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(54) **MONITORING A PHYSIOLOGICAL
PARAMETER OF A CYCLIST**

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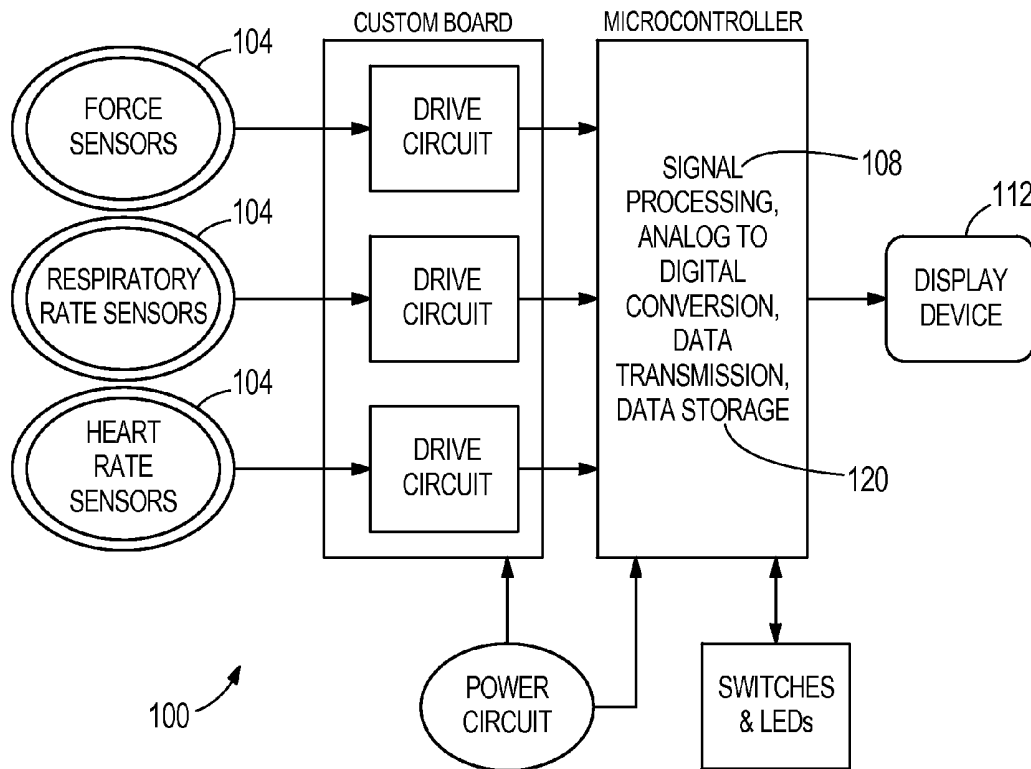
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(57) **ABSTRACT**

The present invention is directed to a system for monitoring a physiological parameter of a cyclist, and methods of using the system. The system comprises a garment, a sensor, and a signal processor. The garment is configured to be worn by the cyclist. The sensor is fixedly coupled to the garment and configured to measure a signal representative of the physiological parameter during pedaling. The signal processor is operatively coupled to the sensor and configured to determine a diagnosis based on the measured signal. An alert is generated in response to the diagnosis substantially in real time.

Related U.S. Application Data

(60) Provisional application No. 61/764,696, filed on Feb. 14, 2013.



