ABSTRACT

"A SENSOR ELEMENT"

The sensor element (102) includes a light input (120) configured to receive input light, a sample chamber (108) configured to accommodate a sample (124), and at least one polymer waveguide optically coupling the light input with the sample chamber, the at least one polymer waveguide (126) including a first contact portion (112) and a second contact portion (114), wherein at least a portion of the second contact portion may be arranged in the sample chamber. The second contact portion may include a different structure than the first contact portion so that a change of the light intensity of the input light passing through the second contact portion may be caused due to an interaction between the input light passing through the second contact portion and the sample, wherein the change of the light intensity of the input light passing through the second contact portion may be different from the change of the light intensity of the input light passing through the first contact portion.

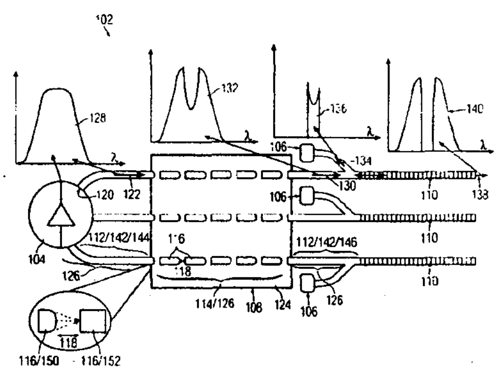

FIG. 1

Claims

What is claimed is:

1. A sensor element comprising:

a light input configured to receive input light,

a sample chamber configured to accommodate a sample including target analyte or target molecules; and

at least one polymer waveguide optically coupling the light input with the sample chamber, the at least one polymer waveguide comprising a first contact portion and a second contact portion, wherein at least a portion of the second contact portion is arranged in the sample chamber;

wherein the second contact portion has a different structure than the first contact portion, the first contact portion comprises a continuous portion to optically couple the light input to the second contact portion and the second contact portion comprises at least two shaped portions, each shaped portion separated by a gap so that a change of the light intensity of the input light passing through the second contact portion may be caused due to light absorption based on a direct interaction between the input light passing through the second contact portion and the sample in the gap, wherein the change of the light intensity of the input light passing through the second contact portion is different from the change of the light intensity of the input light passing through the first contact portion for measurement of a concentration of the target analyte or target molecules within the sample.

2. The sensor element of claim 1, further comprising:

at least one optical detector positioned in optical communication with the at least one polymer waveguide for detecting a resultant light after the input light travels along the at least one polymer waveguide and through the sample chamber.

3. The sensor element of claim 2,

wherein the at least one optical detector comprises one or more of a group consisting of a photodiode, a photomultiplier, a charged-coupled device detector, a light dependent resistor, a phototransistor and a photocell.

4. The sensor element of claim 2 or 3, further comprising:

at least one filter configured to output a pre-determined wavelength of the resultant light, the at least one filter being positioned in the optical path between the at least one polymer waveguide and the at least one optical detector.

5. The sensor element of claim 4,

wherein the at least one filter comprises one or more of a group consisting of a Bragg grating filter, a Fabry-Perot filter, an absorptive filter, a dichroic filter and an interference filter.

6. The sensor element of any one of claims 1 to 5,

wherein the first contact portion comprises the continuous portion with a constant diameter.

7. The sensor element of any one of claims 1 to 6,

wherein the at least two shaped portions are positioned along a common axis.

8. The sensor element of any one of claims 1 to 7,

wherein the second contact portion comprises a spiral portion or a U-shaped portion.

9. The sensor element of any one of claims 1 to 8, further comprising:

a light source configured to provide the input light to the light input.

10. The sensor element of claim 9,

wherein the light source comprises one or more of a group consisting of a laser, a white light, a fluorescent light, a laser diode, a light emitting diode, an organic light emitting diode, a gas discharge light source, an incandescent lamp and an electroluminescent lamp.

11. The sensor element of any one of claims 1 to 10, further comprising:

a further sample chamber configured to accommodate a further sample.

12. The sensor element of claim 11, further comprising:

a further polymer waveguide optically coupling the further sample chamber with the light input.

13. The sensor element of claim 12, further comprising:

a further optical detector, the further optical detector positioned in optical communication with the further polymer waveguide for detecting a further resultant light after the input light travels along the further polymer waveguide and through the further sample chamber.

14. The sensor element of any one of claims 1 to 13,

wherein the sample comprises macromolecular biomolecules.

15. The sensor element of any one of claims 1 to 14,

wherein the at least one polymer waveguide further comprises an intermediate contact portion, the intermediate contact portion positioned between the first contact portion and the second contact portion.

16. A sensor element comprising:

a light input configured to receive input light,

a sample chamber configured to accommodate a sample including target analyte or target molecules; and

at least one polymer waveguide optically coupling the light input with the sample chamber, the at least one polymer waveguide comprising a first contact portion and a second contact portion, wherein at least a portion of the second contact portion is arranged in the sample chamber;

wherein the second contact portion has a different structure than the first contact portion, the first contact portion comprises a continuous portion to optically couple the light input to the second contact portion and the second contact portion comprises a continuous portion with at least one hole, each of the at least one hole being spaced from another at a regular interval along the length of the continuous portion with the at least one hole so that a change of the light intensity of the input light passing through the second contact portion may be caused due to light absorption based on a direct interaction between the input light passing through the second contact portion and the sample in the at least one hole, wherein the change of the light intensity of the input light passing through the second contact portion is different from the change of the light intensity of the input light passing through the first contact portion for measurement of a concentration of the target analyte or target molecules within the sample.

17. The sensor element of claim 16,

wherein the distance between each of the at least one hole is in the range of 100 μm to 10 cm.

18. A sensor element comprising:

a light input configured to receive input light, a sample chamber configured to accommodate a sample including target analyte or target molecules; and

at least one polymer waveguide optically coupling the light input with the sample chamber, the at least one polymer waveguide comprising a first contact portion and a second contact portion, wherein at least a portion of the second contact portion is arranged in the sample chamber;

wherein the second contact portion has a different structure than the first contact portion, the first contact portion comprises a continuous portion to optically couple the light input to the second contact portion and the second contact portion comprises a first tapered portion and a second tapered portion, the first tapered portion in optical communication with the second tapered portion and configured to enhance an evanescent wave of the input light passing through the second contact portion so that a change of the light intensity of the input light passing through the second contact portion may be caused due to light absorption based on an indirect interaction between the input light passing through the second contact portion and the sample, wherein the change of the light intensity of the input light passing through the second contact portion is different from the change of the light intensity of the input light passing through the first contact portion for measurement of a concentration of the target analyte or target molecules within the sample.

19. A sensor arrangement, comprising:

a sensor element comprising

a light input configured to receive input light,

a sample chamber configured to accommodate a sample including target analyte or target molecules;

at least one polymer waveguide optically coupling the light input with the sample chamber, the at least one polymer waveguide comprising a first contact portion and a second contact portion, wherein at least a portion of the second contact portion is arranged in the sample chamber;

at least one optical detector positioned in optical communication with the at least one polymer waveguide for detecting a resultant light after the input light travels along the at least one polymer waveguide and through the sample chamber;

a light source configured to provide the input light to the light input;

a first device comprising the light source and the at least one optical detector; and

a second device comprising the sample chamber and the at least one polymer waveguide;

wherein the second contact portion has a different structure than the first contact portion, the first contact portion comprises a continuous portion to optically couple the light input to the second contact portion and the second contact portion comprises at least two shaped portions, each shaped portion separated by a gap so that a change of the light intensity of the input light passing through the second contact portion may be caused due to light absorption based on a direct interaction between the input light passing through the second contact portion and the sample in the gap, wherein the change of the light intensity of the input light passing through the second contact portion is different from the change of the light intensity of the input light passing through the first contact portion for measurement of a concentration of the target analyte or target molecules within the sample.

20. The sensor arrangement of claim 19,

wherein the second device is detachably coupled with the first device.

21. The sensor arrangement of claim 19 or 20,

wherein the first device comprises a slot or socket configured for receiving a portion of the second device.

22. The sensor arrangement of any one of claims 19 to 21, further comprising

a guiding element configured to allow the second device to be mechanically aligned to the first device.

Dated this the 09th day of February 2012.

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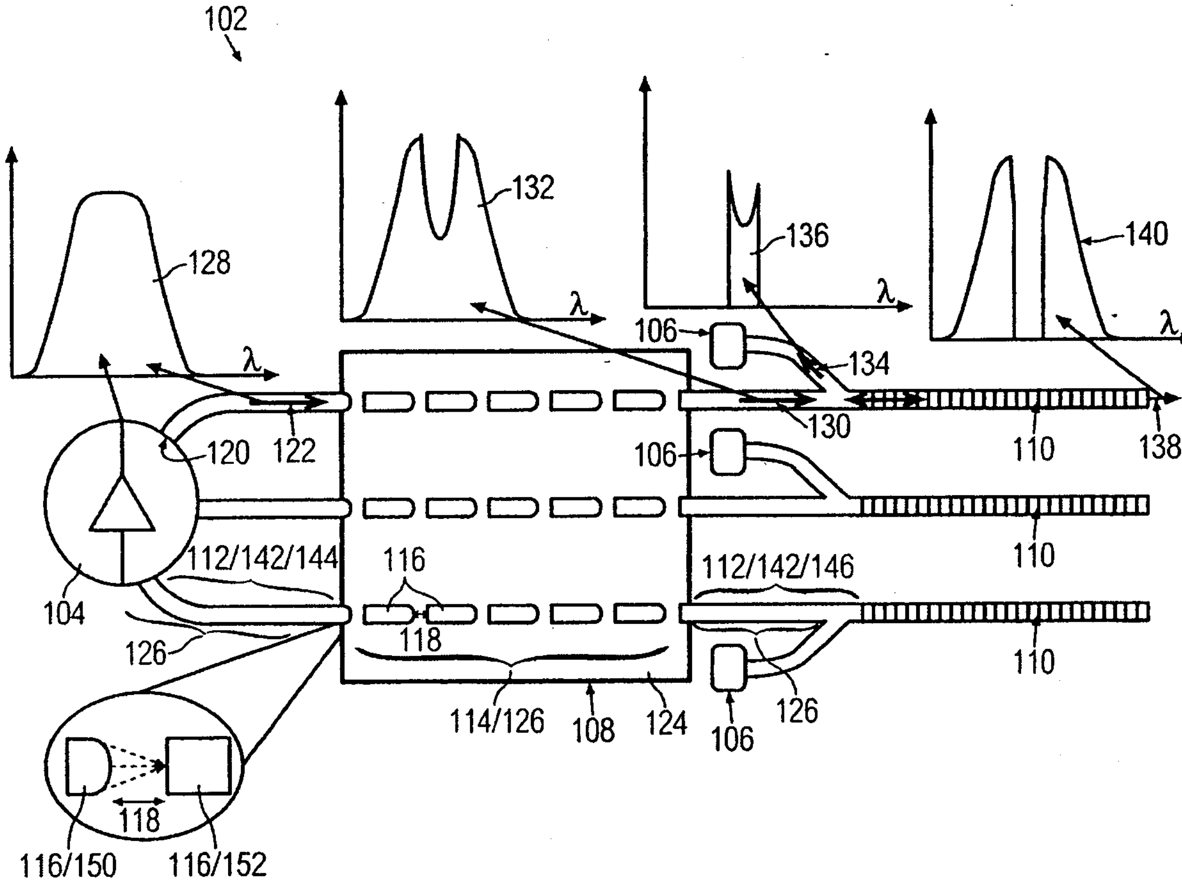

