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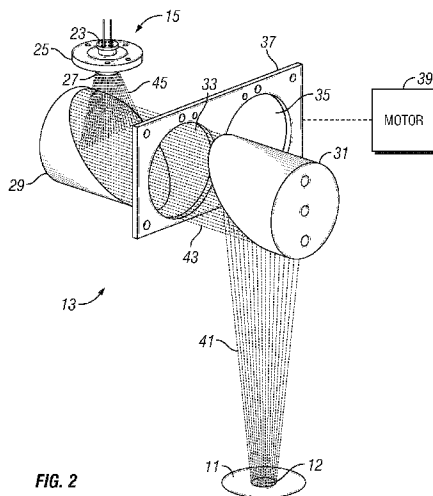


FIG. 2

(57) Abstract: A method and apparatus for the noninvasive detection of a concentration of a substance in a body, such as glucose in the human bloodstream is disclosed. The apparatus measures substance concentration by detecting radiation in the far infrared range emitted by the body using an infrared detected in combination with a set of adequate filters. In order to achieve the accuracy required, the radiation values detected by the detector are corrected for the emissions of the system components. The temperature of each system component including the detector temperature and an ambient temperature is determined using temperature sensors attached to the various system components. These temperatures are correlated with a set of predetermined calibration parameters to correct the detector readings.



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APPARATUS AND METHOD FOR NON-INVASIVE MEASUREMENT OF A SUBSTANCE WITHIN A BODY

BACKGROUND

[0001] The present application relates generally to the non-invasive measurement of various substances in a body, such as the measurement of the concentration of glucose in the human body and, more specifically, to a far infrared detection system to analyze and determine, non-invasively, the concentration of a substance in a body.

[0002] Spectroscopic techniques using infrared (“IR”) radiation are known in the prior art and have been widely used for non-invasive measurement of the concentration of substances of interest in a body. One area of particular interest is the use of these techniques for the non-invasive measurement of the concentration of glucose and other constituents of the human bloodstream.

[0003] The infrared spectra includes the near infrared (approximately 1 to 3 microns), the middle infrared (approximately 3 to 6 microns), the far infrared (approximately 6 to 15 microns), and the extreme infrared (approximately 15 to 100 microns). Typical prior art glucose and other non-invasive blood constituent measuring devices operate in the near infrared regions where the absorption of infrared energy by glucose and other blood constituents is relatively low. However, it is known that glucose and other blood constituents have strong and distinguishable absorption spectra in both the middle and far infrared regions.

[0004] It has been found in a far infrared detection system that the resolution of the system should be equivalent to 0.01°C to provide sufficiently accurate measurements. At this high level of accuracy, the blackbody emission of any component of the system (mirrors, filters, field limiters, detector, for example) can cause perturbations in the measurement. The conventional solution to such a problem is to cool the system to a cryogenic temperature (-180°C, for example), and have the system sealed and filled with dry nitrogen to avoid moisture accumulation. However, for a consumer product, such a solution is impractical and expensive.

SUMMARY

[0005] The present application discloses a far infrared system to analyze and determine, non-invasively, the concentration of a substance in a body. In accordance with one embodiment, an apparatus for the non-invasive measurement of a substance within a body includes a detector for sensing radiation emitted or remitted from a body, a human body, for example. An optical system is provided and aligned to focus IR radiation emitted by the body on a sensitive area of the detector.

[0006] Each element of the system within the field of view of the detector and the detector itself has a temperature measuring device such as a thermistor attached to it for the purpose of measuring its temperature. For the detector to accurately measure the energy radiated by the body, the system is calibrated to compensate for the effect of the temperature of each element in the detector field of view. Using a heating or heating/cooling unit for each element separately, the temperature of each element can be varied for the purpose of calibration while the temperatures of the other elements of the system remain stable. This process is repeated many times in various ambient temperatures and various body temperatures in order to calibrate the effect of each element on the measurement in all ranges of conditions relevant for the measurement.

[0007] This procedure is repeated for each element in the field of view of the detector yielding a look-up table ("LUT") representing the contribution of each element to the detector's measurement. The perturbations due to the temperature of each of the system elements are taken into account in each measurement, thereby enabling the system to obtain a high level of accuracy.

[0008] During the creation and build-up of the LUT, it was found that the temperature effect of a baffle used to limit the field of view of the detector is 10:1 relative to the body reading. Calibration alone cannot compensate for such a significant effect.

[0009] The solution in the far infrared region is to reduce the emissivity of the baffle by enhancing its reflectivity. However, enhancing the reflectivity of the baffle creates an additional problem of reflecting stray energy to the detector. A spherical baffle was designed with an internal surface, *i.e.*, the surface of the baffle opposite the detector, that is polished and gold-plated to lower the emissivity. The baffle design eliminates any reflection or multiple reflections from reaching the sensitive area of the detector.

[0010] The base plate that the detector and the baffle are mounted on and the baffle have substantially the same temperature as the detector. The base plate and the outer surface of the baffle are designed as a radiation trap having a dull black surface providing an emissivity of about 97%.

[0011] The design of the system optics creates an image of the detector sensitive area on the surface of the body in order to collect the IR radiation emitted or remitted from the body. The area on the surface of the body subtended by the image of the detector sensitive area is critical since the detector is averaging the IR radiation emitted or remitted from this area.

