(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
14 October 2010 (14.10.2010)

PCT

(10) International Publication Number
WO 2010/116297 A1

(51) International Patent Classification:
G01K 1/14 (2006.01) *A41D 13/12* (2006.01)
G01K 1/16 (2006.01) *A61B 5/00* (2006.01)
G01K 13/00 (2006.01)

(21) International Application Number: PCT/IB2010/051418

(22) International Filing Date: 1 April 2010 (01.04.2010)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09157392.3 6 April 2009 (06.04.2009) EP

(71) Applicant *(for all designated States except US)*: **KONINKLIJKE PHILIPS ELECTRONICS N.V.** [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **KLEWER, Jasper** [NL/NL]; c/o High Tech Campus, Building 44, NL-5656 AE Eindhoven (NL). **CHEUNG, Amy, O., M.** [GB/NL]; c/o High Tech Campus, Building 44, NL-5656 AE Eindhoven (NL). **VAN PIETERSON, Liesbeth** [NL/NL]; c/o High Tech Campus, Building 44, NL-5656 AE Eindhoven (NL). **BAKKERS, Erik, P., A., M.** [NL/NL]; c/o High Tech Campus, Building 44, NL-5656 AE Eindhoven (NL).

(74) Agents: **VAN VELZEN, Maaike, M.** et al.; High Tech Campus, Building 44, NL-5600 AE Eindhoven (NL).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report (Art. 21(3))*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(54) **Title**: A TEMPERATURE SENSOR FOR BODY TEMPERATURE MEASUREMENT

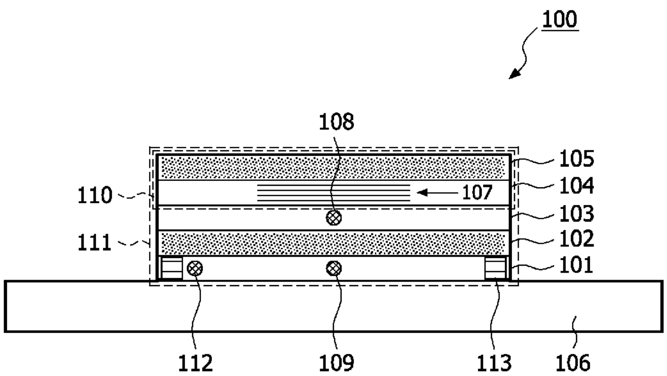

FIG. 1

(57) **Abstract**: This invention relates to a temperature sensor for body temperature measurements. The temperature sensor is made of several layers, where a first layer has a central heater embedded therein, a second layer which is attached to the first layer has at least one first thermistor embedded therein for measuring a first temperature value, a third layer has at one ore second thermistor embedded therein separated from the first thermistor for measuring at least one second temperature value, but this third layer is adapted to be in contact to the skin of the surface of the body for conducting the heat escaping from the body through the layers. The difference between the first and the second temperature values indicates the heat flux from the body. The heat emitted from central heater is tuned oppositely to the heat flux until a zero heat flux is reached, where the temperature at the at least one second thermistor at zero heat flux indicates the body temperature. These layers are fabric layers.

WO 2010/116297 A1

A temperature sensor for body temperature measurement

FIELD OF THE INVENTION

The present invention is related to a temperature sensor for body temperature measurements, and to a garment comprising the temperature sensor.

BACKGROUND OF THE INVENTION

In the recent years, there has been some development in developing core body temperature sensors. A heat flux temperature sensor is an example of such a core body temperature sensor, but the measuring is based on so-called zero heat flux principle, but this principle is used in the “low power core body temperature monitoring” for continuous temperature monitoring of patients. According to this principle the core body temperature is measured by placing the sensor on the skin of e.g. the forehead of the patient. An accurate temperature measurement requires that the sensor is flexible so that it follows that skin surface so as to ensure that there are no air gaps between the skin and sensor, which otherwise can have adverse effect on the measurement accuracy.

Although the prior art heat flux temperature sensors are somewhat flexible, they are suitable for high acuity applications, e.g. during surgery where the sensor monitors the core body temperature during the surgery and where the patient is not moving.