FIG. 1

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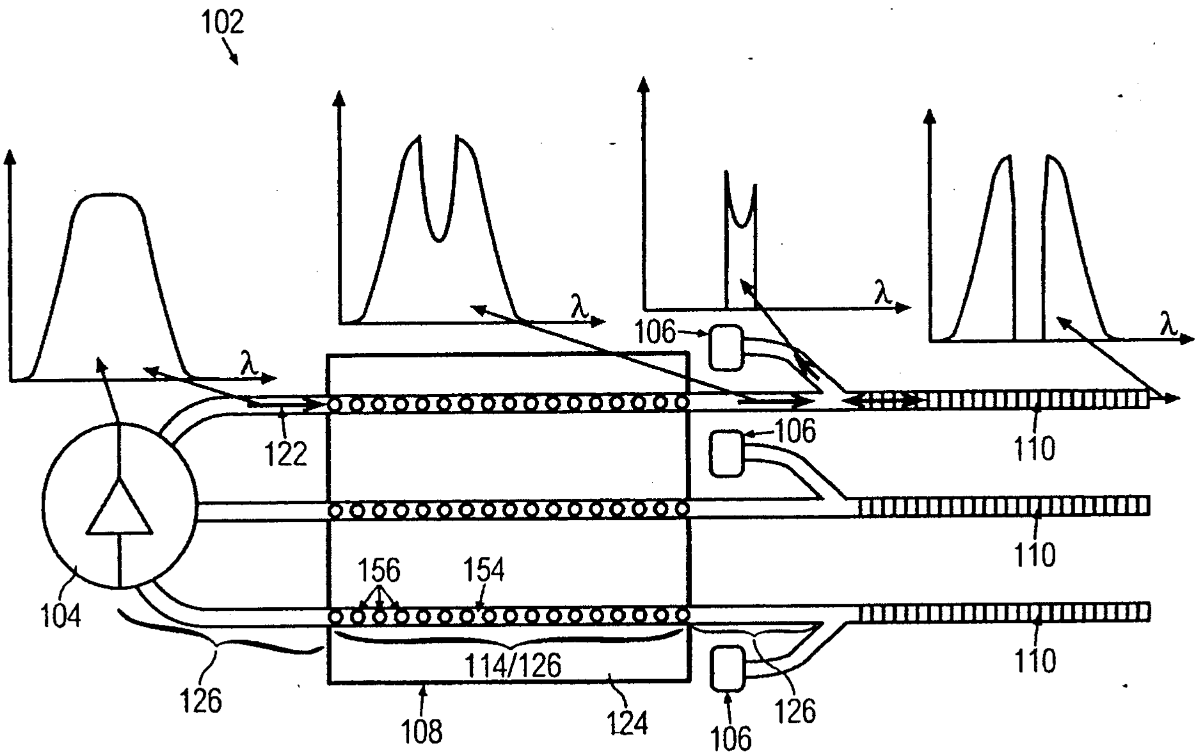

FIG. 2

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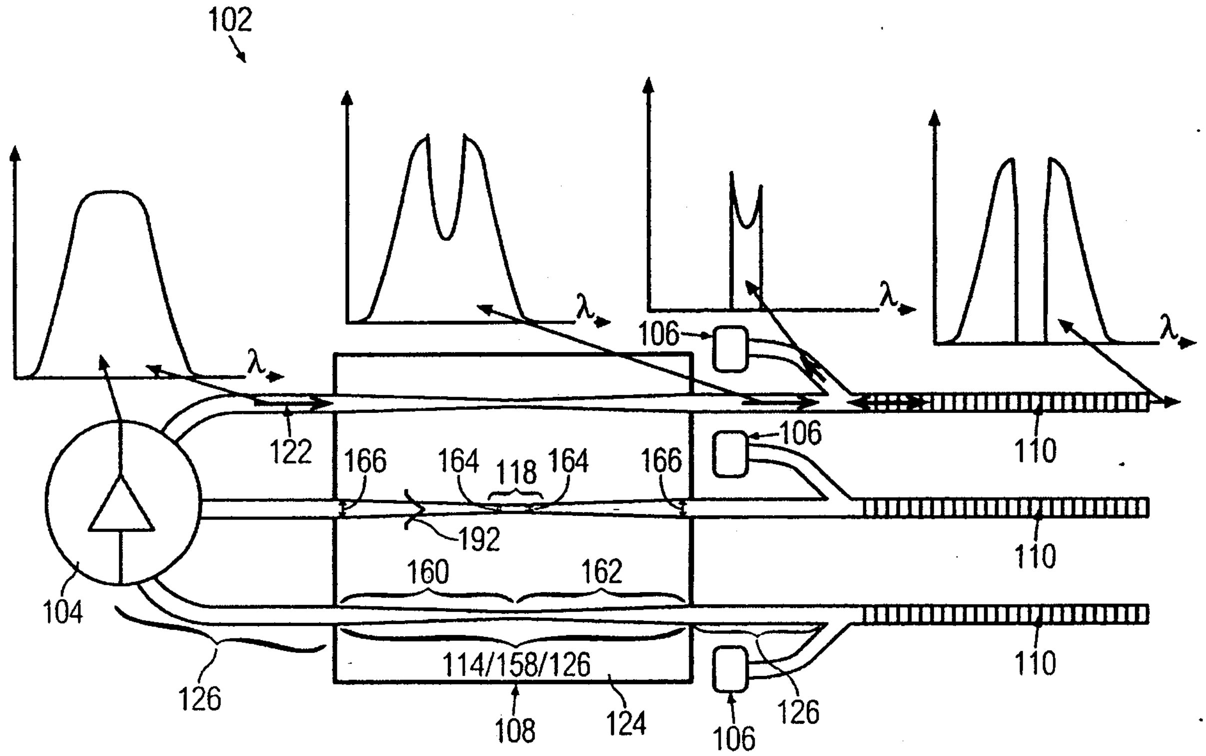

FIG. 3

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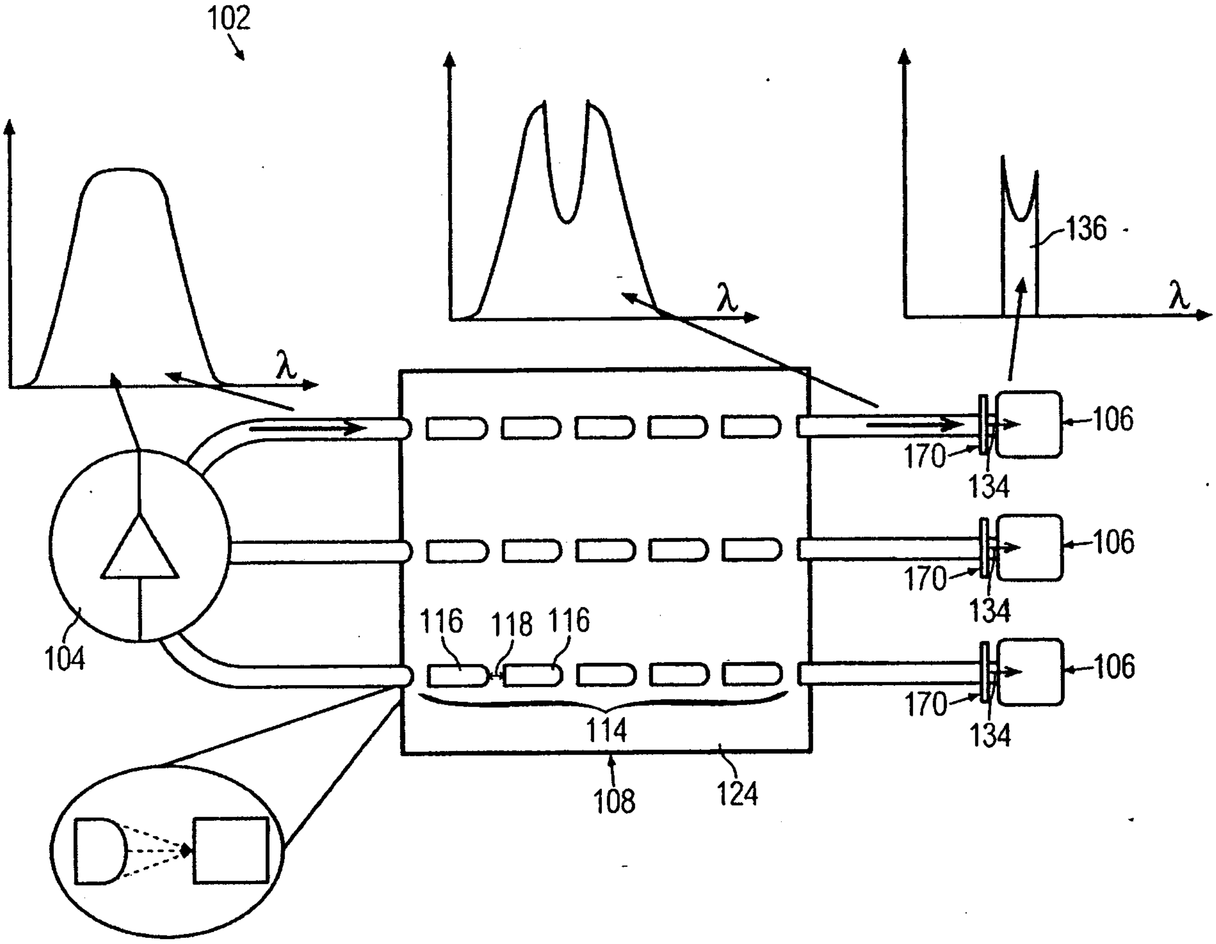