[0012] In accordance with another embodiment, the present optical apparatus comprises two changeable optical filters, a first mirror positioned to a first side of the optical filter, and a second mirror positioned to a second side of the optical filter opposite the first mirror. A detector is positioned to the second side of the optical filter. A baffle partially surrounds a sensitive surface of the detector. Temperature-measuring devices are configured to measure the temperature of the baffle, mirrors and filters. The first mirror is configured to receive IR radiation from a measured surface of the body, collimate the IR radiation to a beam, and reflect the collimated IR beam toward and through the optical filter. One of the optical filters is configured to filter out a portion of the collimated IR beam having wavelengths that fall outside a selected bandwidth, and the second optical filter is configured to filter out a portion of the collimated IR beam having wavelengths that fall within a selected bandwidth. The filters are changeable by a motorized mechanism, and each IR radiation measurement consists of at least one measurement with one filter and a second measurement with the second filter. The second mirror is configured to receive the collimated and filtered IR beam and reflect it toward the detector. The baffle is configured to block stray IR radiation so that it does not reach the detector sensitive area.

[0013] Each of the two radiation measurements is then corrected to eliminate the effect of the emission of the system elements on the measurement. The ratio of the two radiation measurements after the correction and normalization for a black body reading is correlated to the concentration of the desired substance in the body, such as the concentration of glucose in the bloodstream of a human body, for example.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The following figures, in which like numerals indicate elements, form part of the present specification and are included to further demonstrate certain aspects of the present invention. The invention may be better understood by reference to one or more of these figures in combination with the detailed written description of specific embodiments presented herein.

[0015] Fig. 1 illustrates a block diagram of a system for the non-invasive measurement of the concentration of a substance in a body;

[0016] Fig. 2 is a perspective view of the optical and detector apparatus of Fig. 1 illustrating the path of travel for electromagnetic rays between the body and the detector;

[0017] Fig. 3 is a perspective view of the detector of Figs. 1 and 2;

[0018] Fig. 4 is a perspective view of the optical and detector apparatus of Fig. 2, showing the locations on the various elements of the optical and detector apparatus of the temperature measurement devices; and

[0019] Figs. 5 and 6 are cross-sectional views of the detector and baffle of the optical and detector apparatus shown in Fig. 2.

[0020] These and other embodiments of the present application will be discussed more fully in the description. The features, functions, and advantages can be achieved independently in various embodiments of the claimed invention, or may be combined in yet other embodiments.

DETAILED DESCRIPTION

[0021] One or more illustrative embodiments are described below. Not all features of an actual implementation are necessarily described or shown for the sake of clarity.

[0022] Referring now to Fig. 1, a block diagram of a system 10 for the non-invasive measurement of the concentration of a substance in a body is shown. Infrared (“IR”) radiation emitted or reflected from the surface of a body 11 is collected and collimated by optics subsystem 13 and focused on IR detector assembly 15. The body 11 is the source of the IR radiation being measured by the system 10. The body 11 is typically a portion of a surface of a body of interest, such as a human body, for example. The optical subsystem 13 includes at least two changeable filters 33, 35, as shown in Fig. 2, that allow two different wavelength bandwidth signals, the first including a characteristic wavelength of a desired substance, such as glucose, for example, to be measured, the second being a portion of the emitted radiation not including the substance characteristic wavelength to be used as a reference signal.

[0023] The detector assembly 15 senses both signals and provides an output voltage that is proportional to the intensity of each of the two signal measurements to the microprocessor 17. Temperature sensors, as shown in Fig. 4, provide the temperatures of the various optical subsystem and detector assembly components and the ambient temperature to the microprocessor 17 via lines 2, 6, and 8 and a look up table (“LUT”) 21. In a calibration process, the temperature of each of the optical subsystem and detector assembly components is varied while the temperature of the remaining system components is held stable to provide a set of calibration parameters that are stored in the LUT 21.

[0024] The microprocessor 17 uses the set of predetermined calibration parameters to correct each of the two radiation measurements to eliminate the effect of the emission of the system elements on the measurement. The ratio of the two radiation measurements after the correction and normalization for a black body reading is correlated to the concentration of the desired substance in the body, such as the concentration of glucose in the bloodstream of a human body, for example. The result is then provided to an output device 19, such as an LCD or LED video monitor, for example.

[0025] Referring now also to Fig. 2, a schematic perspective view of the configuration of the optical and detector components of the system 10 shown in Fig. 1, illustrating the path of travel for IR rays between the body 11 and the detector 15 is shown. The detector 15 includes the detector element 23, detector base 25 and a baffle 27. The configuration of the optical and detector components is designed such that an image 12 of the sensitive or active area 47 of the detector 15 (as shown in Fig. 3) is created at the body 11 on the focal plane of mirror 31.

[0026] The area of image 12 preferably has a diameter approximately 6 mm. IR radiation emitted from or reflected by the body 11 at image 12 in beam 41 is collected and collimated by mirror 31. The IR radiation is reflected by mirror 31 and propagated to mirror 29 in a collimated beam 43 of parallel rays via filter 33 or filter 35. The focal plane of mirror 29 is located at the surface of the sensitive area 47 of the detector assembly 15. The beam 43 reaching mirror 29 is reflected and propagated as beam 45 and focused at the focal plane of mirror 29 incident on the detector assembly 15 sensitive area 47.

[0027] The detector assembly 15 is partially surrounded by a baffle 27 on the side facing the mirror 29. The baffle 27 insures that substantially only beam 45 is incident only on the sensitive area 47. Baffle 27 also blocks any stray radiation from reaching the sensitive area 47 of

detector assembly 15. Thus, the optical subsystem 13 is aligned such that the image 12 is positioned at the surface of body 11 and the beam 41 of IR radiation is incident on the sensitive area 47 of detector assembly 15 via mirror 31, filter 33 or filter 35 and mirror 29.

[0028] In one embodiment, mirrors 29 and 31 are preferably ninety-degree (90°) off-axis parabolic mirrors coated with gold or other suitable reflective material. Preferably mirror 29 will have a focal length of about one (1) inch and mirror 31 will have a focal length of about three (3) inches. Other suitably designed reflective mirrors may be used for the optical subsystem 13 such as ellipsoid mirrors or a combination of ellipsoid and hyperbolic mirrors, for example.

