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(54) **Title**: DEVICE FOR GENERATING AND PRODUCING SOUND AND/OR LIGHT

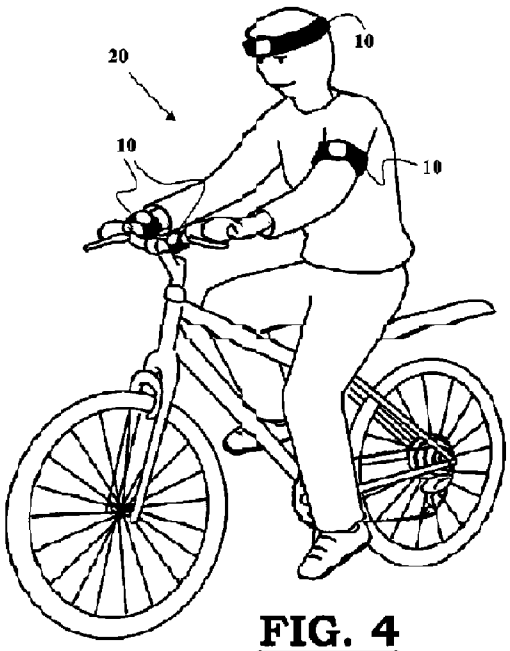

FIG. 4

(57) **Abstract**: The invention relates to a device for generating and producing sound and/or light, the sensor means (1) being a precircuit of the electronic circuit (4, 5) in such a way that the electronic circuit (4, 5) is started up when the sensor means (1) detect the aforementioned movement, the electronic circuit comprising a microcontroller (4) provided with a built-in switching function (4a, 4b) which is provided to be switched on by the voltage which is generated by the sensor means (1) and to be switched back off by the microcontroller (4) itself.

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DEVICE FOR GENERATING AND PRODUCING SOUND AND/OR LIGHT

Technical Field

The invention relates to a device for generating and producing sound and/or light, comprising

- means for producing the sound and/or the light;
- sensor means which are provided to generate a voltage as a consequence of a movement of at least one component of the device;
- a power supply for delivering power supply voltage to the electronic circuit; and
- an electronic circuit which is electrically connected to the sensor means, the means for producing the sound and/or the light, and the power supply, the electronic circuit being provided for generating the sound and/or the light.

Background Art

US 7,038,575 B1 describes a device for generating sound, comprising an article which is adapted to be worn on a user's hand, and an electronic assembly secured to the article. A structure is also provided for generating sound within this electronic assembly. Finally, the device comprises an actuator for providing the electronic assembly with power in order to be able to produce sound. In one of the embodiments, the electronic assembly is provided with a power source, a sensor, an electronic circuit for storing sound and driving sound generation, and a loudspeaker. The power source is electrically connected to the sensor and the loudspeaker in order to provide them with power. The sensor is electrically connected to the power source and the electronic circuit. The sensor detects whether the desired action has taken place, for example when two hands have been brought together in order to make a clapping sound. This can take place by a multiplicity of structures, for example a piezoelectric shock pulse sensor. Furthermore, the electronic circuit is electrically connected to the sensor and the loudspeaker. The electronic circuit has stored sounds and drives the stored sound pulses or sound sequences into the loudspeaker. Furthermore, the loudspeaker is electrically connected to, and driven by, the electronic circuit and electrically connected to the power source.

The drawback of this device is that the device is constantly live and thus constantly consumes energy.

Disclosure of the invention

The object of the invention is accordingly to provide a device for generating sound and/or light according to the preamble of the first claim, the device operating in a more energy-efficient manner.

This object of the invention is achieved by providing a device for generating and producing sound and/or light, comprising

- means for producing the sound and/or the light;
- sensor means which are provided to generate a voltage as a consequence of a movement of at least one component of the device;
- a power supply for delivering power supply voltage to the electronic circuit; and
- an electronic circuit which is electrically connected to the sensor means, the means for producing the sound and/or the light, and the power supply, the electronic circuit being provided for generating the sound and/or the light;

the sensor means being provided in such a way with respect to the electronic circuit that the sensor means are a precircuit of the electronic circuit in such a way that the electronic circuit is started up when the sensor means detect the aforementioned movement, as a result of which the aforementioned means for producing the sound and/or the light are activated, and the electronic circuit comprising a microcontroller (4) which is provided for generating the sound and/or the light and which is started up by the voltage which is generated by the sensor means (1) when the aforementioned movement is detected by these sensor means (1), this microcontroller (4) being provided with a built-in switching function (4a, 4b) which is provided

- to be switched on by the voltage which is generated by the sensor means (1) when the aforementioned movement is detected by these sensor means (1), as a result of which the microcontroller (4) is started up at that moment, and
- to be switched back off by the microcontroller (4) itself.

