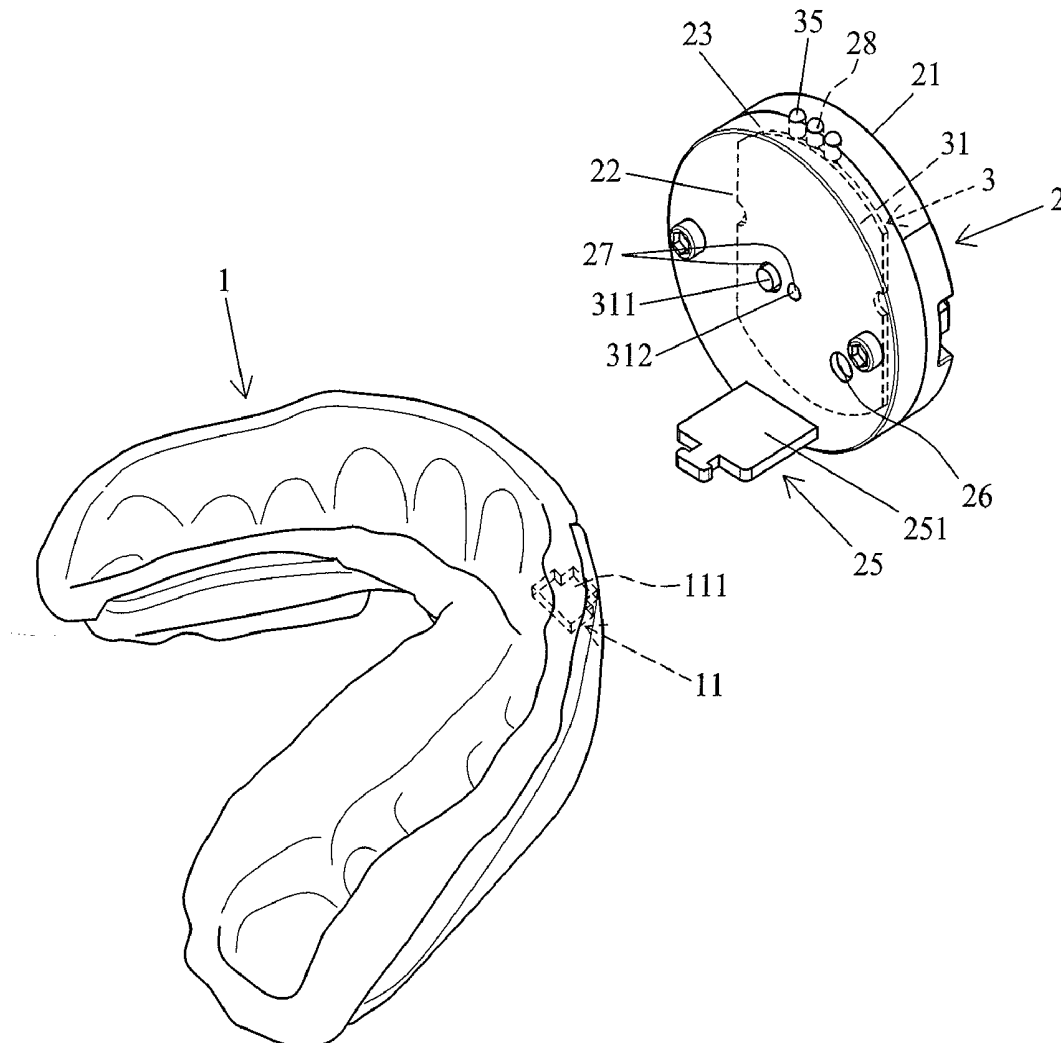(19) **United States**

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(54) **RESPIRATION DETECTION DEVICE**

