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(54) **CONTACT-TYPE SENSOR**

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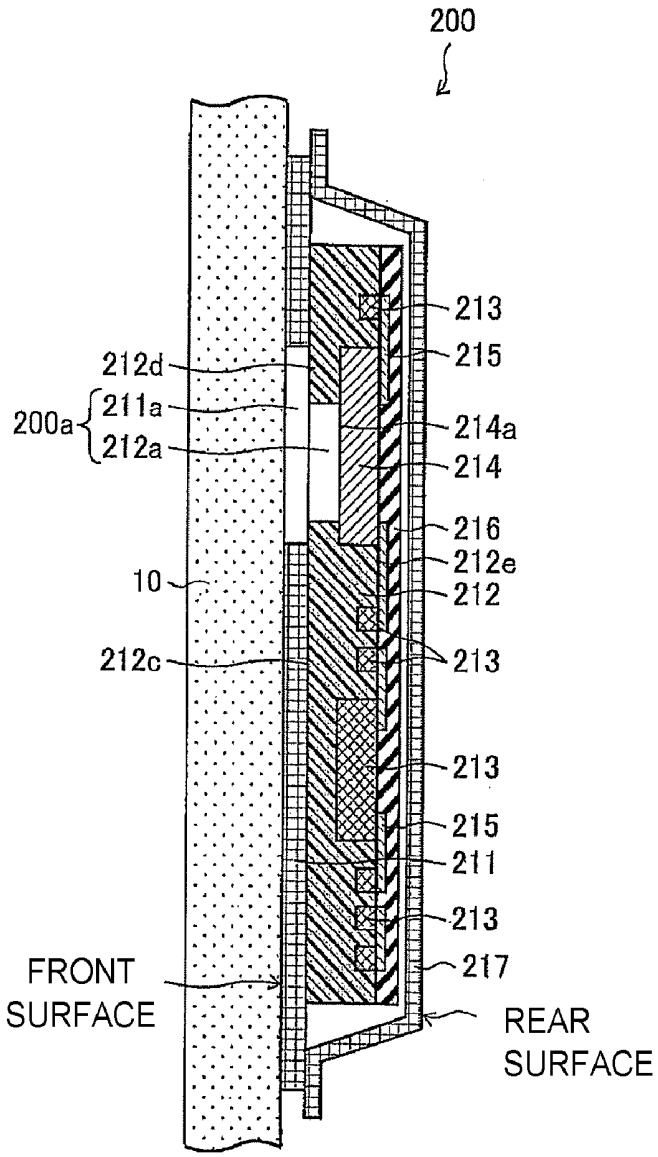
(57) **ABSTRACT**

The present invention limits measurement error and sensor element damage. When a contact-type sensor (**200**) is placed in contact with skin (**10**), a gap (**200***a*) is formed between the skin (**10**) and a sensor element (**214**). The contact-type sensor (**200**) is provided with a water-repellent resin base plate (**212**) and a water-absorbing sheet (**211**) that, together with the skin (**10**) and the sensor element (**214**), surround the gap (**200***a*).



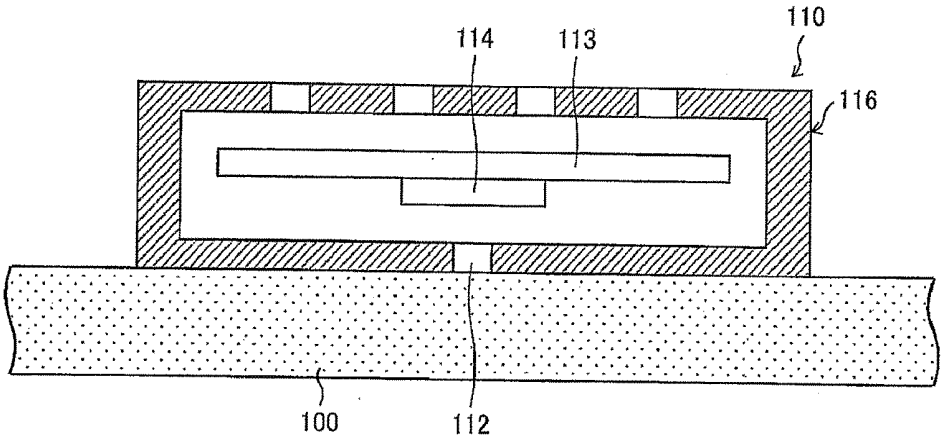


FIG. 1

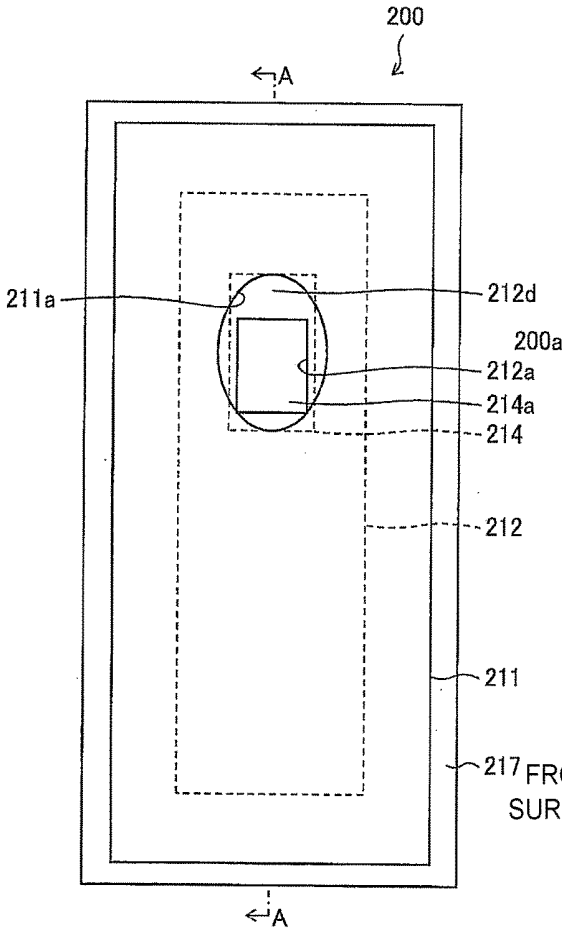


FIG. 2(a)

