(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 786 702 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
**06.06.2018 Bulletin 2018/23**

(21) Application number: **14159185.9**

(22) Date of filing: **12.03.2014**

(51) Int Cl.:
***A61B 5/00*** *(2006.01)* ***A61B 5/02*** *(2006.01)*
***A61B 5/021*** *(2006.01)* ***A61B 5/024*** *(2006.01)*
***A61B 5/0255*** *(2006.01)*

(54) **Physiology signal sensing device**

Physiologiesignalerfassungsvorrichtung

Dispositif de détection de signal physiologique

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(30) Priority: **01.04.2013 TW 102111641**

(43) Date of publication of application:
**08.10.2014 Bulletin 2014/41**

(73) Proprietor: **Maisense Inc.**
**Zhubei City, Hsinchu County 30264 (TW)**

(72) Inventors:
- **Tu, Tse-Yi**
  **30273 Zhubei City, Hsinchu County (TW)**
- **Chao, Paul C.P.**
  **30273 Zhubei City, Hsinchu County (TW)**
- **Lee, Yung-Pin**
  **30273 Zhubei City, Hsinchu County (TW)**

(74) Representative: **2K Patentanwälte Blasberg Kewitz & Reichel Partnerschaft mbB**
**Schumannstrasse 27**
**60325 Frankfurt am Main (DE)**

(56) References cited:
**WO-A1-2009/109903**
**CN-A- 1 572 237**
**JP-A- 2003 532 478**
**US-A- 4 561 447**
**US-A1- 2007 287 923**
**US-A1- 2009 177 096**
**US-A1- 2011 152 694**



EP 2 786 702 B1

## Description

## BACKGROUND OF THE INVENTION

### Field of the Invention

**[0001]** The present invention relates to a sensing device, and in particular, to a physiological signal sensing device and is defied by the claims.

### Description of the Related Art

**[0002]** In general, conventional mechanical blood pressure monitors have pumping cuffs to apply pressure on users. However, the pressure generated by the pumping cuff is not comfortable for users, and thus, the blood pressure monitors may not be continually used for a long time. Moreover, the blood pressure monitors are not be carried easily by a user because of the large size and the heavy weight of the pumping cuff. US 4561447 discloses an apparatus for detecting a blood pressure pulse wave of an arterial vessel of a living subject, with ease of manipulation and with high detecting reliability, irrespective of variations in pressing force applied to the housing of a sensing unit upon depression thereof onto an appropriate part of the subject..

**[0003]** Otherwise, an electronic type of conventional blood pressure monitors is available, which utilizes piezoelectric sensors for detecting. The piezoelectric sensors have the advantage of being small size, and continually used for a long time is available. However, the cost of the piezoelectric sensor is high, and the blood pressure detected by the blood pressure monitor is not accurate because the current generated by the piezoelectric sensor is unstable. Thus, the piezoelectric sensor is usually used for detecting heart rates only.

## BRIEF SUMMARY OF THE INVENTION

**[0004]** To solve the problems of the prior art, the object of the present disclosure is to provide an enhanced physiological signal sensing device that is accurate and can be produced at lower costs. A further object of the present invention is to provide an enhanced physiological signal sensing device that may be continually used for a long time and be easily carried by users.

**[0005]** The present disclosure provides a physiological signal sensing device including an elastic pad and a strain sensor element. The elastic pad is used for contact with a human body, more particularly with a portion of a human body, such as a limb, including a blood vessel and is configured to correspond to the blood vessel of the human body used for sensing the vital signal or physiological signal. The strain sensor element includes a sensing body and a conductive element. The sensing body is disposed in the elastic pad, and the conductive element disposed on the sensing body has a variable resistance value. The conductive element is deformed and strained according to a vibration or deformation of the blood vessel caused by the blood circulating in the blood vessel due to the pumping action of the heart, and the resistance value of the conductive element varies according to the strain of the conductive element.

**[0006]** The present disclosure further provides a physiological signal sensing device including an elastic pad, an elastic strip, a strain sensor element, and a processing module. The elastic pad is for contact with a human body and corresponds to a blood vessel of the human body. The elastic strip is disposed in the elastic pad. The strain sensor element is disposed on the elastic strip, and includes a sensing body and a conductive element. The conductive element disposed on the sensing body has a variable resistance value. The processing module is electrically connected to the conductive element.

**[0007]** The conductive element is deformed or strained according to a vibration or deformation of the blood vessel caused by the blood circulating in the blood vessel due to the pumping action of the heart, and the resistance value of the conductive element varies according to the strain of the conductive element. The processing module generates a physiological signal according to the resistance value.

**[0008]** In conclusion, the physiological signal sensing device of the present disclosure generates a physiological signal according to changes of the resistance value, which depends on the strain of the conductive element, and thus, an accurate detection is provided. The physiological signal sensing device of the present disclosure can be produced at lower manufacturing costs. Moreover, the physiological signal sensing device of the present disclosure excludes a pumping cuff. Thus, the physiological signal sensing device may be continually used for a long time and be easily carried by a user, and the size thereof is small and the weight thereof is light.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0009]** The invention can be more fully understood by reading the subsequent detailed description and examples with references made to the accompanying drawings, wherein:

Fig. 1 is a perspective view of a physiological signal sensing device according to a first embodiment of the present disclosure;

Fig. 2 is an exploded view of the physiological signal sensing device according to the first embodiment of the present disclosure;

Fig. 3 is a cross-sectional view of the physiological signal sensing device according to the first embodiment of the present disclosure;

Fig. 4 is a top view of the physiological signal sensing device of the present disclosure during a detection process;

Figs. 5 and 6 are cross-sectional views of the physiological signal sensing device of the present disclosure during a detection process;

Fig. 7 is a system diagram of the physiological signal sensing device according to a first embodiment of the present disclosure;

Fig. 8 is a cross-sectional view of a physiological signal sensing device according to a second embodiment of the present disclosure; and

Fig. 9 is a cross-sectional view of a physiological signal sensing device according to a third embodiment of the present disclosure.

## DETAILED DESCRIPTION OF THE INVENTION

**[0010]** The shape, size, or thickness in the drawings may not be drawn to scale or simplified for clarity purpose; rather, these drawings are merely intended for illustration.

**[0011]** Fig. 1 is a perspective view of a physiological signal sensing device 1 according to a first embodiment of the present disclosure. Fig. 2 is an exploded view of the physiological signal sensing device 1 according to the first embodiment of the present disclosure. Fig. 3 is a cross-sectional view of the physiological signal sensing device 1 according to the first embodiment of the present disclosure. The physiological signal sensing device 1 is for detecting physiological signals of users, more particularly for detecting vital signals, such as blood pressure, pulse rate, and heart rate, to obtain information on the physiological state of the user.

**[0012]** The physiological signal sensing device 1 includes a sensor 10 and a pressing element 20. The sensor 10 is disposed on the pressing element 20. The sensor 10 may contact with a human body and correspond to a blood vessel of the human body. The pressing element 20 presses the sensor 10 to increase the sensitivity of the sensor 10. The sensor 10 deforms or is deformed according to the vibration or deformation of the blood vessel. More particularly, the blood circulating in the blood vessels of a user exerts a pressure upon the walls of blood vessels, which varies during each heartbeat, between a maximum (systolic) and a minimum (diastolic) pressure, due to the pumping action of the heart of the user. This results in a vibration or more or less regular deformation of the walls of the blood vessel of the user, which is sensed by means of the conductive element 112.

