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

(11) **EP 3 047 794 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
28.06.2017 Bulletin 2017/26

(21) Application number: **14780531.1**

(22) Date of filing: **16.09.2014**

(51) Int Cl.:
A61B 5/00 *(2006.01)* ***A61B 5/0205*** *(2006.01)*
G01L 1/20 *(2006.01)* ***A61B 5/024*** *(2006.01)*
A61B 5/08 *(2006.01)* ***B32B 5/26*** *(2006.01)*
B60N 2/44 *(2006.01)*

(86) International application number:
PCT/ES2014/070705

(87) International publication number:
WO 2015/036647 (19.03.2015 Gazette 2015/11)

(54) **PIEZORESISTIVE TEXTILE SENSOR AND SYSTEM FOR DETECTING THE HEART AND/OR RESPIRATORY RATE**

PIEZORESISTIVER STOFFSENSOR UND SYSTEM ZUR ERFASSUNG DER HERZ- UND/ODER ATMUNGSRATE

CAPTEUR TEXTILE PIÉZORÉSISTIF ET SYSTÈME DE DÉTECTION DU RYTHME CARDIAQUE ET/OU RESPIRATOIRE

(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: **16.09.2013 ES 201331341**

(43) Date of publication of application:
27.07.2016 Bulletin 2016/30

(73) Proprietor: **Sensing Tex, S.L.**
08042 Barcelona (ES)

(72) Inventors:
- **RIDAO GRANADO, Miguel**
  08042 Barcelona (ES)
- **GOMEZ ANTA, Luis Miguel**
  08042 Barcelona (ES)

(74) Representative: **Isern-Jara, Nuria**
J. Isern Patentes y Marcas
Avda. Diagonal 463 Bis 2°
08036 Barcelona (ES)

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Description

[0001] The object of the invention herein is a textile, piezoresistive sensor especially designed for detecting the heartbeat and/or respiratory rate, whose main characteristic is its textile nature and that it is non-intrusive in the human body for measurement, (which simply means that it makes contact with the textile sensor of the surface with very little pressure, the usual pressures produced between the contact surfaces of objects on which the human body lies: a seat, a mattress, a chair, etc). The object of the present invention also includes a system applicable to a large textile area, in order to monitor the heartbeat and/or respiratory rate of a user either for medical reasons, for safety and for other applications.

STATE OF THE ART

[0002] At present, in order to detect the respiratory rate of a user, it is necessary to use different means or components placed directly on said user, which set the parameters for respiration and/or the heartbeat depending on the particular needs of each case.

[0003] In the case of piezoresistive materials such as sensor systems for measuring respiratory rate and heartbeat, this implies that the user must typically wear masks with piezoresistive elements, or be positioned in certain ways (awkward postures) which enable the electrical conductivity to be varied with deformation of the material. In addition, these materials are textile and/or flexible.

[0004] An example of use of piezoresistive systems for measuring heart rate may be the U.S.

[0005] Patent US7689271B1, and unlike the object of the present invention, the object of said American patent is not based on a textile, deformable surface and which also requires a forced position in which at least the ends must be in contact with the sensor surface, but the sensor of the invention is based on the capture of signals, and because the sensor is much more sensitive, it requires a much simpler processing.

[0006] A piezoresistive system is also known from document US 2006/0255903 A1. All known systems and devices would be incompatible, for example, with simultaneously operating machinery or vehicles, or with any other hazardous activity that required the user's full attention. This would be the case for an intrusive system for monitoring respiration and/or the heart rate of a driver, and to therefore know the condition thereof in order to avoid accidents due to fatigue or drowsiness.

DESCRIPTION OF THE INVENTION

[0007] The invention herein has been developed with the aim of providing a textile piezoresistive sensor that resolves the aforementioned drawbacks, further providing other additional advantages that will be apparent from the description detailed hereinafter.

[0008] An object of the invention herein is therefore a textile piezoresistive sensor for detecting heart rate and respiration, comprising a lower textile layer onto which a conductive ink or paste is deposited, such that a number of first conductive strips are defined, while said lower textile layer is attached to a second piezoresistive textile layer onto which a second conductive strip is placed to which an upper textile layer is finally placed which can receive the ink and/or conductive pastes deposited.