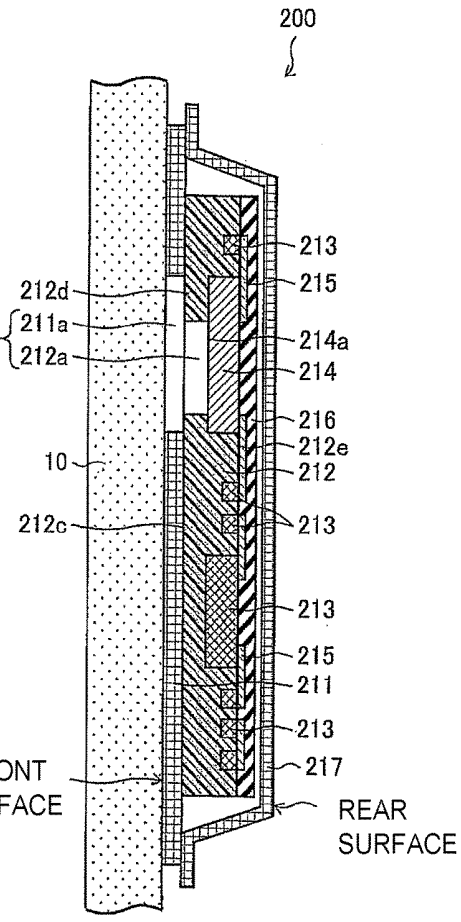


FIG. 2(b)

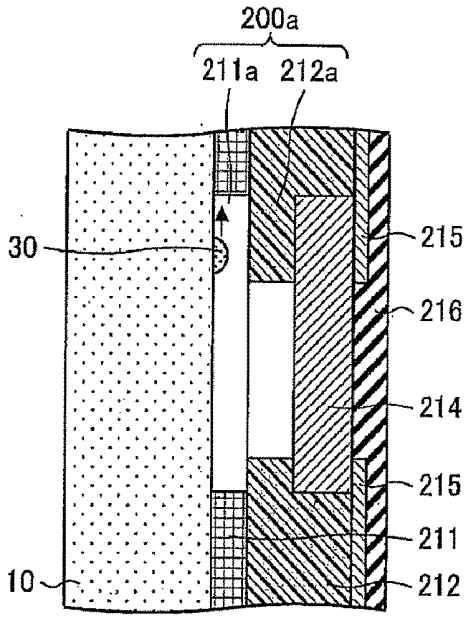

200a
211a
212a
30
215
216
214
215
211
10
212

FIG. 4(a)

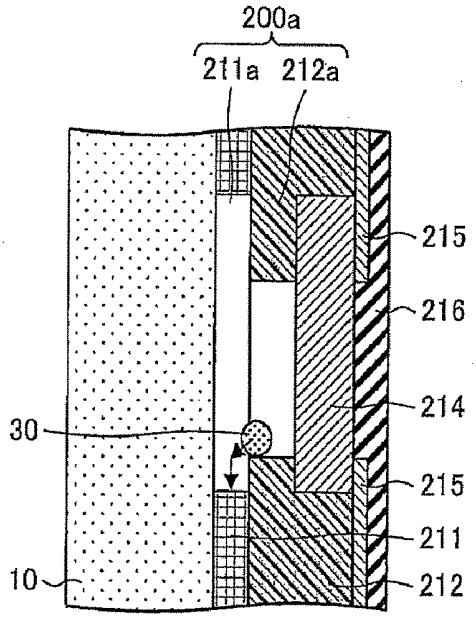

200a
211a
212a
215
216
214
30
215
211
10
212

FIG. 4(b)

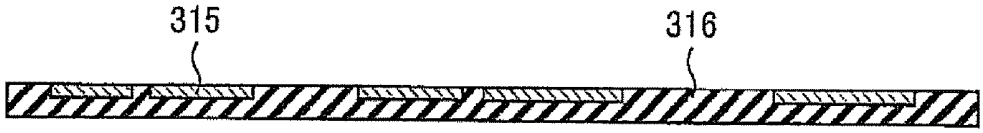


FIG. 5(a)

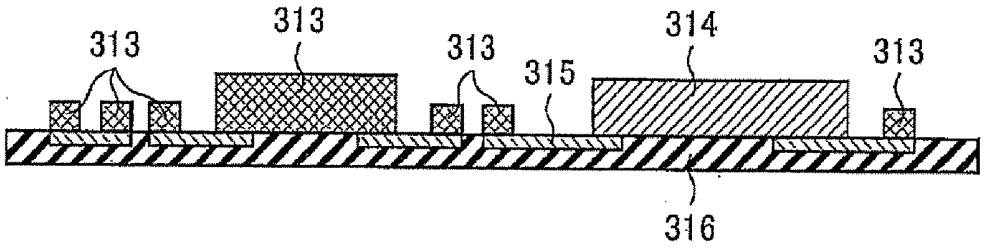


FIG. 5(b)

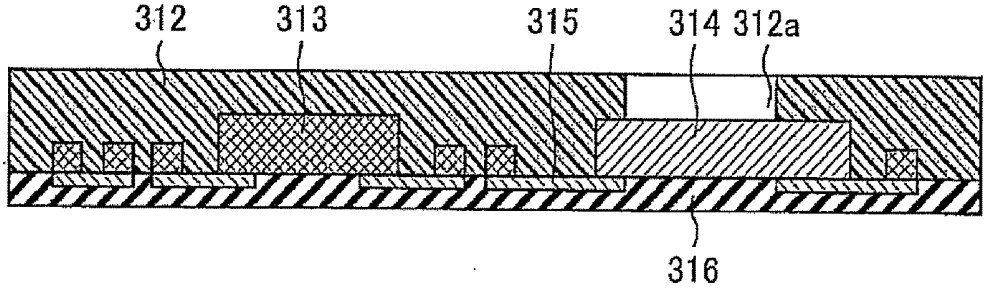


FIG. 5(c)

