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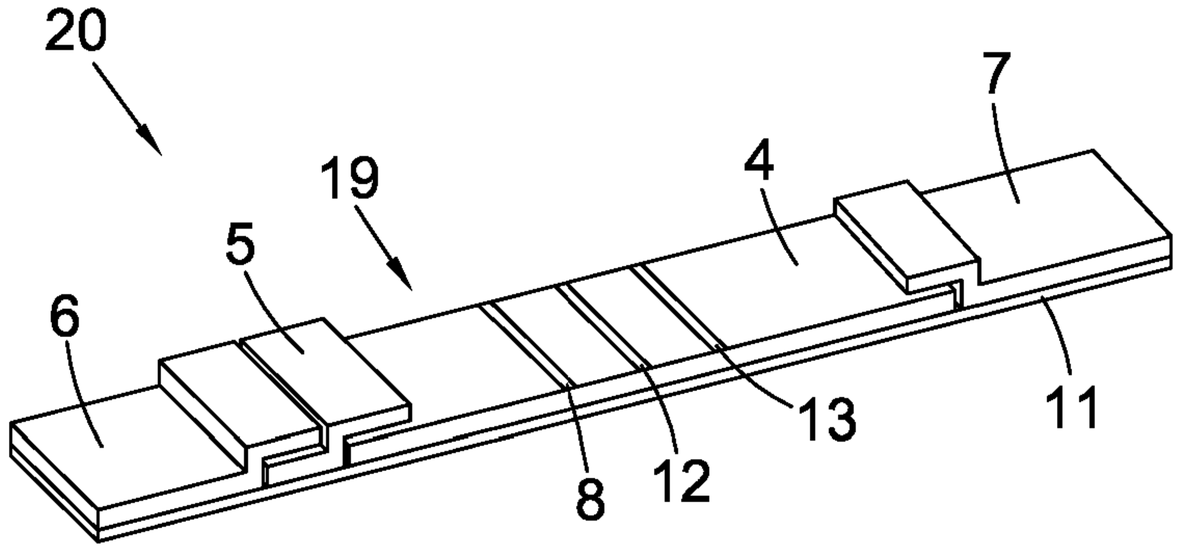