However, for applications where the skin is actually moving more, e.g. for monitoring temperature of newborns, or more general use (e.g. outside the hospital) their use is somewhat limited due to the lack of flexibility needed to follow the skin surface. Also the prior art sensors are obtrusive, either for newborns requiring an adhesive on the skin, or for non-high acuity applications being visible on the patient’s forehead, changing the appearance of the patient.

SUMMARY DESCRIPTION OF THE INVENTION

The object of the present invention is to overcome the above mentioned drawbacks by providing a temperature sensor with enhanced flexibility.

According to a first aspect the present invention relates to a temperature sensor for body temperature measurements, comprising:

- a first layer having a central heater embedded therein,
- a second layer attached to the first layer having at least one first thermistor embedded therein for measuring a first temperature value,
- at least one third layer having at least one second thermistor embedded therein separated from the first thermistor for measuring at least one second temperature value, the at least one third layer being adapted to be in contact to the skin of the surface of the body for conducting the heat escaping from the body through the layers, the difference between the first and the second temperature values indicating the vertical heat flux from the body, where the heat emitted from central heater is tuned oppositely to the vertical heat flux until a zero heat flux is reached, where the temperature at the at least one second thermistor at zero heat flux indicates the body temperature,

wherein the first, second and at least the third layer are fabric layers.

Accordingly, a very flexible temperature sensor is provided which follows the skin of the body and that can easily be integrated into garment, such as a cap, baby cap, headband, shirt, diaper and belt, and even into a bed object such as a pillow, blanket or seat which is in contact with the body. Another advantage offered by the flexible body temperature is comfort, while not critical in the high acuity setting, is of great importance in the low acuity setting and use outside of the hospital.

In one embodiment, the layers are stitched or laminated together, interwoven, or combination thereof.

In one embodiment, the first and the second layers are made of the same fabric and form a single functional layer having the central heater and the at least one first thermistor embedded therein such that they are separated from each other.

In one embodiment, the central heater is stitched, or embroidered, or woven, or laminated into the first layer using conductive yarn. The conductive yarn can for example be a metal coated polymer such as Ag-coated polyester, stainless steel (containing) yarn or Cu wire (with or without silver coating).

In one embodiment, the dimension of the central heater is adapted to the depth of measurement such that the larger the depth is to be measured the larger becomes the dimension of the central heater.

In one embodiment, the central heater is printed onto the first layer using conductive ink or conductive paste.

In one embodiment, the central heater is made of a conductive material with a resistance between 5-150 ohm/meter.

In one embodiment, the thermistors are attached to a woven, stitched or knitted conductive circuit.

In one embodiment, the conductive circuit is made of conductive material having a resistance lower 20 ohm/meter.

In one embodiment, the fabric layers are made of woven or non-woven fabrics.

In one embodiment, the second and the at least the third layers are separated by a flexible heat insulating layer. The flexible heat insulating layer may as an example be selected from: neoprene (polychloroprene), PVDF, EPDM (ethylene propylene diene monomer), and foam type materials polyethylene (PE), polypropylene (PP), methylacrylate (EMA), ethylenevinylacetate (EVA), polyolefin.

In one embodiment, the temperature sensor further comprises an insulating layer applied on top of the first layer. In that way, heat losses may be prevent and thus a less power is required to run the sensor.

In one embodiment, the temperature sensor further comprises a transmitter for transmitting the temperature measured at the at least one second thermistor at zero heat flux to an external monitoring device comprising a receiver. Accordingly, the temperature can be continuously monitored via e.g. a wireless communication link. This is of particular advantage when monitoring e.g. newborns where the measured temperature is displayed on the external monitoring device (e.g. babyphone).

In one embodiment, the temperature sensor is integrated into patch.

In one embodiment, the patch further comprises a processing unit for converting the output from the at least one second thermistor at zero heat flux into the measured body temperature, a battery, and an indicator means for indicating the measured body temperature. This patch can be made so that it is either re-usable or disposable. Accordingly, this allows unobtrusive temperature monitoring, e.g. for children with fewer.