[0009] Thanks to its special design and functionality, the sensor presented herein can detect small changes in pressure caused by the movement of the rib cage in contact with the sensor even with low pressure between the body and the object.

[0010] Another major advantage of the sensor presented herein is that, given that it is a textile, it is flexible, deformable, light, washable and, therefore, can be integrated into covers for beds, chairs or the like, seats for vehicles or dangerous machinery, and in general, objects with three-dimensional shapes and that are even deformable during use.

[0011] Accordingly, given that it is a textile and being a non-intrusive sensor, the respiratory rate and/or heartbeat can be detected and/or measured while the user is lying on a mattress and/or sitting on a chair, having previously installed the sensor in the mattress cover or upholstery of the chair, for example. A driver of a vehicle or hazardous machinery can also be monitored such that situations of fatigue or drowsiness can be avoided. Due to minimal intrusiveness, the object of the present invention does not alter any normal operations performed by the users.

[0012] The sensor disclosed herein has high sensitivity in the low pressure area, which enables a small variation in the pressure applied on the fabric to be transformed into voltage increments that can be captured by suitable electronics. This is necessary for detecting pressure variations produced by the movement of the chest for the respiratory rate, in the order of $8g/cm^2$ and less than $1g/cm^2$ for the heart rate.

[0013] Preferably, the first and second conductive strip comprises at least one of the following elements: silver, silver chloride, copper, nickel, graphite, conductive polymers and carbon nanofibres. Furthermore, said first conductive strips and said second conductive strip may be applied by printing, either by screen printing or inkjet or by weaving, embroidering or stitching wires coated or impregnated with the above materials in specific designs.

[0014] In respect of the second piezoresistive textile layer, there may be a sensitivity which involves resistive changes exceeding 26 Ohms for a voltage of 12V, for changes in the pressure exerted of 1 g/cm^2.

[0015] Another object of the invention is also a heartbeat and/or respiration detection system, that incorporates at least one analogue-digital converter and a signal amplifier circuit that comprises at least one textile piezoresistive sensor according to the other object of the invention. If an array of sensors is arranged on a support and/or the seat of a chair, sofa or vehicle, for example,

the user can move freely wherever they are located as at least one of the sensors that is used can measure the heartbeat and/or respiratory rate under the conditions specified herein.

[0016] Said respiratory rate detection system can measure pressure variations lower than 35g/cm^2, more preferably lower than 28g/cm^2. It can also carry out at least 4 measurements per minute, more preferably at least 40 measurements per minute. The supply voltage of the system herein may be 12V.

[0017] Throughout the description and claims the word "comprise" and its variants do not intend to exclude other technical characteristics, addends, components or steps. For persons skilled in the art, other objects, advantages and characteristics of the invention will emerge partly from the description and partly from implementing the invention. The following examples and drawings are provided by way of illustration and are not intended to limit the invention disclosed herein. Furthermore, the invention herein covers all possible combinations of particular and preferred embodiments set forth herein.

BRIEF DESCRIPTION OF THE FIGURES

[0018] Described very briefly hereinafter are a series of drawings that help to better understand the invention and which are expressly related to an embodiment of said invention that is presented as a non-limiting example thereof.

FIG 1. Shows a schematic view of the textile piezoresistive sensor, according to the invention herein; and

FIG 2. Shows a schematic sectional view of the sensor in Figure 1.

PREFERRED EMBODIMENT OF THE INVENTION

[0019] A preferred embodiment of the invention is shown in the attached drawings. More specifically, a textile piezoresistive sensor for detecting a heart rate and respiration that comprises a lower textile layer (1) is shown, onto which a conductive ink or paste is deposited, such that a number of first conductive strips (2) are defined, while said lower textile layer (1) is attached to a second piezoresistive textile layer (3), onto which a second conductive strip (4) is placed to which an upper textile layer (5) is finally placed which can receive the ink and/or conductive pastes deposited.

[0020] The fact that three textile layers (1, 3, 5) are incorporated means a more reliable measurement of the heart rate can be taken rather than having a single layer, while maintaining optimal sensitivity in terms of conductance.