Fig. 1

16
08 09

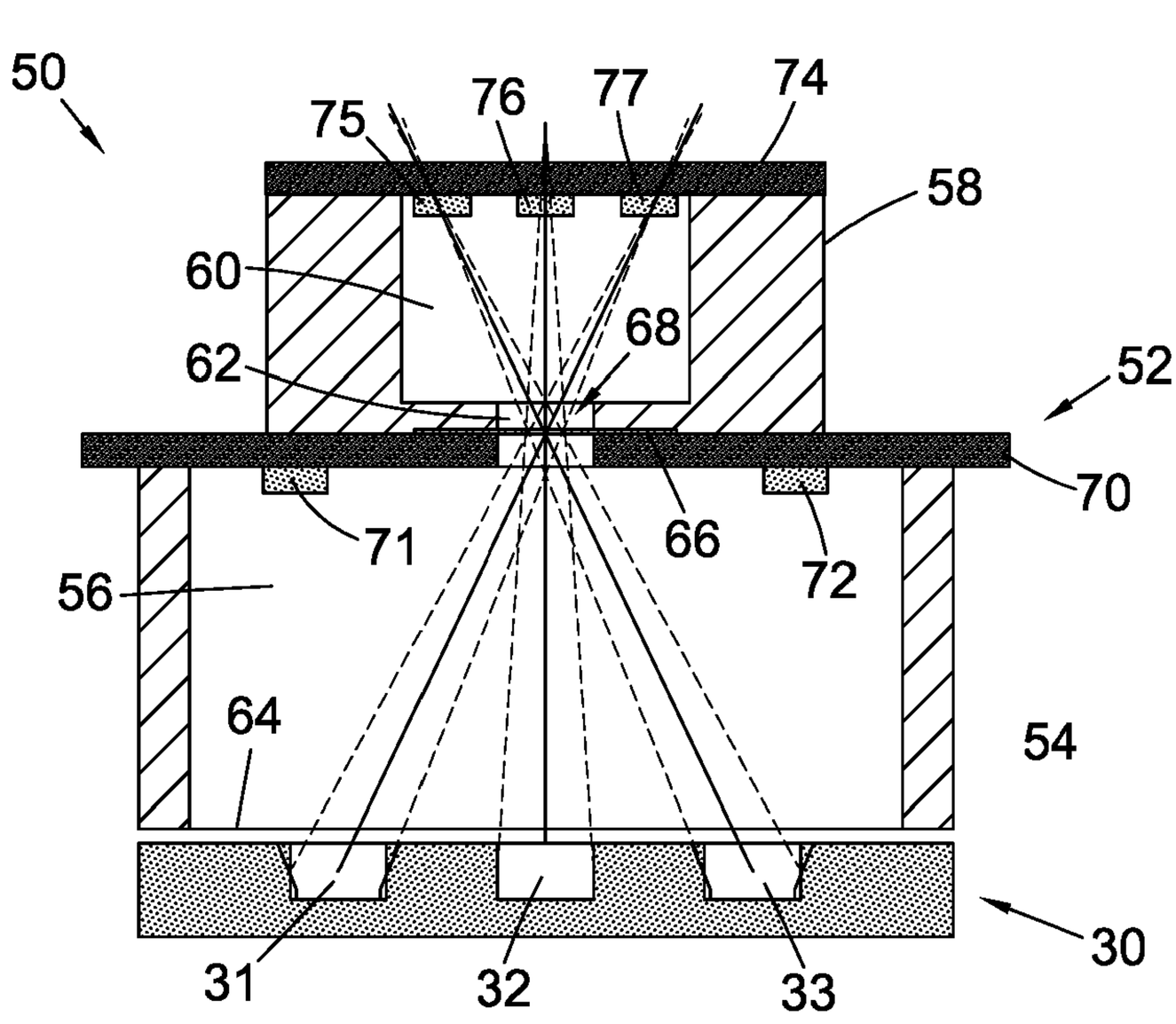

Fig. 2A

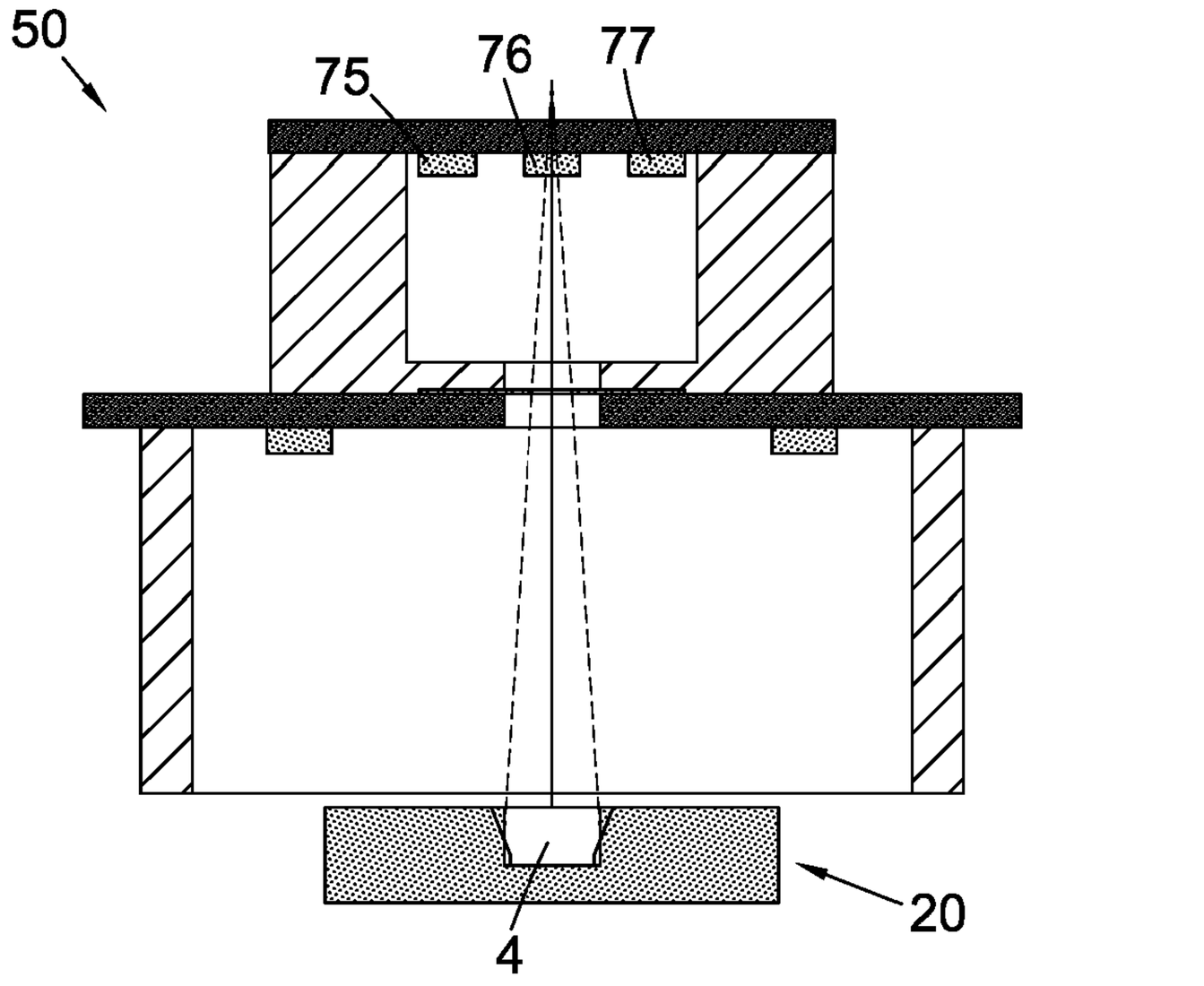

Fig. 2B

08 09 16

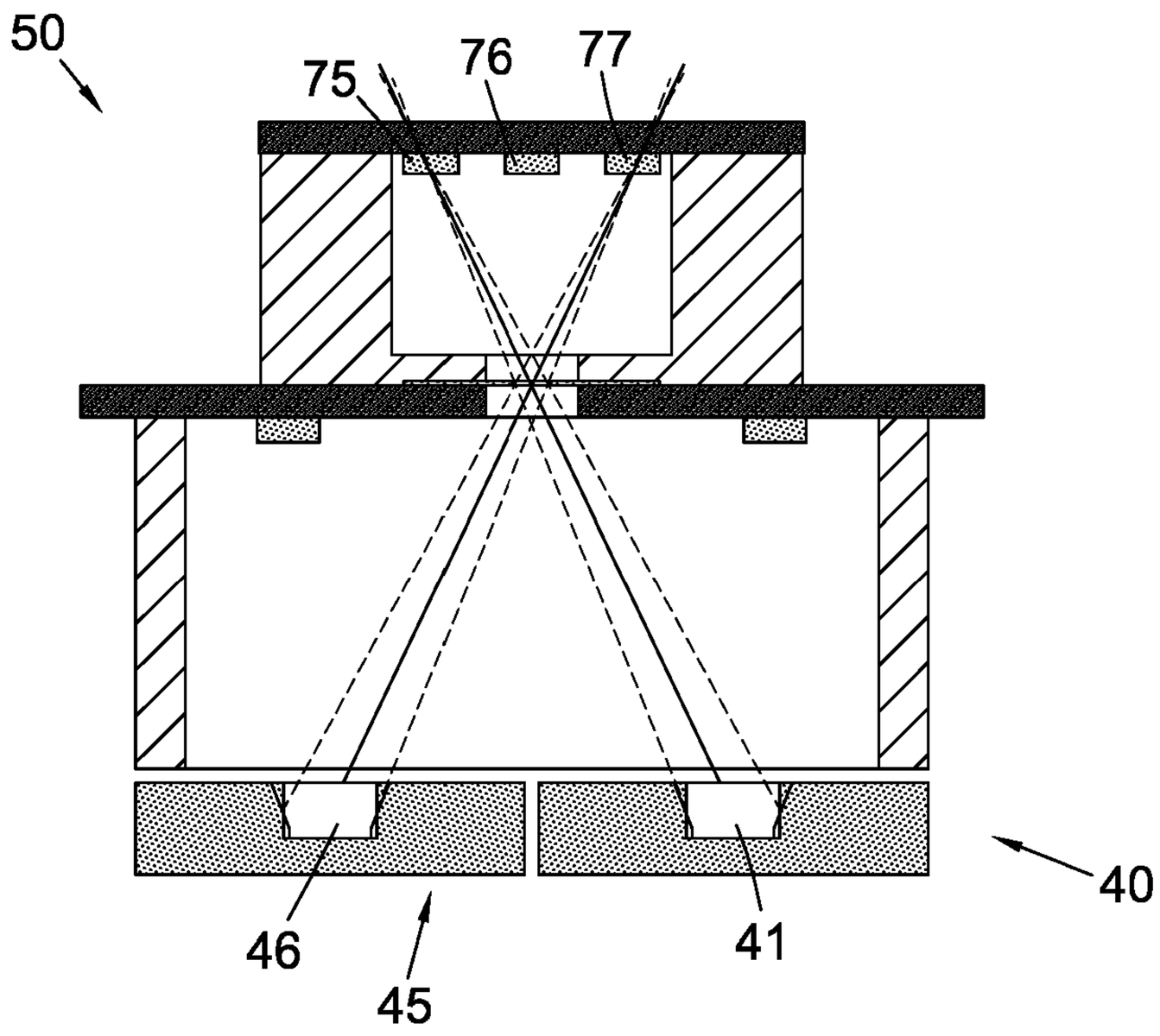

Fig. 2C

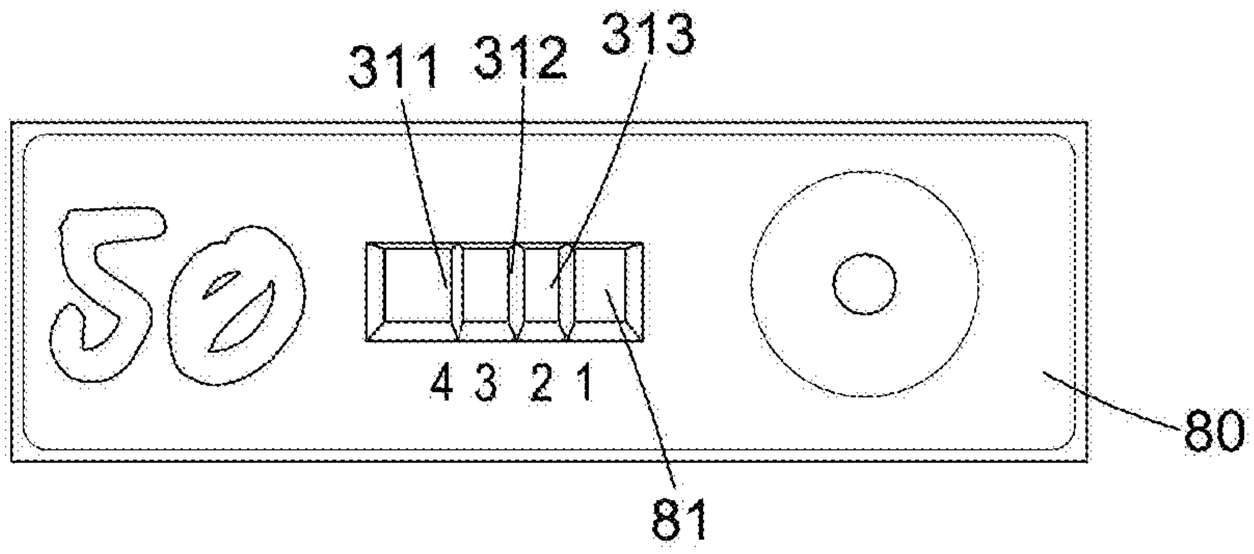
