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- (71) Applicant (for all designated States except US): **KONINKLIJKE PHILIPS ELECTRONICS N.V.** [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).
- (71) Applicant (for DE only): **PHILIPS INTELLECTUAL PROPERTY & STANDARDS GMBH** [DE/DE]; Stein-damm 94, 20099 Hamburg (DE).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **SCHMEINK, Anke** [DE/DE]; Templergraben 55, 52056 Aachen (DE). **PIN-TER, Robert** [AT/DE]; Weisshausstr. 2, 52066 Aachen (DE).

- (74) Common Representative: **KONINKLIJKE PHILIPS ELECTRONICS N.V.**; c/o Hema Sridhar, Philips Intellectual Property & Standards Philips Electronics India Ltd., Manyata Tech Park, Nagavara, Bangalore 560045 (IN).
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(54) Title: SYSTEM FOR INDUCING A SUBJECT TO FALL ASLEEP

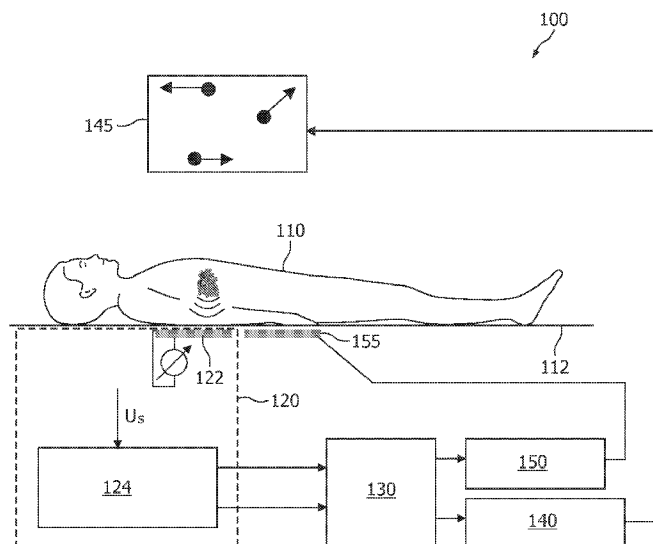


FIG. 1

(57) Abstract: A system (100) for inducing a subject (110) to fall asleep comprises a monitor (120) for monitoring heart rate and breathing rate of the subject (110), a coherence assessing device (130) coupled to the monitor (120) for assessing a degree of coherence between the heart rate and the breathing rate, and an output device (140, 150) coupled to the coherence assessing device (130). The output device (140, 150) may comprise a light pattern generator (140) for generating a light pattern (145) in view of the subject (110) based on the degree of coherence. The output device (140, 150) may alternatively or additionally comprise an instructing system (150) for instructing the subject on a breathing pattern, and wherein the instructions are given based on the degree of coherence.

WO 2009/133517 A1

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System for inducing a subject to fall asleep

## FIELD OF THE INVENTION

The invention relates to a system for inducing a subject to fall asleep, in particular a subject woken up from sleep.

## 5 BACKGROUND OF THE INVENTION

The International Classification of Sleep Disorders distinguishes more than 80 different disorders, which can be effectively treated. Problems with falling asleep or daytime sleepiness affect approximately 35 to 40% of the U.S. adult population annually and are a significant cause of morbidity and mortality. A disturbed sleep diminishes the recreation it provides to the sleeper. If bad sleep quality prevails over extended periods of time, it can lead to a bad general health condition, limited energy and stress resistance. Difficulties in falling asleep affect 6% – 9% of the general population. However, especially in elderly patients the prevalence is much higher. A study investigating people aged 66 – 97 found difficulties initiating sleep in 26.7% of the male test subjects and in 44.1% of the female test subjects.

15 People with problems staying asleep report that they can fall asleep fairly well, but wake up a couple of hours later and cannot get back to sleep. Reasons can be manifold. If somebody wakes up and his thoughts keep spinning around his worries, what he experienced throughout the day and his plans for the next day etc., he will have difficulties to clear his mind and relax sufficiently in order to fall asleep again.

20 WO2007105127 A1 discloses a system for inducing a subject to fall to sleep, comprising a light pattern generator for generating a time varying light pattern in view of the subject. Further, the system comprises a breathing rate measuring unit for measuring a breathing frequency of the subject. In addition, the system comprises a control unit connected to the breathing rate measuring unit and the light pattern generator, for controlling the light pattern generator, such that the generated light pattern has a pattern frequency substantially between the measured breathing frequency and a pre-selected desired frequency. However, such a system may not induce sleep in the subject satisfactorily.

## SUMMARY OF THE INVENTION

It is therefore an object of the invention to provide an improved system for inducing a subject to fall asleep.

According to a first aspect of the invention, a system for inducing a subject to fall asleep comprises a monitor for monitoring heart rate and breathing rate of the subject, a coherence assessing device coupled to the monitor, for assessing a degree of coherence between the heart rate and the breathing rate; and an output device coupled to the coherence assessing device for generating an output based on the degree of coherence to induce the subject to sleep.

In the process of inducing sleep according to the present invention, the heart rate as well as the breathing rate is monitored. Monitoring a single physiological parameter is not enough to deduce whether the subject is relaxed or stressed. Heart rate variability (HRV) refers to the beat-to-beat alterations in the heart rate. Under resting conditions, the heart rate of healthy individuals exhibits a periodic variation. This rhythmic phenomenon, known as respiratory sinus arrhythmia (RSA), fluctuates with the phase of respiration: cardio-acceleration during inspiration and cardio-deceleration during expiration. This way the heart rate tends to synchronize with the person's breathing activity. Therefore it is possible to derive the breathing frequency from the variations of the heart rate while the subject is relaxed. The heart rate and the breathing rate synchronize if a subject is in a positive or relaxed mood (high coherence) and de-synchronize if the subject is in a negative or stressed mood (low coherence). In the positive mood, the variation of the heart rate occurs in a sine wave manner.

According to an embodiment of the invention, the monitor comprises a sensor arranged to be unobtrusively situated under the chest of the subject, wherein the sensor is adapted for sensing signals generated by a mechanical impact and a deformation of the chest wherein the mechanical impact is created by a heartbeat and the deformation of the chest is due to breathing; and a processing unit configured for receiving the signals from the sensor and extracting the heart rate and the breathing rate of the subject.

Many people do not feel comfortable wearing electronic sensors while lying in the bed. A sensor unobtrusively situated in the bed according to the invention will not cause any inconvenience to the subject. In order to induce sleep to the subject, there is no special device introduced into a bedroom. Installing unusual or unfamiliar devices in the bedroom can induce anxieties in some persons, preventing them from sleeping. The approach of this invention is based on an insight, that the problem to promote sleep in a home setting calls for

an absolutely unobtrusive and comfortable solution, because introducing intrusive technology into the bedroom – one of the most private spaces of a person – is strictly rejected by customers. This system with unobtrusive sensor further ensures that a sleeping partner of the subject is not disturbed.