FIG. 4

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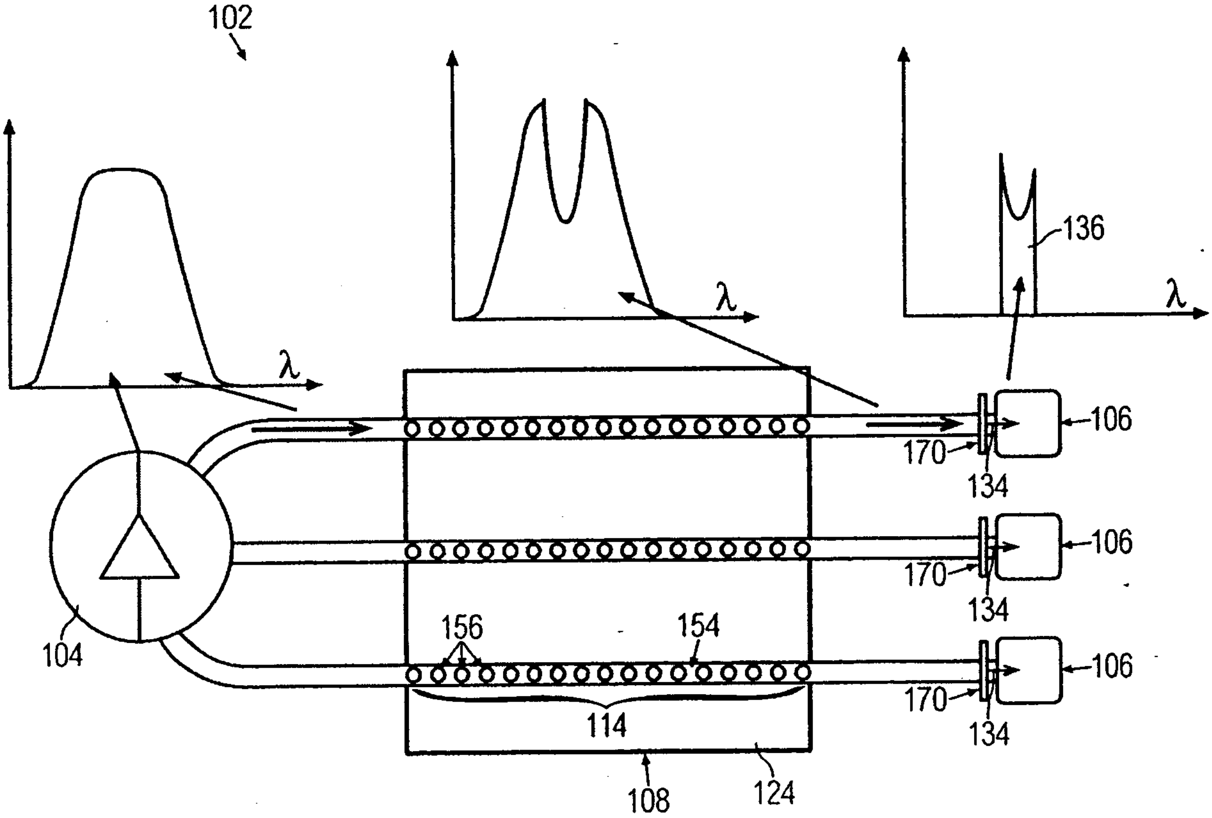

FIG. 5

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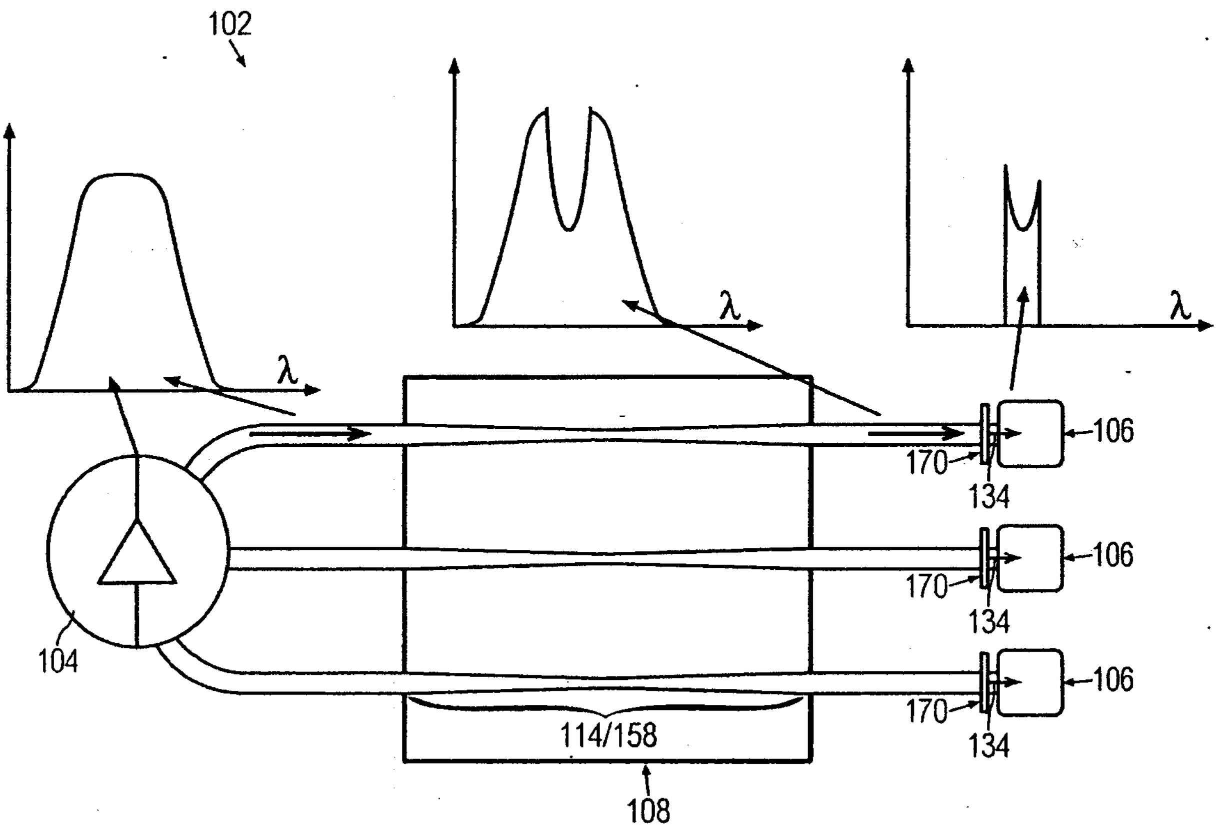

FIG. 6

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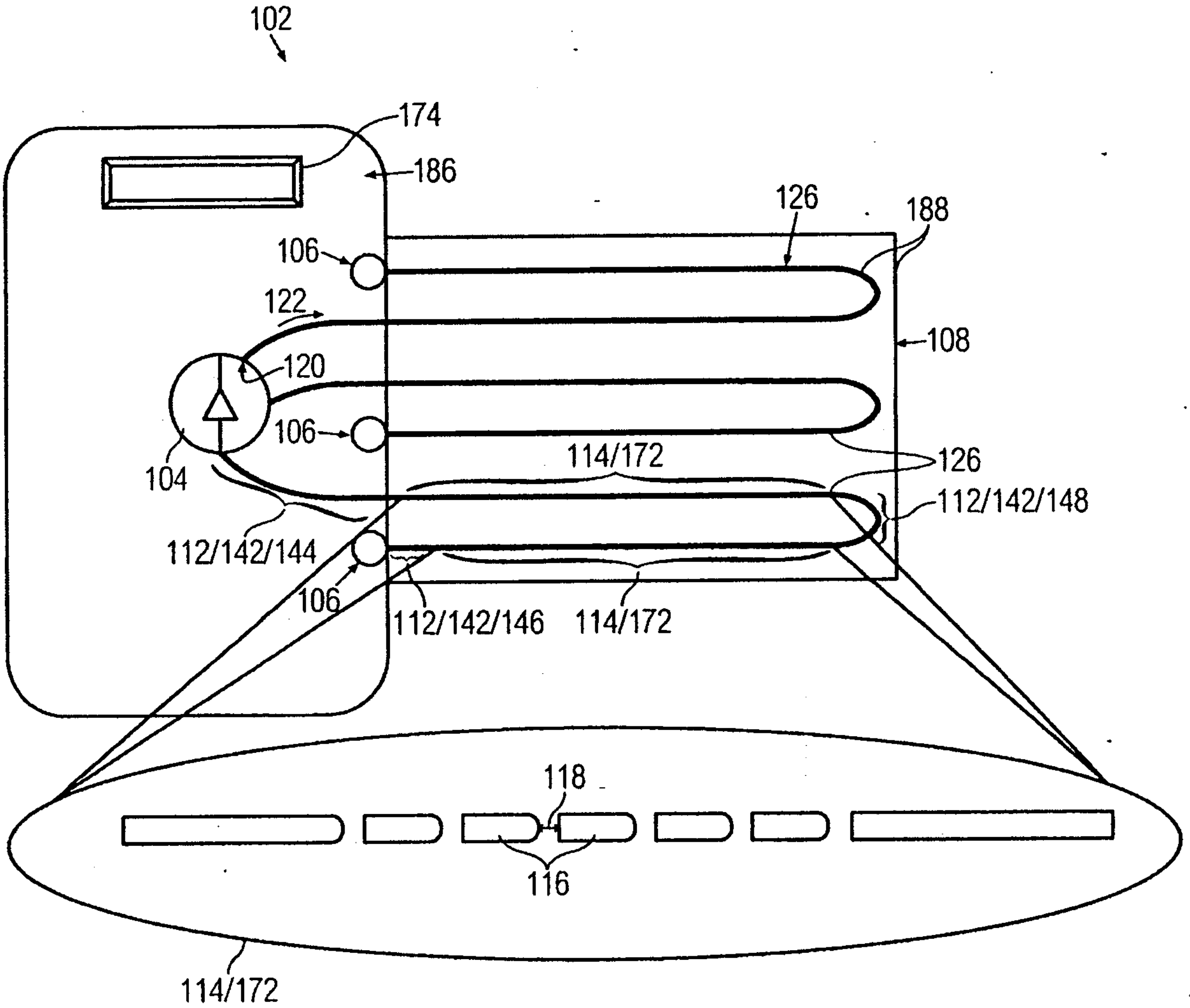