[0029] Filter 33 and filter 35 are mounted in frame 37, frame 37 being positioned between mirror 29 and mirror 31. The filters 33, 35 are switched between positions intercepting the beam 43 using a suitable driving mechanism, such as a motor or pneumatic pressure, for example, coupled to frame 37. In one embodiment, motor 39 is coupled to the frame 37 and positions the frame 37 between the mirror 29 and mirror 31 such that the desired filter 33, 35 intercepts the beam 43. One of the filters, filter 33, for example, will preferably be a narrow band filter passing the wavelengths of the spectral characteristic of the substance being measured. The other filter, filter 35, for example, will preferably be a narrow band filter passing those wavelengths of a spectral characteristic not sensitive to the substance being measured. For example, in some embodiments, filter 33 will limit the bandwidth to that region of the spectrum where there is no emission for the substance being measured (for glucose, for example, the bandwidth would be 10.5 μ -15 μ), while filter 35 would have a bandwidth characteristic of the emission of the substance being measured (for glucose, the bandwidth would be 8.5 μ -10.5 μ).

[0030] Referring now also to Fig. 3, a perspective view of the detector element 23 shown in Figs. 1 and 2 is illustrated. Any suitable IR detector responsive to the desired wavelengths of interest may be used. The detector element 23 includes a chip providing the IR sensitive material forming the detector sensitive area 47. The chip, or sensitive area 47, is enclosed in a case 51 and mounted to a base 53. The case 51 has an appropriately-sized opening forming a window 49 in its top surface to allow the IR radiation to reach the sensitive area 47. The window 49 is covered by a material transparent to the radiation of interest, such as silicon or other suitable material. Leads 55 connect the detector element 23 to the microprocessor 17 and other circuitry. In one embodiment, a passive IR sensor known as a thermopile detector is used. Thermopile detectors respond to IR power emitted by an object in its field of view by producing

a voltage that is proportional to incident power. One suitable thermopile detector is manufactured by Dexter Research Corporation (part number ST150). The thermopile detector used in one embodiment has a sensitive area 47 with dimensions of 1.5mm x 1.5mm and a window 49 of silicon.

[0031] Referring now also to Fig. 4, a perspective view of the optical subsystem 13 and detector assembly 15 of Fig. 2 is shown, illustrating suitable locations on the various elements of the optical subsystem and detector assembly where temperature measurement devices may be located. Each element of the optical subsystem and detector assembly will emit electromagnetic radiation including IR radiation as a function of its temperature. In order to achieve the resolution necessary to produce an accurate measurement of the desired substance, the emission of each element in the system is preferably taken into account.

[0032] Each element of the optical subsystem 13 within the field of view of the detector assembly 15, as well as the detector assembly 15, includes one or more suitable temperature sensing devices mounted at suitable locations on the element to accurately measure the temperature of the element. In one embodiment, thermistors are used as the temperature measuring devices. A thermistor is a temperature dependent resistor typically composed of a semiconductor material. The resistance of a thermistor is inversely proportional to temperature, *i.e.*, as the temperature increases, its resistance decreases. While other suitable temperature sensors can be used, thermocouples, for example, typically a thermistor provides a greater output voltage.

[0033] In the embodiment shown in Fig. 4, thermistor 61 is located internally to the detector assembly 15 to measure the temperature of the cold junction where a thermopile detector is used. Thermistor 63 measures the temperature of the baffle 27. Thermistors 65 and 67 measure the temperature of mirror 29, and thermistors 71 and 73 measure the temperature of mirror 31. Two thermistors are used for each mirror due to the size and mass of the mirrors. Thermistor 69 measures the temperature of the filters 33, 35 and of frame 37 assembly. Thermistor 75 measures the ambient room temperature. The temperature of each element is matched with a set of predetermined calibration parameters stored in LUT 21 together with the temperature of detector 15, ambient temperature, and the temperature of body 11, to compensate for any perturbations in a substance concentration measurement due to the temperatures of the various optical subsystem and detector assembly elements.

[0034] Referring now also to Fig. 5, a cross-sectional view of the detector assembly 15 and baffle 27 of the optical and detector apparatus of Fig. 2 is shown. In the illustrated embodiment, detector element 23 is held by a retainer ring 81 in thermal contact with detector base 25. Baffle 27 is attached to the detector base 25 with fasteners 26, establishing good thermal contact between the detector element 23, ring 81, detector base 25, and baffle 27. The inner surface 83 of baffle 27 is preferably gold-coated and polished to create a mirror. The inner surface 83 of baffle 27 is designed to have a very low emissivity and high reflectivity. The shape of the inner surface 83 of baffle 27 is designed to minimize or prevent any reflection or multi-reflection of radiation from incident on the sensitive area 47 of the detector element 23.

[0035] In one embodiment, the inner surface 83 of baffle 27 forms a spherical surface, the center of the sphere coinciding with the center of the detector sensitive area 47, enclosing the detector element 23. An opening 95 is formed in the portion of the sphere over and opposite the sensitive area 47. The dimensions of the opening 95 are sufficient to allow the beam 45 (as shown in Fig. 2) to be incident on the sensitive area 47 and minimize or prevent any stray radiation from reaching the detector sensitive area 47. The front surface 89 of the detector element 23, the exposed surface 87 of retainer ring 81 and the exposed portion 85 of detector base 25 within the sphere are coated with a suitable material, such as a suitable black coating, for example, to create a radiation trap for any stray radiation. Thermistor 63 measures the temperature of the baffle 27 to enable compensation for its emission effects on the substance concentration measurements.