[0021] Said first conductive strip (2) and second conductive strip (4) comprises at least one of the following: silver, silver chloride, copper, nickel, graphite, conductive polymers and carbon nanofibres, wherein some or all of them may be present. In respect of said first conductive strips (2) and said second conductive strip (4), they may be applied by printing, either by screen printing or ink jet or by weaving, embroidering or stitching wires coated or impregnated with the above materials in specific designs.

[0022] Preferably, the fabric of the second piezoresistive textile layer (3) has a concentration of conductive particles of 34g/m^2, in particular made of copper as it has been observed in tests that it enables optimum transmission of electrical signals from the sensor to the other elements with the least amount of conductive materials. Nonetheless, it will be obvious that such an amount and/or material should be modified according to individual needs.

[0023] A heartbeat and/or respiration detection system that incorporates at least one analogue-digital converter (not shown) and a signal amplifier circuit (not shown) that comprises at least one piezoresistive textile sensor defined above is also an object of the invention herein. To measure heartbeat and/or respiratory rate for example, a plurality of said sensors may be provided in the seat of a vehicle, such that the user can move freely in the seat, as at least one of said sensors will obtain the correct reading.

[0024] It has been proven in the laboratory that in order to measure the heartbeat and/or respiratory rate it is necessary to measure pressure variations between the body and the sensor element lower than 35g/cm^2 although more preferably lower than 28g/cm2, as is the case of the sensor herein which advantageously can measure pressure variations of 1g/cm^2, having sensitivity to variation in resistance which involves resistive changes greater than 26 Ohms at a voltage of 12V. In respect of the measurement cycles, it has been established that the system should perform some 40 measurements per minute. In this manner, the number of breaths and heartbeats of the user can be optimally monitored.

[0025] When used in a conventional vehicle, for example, the system of the invention can be fed by a 12V current, although 6V or 24V voltages could also be used. The power supply (not shown) may be of any type known in the state of the art.

[0026] The conductive strips (2.4) are those that are connected to the analogue/digital converter or a signal booster in order to filter the noise from the electrical signal and boost the signal from the sensor assembly through the strips (2, 4). This noise filter is essential for operation in a vehicle or machinery, where there may be a lot of pollutant signals that would distort the results obtained by the system, making it impractical for use.

[0027] By using this system it is possible to control, among other things, the drowsiness or fatigue of a user, because it could also be used on a sofa, mattress or chair to monitor a patient.

[0028] When in use, the system herein would be installed for example in a vehicle seat, preferably provided with an array of sensors such as those defined in the invention herein. The user would sit and would be able

to drive or operate the machinery normally, wearing his clothes without noticing any intrusive element. The flexibility and elasticity of the sensors which fully adapts to all types of seats further contributes to the above. If the system detects that the parameters of the heartbeat or respiratory rate are modified according to a pattern of drowsiness, it may send a signal by any audio or visual means (not shown) to prevent the user from having an accident.

[0029] Although the option of the seat has been mentioned, incorporating the present invention into a safety belt across the chest to monitor the user of a vehicle could also be an option.

[0030] Therefore, the drawbacks of other systems based on the visual control of the user's eyes to determine the fatigue of the latter can be avoided, such as the wide range of features and different shapes of eyes, wearing glasses, inadequate brightness, and many others that make the use of these systems impractical.

Claims

1. Vehicle seat comprising a heartbeat and/or respiration detection system that comprises a plurality of textile piezoresistive sensors provided as an array of sensors, the array of piezoresistive sensors comprising a lower textile layer (1), onto which a conductive ink or paste is deposited such that a number of first conductive strips (2) are defined, said first conductive strips (2) being attached to a piezoresistive textile layer (3), the piezoresistive textile layer (3) being also attached to a second conductive strip (4), the second conductive strip (4) being a conductive ink and/or paste deposited on an upper textile layer (5), the sensors having high sensitivity in low pressure area, the heartbeat and/or respiration detection system further comprising at least one analogue-digital converter and a signal amplifier circuit, the conductive strips (2, 4) being connected to the analogue-digital converter or signal amplifier circuit, means for detecting that parameters of the heartbeat or respiratory rate are modified according to a pattern of drowsiness, and an audio or visual means configured to send a signal to the user when drowsiness has been detected.