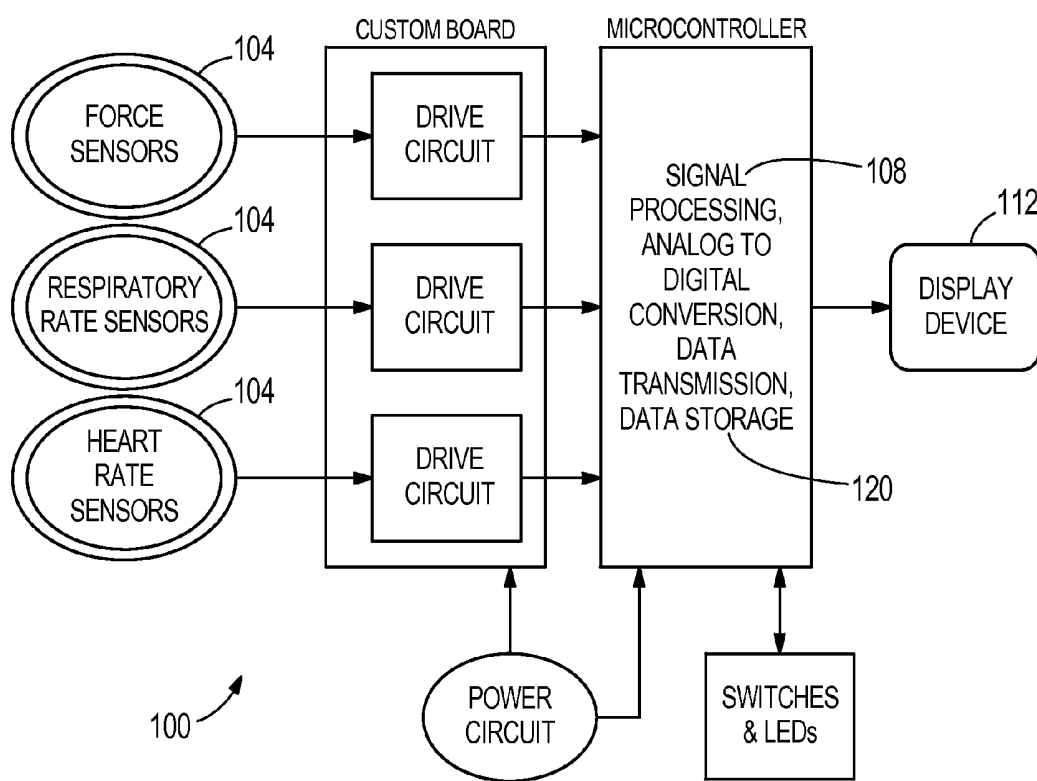


FIG. 1

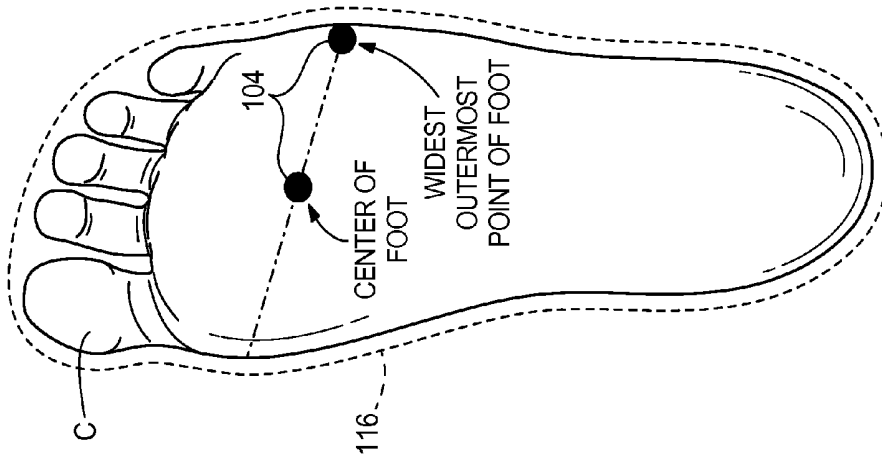


FIG. 3

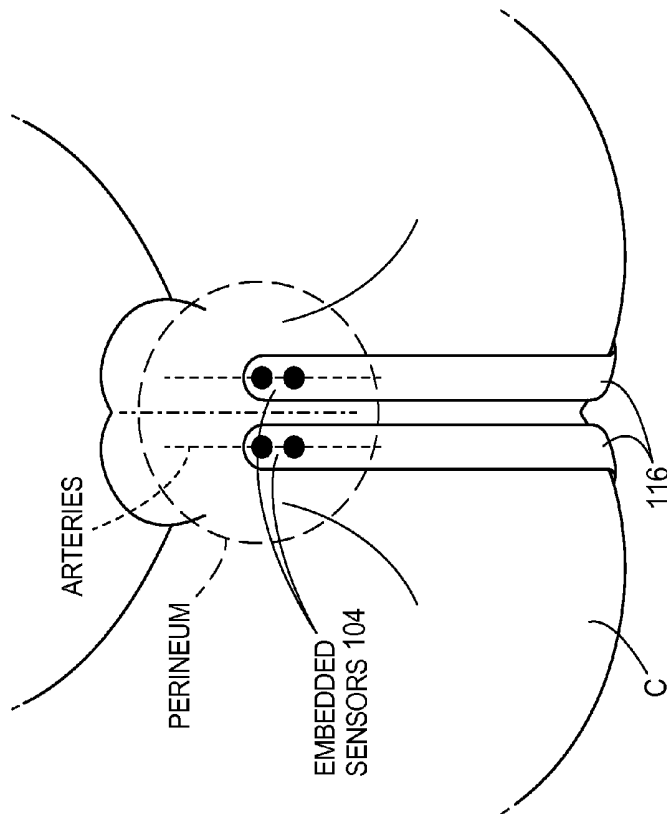


FIG. 2