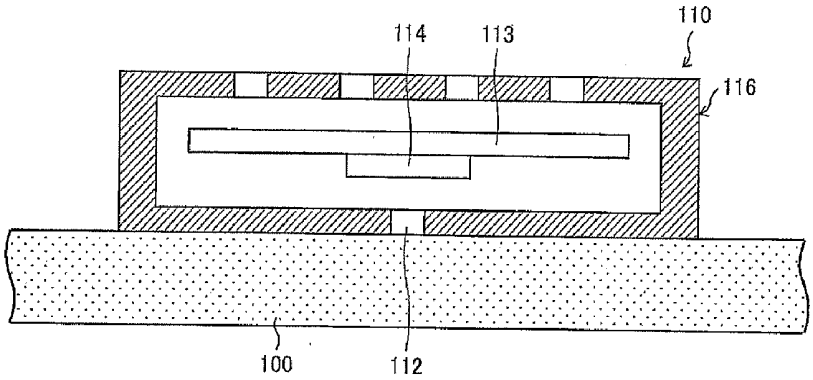

114
113
110
116
100
112

FIG. 1

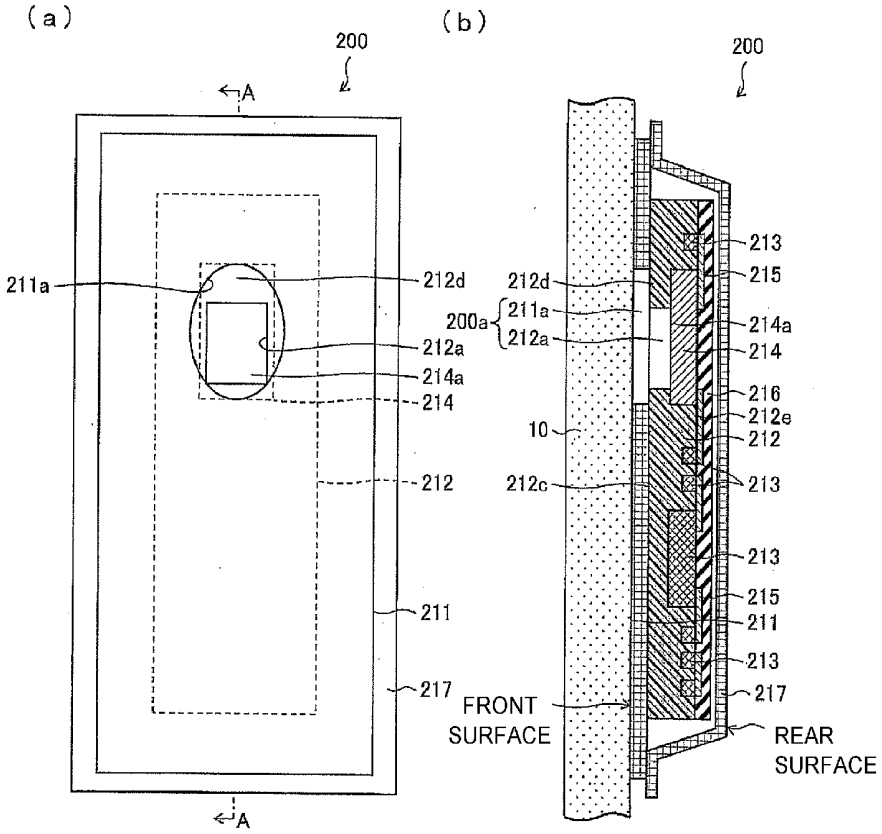

(a)
(b)
200
200
A
A
211a
212d
212a
214a
214
212
211
217
212d
211a
212a
200a
213
215
214a
214
216
212e
212
10
212c
213
213
215
211
213
217
FRONT SURFACE
REAR SURFACE

FIG. 2

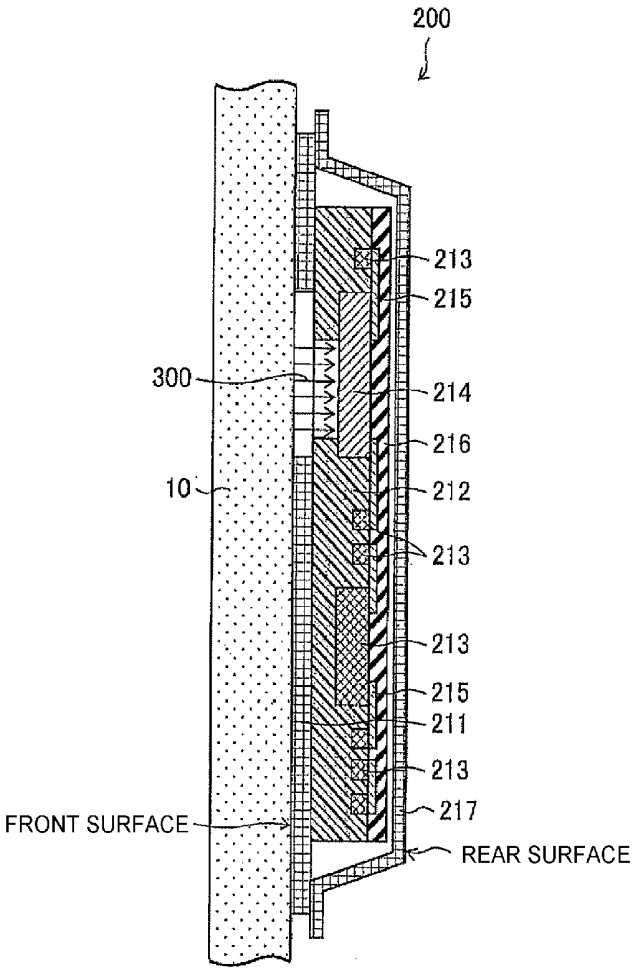

200
213
215
300
214
216
10
212
213
213
215
211
213
217
FRONT SURFACE
REAR SURFACE

FIG. 3

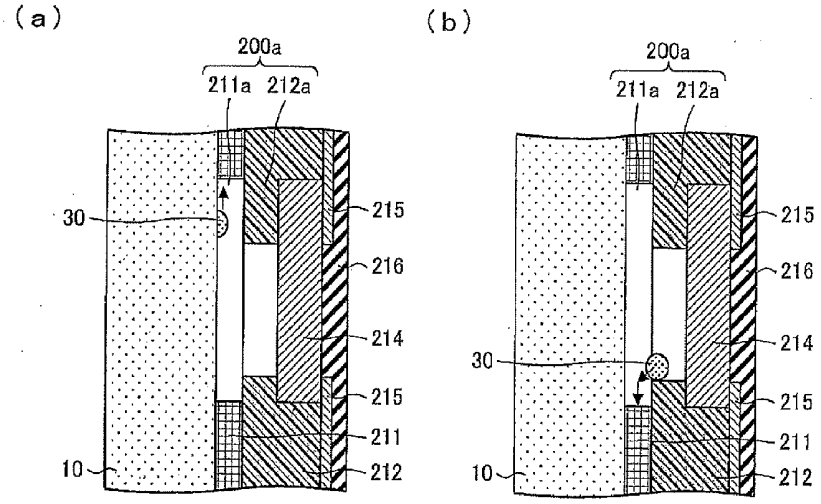

(a)
200a
211a
212a
30
215
216
214
215
211
212
10
(b)
200a
211a
212a
215
216
214
30
215
211
212
10