The advantage of this device is that the electronic circuit does not consume any power provided that the sensor has not generated any energy, thus providing an energy-efficient device.

This low energy consumption also allows use to be made of alternative energy sources such as solar energy.

The movement of at least one component of the device may in this case be for example a movement of the printed circuit board or other substrate on which the sensor means are mounted, as a result of which the sensor means detect this movement, and also a movement of the sensor itself, as a result of which the sensor detects the movement.

In a preferred embodiment of a device according to the invention, the sensor means consist of a piezoelectric shock sensor.

This piezoelectric shock sensor utilizes the piezoelectric effect, this being the phenomenon that crystals of specific materials produce an electric voltage under the influence of pressure, for example bending (deformation), and also the phenomenon according to which these crystals deform when an electric voltage is applied. When the printed circuit board or other substrate on which this piezoelectric shock sensor is mounted is moved, then the piezoelectric shock sensor will also move, as a result of which the piezoelectric shock sensor will be deformed and as a result generate a voltage. When the piezoelectric shock sensor itself moves, the piezoelectric shock sensor will deform and as a result generate a voltage.

All the characteristics of the sound and the light are programmed into the microcontroller. Examples of such characteristics of sound are the type of sound, how long the sound and which sound should be produced, and the like. The sound may be both a natural and a synthesized sound. Synthesized sound is preferred, since this can be reproduced more loudly and, in addition, requires less memory capacity.

Examples of characteristics of light are how long the LEDs should be activated, the frequency thereof and the like. If a plurality of differently coloured LEDs are

provided, examples of these characteristics are the sequence, the frequency, colour transition(s) of the light signal, and the like.

The last function of the program which is programmed into the microcontroller is preferably a shut-down function, wherein the production of the sound and/or the light stops automatically. If the sensor means experience a movement again, the sound and/or the light can be reactivated for a specific period of time.

In a particular embodiment of a device according to the invention, the sensor means comprise a conditioning circuit which is provided to activate the production of the sound and/or the light at the moment at which the duration of the aforementioned movement and the voltage which is generated by the sensor means as a consequence of this movement exceed a preset minimum value, and which is provided to forward in conditioned form the voltage which is generated by the sensor means to the microcontroller, as a result of which this microcontroller is started up.

If the device according to the invention is provided for generating light as a consequence of a movement of at least one component of the device, the means for producing light preferably consist of one or more LEDs.

If the device according to the invention is provided for generating sound as a consequence of movement of at least one component of the device, the aforementioned electronic circuit preferably comprises an amplifier which is provided for bidirectionally driving the means which are provided for producing the sound.

As a result of the provision of an amplifier of this type, the voltage is doubled over the aforementioned means, thus providing a double amplitude of the audio signal and thus a louder audio signal.

More particularly, the amplifier is provided with a built-in switching function which is provided to be switched on and off by the microcontroller.

The means for producing sound preferably consist of an audio transducer (= loudspeaker).

More preferably, the audio transducer is piezoelectrically embodied.

The advantage of the use of a piezoelectric transducer over a dynamic loudspeaker is that a piezoelectric transducer is more energy-efficient and, in addition, smaller and lighter.

This device according to the invention has various uses, a non-limiting list of which will be set out hereinafter.

On the one hand, it is possible to attach the device according to the invention in a reopenable or non-reopenable holder. This holder can be provided to be detachably or non-detachably secured to a bearing surface. An example of a detachable connection of this type is a Velcro, a snap connection, etc. This bearing surface is for example in the form of bicycle handlebars, a helmet of a cyclist, skater/skeelers, etc. This holder itself can also be incorporated somewhere. Thus, for example, this holder, into which a device according to the invention is incorporated, can be integrated into a flexible band which can be worn around a body part of a user such as a wrist, an upper arm, the head, a leg, an ankle, and the like. This band can for example also be applied around bicycle handlebars. Other examples are the incorporation of a holder of this type into a helmet or another housing which is wearable either on the body or not.