FIG. 7

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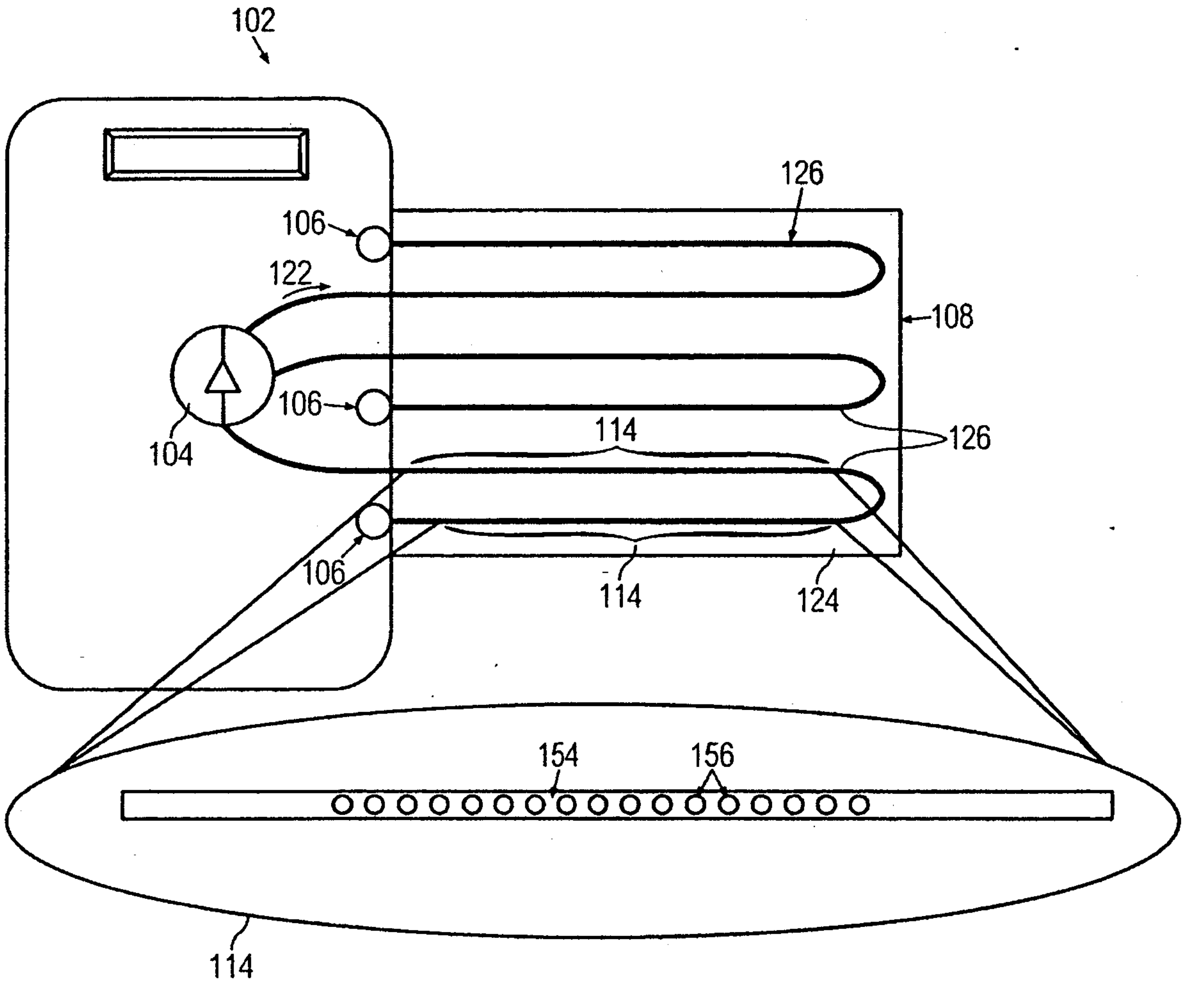

FIG. 8

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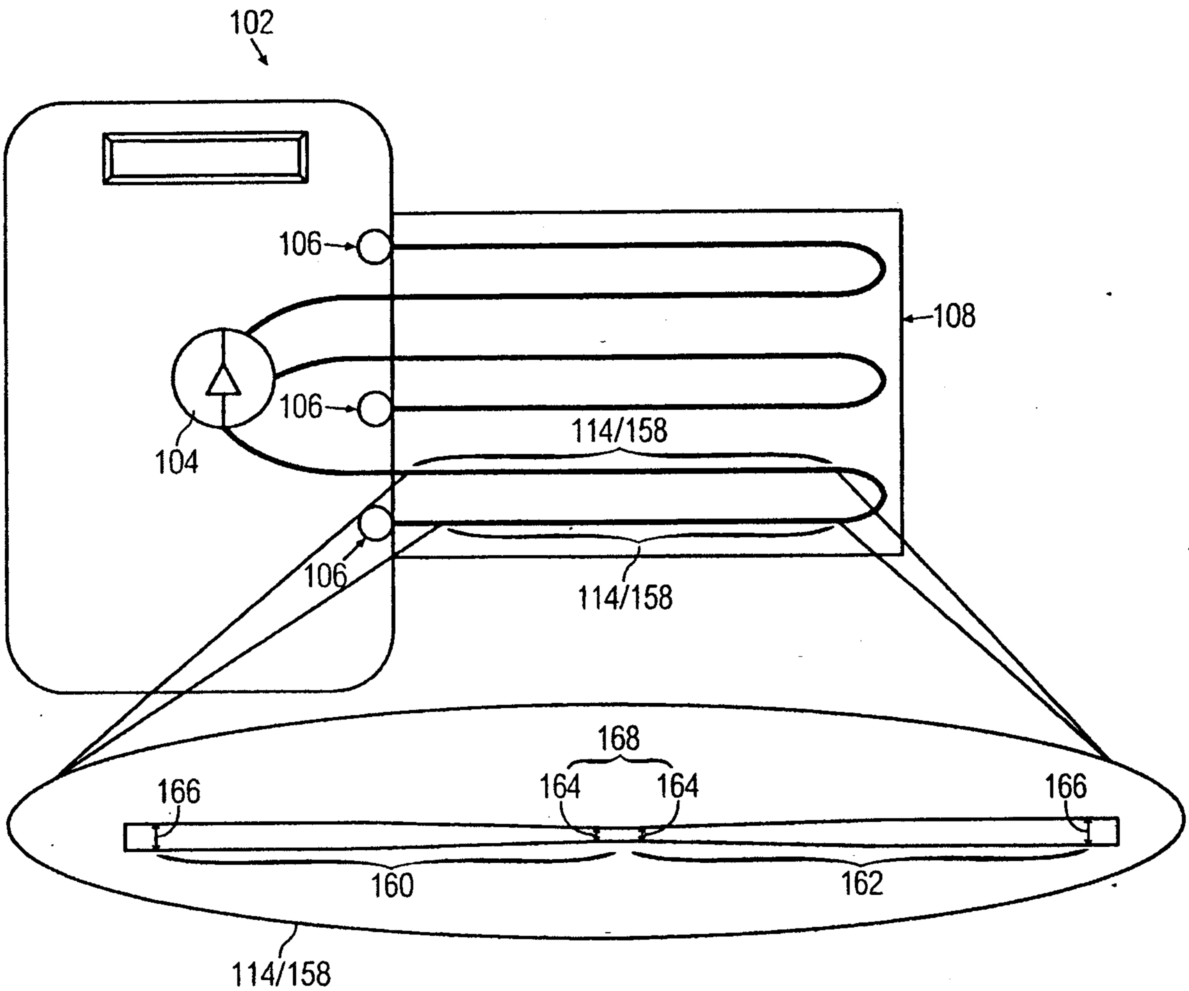

FIG. 9

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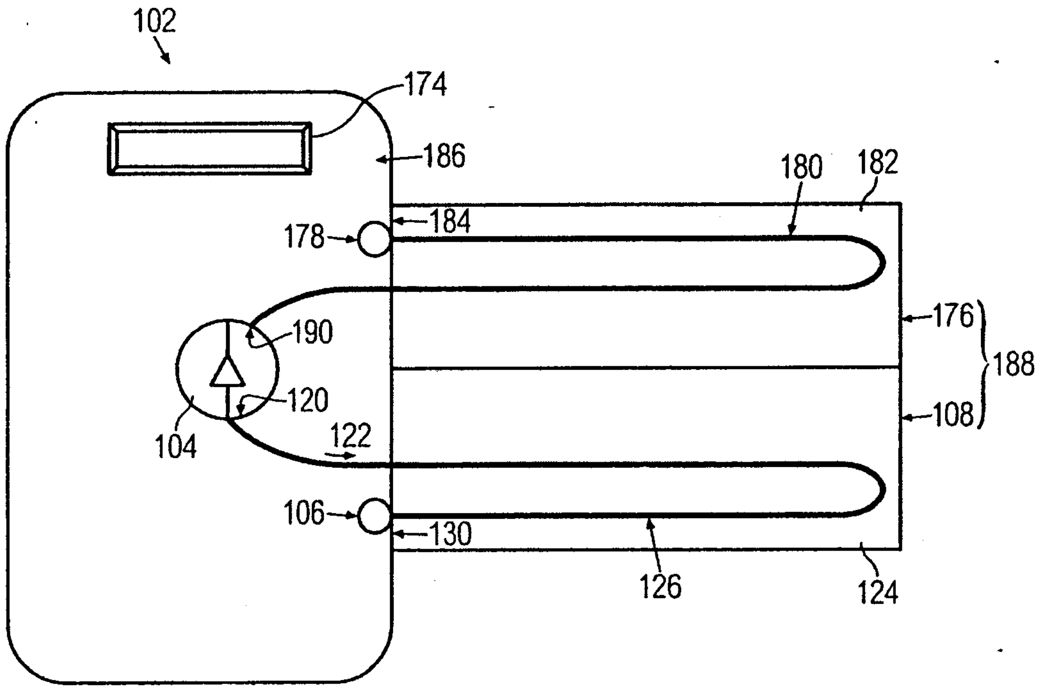