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(57) **ABSTRACT**

A respiration detection device includes a mouth guard mounted in a mouth of a user. A coupling seat is mounted to a front end of the mouth guard and is located in a position in front of a nose and the mouth of the user. A detection unit includes a circuit board, a microphone, a micro-processing circuit, and a transmission circuit. The circuit board is mounted to the coupling seat and is connected to a battery. The micro-processing circuit, the transmission circuit, and the microphone are mounted on the circuit board. The micro-processing circuit is configured to receive and process a message from the microphone to indicate a respiratory rate of the user. The transmission circuit is electrically connected to the micro-processing circuit and is configured to proceed with data transmission with an external device. The respiration detection device can accurately detect the respiratory rate in real time.
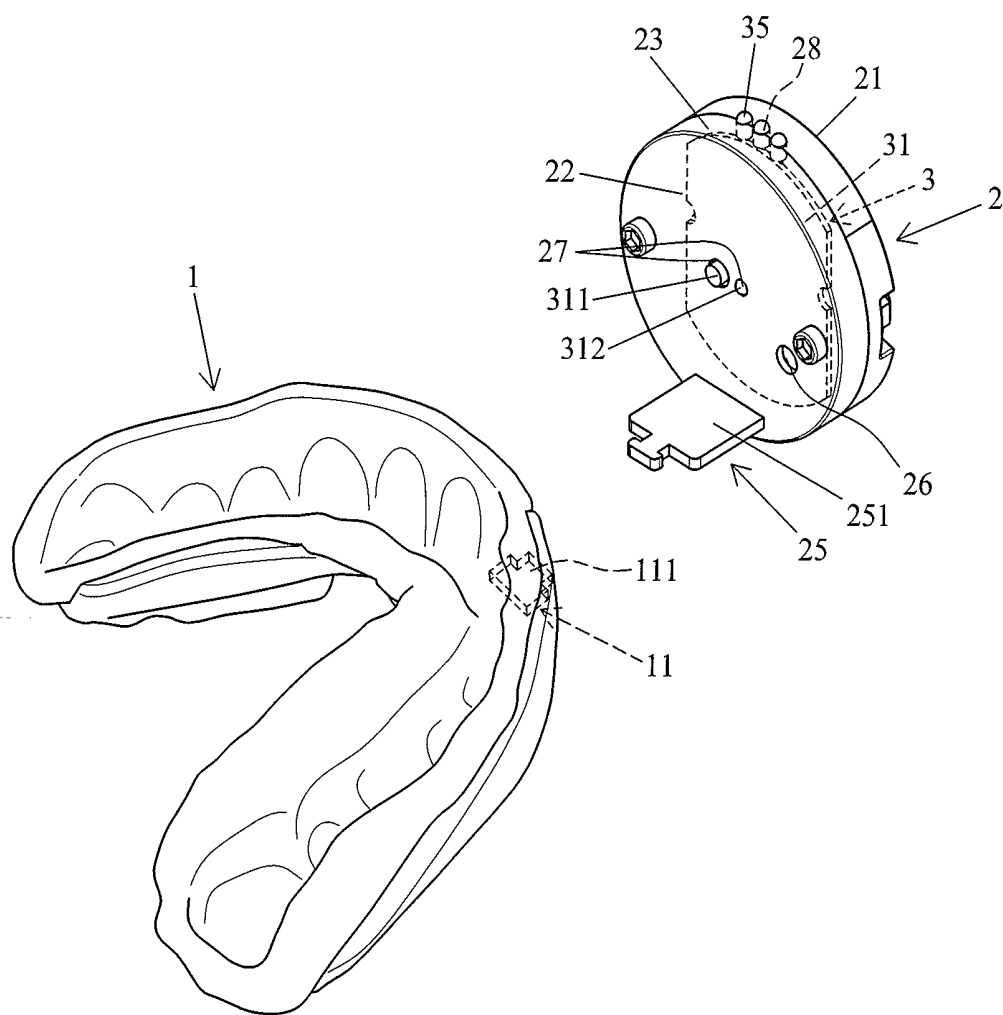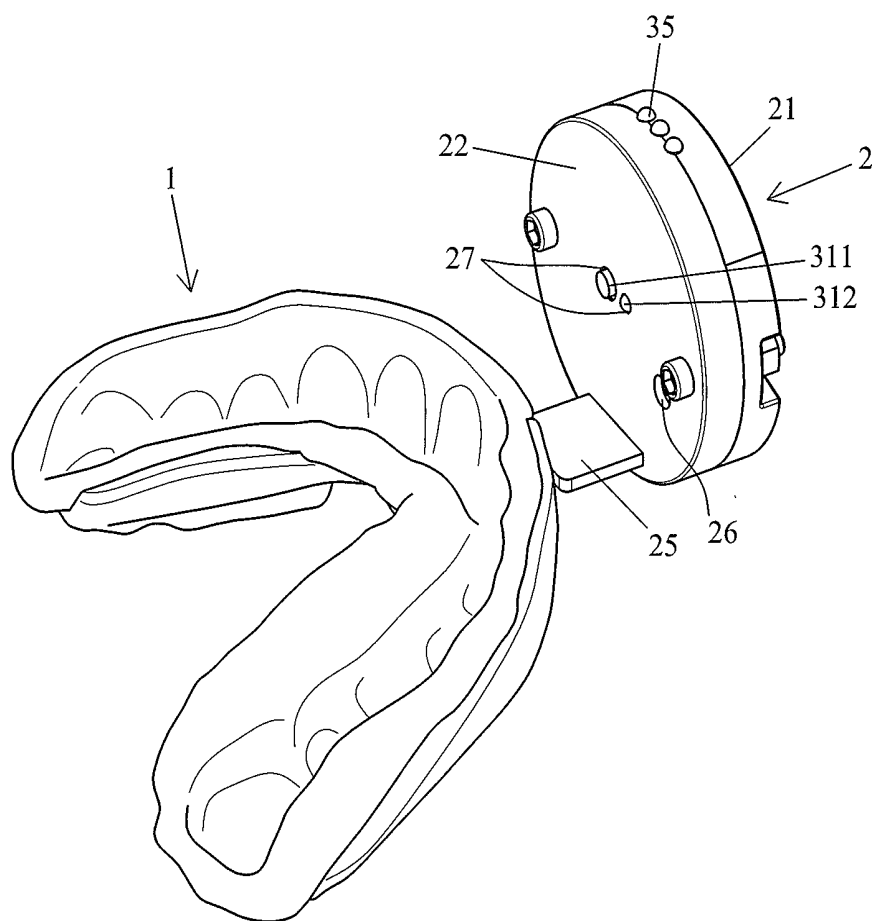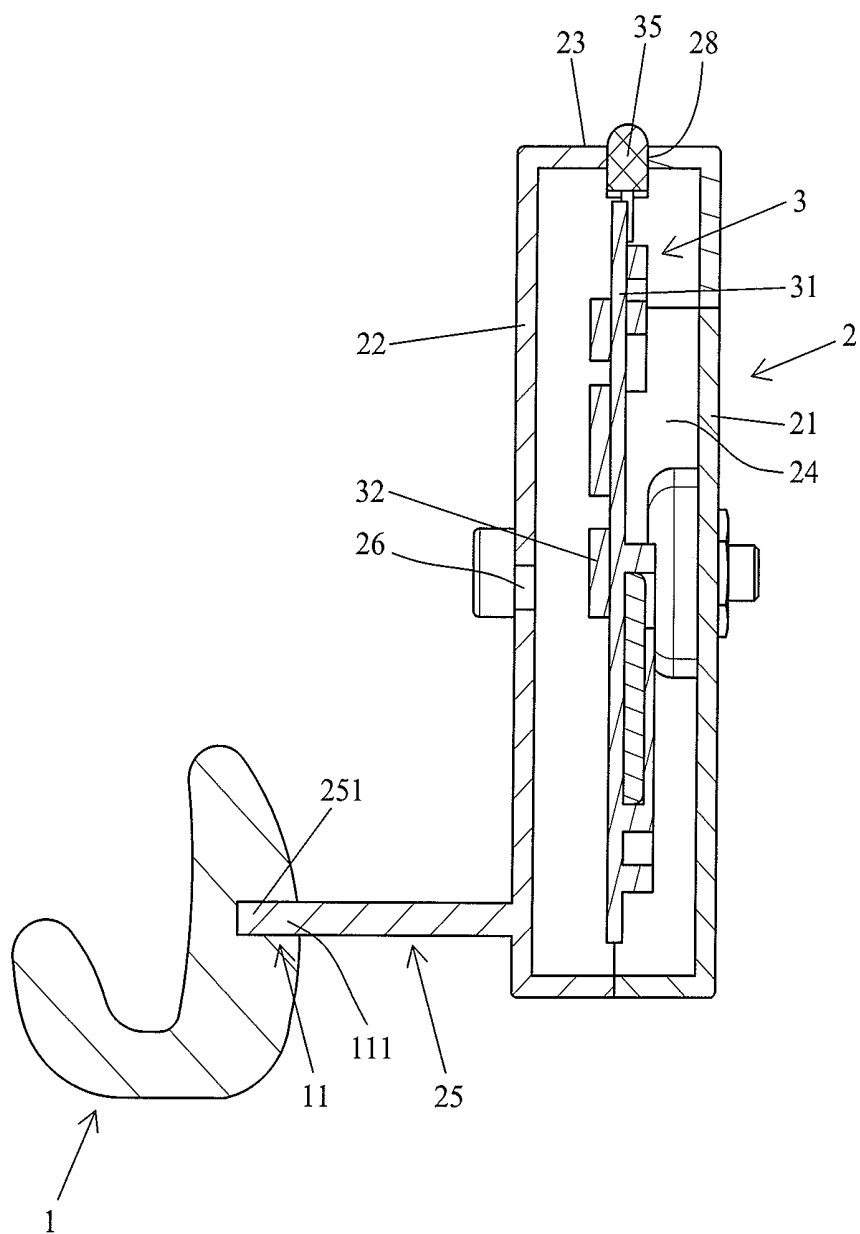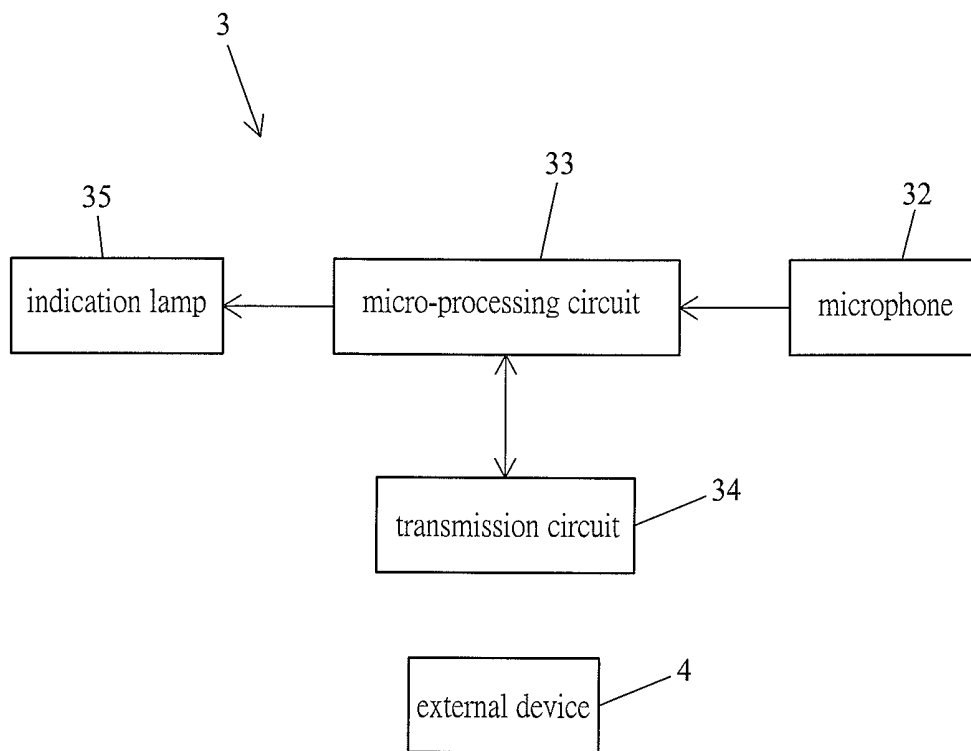
F I G . 1