5                   According to a preferred embodiment, the sensor is a ferroelectret foil. In order to measure the heart rate and the breathing rate unobtrusively, a ferroelectret foil is put under the chest of the subject, preferably placed under his bed sheet. The foil generates an electric voltage if exposed to a mechanical pressure. When the mechanical pressure is applied to the ferroelectret foil, surface charges are displaced, thereby creating an electric voltage.  
10                  The ferroelectret foil picks up the mechanical impact created by every heartbeat, as well as the chest deformation due to respiration. The respiratory action results in a low-frequency signal on which the heartbeats are superimposed as small peaks. The processing unit coupled to the sensor extracts the heart rate and the breathing rate from these signals for calculating the degree of coherence between them.

15                   According to an embodiment of the invention, the output device comprises a light pattern generator connected to the coherence assessing device for generating a light pattern in view of the subject based on the degree of coherence, wherein the light pattern is capable of inducing sleep to the subject. Based on the degree of coherence the light pattern generator generates a light pattern which is visible to the subject and promotes relaxation to  
20                  the subject and puts him to sleep.

                    In a preferred embodiment according to the invention, the light pattern comprises a sequence with objects having different optical properties such as shapes, colors, positions, light intensities and different velocities in different directions, so that light patterns having different optical images and different velocities can be observed by the subject in  
25                  order to fall asleep.

                    According to another embodiment of the invention, the light pattern objects become brighter, larger and move faster at a lower degree of coherence, wherein the light pattern objects become lighter, smaller and move slower at a higher degree of coherence. After determining the degree of coherence, brightness and color of the light pattern objects  
30                  can be modified depending on the degree of coherence between the heart rate and the breathing rate. At the high degree of coherence, which indicates the highly relaxed state, lighting will be dimmed down and the colors of the light pattern objects are modified towards warmer tones. On the other hand light pattern objects will be brighter, larger and move faster

at low degree of coherence which distract wandering thoughts of the subject and try to relax him.

In a preferred embodiment according to the invention, the output device comprises an instructing system for instructing the subject on a breathing pattern, and  
5 wherein the instructions are given based on the degree of coherence. The breathing instructions may be given to the subject either by sound or by a mechanical stimulation. If the breathing instructions are given with the help of a loudspeaker or headphones, different tones are used for the inhale and exhale command. One complete breathing cycle would be represented by a first tone for inhalation followed by a second tone for exhalation and a pause  
10 between the first and second tones. By prolonging inhalation and exhalation phases of the breathing cycles, the frequency of the cycles will automatically go down at higher degrees of coherence. This way, a positive feedback is created. If the subject relaxes, his degree of coherence will go up, which leads to a lower frequency of the instructed breathing cycles, and this promotes further relaxation. Additionally, the volume of the signals is decreased, in  
15 order to promote sleep.

In order to achieve a maximum of unobtrusiveness, the breathing instructions are delivered with the help of a mechanical actor integrated in the bed, for example into the bed sheet. According to a preferred embodiment of the invention, the breathing instructions are generated by a mechanical actor comprising a ferroelectret foil or a piezo foil. If an  
20 electric voltage is applied to the actor, a mechanical deformation of the actor occurs and the breathing instructions are given to the subject through a mechanical stimulation. The frequency of the breathing instructions is adapted such that it becomes lower at a higher degree of coherence. Additionally at high degrees of coherence, the amplitude of the mechanical stimuli i.e., the amplitude of the mechanical vibration is faded away slowly by  
25 reducing the amplitude of the voltage applied to the actor. The actor may be located under the back of the subject. An advantage of using a ferroelectret foil as the actor for giving breathing instructions is that it can be made thin and flexible and can be integrated into a bed sheet.

According to another aspect of the invention, a method for inducing sleep in a  
30 subject comprises the steps of measuring heart rate and breathing rate of the subject; assessing a degree of coherence between the heart rate and the breathing rate; generating an output in view of the subject based on the degree of coherence; and repeating the abovementioned steps at a plurality of time intervals.

According to preferred embodiments of the invention, the output comprises a light pattern and/or breathing instructions based on the degree of coherence.

According to a further aspect of the invention, the abovementioned system is integrated into a natural installation found in a bedroom, for example an alarm clock. A seamless integration of the system into the bedroom environment is of paramount importance to make the subject feel comfortable. Integrating the system in a projection alarm clock is unobtrusive and the subject does not need an extra visible device in his bedroom. Using the projector of the alarm clock, the light patterns are projected on a wall or a ceiling and are unobtrusive to the sleeping partner.

10

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 illustrates an embodiment of a system for inducing a subject to fall asleep according to the invention;

Fig. 2 illustrates a degree of coherence of heart rate and breathing rate of a subject in different moods;

15

Fig. 3a illustrates an example reading of a signal  $U_s$  generated by a ferroelectret foil situated under the bed sheet of a subject;

Fig. 3b illustrates a respiratory component obtained from a ferroelectret foil signal by a low-pass filtering;

20

Fig. 4 illustrates a heart beat component obtained from a ferroelectret foil signal with help of a correlation technique;

Fig. 5a and Fig. 5b illustrate a calculation of degree of coherence between the heart rate and breathing rate;

Fig. 6 illustrates a strategy for adapting velocity, color and brightness of the projected light pattern, depending on the degree of coherence;

25

Fig. 7 illustrates a macrostructure of a relaxation exercise: slowly decreasing the frequency of breathing cycles and prolonging the cycle duration;

Fig. 8a illustrates a simple binary stimulation with inhalation time and exhalation time as parameters; absence of stimulus during exhalation;

30

Fig. 8b illustrates an advanced stimulation with gradually varying stimulus intensity; absence of stimulus during exhalation;

Fig. 8c illustrates an advanced asymmetric stimulation with gradually varying stimulus intensity; increasing intensity during inhalation, decreasing intensity during exhalation, allowing the introduction of breathing pauses with no stimulation;

Fig. 8d illustrates a most advanced asymmetric stimulation with gradually varying stimulus intensity and varying stimulus frequency, the additional frequency coding allowing the user to better recognize the turning point from inhalation to exhalation;

5 Fig. 9 illustrates a strategy for adapting the length of inhalation and exhalation phases, the frequency of the instructed breathing cycles, the amplitude of the mechanical stimulation / vibration signals, and the volume of the acoustic signals, depending on the degree of coherence; and

Fig. 10 illustrates an article including the system of Fig. 1.

## 10 Detailed description of embodiments of the invention

The present invention will be described with respect to particular embodiments and with reference to certain drawings but the invention is not limited thereto. The drawings described are only schematic and are non-limiting. In the drawings, the size of some of the elements may be exaggerated and not drawn on scale for illustrative purposes.

15 Where the term “comprising” is used in the present description and claims, it does not exclude other elements or steps. Where an indefinite or definite article is used when referring to a singular noun e.g. "a" or "an", "the", this includes a plural of that noun unless something else is specifically stated.

20 Furthermore, the terms first, second, third and the like in the description and in the claims, are used for distinguishing between similar elements and not necessarily for describing a sequential or chronological order. It is to be understood that the terms so used are interchangeable under appropriate circumstances and that the embodiments of the invention described herein are capable of operation in other sequences than described or illustrated herein.

25 Moreover, the terms top, bottom, over, under and the like in the description and the claims are used for descriptive purposes and not necessarily for describing relative positions. It is to be understood that the terms so used are interchangeable under appropriate circumstances and that the embodiments of the invention described herein are capable of operation in other orientations than described or illustrated herein.