**[0013]** The sensor 10 includes an elastic pad 11, a strain sensor element 12, and an elastic strip 13. The elastic pad 11 includes soft rubber, soft plastic, soft polymer, liquid silicone rubber, or polydimethylsiloxane (PDMS). The hardness of Shore A of the elastic pad 11 may be from 0 HA to 50 HA, or from 20 HA to 50 HA. The thickness of the elastic pad 11 is from 0.01 mm to 20 mm. In the embodiment, the elastic pad 11 includes polydimethylsiloxane, and the thickness of the elastic pad 11 is 7 mm.

**[0014]** The strain sensor element 12 is disposed in the elastic pad 11, and includes a sensing body 121 and a conductive element 122. The sensing body 121 may be a sheet structure and may be an insulated material, such as a rubber or a soft plastic. The conductive element 122 may be a sheet structure or a wire disposed in the sensing body 121. In another embodiment, the conductive element 122 is disposed on a surface of the sensing body 121.

**[0015]** The elastic strip 13 is disposed in the elastic pad 11 and disposed on the sensing body 121. The elastic strip 13 may be located between a contact surface 111 of the elastic pad 11 and the sensing body 121, and is disposed about 0.01 mm to 10 mm away from the contact surface. In the embodiment, the distance is about 2 mm. The elastic strip 13 may be parallel to the sensing body 121 and the conductive element 122. The area of the elastic strip 13 is greater than the area of sensing body 121. The elastic strip 13 includes metal material, such as carbon steel. The tensile strength of the elastic strip 13 is from 600 MPa to 1000 MPa, the yield strength thereof is from 350 MPa to 500 MPa, the brinell hardness thereof is about 248, and the thickness thereof is from 0.1 um to 500 um.

**[0016]** The pressing element 20 is disposed on a pressure surface 112 and a side surface of the elastic pad 11. The pressure surface 112 and the contact surface 111 are respectively located at two opposite sides of the elastic pad 11. The pressing element 20 includes a retaining belt 21, a housing 22, and a plurality of elastic elements 23. The retaining belt 21 may be elastic material, such as an elastic fabric. In another embodiment, the retaining belt 21 may include two belt structures hooked to each other, such as a watch belt.

**[0017]** The housing 22 is disposed on the retaining belt 21. In the embodiment, two ends of retaining belt 21 are fixed on two opposite sides of the housing 22. The housing 22 may include two retaining holes 221 and a receiving groove 222. The retaining hole 221 is located at a sidewall of the housing 22, and communicates with the receiving groove 222. The elastic element 23 may be a spring disposed in the receiving groove 222.

**[0018]** The cover 24 is located between the elastic element 23 and the elastic pad 11, and located in the receiving groove 222 of the housing 22. The cover 24 has a holding groove 241 and two retaining protrusion 242 communicating with the holding groove 241. The pressure surface 112 of the elastic pad 11 may be fixed in the holding groove 241. The retaining protrusion 242 is located in the retaining hole 221 to limit the cover 24 from moving in the receiving groove 222.

**[0019]** The pressing element 20 may be a watch like structure, and thus, the physiological signal sensing device 1 may be fixed on the wrist of a user by the retaining belt 21. The cover 24 presses the elastic pad 11 by the elastic element 23 to make the sensor 10 of the elastic pad 11 stably attach on the skin of the human body, particularly on the wrist of a user. Thus, the sensor 10 may continually process detection of a user for a long period of time.

**[0020]** In another embodiment, the elastic element 23 includes elastic material, such as rubber or soft plastic, and the cover 24 may be excluded. The two opposite sides of the elastic element 23 are respectively fixed on the receiving groove 222 and the pressure surface 112 of the elastic pad 11.

**[0021]** Fig. 4 is a top view of the physiological signal sensing device 1 of the present disclosure during a detection process. Figs. 5 and 6 are cross-sectional views of the physiological signal sensing device 1 of the present disclosure during a detection process. For the purpose of simplification and clarity, the pressing element 20 is not drawn on Figs. 4 to 6.

**[0022]** When the user uses the physiological signal sensing device 1, the physiological signal sensing device 1 may be fixed on the human body A1 (such as wrist or portions of other limbs that include blood vessels that can be monitored easily), and the elastic pad 11 contacts with the skin A2 of the human body A1 and is configured to correspond to a blood vessel A3 of the human body A1, more particularly has a geometrical shape that is mated to the shape of the portion of the human body A1 to be monitored. Namely, the elastic pad 11, the strain sensor element 12, and the elastic strip 13 are located above the blood vessel A3 and adjacent to blood vessel A3. The blood vessel A3 may be an artery, such as a radial artery.

**[0023]** Since the material of the elastic pad 11 is soft, it is comfortable for a user to carry with, and decreases the noise signal generated by the vibration of the blood vessel A3. The length of the elastic strip 13 is greater than (double of the size in the embodiment) the diameter of the blood vessel A3 and the material of the elastic strip 13 is elastic metal, and thus, the strain of the elastic strip 13 may accurately match to a minor vibrations of the blood vessel A3. Because the strain sensor element 12 is attached to the elastic strip 13, the curvatures of the strain sensor element 12 and the elastic strip 13 are the same.

**[0024]** The conductive element 122 within the strain sensor element 12 may be a wire, curved inside of the sensing body 121. As shown in Fig. 4, the conductive element 122 may include a plurality of straight sections parallel to each other. The straight sections may be substantially perpendicular to the blood vessel A3 to obtain detection.

**[0025]** As shown in Fig. 5, the blood vessel A3 constricts in the diastolic phase of the cardiac cycle. The elastic pad 11, the strain sensor element 12, and the elastic strip 13 are not bent, or bent according to the curvature of the skin A2. As shown in Fig. 6, the blood vessel A3 dilates in the phase systolic of the cardiac cycle. The skin A2 is curved according to the vibration of the blood vessel A3.

**[0026]** The elastic pad 11 and the elastic strip 13 continually deforms according to the degree of the vibration of the skin A2 and the blood vessel A3, and the strain sensor element 12 continually deforms according to the strain of the elastic strip 13. Thus, the strain of the strain sensor element 12 corresponds to the degree of the vibration of the blood vessel A3 and the skin A2. Also, the elastic pad 11, the strain sensor element 12, the conductive element 122, and the elastic strip 13 disposed above the blood vessel A3 have a greater curvature according to the diastolic blood vessel A3.

**[0027]** Since the conductive element 122 is bent or curved, the length and/or the curvature of the conductive element 122 changes, and thus, the resistance value of the conductive element 122 changes. Namely, the length and/or the curvature of the conductive element 122 continually changes with each of the systolic or diastolic vibrations of the blood vessel A3, and the resistance value continually changes according to the changing of the length and/or the curvature of the conductive element 122. Therefore, the resistance value of the conductive element 122 according to the vibration of the blood vessel A3, and the frequency of the change of the resistance value corresponds to the heart rate of the user.