On the other hand, it is also possible to integrate the device itself, without the device being incorporated into a separate holder, into a housing such as a flexible band, a helmet, or other housing which is wearable either on the body or not.

The device according to the invention can be provided to produce solely sound or light, or else a combination of both.

The aforementioned holder or the aforementioned housing is preferably made of a material such that, irrespective of what part of this holder or housing is tapped, the sound and/or the light is produced.

An important use of a holder of this type or a housing of this type that the user may wear on his body resides in the field of vulnerable road users, the aforementioned holder or housing serving as a personal warning device. The holder or housing is embodied in such a way that when a vulnerable road user is impeded in his activity by other vulnerable road users, a sound is produced when the former vulnerable road user taps the holder or housing. The term "vulnerable road users" includes cyclists, walkers, joggers/runners, skaters/skeelers and the like. The device which is applied in the aforementioned holder or is integrated into the aforementioned housing should in this use produce a sufficient number of decibels in accordance with the traffic safety standards. Furthermore, the device is preferably set in such a way that the sound is reproduced merely when the aforementioned holder or housing is tapped by the vulnerable road user, and not at a minimal shock, including the movement rhythm of a jogger/runner, or the shuddering of a bicycle as it rides over cobblestones.

Another use is for example the incorporation of the device according to the invention, which is provided with one or more LEDs for producing light, into a holder or a housing such as a flexible band or another suitable housing for use at events such as festivals. Here too, the aforementioned holder or housing is again preferably made of such a material and the device is set in such a way that light is produced whenever the holder or housing is tapped.

This invention will now be explained in greater detail based on the following detailed description of two exemplary embodiments of a device according to the invention. The aim of this description is exclusively to provide a clarificatory example and to indicate further advantages and special features of this invention, and can thus in no way be interpreted as a limitation of the scope of the invention or of the patent rights applied for in the claims.

Brief description of drawings

This detailed description refers by means of reference numerals to the appended drawings, in which:

- *Figure 1* is an electric block diagram of a preferred embodiment of a device according to the invention that is provided for generating and producing sound as a consequence of movement of a piezoelectric sensor;
- *Figure 2* is an electric block diagram of a preferred embodiment of a device according to the invention that is provided for generating and producing light as a consequence of movement of a piezoelectric sensor;
- *Figure 3a* is a perspective front view of an exemplary embodiment of a flexible band incorporating a device according to the invention that is provided for producing and generating sound;
- *Figure 3b* is an exploded perspective front view of the flexible band as may be seen in Figure 3a; and
- *Figure 4* shows a cyclist who is provided around his head, right wrist and left upper arm with a flexible band such as is shown in Figure 3a, and is also provided with a flexible band of this type around the handlebars of his bicycle.

Mode(s) for carrying out the invention

Figure 1 is an electric block diagram of an exemplary embodiment of a device according to the invention that is provided for generating and producing sound as a consequence of a conditioned movement, or in other words a movement having a preset duration and wherein the sensor means generate a preset voltage. An example of an order of magnitude of the duration of the movement is at least 800 ns and the minimum voltage of the sensor means is at least 100 mV.

For this purpose, this device comprises:

- a piezoelectric shock sensor (1) which is provided for detecting the conditioned movement of at least one component of the device;
- a conditioning circuit (2) which forms part of the piezoelectric shock sensor (1) and in which the aforementioned preset values of the duration of the conditioned movement and the predefined voltage of the piezoelectric sensor (1) are set;
- an audio transducer (3), preferably a piezoelectric audio transducer, which is provided for producing the sound;
- an electronic circuit consisting of

- a microcontroller (4) which functions as an audio generator;
- an amplifier (5) which bidirectionally drives the audio transducer (3);

– a battery (6) which is provided for delivering power to the electronic circuit.

The microcontroller (4) is in this case provided with a built-in switching function (4a, 4b) which is on the one hand provided to be switched on by the voltage which is generated by the piezoelectric shock sensor (1) when the aforementioned conditioned movement is detected by this piezoelectric shock sensor, as a result of which the microcontroller (4) is started up at that moment [see 4b in Figure 1], and is on the other hand switched back off [see 4a in Figure 1].