FIG. 10

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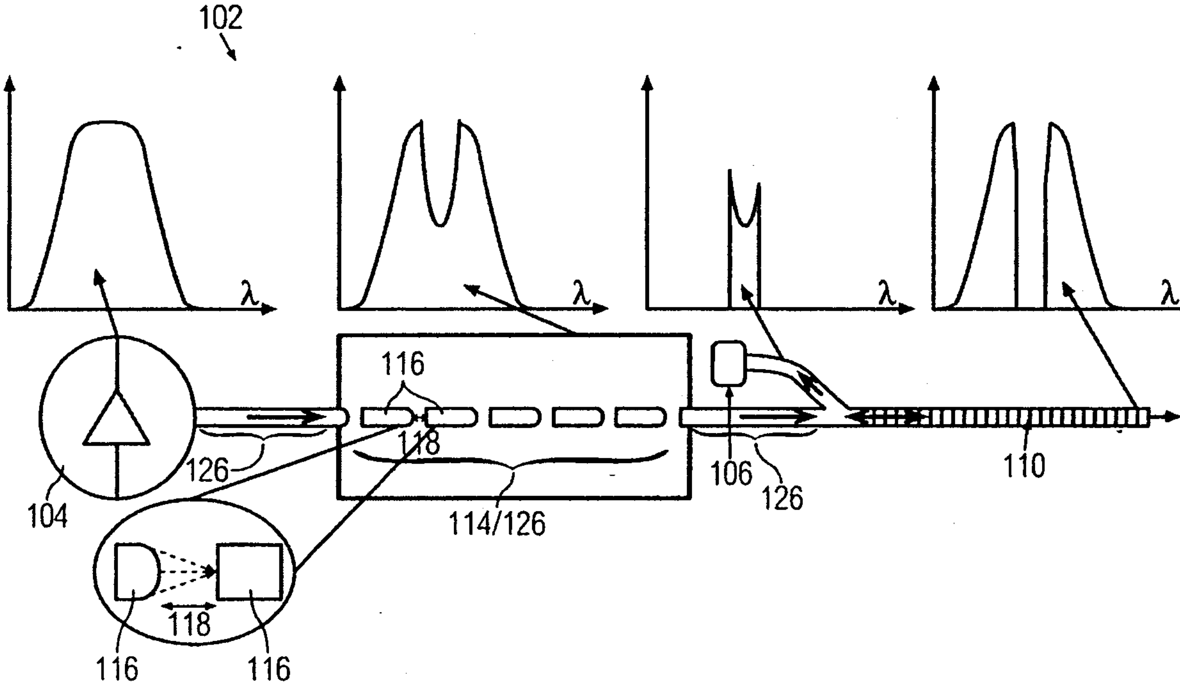

FIG. 11

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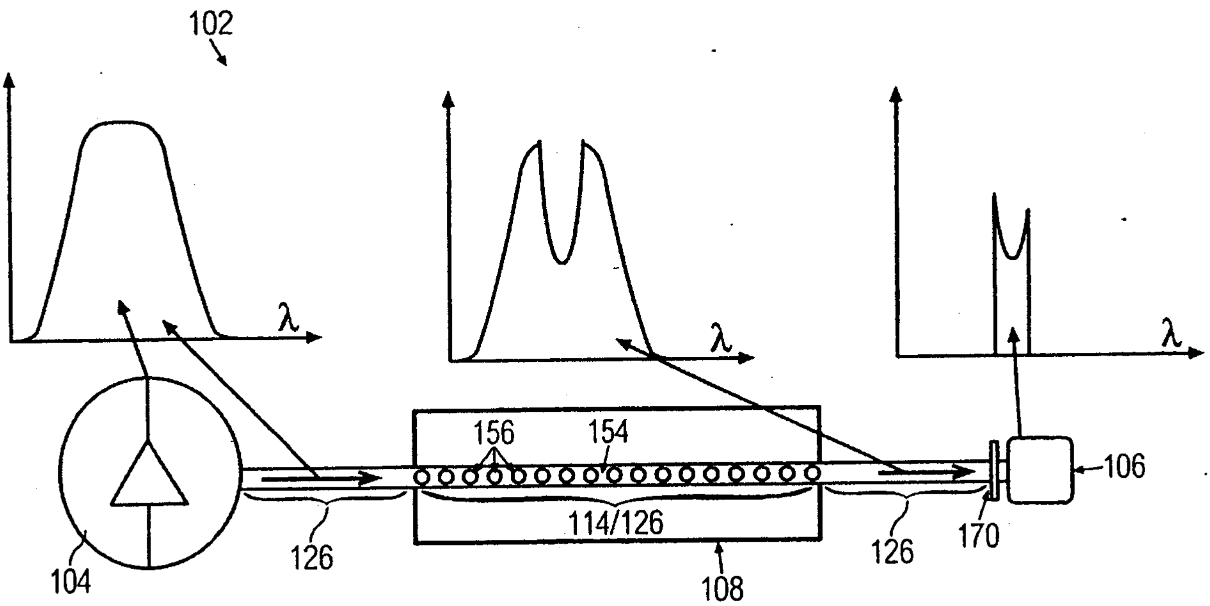

FIG. 12

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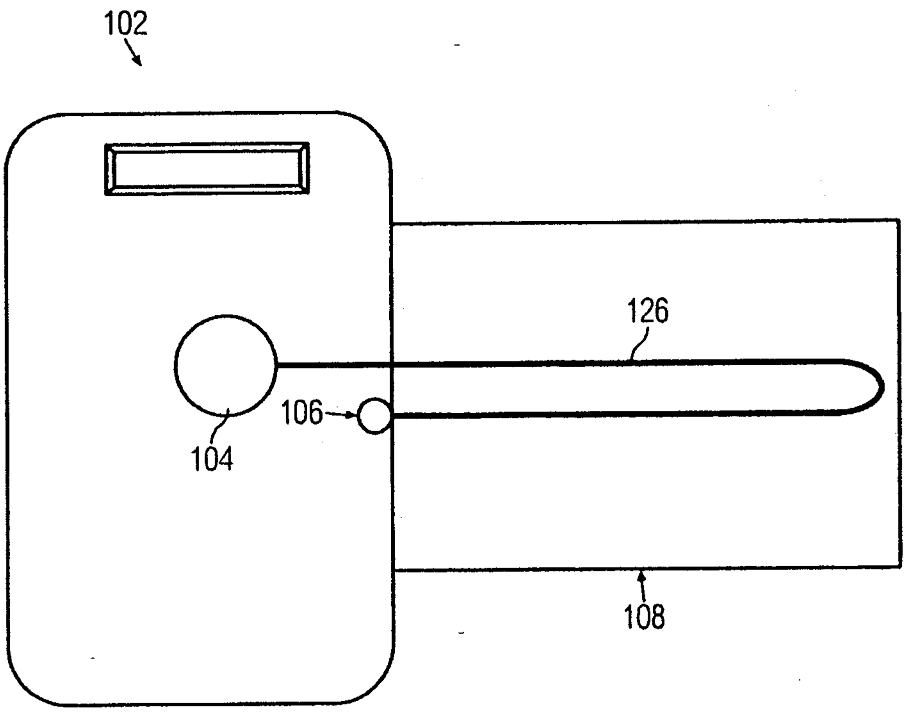

FIG. 13

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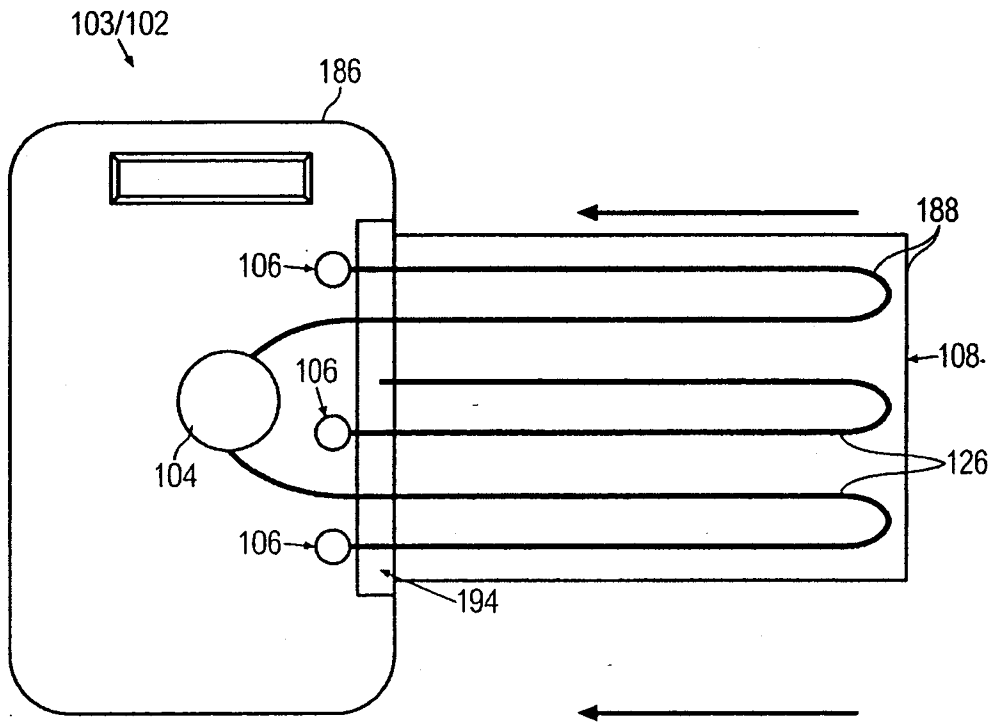