2. Vehicle seat according to claim 1, wherein the heartbeat and/or respiration detection system is configured to measure pressure variations lower than 1 g/cm^2.

3. Vehicle seat according to claim 1, wherein the piezoresistive textile layer (3) has a conductive material concentration of 34 g/m^2.

4. Vehicle seat according to claim 1, wherein the heartbeat and/or respiration detection system is configured to conduct at least 40 measurements per minute.

5. Vehicle seat according to claim 1, wherein the mains voltage supply of the system is 12V.

6. Safety belt for a vehicle configured to be placed across the chest comprising a heartbeat and/or respiration detection system that comprises a plurality of textile piezoresistive sensors provided as an array of sensors, the array of piezoresistive sensors comprising a lower textile layer (1), onto which a conductive ink or paste is deposited such that a number of first conductive strips (2) are defined, said first conductive strips (2) being attached to a piezoresistive textile layer (3), the piezoresistive textile layer (3) being also attached to a second conductive strip (4), the second conductive strip (4) being a conductive ink and/or paste deposited on an upper textile layer (5), the sensors having high sensitivity in low pressure area, the heartbeat and/ or respiration detection system further comprising at least one analogue-digital converter and a signal amplifier circuit, the conductive strips (2, 4) being connected to the analogue-digital converter or signal amplifier circuit, means for detecting that parameters of the heartbeat or respiratory rate are modified according to a pattern of drowsiness, and an audio or visual means configured to send a signal to the user when drowsiness has been detected.

7. Safety belt according to claim 6, wherein the heartbeat and/or respiration detection system is configured to measure pressure variations lower than 1 g/cm^2.

8. Safety belt according to claim 6, wherein the piezoresistive textile layer (3) has a conductive material concentration of 34 g/m^2.

9. Safety belt according to claim 6, wherein the heartbeat and/or respiration detection system is configured to conduct at least 40 measurements per minute.

10. Safety belt according to claim 6, wherein the mains voltage supply of the system is 12V.

11. Cover for an object with three-dimensional shapes and deformable during use, comprising a heartbeat and/or respiration detection system that comprises a plurality of textile piezoresistive sensors provided as an array of sensors, the array of piezoresistive sensors comprising a lower textile layer (1), onto which a conductive ink or paste is deposited such that a number of first conductive strips (2) are defined, said first conductive strips (2) being attached to a piezoresistive textile layer (3), the piezoresistive

textile layer (3) being also attached to a second conductive strip (4), the second conductive strip (4) being a conductive ink and/or paste deposited on an upper textile layer (5), the sensors having high sensitivity in low pressure area, the heartbeat and/or respiration detection system further comprising at least one analogue-digital converter and a signal amplifier circuit, the conductive strips (2, 4) being connected to the analogue-digital converter or signal amplifier circuit, means for detecting that parameters of the heartbeat or respiratory rate are modified according to a pattern of drowsiness, and an audio or visual means configured to send a signal to the user when drowsiness has been detected.

12. Cover according to claim 11, wherein the heartbeat and/or respiration detection system is configured to measure pressure variations lower than 1 g/cm^2.

13. Cover according to claim 11, wherein the piezoresistive textile layer (3) has a conductive material concentration of 34 g/m^2.

14. Cover according to claim 11, wherein the heartbeat and/or respiration detection systems configured to conduct at least 40 measurements per minute.