30 The figures are merely schematic views of preferred embodiments according to the invention. In the figures, the same reference numbers refer to equal or corresponding parts.

Fig. 1 illustrates an embodiment of a system 100 for inducing a subject 110 to fall asleep. The system 100 comprises a monitor 120 for monitoring heart rate and breathing

rate of the subject 110. The monitor comprises a sensor 122 and a processing unit 124. The sensor 122 is unobtrusively situated under the chest of the subject 110 under his bed sheet 112. The sensor 122 is a ferroelectret foil or a piezo foil. Further, the system 100 comprises a device 130 for assessing a degree of coherence between the heart rate and the breathing rate. A light pattern generator 140 is connected to the device 130. It generates a light pattern 145 in view of the subject 110. The system 100 also comprises an instructing system 150 for instructing the subject how to breathe by generating breathing instructions to the subject 110 through an actor 155 placed under the bed sheet 112.

Fig. 1 depicts an unobtrusive vital parameter measurement used for inducing sleep to the subject 110 by manipulating direction, brightness, color and velocity of projected light pattern 145 and/or through breathing instructions given by the actor 155. The light pattern generator 140 comprises means for projecting a light pattern on a surface, such as a screen, wall and/or a ceiling which is in view of the subject 110, so that the subject 110 can observe the light pattern that is generated. In order to measure the heart rate and the breathing rate unobtrusively, the ferroelectret foil 122 is put under the bed sheet 112. The ferroelectret foil 122 generates an electric voltage if exposed to mechanical pressure. It picks up the mechanical impact created by every heartbeat, as well as the chest deformation due to respiration. It was found that the respiratory action results in a low-frequency signal on which the heartbeats are superimposed as small peaks.

#### Monitoring heart rate and breathing rate:

Heart rate variability (HRV) refers to the beat-to-beat alterations in heart rate. Under resting conditions, the heart rate of healthy individuals exhibits a periodic variation. This rhythmic phenomenon, known as respiratory sinus arrhythmia (RSA), fluctuates with the phase of respiration: cardio-acceleration during inspiration and cardio-deceleration during expiration. This way the heart rate tends to synchronize with the person's breathing activity under resting conditions. Therefore it is possible to derive the breathing frequency from the variations of the heart rate.

Fig. 2 shows synchronization of the heart rate and the breathing rate when the subject is in a positive or relaxed mood (high coherence), compared to the de-synchronization found when the subject is in a negative or stressed mood (low coherence). In the positive mood, the variation of the heart rate occurs in a sine wave manner.

The voltage generated by the ferroelectret foil 122 is the superposition of a component representing the low-frequency respiratory action and another component

representing the heartbeat-induced impulses. Fig. 3a illustrates an example signal  $U_s$  as measured by the ferroelectret foil 122 situated underneath the bed sheet 112. In the unprocessed signal shown in Fig. 3a, the two signal components are discernible. The low-frequency respiratory component can be easily extracted by low-pass filtering of the signal, because the respiratory frequency is significantly lower than the heart rate. The result is shown in Fig. 3b. The signal component related to the heartbeats can be extracted from the signal delivered by the ferroelectret foil 122 with the help of a correlation technique by the processing unit 124. Fig. 4 shows an unprocessed foil signal in the upper trace whereas the lower trace is the result of calculating an auto-correlation function of the signal in the time domain. The heartbeat-induced peaks visible in the unprocessed signal are clearly marked by the maxima in the auto-correlation function.

#### Calculation of the degree of coherence:

After the heart rate component is separated from the breathing rate component, the degree of coherence between the two components is determined, as shown in Fig. 5a and Fig. 5b. A segment of  $N$  samples is taken from both components, and the following calculation is applied:

$$coherence = \sum_{i=0}^{N-1} respiration(i) \cdot heartrate(i)$$

If the maxima in the respiratory signal coincide with the maxima in the heart rate signal, as it is shown in Fig. 5a, the calculated degree of coherence is high, because positive values from one segment are multiplied with positive values from the other segment, and negative values from one segment are multiplied with negative values from the other segment. So in this case, all elements contributing to the sum calculation are positive. If maxima in one segment coincide with minima in the other segment, the sum result is smaller in this case, because then positive values from the one segment are multiplied with negative values from the other segment, giving negative contributions to the sum calculation.

#### Generating light patterns:

After determining the degree of coherence, it is translated into spectrum, velocity and brightness of the light pattern as shown in Fig. 6. Lighting will be dimmed down and the light colors are modified towards warmer tones improving thereby a person's relaxation status. Similarly, the velocity of the moving objects of the light pattern is reduced

as the degree of coherence between the heart rate and the breathing rate becomes high. This positive feedback results in a highly effective procedure of getting back to sleep.

Generating breathing instructions:

5 In general, all breathing techniques, targeting at an increased level of relaxation, prescribe a deep and slow breath. For the macrostructure of the breathing pattern, it is therefore proposed to slowly decrease the frequency of the breathing cycles over time during any relaxation exercise, as shown in Fig. 7, and to prolong the duration of the cycles.

10 With the help of the ferroelectret foil 155 instructions shall be given to the subject 110 as to how he or she should breathe. This means that the instructions come as a mechanical stimulation. For the microstructure of this stimulation during each breathing cycle, various patterns are conceivable, which are outlined in Figs. 8a to 8d. All the patterns described in these figures and any combinations thereof are conceivable for the stimulation. However, the stimulation pattern presented in Fig. 8d is the preferred one in the context of  
15 this invention.

The pattern shown in Fig. 8d allows the use of pauses between the breathing cycles. It furthermore allows the subject 110 to easily identify where in the breathing cycle he currently is, because that is doubly coded. Firstly, it is given by the varying amplitude of the stimuli. Secondly, the stimuli are not delivered continuously, but as bursts or impulses, as  
20 shown in Fig. 8d, and the repetition frequency of the bursts or impulses also varies.

If the breathing instructions are given with the help of the actor 155 by means of a mechanical stimulation, the frequency of the breathing instructions becomes lower at higher degrees of coherence as shown in Fig. 9. Additionally, the amplitude of the stimuli that are used is also faded away, i.e. the amplitude of the mechanical vibration is reduced by  
25 reducing the amplitude of the voltage applied to the foil actor 155. The actor 155 is a ferroelectret foil or a piezo foil. If a mechanical force is applied to the foil, surface charges are displaced, thereby creating an electric voltage. Reversely, if an electric voltage is applied to the foil, a mechanical deformation of the foil results. In other words, the ferroelectret foil acts as both a sensor 122 and an actor 155. An electric voltage is applied to the ferroelectret  
30 foil 155 which is integrated into the bed sheet 112, in order to give the breathing instructions through the vibration. The characteristic of this vibration is determined by the nature of the voltage which is applied.