FIG. 14

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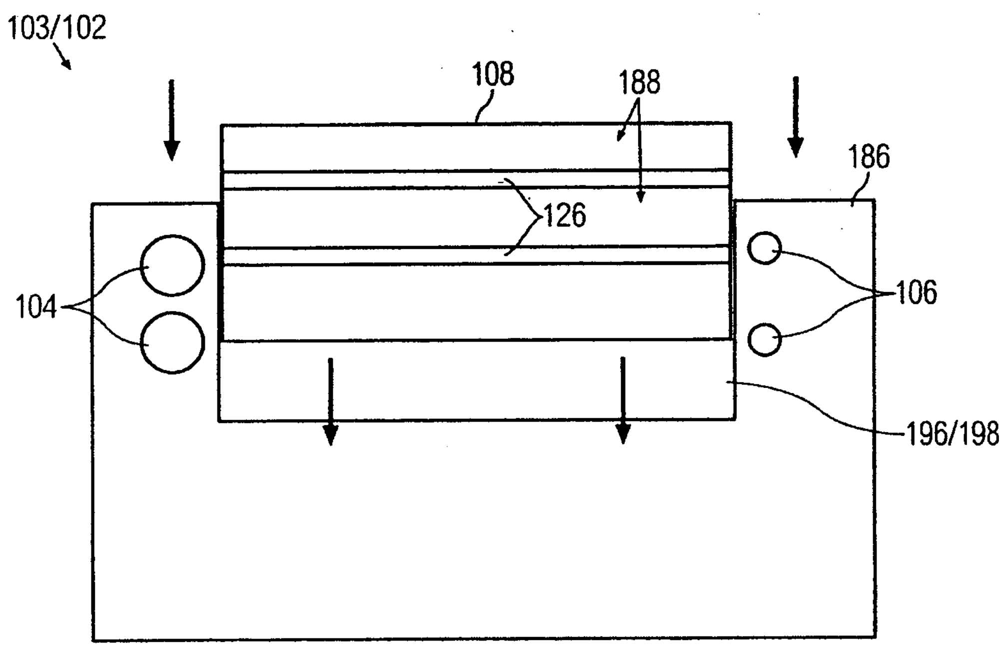

FIG. 15

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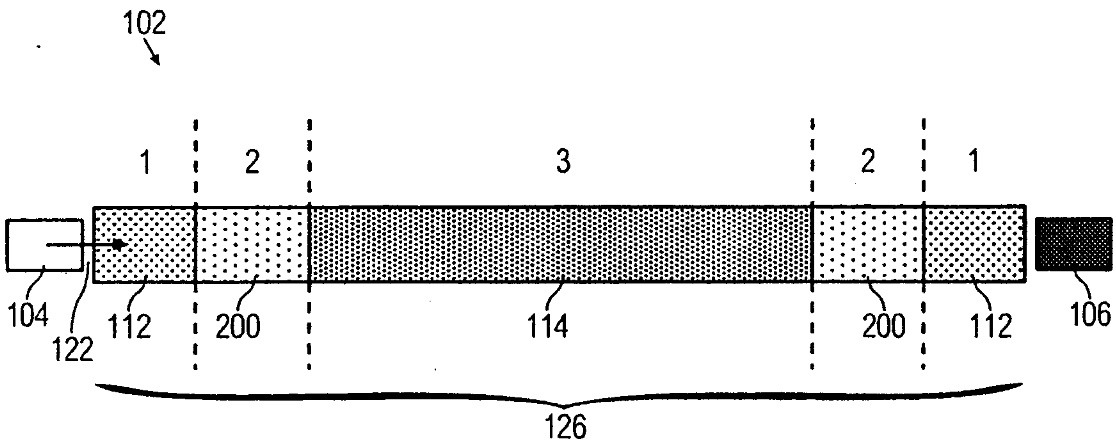

FIG. 16

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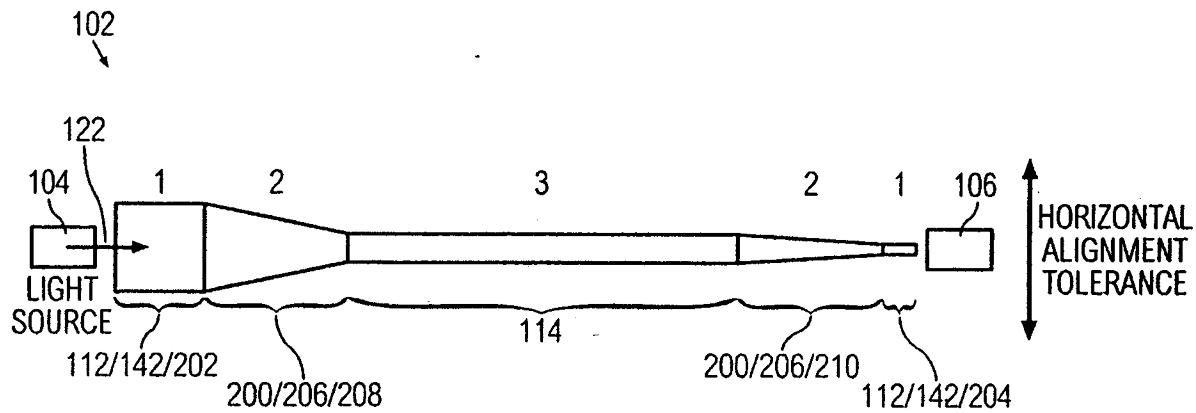

FIG. 17A

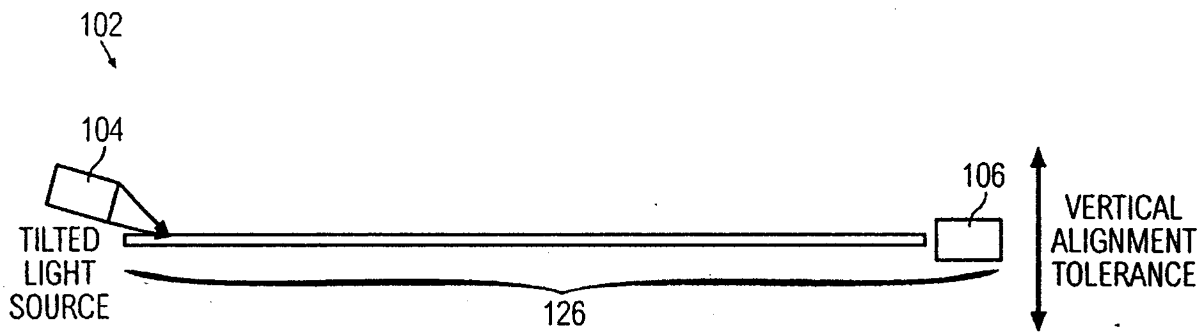

FIG. 17B

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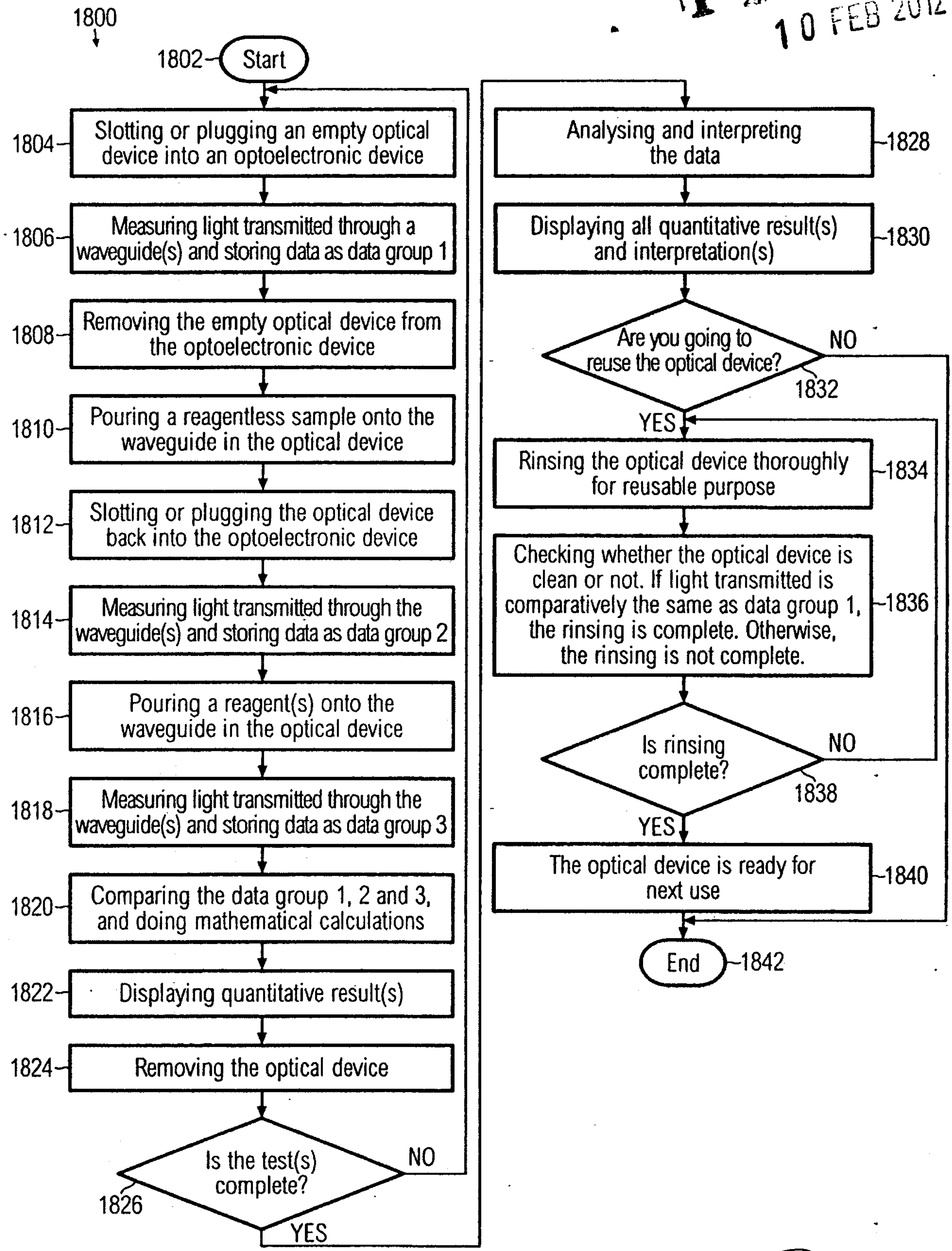