In one embodiment, the temperature sensor further comprises a side thermistor arranged at the periphery of the third layer and adapted to measure a third temperature value at the periphery of the third layer, where the difference between the second and the third temperature values indicates the horizontal heat flux within the third layer.

In one embodiment, the temperature sensor further comprises a side heater arranged at the periphery of the third layer adapted to be tuned oppositely to the heat until a zero horizontal heat flux is reached in the third layer.

It is thus possible to prevent lateral heat loss, but the biggest source of lateral heat loss is heat that is escaping from the brain that is not going vertically, but diagonally. Using an additional side thermistor along with the thermistor in the third layer makes it possible to detect the lateral heat flux. It is therefore possible to operate the side heater such that the lateral heat flux becomes zero. This makes the temperature profile uniform in the lateral direction, reducing the problem to one dimension.

According to a second aspect, the present invention relates to a garment comprising said temperature sensor integrated therein such that when the garment is placed onto the body or is being worn by the body the at least one third layer becomes in contact to the skin of the surface of the body. As mentioned previously, such garment may as an example include a cap, baby cap, headband, shirt, diaper and belt, and even into a bed object such as a pillow, blanket or seat which is in contact with the body and the like.

The aspects of the present invention may each be combined with any of the other aspects. These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will be described, by way of example only, with reference to the drawings, in which

Fig. 1 shows one embodiment of a temperature sensor for body temperature measurements according to the present invention, and

Fig. 2 shows a system adapted to be integrated into the temperature sensor or a patch or a garment, and

Fig. 3 shows a garment comprising the temperature sensor from Fig. 1 integrated therein.

DESCRIPTION OF EMBODIMENTS

Fig. 1 shows one embodiment of a temperature sensor 100 for body temperature measurements according to the present invention. The temperature sensor 100 comprises a first layer 104 having a central heater 107 embedded therein, a second layer 103 attached to the first layer 104 having at least one first thermistor (Ttop) 108 embedded therein for measuring a first temperature value t^{first}, a third layer 101 having at least one second thermistor (Tbottom) 109 embedded therein separated from the first thermistor (Ttop) 108 for measuring at least one second temperature value t^{second}. The third layer 101 is adapted to be in contact to the skin of the surface 106 of the body for conducting the heat escaping from the body through the layers. The difference between the first and the second temperature values, i.e. t^{second} - t^{first} indicates the vertical heat flux from the body. The central heater 107 is adapted to be tuned oppositely to the vertical heat flux t^{second} - t^{first} until a zero heat flux is reached, i.e. until $t^{second} = t^{first}$. At this zero vertical heat flux, the temperature at the second thermistor (Tbottom) 109 at zero heat flux indicates the body temperature, or more particularly the core body temperature. The fabric layers may be made of woven or non-woven fabrics. The thickness of each layer is typically in the millimeter range, but may just as well be less than a millimeter.

The second layer 103 and the third layer 101 further comprise a woven, stitched or knitted conductive circuit, respectively, to which the thermistors in the respective layers are attached to. The thermistor can be attached by soldering, clamping or using conductive epoxy or Anisotropic Conductive Foil/paste (ACF/ACP). The conductive circuit may be made of a (common) ground and a signal line using e.g. conductive yarn that is stitched, woven, knitted or laminated to/into a fabric. In one embodiment, the conductive circuit is made of conductive material having a resistance lower 20 ohm/meter.

The first, second and at least the third layer are fabric layers 104, 103, 101 may be stitched or laminated together, interwoven, or combination thereof which makes the sensor soft, flexible and thin.

In one embodiment, the temperature sensor 100 further comprises a top layer 105 made of insulating material, which may be transparent, e.g. so as for illustrative purposes such as to show a nice illustrative shape (a picture).

In one embodiment, the first and second layers 104, 103 are made of the same fabric and form a part of a single layer 110 containing both the thermistor (Ttop) 108 and the heating element 107 on the same fabric, such that this single layer 110 comprises both the thermistor (Ttop) 108 and the heating element 107. A care must be taken to prevent shorts between the thermistor (Ttop) 108 and the heating element 107.