If the breathing instructions are given with the help of a loudspeaker or headphones (not shown), different tones for the inhale and exhale command are used. One

complete breathing cycle would be represented by the first tone for inhalation, followed by the second tone for exhalation and a pause between them. By prolonging inhalation and exhalation phases of the prescribed breathing cycles, the frequency of the cycles will automatically go down at higher degrees of coherence. This way, a positive feedback is created. When the subject relaxes, his degree of coherence will go up, which leads to a lower frequency of the instructed breathing cycles, and this promotes further relaxation. Additionally, the volume of the signals is decreased in order to promote falling asleep as shown in Fig. 9

The system of Fig. 1 may be integrated into an article such as an alarm clock, e.g. Philips AJ3600 Projection Radio Alarm Clock as depicted in Fig. 10. The light pattern generator of the system comprises means for projecting a light pattern on a surface, such as a screen, wall and/or a ceiling which is in view of the subject 110, so that the subject 110 can observe the light pattern that is generated. The moving patterns calm down the woken up person and keep his mind from spinning around worries.

It should be noted that the abovementioned strategies are given as examples. Whilst specific embodiments of the invention have been described above, it will be appreciated that the invention may be practiced otherwise than as described. . A single suitably programmed processor or other unit may fulfill the functions of several items recited in the claims. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. Any reference signs in the claims shall not be construed as limiting the scope.

## CLAIMS:

1. A system (100) for inducing a subject (110) to fall asleep, comprising:  
a monitor (120) for monitoring heart rate and breathing rate of the subject  
(110);  
a coherence assessing device (130) coupled to the monitor (120) for assessing  
5 a degree of coherence between the heart rate and the breathing rate; and  
an output device (140, 150) coupled to the coherence assessing device (130)  
for generating an output based on the degree of coherence to induce the subject to sleep.
2. A system as claimed in claim 1, wherein the output device (140, 150)  
10 comprises a light pattern generator (140) coupled to the coherence assessing device (130) for  
generating a light pattern (145) in view of the subject (110) based on the degree of coherence,  
wherein the light pattern (145) is capable of inducing sleep to the subject.
3. The system (100) of claim 1, wherein the monitor (120) comprises:  
15 a sensor (122) arranged to be unobtrusively situated under the chest of the  
subject (110), wherein the sensor (122) is adapted for sensing signals generated by a  
mechanical impact and a deformation of the chest wherein the mechanical impact is created  
by a heartbeat and the deformation of the chest is due to breathing; and  
a processing unit (124) configured for receiving the signals from the sensor  
20 and extracting the heart rate and the breathing rate of the subject (110).
4. The system (100) of claim 3, wherein the sensor (122) is a ferroelectret foil or  
a piezo foil.
- 25 5. The system (100) of claim 2, wherein the light pattern (145) comprises a  
sequence with objects having different shapes, colors, positions, velocities and light  
intensities.

6. The system (100) of claim 2, wherein the light pattern (145) objects become brighter, larger and move faster at a lower degree of coherence, whereas the light pattern (145) objects become lighter, smaller and move slower at a higher degree of coherence.

5 7. The system (100) of claim 1, wherein the output device (140, 150) comprises an instructing system (150) for instructing the subject (110) on a breathing pattern, and wherein the instructions are given based on the degree of coherence.

8. The system of claim 7, wherein the breathing instructions are generated by a  
10 mechanical actor (155) comprising a ferroelectret foil or a piezo foil.

9. A method for inducing sleep in a subject (110), comprising the steps of:  
i. measuring heart rate and breathing rate of the subject (110);  
ii. assessing a degree of coherence between the heart rate and the  
15 breathing rate;  
iii. generating an output based on the degree of coherence; and  
iv. repeating the steps i to iii at a plurality of time intervals.

10. A method for inducing sleep as claimed in claim 9, wherein the output is a  
20 light pattern (145) in view of the subject (110).

11. A method for inducing sleep as claimed in claim 9, wherein the output comprises breathing instructions based on the degree of coherence..