311
312
313
4 3 2 1
80
81

Fig. 3A

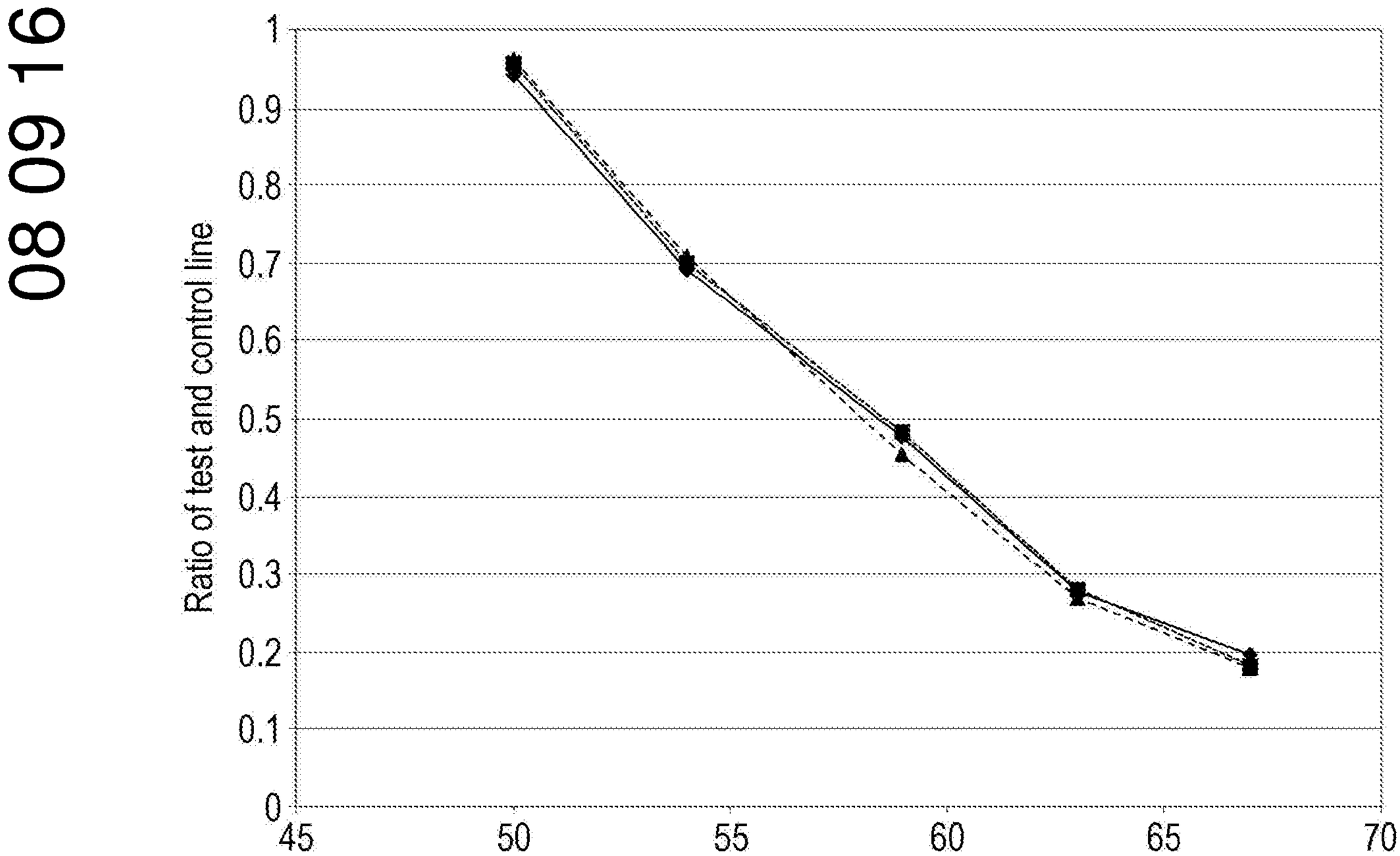
08 09 10
Ratio of test and control line
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
45
50
55
60
65
70
Line Brightness