FIG. 18

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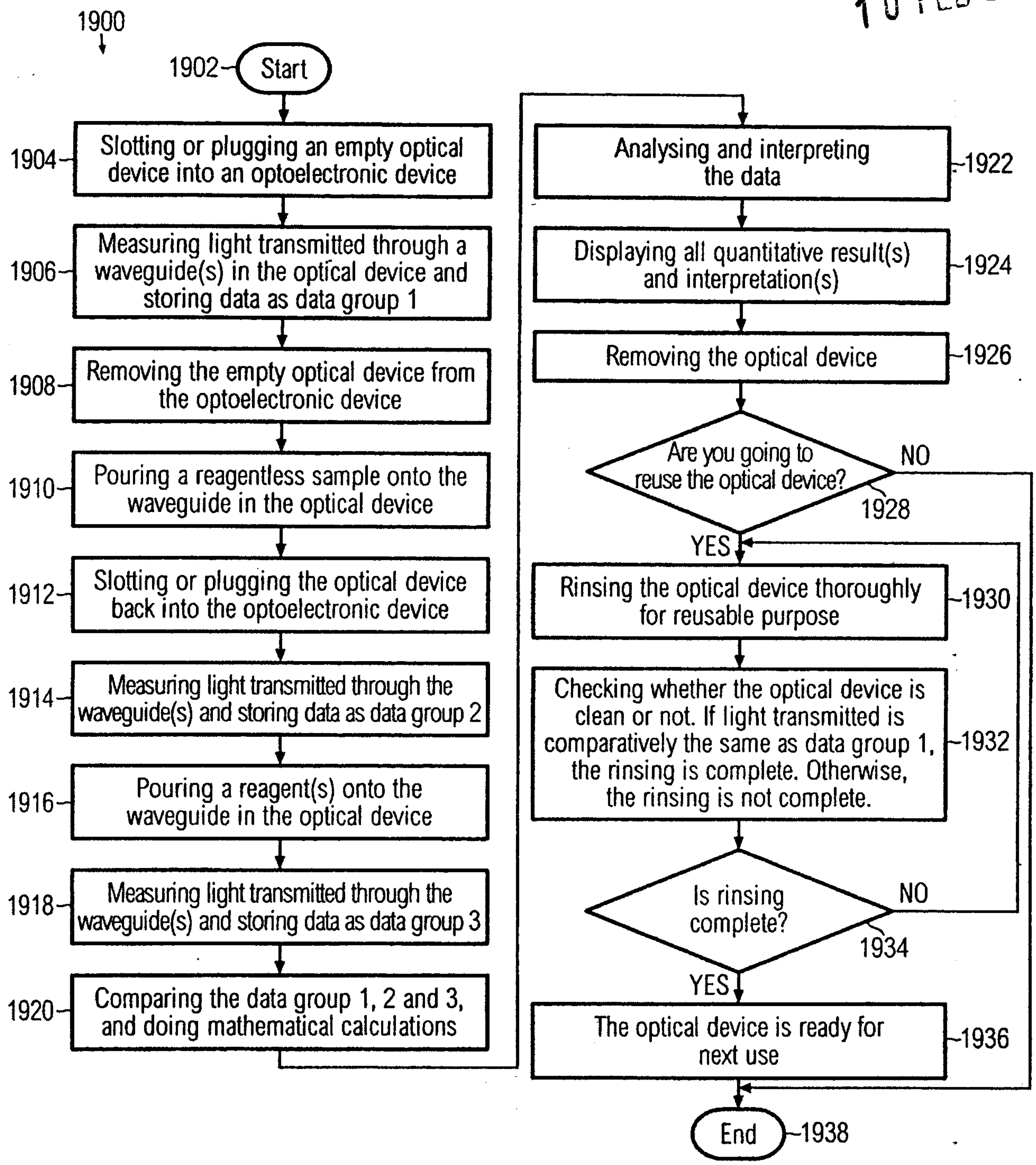

FIG. 19

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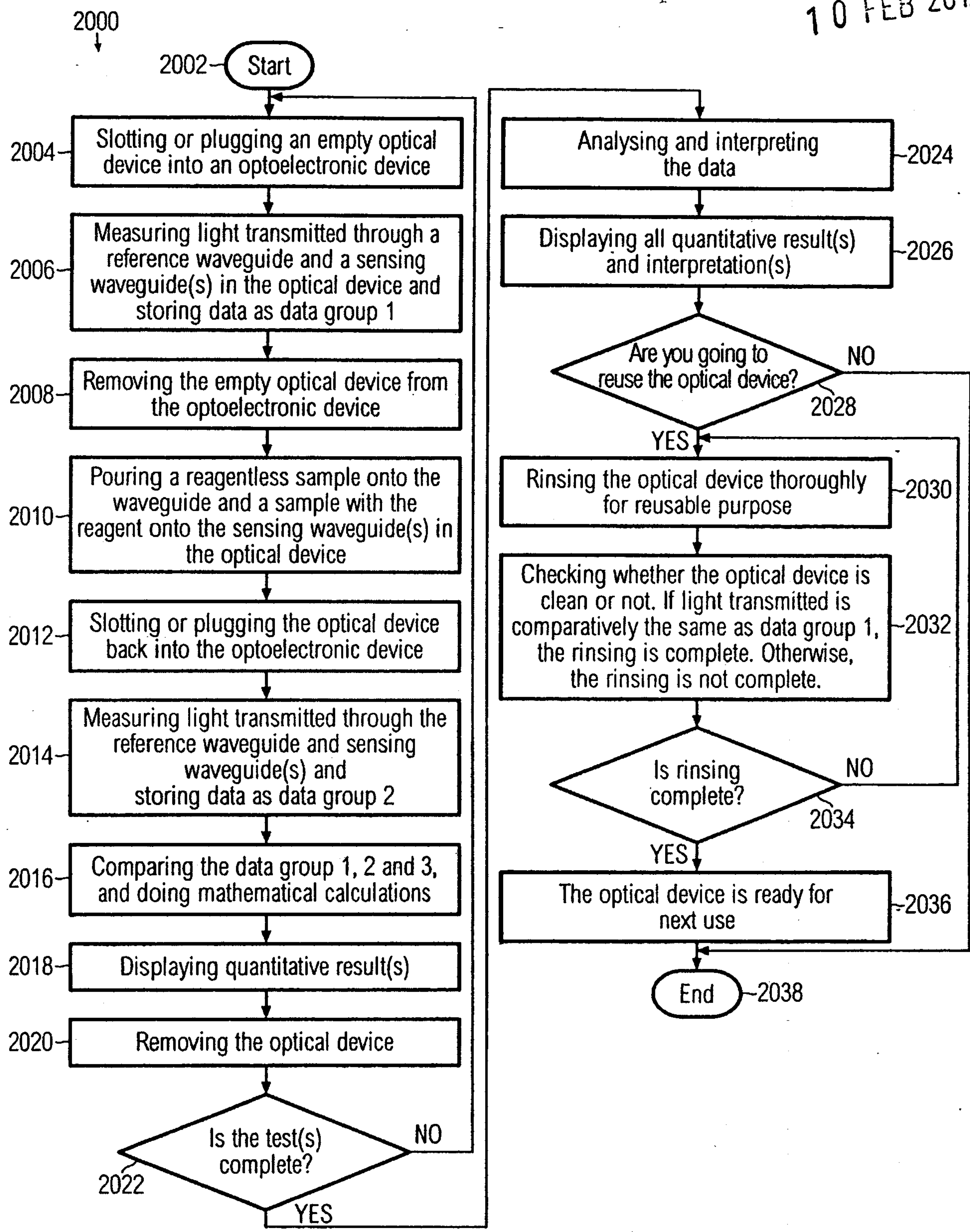