[0036] Referring now also to Fig. 6, a cross-sectional view of the detector assembly 15 and baffle 27 of the optical and detector apparatus of Fig. 2 according to another embodiment is shown. In this embodiment, as described above with reference to paragraph 0028 and Fig. 2, mirrors 29 and 31 are preferably ninety-degree (90°) off-axis parabolic mirrors coated with gold or other suitable reflective material. The inner surface 83 of baffle 27 preferably forms a spherical surface having the center 99 of the sphere positioned off center with respect to the center 97 of the detector sensitive area 47. An opening 95 is formed in the portion of the sphere over and opposite the sensitive area 47. Since the maximum of the IR energy distribution of an off-axis mirror is off center, the position of the center 99 of the baffle opening 95 is also offset from the center 97 of the detector sensitive area 27 to provide maximum IR energy collection. The dimensions of the opening 95 are sufficient to allow the beam 45 (as shown in Fig. 2) to be

incident on the detector sensitive area 47 and minimize or prevent any stray radiation from reaching the detector sensitive area 47.

[0037] Although the invention has been described in terms of certain embodiments, other embodiments that are apparent to those of ordinary skill in the art, including embodiments which do not provide all of the features and advantages set forth herein, are also within the scope of this invention. Accordingly, the scope of the invention is defined by the claims that follow.

WHAT IS CLAIMED IS:

1. A system for non-invasive measurement of a substance within a body, comprising:
a detector configured to sense radiation emitted or remitted from a body;
an optical subsystem configured to focus the radiation on a sensitive area of the detector;
and
one or more temperature sensors attached to one or more of a plurality of elements of the optical subsystem and to the detector.
2. The system of Claim 1, wherein the temperature of one or more of the plurality of optical subsystem elements and the temperature of the detector are matched with a set of predetermined compensation parameters stored in a look-up table for compensating for an effect on the non-invasive measurement of the temperature of each of the one or more of the plurality of elements and the detector, an ambient temperature and a temperature measured at a surface of the body.
3. The system of Claim 1, wherein the detector comprises an infrared energy sensor.
4. The system of Claim 3, wherein the infrared energy sensor comprises a thermopile detector.
5. The system of Claim 1, wherein the optical subsystem comprises one or more mirrors configured to focus the radiation on the sensitive area of the detector.
6. The system of Claim 5, wherein the optical subsystem comprises at least two ninety degree (90°) off-axis parabolic mirrors.
7. The system of Claim 5, wherein the optical subsystem comprises at least two mirrors including at least one attenuation filter disposed between the two mirrors for attenuating radiation in a selected wavelength band.
8. The system of Claim 5 wherein the optical subsystem two attenuation filters mounted on a moveable frame disposed between the two mirrors.
9. The system of Claim 8 wherein the two attenuation filters comprise a first bandpass filter for attenuating radiation in a first selected wavelength band, the first selected wavelength band

including at least one wavelength characteristic of the substance and a second bandpass filter for attenuating radiation in a second selected wavelength band, the second selected wavelength band minimizing wavelengths characteristic of the substance.

10. Apparatus for non-invasive measurement of a substance within a body, the apparatus comprising:

a detector for sensing radiation emitted or remitted from a body;

optics configured to focus the radiation on a sensitive area of the detector; and

a baffle attached to and in thermal contact with the detector, the baffle being disposed to at least partially surround a detector sensitive area and configured to minimize the incidence of stray radiation on the detector sensitive area,

wherein an interior surface of the baffle opposite the detector has a high reflectivity and low emissivity, the interior surface of the baffle being formed to minimize the incidence of radiation reflection or multi-reflection on the detector sensitive area.

11. The apparatus of Claim 10, further comprising one or more temperature sensors attached to one or more of a plurality of elements of the optics and to the detector.

12. The apparatus of Claim 11, wherein the temperature of the one or more of the plurality of optics elements and the temperature of the detector are matched with a set of predetermined compensation parameters stored in a look-up table for compensating for an effect on the non-invasive measurement of the temperature of each of the one or more of the plurality of optics elements and the detector, an ambient temperature and a temperature measured at a surface of the body.

13. The apparatus of Claim 10, wherein the interior surface of the baffle constitutes a portion of a sphere surrounding the detector, a portion of the baffle above and opposite the sensitive area of the detector having an opening allowing the radiation to reach the sensitive area of the detector.

14. The apparatus of Claim 13, wherein an exterior surface of the baffle being coated with a suitable black coating for absorbing stray radiation.

15. A method of noninvasively measuring a concentration of a substance in a body using an apparatus including a detector and an optical system, the method comprising the steps of:

detecting an infrared radiation value emitted by the body in a wavelength range including at least one wavelength characteristic of the substance;

measuring the temperature of the detector and one or more components of the optical system; and

correlating the temperatures of the detector and the one or more components of the optical system with a set of predetermined calibration parameters to correct the detected infrared radiation value for the effects of the emission of each of the detector and the one or more components of the optical system.

16. A method as in Claim 15, further comprising the step of measuring the ambient temperature.

17. A method as in Claim 16, further comprising the step of measuring the temperature of the body.

18. A method as in Claim 15, further comprising the step of limiting the wavelength range of the detected infrared radiation value.

19. A method as in Claim 18, further comprising the step of limiting the wavelength range of the detected infrared radiation value to a first wavelength range including at least one wavelength characteristic of the substance to provide a first detected radiation value, and limiting the wavelength range of the detected infrared radiation value to a second wavelength range wherein wavelengths characteristic of the substance are minimized to provide a second detected radiation value.