In one embodiment, the third layer 101 and the thermistor (Tbottom) 109 along with the first and second layers 104, 103 form a part of a single layer 111 on the same fabric. It is possible with 3D knitting technologies to make spacerfabrics integrated with two (or more) top layers.

In one embodiment, the second and the at least the third layers are separated by a flexible heat insulating layer 102, made of e.g. neoprene (polychloroprene), ethylene propylene diene monomer (PVDF, EPDM), and foam type materials polyethylene (PE), polypropylene (PP), methylacrylate (EMA), ethylenevinylacetate (EVA), polyolefin.

Referring to the embodiment shown in Fig. 1, the five layers 101-104 may be stitched or laminated together, or it is also possible to combine several of the layers into one fabric.

In one embodiment, the central heater 107 has a cross section that is adapted to the depth of measurement such that the larger the depth is to be measured, the larger should the cross section of the heater be. An example of a cross section is a cross section within millimeter up to few centimeters. The central heater can be made by stitching, weaving, knitting or laminating conductive yarns to/into a fabric, where the conductive yarns may be (but not necessarily) surrounded by an insulating polymer layer, or it may be printed onto the first layer using conductive ink or conductive paste. In one embodiment, the resistance of the heater is such that it can deliver around 100 mW. Referring to the setup shown in Fig. 1, this corresponds to resistances between 5 and 50 ohm. This can be achieved by matching the length of the conductive wire with the resistance. As an example, 80 Ohm/m stainless steel wire of 25cm is 20 Ohm. The shape of the central heater should preferably be such that it gives rise to a homogeneous temperature profile in the lower layers. This shape could as an example be a spiral, but other shapes are of course also possible.

The third layer 101 is a fabric layer that incorporates at least one thermistor, and a conductive circuit to connect the thermistor. The thermistor can be attached by soldering, clamping or using conductive epoxy or ACF/ACP. The conductive circuit consists of a (common) ground and a signal line and can be made using conductive yarn that is stitched, woven, knitted or laminated to/into a fabric. The conductive circuit can be made in or as part of an illustrative design, or for hygienic layer/coating such that it becomes in contact with the skin (106).

In one embodiment, the temperature sensor 100 further comprises a transmitter (not shown) for transmitting the temperature measured at the at least one second thermistor at zero heat flux to an external monitoring device comprising a receiver. Such a monitoring device may as an example be a babyphone or some external monitoring unit that further comprises a processing unit that monitors that baby temperature continuously during the first days.

It should be noted that the temperature sensor 100 is not limited to this particular number of layers. The number of layers may just as well include more than four or five layers, also the number of thermistors does not necessarily be limited to the two thermistors 108 and 109, but three or more may just as well be implemented to measure the vertical heat flux.

Until now, the measured heat flux is a vertical heat flux which is proportional to $t^{second} – t^{first}$.

In one embodiment, the temperature sensor 100 further comprises a side thermistor (Tside) 112 arranged at the periphery of the third layer 101 and adapted to measure a third temperature value t^{third} at the periphery of the third layer 101. The difference between the second and the third temperature values, i.e. $t^{third} – t^{second}$ indicates the horizontal heat flux within the third layer 101. To compensate the heat loss due to the horizontal heat flux, a side heater 113 is arranged at the periphery of the third layer adapted to be tuned oppositely to the heat flux $t^{third} – t^{second}$ until a zero horizontal heat flux is reached in the third layer. In one embodiment, the side heater 113 has substantially the same geometry as the third layer, e.g. a ring (if the third layer is a ring) made of similar elements as discussed previously in conjunction with the central heater. Accordingly, the side heater 113 is controlled by the horizontal heat flux, whereas the central heater 107 is controlled by the vertical heat flux. One of the reasons of using such a side heater 113 is to prevent lateral heat loss. The biggest source of lateral heat loss is heat that is escaping from the brain that is not going vertically, but diagonally. So the temperature profile in the skull becomes 2-dimensional. The side heater makes the temperature profile uniform in the lateral direction, reducing the problem to 1 dimension. The thermistor 112 at the periphery is used to detect this lateral temperature profile. A minor source of lateral heat loss is heat that is escaping from the center of the sensor to the side of the sensor. But this is minimal, given the flatness of the sensor.