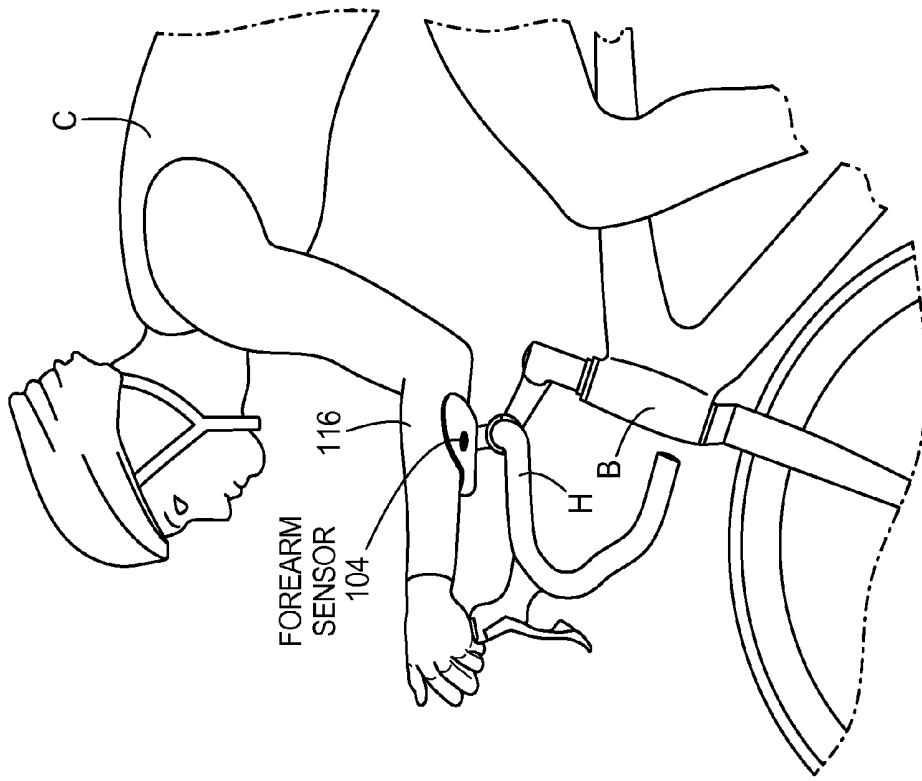


FIG. 5

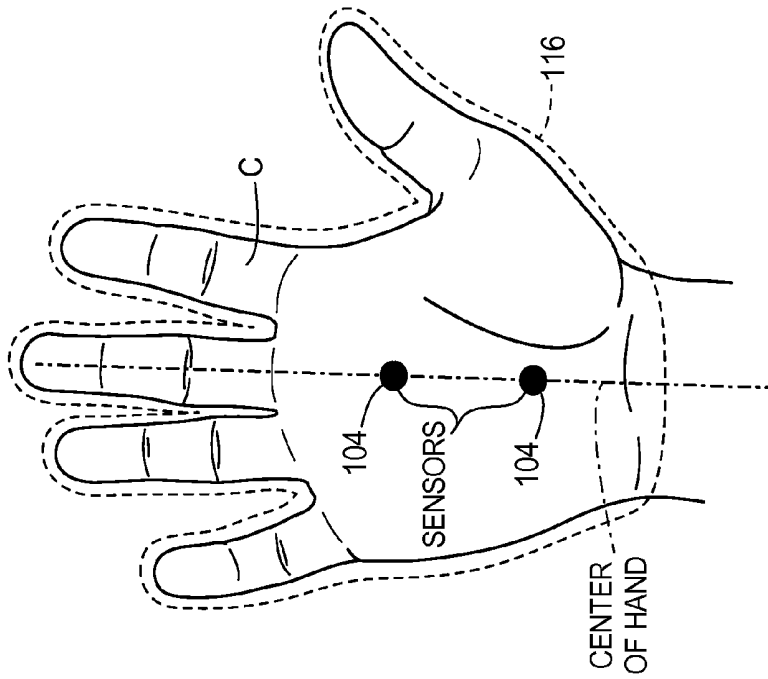
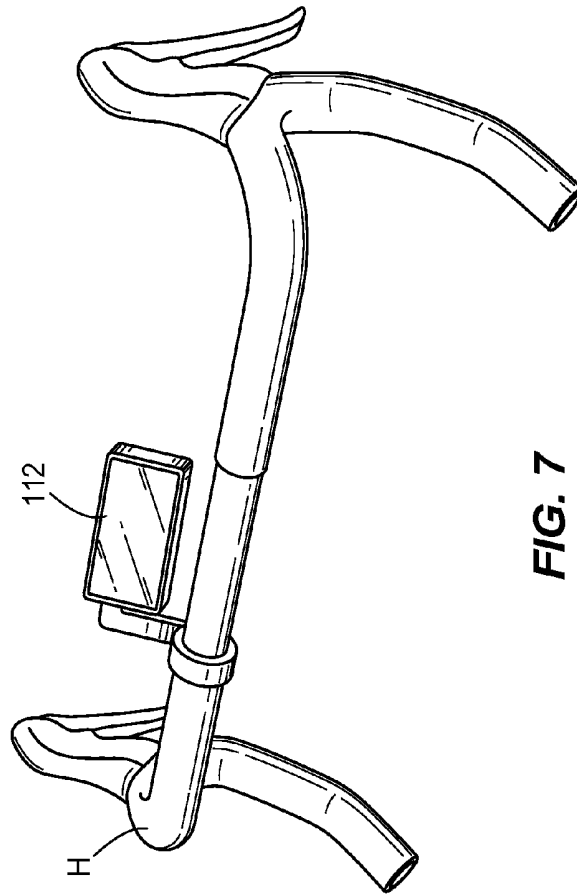
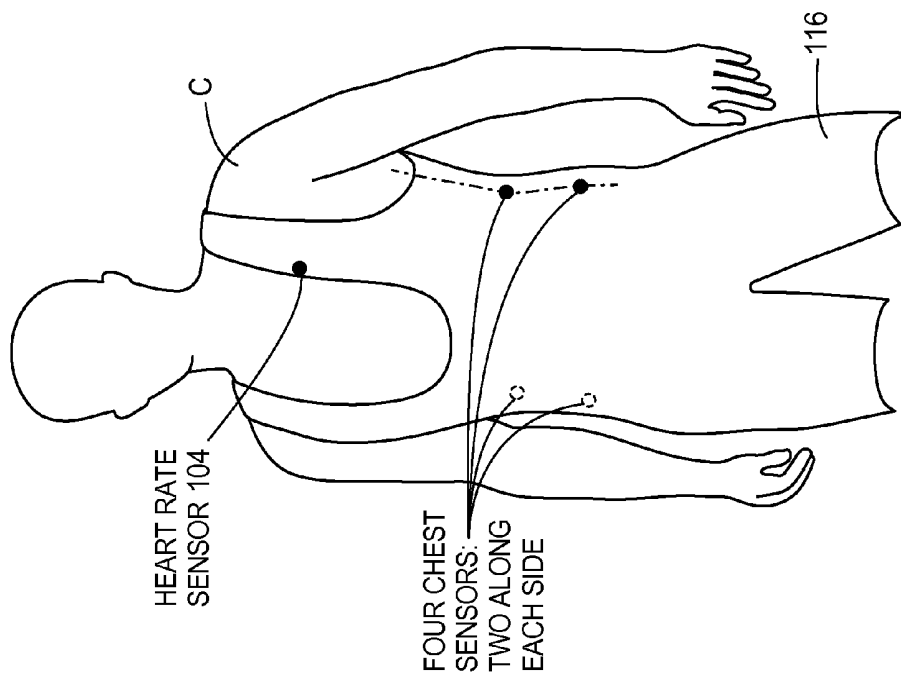