F I G . 2

F I G . 3

3

35

33

32

| indication lamp | ← | micro-processing circuit | ← | microphone |

34

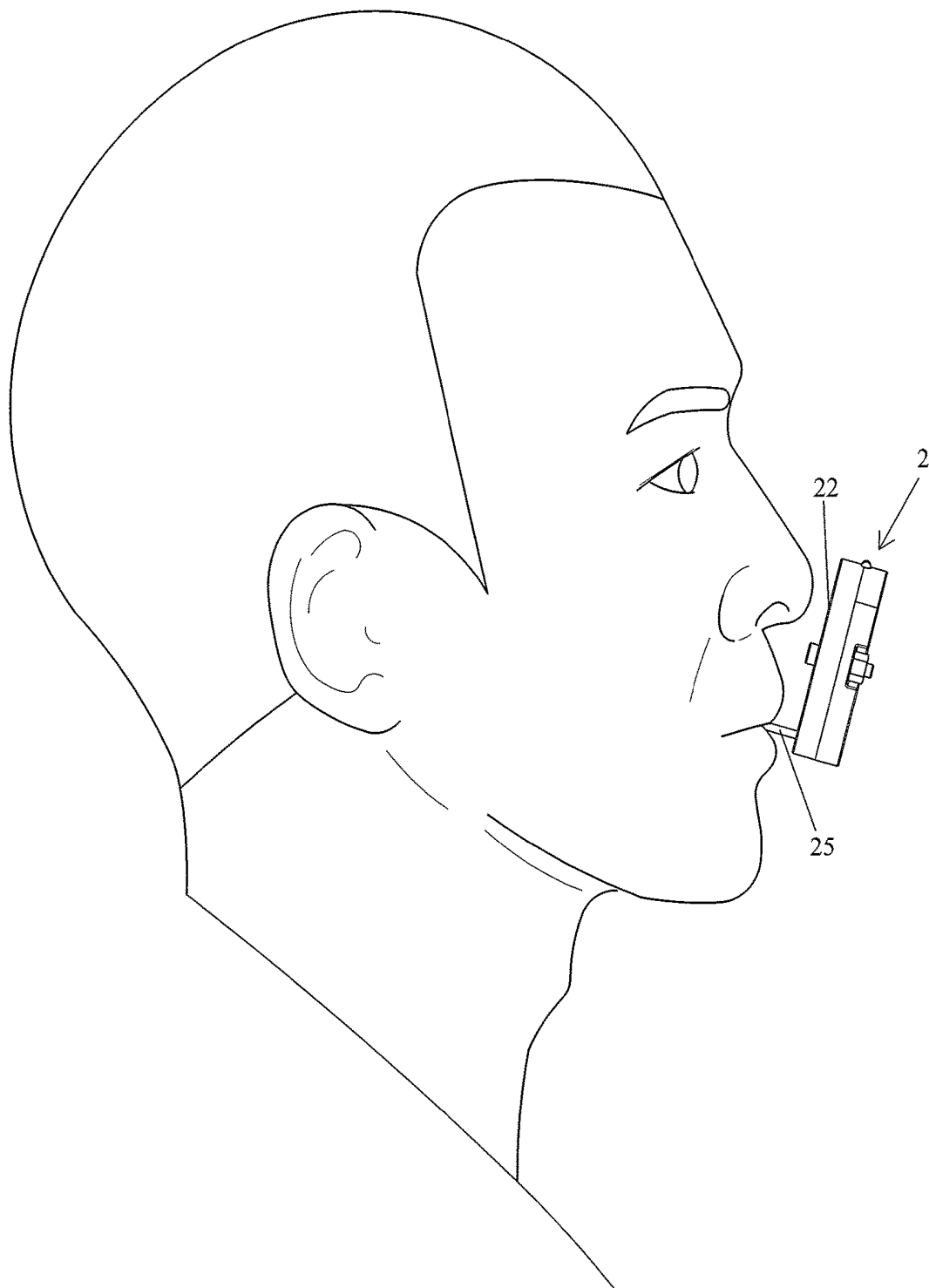transmission circuit

4

external device

F I G . 4

F I G . 5

RESPIRATION DETECTION DEVICE

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a respiration detection device and, more particularly, to a detection device for accurately detecting the respiratory rate.

[0002] Respiration provides the body with oxygen and removes the waste gas. The respiration rate is one of the indexes for detecting the cardiopulmonary function of the body. An adult at rest breathes about 12-20 times per minute. The body needs more oxygen during exercise, and the respiratory rate increases. The respiratory rates are different due to different exercise intensities. For example, the respiratory rate during fast running is greater than slow running. Thus, timely detection of the respiratory rate can avoid danger resulting from excessive exercise during body abnormality.

[0003] Although people can detect the respiratory rate by themselves, real-time detection during running and cycling are difficult. Namely, the respiratory rate during exercise cannot be known.