The amplifier (5) is in this case provided with a built-in switching function (5a) which is provided to be switched on and off by this microcontroller (4).

The electric block diagram shown functions in this case as follows: The piezoelectric shock sensor (1) is not provided with a power supply voltage, but itself generates energy by deforming the crystal of this shock sensor (1) by the movement experienced by at least one component of the device. This voltage is monitored by the conditioning unit (2), as is the duration of the movement. As soon as the aforementioned voltage and duration reach the preset value, the microcontroller (4) provided for generating the sound is activated. During start-up of this microcontroller (4), the microcontroller will power itself by activating the switching function (4b), wherein the switching function (4a) of the microcontroller (4) itself may go back to stand-by. The microcontroller (4) will subsequently power the amplifier (5) by activating the switching function (5a) of the amplifier (5), so that the amplifier can amplify the sound and can reproduce it via the audio transducer (3). As a result of the fact that the switching function (4a) of the microcontroller (4) itself goes back to stand-by, the sound can be produced again each time the piezoelectric sensor detects a (conditioned) movement.

Figure 2 is an electric block diagram of an exemplary embodiment of a device according to the invention that is provided for generating and producing light as a consequence of a conditioned movement.

For this purpose, this device comprises:

- a piezoelectric shock sensor (1) which is provided for detecting the conditioned movement of at least one component of the device;
- a conditioning circuit (2) which forms part of the piezoelectric shock sensor (1) and in which the aforementioned preset values of the duration of the conditioned movement and the predefined voltage of the piezoelectric sensor (1) are set;
- one or more LEDs (7) which are provided for producing the light (signal);
- an electronic circuit consisting of a microcontroller (4) which functions as a light generator;
- a battery (6) which is provided for delivering power to the electronic circuit.

The microcontroller (4) is in this case provided with a built-in switching function (4a, 4b) which is on the one hand provided to be switched on by the voltage which is generated by the piezoelectric shock sensor (1) when the aforementioned conditioned movement is detected by this piezoelectric shock sensor, as a result of which the microcontroller (4) is started up at that moment [see 4b in Figure 2], and is on the other hand switched back off [see 4a in Figure 2].

The electric block diagram shown functions in this case as follows: The piezoelectric shock sensor (1) is not provided with a power supply voltage, but itself generates energy by deforming the crystal of this shock sensor (1) by the movement experienced by at least one component of the device. This voltage is monitored by the conditioning unit (2), as is the duration of the movement. As soon as the aforementioned voltage and duration reach the preset value, the microcontroller (4) provided for generating the light is activated. During start-up of this microcontroller (4), the microcontroller will power itself by activating the switching function (4b), wherein the switching function (4a) of the microcontroller (4) itself may go back to stand-by. The microcontroller (4) will subsequently activate the aforementioned one or more LEDs (7). As a result of the fact that this switching function (4a) goes back to stand-by, the sound can activate the LEDs (7) again each time the piezoelectric sensor detects a (conditioned) movement.

Physically, all the elements shown in Figures 1 and 2 are preferably applied to a printed circuit board or another substrate and are mutually electrically connected to one another. However, it is also possible to provide various printed circuit boards or

other substrates which are flexibly connected to one another, as a result of which it is for example possible to integrate these elements into a flexible band.

Figures 3a and 3b show an example of a flexible band (10) which is provided with a device (100) for generating and producing sound. The device (100) consists in this case of a printed circuit board (101) to which an audio transducer (3), a microcontroller (4) which serves as a sound generator, a piezoelectric shock sensor (1), an amplifier (5) and a battery (6) as a power supply are applied. However, Figure 3b shows only the audio transducer (3) and the microcontroller (4).

The flexible band (10) is in this case provided with a space (11) into which a holder (13), which can be closed off by a cover (12), can be detachably introduced. For this purpose, the holder (13) has a shape corresponding to the shape of the aforementioned space (11). Furthermore, the cover (12) can also be redetached from the holder (13).

Figure 4 shows a cyclist (20) who is provided around his head, right wrist and left upper arm with a flexible band (10) as described hereinbefore. As may be seen in Figure 4, a flexible band (10) of this type is also applied around the handlebars of the bicycle.

A flexible band (10) of this type can also be worn by other vulnerable road users such as runners/joggers and skaters/bladers.