Fig. 4

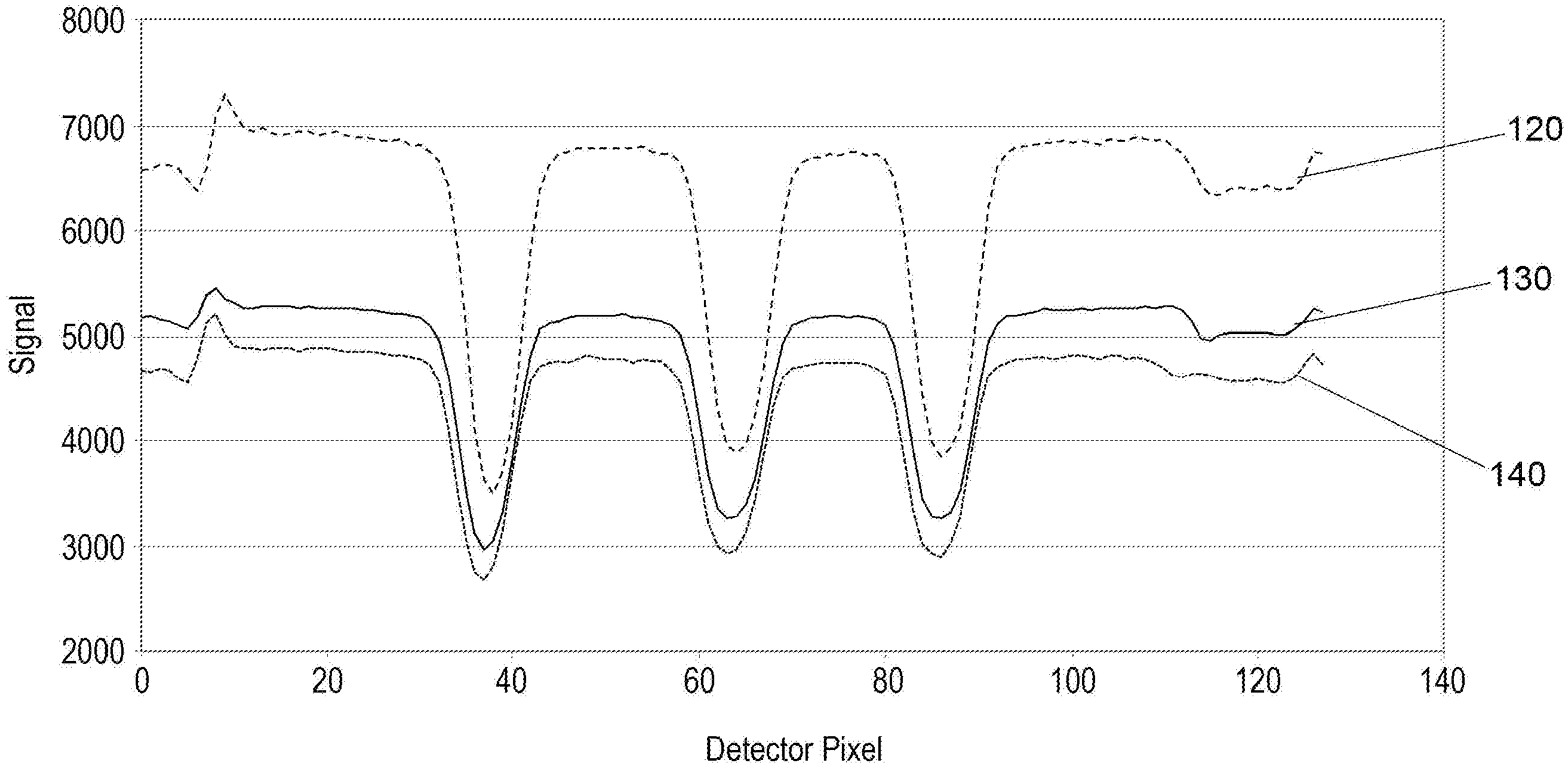
8000
7000
6000
5000
4000
3000
2000
Signal
0
20
40
60
80
100
120
140
Detector Pixel
120
130
140

Fig. 3B

OPTICAL DEVICE

[0001] This invention relates to an optical device for the quantitative determination of the concentration of at least one analyte in a liquid sample using at least one lateral flow device (LFD).

BACKGROUND

[0002] Our patent application WO2015/121672 discloses assay devices for the quantitative determination of the concentration of at least one analyte in a liquid sample The present invention, at least in its preferred embodiments aims to provide an alternative to devices of the prior art.

BRIEF SUMMARY OF THE DISCLOSURE

[0003] In accordance with the present invention there is provided an optical device as defined in the accompanying claims.

[0004] Thus, in accordance with the present invention a simple optical configuration is provided which can direct light from the test regions of an assay device onto optical detectors without requiring a lens.