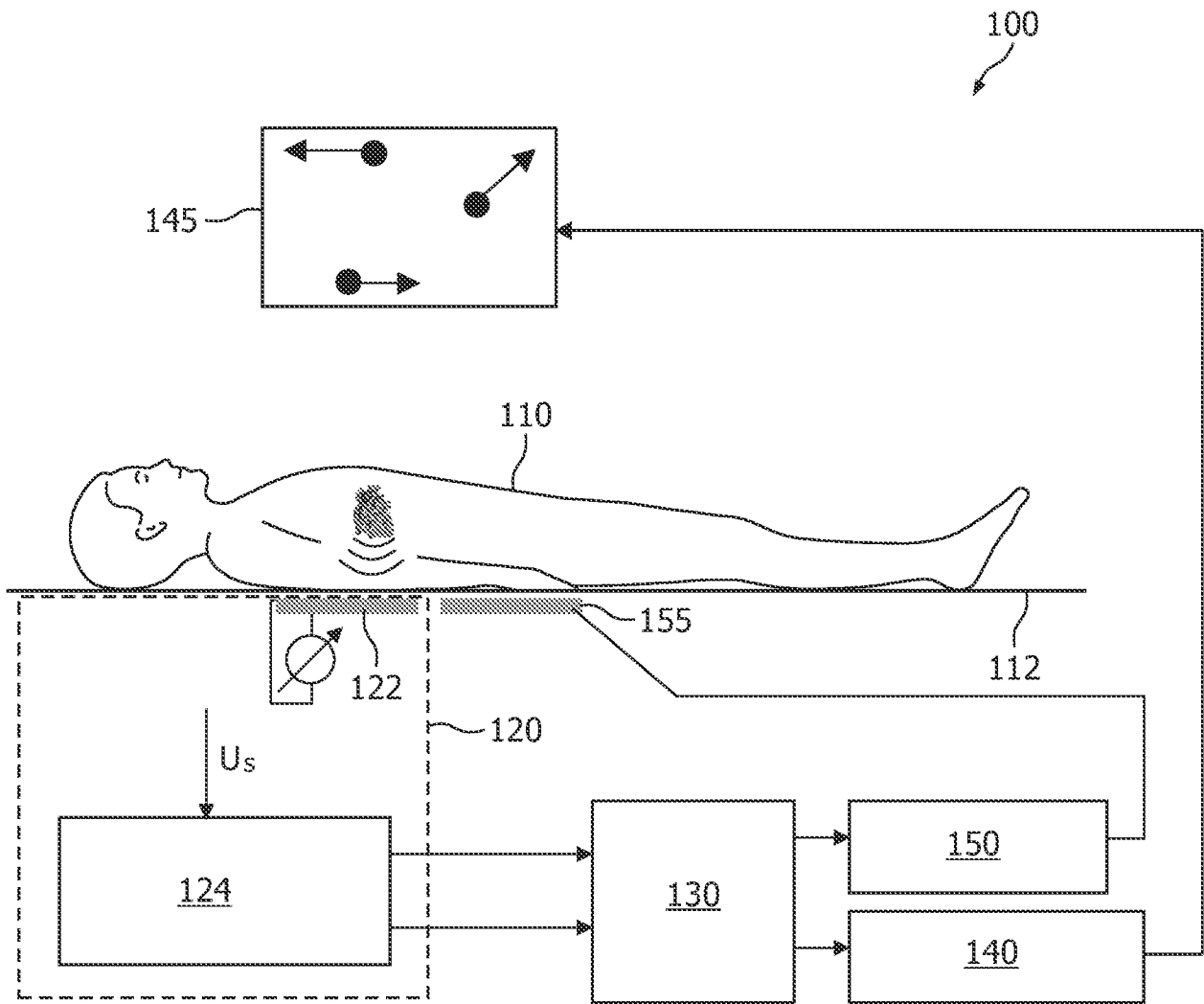


FIG. 1

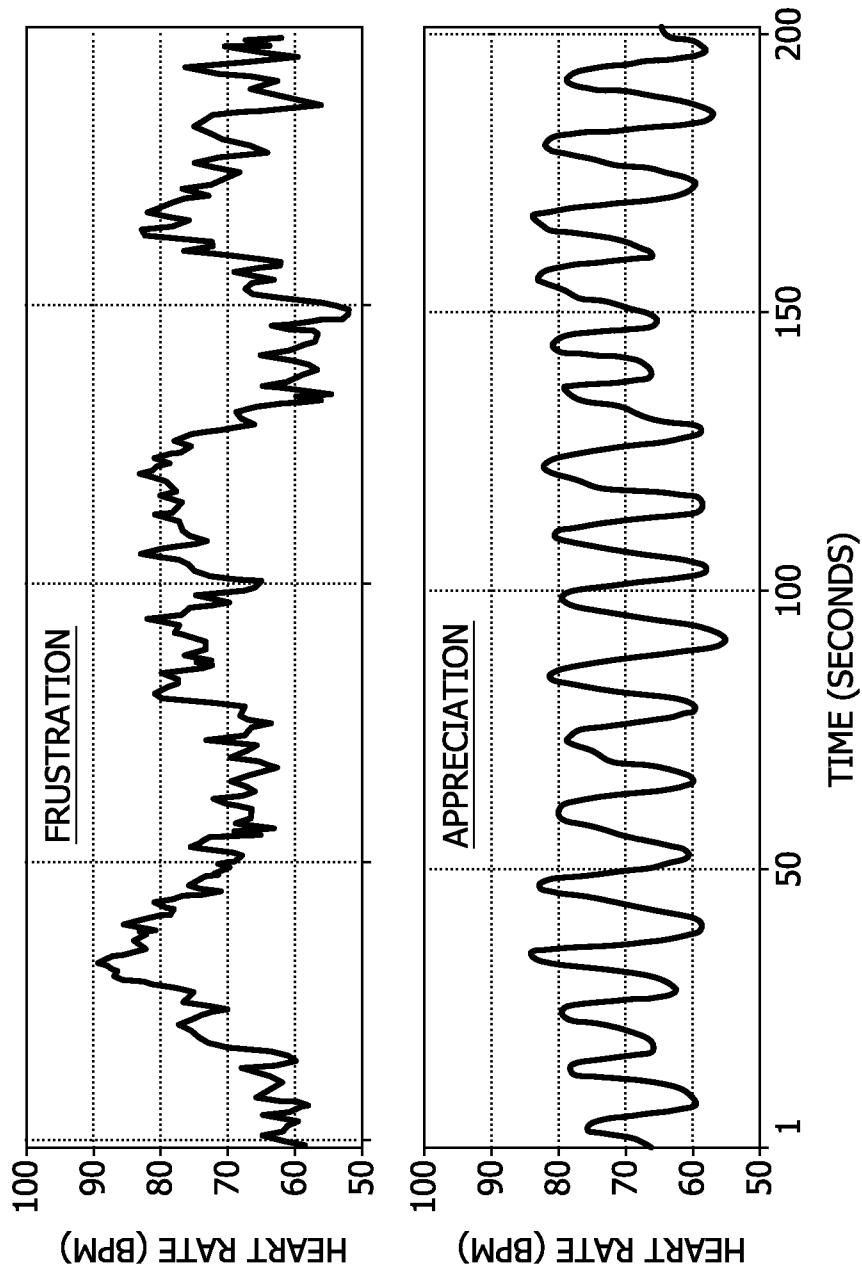


FIG. 2

3/9

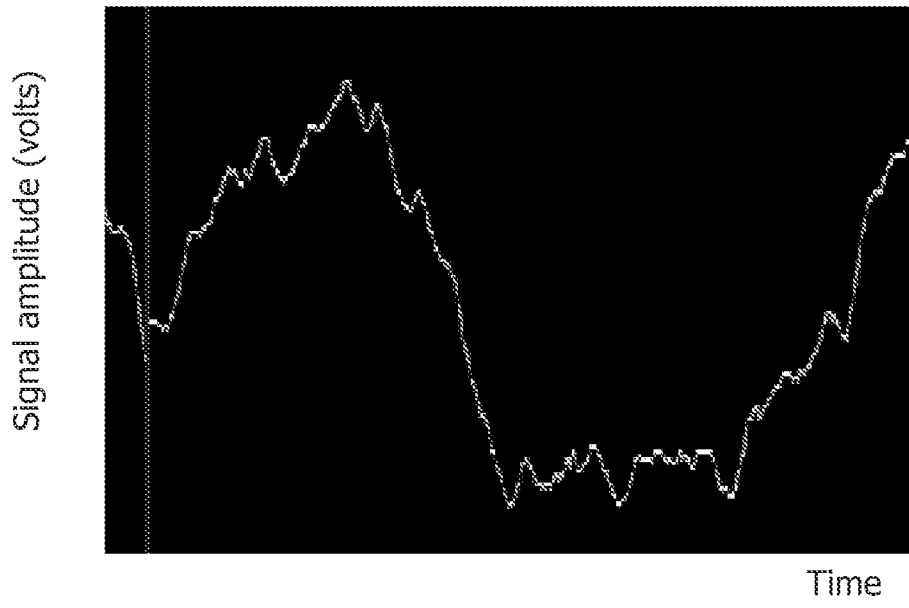