FIG. 4



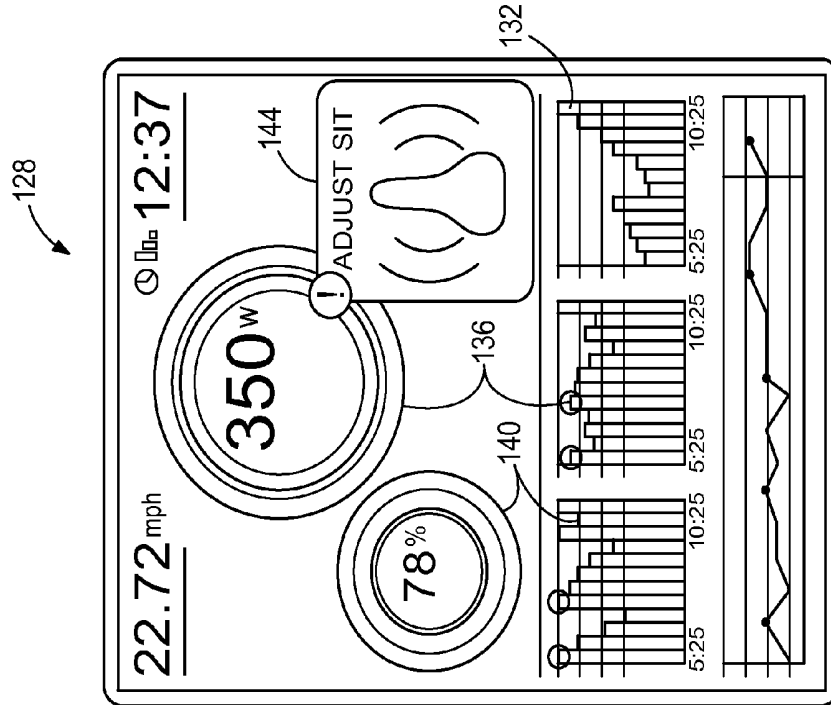


FIG. 8

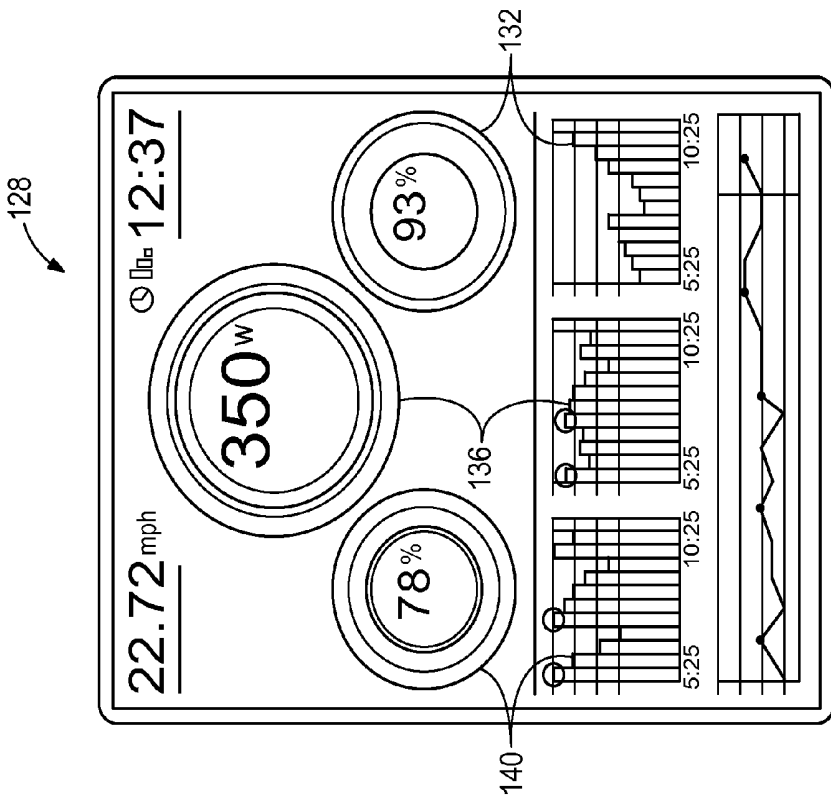


FIG. 9

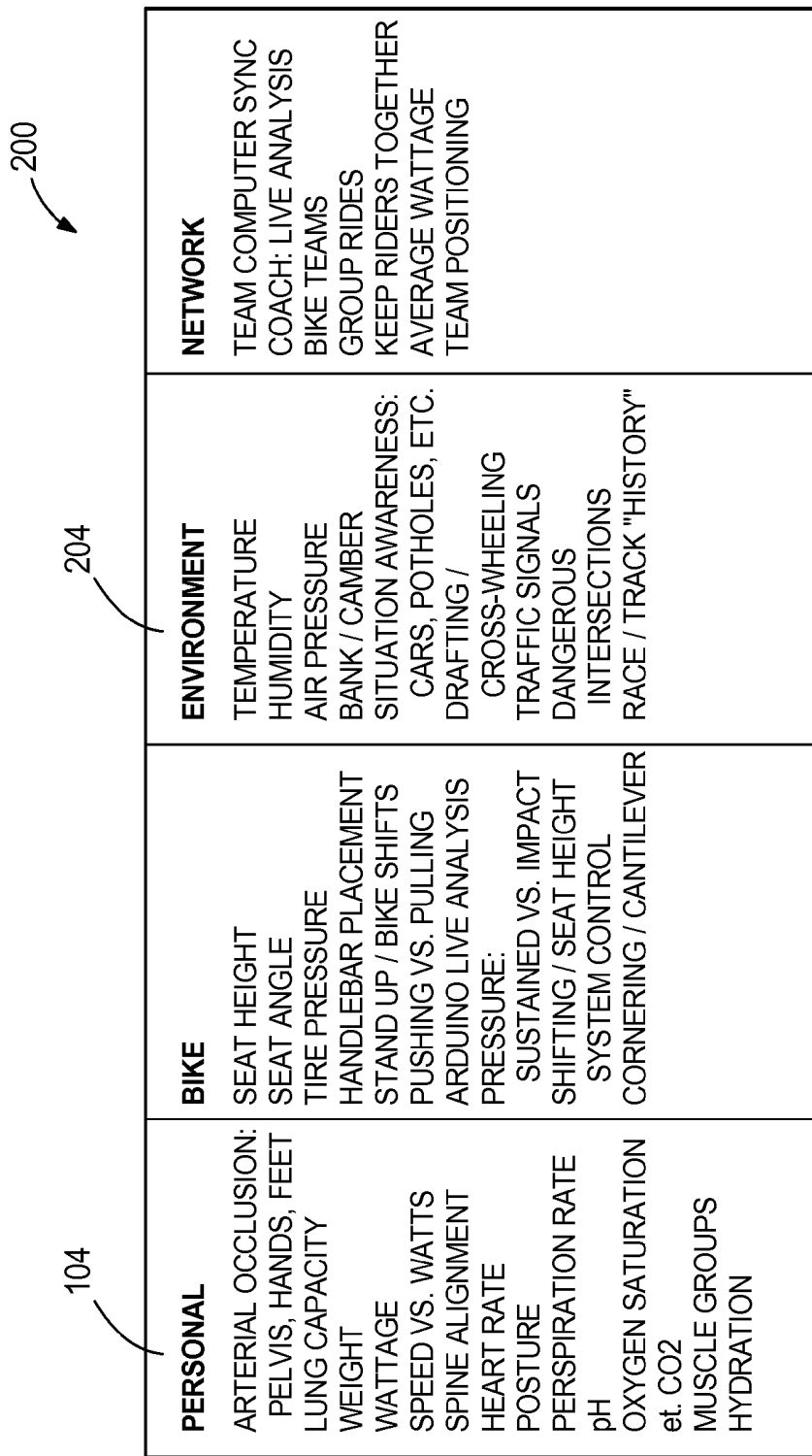


FIG. 10

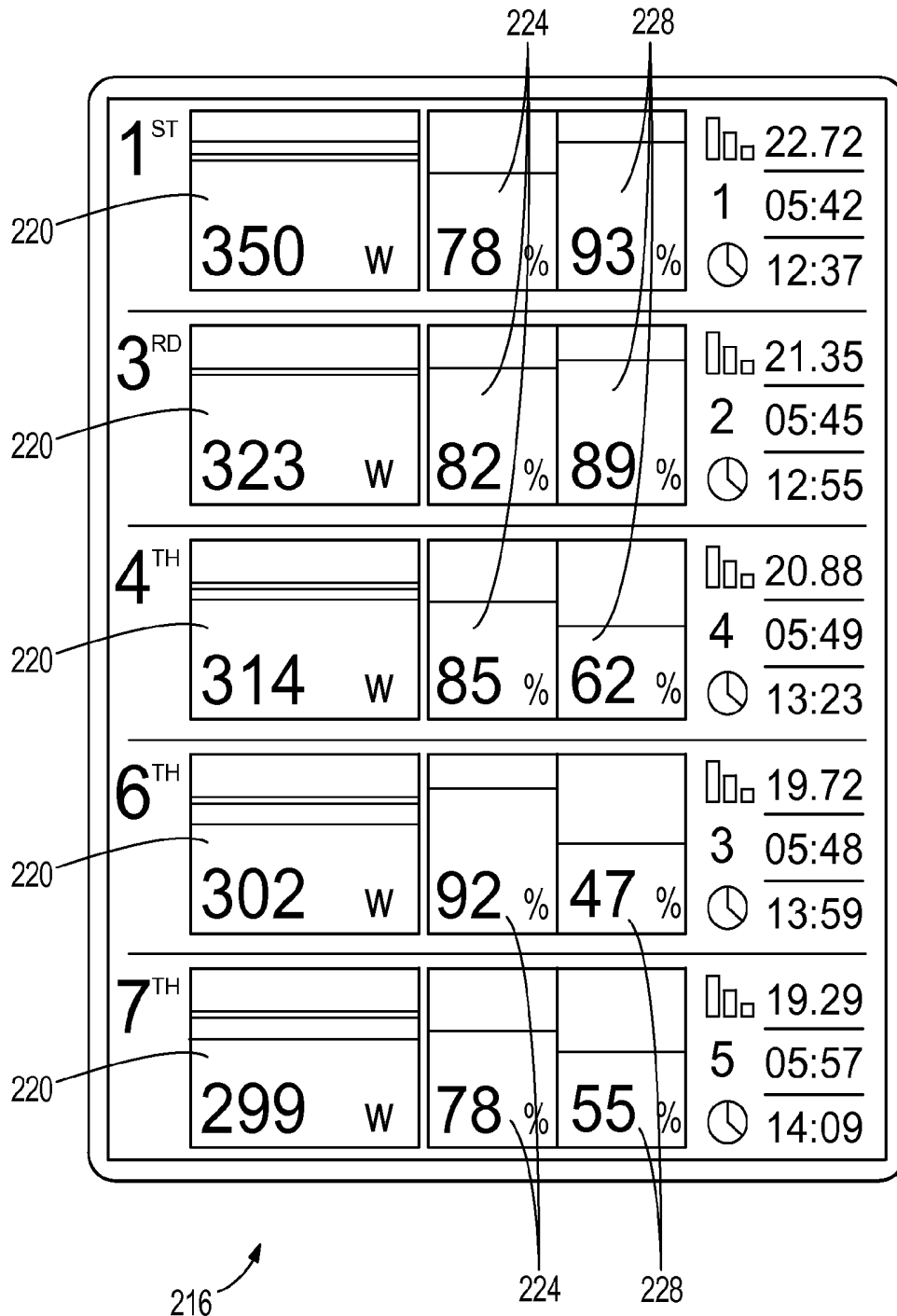


FIG. 11

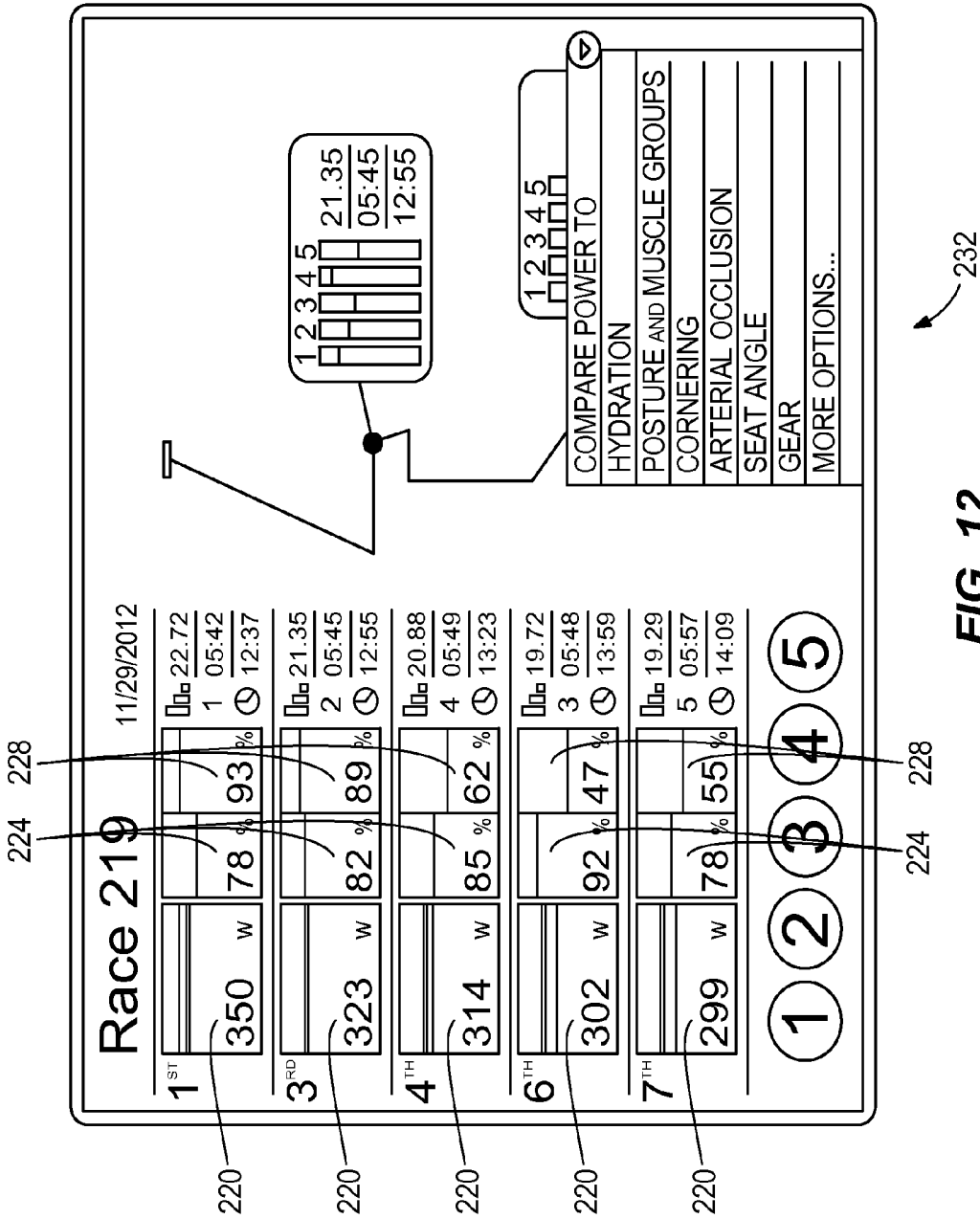


FIG. 12

MONITORING A PHYSIOLOGICAL PARAMETER OF A CYCLIST

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Patent Application No. 61/764,696, filed on Feb. 14, 2013, the contents of which are fully incorporated herein by reference.