20. A method as in Claim 19, wherein the first wavelength range comprises 8.5 μ to 10.0 μ and the second wavelength range comprises 10.5 μ to 15.0 μ .

21. A method as in Claim 19, further comprising the steps of:

correcting the first and second detected radiation values for the effects of the emission of each of the detector and the one or more components of the optical system;

normalize the first and second detected radiation values for a blackbody reading; and

correlating the ratio of the first and second detected radiation values to the concentration of the substance in the body.

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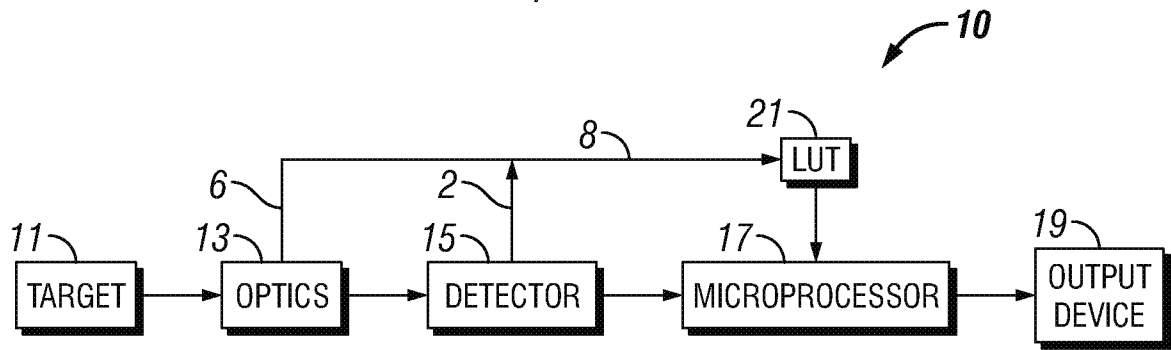