FIG. 4

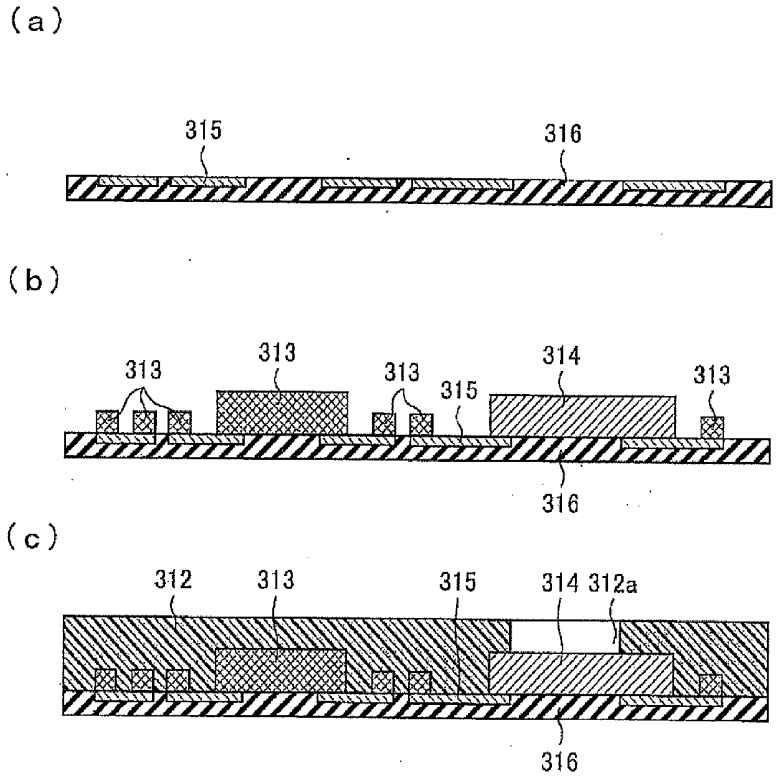


FIG. 5

CONTACT-TYPE SENSOR

TECHNICAL FIELD

[0001] The present disclosure relates to a contact-type sensor which is adapted to perform measurement while being in contact with an object to be measured such as the skin of the body.

BACKGROUND ART

[0002] There is an increasing demand for contact-type sensors capable of constantly measuring body temperature or body surface humidity and perspiration. Contact-type sensors are aimed at prevention of hyperthermia such as sunstroke, thermal fatigue, heatstroke and so on, or early detection of diseases accompanied by high temperature fever such as influenza. The contact-type sensor is attached to a surface portion (the skin) of a human body and has a sensor element for performing measurement of a degree of perspiration or temperature, and it is thin, lightweight, compact, highly water resistant wearable electronic equipment.

[0003] Conventionally, as a contact-type sensor, a body perspiration monitoring apparatus proposed in Patent Literature 1 is known. FIG. **1** is a schematic diagram illustrating this body perspiration monitoring apparatus. As illustrated in FIG. **1**, the body perspiration monitoring apparatus **110** includes a sensor element (temperature and humidity sensor) **114**, a shielding plate **113** for controlling a flow of sweat vapor, and a case **116** designed to optimize sensor sensitivity and serving to measure a degree of perspiration from the skin **100**.

[0004] Further, Patent Literature 2 proposes a warning apparatus which includes the components included in the body perspiration monitoring apparatus of Patent Literature 1 and a sensor element which captures heat dissipation over time and predicts the occurrence of hyperthermia.

LITERATURE LIST

Patent Literature

Patent Literature 1:

[0005] Japanese Unexamined Patent Application Publication No. 2012-85983

Patent Literature 2:

[0006] Japanese Unexamined Patent Application Publication No. **2013-90894**

Patent Literature 3:

[0007] Japanese Patent No. 5359550

SUMMARY OF THE INVENTION

Technical Problem

[0008] In the apparatuses proposed in Patent Literatures 1 and 2, as illustrated in FIG. **1**, an inflow hole **112** for introducing the sweat vapor discharged from the skin **100** is formed. Not only the sweat vapor but also a liquid (for example, sweat in a liquid state) may enter an inside of the apparatus from the inflow hole **112**, and the liquid may adhere to the sensor element **114** in some cases. When liquid adheres to the sensor element **114**, there may be certain problems such as measurement errors being likely to occur and the sensor element **114** also being easily damaged.

[0009] The present invention has been made in view of the above problems, and an object thereof is to prevent measurement errors and breakage in a sensor element in a contact-type sensor.

Solution to Problem

[0010] To solve the above-described problems, a contact-type sensor of the present invention includes a contact portion which is brought into contact with an object to be measured, a sensor element which is disposed with a gap between the sensor element and the object to be measured and detects a detection target generated from the object to be measured when the contact portion is in contact with the object to be measured, and a water repellent portion and a water absorbing portion which surrounds the gap together with the object to be measured and the sensor element when the contact portion is in contact with the object to be measured.

Advantageous Effects of Invention

[0011] An object of the present invention is to suppress the measurement error and the breakage of the sensor element in the contact-type sensor.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. **1** is a schematic diagram illustrating a conventional body perspiration monitoring apparatus.

[0013] FIG. **2** is a front view and a cross-sectional view of a contact-type sensor according to an embodiment of the present invention.

[0014] FIG. **3** is a view illustrating a state in which infrared radiation emitted from the skin is directed toward a sensor element of the contact-type sensor of FIG. **2**.

[0015] FIG. **4** is a view illustrating a state in which a liquid enters a gap between the sensor element and the skin.

[0016] FIG. **5** is a cross-sectional view illustrating a manufacturing process of a contact-type sensor according to a modified example.

DESCRIPTION OF THE EMBODIMENTS

[0017] Hereinafter, a contact-type sensor according to an embodiment of the present invention will be described with reference to the drawings. FIG. **2**(*a*) is a front view schematically illustrating a contact-type sensor according to one embodiment of the present invention, and FIG. **2**(*b*) is a view schematically illustrating a cross section taken along line A-A of the contact-type sensor of FIG. **2**(*a*).