FIG. 3a

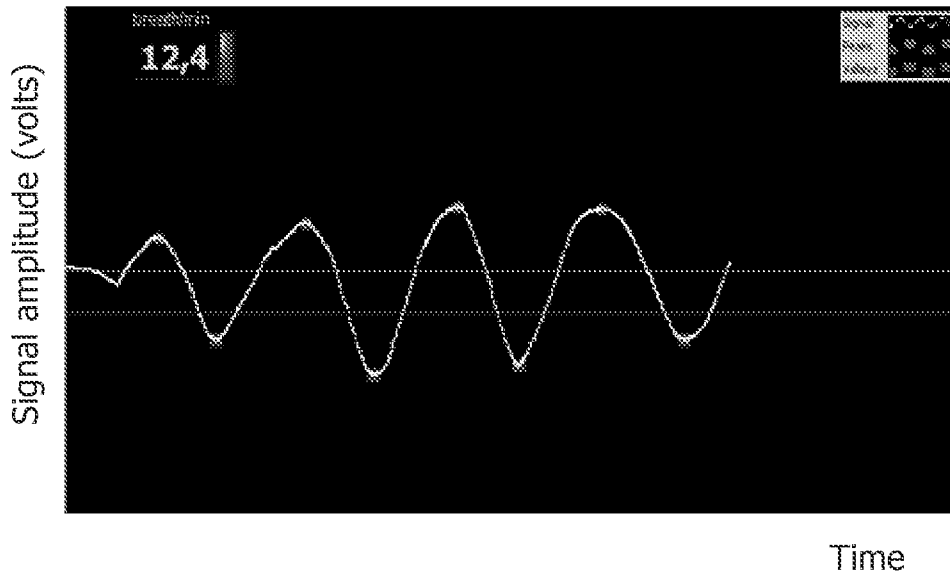


FIG. 3b

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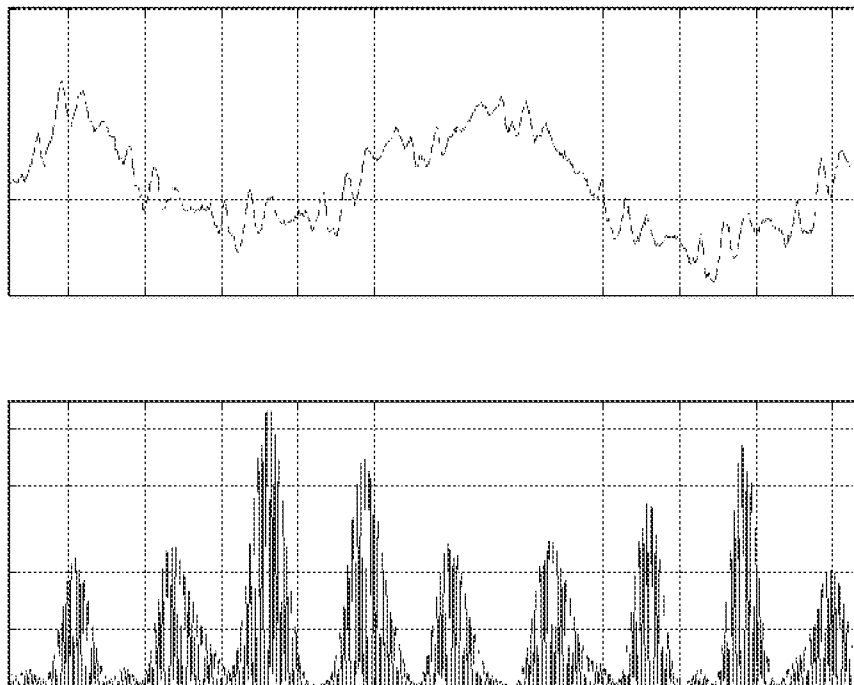