For safety reasons, the flexible band (10) can be provided with one or more reflective zones or be embodied so as to be fully reflective.

It is however also possible to provide the flexible band (10), such as is shown in Figures 3a and 3b, with a device (100) which is provided for generating and producing light (not shown in the figures). LEDs (7) are preferably used in this case. In this case, one or more LEDs (7) can be applied over a part of or the entire surface of the flexible band (10). It is possible both for these LEDs (7) to be applied through the aforementioned surface of the flexible band (10) and for these LEDs (7) to be integrated into the material of the flexible band (10). In the latter case, this material

should be sufficiently transparent to allow a part of or the entire flexible band (10) to be lit up.

It is also possible to provide the flexible band (10), such as is shown in Figures 3a and 3b, with a device (100) according to the invention for generating and producing both sound and light (not shown in the figures).

The flexible band (10), such as is shown in Figures 3a and 3b, is preferably made of a flexible yet sufficiently robust material in such a way that the sound is produced whenever the band is tapped for a sufficiently long time and the sensor means generate a sufficient voltage.

Furthermore, the flexible band (10) can be provided with any detachable closure such as a Velcro, a push button, a clasp closure (such as is used in clocks), and the like (not shown in the figures).

CLAIMS

1. Device (100) for generating and producing sound and/or light, comprising
   - means (3, 7) for producing the sound and/or the light;
   - sensor means (1) which are provided to generate a voltage as a consequence of a movement of at least one component of the device;
   - a power supply (6) for delivering power supply voltage to the electronic circuit (4, 5);
   - an electronic circuit (4, 5) which is electrically connected to the sensor means (1), the means (3, 7) for producing the sound and/or the light and the power supply (6), this electronic circuit (4, 5) being provided for generating the sound and/or the light; and

   characterized in that the sensor means (1) are provided in such a way with respect to the electronic circuit (4, 5) that the sensor means are a precircuit of the electronic circuit (4, 5) in such a way that the electronic circuit (4, 5) is started up when the sensor means (1) detect the aforementioned movement, as a result of which the aforementioned means (3, 7) for producing the sound and/or the light are activated, and the electronic circuit comprising a microcontroller (4) which is provided for generating the sound and/or the light and which is started up by the voltage which is generated by the sensor means (1) when the aforementioned movement is detected by these sensor means (1), this microcontroller (4) being provided with a built-in switching function (4a, 4b) which is provided
   - to be switched on by the voltage which is generated by the sensor means (1) when the aforementioned movement is detected by these sensor means (1), as a result of which the microcontroller (4) is started up at that moment, and
   - to be switched back off by the microcontroller (4) itself.

2. Device according to claim 1, characterized in that the sensor means consist of a piezoelectric shock sensor (1).

3. Device according to claim 1 or 2, characterized in that the sensor means (1) comprise a conditioning circuit (2) which is provided to activate the production of the sound and/or the light at the moment at which the duration

of the aforementioned movement and the voltage which is generated by the sensor means (1) as a consequence of this movement exceed a preset minimum value, and which is provided to forward in conditioned form the voltage which is generated by the sensor means (1) to the microcontroller (4), as a result of which this microcontroller (4) is started up.

4. Device according to one of claims 1 to 3, characterized in that if the device (100) is provided for generating light as a consequence of a movement of at least one component of the device, the means for producing light consist of one or more LEDs (7).

5. Device according to one of claims 1 to 3, characterized in that if the device (100) is provided for generating sound as a consequence of movement of at least one component of the device (100), the aforementioned electronic circuit comprises an amplifier (5) which is provided for bidirectionally driving the means (3) which are provided for producing the sound.

6. Device according to claim 5, characterized in that the amplifier (5) is provided with a built-in switching function (5a) which is provided to be switched on and off by the microcontroller (4).

7. Device according to claim 5 or 6, characterized in that the means for producing sound consist of an audio transducer (3).

8. Device according to claim 7, characterized in that the audio transducer (3) is piezoelectrically embodied.

9. Device according to one of claims 1 to 8, integrated into an openable or non-openable housing (13), such as a flexible band (10), helmet or other housing which is wearable either on the body or not.

10. Device according to one of claims 1 to 8, incorporated into an openable or non-openable separate holder (13), provided to be detachably or non-detachably secured to a bearing surface, such as bicycle handlebars, a helmet or other housing which is wearable either on the body or not.