[0018] The contact-type sensor **200** of the embodiment is used by being brought into contact with the skin (body surface) **10** of a person as an object to be measured and is an electronic device which detects a body temperature of the person with a thermopile installed therein. Further, in the embodiment, as illustrated in FIG. **2**(*b*), in the contact-type sensor **200**, a side thereof which is brought into contact with the skin **10** is a front surface, and a side thereof opposite to the side in contact with the skin **10** is a rear surface.

[0019] As illustrated in FIG. **2**, the contact-type sensor **200** includes a water absorptive sheet **211**, a resin substrate

(casing) **212**, electronic components **213**, a sensor element **214**, wiring **215**, an insulating layer **216** and a hygroscopic sheet **217**.

[0020] In the contact-type sensor **200**, the water absorptive sheet **211**, the resin substrate **212**, the wiring **215**, the insulating layer **216** and the hygroscopic sheet **217**, respectively in a direction from the front surface side toward the rear surface side are arranged parallel to each other, and the electronic components **213** and the sensor element **214** are embedded in the resin substrate **212**.

[0021] The resin substrate **212** is a member having a substantially flat plate shape and is formed of a resin, and the electronic component **213** and the sensor element **214** are embedded and supported therein. Further, in the embodiment, a surface of the resin substrate **212** facing the water absorptive sheet **211** is defined as a substrate front surface **212***c*, and a surface thereof opposite to the substrate front surface **212***c* is defined as a substrate rear surface **212***e*.

[0022] The electronic component **213** is a resistor, a condenser, an IC, or the like. The sensor element **214** is an element which detects infrared rays necessary for measuring a temperature (body temperature) of a human body on which measurement is to be performed. Specifically, the sensor element **214** is a thermopile for detecting infrared rays emitted from the skin **10** and is an element which needs to be separated from the skin **10** by a certain distance.

[0023] Further, the sensor element **214** and the electronic component **213** are embedded in the resin substrate **212** and exposed from the substrate rear surface **212***e*. On the substrate rear surface **212***e*, exposed portions of the sensor element **214** and the electronic component **213** serve as electrodes. Also, the wiring **215** for electrically connecting the electrodes is formed on the substrate rear surface **212***e*.

[0024] Further, the sensor element **214** is embedded in the resin substrate **212** so that the substrate front surface **212***c* protrudes toward the front surface side of the contact-type sensor **200** further than the sensor element **214**. That is, when the contact-type sensor **200** is brought into contact with the skin **10**, the substrate front surface **212***c* protrudes toward the skin **10** side further than the sensor element **214**.

[0025] Also, as illustrated in FIG. **2**(*b*), in the contact-type sensor **200**, a surface of both surfaces of the water absorptive sheet **211** on a side opposite to a surface thereof facing the substrate front surface **212***c* is used as a contact portion, and the contact portion is used by being brought into contact with the skin **10**. At this time, a gap **200***a* is formed between the sensor element **214** and the skin **10**.

[0026] Specifically, in the water absorptive sheet **211**, an opening portion **211***a* is formed between the sensor element **214** and the skin **10**, and in the resin substrate **212**, a hollow portion **212***a* is formed between the sensor element **214** and the skin **10**. Additionally, the opening portion **211***a* and the hollow portion **212***a* are aligned with the gap **200***a*.

[0027] When a surface of the sensor element **214** on a front surface side of the contact-type sensor **200** is defined as a sensor element front surface **214***a*, as illustrated in FIG. **2**(*b*), the hollow portion **212***a* is formed to expose a part of the sensor element front surface **214***a* to the front surface side of the contact-type sensor **200**, and the other portion (portion other than the above portion) of the sensor element front surface **214***a* is covered on the resin substrate **212**. Therefore, by restricting the area of the hollow portion **212***a* to that with which only a necessary and sufficient amount of infrared radiation for measurement reaches the sensor element front surface **214***a* (detection surface), it is possible to prevent unnecessary substances from reaching the sensor element front surface **214***a* as much as possible.

[0028] Furthermore, in the embodiment, when a portion of the resin substrate **212** which faces a part of the sensor element front surface **214***a* is a facing portion **212***d*, the facing portion **212***d* is in a form of being in contact with the sensor element front surface **214***a*, but a gap may be formed between the facing portion **212***d* and the sensor element front surface **214***a*.

[0029] Subsequently, the contact-type sensor **200** of the embodiment will be described together with a manufacturing process thereof

Process A

[0030] First, a process A is performed. The process A is a process of forming the resin substrate **212** on which the electronic component **213**, the sensor element **214**, the wiring **215** and the insulating layer **216** are mounted.

[0031] First, the resin substrate **212** in which the electronic component **213** and the sensor element **214** are embedded is formed by insert molding. The electronic components **213** and the sensor element **214** are embedded in the resin substrate **212** by insert molding and exposed from the substrate rear surface **212**e.

[0032] Further, by the insert molding, the hollow portion **212***a* is formed so that the sensor element **214** is exposed from the substrate front surface **212***c* side (that is, the hollow portion **212***a* is formed in a region of the resin substrate **212** located between the skin **10** and the sensor element **214**).

[0033] In other words, the hollow portion **212***a* is a concave portion formed on the substrate front surface **212***c* side of the resin substrate **212**, a bottom surface of the concave portion corresponds to the sensor element front surface **214***a*, and a side surface of the concave portion is the facing portion **212***d* in FIG. **2**(*b*).

[0034] Next, on the substrate rear surface **212***e* side, the wiring **215** which connects the electrodes of each electronic component **213** (or the electrodes of the electronic component **213** and the sensor element **214**) is formed. In addition, the wiring **215** is a print wiring (printed wiring).

[0035] Next, the insulating layer **216** covering the substrate rear surface **212***e* is formed. As the insulating layer **216**, an insulating resin can be used. As the insulating resin, for example, (1) a modified acrylate resist such as urethane acrylate, or (2) a soft coating material such as a polyester elastomer or olefin elastomer can be used.

[0036] Further, a portion of the electronic component **213** and the sensor element **214** exposed from the substrate rear surface **212***e*, and the wiring **215** are also covered with the insulating layer **216**. As a result, as illustrated in FIG. **2**(*b*), the wiring **215** and the electronic component **213** are sealed with the resin substrate **212** and the insulating layer **216**.

[0037] In this way, the electronic component **213** and the sensor element **214** are embedded in the resin substrate **212**, and the wiring **215** and the insulating layer **216** are provided on the substrate rear surface **212***e* of the resin substrate **212**. Further, the process A can be realized by using the technique proposed in Patent Literature 3 (Japanese Patent No. 5359550).