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[0005] The optical device further comprises an optical emitter arranged to illuminate a test region of the assay device when the assay device is received at the sample port. The optical emitter is provided in the first chamber, and the first chamber is provided with a light reflective inner surface.

[0006] The plurality of optical detectors is a plurality of planar optical detectors, and each of the plurality of planar optical detectors may be an optical detector array comprising a plurality of optical detector pixels. In one embodiment the plurality of planar detectors is three optical detectors. The plurality of planar optical detectors may be one of a silicon photodiode array, an organic photodiode array, a CCD and a CMOS image sensor.

[0007] In embodiments of the invention, the width of the aperture may be between 0.1millimetres and 0.4 millimetres. The length of the aperture may be between 1 millimetres and 3 millimetres. The aperture may be located substantially centrally between the plurality of optical detectors.

[0008] The first chamber is provided with a light reflective, for example white, inner surface. By making the inner surface of the first chamber white, the first chamber acts as a ‘light integrating sphere’, resulting in a much higher light throughput. In effect, the first chamber acts in a manner which is broadly similar to that of an integrating sphere, in which the light impinges on the surfaces at a genuinely random angle of a known distribution. Whilst the light distribution in the first chamber will differ to some extent depending upon

the geometry of the chamber, any differences will be relatively slight, and a substantial portion of light will be internally reflected and effectively 'bounce around' inside the chamber, in a diffuse fashion. The overall result is that the amount of light illuminating the test region is enhanced. This leads to more reproducible results.

[0009] The amount of light received by the detector is sufficient to provide a detectable signal, without the need for incorporating a lens in the device. The absence of a lens means that the problem of unwanted light scatter caused by dust interacting with a lens and image distortion caused by the lens aberration are avoided. Furthermore, omission of the lens reduces component and manufacturing costs and make the construction simple and robust with respect to handling. The few components means that it may be compact and easy to use.

[0010] The first chamber may be made of any rigid white plastic material such as Nylon, Acrylonitrile Butadiene Styrene (ABS) or Acetal.

[0011] The optical emitter (source of illumination) in said first chamber may be any light source such as a light emitting diode (LED), halogen lamp, organic light emitting diode (OLED) or laser diode (LD). The light source such as the LEDs may be white or may be coloured. This will depend upon the particular arrangement within the lateral flow device and in particular, the sort of label used in the assay system. Thus the LEDs may be for example, green, blue or red depending upon the nature of the colour of the line. Thus for example, for use in conjunction with a lateral flow device that utilises gold nanoparticles which generate reddish lines, as the labelling system, it may be advantageous to utilise a green LED to maximise the signal received by the detector.

[0012] Uniform illumination of the test region is an important factor for better signal quality and so two or more light sources surrounding assay device may be a better configuration than a single light source.

[0013] The aperture between the first and second chambers may take the form of a pin-hole opening but in particular embodiments is in the form of a slit. A slit allows the device

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to efficiently detect a line signal such as that generated by a lateral flow device. In effect, the slit allows for averaging of the signal across the width of the strip.

[0014] In the absence of a lens, light has a clear path through the aperture to the detector. Any irregularities in the shape of the aperture can be minimised by creating the aperture using a precise process such as a chemical etching, a laser cutting or a press punching process.

[0015] Suitably the slit is from 0.05mm to 0.5mm wide and in particular from 0.1mm to 0.3mm wide in order to produce a clear image of a line at the detectors.

[0016] The length of the slit will depend upon the dimensions of the line signal produced by the assay device. Furthermore, in case of multiple detector arrays in the said second chamber, cross-talk between neighbour lateral flow membranes should be considered. Typically the length of the slit will be in the range of from 0.1mm to 5mm, more preferably in the range of 1-3mm and most preferably about 2mm.

[0017] Since there is no need to consider lens aberrations in the device of the present invention, it may be designed such that the distance between the aperture and the signal being read on the assay device and the distance between the aperture and the detector only follows simple ray optics. For example, if the detector's active length and the assay device's signal window are the same dimension then their distances will be the same and if the detector's active length is a half of the assay device's signal window dimension then the distance between the aperture and the detector is a half of the distance of the aperture and the signal being read on the assay device. The distance across the first chamber from the sample port to the aperture and the distance across the second chamber from the aperture to the detector may be for example in the range of 5-100mm, more preferably in the range of 10- 50mm and the most preferably in the range of 10-30mm.

[0018] The second chamber is suitably provided with a non-reflective inner surface, and in particular a black inner surface so as to avoid spurious and/or stray light.

[0019] The dimensions of the second chamber may be relatively small as described above in order to ensure that the overall device remains compact.

[0020] The second chamber may be made of any rigid black plastic material such as Nylon, Acrylonitrile Butadiene Styrene (ABS) or Acetal.

[0021] The optical detector provided in the second chamber may be any suitable photodetector including for example a silicon photodiode array, a complementary metal-oxide semiconductor (CMOS), a charge coupled devices (CCD) or an organic photo diode (OPD).

[0022] The lateral flow device may comprise, in addition to the lateral flow membrane, a conjugate pad in fluid communication with a proximal end of the lateral flow membrane, the conjugate pad comprising optically detectable tagging particles bound to a first assay component, and a wicking pad in fluid communication with a distal end of the lateral flow membrane. The lateral flow membrane is capable of transporting fluid from the conjugate pad to the wicking pad by capillary action. The lateral flow membrane comprises at least one test region comprising an immobilised second assay component for retaining the tagging particles in the test region in dependence on the binding between the analyte, the first assay component and the second assay component in order to generate a concentration of tagging particles in the test region that is indicative of the concentration of the analyte in the liquid sample.

[0023] At least one of the test regions may be in the shape of a substantially rectangular line. Alternatively, at least one of the test regions may be a circle, square or dot. It will be appreciated that the test regions may be supplied in any conceivable shape fitting within the boundary of the lateral flow membrane.

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[0024] In an embodiment of the LFD, the tagging particles absorb light at a wavelength emitted by the emitter, and the detector is arranged to detect light from the emitter passing through the lateral flow membrane, whereby the attenuation of the light intensity detected by the detector due to absorption by the immobilised tagging particles is indicative of the concentration of the analyte in the liquid sample. For example, the tagging particles may be gold nanoparticles which appear red when concentrated and may be illuminated by green light from the illumination source. As a further example, the tagging particles may be blue polystyrene particles and may be illuminated by red light from the illumination source. The light from the illumination source may be in the visible spectrum, but could also be in the ultraviolet or infra red wavelength ranges.