FIG. 20

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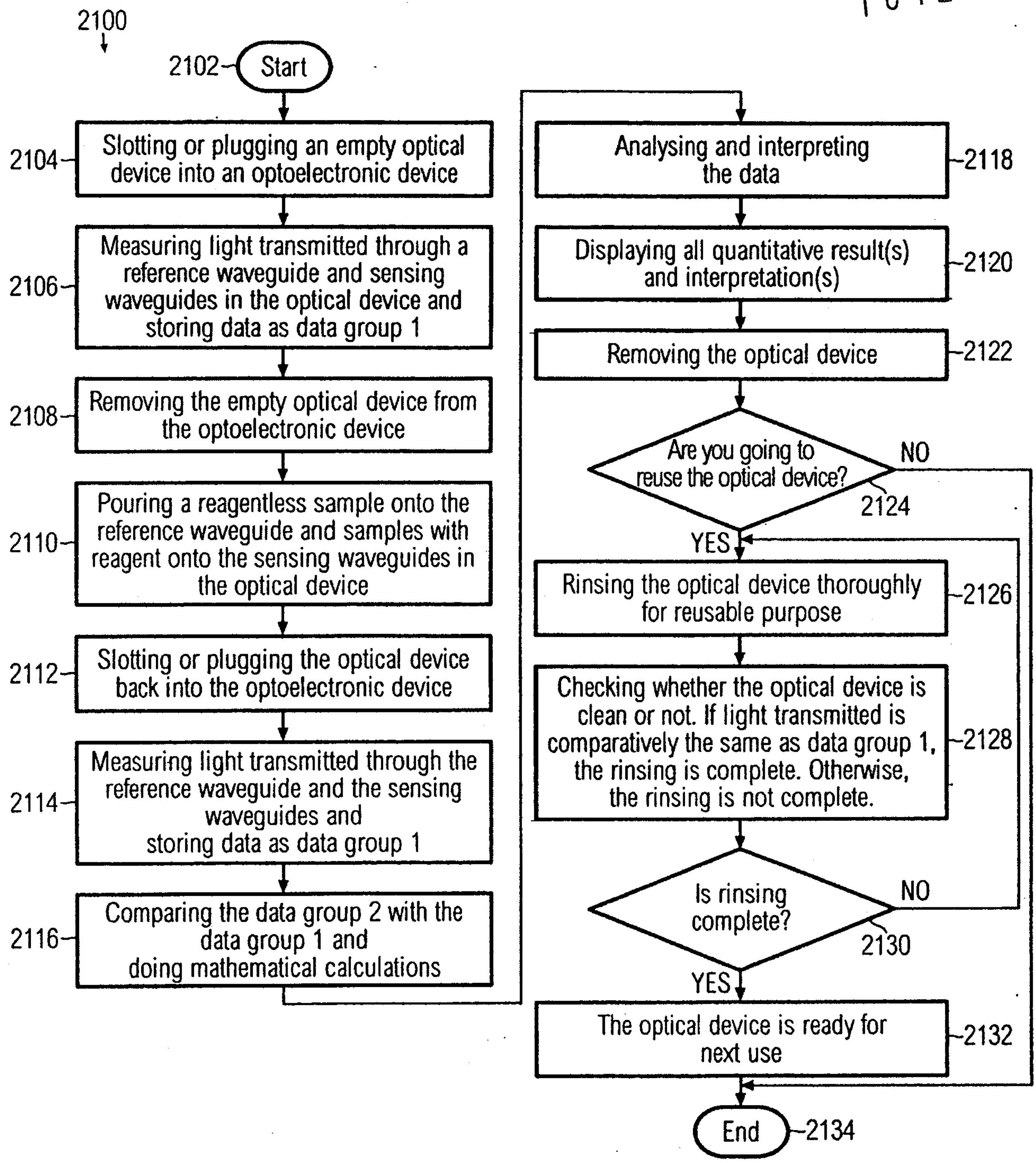

FIG. 21

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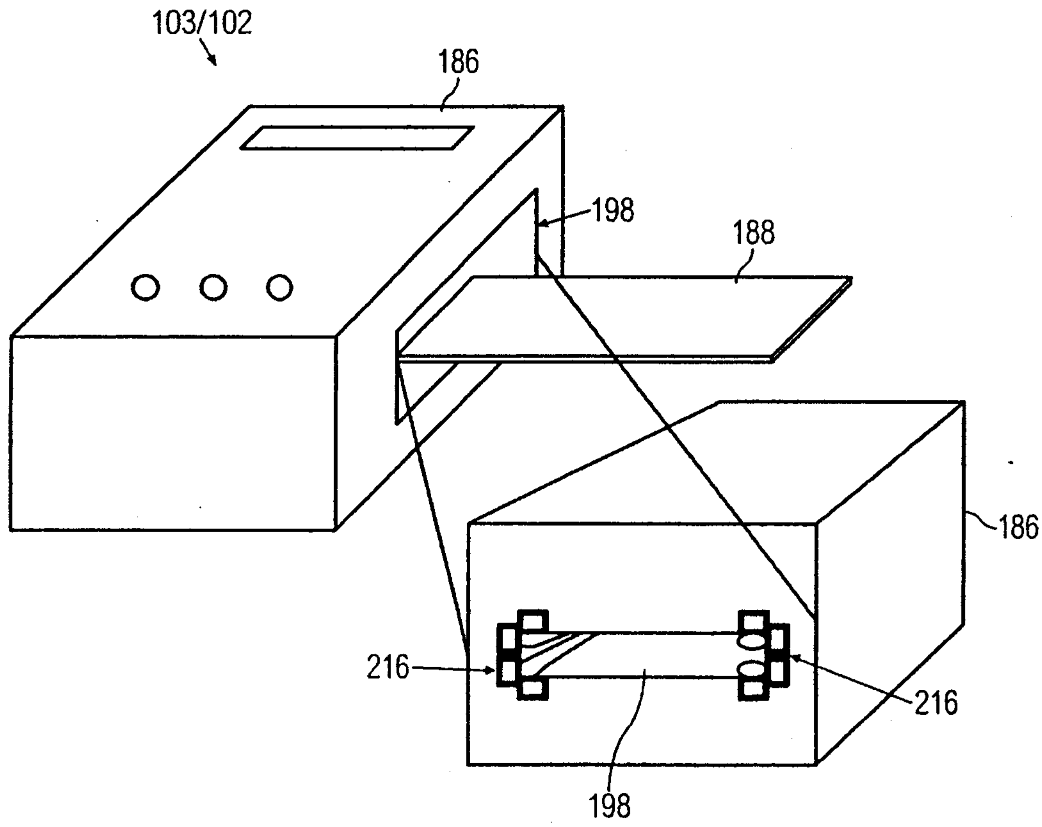

FIG. 22

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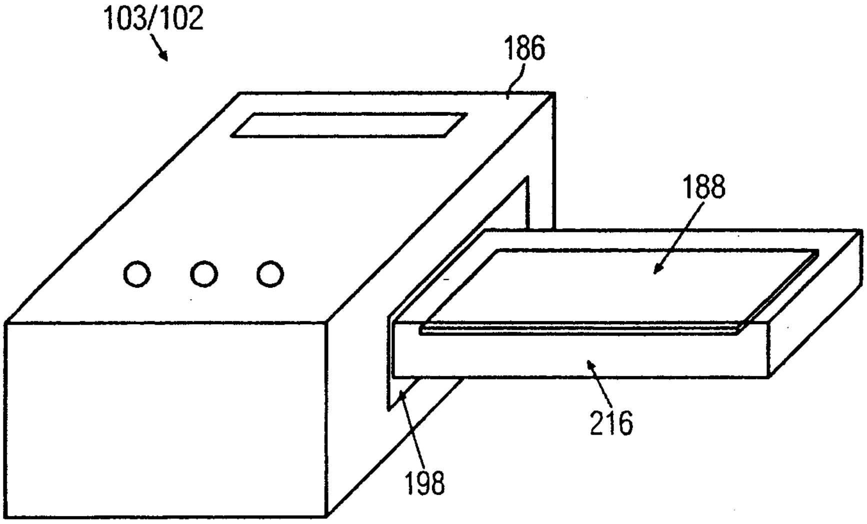

FIG. 23

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A SENSOR ELEMENT

Technical Field

[0001] Embodiments relate to a sensor element.

Background

[0002] Measuring or detecting molecules or analytes in samples is a rapidly growing demand in environmental, medical, agricultural, chemical and industrial sectors. In the environmental sector, such sensors or detectors may be employed to measure certain molecule contents inside city water or reservoirs. For the medical sector, such devices may be employed for measuring or detecting biomolecules as disease markers in situ and/or continuously.

[0003] It is common in the medical field to measure the concentration of molecules in fluids obtained from patients. The demand for new tests of blood or urine chemistry has increased rapidly, with resultant growth of centralized testing laboratories. The current performance of quantitative diagnostic or screening tools may be largely restricted to centralized laboratories because of the need for long assay times, and relatively bulky, complex and expensive analytical equipment, as well as highly trained personnel. If a wider range of the diagnostic and health monitoring tools may be run simpler, more inexpensively and at the point of care or in the home healthcare, the health of millions patients may be improved annually, particularly for old people who often need regular health monitoring or check up but have difficulties to visit the healthcare facilities.

[0004] Therefore, there is a need for a simple, compact, smart, robust and inexpensive sensor element which can provide high quality results.

Summary

[0005] In various embodiments, a sensor element is provided. The sensor element may include a light input configured to receive input light, a sample chamber configured to accommodate a sample and at least one polymer waveguide optically coupling the light input with the sample chamber, the at least one polymer waveguide may include a first contact portion and a second contact portion, wherein at least a portion of the second contact portion may be arranged in the sample chamber. The second contact portion may include a different structure than the first contact portion so that a change of the light intensity of the input light passing through the second contact portion may be caused due to an interaction between the input light passing through the second contact portion and the sample and wherein the change of the light intensity of the input light passing through the second contact portion may be different from the change of the light intensity of the input light passing through the first contact portion.

Brief Description of the Drawings

[0006] In the drawings, like reference characters generally refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead generally being placed upon illustrating the principles of various embodiments. In the following description, various embodiments of the invention are described with reference to the following drawings, in which:

FIG. 1 shows a top view of a sensor element with a light source and three optical detectors respectively positioned on two opposite sides of a sample chamber, three Bragg grating filters and a second contact portion including at least two shaped portions, each shaped portion separated by a gap according to an embodiment;

FIG. 2 shows a top view of a sensor element with a light source and three optical detectors respectively positioned on two opposite sides of a sample chamber, three Bragg grating filters and a second contact portion including a continuous portion with at least one hole according to an embodiment;

FIG. 3 shows a top view of a sensor element with a light source and three optical detectors respectively positioned on two opposite sides of a sample chamber, three Bragg grating filters and a second contact portion including a continuous portion with a varying diameter according to an embodiment;

FIG. 4 shows a top view of a sensor element with a light source and three optical detectors respectively positioned on two opposite sides of a sample chamber, three Fabry-Perot filters and a second contact portion including at least two shaped portions, each shaped portion separated by a gap according to an embodiment;

FIG. 5 shows a top view of a sensor element with a light source and three optical detectors respectively positioned on two opposite sides of a sample chamber, three Fabry-Perot filters and a second contact portion including a continuous portion with at least one hole according to an embodiment;

FIG. 6 shows a top view of a sensor element with a light source and three optical detectors respectively positioned on two opposite sides of a sample chamber, three Fabry-