[0038] The resin substrate **212** is manufactured by adding a water repellent additive to a resin base material. In the embodiment, PC (polycarbonate) is used as a base material, a fluorine-based surfactant (trade name: Surflon: AGC Seimi

Chemical Co., Ltd.) is used as a water repellent additive, and the resin substrate **212** is manufactured by adding about 1 wt % of a fluorine-based surfactant to PC. Therefore, the resin substrate **212** becomes a water repellent substrate (water repellent portion, water repellent layer) having water repellency.

[0039] Further, in addition to PC, PE (polyester), PA (polyamide), PPC (polyphenylene sulfide), PP (polypropylene), elastomers or the like may be used as the base material used for the resin substrate **212**. Also, as the water repellent additive used for the resin substrate **212**, silicon-based pellets may be used in addition to the fluorine-based surfactant.

[0040] Furthermore, an amount of the water repellent additive added to the base material is set to an appropriate value in a range of 1 to 5 wt % according to a type of the base material and the water repellent additive.

Process B

[0041] The process A is followed by a process B. The process B is a process of covering the resin substrate **212**, in which the electronic component **213** and the sensor element **214** are embedded, with the water absorptive sheet **211** and the hygroscopic sheet **217**.

[0042] Specifically, the water absorptive sheet **211** and the hygroscopic sheet **217** which are larger in area than each of the substrate front surface **212***c* and the substrate rear surface **212***e* and also have substantially rectangular shapes are prepared. Additionally, as illustrated in FIG. **2**, the absorptive sheet **211** is disposed to face the substrate front surface **212***c*, the hygroscopic sheet **217** is disposed to face the insulating layer **216**, and an end of the water absorptive sheet **211** and an end of the hygroscopic sheet **217** are adhered to each other. The resin substrate **212** is placed inside a bag formed of the water absorptive sheet **211** and the hygroscopic sheet **217** so that the absorptive sheet **211** covers the substrate front surface **212***c* and the hygroscopic sheet **217** covers the insulating layer **216** formed on the substrate rear surface **212***e*.

[0043] The water absorptive sheet **211** is positioned between the skin **10** and the resin substrate **212** when the contact-type sensor **200** is in use and is in contact with the skin **10**. As the water absorptive sheet **211**, a material with good water absorptiveness such as a cloth material (for example, a cloth material having a structure having gaps between fibers such as gauze or the like), a sponge, or a foamed resin is used. Therefore, while the contact-type sensor **200** is in contact with the skin **10**, liquid sweat generated from the skin **10** is absorbed into the water absorptive sheet **211**.

[0044] Further, as the water absorptive sheet **211**, a sponge material such as a urethane-based material may be used, and a foamed resin material may be used. A sheet obtained by applying a gel material (gel material capable of absorbing moisture of several hundred times the weight of the gel material itself) on a nonwoven fabric or the like can also be used as the water absorptive sheet **211**.

[0045] Since the hygroscopic sheet **217** is positioned on an opposite side (rear surface side) to a side in contact with the skin **10** in the contact type sensor **200**, it is preferable that the hygroscopic sheet **217** has a superior function of absorbing sweat vapor evaporated from the skin **10**. Therefore, as the hygroscopic sheet **217**, natural fiber (cotton, hemp, silk, or the like) having good hygroscopicity or regenerated fiber (rayon or the like) is used.

[0046] After the resin substrate **212** is wrapped with the water absorptive sheet **211** and the hygroscopic sheet **217**, the opening portion **211***a* is formed in a portion of the water absorptive sheet **211** which faces the hollow portion **212***a* and the sensor element **114**.

[0047] Therefore, as illustrated in FIG. **3**, when the water absorptive sheet **211** of the contact-type sensor **200** is brought into contact with the skin **10**, the sensor element **214** is disposed at a portion spaced apart from the skin **10** at a predetermined distance, and the gap **200***a* is formed between the sensor element **214** and the skin **10**. Accordingly, in the gap **200***a*, infrared rays **300** are generated from the skin **10**, and the infrared rays **300** reach the sensor element front surface **214***a* (detection surface), and thus a body temperature is measured.

[0048] Also, since the measurement is performed as described above, in the contact-type sensor **200** of the embodiment, it is necessary to form the gap **200***a* between the sensor element **214** and the skin **10**, and also it is not possible to perform sealing for providing waterproofing with respect to the gap **200***a*.

[0049] Therefore, as described above, the contact-type sensor **200** of the embodiment includes (a) the contact portion (water absorptive sheet **211**) which is brought into contact with the skin **10** to be measured, (b) the sensor element **214** which is disposed with the gap **200***a* between the sensor element **214** and the skin **10** and detects the infrared rays (detection target) **300** generated from the skin **10** when the water absorptive sheet **211** is in contact with the skin **10**, and (c) a water repellent portion (water repellent layer) and a water absorbing portion (water absorbing layer) which surrounds the gap **200***a* together with the skin **10** and the sensor element **214** when the water absorptive sheet **211** is in contact with the skin **10**. Also, the resin substrate **212** serves as the water repellent portion, and the water absorptive sheet **211** serves as the water absorbing portion.

[0050] Therefore, even when a liquid (for example, sweat in a liquid state) enters the gap **200***a* between the skin **10** and the sensor element **214**, (1) as illustrated in FIG. **4**(*a*), the liquid **30** is absorbed by the water absorbing portion formed of the water absorptive sheet **211** by a capillary phenomenon, or (2) as illustrated in FIG. **4**(*b*), the liquid **30** is repelled by a water repellent effect of the water repellent portion (the resin substrate **212**) and is absorbed by the water absorbing portion (the water absorptive sheet **211**).

[0051] Accordingly, since it is possible to prevent the liquid from reaching the sensor element **214** even when the liquid (for example, sweat in the liquid state) enters the gap **200***a* between the skin **10** and the sensor element **214** from the opening portion **211***a*, it is possible to prevent a problem (measurement error and breakage of internal elements) caused by the liquid being attached to the sensor element **214**.

[0052] In addition, in the contact-type sensor **200** of the embodiment, the electronic component **213** and the wiring **215** are sealed with the resin substrate **212** and the insulating layer **216**. That is, the electronic component **213** and the wiring **215** are surrounded by the resin substrate **212** and the insulating layer **216** without a gap so as not to be in contact with external air. Therefore, the electronic component **213** and the wiring **215** are shielded from water or moisture in

the air, and a waterproofing effect with respect to the electronic component **213** and the wiring **215** can be obtained.