In one embodiment, the temperature sensor 100 is integrated into patch (not shown), where the patch further comprises a system 200 (see Fig. 2) comprising a processing unit (P) 201 such as a microprocessor for converting the output from the at least one second thermistor at zero heat flux into the measured body temperature, a battery (B) 203, and an indicator means (I_M) 202 for indicating the measured body temperature. The indicator means (I_M) 202 may as an example be a display such as a color display. The indicator means (I_M) 202 may be replaced by a transmitter (T) 204 for transmitting the measured body temperature to a monitoring device comprising a receiver (e.g. a babyphone). This patch can be made so that it is either re-usable or disposable. Accordingly, this allows unobtrusive temperature monitoring, e.g. for children with fewer.

Although not depicted here, the system 200 shown in Fig. 2 may also be integrated into the temperature sensor 100.

Fig. 3 shows a garment 301 comprising the temperature sensor 100 from Fig. 1 integrated therein such that when the garment is placed onto the body or is being worn by the body the at least one third layer 101 becomes in contact to the skin of the surface 106 of the body. An example of such garment is mattress, sleeping bag, pillow, sheet, blanket, belt etc.

Example:

During the first days, newborns can have difficulties to keep a constant temperature. Therefore, it is recommended to measure the temperature frequently, and adjust clothing and heating accordingly. Too cold is not good, but overheating is even more dangerous. Present babyphones show the temperature of the room, but not of the baby.

In this example the temperature sensor 100 is integrated into a baby cap 301 such that when the baby cap is worn by the baby the sensor becomes automatically well positioned on the forehead for the measurement. This allows measuring the temperature of the baby continuously during the first days and displayed via e.g. a wireless link on the babyphone 302. However, integration possibilities are not limited to a baby cap; but could be extended to any fabric (mattress, sleeping bag, pillow, sheet, blanket, etc.) surrounding the baby. In this example, the cap 201 further comprises the system shown in Fig. 2, namely a battery (B) 203, a microcontroller (M_C) 205 for signal processing. However, instead of the indicator means (I_M) 202 the system comprises a transmitter (T) 204 to transmit the signal to the babyphone 202. For clinical applications, the signal may be sent to a wireless patient monitoring system or a bedside monitor.

Certain specific details of the disclosed embodiment are set forth for purposes of explanation rather than limitation, so as to provide a clear and thorough understanding of the present invention. However, it should be understood by those skilled in this art, that the present invention might be practiced in other embodiments that do not conform exactly to the details set forth herein, without departing significantly from the spirit and scope of this disclosure. Further, in this context, and for the purposes of brevity and clarity, detailed descriptions of well-known apparatuses, circuits and methodologies have been omitted so as to avoid unnecessary detail and possible confusion.

Reference signs are included in the claims, however the inclusion of the reference signs is only for clarity reasons and should not be construed as limiting the scope of the claims.

CLAIMS:

1. A temperature sensor (100) for body temperature measurements, comprising:

- a first layer (104) having a central heater (107) embedded therein,
- a second layer (103) attached to the first layer (104) having at least one first thermistor (108) embedded therein for measuring a first temperature value,
- at least one third layer (101) having at least one second thermistor (109) embedded therein separated from the first thermistor (108) for measuring at least one second temperature value, the at least one third layer (101) being adapted to be in contact to the skin of the surface (106) of the body for conducting the heat escaping from the body through the layers, the difference between the first and the second temperature values indicating the heat flux from the body, where the heat emitted from central heater is tuned oppositely to the heat flux until a zero heat flux is reached, where the temperature at the at least one second thermistor at zero heat flux indicates the body temperature,

wherein the first, second and at least the third layer are fabric layers.