**[0028]** Since the present disclosure utilizes the strain of the sensor 10 to detect, it is possible to continually detect the physiological signal or vital signal. Moreover, the sensor 10 has the advantages of being small in size and having a light weight, and thus, the sensor 10 can be easily carried by a user.

**[0029]** Fig. 7 is a system diagram of the physiological signal sensing device 1 according to a first embodiment of the present disclosure. The physiological signal sensing device 1 further includes a signal processing device 30 electrically connected to the sensor 10 and generating the physiological signal according to the strain of the sensor 10. The signal processing device 30 is selectively disposed on the retaining belt 21. The signal processing device 30 includes a processing module 31, a display module 32, a wireless transmission module 33, a positioning module 34, and an input module 35. The processing module 31 is electrically connected to the display module 32, the wireless transmission module 33, the positioning module 34, the input module 35, and the conductive element 122.

**[0030]** The processing module 31 detects and records the resistance value according to the strain, such as the change of the length and the curvature, of the element 122, and generates a physiological signal according to the record. In the embodiment, the processing module 31 includes a wheatstone bridge 311. The wheatstone bridge 311 is electrically connected to the conductive element 122, and the processing module 31 utilizes the wheatstone bridge 311 to detect the resistance value of the conductive element 122. The physiological signal may be a wave-shaped signal according to the vibration of the blood vessel A3 in real-time, and thus, the processing module 31 may calculate the physiology information, such as pulse, blood pressure, and heart rate of the user according to the physiological signal. The processing module 31 may control the display module 32 to display the physiological signal and the physiology information.

**[0031]** The positioning module 34 receives the coordinate signal and transmits it to the processing module 31. The processing module 31 controls the wireless transmission module 33 to transmit a wireless signal to a remote electronic device, such as a mobile phone or computer, according to the physiological signal. Thus, the health condition of a user may be analyzed or tracked by doctors or family of the user. If the health condition of the user gets worse, the position of the user can be known and appropriate actions may be executed.

**[0032]** The input module 35 may be a button operated to switch the information, such as the blood pressure, pulse, or heart rate of the user, displayed by the display module 32.

**[0033]** In another embodiment, the signal processing device 30 may just include the processing module 31 and the wireless transmission module 33 to further decrease the size and the weight of the physiological signal sensing device 1.

**[0034]** Fig. 8 is a cross-sectional view of a physiological signal sensing device 1a according to a second embodiment of the present disclosure. The physiological signal sensing device 1a may exclude the pressing element 20 of the first embodiment. The sensor 10a may be adhered to the human body A1 (as shown in Figs. 5 and 6) or retained on the human body A1 by a hand of a user. The sensor 10a may provide pressure by the gravity thereof on the human body A1. The elastic strip 13 may be selectively excluded to further decrease the size and the weight of the physiological signal sensing device 1a.

**[0035]** Fig. 9 is a cross-sectional view of a physiological signal sensing device 1b according to a third embodiment of the present disclosure. The differences between the third embodiment and the first embodiment are described as follows. The third embodiment excludes the elastic element 23 of the first embodiment. The housing 22b may exclude the retaining hole 221 of the first embodiment, and the cover 24b may exclude the retaining protrusion 242 of the first embodiment. The distance between the strain sensor element 12 of the sensor 10b and the pressure surface 112 of the elastic pad 11b is greater than the first embodiment, and the pressure of the elastic pad 11b to the skin A2 (as shown in Figs 5 and 6) is increased due to the weight of the housing 22b and the elastic pad 11b.

**[0036]** In the embodiment, the retaining belt 21 may be excluded. The physiological signal sensing device 1b may be disposed on another device, such as a pen or a mobile phone. The user may directly or indirectly apply a force to the physiological signal sensing device 1b to place the physiological signal sensing device 1b on the human body. In addition, in the disclosed embodiment, the retaining belt 21 may be excluded, too. Moreover, in the embodiment, the cover 24a may be excluded, and the pressure surface 112 of the elastic pad 11a directly contacts with the housing 22a.

**[0037]** In conclusion, the physiological signal sensing device of the present disclosure generates a physiological signal according to changes of the resistance value, which depends on the strain of the conductive element, and thus, accurate detection is provided and the manufacturing cost is decreased. Moreover, the physiological signal sensing device of the present disclosure excludes a pumping cuff. Thus, the physiological signal sensing device may be continually used for a long time and be easily carried by a user, and the size thereof is small and the weight thereof is light.

**[0038]** The disclosed features may be combined, modified, or replaced in any suitable manner in one or more disclosed embodiments, but are not limited to any particular embodiments.

## Claims

1. A physiological signal sensing device, comprising:

   an elastic pad used (11) for contact with a human body and configured to correspond to a blood vessel of the human body; and
   a strain sensor element (12) comprising a sensing body (121) and a conductive element (122) disposed on the sensing body (121), said sensing body disposed in the elastic pad, said conductive element (122) having a variable resistance value, wherein the conductive element (122) is configured to be deformed and strained according to a vibration of the blood vessel, and the resistance value of the conductive element (122) varies according to the strain of the conductive element
   **characterized in that** the strain sensor element (12) including the sensing body (121) and the conductive element (122) is disposed in the elastic pad (11).

2. The physiological signal sensing device as claimed in claim 1, further comprising an elastic strip (13), which is disposed on the sensing body (121) and in the elastic pad (11), wherein the elastic strip is deformed and strained according to the vibration of the blood vessel, and the strain of the conductive element (122) corresponds to the deformation or strain of said elastic strip (13).

3. The physiological signal sensing device as claimed in claim 2, wherein the elastic strip (13) is parallel to the sensing body (121) and the conductive element (122) and the area of the elastic strip (13) is larger than the area of the sensing body (121).

4. The physiological signal sensing device as claimed in claim 3, wherein the elastic strip (13) includes metal material, such as carbon steel, and wherein the tensile strength of the elastic strip (13) is from 600 MPa to 1000 MPa, the yield strength thereof is from 350 MPa to 500 MPa, the brinell hardness thereof

is about 248, and the thickness thereof is from 0.1 μm to 500 μm.

**5.** The physiological signal sensing device as claimed in any of the preceding claims, wherein the sensing body (121) is a sheet structure of an insulated material, such as rubber or a soft plastic.

**6.** The physiological signal sensing device as claimed in any of the preceding claims, wherein a curvature of the conductive element corresponds to the vibration of the blood vessel.

**7.** The physiological signal sensing device as claimed in any of the preceding claims, further comprising a processing module (31) electrically connected to the conductive element, wherein the processing module generates a physiological signal according to the resistance value.

**8.** The physiological signal sensing device as claimed in claim 7, wherein the processing module (31) further comprises a wheatstone bridge (311) electrically connected to the conductive element, and the processing module detects the resistance value by the wheatstone bridge.

**9.** The physiological signal sensing device as claimed in claim 7 or 8, further comprising a display module (32) electrically connected to the processing module, wherein the processing module controls the display module to display the physiological signal.

**10.** The physiological signal sensing device as claimed in any of claims 7 to 9, further comprising a wireless transmission module (33) electrically connected to the processing module, wherein the processing module controls the wireless transmission module to transmit a wireless signal according to the physiological signal.

**11.** The physiological signal sensing device as claimed in any of the preceding claims, further comprising a pressing element (20) disposed on the elastic pad to press the elastic pad.