[0053] Further, according to in the contact-type sensor **200** of the embodiment, the substrate front surface **212***c* is covered with the water absorptive sheet **211**, and the water absorptive sheet **211** is brought into contact with the skin **10** to be measured, and the measurement is performed. In the contact-type sensor **200**, since the water absorptive sheet **211** is in contact with the skin **10**, the sweat generated from the skin is absorbed by the water absorptive sheet **211** at a contact portion, and inhibition of perspiration from the skin is suppressed, and occurrence of dermatitis caused by the inhibition of the perspiration can be suppressed. On the other hand, in the conventional contact-type sensor, since a contact surface with the skin is formed of a material having no water absorbing function, there is a problem that perspiration from the skin is inhibited and thus dermatitus due to the inhibition of the perspiration occurs.

[0054] Further, according to in the contact-type sensor **200** of the embodiment, since the resin substrate **212** is covered with the water absorptive sheet **211** and the hygroscopic sheet **217**, there is an effect of improving waterproofing of the sensor element **214** and the electronic component **213** mounted on the resin substrate **212**.

[0055] Also, in the embodiment, the thermopile is used as the sensor element **214**, but there is no limitation to a thermopile as long as there is a sensor element used at a certain distance from the skin **10**.

[0056] For example, as the sensor element **214**, an electronic polymer type, a resistance change type, or a capacitance change type humidity sensor can be used. In this case, the sensor element **214** detects the sweat vapor generated from the skin **10**, and the contact-type sensor **200** serves as a perspiration measuring device which measures a degree of the perspiration. Additionally, in the contact-type sensor **200**, since the gap **200***a* (a space hardly affected by an external environment) is formed between the skin **10** and the sensor element **214** and the gap **200***a* is surrounded by the water repellent portion and the water absorbing portion, even when a humidity sensor is used as the sensor element **214**, a liquid (for example, sweat in a liquid state) is attached to the sensor element **214** can be suppressed while a space required for measurement is formed between the sensor element **214** and the skin **10**.

Modified Example

[0057] In the above-described embodiment, although the electronic component **213** and the sensor element **214** are embedded in the resin substrate **212** using the method disclosed in Patent Document 3 (Japanese Patent No. 5359550), a method other than the method of Patent Document 3 may be used. For example, a well-known method of manufacturing a printed circuit board can be used. This point will be described with reference to FIG. **5**.

[0058] First, as illustrated in FIG. **5**(*a*), a printed circuit in which a copper wiring **315** is formed on one surface of an insulating layer (insulating substrate) **316** formed of a polyimide resin is manufactured. Subsequently, as illustrated in FIG. **5**(*b*), on a surface of the insulating layer **316** on a side in which the copper wiring **315** is formed, an electronic component **313** (resistor, condenser, IC) and a sensor element **314** are mounted by soldering or the like. Subsequently, as illustrated in FIG. **5**(*c*), a resin substrate **312** is formed on a surface of the insulating layer **316** on the side on which the copper wiring **315**, the electronic component **313** and the sensor element **314** are mounted.

[0059] Specifically, the resin substrate **312** is formed on the insulating layer **316** so that the copper wiring **315** and the electronic component **313** are sealed with the resin substrate **312** and the insulating layer **316** and a hollow portion **312***a* which exposes a side of the sensor element **314** opposite to a side in contact with the insulating layer **316** is formed. Also, like the resin substrate **212**, the resin substrate **312** is prepared by adding a water repellent additive to a base material formed of a resin.

[0060] After that, the process B is performed in the same manner as in the previously described embodiment.

[0061] In the above embodiment, an example in which the contact-type sensor is used in contact with the human skin has been described, but it is obvious that it is not limited to the human skin but applicable to the skin of animals in general.

[0062] The present invention is not limited to each of the above-described embodiments, and various modifications are possible within the range indicated in the claims, and embodiments obtained by appropriately combining technical means disclosed in different embodiments are also included in the technical scope of the present invention.

Summary

[0063] As described above, the contact-type sensor of the present invention includes a contact portion which is brought into contact with an object to be measured, a sensor element which is disposed with a gap between the sensor element and the object to be measured and detects a detection target generated from the object to be measured when the contact portion is in contact with the object to be measured, and a water repellent portion and a water absorbing portion which surrounds the gap together with the object to be measured and the sensor element when the contact portion is in contact with the object to be measured.

[0064] According to the configuration of the present invention, even when a liquid flows into the gap, the liquid can be moved to the water absorbing portion by being repelled by the water repellent portion and then can be absorbed in the water absorbing portion. Therefore, it is possible to prevent the liquid from being attached to the sensor element, and thus it is possible to suppress the measurement error and the breakage of the element.

[0065] Also, in addition to the above-described configuration, the contact-type sensor of the present invention may include a water repellent substrate having the sensor element embedded therein and having a substrate front surface protruding to a side of the object to be measured further than the sensor element when the contact portion is in contact with the object to be measured, and a water absorptive sheet covering the substrate front surface and of which a surface on a side opposite to a surface facing the substrate front surface is the contact portion, and in the water repellent substrate, a hollow portion is formed in a region located between the sensor element and the object to be measured when the contact portion is in contact with the object to be measured, and in the water absorptive sheet, an opening portion may be foil led in a region located between the sensor element and the object to be measured when the contact portion is in contact with the object to be measured, and the gap may be the hollow portion and the opening

portion, the water repellent portion may be the water repellent substrate, and the water absorbing portion may be the water absorptive sheet.

[0066] According to the configuration of the present invention, it is possible to realize the gap surrounded by the object to be measured, the sensor element, the water repellent portion and the water absorbing portion with a simple configuration, and thus there is an advantage that a contact-type sensor having such a configuration is easily manufactured.

[0067] Further, in addition to the above-described configuration, the contact-type sensor of the present invention may include a plurality of electronic components embedded in the water repellent substrate to be exposed from the substrate rear surface when a surface of the water repellent substrate on a side opposite to the substrate front surface is a substrate rear surface, a wiring which connects the electronic components to each other, and an insulating layer provided on the substrate rear surface to seal the wiring and the plurality of electronic components.

[0068] According to the configuration of the present invention, since the electronic component and the wiring can be prevented from being in contact with air, moisture in the air does not come into contact with the electronic component and the wiring, and a waterproof effect with respect to the electronic component and the wiring can be obtained.