FIELD OF THE INVENTION

[0002] This invention relates generally to monitoring a physiological parameter during sports. More particularly, this invention relates to monitoring a physiological parameter during bicycle riding.

BACKGROUND OF THE INVENTION

[0003] During prolonged bicycle riding, for example during long distance rides or trail cycling, bicyclists commonly experience discomfort or sensory and motor impairment. Symptoms of the discomfort or impairment may include a genital numbness and/or paresthesia in the cyclist's forearms, hands, fingers, and feet. These symptoms may persist anywhere from several days to months, and may potentially result in erectile dysfunction and long-term nerve damage. One reason for these symptoms is the fact that a cyclist engages the bicycle seat, handlebar, and the pedals during bicycle riding, and exerts significant pressure or force on these portions of the bicycle. In turn, the force that the cyclist exerts on the portions of the bicycle is matched by a corresponding force exerted by these portions on the cyclist. When the corresponding force is concentrated on particular regions of the cyclist, discomfort or impairment may occur, which may adversely affect the performance of the cyclist. Thus, there has developed a need to mitigate discomfort or sensory and motor impairment during prolonged bicycle riding to improve the performance of the cyclist.

SUMMARY OF THE INVENTION

[0004] The inventors have discovered that discomfort or sensory and motor impairment can be mitigated during prolonged bicycle riding by monitoring a physiological parameter with a sensor fixedly coupled to a garment worn by the cyclist.

[0005] Accordingly, in an embodiment, this invention is a system for monitoring a physiological parameter of a cyclist, comprising a garment, a sensor, and a signal processor. The garment is configured to be worn by the cyclist. The sensor is fixedly coupled to the garment and configured to measure a signal representative of the physiological parameter during pedaling. The signal processor is operatively coupled to the sensor and configured to determine a diagnosis based on the measured signal. An alert is generated in response to the diagnosis substantially in real time.

[0006] In another embodiment, this invention is a method of monitoring a physiological parameter of a cyclist, comprising measuring a signal representative of the physiological parameter during pedaling. The measured signal is processed with a signal processor to determine a diagnosis. An alert is generated in response to the diagnosis substantially in real time.

[0007] Other aspects of the invention will become apparent by consideration of the detailed description and accompanying drawings.

BRIEF DESCRIPTION OF THE FIGURES

[0008] FIG. 1. Schematic illustration of a system according to one embodiment of the invention, including a sensor, a signal processor, and a display device.

[0009] FIG. 2. Plan view of the sensor of FIG. 1 contacting a perineum region of a cyclist.

[0010] FIG. 3. Plan view of the sensor of FIG. 1 contacting a foot of a cyclist.

[0011] FIG. 4. Plan view of the sensor of FIG. 1 contacting a hand of a cyclist.

[0012] FIG. 5. Side view of the sensor of FIG. 1 contacting a forearm of a cyclist.

[0013] FIG. 6. Perspective view of the sensor of FIG. 1 contacting a torso of a cyclist.

[0014] FIG. 7. Perspective view of the display device of FIG. 1 coupled to a handlebar of a bicycle.

[0015] FIG. 8. Plan view of the display device of FIG. 1, illustrating a diagnostics display.

[0016] FIG. 9. Plan view similar to FIG. 8, illustrating the display device generating an alert.

[0017] FIG. 10. Schematic illustration of a system according to an alternate embodiment of the invention, including a sensor, a signal processor, and a display device.

[0018] FIG. 11. Plan view of the display device of FIG. 10, illustrating a diagnostics display in comparison with a network of cyclists.

[0019] FIG. 12. Plan view similar to FIG. 11, illustrating the display device generating a diagnostics display of various physiological parameters.

DETAILED DESCRIPTION

[0020] Described herein is a system for monitoring a physiological parameter of a cyclist, and methods of using the system. The system comprises a garment, a sensor, and a signal processor. The garment includes a fabric defining an inner surface contacting the cyclist when the garment is worn by the cyclist, and an outer surface opposite the inner surface. The sensor is fixedly coupled to the inner surface and configured to measure a signal representative of the physiological parameter during pedaling. The signal processor is operatively coupled to the sensor and configured to determine a diagnosis based on the measured signal. An alert is generated in response to the diagnosis substantially in real time.

1. Definitions

[0021] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting. As used in the specification and the appended claims, the singular forms "a," "and" and "the" include plural references unless the context clearly dictates otherwise.

[0022] For the recitation of numeric ranges herein, each intervening number there between with the same degree of precision is explicitly contemplated. For example, for the range of 6-9, the numbers 7 and 8 are contemplated in addition to 6 and 9, and for the range 6.0-7.0, the numbers 6.0, 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, and 7.0 are explicitly contemplated.

[0023] As used herein, "operatively coupled," "operably coupled," or "operably connected" refers to a configuration of elements such as device components, wherein an action or reaction of one element affects another element, but in a manner that preserves each element's functionality. Operatively coupled device components may be in contact, such as

in electrical contact by a signal-conducting wire between a sensor and a microcontroller containing a microprocessor. Alternatively, operatively coupled components may be coupled by one or more intervening components. In another alternative, operatively coupled components may not be physically coupled, but may be wirelessly coupled such that a signal is output from one component and wirelessly received by a second component.

[0024] When a group of substituents is disclosed herein, it is understood that all individual members of that group and all subgroups, are disclosed separately. When a Markush group or other grouping is used herein, all individual members of the group and all combinations and subcombinations possible of the group are intended to be individually included in the disclosure.

[0025] Every formulation or combination of components described or exemplified herein can be used to practice the invention, unless otherwise stated.

[0026] All patents and publications mentioned in the specification are indicative of the levels of skill of those skilled in the art to which the invention pertains. References cited herein are incorporated by reference herein in their entirety to indicate the state of the art as of their publication or filing date and it is intended that this information can be employed herein, if needed, to exclude specific embodiments that are in the prior art.