FIG. 1

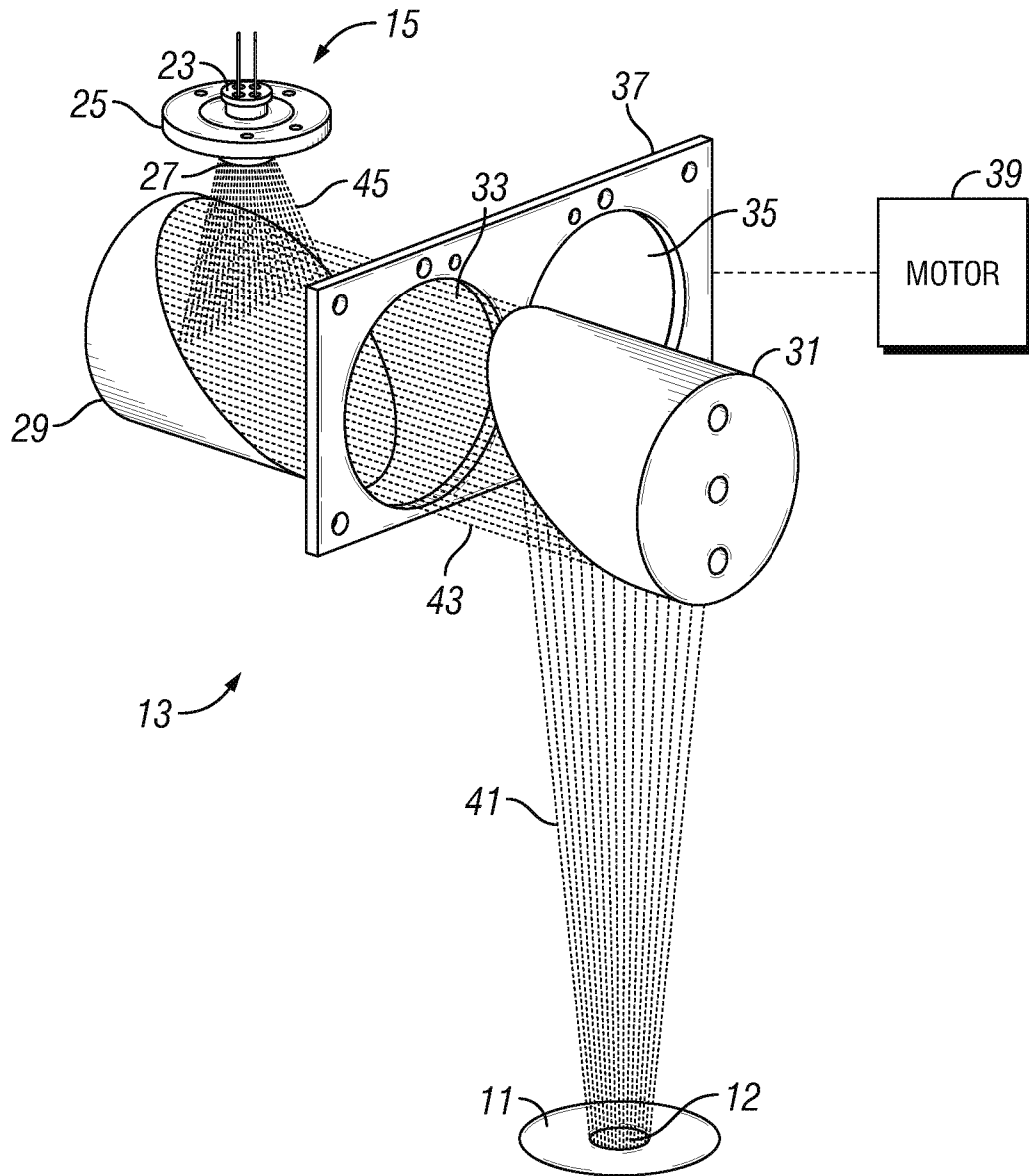


FIG. 2

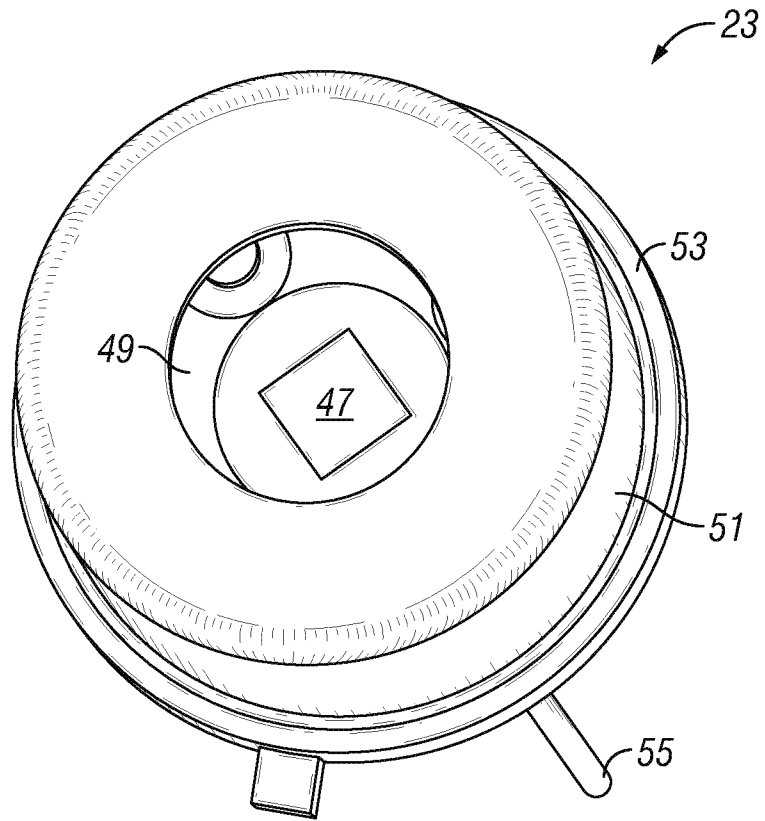


FIG. 3

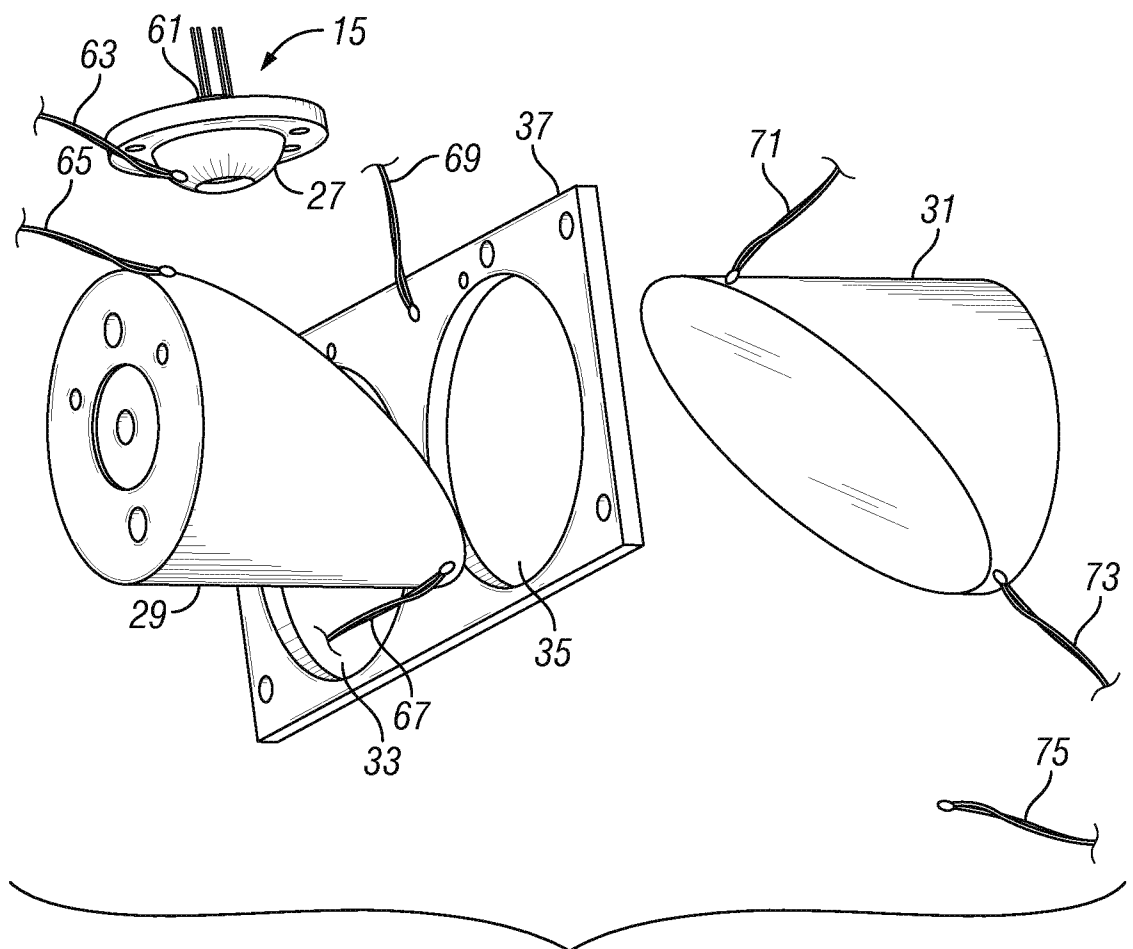


FIG. 4

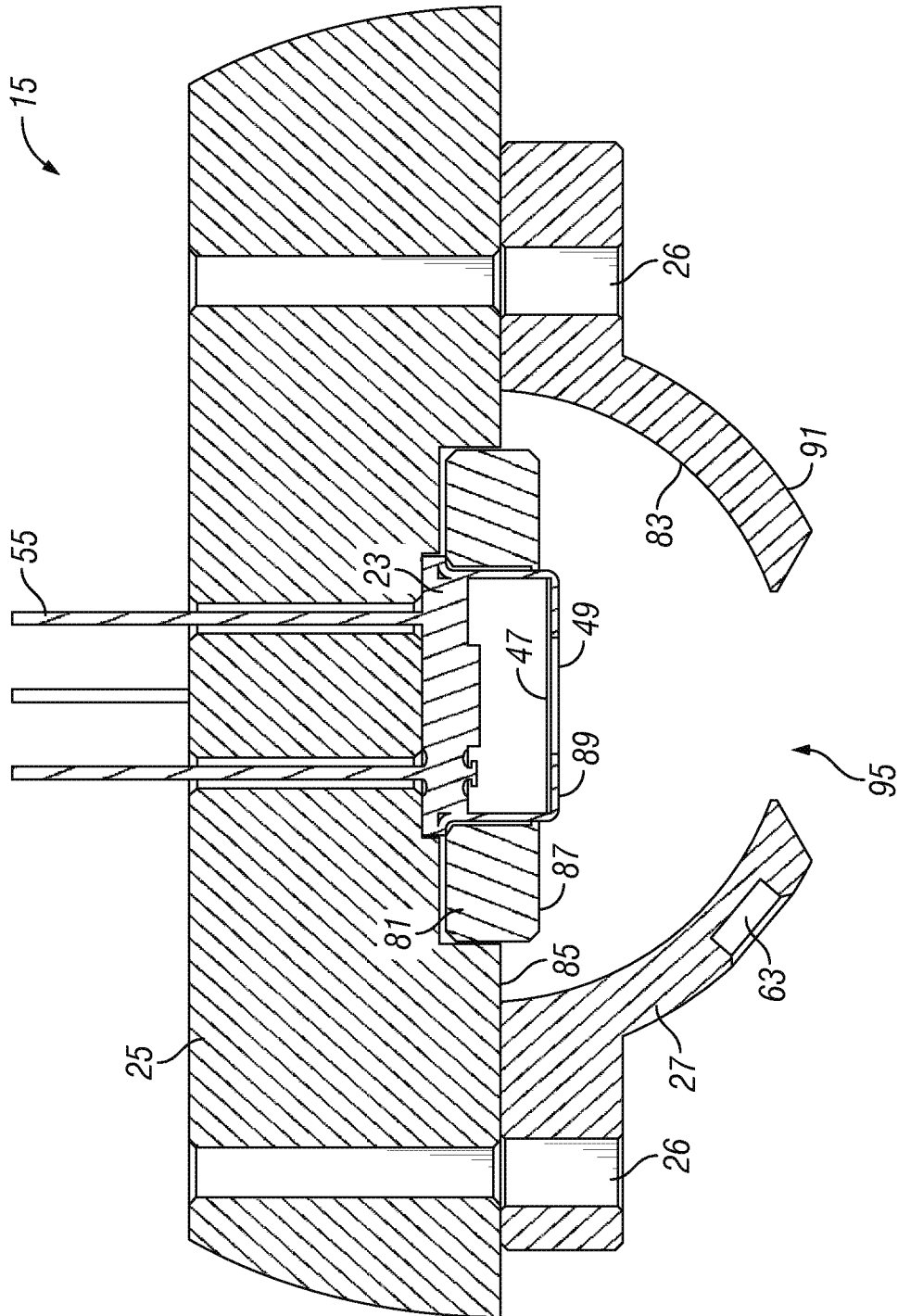


FIG. 5

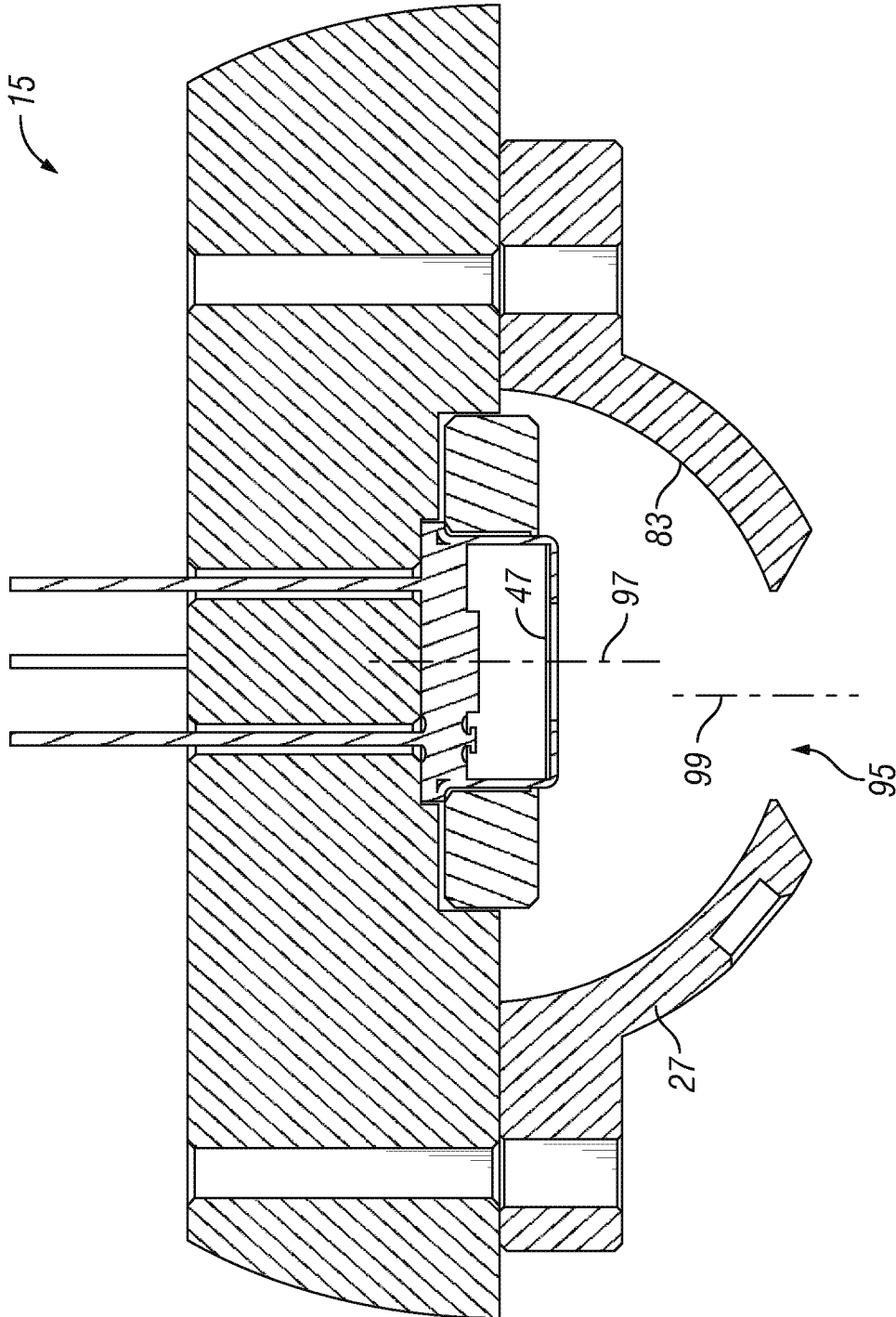


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2010/050901

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61B5/00
ADD.

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)
A61B G01N

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 2005/043630 A1 (BUCHERT JANUSZ MICHAL [US]) 24 February 2005 (2005-02-24) paragraphs [0033], [0037], [0039] - [0055]; claims; figures -----	1-6, 10-13, 15-21
X	US 2009/259407 A1 (GERLITZ JONATHAN [IL]) 15 October 2009 (2009-10-15) paragraphs [0029] - [0044]; claims; figures -----	1-4, 15-21
X	US 2008/269580 A1 (BALISTRERI MARCELLO LEONARDO MARIO [NL] ET AL) 30 October 2008 (2008-10-30) the whole document ----- -/--	1-3,5-9, 15-19,21

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents :

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"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</p> <p>"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</p> <p>"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.</p> <p>"&" document member of the same patent family</p>