15. Cover according to claim 11, wherein the mains voltage supply of the system is 12V.

Patentansprüche

1. Fahrzeugsitz umfassend ein Herzschlag- und/oder Atmungserfassungssystem, das mehrere piezoresistive Textilsensoren umfasst, die als eine Anordnung von Sensoren bereitgestellt sind, wobei die Anordnung von piezoresistiven Sensoren eine untere Textilschicht (1) umfasst, auf welcher eine leitfähige Farbe oder Paste abgelagert ist, so dass eine Anzahl an ersten leitfähigen Streifen (2) definiert sind, wobei die ersten leitfähigen Streifen (2) an einer piezoresistiven Textilschicht (3) befestigt sind, wobei die piezoresistive Textilschicht (3) auch an einem zweiten leitfähigen Streifen (4) befestigt ist, wobei der zweite leitfähige Streifen (4) eine leitfähige Farbe und/oder Paste ist, die auf einer oberen Textilschicht (5) abgelagert ist, wobei die Sensoren eine hohe Empfindlichkeit im Niederdruckbereich aufweisen, wobei das Herzschlag- und/oder Atmungserfassungssystem ferner mindestens einen Analog-Digital-Wandler und eine Signalverstärkerschaltung, wobei die leitfähigen Streifen (2, 4) mit dem Analog-Digital-Wandler oder der Signalverstärkerschaltung verbunden sind, Mittel zum Erfassen, dass Parameter der Herzschlag- oder Atmungsrate nach einem Schläfrigkeitsmuster verändert sind, und ein Audio- oder visuelles Mittel, das ausgebildet ist, um ein Signal zu dem Benutzer zu senden, wenn Schläfrigkeit erfasst worden ist, umfasst.

2. Fahrzeugsitz nach Anspruch 1, wobei das Herzschlag- und/oder Atmungserfassungssystem ausgebildet ist, um Druckveränderungen zu messen, die geringer als 1g/cm^2 sind.

3. Fahrzeugsitz nach Anspruch 1, wobei die piezoresistive Textilschicht (3) eine Konzentration von leitfähigem Material von 34 g/m^2 aufweist.

4. Fahrzeugsitz nach Anspruch 1, wobei das Herzschlag- und/oder Atmungserfassungssystem ausgebildet ist, um mindestens 40 Messungen pro Minute durchzuführen.

5. Fahrzeugsitz nach Anspruch 1, wobei die Netzspannungsversorgung des Systems 12 V beträgt.

6. Sicherheitsgurt für ein Fahrzeug, der ausgebildet ist, um über der Brust platziert zu werden, der ein Herzschlag- und/oder Atmungserfassungssystem umfasst, das mehrere piezoresistive Textilsensoren umfasst, die als eine Anordnung von Sensoren bereitgestellt sind, wobei die Anordnung von piezoresistiven Sensoren eine untere Textilschicht (1) umfasst, auf welcher eine leitfähige Farbe oder Paste abgelagert ist, so dass eine Anzahl an ersten leitfähigen Streifen (2) definiert sind, wobei die ersten leitfähigen Streifen (2) an einer piezoresistiven Textilschicht (3) befestigt sind, wobei die piezoresistive Textilschicht (3) auch an einem zweiten leitfähigen Streifen (4) befestigt ist, wobei der zweite leitfähige Streifen (4) eine leitfähige Farbe und/oder Paste ist, die auf einer oberen Textilschicht (5) abgelagert ist, wobei die Sensoren eine hohe Empfindlichkeit im Niederdruckbereich aufweisen, wobei das Herzschlag- und/oder Atmungserfassungssystem ferner mindestens einen Analog-Digital-Wandler und eine Signalverstärkerschaltung, wobei die leitfähigen Streifen (2, 4) mit dem Analog-Digital-Wandler oder der Signalverstärkerschaltung verbunden sind, Mittel zum Erfassen, dass Parameter der Herzschlag- oder Atmungsrate nach einem Schläfrigkeitsmuster verändert sind, und ein Audio- oder visuelles Mittel, das ausgebildet ist, um ein Signal zu dem Benutzer zu senden, wenn Schläfrigkeit erfasst worden ist, umfasst.

7. Sicherheitsgurt nach Anspruch 6, wobei das Herzschlag- und/oder Atmungserfassungssystem ausgebildet ist, um Druckveränderungen zu messen, die geringer als 1 g/cm^2 sind.

8. Sicherheitsgurt nach Anspruch 6, wobei die piezoresistive Textilschicht (3) eine Konzentration von leitfähigem Material von 34 g/m^2 aufweist.

9. Sicherheitsgurt nach Anspruch 6, wobei das Herzschlag- und/oder Atmungserfassungssystem ausgebildet ist, um mindestens 40 Messungen pro Minute durchzuführen.