FIG. 4

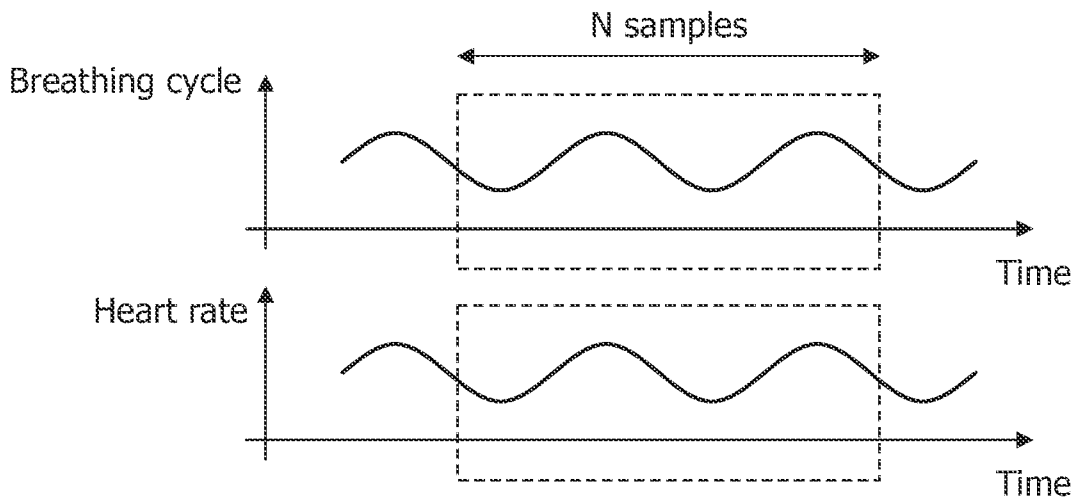


FIG. 5a

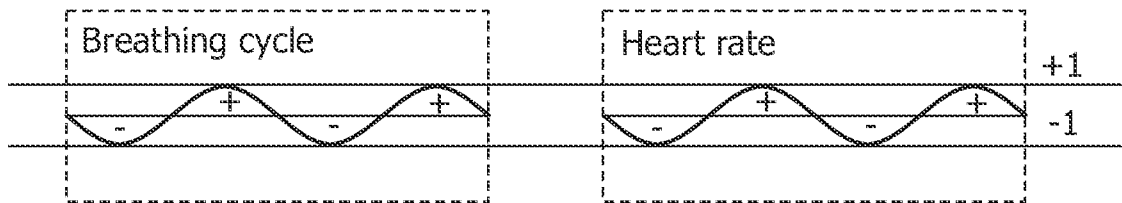


FIG. 5b

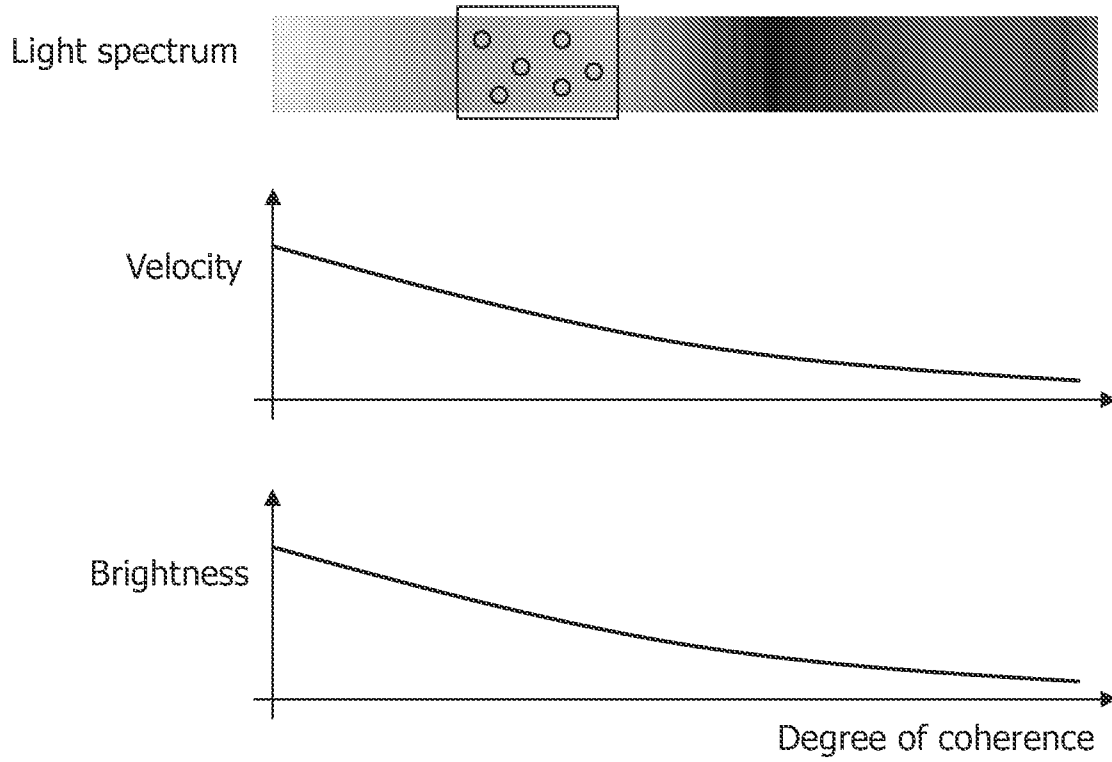


FIG. 6

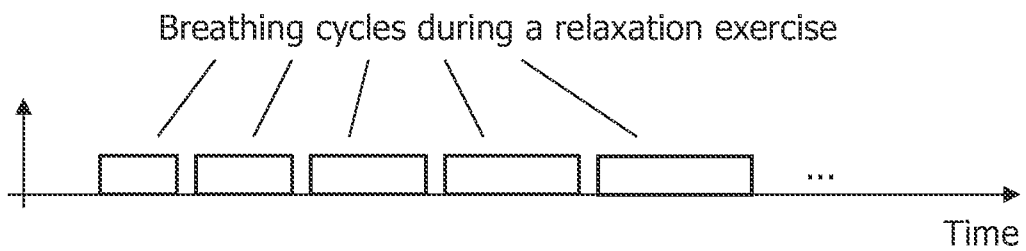


FIG. 7

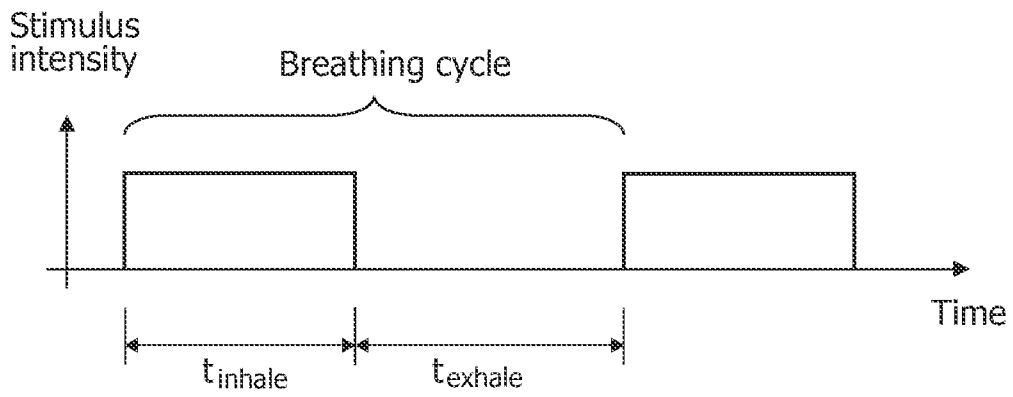


FIG. 8a

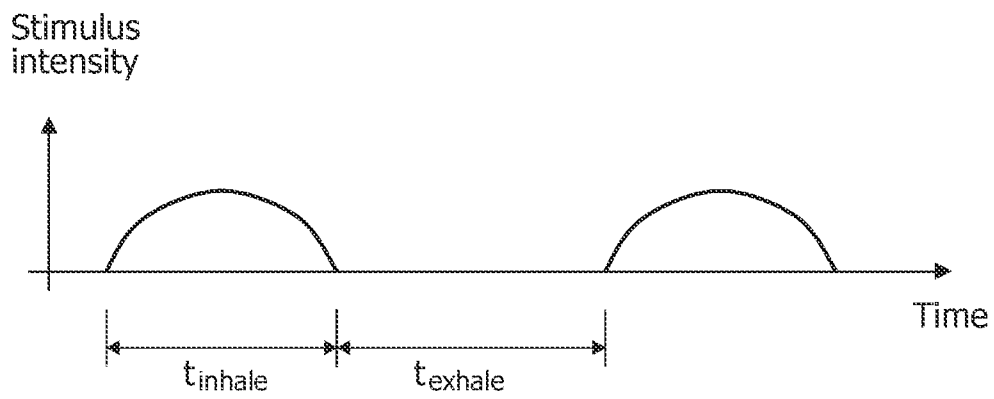


FIG. 8b

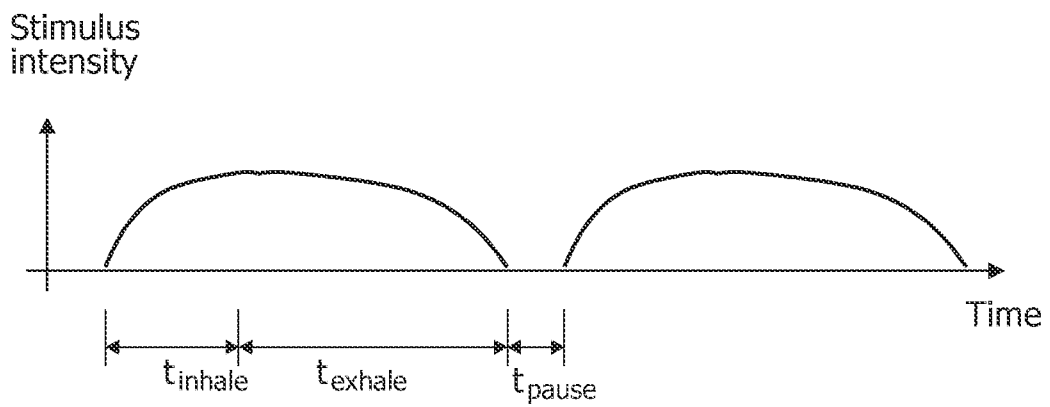


FIG. 8c

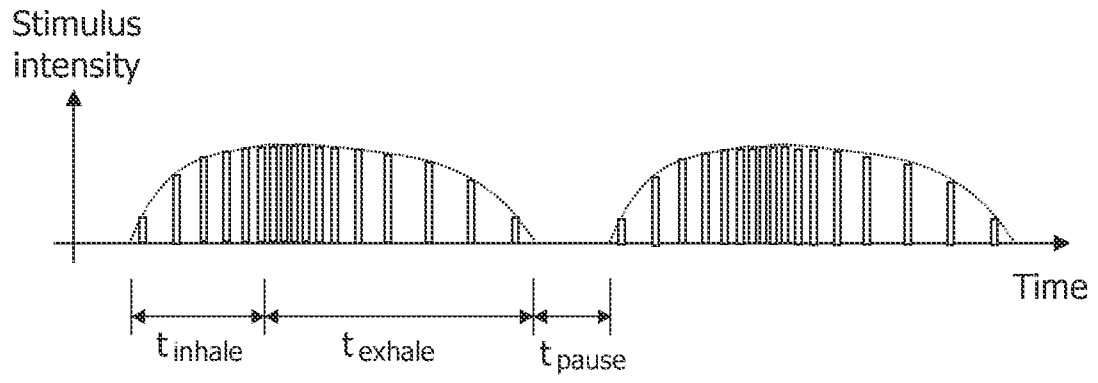


FIG. 8d

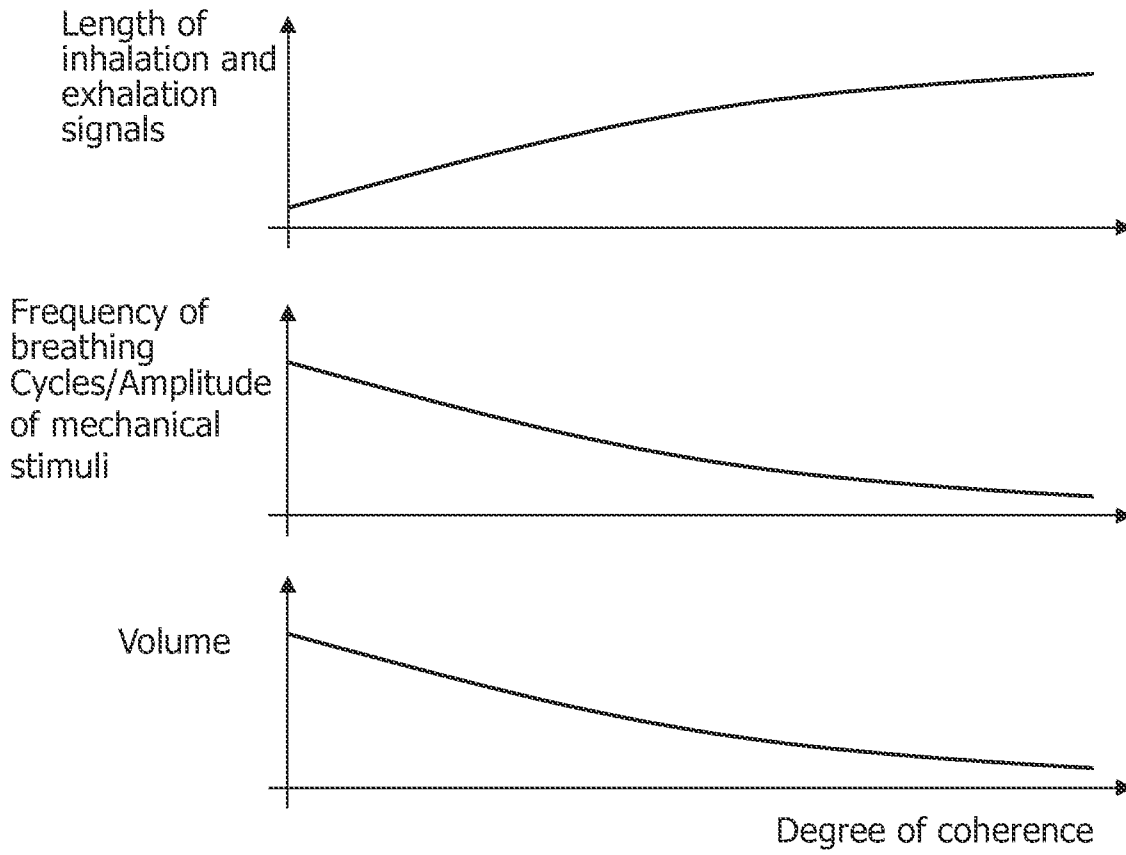


FIG. 9

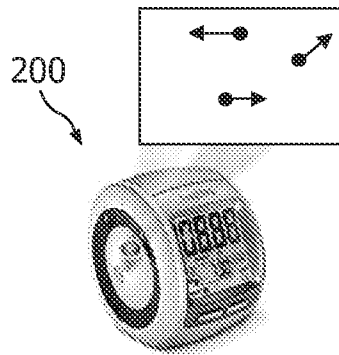


FIG. 10

## INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2009/051724

**A. CLASSIFICATION OF SUBJECT MATTER**  
 INV. A61M21/00 A61B5/00

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)  
 A61M 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.
X	US 2005/143617 A1 (AUPHAN RAPHAEL [FR]) 30 June 2005 (2005-06-30) abstract paragraph [0010] paragraph [0012] paragraph [0031] paragraph [0033] paragraph [0037] paragraph [0040] paragraph [0048] paragraph [0051] paragraph [0056] figures 1,2 figures 5,6 ----- -/--	1-8

 Further documents are listed in the continuation of Box C. 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

30 July 2009

Date of mailing of the international search report

04/09/2009

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2  
 NL - 2280 HV Rijswijk  
 Tel. (+31-70) 340-2040,  
 Fax: (+31-70) 340-3016

Authorized officer

Fuentes, Santiago

## INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2009/051724

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2007/105127 A (KONINKL PHILIPS ELECTRONICS NV [NL]; HAISMA NICOLINE [NL]; BLOEM GERRI) 20 September 2007 (2007-09-20) the whole document	1-8
A	----- WO 2005/055802 A (FIRST PRINCIPLES INC [US]; RANIERE KEITH A [US]) 23 June 2005 (2005-06-23) the whole document -----	1-8