2. A temperature sensor according to claim 1, wherein the layers are stitched or laminated together, interwoven, or combination thereof.

3. A temperature sensor according to claim 1, wherein the first and the second layers (104, 103) are made of the same fabric and form a single functional layer having the central heater (107) and the at least one first thermistor embedded therein such that they are separated from each other.

4. A temperature sensor according to claim 1, wherein the central heater (107) is stitched, or embroidered, or woven, or laminated into the first layer (104) using conductive yarn.

5. A temperature sensor according to claim 1, wherein the dimension of the central heater (107) is adapted to the depth of measurement such that the larger the depth is to be measured the larger becomes the dimension of the central heater.

6. A temperature sensor according to claim 1, wherein the central heater (107) is printed onto the first layer using conductive ink or conductive paste.

7. A temperature sensor according to claim 1, wherein the central heater (107) is made of a conductive material with a resistance between 5-150 ohm/meter.

8. A temperature sensor according to claim 1, wherein the thermistors (108, 109) are attached to a woven, stitched or knitted conductive circuit.

9. A temperature sensor according to claim 8, wherein the conductive circuit is made of conductive material having a resistance lower 20 ohm/meter.

10. A temperature sensor according to claim 1, wherein the fabric layers are made of woven or non-woven fabrics.

11. A temperature sensor according to claim 1, wherein the second and the at least the third layers (103, 101) are separated by a flexible heat insulating layer (102).

12. A temperature sensor according to claim 1, further comprising an insulating layer (105) applied on top of the first layer (104).

13. A temperature sensor according to claim 1, further comprising a transmitter (204) for transmitting the temperature measured at the at least one second thermistor at zero heat flux to an external monitoring device comprising a receiver.

14. A temperature sensor according to claim 1, wherein the temperature sensor (100) is integrated into patch (301).

15. A temperature sensor according to claim 1, wherein the patch (301) further comprises a processing unit (201) for converting the output from the at least one second thermistor (108, 109) at zero heat flux into the measured body temperature, a battery (203), and an indicator means (202) for indicating the measured body temperature.

16. A temperature sensor according to claim 1, further comprising a side thermistor (Tside) (112) arranged at the periphery of the third layer (101) and adapted to measure a third temperature value at the periphery of the third layer (101), where the difference between the second and the third temperature values indicates the horizontal heat flux within the third layer (101).

17. A temperature sensor according to claim 16, further comprising a side heater (113) is arranged at the periphery of the third layer (101)adapted to be tuned oppositely to the heat flux until a zero horizontal heat flux is reached in the third layer.

18. A temperature sensor according to claim 17, wherein the side heater (113) is adapted to the geometrical shape of the third layer (101).

19. A garment (301) comprising the temperature sensor as claimed in claim 1 integrated therein such that when the garment is placed onto the body or is being worn by the body the at least one third layer becomes in contact to the skin of the surface of the body.

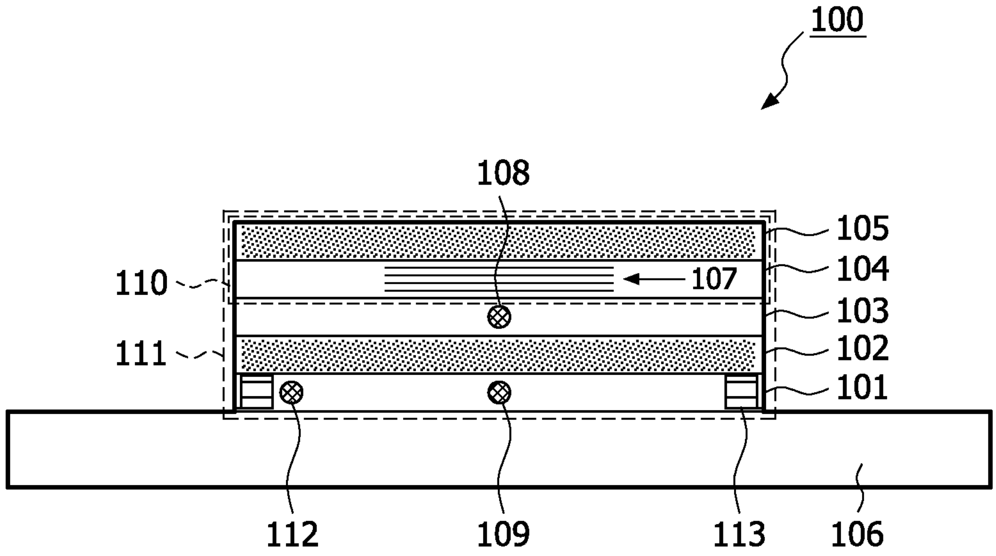
100
108
105
110
104
107
103
111
102
101
112
109
113
106