10. Sicherheitsgurt nach Anspruch 6, wobei die Netzspannungsversorgung des Systems 12 V beträgt.

11. Abdeckung für ein Objekt mit dreidimensionalen Formen, und das während des Gebrauchs verformbar ist, umfassend ein Herzschlag- und/oder Atmungserfassungssystem, dass mehrere piezoresistive Textilsensoren umfasst, die als eine Anordnung von Sensoren bereitgestellt sind, wobei die Anordnung von piezoresistiven Sensoren eine untere Textilschicht (1) umfasst, auf welcher eine leitfähige Farbe oder Paste abgelagert ist, so dass eine Anzahl an ersten leitfähigen Streifen (2) definiert sind, wobei die ersten leitfähigen Streifen (2) an einer piezoresistiven Textilschicht (3) befestigt sind, wobei die piezoresistive Textilschicht (3) auch an einem zweiten leitfähigen Streifen (4) befestigt ist, wobei der zweite leitfähige Streifen (4) eine leitfähige Farbe und/oder Paste ist, die auf einer oberen Textilschicht (5) abgelagert ist, wobei die Sensoren eine hohe Empfindlichkeit im Niederdruckbereich aufweisen, wobei das Herzschlag- und/oder Atmungserfassungssystem ferner mindestens einen Analog-Digital-Wandler und eine Signalverstärkerschaltung, wobei die leitfähigen Streifen (2, 4) mit dem Analog-Digital-Wandler oder der Signalverstärkerschaltung verbunden sind, Mittel zum Erfassen, dass Parameter der Herzschlag- oder Atmungsrate nach einem Schläfrigkeitsmuster verändert sind, und ein Audio- oder visuelles Mittel, das ausgebildet ist, um ein Signal zu dem Benutzer zu senden, wenn Schläfrigkeit erfasst worden ist, umfasst.

12. Abdeckung nach Anspruch 11, wobei das Herzschlag- und/oder Atmungserfassungssystem ausgebildet ist, um Druckveränderungen zu messen, die geringer als 1 g/cm^2 sind.

13. Abdeckung nach Anspruch 11, wobei die piezoresistive Textilschicht (3) eine Konzentration von leitfähigem Material von 34 g/m^2 aufweist.

14. Abdeckung nach Anspruch 11, wobei das Herzschlag- und/oder Atmungserfassungssystem ausgebildet ist, um mindestens 40 Messungen pro Minute durchzuführen.

15. Abdeckung nach Anspruch 11, wobei die Netzspannungsversorgung 12 V beträgt.

Revendications

1. Siège de véhicule comprenant un système de détection des battements de coeur et/ou de la respiration qui comprend une pluralité de capteurs piézorésistifs textiles fournis sous la forme d'une gamme de capteurs, la gamme de capteurs piézorésistifs comprenant une couche de textile inférieure (1), sur laquelle est déposée une encre ou pâte conductrice de sorte qu'un nombre de premières bandes conductrices (2) sont définies, lesdites premières bandes conductrices (2) étant reliées à une couche de textile piézorésistive (3), la couche de textile piézorésistive (3) étant également reliée à une deuxième bande conductrice (4), la deuxième bande conductrice (4) étant une encre et/ou pâte conductrice déposée sur une couche de textile supérieure (5), les capteurs ayant une grande sensibilité dans une zone de basse pression, le système de détection des battements de coeur et/ou de la respiration comprenant en outre au moins un convertisseur analogique-numérique et un circuit amplificateur de signal, les bandes conductrices (2, 4) étant connectées au convertisseur analogique-numérique ou circuit amplificateur de signal, des moyens pour détecter que des paramètres de la fréquence cardiaque ou respiratoire sont modifiés selon un schéma de somnolence, et des moyens audio ou visuels configurés pour envoyer un signal à l'utilisateur lorsqu'une somnolence a été détectée.

2. Siège de véhicule selon la revendication 1, dans lequel le système de détection des battements de coeur et/ou de la respiration est configuré pour mesurer les variations de pression inférieures à 1 g/cm^2.

3. Siège de véhicule selon la revendication 1, dans lequel la couche de textile piézorésistive (3) a une concentration de matériau conducteur de 34 g/m^2.