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Date of the actual completion of the international search 16 March 2011	Date of mailing of the international search report 23/03/2011
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Crisan, Carmen-Clara
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INTERNATIONAL SEARCH REPORT

International application No

PCT/US2010/050901

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 1 568 309 A1 (HITACHI LTD [JP]) 31 August 2005 (2005-08-31) paragraphs [0030] - [0033], [0042] - [0072], [0080] - [0093]; claims; figures -----	1-9, 15-21
X	EP 0 160 768 A1 (BATTELLE MEMORIAL INSTITUTE [CH]) 13 November 1985 (1985-11-13) page 8 - page 14; claims; figures 1,2 -----	10,13,14
A	US 3 770 958 A (KRAKOW B) 6 November 1973 (1973-11-06) column 2, line 57 - column 3, line 54 column 6, line 15 - column 7, line 43 -----	10-14
A	US 2005/033186 A1 (NORDSTROM ROBERT [US] ET AL) 10 February 2005 (2005-02-10) paragraphs [0019], [0040] - [0047] -----	10-14
A	US 2004/257557 A1 (BLOCK MYRON J [US]) 23 December 2004 (2004-12-23) paragraphs [0013] - [0035] -----	10-14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2010/050901

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

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

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

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

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

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

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

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-9, 15-21

System and method for non-invasive measurement of a substance within a body including focusing means

2. claims: 10-14

Apparatus for non-invasive measurement of a substance within a body including a baffle in thermal contact with a radiation detector to minimize stray radiation

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2010/050901

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专利名称(译)	用于非侵入式测量身体内物质的装置和方法		
公开(公告)号	EP2493369A1	公开(公告)日	2012-09-05
申请号	EP2010765885	申请日	2010-09-30
[标]申请(专利权)人(译)	格鲁科威斯塔有限公司		
[标]发明人	GERLITZ YONATAN		
发明人	GERLITZ, YONATAN		
IPC分类号	A61B5/00		
CPC分类号	A61B5/0086 A61B5/14532 A61B2560/0252 G01J3/021 G01J3/0262 G01J3/0286 G01J3/28 G01J3/42 G01J2005/068 G01N21/314 G01N21/3581 G01N2021/3188		
代理机构(译)	LUCAS , BRIAN RONALD		
优先权	12/607903 2009-10-28 US		
外部链接	Espacenet		

摘要(译)

公开了一种用于非侵入性地检测体内物质浓度的方法和装置，例如人血液中的葡萄糖。该装置通过使用结合一组适当的滤光器检测到的红外线检测由身体发射的远红外线范围内的辐射来测量物质浓度。为了获得所需的精度，由检测器检测的辐射值针对系统组件的发射进行校正。使用连接到各种系统组件的温度传感器确定包括检测器温度和环境温度的每个系统组件的温度。这些温度与一组预定的校准参数相关，以校正检测器读数。