11. Device according to claim 9 or 10, characterized in that the holder or housing (13) is integrated into a flexible band (10) which can be worn around a body part of a user, such as a wrist, upper arm, head, leg, ankle, bicycle handlebars and the like.

12. Device according to one of claims 9 to 11, characterized in that the flexible band (10) is provided with one or more reflective zones or is embodied so as to be fully reflective.

13. Device according to one of claims 9 to 12, characterized in that sound and/or light is produced by tapping the holder or housing (13).

14. Device according to one of claims 9 to 13, characterized in that light is produced by LEDs (7) which are applied over a part or the entire surface of the flexible band (10).

15. Device according to claim 14, characterized in that the LEDs (7) are applied through the aforementioned surface of the flexible band (10) or that these LEDs (7) are integrated into the material of the flexible band (10).

16. Device according to one of claims 9 to 15, characterized in that the flexible band (10) is provided with a detachable closure such as a Velcro, push button, clasp closure and the like.

17. Use of a device for producing sound and/or light according to one of claims 1 to 16 as a warning device for vulnerable road users such as cyclists, walkers, joggers, skaters, skeelers and the like.

18. Use of a device according to one of claims 1 to 16 for producing sound and/or light at events such as festivals.

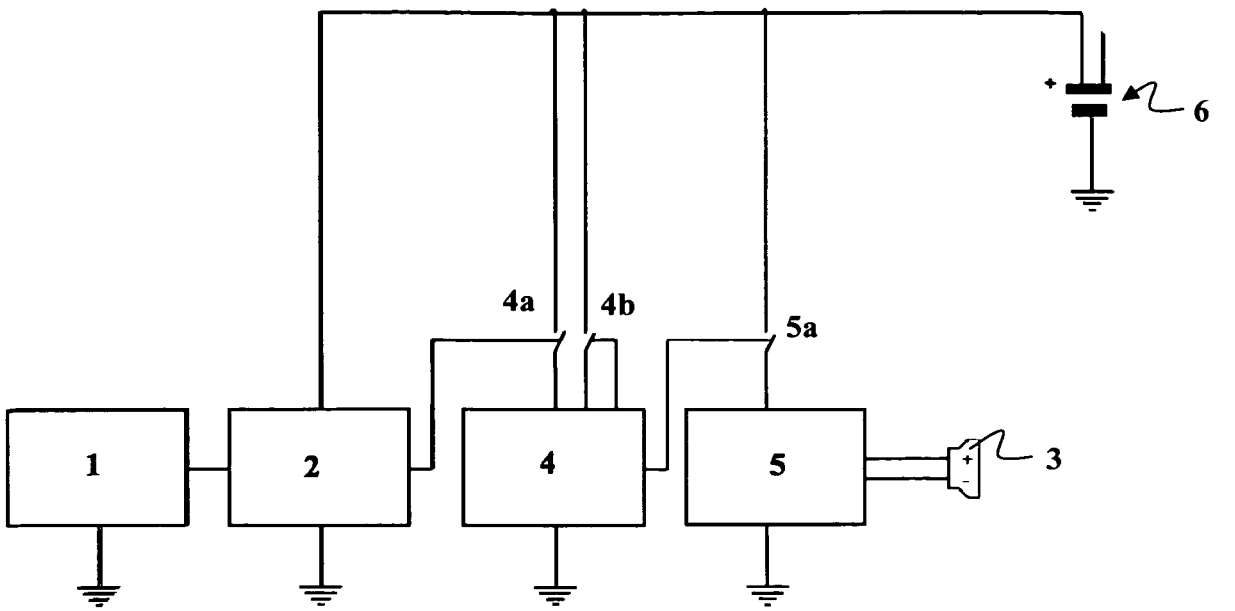

FIG. 1

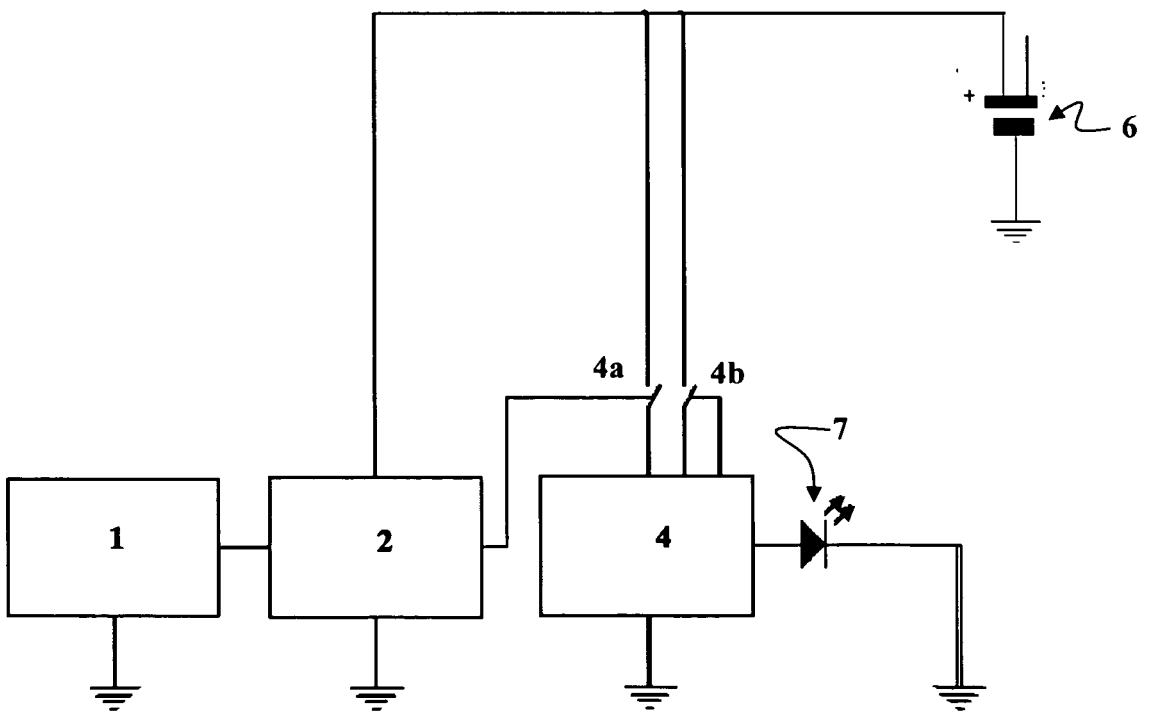

FIG. 2

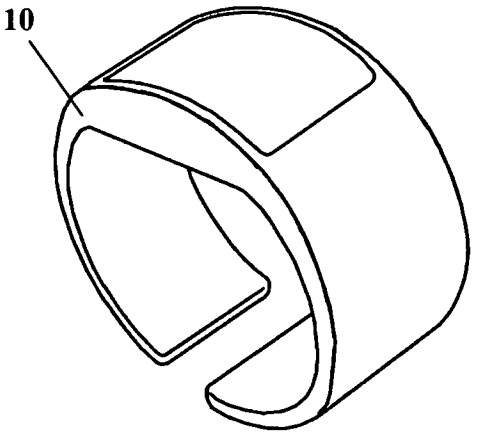

FIG. 3a

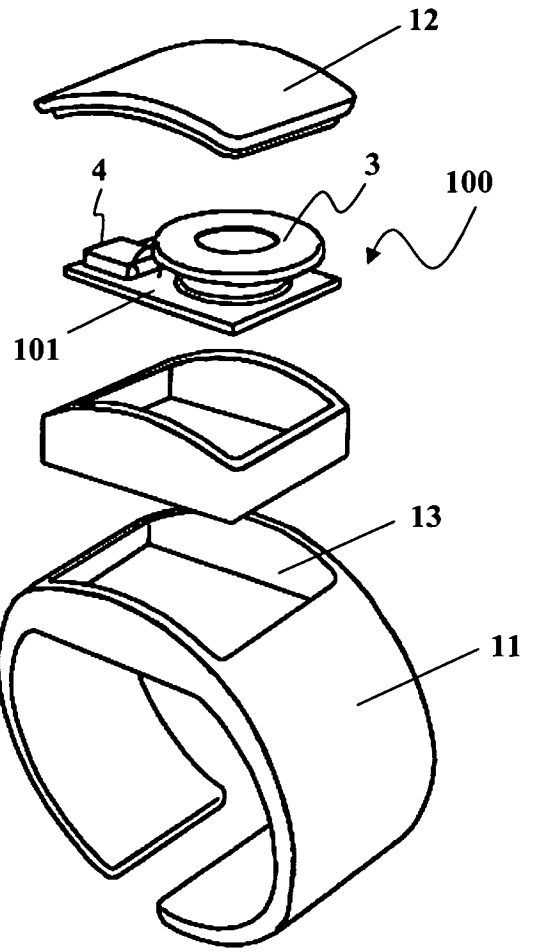

FIG. 3b

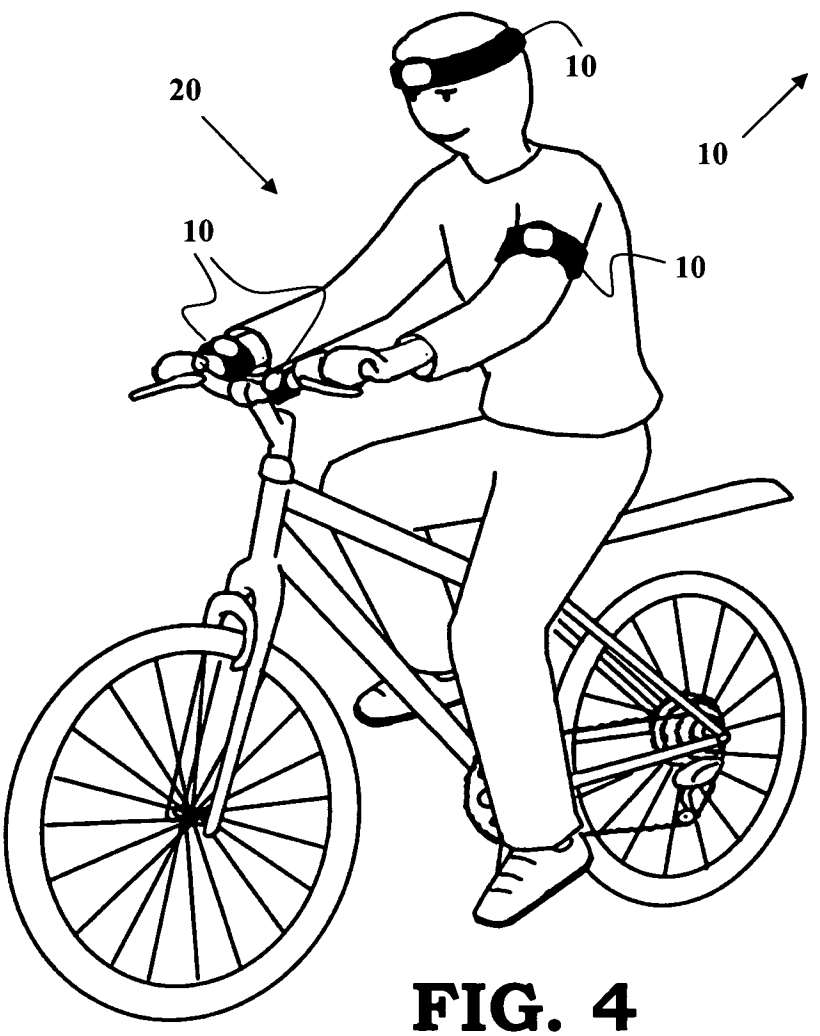

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2010/003622

A. CLASSIFICATION OF SUBJECT MATTER
INV. G08B5/36 G08B5/38 B62J6/04 H05B37/02
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G08B B62J H05B

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 6 175 196 B1 (RAGNER GARY DEAN [US] ET AL) 16 January 2001 (2001-01-16) the whole document	1-18
X	US 5 806 960 A (CHIEN TSENG LU [TW]) 15 September 1998 (1998-09-15) column 10, line 34 - line 47; figure 11	1-18
X	US 2006/077678 A1 (CHEN WEN-SUNG [TW]) 13 April 2006 (2006-04-13) the whole document	1-18
X	US 7 038 575 B1 (FROHMAN JAN A [US] ET AL) 2 May 2006 (2006-05-02) the whole document	1-18
X	DE 43 23 925 A1 (CLAUER FRIEDRICH WILHELM [DE]) 19 January 1995 (1995-01-19) the whole document	1-18

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
17 August 2010	24/08/2010

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2010/003622

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