[0025] The lateral flow membrane may be formed from a light transmissive material. The lateral flow membrane material may be nitrocellulose and may have a thickness of less than 200 microns, preferably less than 150 microns, more preferably less than 100 microns.

[0026] The LFD may further comprise a sample pad in fluid communication with the conjugate pad and arranged to receive the liquid sample. The conjugate pad may perform the role of a sample pad, where no distinct sample pad is provided.

[0027] The lateral flow membrane may comprise a control region. The control region may be positioned between the test region(s) and the distal end of the lateral flow membrane, the control region may comprise an immobilised control component for retaining tagging particles in the control region.

[0028] The first assay component may comprise a molecule which binds the analyte to the tagging particles and the second assay component may comprise a receptor for the analyte. This combination of components is useful in a sandwich assay.

[0029] The first assay component may comprise the analyte or an analogue thereof and the second assay component may comprise a receptor for the analyte. This combination of components is useful in a competitive assay. Alternatively, the first assay component comprises a receptor for the analyte and the second assay component comprises the analyte or an analogue thereof. The assay may be an immunoassay. The receptor may be an antibody which binds to the analyte or an analogue thereof.

[0030] In accordance with an embodiment of the invention, at least a second LFD arranged in parallel with the first LFD under the first chamber.

[0031] Thus, a second LFD allows multiple assay tests to be performed in parallel. In some embodiments, the multiple assay tests may be testing for the same analyte in the same way. Alternatively, the multiple assay tests may be testing for different analytes. Performing assay tests in parallel prevents the mechanism of one assay test interfering with the mechanism of a second assay test.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] Embodiments of the invention are further described hereinafter with reference to the accompanying drawings, in which:

Figure 1 is a schematic view of an assay device for use with an optical device according to an embodiment of the present invention;

Figure 2A is an illustration of an optical device according to an embodiment of the present invention;

Figure 2B is an illustration of an optical device according to an embodiment of the present invention;

Figure 2C is an illustration of an optical device according to an embodiment of the present invention;

Figure 3A is an illustration of a lateral flow device for use with an optical device according to an embodiment of the present invention;

Figure 3B is an illustration of measured signal data from the lateral flow device of Figure 3A using an optical device according to an embodiment of the present invention;

Figure 4 is an illustration of a graph showing the ratio of response values for test and control lines on an LFD, measured using an optical device according to an embodiment of the present invention.

DETAILED DESCRIPTION

[0033] Figure 1 shows an illustration of an assay device 20 for use with an optical device according to an embodiment of the present invention. The assay device 20 takes the form of a cartridge for insertion into a cartridge reader and comprises a sample pad 6, in fluid communication with a conjugate pad 5. The conjugate pad 5 contains particle tags which are capable of binding to an assay component. A lateral flow membrane 4 is connected between the conjugate pad 5 and a wicking pad 7. When a sample is deposited on the sample pad 6, a reservoir of excess sample is formed. The excess sample migrates to the conjugate pad 5. This migration is first caused by the conjugate pad 5, then the wicking action of the lateral flow membrane 4 and then additionally the wicking pad 7. The conjugate pad 5 contains analyte tags. The analyte tags bind to the corresponding available analyte. Capillary action causes the liquid sample, containing any tagged analyte, to flow down the lateral flow membrane 4 from the conjugate pad 5 into the testing area 19 towards the wicking pad 7. Before the sample reaches the wicking pad 7, it encounters a test region in the form of a reaction line 8 containing fixed receptors for the analyte. When the tagged analyte reaches this point, the receptors bind to the analyte, holding the analyte and the tags in place. The presence of the coloured analyte tag will cause the reaction line 8 to change colour as the concentration of the tags increases. In the presently described example, the concentration of the coloured tags is a direct indicator of the concentration of analyte at the reaction line which provides an indication of the concentration of the analyte in the liquid sample.

[0034] The above is an example of a sandwich assay technique. A competitive assay is also possible in which the intensity of the response from a further test region in the form of a further reaction line 12 (usually a colour) is inversely proportional to the amount of analyte present in the sample. In one example of this technique, the conjugate pad 5 additionally contains a pre-tagged second analyte or analyte analogue. The analyte from the sample passes unchanged through the conjugate pad 5, and will bind to the receptors on the further reaction line 12, occupying receptor sites to which the pre-tagged analytes or analyte analogues would otherwise bind. The less analyte there is in the sample, the more pre-tagged analyte or analyte analogue is able to bind to the receptors, resulting in a stronger colouring of the line. In a further example of this technique, the conjugate pad 5 could also or instead contain a tagged receptor. In this case fixed analyte or analyte analogue is immobilised on a reaction line. The more analyte present in the sample, the

more of the tagged receptor that will bind to the analyte from the sample, and so not be available to bind to the fixed analyte or analyte analogue. The competitive assay technique may be used to qualitatively test for the absence of a particular analyte, though is not a purely binary test, and a very small amount of analyte in the sample is still likely to result in binding of the pre-tagged molecule (be that analyte, analyte analogue or receptor) at the position of the line. The competitive assay technique may instead be used to quantitatively indicate the concentration of a particular analyte in the liquid sample.

[0035] There is also another test region in the form of a further line 13 of control receptors on the lateral flow membrane 4 which react with the tagged component itself. The control line 13 contains immobilised receptors which bind to the tagged component. The control line 13 should become coloured whenever the test is carried out, regardless of whether the sample contains any analyte. This helps confirm the test is performing correctly. In the presently described example, the reaction line 8 only changes colour when the analyte is present in the sample. In embodiments with multiple assays, there may be multiple control lines. In this way, the control lines can be used to determine whether each test to be performed by the lateral flow device has been performed. The control line 13 in the current example is provided downstream of the earlier reaction lines. By providing the control line 13 downstream of the reaction lines, the analyte tag must flow through the other reaction lines before they can bind to the control line indicating that a test has been carried out.