4. Siège de véhicule selon la revendication 1, dans lequel le système de détection des battements de coeur et/ou de la respiration est configuré pour réaliser au moins 40 mesures par minute.

5. Siège de véhicule selon la revendication 1, dans lequel la source de tension principale du système est de 12 V.

6. Ceinture de sécurité pour un véhicule configurée pour être placée contre la poitrine comprenant un système de détection des battements de coeur et/ou de la respiration qui comprend une pluralité de capteurs piézorésistifs textiles fournis sous la forme d'une gamme de capteurs, la gamme de capteurs piézorésistifs comprenant une couche de textile inférieure (1), sur laquelle est déposée une encre ou pâte conductrice de sorte qu'un nombre de premiè-

res bandes conductrices (2) sont définies, lesdites premières bandes conductrices (2) étant reliées à une couche de textile piézorésistive (3), la couche de textile piézorésistive (3) étant également reliée à une deuxième bande conductrice (4), la deuxième bande conductrice (4) étant une encre et/ou pâte conductrice déposée sur une couche de textile supérieure (5), les capteurs ayant une grande sensibilité dans une zone de basse pression, le système de détection des battements de coeur et/ou de la respiration comprenant en outre au moins un convertisseur analogique-numérique et un circuit amplificateur de signal, les bandes conductrices (2, 4) étant connectées au convertisseur analogique-numérique ou circuit amplificateur de signal, des moyens pour détecter que des paramètres de la fréquence cardiaque ou respiratoire sont modifiés selon un schéma de somnolence, et des moyens audio ou visuels configurés pour envoyer un signal à l'utilisateur lorsqu'une somnolence a été détectée.

7. Ceinture de sécurité selon la revendication 6, dans laquelle le système de détection des battements de coeur et/ou de la respiration est configuré pour mesurer les variations de pression inférieures à 1 g/cm^2.

8. Ceinture de sécurité selon la revendication 6, dans laquelle la couche de textile piézorésistive (3) a une concentration de matériau conducteur de 34 g/m^2.

9. Ceinture de sécurité selon la revendication 6, dans laquelle le système de détection des battements de coeur et/ou de la respiration est configuré pour réaliser au moins 40 mesures par minute.

10. Ceinture de sécurité selon la revendication 6, dans laquelle la source de tension principale du système est de 12 V.

11. Revêtement pour un objet ayant des formes tridimensionnelles et déformable pendant l'utilisation, comprenant un système de détection des battements de coeur et/ou de la respiration qui comprend une pluralité de capteurs piézorésistifs textiles fournis sous la forme d'une gamme de capteurs, la gamme de capteurs piézorésistifs comprenant une couche de textile inférieure (1), sur laquelle est déposée une encre ou pâte conductrice de sorte qu'un nombre de premières bandes conductrices (2) sont définies, lesdites premières bandes conductrices (2) étant reliées à une couche de textile piézorésistive (3), la couche de textile piézorésistive (3) étant également reliée à une deuxième bande conductrice (4), la deuxième bande conductrice (4) étant une encre et/ou pâte conductrice déposée sur une couche de textile supérieure (5), les capteurs ayant une grande sensibilité dans une zone de basse pression, le système de détection des battements de coeur et/ou de la respiration comprenant en outre au moins un convertisseur analogique-numérique et un circuit amplificateur de signal, les bandes conductrices (2, 4) étant connectées au convertisseur analogique-numérique ou circuit amplificateur de signal, des moyens pour détecter que des paramètres de la fréquence cardiaque ou respiratoire sont modifiés selon un schéma de somnolence, et des moyens audio ou visuels configurés pour envoyer un signal à l'utilisateur lorsqu'une somnolence a été détectée.

12. Revêtement selon la revendication 11, dans lequel le système de détection des battements de coeur et/ou de la respiration est configuré pour mesurer les variations de pression inférieures à 1 g/cm^2.

13. Revêtement selon la revendication 11, dans lequel la couche de textile piézorésistive (3) a une concentration de matériau conducteur de 34 g/m^2.

14. Revêtement selon la revendication 11, dans lequel le système de détection des battements de coeur et/ou de la respiration est configuré pour réaliser au moins 40 mesures par minute.