**12.** The physiological signal sensing device as claimed in claim 11, wherein the pressing element further comprises:

a retaining belt (21);
a housing (22) disposed on the retaining belt; and
an elastic element (23) disposed on the housing for pressing the elastic pad.

**13.** The physiological signal sensing device as claimed in claim 12, wherein the pressing element further comprises:

a retaining belt (21); and
a housing disposed on the retaining belt and the elastic pad, for pressing the elastic pad.

**Patentansprüche**

**1.** Vorrichtung zum Erfassen von physiologischen Signalen, umfassend:

ein elastisches Kissen (11) für den Kontakt mit einem menschlichen Körper und so ausgelegt, dass es korrespondierend zu einem Blutgefäß des menschlichen Körpers angeordnet werden kann; und
ein Dehnungssensorelement (12) mit einem Sensorkörper (121) und einem leitenden Element (122), das auf dem Sensorkörper (121) angeordnet ist, wobei der Sensorkörper in dem elastischen Kissen vorgesehen ist, wobei das leitende Element (122) einen variablen Widerstandswert aufweist, wobei das leitende Element (122) so ausgelegt ist, dass es gemäß einer Vibration des Blutgefäßes verformt und gespannt bzw. gedehnt wird, und wobei der Widerstandswert des leitenden Elements (122) entsprechend der Dehnung des leitenden Elements variiert,
**dadurch gekennzeichnet, dass** das Dehnungssensorelement (12) mit dem Sensorkörper (121) und dem leitenden Element (122) in dem elastischen Kissen (11) angeordnet ist.

**2.** Vorrichtung zum Erfassen von physiologischen Signalen nach Anspruch 1, weiterhin umfassend einen elastischen Streifen (13), der auf dem Sensorkörper (121) und in dem elastischen Kissen (11) angeordnet ist, wobei der elastische Streifen entsprechend der Vibration des Blutgefäßes verformt und gespannt bzw. gedehnt wird und die Dehnung des leitenden Elements (122) der Verformung oder Dehnung des elastischen Streifens (13) entspricht.

**3.** Vorrichtung zum Erfassen von physiologischen Signalen nach Anspruch 2, wobei der elastische Streifen (13) parallel zum Sensorkörper (121) und dem leitenden Element (122) verläuft und die Fläche des elastischen Streifens (13) größer ist als die Fläche des Sensorkörpers (121).

**4.** Vorrichtung zum Erfassen von physiologischen Signalen nach Anspruch 3, wobei der elastische Streifen (13) ein Metallmaterial, wie beispielsweise einen Kohlenstoffstahl, enthält und wobei die Zugfestigkeit des elastischen Streifens (13) von 600 MPa bis 1000 MPa reicht, seine Streckgrenze von 350 MPa bis

500 MPa reicht, seine Brinellhärte etwa 248 beträgt und seine Dicke von 0,1 $\mu$m bis 500 $\mu$m reicht.

**5.** Vorrichtung zum Erfassen von physiologischen Signalen nach einem der vorhergehenden Ansprüche, wobei der Sensorkörper (121) eine Folienstruktur aus einem isolierenden Material, wie beispielsweise Gummi oder einem weichen Kunststoff, ist.

**6.** Vorrichtung zum Erfassen von physiologischen Signalen nach einem der vorhergehenden Ansprüche, wobei eine Krümmung des leitenden Elements der Vibration des Blutgefäßes entspricht.

**7.** Vorrichtung zum Erfassen von physiologischen Signalen nach einem der vorhergehenden Ansprüche, weiterhin umfassend ein Verarbeitungsmodul (31), das elektrisch mit dem leitenden Element verbunden ist, wobei das Verarbeitungsmodul ein physiologisches Signal entsprechend dem Widerstandswert erzeugt.

**8.** Vorrichtung zum Erfassen von physiologischen Signalen nach Anspruch 7, wobei das Verarbeitungsmodul (31) weiterhin eine Wheatstone-Brücke (311) aufweist, die elektrisch mit dem leitenden Element verbunden ist, und das Verarbeitungsmodul den Widerstandswert durch die Wheatstone-Brücke erfasst.

**9.** Vorrichtung zum Erfassen von physiologischen Signalen nach Anspruch 7 oder 8, weiterhin umfassend ein Anzeigemodul (32), das elektrisch mit dem Verarbeitungsmodul verbunden ist, wobei das Verarbeitungsmodul das Anzeigemodul steuert, um das physiologische Signal anzuzeigen.

**10.** Vorrichtung zur Erfassung eines physiologischen Signals nach einem der Ansprüche 7 bis 9, weiterhin umfassend ein drahtloses Übertragungsmodul (33), das elektrisch mit dem Verarbeitungsmodul verbunden ist, wobei das Verarbeitungsmodul das drahtlose Übertragungsmodul steuert, um ein drahtloses Signal entsprechend dem physiologischen Signal zu übertragen.

**11.** Vorrichtung zum Erfassen von physiologischen Signalen nach einem der vorhergehenden Ansprüche, weiterhin umfassend ein Druckelement (20), das auf dem elastischen Kissen angeordnet ist, um das elastische Kissen mit Druck zu beaufschlagen.

**12.** Vorrichtung zum Erfassen von physiologischen Signalen nach Anspruch 11, wobei das Druckelement weiterhin umfasst:

einen Haltegurt (21);
ein Gehäuse (22), das auf dem Haltegurt angeordnet ist; und
ein am Gehäuse angeordnetes elastisches Element (23), um das elastische Kissen mit Druck zu beaufschlagen.

**13.** Vorrichtung zum Erfassen von physiologischen Signalen nach Anspruch 12, wobei das Druckelement weiterhin umfasst:

einen Haltegurt (21); und
ein auf dem Haltegurt und dem elastischen Kissen angeordnetes Gehäuse, um das elastische Kissen mit Druck zu beaufschlagen.

## Revendications

**1.** Un dispositif de détection d'un signal physiologique, comprenant:

un tampon élastique utilisé (11) pour un contact avec un corps humain et configuré pour correspondre à un vaisseau sanguin du corps humain; et
un capteur de contrainte (12) comprenant: un corps de détection (121) et un élément conducteur (122) disposé sur le corps de détection (121), ledit corps de détection étant disposé dans le tampon élastique, ledit élément conducteur (122) ayant une résistance variable, dans lequel l'élément conducteur (122) est configuré pour être déformé et contraint selon une vibration du vaisseau sanguin, et la valeur de résistance de l'élément conducteur (122) varie en fonction de la déformation de l'élément conducteur,
**caractérisé en ce que** le capteur de contrainte (12) comportant le corps de détection (121) et l'élément conducteur (122) est disposé au sein du tampon élastique (11).

**2.** Le dispositif de détection d'un signal physiologique tel que revendiqué dans la revendication 1, comprenant en outre une bande élastique (13), qui est disposée sur le corps de détection (121) et dans le tampon élastique (11), dans lequel la bande élastique est déformée et contrainte en fonction de la vibration du vaisseau sanguin, et la déformation du l'élément conducteur (122) correspond à la déformation ou à la déformation de ladite bande élastique (13).

**3.** Le dispositif de détection d'un signal physiologique tel que revendiqué dans la revendication 2, dans lequel la bande élastique (13) est parallèle au corps de détection (121) et l'élément conducteur (122) et la surface de la bande élastique (13) sont plus larges que la surface du corps de détection (121).