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/IB2009/051724

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.: 9-11  
because they relate to subject matter not required to be searched by this Authority, namely:  
**Rule 39.1(iv) PCT - Method for treatment of the human or animal body by therapy**
2.  Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1.  As all required additional search fees were timely paid by the applicant, this international search report covers allsearchable claims.
2.  As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/IB2009/051724
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005143617 A1	30-06-2005	NONE	
WO 2007105127 A	20-09-2007	CN 101400399 A	01-04-2009
		EP 1996270 A1	03-12-2008
		US 2009062598 A1	05-03-2009
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		RU 2340365 C2	10-12-2008
		US 2006106275 A1	18-05-2006
		US 7041049 B1	09-05-2006

专利名称(译)	诱导受试者入睡的系统		
公开(公告)号	<a href="#">EP2285441A1</a>	公开(公告)日	2011-02-23
申请号	EP2009738530	申请日	2009-04-28
[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. 飞利浦知识产权及标准部GMBH		
当前申请(专利权)人(译)	皇家飞利浦电子N.V. 飞利浦知识产权及标准部GMBH		
[标]发明人	SCHMEINK ANKE PINTER ROBERT		
发明人	SCHMEINK, ANKE PINTER, ROBERT		
IPC分类号	A61M21/00 A61B5/00 A61M21/02 A61B5/024 A61B5/08		
CPC分类号	A61B5/024 A61B5/0816 A61B5/6892 A61B2562/0247 A61M21/02 A61M2021/0027 A61M2021/0044 A61M2021/0061 A61M2230/06 A61M2230/42		
代理机构(译)	kroeze antonius , 约翰		
优先权	2008103789 2008-04-30 EP		
其他公开文献	EP2285441B1		
外部链接	<a href="#">Espacenet</a>		

#### 摘要(译)

用于诱导受试者 ( 110 ) 入睡的系统 ( 100 ) 包括用于监测受试者 ( 110 ) 的心率和呼吸速率的监测器 ( 120 ) , 连接到监测器 ( 120 ) 的相干性评估装置 ( 130 ) 评估心率和呼吸速率之间的一致程度 , 以及耦合到相干性评估设备 ( 130 ) 的输出设备 ( 140,150 ) 。输出设备 ( 140,150 ) 可以包括光图案生成器 ( 140 ) , 用于基于相干程度在对象 ( 110 ) 的视图中生成光图案 ( 145 ) 。输出设备 ( 140,150 ) 可以替代地或附加地包括用于指示对象呼吸模式的指示系统 ( 150 ) , 并且其中基于相干程度给出指令。