[0069] Further, in the contact-type sensor of the present invention, in addition to the above-described configuration, the object to be measured may be a body surface, and the water absorptive sheet serving as the contact portion may be included.

[0070] According to the configuration of the present invention, sweat generated from the body surface (skin) at the contact portion between the body surface and the water absorptive sheet is absorbed by the water absorptive sheet, inhibition of perspiration from the skin is suppressed, and occurrence of dermatitis caused by the inhibition of the perspiration can be suppressed.

[0071] Also, in the contact-type sensor of the present invention, in addition to the above-described configuration, the object to be measured may be the body surface, and the sensor element may be a thermopile which detects infrared rays generated from the body surface as the detection target to measure a temperature of the body surface. Alternatively, in the contact-type sensor of the present invention, in addition to the above-described configuration, the object to be measured may be a body surface, and the sensor element may be a humidity sensor which detects sweat vapor generated from the body surface as the detection target to measure a degree of perspiration of the body surface.

REFERENCE SIGNS LIST

[0072] **10** Skin (body surface, object to be measured)
[0073] **200** Contact-type sensor
[0074] **200***a* Gap
[0075] **211** Absorptive sheet (absorbing portion, contact portion)
[0076] **211***a* Opening portion
[0077] **212** Resin substrate (water repellent portion, water repellent substrate)
[0078] **212***a* Hollow portion
[0079] **212***c* Substrate front surface
[0080] **212***e* Substrate rear surface
[0081] **213** Electronic component
[0082] **214** Sensor element
[0083] **215** Wiring
[0084] **216** Insulating layer
[0085] **217** Hygroscopic sheet
[0086] **300** Infrared ray (detection object)
[0087] **313** Electronic component
[0088] **312** Resin substrate
[0089] **312***a* Hollow portion
[0090] **314** Sensor element
[0091] **315** Copper wiring (wiring)
[0092] **316** Insulating layer

1. A contact-type sensor comprising:
a contact portion which is brought into contact with an object to be measured,
a sensor element which is disposed with a gap between the sensor element and the object to be measured and detects a detection target generated from the object to be measured when the contact portion is in contact with the object to be measured, and
a water repellent portion and a water absorbing portion which surrounds the gap together with the object to be measured and the sensor element when the contact portion is in contact with the object to be measured.

2. The contact-type sensor according to claim **1**, further comprising a water repellent substrate having the sensor element embedded therein and having a substrate front surface which protrudes to a side of the object to be measured further than the sensor element when the contact portion is in contact with the object to be measured, and a water absorptive sheet which covers the substrate front surface and of which a surface on a side opposite to a surface facing the substrate front surface is the contact portion,
wherein, in the water repellent substrate, a hollow portion is formed in a region located between the sensor element and the object to be measured when the contact portion is in contact with the object to be measured, and in the water absorptive sheet, an opening portion is formed in a region located between the sensor element and the object to be measured when the contact portion is in contact with the object to be measured, and the gap is the hollow portion and the opening portion, the water repellent portion is the water repellent substrate, and the water absorbing portion is the water absorptive sheet.

3. The contact-type sensor according to claim **2**, further comprising a plurality of electronic components embedded in the water repellent substrate to be exposed from a substrate rear surface when a surface of the water repellent substrate on a side opposite to the substrate front surface is the substrate rear surface, a wiring which connects the electronic components to each other, and an insulating layer provided on the substrate rear surface to seal the wiring and the plurality of electronic components.

4. The contact-type sensor according to claim **1**, wherein the object to be measured is a body surface, and the water absorptive sheet which serves as the contact portion is included.

5. The contact-type sensor according to claim **1**, wherein the object to be measured is the body surface, and the sensor element is a thermopile which detects infrared rays generated from the body surface as the detection target to measure a temperature of the body surface.

6. The contact-type sensor according to claim **1**, wherein the object to be measured is the body surface, and the sensor

element is a humidity sensor which detects sweat vapor generated from the body surface as the detection target to measure a degree of perspiration of the body surface.

7. The contact-type sensor according to claim **2**, wherein the object to be measured is the body surface, and the sensor element is a thermopile which detects infrared rays generated from the body surface as the detection target to measure a temperature of the body surface.

8. The contact-type sensor according to claim **3**, wherein the object to be measured is the body surface, and the sensor element is a thermopile which detects infrared rays generated from the body surface as the detection target to measure a temperature of the body surface.

9. The contact-type sensor according to claim **4**, wherein the object to be measured is the body surface, and the sensor element is a thermopile which detects infrared rays generated from the body surface as the detection target to measure a temperature of the body surface.

10. The contact-type sensor according to claim **2**, wherein the object to be measured is the body surface, and the sensor element is a humidity sensor which detects sweat vapor generated from the body surface as the detection target to measure a degree of perspiration of the body surface.

11. The contact-type sensor according to claim **3**, wherein the object to be measured is the body surface, and the sensor element is a humidity sensor which detects sweat vapor generated from the body surface as the detection target to measure a degree of perspiration of the body surface.

12. The contact-type sensor according to claim **4**, wherein the object to be measured is the body surface, and the sensor element is a humidity sensor which detects sweat vapor generated from the body surface as the detection target to measure a degree of perspiration of the body surface.

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专利名称(译)	接触式传感器		
公开(公告)号	US20180168505A1	公开(公告)日	2018-06-21
申请号	US15/736781	申请日	2016-08-23
[标]申请(专利权)人(译)	欧姆龙株式会社		
申请(专利权)人(译)	欧姆龙公司		
当前申请(专利权)人(译)	欧姆龙公司		
[标]发明人	KAWAI WAKAHIRO		
发明人	KAWAI, WAKAHIRO		
IPC分类号	A61B5/00 A61B5/01 G01J5/12		
CPC分类号	A61B5/6801 A61B5/01 A61B5/4266 G01J5/12 B32B2307/7265 A61B5/6833 G01J5/0025 G01J5/0285 A61B2562/16		
优先权	2015193423 2015-09-30 JP		
外部链接	Espacenet USPTO		

摘要(译)

本发明限制了测量误差和传感器元件损坏。当接触式传感器（ 200 ）与皮肤接触（ 10 ）时，间隙（ 200 ）在皮肤（ 10 ）和传感器元件（ 214 ）之间形成。接触式传感器（ 200 ）配有防水树脂基板（ 212 ）和吸水板（ 211 ）与皮肤（ 10 ）和传感器元素（ 214 ）一起围绕间隙（ 200 ）。