**4.** Le dispositif de détection d'un signal physiologique tel que revendiqué dans la revendication 3, dans lequel la bande élastique (13) comporte un matériau métallique, tel que de l'acier carbone, et dans lequel la tension de traction de la bande élastique (13) est entre 600 MPa et 1000 Mpas, la limite d'élasticité de celle-ci étant entre 350 Mpa et 500 Mpas, et dont la dureté Brinell est environ 248, et dont l'épaisseur est entre 01 $\mu$m et 500 $\mu$m.

**5.** Le dispositif de détection d'un signal physiologique tel que revendiqué dans l'une quelconque des revendications précédentes, dans lequel le corps de détection (121) est une structure plane d'un matériau isolant, tel que du caoutchouc ou d'un plastique mou.

**6.** Le dispositif de détection d'un signal physiologique tel que revendiqué dans l'une quelconque des revendications précédentes, dans lequel une courbure de l'élément conducteur correspond à la vibration du vaisseau sanguin.

**7.** Le dispositif de détection d'un signal physiologique tel que revendiqué dans l'une quelconque des revendications précédentes, comprenant en outre un module de traitement (31) connecté électriquement à l'élément conducteur, dans lequel le module de traitement génère un signal physiologique en fonction de la valeur de résistance.

**8.** Le dispositif de détection d'un signal physiologique tel que revendiqué dans la revendication 7, dans lequel le module de traitement (31) comprend en outre un pont de Wheatstone (311) connecté électriquement à l'élément conducteur, et le module de traitement détecte la valeur de résistance au moyen du pont de Wheatstone.

**9.** Le dispositif de détection d'un signal physiologique tel que revendiqué dans la revendication 7 ou 8, comprenant en outre un module d'affichage (32) connecté électriquement au module de traitement, dans lequel le module de traitement commande le modulé d'affichage pour afficher le signal physiologique.

**10.** Le dispositif de détection d'un signal physiologique tel que revendiqué dans l'une quelconque des revendications 7 à 9, comprenant en outre un module de transmission sans fil (33) connecté électriquement au module de traitement, dans lequel le module de traitement commande le module de transmission sans fil en fonction du signal physiologique .

**11.** Le dispositif de détection d'un signal physiologique tel que revendiqué dans l'une quelconque des revendications précédentes, comprenant en outre un élément de pression (20) disposé sur le tampon élastique pour presser le tampon élastique.

**12.** Le dispositif de détection d'un signal physiologique tel que revendiqué dans la revendication 11, dans lequel l'élément de pression comprend en outre:

une courroie de retenue (21);
un boîtier (22) disposé sur la courroie de retenue; et
un élément élastique (23) disposé sur le boîtier pour presser le tampon élastique.

**13.** Le dispositif de détection d'un signal physiologique tel que revendiqué dans la revendication 12, dans lequel l'élément de pression comprend en outre:

une courroie de retenue (21); et
un logement disposé sur la courroie de retenue et sur le patin élastique, pour presser le patin élastique.