FIG. 1

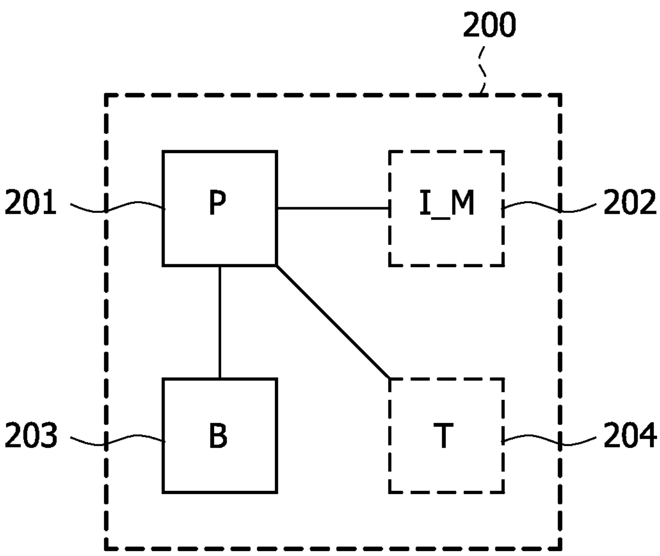
200
201
P
I_M
202
203
B
T
204

FIG. 2

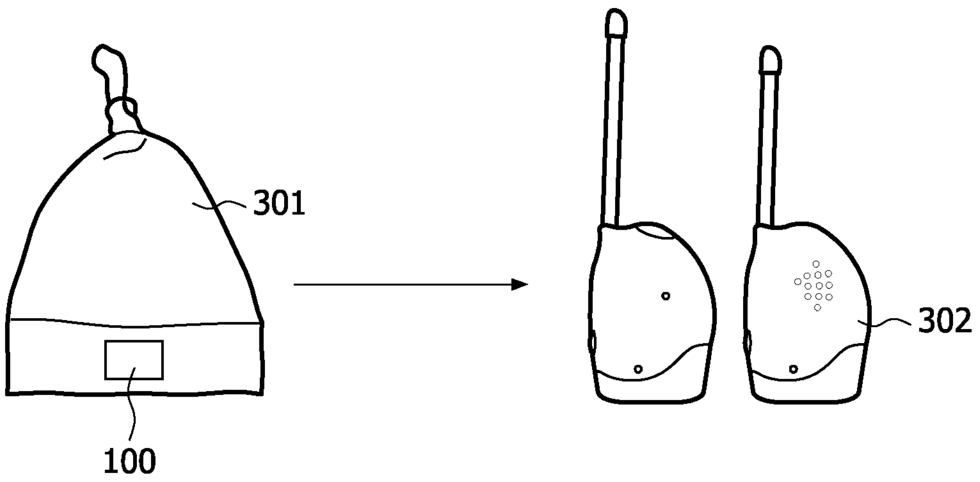

FIG. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2010/051418

A. CLASSIFICATION OF SUBJECT MATTER
INV. G01K1/14 G01K1/16 G01K13/00 A41D13/12 A61B5/00
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G01K A41D A61B