[0004] U.S. Patent Publication No. 2012/0172677 discloses a monitoring system for monitoring data of a user. In an example, the monitoring system includes a dental appliance (such as a mouth guard) mounted in a mouth of the user. A circuit board and a sensor are mounted in the mouth guard for detection of the respiratory rate or other biometric data. However, the mouth guard in the mouth is not in a position corresponding to the respiratory tract, and the detected state cannot be displayed to the outside. The detected respiratory rate could have a larger error, and the breathing state cannot be known in real time.

BRIEF SUMMARY OF THE INVENTION

[0005] An objective of the present invention is to provide a detection device for detecting respiratory rate with improved accuracy.

[0006] Another objective of the present invention is to provide a detection device for providing real time information of the breathing state.

[0007] A respiration detection device according to the present invention includes a mouth guard, a coupling seat, and a detection unit. The mouth guard is adapted to be mounted in a mouth of a user. The mouth guard includes a front end having a first coupling portion. The coupling seat is mounted to the front end of the mouth guard and is adapted to be located in a position in front of a nose and the mouth of the user. The coupling seat includes a second coupling portion coupled with the first coupling portion. The detection unit includes a circuit board, a microphone, a micro-processing circuit, and a transmission circuit. The circuit board is mounted to the coupling seat and is adapted to be connected to a battery. The micro-processing circuit, the transmission circuit, and the microphone are mounted on the circuit board. The micro-processing circuit is configured to receive and process a message from the microphone to indicate a respiratory rate of the user. The transmission circuit is electrically connected to the micro-processing circuit and is configured to proceed with data transmission with an external device.

[0008] The respiration detection device as claimed in claim 1, with the detection unit further including a plurality of indication lamps electrically connected to the micro-processing circuit, wherein when the micro-processing circuit receives a message indicating the breathing times reach a set value, the micro-processing circuit activates a corresponding one of the plurality of indication lamps to emit light.

[0009] In an example, the transmission circuit includes a blue tooth module configured to proceed with data transmission with a blue tooth module of the external device.

[0010] In an example, the first coupling portion of the mouth guard has a slot, and the second coupling portion of the coupling seat has a tab inserted into the slot.

[0011] In an example, the coupling seat includes a front wall, a rear wall, and an annular wall. The front wall, the rear wall, and the annular wall define a chamber. The rear wall includes a detection hole. The circuit board of the detection unit is mounted in the chamber of the coupling seat. The microphone is aligned with the detection hole of the coupling seat.

[0012] In another example, the coupling seat includes a front wall, a rear wall, and an annular wall. The front wall, the rear wall, and the annular wall define a chamber. The rear wall includes a detection hole and a plurality of through-holes. The annular wall includes an upper end having a plurality of holes. The detection unit further includes a plurality of indication lamps. The circuit board is mounted in the chamber of the coupling seat. A power switch and a power indication lamp are mounted in the plurality of through-holes. The microphone is aligned with the detection hole of the coupling seat. The plurality of indication lamps is mounted in the plurality of holes of the annular wall of the coupling seat.

[0013] The mouth guard is placed into a mouth of a user with the rear wall of the coupling seat located in a position in front of a nose and the mouth of the user. The three indication lamps are set to emit in accordance with different respiration rates. An application (APP) of the present invention can be downloaded into the external device with a blue tooth module. The BMI of the user is used to obtain the maximum breathing times per minute of the user. The breathing times per minute of the user can be displayed. Furthermore, the user can change settings to make each of the indication lamps to emit light according to the corresponding respiratory rate.

[0014] In practice, the sound resulting from breathing through the nose and mouth of the user can be directly received by the microphone through the detection hole, providing excellent detection accuracy. The signal received by the microphone is inputted to the micro-processing circuit. The user uses the external device to wirelessly obtain the detection value of the micro-processing circuit via the transmission circuit. The user during exercise can know whether the current respiratory rate is normal in real time and can maintain his or her health by understanding his or her physical condition.

[0015] The present invention will become clearer in light of the following detailed description of illustrative embodiments of this invention described in connection with the drawings.

DESCRIPTION OF THE DRAWINGS

[0016] FIG. 1 is an exploded, perspective view of a respiration detection device according to the present invention.

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[0017]   FIG. **2** is a perspective view of the respiration detection device according to the present invention.

[0018]   FIG. **3** is a cross sectional view of the respiration detection device according to the present invention.