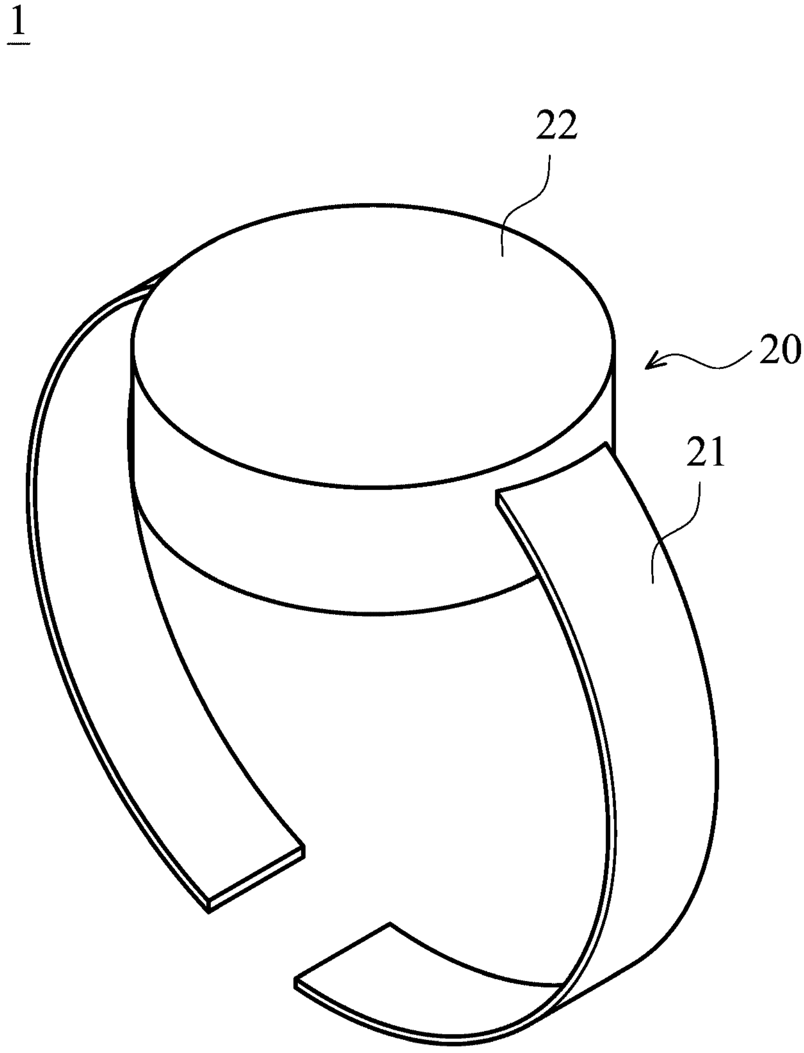


FIG. 1

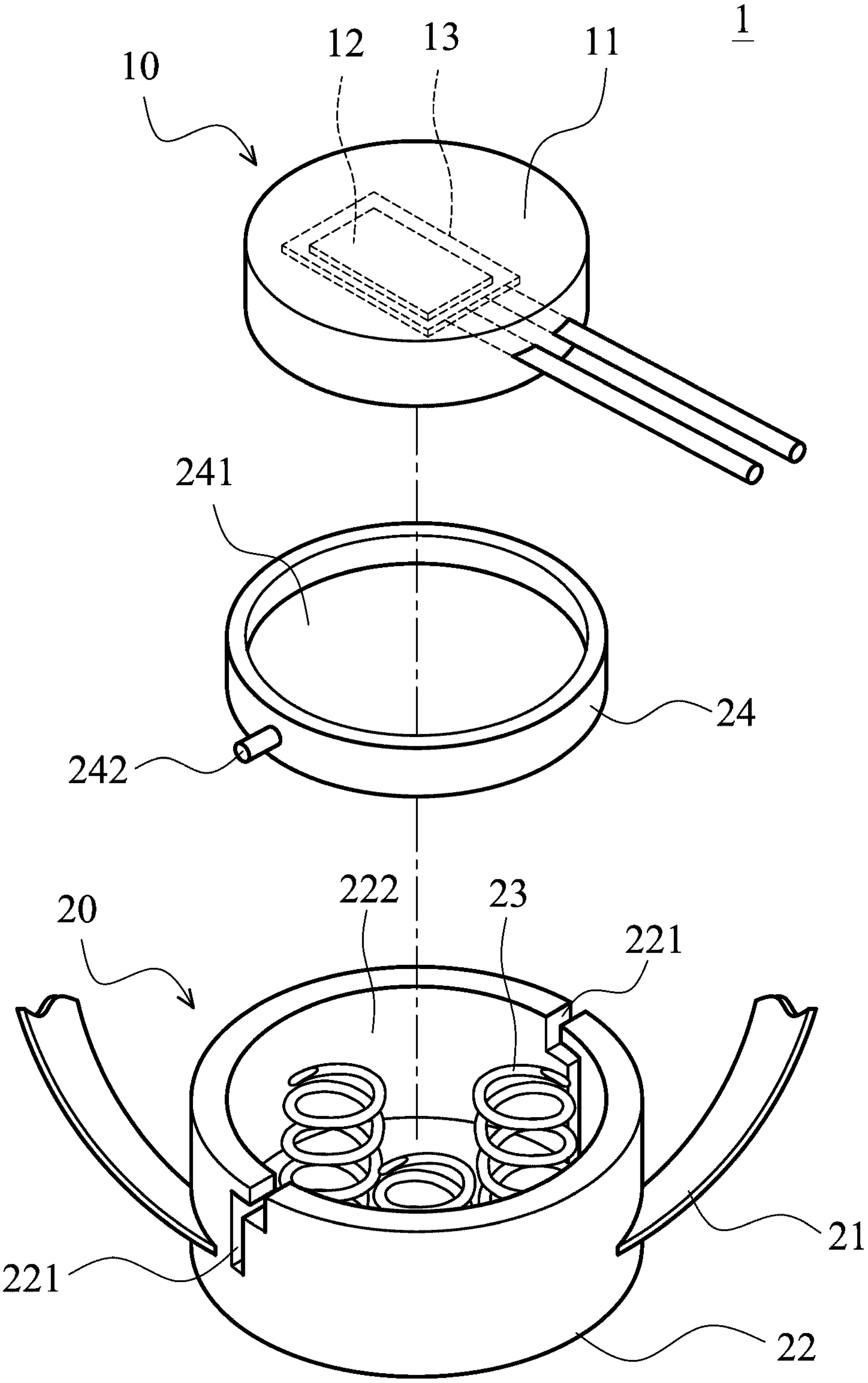


FIG. 2

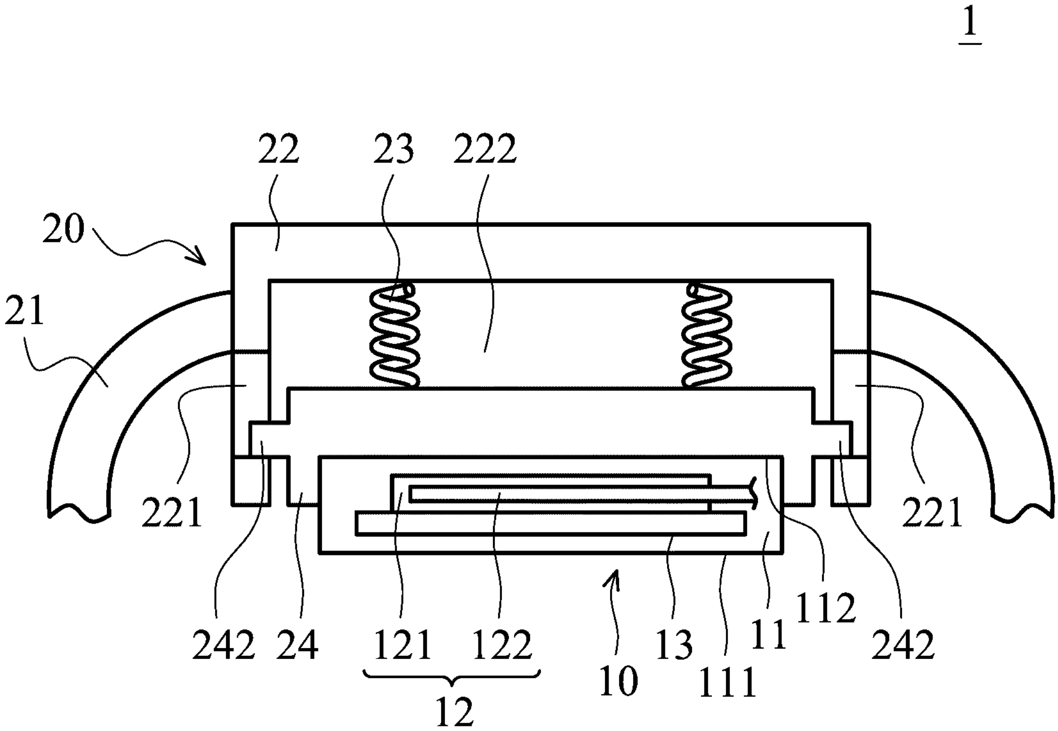
1
22
23
222
20
21
221
221
242
24
121
122
12
10
13
111
11
112
242