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

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

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3 933 045 A (FOX RONALD HOWARD ET AL) 20 January 1976 (1976-01-20) * abstract; figures 2,3 column 2, line 3 - column 3, line 9	1-19
Y	LYMBERIS A ET AL: "Advanced Wearable Health Systems and Applications -Research and Development Efforts in the European Union" 1 May 2007 (2007-05-01), IEEE ENGINEERING IN MEDICINE AND BIOLOGY MAGAZINE, IEEE SERVICE CENTER, PISACATAWAY, NJ, US LNKD- DOI:10.1109/MEMB.2007.364926, PAGE(S) 29 - 33 , XP011222373 ISSN: 0739-5175 page 31	1-19

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 July 2010	30/07/2010

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	de Bakker, Michiel

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	NOURY N ET AL: "A smart cloth for ambulatory telemonitoring of physiological parameters and activity: the VTAMN project" 28 June 2004 (2004-06-28), ENTERPRISE NETWORKING AND COMPUTING IN HEALTHCARE INDUSTRY, 2004. HEAL THCOM 2004. PROCEEDINGS. 6TH INTERNATIONAL WORKSHOP ON ODAWARA, JAPAN JUNE 28-29, 2004, PISCATAWAY, NJ, USA,IEEE LNKD- DOI:10.1109/HEALTH.2004.1324507, PAGE(S) 155 - 160 , XP010717231 ISBN: 978-0-7803-8453-8 * abstract paragraph [003F]; figures 14,15	1-19
A	DITTMAR A ET AL: "A Non Invasive Wearable Sensor for the Measurement of Brain Temperature" 30 August 2006 (2006-08-30), ENGINEERING IN MEDICINE AND BIOLOGY SOCIETY, 2006. EMBS '06. 28TH ANNUAL INTERNATIONAL CONFERENCE OF THE IEEE, IEEE, PISCATAWAY, NJ, USA, PAGE(S) 900 - 902 , XP031389980 ISBN: 978-1-4244-0032-4 the whole document	1-19
A	YAMAKAGE MICHIAKI ET AL: "Deep temperature monitoring using a zero-heat-flow method." 2003, JOURNAL OF ANESTHESIA 2003 LNKD- PUBMED:12903922, VOL. 17, NR. 2, PAGE(S) 108 - 115 , XP002590941 ISSN: 0913-8668 pages 108-109, paragraph 2; figure 1	1-19

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2010/051418

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3933045 A	20-01-1976	DE 2121189 A1	11-11-1971
		GB 1354874 A	05-06-1974

patsnap

专利名称(译)	用于体温测量的温度传感器		
公开(公告)号	EP2417430A1	公开(公告)日	2012-02-15
申请号	EP2010714081	申请日	2010-04-01
[标]申请(专利权)人(译)	皇家飞利浦电子股份有限公司		
申请(专利权)人(译)	皇家飞利浦电子N.V.		
当前申请(专利权)人(译)	皇家飞利浦电子N.V.		
[标]发明人	KLEWER JASPER CHEUNG AMY O M VAN PIETERSON LIESBETH BAKKERS ERIK P A M		
发明人	KLEWER, JASPER CHEUNG, AMY, O., M. VAN PIETERSON, LIESBETH BAKKERS, ERIK, P., A., M.		
IPC分类号	G01K1/14 G01K1/16 G01K13/00 A41D13/12 A61B5/00		
优先权	2009157392 2009-04-06 EP		
其他公开文献	EP2417430B1		
外部链接	Espacenet		

摘要(译)

本发明涉及一种用于体温测量的温度传感器。温度传感器由若干层制成，其中第一层具有嵌入其中的中央加热器，附接到第一层的第二层具有嵌入其中的至少一个第一热敏电阻，用于测量第一温度值，第三层具有嵌入其中的一个或多个第二热敏电阻与第一热敏电阻分开，用于测量至少一个第二温度值，但该第三层适于与身体表面的皮肤接触，以传导从身体通过层逸出的热量。 。第一和第二温度值之间的差异表示来自身体的热通量。从中央加热器发出的热量与热通量相反地调节，直到达到零热通量，其中至少一个第二热敏电阻在零热通量处的温度表示体温。这些层是织物层。