[0019]   FIG. **4** is a diagrammatic block diagram of a detection unit of the respiration detection device according to the present invention.

[0020]   FIG. **5** is a diagrammatic perspective view illustrating use of the respiration detection device according to the present invention.

DETAILED DESCRIPTION OF THE
INVENTION

[0021]   With reference to FIGS. **1-4**, a respiration detection device according to the present invention includes a mouth guard **1**, a coupling seat **2**, and a detection unit **3**. The mouth guard **1** is adapted to be mounted in a mouth of a user. The mouth guard **1** includes a front end having a first coupling portion **11**. The first coupling portion **11** includes a slot **111**.

[0022]   The coupling seat **2** is mounted to the front end of the mouth guard **1** and includes a front wall **21**, a rear wall **22**, and an annular wall **23**. The front wall **21**, the rear wall **22**, and the annular wall **23** define a chamber **24**. A second coupling portion **25** protrudes rearward from a lower end of the annular wall **22** and is coupled to the first coupling portion **11**. The second coupling portion **25** has a tab **251** inserted into the slot **111**. The rear wall **22** includes a detection hole **26** and a plurality of through-holes **27**. The annular wall **23** includes an upper end having three holes **28**.

[0023]   The detection unit **3** includes a circuit board **31**, a microphone **32**, a micro-processing circuit **33**, a transmission circuit **34**, and three indication lamps **35**. The circuit board **31** is mounted in the chamber **24** of the coupling seat **2** and is connected to a battery (not shown). A power switch **311** and a power indication lamp **312** are mounted in the through-holes **27** of the rear wall **22** of the coupling seat **2**. The micro-processing circuit **33**, the transmission circuit **34**, and the microphone **32** are mounted on the circuit board **31**. The microphone **32** is aligned with the detection hole **26** of the coupling seat **2**. The micro-processing circuit **33** is configured to receive and process a message from the microphone **32** to indicate a respiratory rate of the user. The transmission circuit **34** is electrically connected to the micro-processing circuit **33** and can include a blue tooth module configured to proceed with data transmission with a blue tooth module of an external device **4** (such as a mobile phone or any other device). The indication lamps **35** can be light emitting diodes (LEDs), are mounted in the holes **28** of the annular wall **23** of the coupling seat **2**, and are electrically connected to the micro-processing circuit **33**. The indication lamps **35** are different and are set to correspond to different breathing times. Furthermore, when the micro-processing circuit **33** receives a message indicating the breathing times reach a set value, the micro-processing circuit **33** activates a corresponding one of the indication lamps **35** to emit light.

[0024]   With reference to FIGS. **1-5**, the tab **251** of the second coupling portion **25** of the coupling seat **2** is inserted into the slot **111** of the first coupling portion **11** of the mouth guard **1**. The mouth guard **1** is placed into a mouth of a user with the rear wall **22** of the coupling seat **2** located in a position in front of a nose and the mouth of the user. The three indication lamps **35** are set to emit light in accordance with different respiration rates. For example, flickering

green, orange, and red lights respectively corresponding to 50%, 70%, and 90% of the maximum breathing times can be emitted to remind the user of his or her current physical condition in real time.

[0025]   An application (APP) of the present invention can be downloaded into the external device **4** with a blue tooth module. By using the APP, the sex, age, height, and weight of the user can be inputted and converted into the body mass index (BMI). The BMI is multiplied with a preset coefficient to obtain the maximum breathing times per minute of the user. The breathing times per minute of the user can be displayed. Furthermore, an alarm effect can be provided by the different indication lamps **35** respectively corresponding to 50%, 70%, and 90% of the maximum breathing times. Since different users have different physical conditions, and the APP can be finely adjusted, such that an alarm effect can be provided at different set values of different respiratory rates through the transmission circuit **34** and the micro-processing circuit **33**. Furthermore, the user can change the set values to make each of the indication lamps **35** to emit light according to the corresponding respiratory rate, thereby avoiding danger resulting from excessive training of an athlete.

[0026]   In practice, the sound resulting from breathing through the nose and mouth of the user can be directly received by the microphone **32** through the detection hole **25**, providing excellent detection accuracy. The signal received by the microphone **32** is inputted to the micro-processing circuit **33**. The user uses the external device **4** to wirelessly obtain the detection value of the micro-processing circuit **33** via the transmission circuit **34**. The user during exercise can know whether the current respiratory rate is normal in real time and can maintain his or her health by understanding his or her physical condition.