FIG. 3

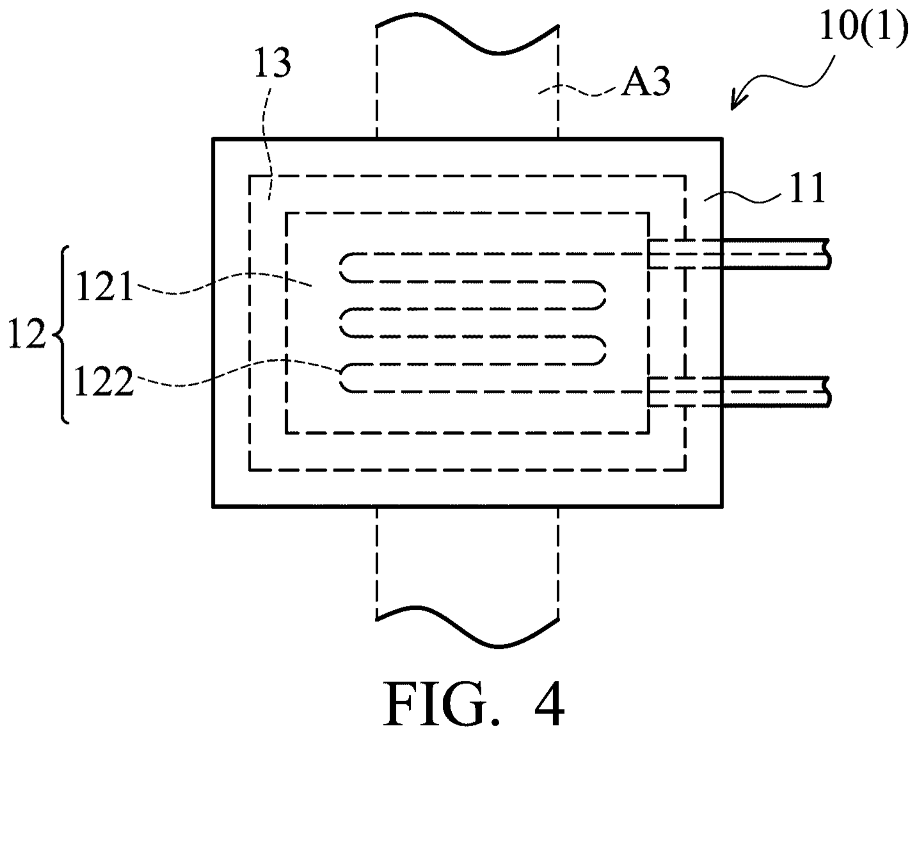
10(1)
13
A3
11
12
121
122

FIG. 4

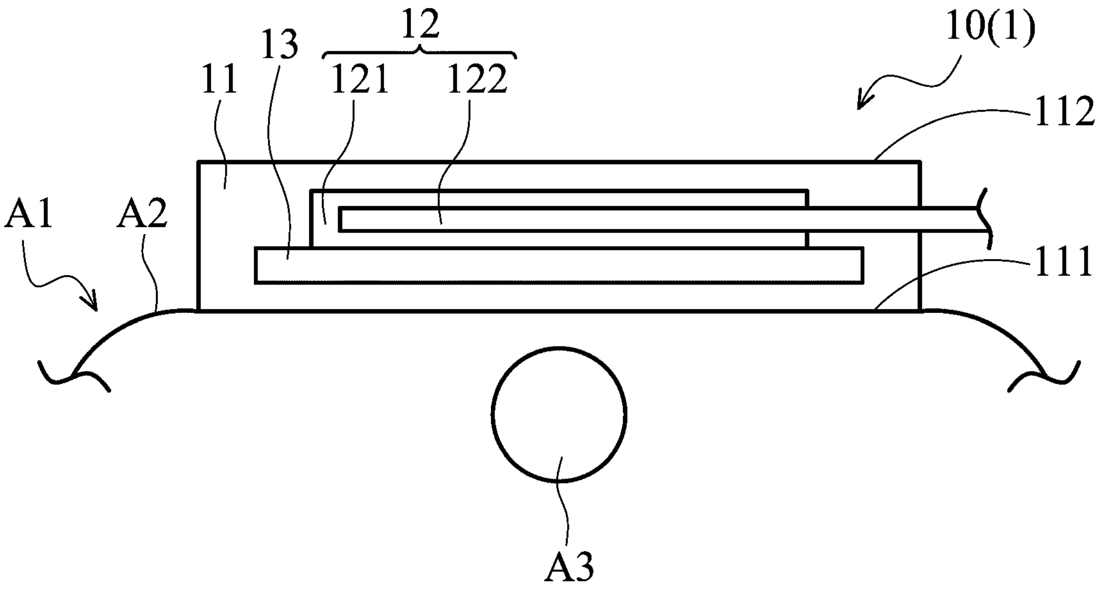
12
13
121
122
10(1)
11
112
A1
A2
111
A3

FIG. 5

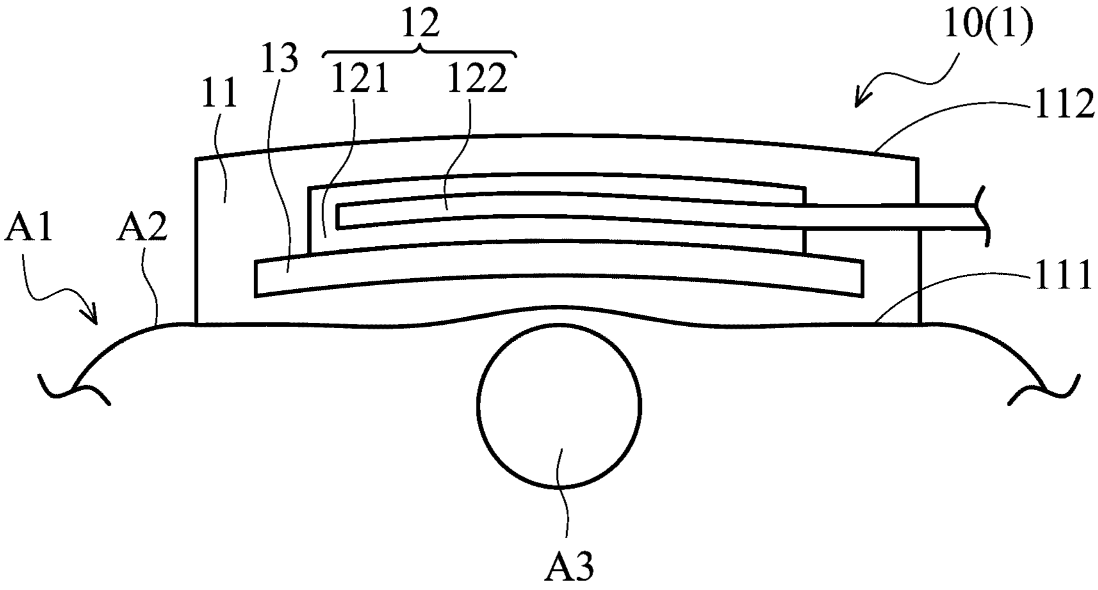
12
13
121
122
10(1)
11
112
A1
A2
111
A3

FIG. 6

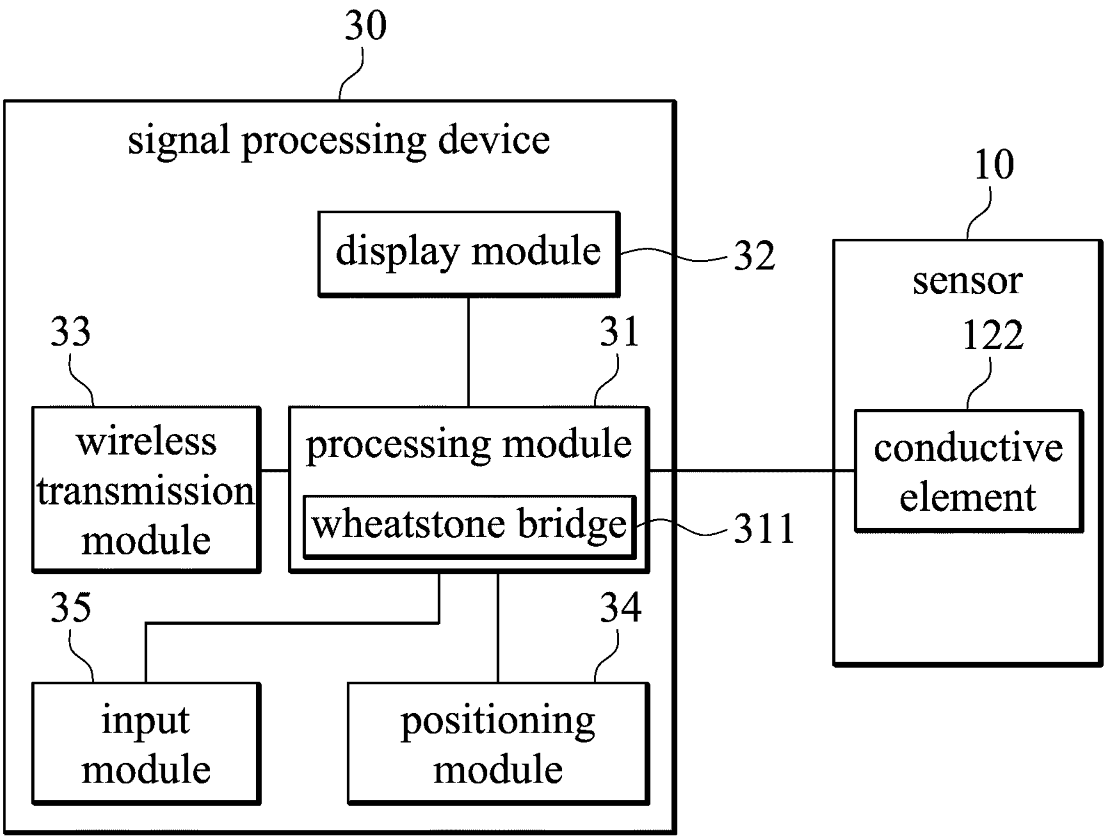
30
signal processing device
display module
32
33
31
wireless transmission module
processing module
wheatstone bridge
311
35
34
input module
positioning module
10
sensor
122
conductive element