[0027] As used herein, “comprising” is synonymous with “including,” “containing,” or “characterized by,” and is inclusive or open-ended and does not exclude additional, unrecited elements or method steps. As used herein, “consisting of” excludes any element, step, or ingredient not specified in the claim element. As used herein, “consisting essentially of” does not exclude materials or steps that do not materially affect the basic and novel characteristics of the claim. In each instance herein any of the terms “comprising,” “consisting essentially of” and “consisting of” may be replaced with either of the other two terms. The invention illustratively described herein suitably may be practiced in the absence of any element or elements, limitation or limitations which is not specifically disclosed herein.

[0028] As used herein, “perineum region” refers to an area between the pubic symphysis and the coccyx and is used to refer to both the surface region and underlying structure such as blood vessels, including blood vessels that supply blood to the penis in males. In particular, it is that region that is generally supported by a conventional bicycle seat.

[0029] As used herein, “perineal artery occlusion pressure” or “perineal artery occlusion force” refers to the pressure or force at which blood flow in the artery stops. For example, perineal artery occlusion force could be about 10 N on each of the right and left branch of perineal artery depending on the subject.

2. System for Monitoring a Physiological Parameter of a Cyclist

[0030] Turning now to the drawings, FIG. 1 shows a system 100 according to one embodiment of the invention, including a plurality of sensors or personal sensors 104, a signal processor 108, and a display device 112. The system 100 may be used by a cyclist C (not shown in FIG. 1; see FIGS. 2-6) during riding a bicycle B (not shown in FIG. 1; see FIG. 5), which may be a regular bicycle such as racing bike, road bike, mountain bike or a hybrid. Alternatively, the system 100 may be used in relation to bike fitting or testing with a stationary or

simulated bicycle, or even simply a post optionally having pedals to support the user's feet.

[0031] In the illustrated embodiment, the sensors 104 include force sensors, respiratory rate sensors, and heart rate sensors. As explained below, each sensor 104 is coupled to a garment 116 (not shown in FIG. 1; see FIGS. 2-6) and configured to measure a signal representative of a physiological parameter during pedaling. In some embodiments, the sensors 104 may be configured to measure signals representative of physiological parameters comprising at least one of arterial occlusion force, lung capacity, weight, wattage output, spine alignment, posture, respiratory rate, perspiration rate, heart rate, muscle group use, and hydration. In other embodiments, the sensors 104 may be configured to measure signals representative of other physiological parameters. Any force or pressure sensor known in the art may be used so long as the sensor is capable of reliably measuring a signal representative of a physiological parameter during the bicycle exercise. The sensors 104 may measure pedaling cadence, example. In some embodiments, force is measured and reported, while in other embodiments, pressure is calculated by the formula $P=F/A$, where P is pressure, F is force, and A is the area (e.g., area of a sensor over which the force F is applied). One example of a suitable sensor is a Flexiforce® force sensor from Tekscan (South Boston, Mass.) (see, e.g., U.S. Pat. No. 6,272,936). Any sensor, however, that is thin so as to provide non-intrusive measurement and capable of reliable positioning to the garment 116 may be used. The sensor may be re-positioned on the garment so as to appropriately measure the desired physiological parameter. This re-positioning may be accomplished via adjustable straps, for example, that move the sensors to a desired location on the garment. Upon re-positioning, the sensors may be fixedly coupled to the garment. In an aspect, the sensor 104 measures the force over area that is circular having a diameter that is less than or equal to 1 cm, 0.8 cm, 0.5 cm or about 0.95 cm.

[0032] Although FIG. 1 illustrates the system 100 as including three types of sensors 104, other embodiments may utilize other types or numbers of sensors 104. The system 100 and methods disclosed herein can use any number of sensors 104 as desired. However, as the number of sensors 104 increases, redundant and unnecessary measurements may be obtained. Accordingly, in an aspect, the number of sensors 104 may be no more than 20, no more than 19, no more than 18, no more than 17, no more than 16, no more than 15, no more than 14, no more than 13, no more than 12, no more than 11, no more than 10, no more than 9, no more than 8, no more than 7, no more than 6, no more than 5, no more than 4, no more than 3, no more than 2, or no more than 1.

[0033] In some embodiments, each sensor 104 may be configured to measure a respective signal at predetermined intervals. In an aspect, the data acquisition frequency may be about 20 Hz, from about 10 Hz to about 30 Hz, or selected based on the cadence of the rider, so that data acquisition occurs at least twice during the range of pedal motion. Under different ride conditions and users, cadence may range from 50 rpm to about 120 rpm. In an aspect, the acquisition may be periodically turned on and then turned off to ensure data is sampled over the entire ride.

[0034] In some embodiments, a data storage 120 may be operatively coupled to the sensor 104 and configured to record the measured signal. The data storage 120 may be used to store the measured signal locally or to a remote location, for storage and later analysis. In some embodiments, the data

storage **120** may include an SD card, a MicroSD card, and a universal serial bus (USB) device. In other embodiments, however, the system **100** may not include the data storage **120**.

[0035] The signal processor **108** is operatively coupled to the sensors **104**, and configured to determine a diagnosis based on the measured signal. In some embodiments, the signal processor **108** may include a self-contained microcontroller (and associated components such as power supply, pressure sensors, wiring) capable of being used in the field, such as during a non-stationary bicycle ride outdoors. In contrast, a microcontroller that is not self-contained may not be portable for real-time use and remain in the testing facility where it is hooked into a computer or other data-recording/observing device. In some embodiments, the signal processor **108** may include a Rabbit® 4000 microprocessor (see, e.g., <http://www.digi.com/products/wireless-wired-embedded-solutions/software-microprocessors-accessories/systems-on-chip/rabbit4000#overview>) that receives analog input from the sensors **104** and converts them into digital signals to be stored in its memory. Other optional components may be included in the microcontroller as desired, including switches and LED to indicate sensor and/or recording status. For example, operational amplifiers may be included such as National Semiconductor LM324 low power quad operational simplifiers.

[0036] In some embodiments, the system **100** includes a signal transmission network operatively coupled to the sensors **104** and signal processor **108**. The signal transmission network may be configured to transmit the signal according to at least one of a wired interface and ANT+, Bluetooth, Zig-Bee, WiFi, cellular access technologies (e.g., 2G, 3G, Universal mobile Telecommunications Systems (UMTS), GSM, Long Term Evolution (LTE), or more), etc.

