =	
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).		$130			$260	
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))			$185			$370	
			TOTAL	515		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 ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $25 =		OR	X $50 =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $105 =		OR	X $210 =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					$185		OR	$370	
					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	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $25 =		OR	X $50 =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $105 =		OR	X $210 =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					$185		OR	$370	
					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.