[0036] In the present case, the lateral flow membrane 4 is approximately 100μm microns thick and the reaction lines 8, 12 and control line 13 are each 1.0mm x 5.0mm with a 4.0mm gap between them. In examples, the lateral flow membrane may be formed from a light-transmissive material such as nitrocellulose. The sample pad 6, conjugate pad 5, lateral flow membrane 4 and wicking pad 7 may be provided on a transparent substrate 11. In other examples, the sample pad 6, conjugate pad 5, lateral flow membrane 4 and wicking pad 7 may be provided on an opaque substrate.

[0037] A range of different tags and receptor lines can be used to determine the presence, absence, or concentration of multiple different analytes. The presence of some analytes may be tested in combination with the absence of different, or the same, analytes. Tests for example assays are described in our patent application WO2015/121672. Example labelling particles include gold nano-particles, coloured latex particles, or fluorescent labels. It will also be understood that different numbers and/or configurations of test regions in the form of reaction lines or control lines may be envisaged by the present disclosure.

[0038] Whilst common household assay tests, such as some pregnancy tests, have an apparently binary result and require a user to manually interpret the results, the assay device may use an optical device in the form of a cartridge reader as will be described hereinafter and having a light source and a light detector to measure the light absorption as a result of the analyte test. Whilst the presently described example uses the absorption of light by a substance to indicate the concentration of an analyte in a test sample, embodiments can equally be envisaged where the tag on the analyte is luminescent and emits light itself, either as a result of fluorescence, phosphorescence, or as a result of a chemical or electrochemical reaction.

[0039] Figure 2A shows an optical device for quantitative determination of the concentration of at least one analyte in a liquid sample provided on an assay device as described previously. The optical device 50 is in accordance with an embodiment of the present invention. The optical device 50 comprises a housing 52 having a first portion 54 defining a first chamber 56 and a second portion 58 defining a second chamber 60. The first chamber 56 is connected to the second chamber 60 by an optical passageway 62 between a distal end of the first chamber 56 and a proximal end of the second chamber 60. The first chamber 56 is provided with an opening in the form of a sample port 64 at a proximal end thereof. The sample port 64 is for receiving light from reaction lines 8, 12 and control line 13 of assay device 20 when the assay device 20 is engaged with the optical device 50 as described previously. An internal surface of the first portion 54 of the housing 52 is of a substantially white colour. In this way, an internal surface of the first chamber 56 is substantially white. In this embodiment, the first portion 54 of the housing 52 is formed from a white plastics material. An internal surface of the second portion 58 of the housing 52 is of a substantially black colour. In this way, an internal surface of the second chamber 60 is substantially black. In this example, the second portion 58 of the housing 52 is formed from a substantially non-reflective black plastics material. The optical passageway 62 comprises a mask layer 66 having defined therein an aperture 68. The aperture 68 in this example has a width of 0.2 millimetres and a length of 2 millimetres. The aperture 68 facilitates the passage of light from the first chamber 56 to the second chamber 60. In this example, the distal end of the first chamber 56 is defined by an emitter printed circuit board (PCB) 70 having mounted thereto an illumination source in the form of two light-emitting diodes (LEDs) 71, 72. It will be understood that the illumination source may be provided by any number of LEDs, for example more than two LEDs. The LEDs 71, 72 are mounted on the emitter PCB 70 symmetrically about the optical passageway 62 (and the aperture 68). A distal end of the second chamber 60 is defined by a detector PCB 74 having mounted thereto a plurality of detectors in the form of a left photodiode array 75, a middle photodiode array 76 and a right photodiode array 77. In an example, the photodiode arrays

may be silicon photodiode arrays. The three photodiode arrays 75, 76, 77 are arranged in parallel with a periodicity of 4.7 millimetres. In this example, each photodiode array 75, 76, 77 comprises 1 x 128 pixel arrays, having an active region of approximately 64 micrometres x 8 millimetres.

[0040] An overall height of the optical device 50 from the proximal end of the first chamber 56 to the distal end of the second chamber 60 is approximately 35 millimetres, making the optical device 50 compact and easy to transport.

[0041] In use, the sample port 64 of the optical device 50 is placed adjacent to an assay device 30. The assay device 30 comprises a left lateral flow membrane 31, a middle lateral flow membrane 32 and a right lateral flow membrane 33, each comprising one or more test regions as described previously. The optical device 50 is aligned with the assay device 30 such that the lateral flow membranes 31, 32, 33 are centred in the sample port 64 provided at the proximal end of the first chamber 56. In use, light from the LEDs 71, 72 may illuminate substantially the whole of the first chamber 56 diffusely. In this way, the lateral flow membranes 31, 32, 33 are illuminated from a plurality of different directions. A portion of the light reflected by each of the lateral flow membranes 31, 32, 33 is reflected back into the first chamber 56 and directly through the aperture 68 defined within the mask layer 66. Each photodiode array 75, 76, 77 is located such that the portion of light passing through the aperture 68 after reflection at the respective lateral flow membranes 31, 32, 33 impinges on the respective photodiode array 75, 76, 77. The signal generated by each photodiode array 75, 76, 77 may then be analysed to determine an indication of a quantitative concentration of an analyte in a liquid sample provided to the assay device 30.

[0042] In one example, the optical device is arranged to be operated with an assay device having three lateral flow membranes. The lateral flow membranes 31, 32, 33 are spaced having a period of 10.5 millimetres in a direction in a plane of the lateral flow membranes and transverse to a flow direction on the lateral flow membranes 31, 32, 33. In use, a portion of light reflected from the middle lateral flow membrane 32passes through the aperture 68 and impinges on the middle photodiode array 76. Due to the small width of the aperture 68, and the spacing between the photodiode arrays 75, 76, 77 the light reflected from the middle lateral flow membrane 32cannot reach either of the left photodiode array 75 or the right photodiode array 77. Similarly, light reflected from the left lateral flow membrane 31 impinges on the right photodiode array 77 and does not impinge on either of the left photodiode array 75 or the middle photodiode array 76. Light reflected from the right lateral flow membrane 33 impinges on the left photodiode array 75 and does not impinge on either of the middle photodiode array 76 or the right photodiode array 77.