15. Revêtement selon la revendication 11, dans lequel la source de tension principale du système est de 12 V.

Figure 1

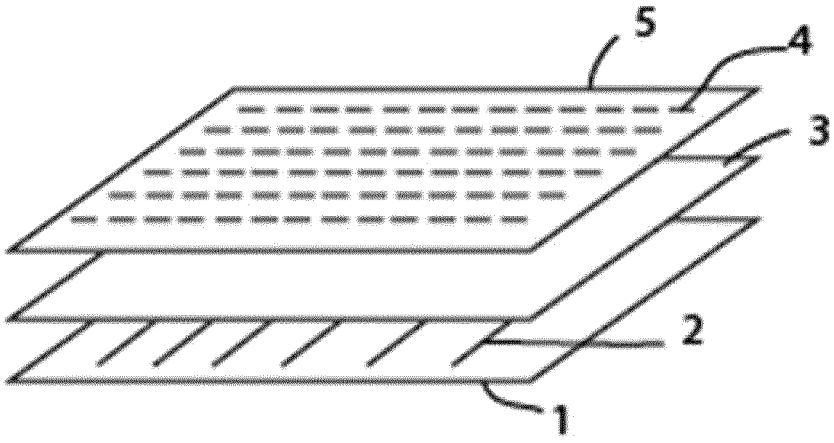
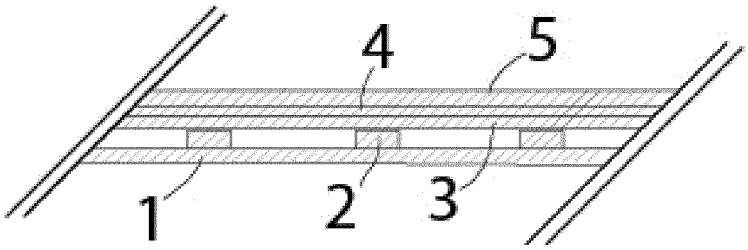


Figure 2



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 7689271 B1 **[0005]**
- US 20060255903 A1 **[0006]**

专利名称(译)	压阻式纺织品传感器和用于检测心脏和/或呼吸率的系统		
公开(公告)号	EP3047794B1	公开(公告)日	2017-06-28
申请号	EP2014780531	申请日	2014-09-16
[标]申请(专利权)人(译)	传感TEX		
申请(专利权)人(译)	传感TEX，S.L.		
当前申请(专利权)人(译)	传感TEX，S.L.		
[标]发明人	RIDAO GRANADO MIGUEL GOMEZ ANTA LUIS MIGUEL		
发明人	RIDAO GRANADO, MIGUEL GOMEZ ANTA, LUIS MIGUEL		
IPC分类号	A61B5/00 A61B5/0205 G01L1/20 A61B5/024 A61B5/08 B32B5/26 B60N2/44 B60N2/90		
CPC分类号	A61B5/0205 A61B5/02444 A61B5/0816 A61B5/6804 G01L1/205 B32B5/26 B32B2307/20 B32B2307/202 B32B2307/4026 B32B2535/00 B60N2/90 A61B5/02 A61B5/024 A61B5/08 A61B5/6893 A61B2562/0247 A61B2562/166		
优先权	2013031341 2013-09-16 ES		
其他公开文献	EP3047794A1		
外部链接	Espacenet		

摘要(译)

用于检测心跳和呼吸速率的纺织压阻传感器，其包括下织物层，在其上沉积导体墨水或糊剂，使得限定第一导体条带，同时将所述下部织物层附接到第二压阻织物层上，第二导体条放置在其上，最终放置上部织物层，其可以接收沉积的墨水和/或导体浆料，所述纺织品压阻式传感器存在于用于检测心跳和呼吸速率的系统中。

Figure 1

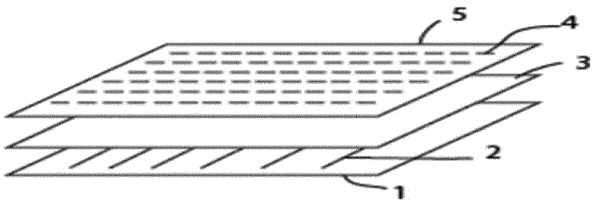

Figure 2