[0027]   Thus, the present invention can accurately detect the respiratory rate and can display the effect in real time. As a result, the present invention is suitable for various athletes.

[0028]   Although specific embodiments have been illustrated and described, numerous modifications and variations are still possible without departing from the scope of the invention. The scope of the invention is limited by the accompanying claims.

    1. A respiration detection device comprising:
    a mouth guard adapted to be mounted in a mouth of a user, with the mouth guard including a front end having a first coupling portion;
    a coupling seat mounted to the front end of the mouth guard and adapted to be located in a position in front of a nose and the mouth of the user, with the coupling seat including a second coupling portion coupled with the first coupling portion; and
    a detection unit including a circuit board, a microphone, a micro-processing circuit, and a transmission circuit, with the circuit board mounted to the coupling seat and adapted to be connected to a battery, with the micro-processing circuit, the transmission circuit, and the microphone mounted on the circuit board, with the micro-processing circuit configured to receive and process a message from the microphone to indicate a respiratory rate of the user, and with the transmission circuit electrically connected to the micro-processing circuit and configured to proceed with data transmission with an external device.

2. The respiration detection device as claimed in claim **1**, with the detection unit further including a plurality of indication lamps electrically connected to the micro-processing circuit, wherein when the micro-processing circuit receives a message indicating the breathing times reach a set value, the micro-processing circuit activates a corresponding one of the plurality of indication lamps to emit light.

3. The respiration detection device as claimed in claim **2**, wherein the transmission circuit includes a blue tooth module configured to proceed with data transmission with a blue tooth module of the external device.

4. The respiration detection device as claimed in claim **1**, wherein the first coupling portion of the mouth guard has a slot, and the second coupling portion of the coupling seat has a tab inserted into the slot.

5. The respiration detection device as claimed in claim **1**, with the coupling seat including a front wall, a rear wall, and an annular wall, with the front wall, the rear wall, and the annular wall defining a chamber, with the rear wall including a detection hole, with the circuit board of the detection unit mounted in the chamber of the coupling seat, and with the microphone aligned with the detection hole of the coupling seat.

6. The respiration detection device as claimed in claim **1**, with the coupling seat including a front wall, a rear wall, and an annular wall, with the front wall, the rear wall, and the annular wall defining a chamber, with the rear wall including a detection hole and a plurality of through-holes, with the annular wall including an upper end having a plurality of holes, with the detection unit further including a plurality of indication lamps, with the circuit board mounted in the chamber of the coupling seat, with a power switch and a power indication lamp mounted in the plurality of through-holes, with the microphone aligned with the detection hole of the coupling seat, and with the plurality of indication lamps mounted in the plurality of holes of the annular wall of the coupling seat.

* * * * *

专利名称(译)	呼吸检测装置		
公开(公告)号	US20180146887A1	公开(公告)日	2018-05-31
申请号	US15/361523	申请日	2016-11-28
[标]申请(专利权)人(译)	城隍CHUNG		
申请(专利权)人(译)	程，黄-CHUNG		
当前申请(专利权)人(译)	程，黄-CHUNG		
[标]发明人	CHENG HUANG CHUNG		
发明人	CHENG, HUANG-CHUNG		
IPC分类号	A61B5/08 A61B5/00 A63B71/08		
CPC分类号	A61B5/0816 A61B5/682 A63B71/085 A61B5/7278 A61B2503/10 A61B5/742 A61B5/486 A61B5/746 A61B2562/0204 A61B5/0022 A61B7/003		
外部链接	Espacenet USPTO		

摘要(译)

呼吸检测装置包括安装在使用者口中的护嘴器。联接座安装到护口器的前端，并且位于使用者的鼻子和嘴的前方的位置。检测单元包括电路板，麦克风，微处理电路和传输电路。电路板安装在联轴器座上并与电池连接。微处理电路，传输电路和麦克风安装在电路板上。微处理电路被配置为从麦克风接收和处理消息以指示用户的呼吸率。传输电路电连接到微处理电路，并被配置为与外部设备进行数据传输。呼吸检测装置可以实时准确地检测呼吸率。