[0043] To reduce stray light from the LEDs 71, 72 impinging on any of the photodiode arrays 75, 76, 77 without reflecting on the respective lateral flow membranes 31, 32, 33 the LEDs 71, 72 may be configured to emit light diffusely. In an example, the LEDs 71, 72 may be directed towards a side wall of the first chamber 56. In this way, the proportion of light impinging on the photodiode arrays 75, 76, 77 and not originating from a reflection on the respective lateral flow membranes 31, 32, 33 may be reduced. This prevents saturation of the photodiode arrays 75, 76, 77 with high levels of background illumination whilst maintaining an accuracy of the optical device 50.

[0044] Figures 2B and 2C are illustrations of further examples of the use of the optical device 50. Without changing a configuration of the optical device 50 it is easy to use the optical device 50 on a number of different assay device cartridges. In one example, as shown in Figure 2B, the optical device 50 can be used with an assay device cartridge 20 having a single lateral flow membrane 4 provided thereon. The assay device cartridge 20 is positioned in a central location beneath the sample port 64. In this way, reflection from the lateral flow membrane 4 only impinges on the middle photodiode array 76. A further example is shown in Figure 2C. In this example, two assay device cartridges 40, 45 can each be provided with a single lateral flow membrane 41, 46. The lateral flow membranes 41, 46can each be analysed using the left photodiode array 75 and the right photodiode array 77 respectively. The two lateral flow membranes 41, 46 may be a duplicated analyte test, a test for the same analyte but configured for different concentration ranges or two different analyte tests.

[0045] To analyse the test region(s) of lateral flow membrane(s) on an assay device, a set of reference detection values indicative of a response of each photodiode array can be obtained using a blank assay device (not shown). The reference detection values can be stored in a storage area electrically connected to the optical device 50. Following this, an assay device having had a liquid sample applied thereto is analysed by the optical device 50 and the raw detection values indicative of the response of each photodiode array are obtained. The difference between the raw detection values and the reference detection values is determined by a controller comprising a processor. Figure 3A is an illustration of an example of an assay device 80 having a lateral flow membrane 81 provided thereon and suitable for use with an optical device as described herein. The assay device 80 in this example is a replica assay device for illustration purposes. The lateral flow membrane 81 comprises a test line-1 313, a test line-2 312 and a control line 311.

[0046] Figure 3B is a graph showing the reference detection values from a blank assay device subtracted from the raw detection values determined by using the optical device 50 on the assay device 80 of Figure 3A. The dashed line curve 120 is indicative of a signal

measured by the middle photodiode array 76, the solid line curve 130 is indicative of a signal measured by the left photodiode array 75 and the dotted line curve is indicative of a signal measured by the right photodiode array 77. Although the three curves are read from the lateral flow membrane 81, the absolute signal intensities are different due to variations in the calibration of each photodiode array 75, 76, 77. However, three dips can be observed which correspond to each of the lines 311, 312, 313 on the lateral flow membrane 81 on assay device 80 of Figure 3A.

[0047] Whilst the measured values for each of the three curves in the graph shown in Figure 3B are different in their absolute intensities, the ratios of a test line to the control line 311 are substantially the same for each different photodiode array (within a tolerance range) as shown by the graph in Figure 4. Figure 4 shows the ratio of a test line to the control line for 5 different samples, each having lines of different intensity. The calculated ratio from three photodiode arrays are nearly identical. Therefore, any of the photodiode arrays can be used to determine an indication of the reflections from a test region on a lateral flow membrane of an assay device cartridge, whilst maintaining comparability of the resulting determined analyte concentrations.

[0048] In summary, an optical device for the quantitative determination of the concentration of at least one analyte in a liquid sample comprises a housing 52 defining a first chamber 56 and a second chamber 60. A sample port 64 is defined in the first chamber 56. The sample port 64 receives light from a plurality of test regions of an assay device when the optical device is engaged with the assay device. The optical device further comprises a plurality of optical detectors 75, 76, 77 provided in the second chamber 60 and a mask member 66 interposed between the first chamber 56 and the second chamber 60 and having an aperture 68 defined therein and configured to direct light from the sample port 64 onto the optical detectors 75, 76, 77.

[0049] Throughout the description and claims of this specification, the words “comprise” and “contain” and variations of them mean “including but not limited to”, and they are not intended to (and do not) exclude other moieties, additives, components, integers or steps. Throughout the description and claims of this specification, the singular encompasses the plural unless the context otherwise requires. In particular, where the indefinite article is used, the specification is to be understood as contemplating plurality as well as singularity, unless the context requires otherwise.

[0050] Features, integers, characteristics, compounds, chemical moieties or groups described in conjunction with a particular aspect, embodiment or example of the invention are to be understood to be applicable to any other aspect, embodiment or example described herein unless incompatible therewith. All of the features disclosed in this

specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

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CLAIMS

1. An optical device for the quantitative determination of the concentration of at least one analyte in a liquid sample, the liquid sample provided in an assay device comprising a lateral flow membrane having a plurality of test regions for retaining tagging particles in the plurality of test regions in dependence on the concentration of the analyte in the liquid sample, the optical device comprising:

a housing defining a first chamber and a second chamber;

a sample port defined in the first chamber, the sample port for receiving light from the plurality of test regions of the assay device when the optical device is engaged with the assay device;

a plurality of optical detectors provided in the second chamber;

a mask member interposed between the first chamber and the second chamber and having an aperture defined therein configured to direct light from the sample port onto the optical detectors; and

an optical emitter provided in the first chamber and arranged to illuminate a test region of the assay device when the assay device is received at the sample port,

wherein the first chamber is provided with a light reflective inner surface.

2. An optical device as claimed in claim 1, wherein the plurality of optical detectors is a plurality of planar optical detectors, each planar optical detector being an optical detector array comprising a plurality of optical detector pixels.

3. An optical device as claimed in claim 2, wherein the plurality of planar optical detectors is three optical detectors.

4. An optical device as claimed in claim 2 or claim 3, wherein each of the plurality of planar optical detectors is one of a silicon photodiode array, an organic photodiode array, a CCD and a CMOS image sensor.

5. An optical device as claimed in any preceding claim, wherein a width of the aperture is between 0.1 millimetres and 0.4 millimetres.

6. An optical device as claimed in any preceding claim, wherein a length of the aperture is between 1 millimetres and 3 millimetres.

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7. An optical device as claimed in claim 5 or claim 6, wherein the aperture is located substantially centrally between the plurality of optical detectors.

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