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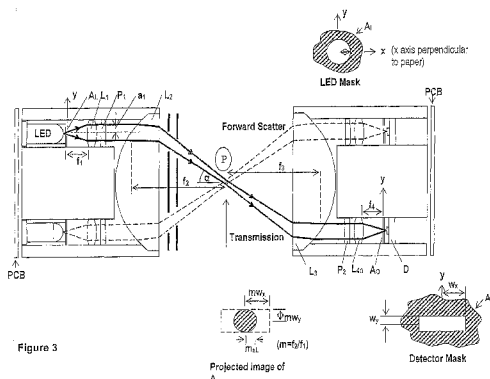
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(54) Title: DEVICE AND METHOD FOR MEASURING SCATTERING OF RADIATION



(57) Abstract: A photometric device for investigating a sample, comprises an array of radiation sources that are spaced apart from one another, and which are operable to generate radiation that differs from that generated by the other radiation sources in the array. The device includes a lens arrangement for focusing the radiation at a region of space where a sample may be located for example by means of a sample holder, and at least one detector for receiving radiation from the region of space. Preferably, a number of detectors are employed that are spaced apart from one another, and especially about an axis of the device, so that one radiation detector can detect radiation transmitted by the sample and the other detectors can detect radiation scattered by it. The radiation sources may be time division multiplexed so that in each time slot the detectors receive radiation originating from each radiation source. In an alternative embodiment, the radiation from the region of space may be transmitted to the sample via a beam homogeniser, for example an optical waveguide in the form of an optical fibre, which may be used to reduce or remove speckle where laser diodes are employed as the radiation sources. The device may be used to determine the particle size distribution of particles in a sample by a method employing Bayesian inference.



**INTERNATIONAL SEARCH REPORT**

International application No  
PCT/GB2009/000259

**A. CLASSIFICATION OF SUBJECT MATTER**  
INV. G01N15/02 G01N21/49 G01J1/08

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
G01N G01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 118 531 A (HERTEL MARTIN [DE] ET AL) 12 September 2000 (2000-09-12)  figure 1	1-11, 13-16, 18-26
A	WO 2007/066113 A1 (UNIV LOUGHBOROUGH [GB]; SIMPSON TERRY ANTHONY [GB]; KUSMARTSEVA OLGA []) 14 June 2007 (2007-06-14) figure 2	1-26
A	US 5 352 901 A (POORMAN RICHARD N [US]) 4 October 1994 (1994-10-04) figures 1-2	1-26
A	US 5 416 580 A (TRAINER MICHAEL N [US]) 16 May 1995 (1995-05-16) figure 5	1-26
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Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*Z\* document member of the same patent family

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## INTERNATIONAL SEARCH REPORT

International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1 063 512 A2 (LASER SENSOR TECHNOLOGY INC [US] METTLER TOLEDO AUTOCHEM INC [US]) 27 December 2000 (2000-12-27) figure 3	1-26
A	US 3 822 095 A (HIRSCHFELD T) 2 July 1974 (1974-07-02) figure 2	1-26
A	US 6 122 042 A (WUNDERMAN IRWIN [US] ET AL) 19 September 2000 (2000-09-19) figure 10	1-26
A	US 6 507 400 B1 (PINA JEAN-CHARLES [US] ET AL) 14 January 2003 (2003-01-14) figure 2a	1-26
X	US 6 373 568 B1 (MILLER PETER J [US] ET AL) 16 April 2002 (2002-04-16) figure 1	27-37, 39-41 38
A	US 6 765 669 B1 (PAWLUCZYK ROMUALD [CA]) 20 July 2004 (2004-07-20) figure 5D	27-41
A	EP 1 275 964 A1 (HAMAMATSU PHOTONICS KK [JP]) 15 January 2003 (2003-01-15) figure 1	27-41
A	WO 95/20811 A1 (SDL INC [US]) 3 August 1995 (1995-08-03) figure 10A	27-41
A	US 6 665 060 B1 (ZAHNISER DAVID J [US] ET AL) 16 December 2003 (2003-12-16) figure 11	27-41
A	US 2005/046850 A1 (CHOW PETER P [US]) 3 March 2005 (2005-03-03) figure 7	27-41
A	EP 0 522 548 A1 (EATON CORP [US]) 13 January 1993 (1993-01-13) figure 1	27-41
A	WO 00/75701 A2 (HUTCHINSON TECHNOLOGY [US]) 14 December 2000 (2000-12-14) figure 3	27-41

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/GB2009/000259

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1.  As all required additional search fees were timely paid by the applicant, this international search report covers allsearchable claims.
  
2.  As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
  
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:  
  
1-41
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

## 1. claims: 1-26

The present application according to claims 1-26 relates to a photometric device comprising an array of radiation sources generating radiation differing from each other e.g. by polarisation or wavelength which direct radiation via a lens arrangement to a region of space and in which radiation returning from the region of space due to e.g. scattering, fluorescence is detected by at least one radiation detector wherein a common objective lens is provided for directing light to or from the region of space whereby the rays pass through different parts of the objective lens which has a hole therethrough to prevent or reduce crosstalk.

## 2. claims: 27-41

The present application according to claims 27-28, 29-41 - relates to a photometric device comprising an array of radiation sources generating radiation differing from each other which directs radiation via a lens arrangement to a region of space and which comprises an optical waveguide such as an optical fibre which extends from the region of space in which the source beams are directed to a volume in which the sample may be located.

## 3. claims: 42-45

The present application according to claims 42-45 relates to a device and method for determining the posterior probability distribution of the mean over time of the particle size distribution by determining a scattering vector  $z$  of particles in the region of space and applying Bayesian inference to said vector using prior information on likely particle size distribution and Mie scattering equations.

## 4. claims: 46-47

The present application according to claims 46-47 relates to a method of determining the posterior probability distribution of the size concentration vector comprising determining a scattering vectors  $z$  and employing a Markov chain Monte Carlo sampling scheme.

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2009/000259

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6118531	A	12-09-2000	NONE
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