FIG. 7

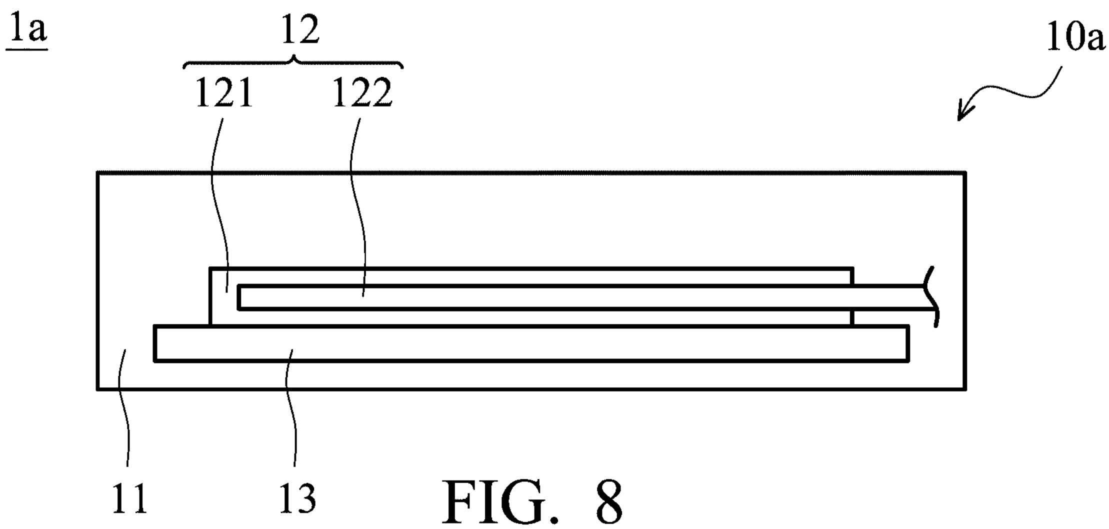
1a
12
121
122
10a
11
13

FIG. 8

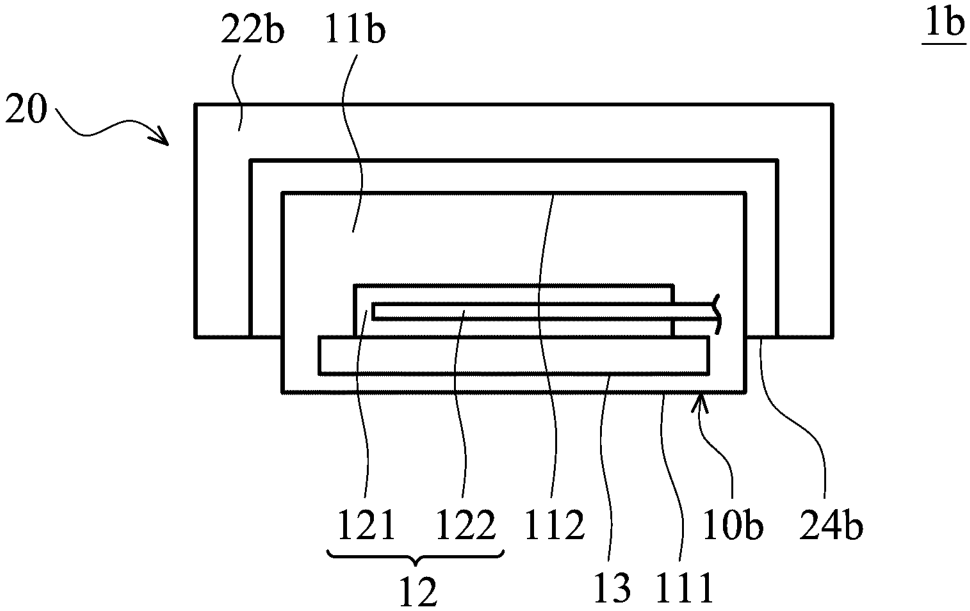


FIG. 9

## REFERENCES CITED IN THE DESCRIPTION

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

### Patent documents cited in the description


- US 4561447 A **[0002]**

| | | | |
|---|---|---|---|
| 专利名称(译) | 生理信号传感装置 | | |
| 公开(公告)号 | EP2786702B1 | 公开(公告)日 | 2018-06-06 |
| 申请号 | EP2014159185 | 申请日 | 2014-03-12 |
| 申请(专利权)人(译) | MEDSENSE INC. | | |
| 当前申请(专利权)人(译) | MAISENSE INC. | | |
| [标]发明人 | TU TSE YI<br>CHAO PAUL C P<br>LEE YUNG PIN | | |
| 发明人 | TU, TSE-YI<br>CHAO, PAUL C.P.<br>LEE, YUNG-PIN | | |
| IPC分类号 | A61B5/00 A61B5/02 A61B5/021 A61B5/024 A61B5/0255 | | |
| CPC分类号 | A61B5/02 A61B5/02438 A61B5/681 A61B5/6824 A61B5/6831 A61B2562/0261 | | |
| 优先权 | 102111641 2013-04-01 TW | | |
| 其他公开文献 | EP2786702A2<br>EP2786702A3 | | |
| 外部链接 | Espacenet | | |


摘要(译)

生理信号传感装置包括弹性垫和应变传感器元件。弹性垫用于与人体接触，并且对应于人体的血管。应变传感器元件设置在弹性垫中并包括导电元件。导电元件根据血管的振动而变形，并且导电元件的电阻值根据导电元件的应变而变化。


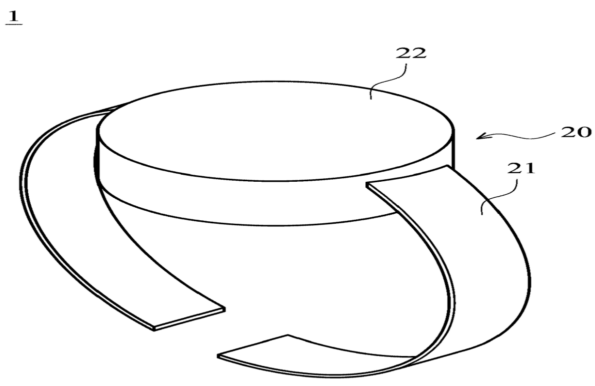


FIG. 1