[0037] Referring also to FIG. 2, the system **100** includes the garment **116** (e.g., trouser including strips for embedding the sensors **104**) configured to be worn by the cyclist C. The illustrated sensors **104** are fixedly coupled to the garment **116**. In the illustrated embodiment, the sensors **104** are sewn or stitched to the garment **116** and substantially surrounded thereby or embedded therein. In other embodiments, however, the sensor **104** may be fixedly coupled to the garment **116** via other suitable mechanisms. For example, the sensor **104** may be fixedly coupled to the garment **116** by adhesive tape, a bandage, or any fabric hook and loop fastener, such as a Velcro fastener. The sensors **104** may be pressure sensors, such as a pressure transducer whose voltage output is related to the force exerted on a force-sensing element such as a resistor whose resistance changes depending on the applied force.

[0038] In the illustrated embodiment, the sensors **104** are fixedly coupled to a crotch portion of the garment **116**, positioned adjacent a perineum region of the cyclist C when the garment **116** is worn by the cyclist C. The illustrated sensors **104** are configured to measure a signal representative of the perineal arterial occlusion pressure or force. In the illustrated embodiment, four sensors **104** are fixedly coupled to the crotch portion of the garment **116**, at distal and proximal positions of the left and right internal pudendal arteries respectively. In other embodiments, six sensors **104** may be fixedly coupled to the crotch portion of the garment **116**, at distal, mid, and proximal positions of the left and right internal pudendal arteries. In still other embodiments, other numbers of sensors **104** may be fixedly coupled to the crotch

portion of the garment **116** so as to suitably monitor a dynamic pressure or force adjacent a desired location while the cyclist C is pedaling or moving.

[0039] In an embodiment, the signal processor **108** determines a diagnosis based on the measured perineal arterial pressure or force and a user-selected perineal arterial occlusion pressure or force level. In an aspect, the user-selected occlusion pressure or force level is the perineal arterial occlusion pressure, force, or a fraction thereof, such as greater than or equal to 80%, greater than or equal to 90%, or selected from a range that is greater than or equal to 80% and less than or equal to 100% of the perineal arterial occlusion pressure or force.

[0040] Referring also to FIG. 3, the illustrated sensors **104** are fixedly coupled to a sole portion of the garment **116** (e.g., shoe), positioned adjacent a foot of the cyclist C. In the illustrated embodiment, the sensors **104** are positioned adjacent a center of the foot and an outermost point of the foot when the garment **116** is worn by the cyclist C. In other embodiments, the sensors **104** may be fixedly coupled to the garment **116** so as to suitably monitor a dynamic pressure or force adjacent the toes, forefoot, instep, arch, or heel of the cyclist C while the cyclist C is moving. In still other embodiments, the sensors **104** may be configured to measure a signal representative of the weight of the cyclist C when the garment **116** is worn by the cyclist C.

[0041] Referring also to FIG. 4, the illustrated sensors **104** are fixedly coupled to a palm portion of the garment **116** (e.g., glove), positioned adjacent a hand of the cyclist C when the garment **116** is worn by the cyclist C. In the illustrated embodiment, the sensors **104** are positioned adjacent a centerline of the hand when the garment **116** is worn by the cyclist C. In other embodiments, the sensors **104** may be positioned adjacent a radial artery or any other peripheral arteries in the hand of the cyclist C. In further embodiments, the sensors **104** may be fixedly coupled to the garment **116** so as to suitably monitor a dynamic pressure or force adjacent the hypothenar eminence, ulnar nerve, or palmar metacarpal arteries of the cyclist C while the cyclist C is pedaling or moving. In still other embodiments, the sensors **104** may be configured to measure a signal representative of oxygen saturation and positioned adjacent a fingertip of the cyclist C when the garment **116** is worn by the cyclist C.

[0042] Referring also to FIG. 5, the illustrated sensor **104** is fixedly coupled to a forearm portion of the garment **116**, positioned adjacent a forearm F of the cyclist C when the garment **116** is worn by the cyclist C. In other embodiments, the sensors **104** may be fixedly coupled to the garment **116** so as to suitably monitor a dynamic pressure or force adjacent the radial artery, an ulnar artery, or any other peripheral arteries in the forearm of the cyclist C while the cyclist C is pedaling or moving.

[0043] Referring also to FIG. 6, the illustrated sensors **104** are fixedly coupled to a torso of the garment **116** (e.g. bib). In the illustrated embodiment, one sensor **104** is positioned adjacent a chest portion and four sensors **104** are positioned adjacent side rib portions of the cyclist C (two sensors **104** along each side). In other embodiments, other numbers of sensors **104** may be fixedly coupled to the torso of the garment **116** so as to suitably monitor a physiological parameter such as heart rate, respiratory rate, and lung capacity while the cyclist C is moving. In some embodiments, the garment **116** may include a fabric that stretches and recovers or resiliently returns from stretch in response to motion of the cyclist C.

The sensors **104** in this embodiment may include a strain gauge configured to measure the chest wall movement. In other embodiments, the sensors **104** may include a piezoelectric compression sensor or any other mechanical or electric sensors depending on the use requirements or preferences for the system **100**. Moreover, although the illustrated embodiment includes a plurality of sensors **104**, other embodiments may include a single sensor **104**.

[0044] Referring also to FIG. 7, the system **100** may include the display device **112** coupled to a handlebar H of the bicycle B (not shown; see FIG. 5). Also referring to FIGS. 8 and 9, the display device **112** may be operatively coupled to the signal processor **108** and configured to generate a diagnostics display **128** in response to the diagnosis substantially in real time. In the illustrated embodiment, the diagnostics display **128** comprises a listing of arterial pressure or force **132**, wattage output **136**, and hydration **140**. In other embodiments, the diagnostics display **128** may further comprise a listing of at least one of lung capacity, weight, spine alignment, posture, respiratory rate, perspiration rate, heart rate, and muscle group use. In still other embodiments, the diagnostics display **128** may further comprise a listing of other physiological parameters.

[0045] Referring also to FIG. 9, the display device **112** may generate an alert, alarm, or warning **144** substantially in real time in response to the diagnosis of the signal processor **108**. For example, when the signal processor **108** determines that the measured perineal arterial pressure or force meets or exceeds a fraction of the user-selected perineal arterial occlusion pressure or force level, the display device **112** may display the illustrated alert **144**. The display device **112** can thus provide a real-time warning so as to preempt potentially deleterious effects on the performance of the cyclist C. The actual cut-off values for generating the alert **144** may be assigned depending on the degree of risk tolerance in the particular setting.

[0046] FIG. 10 shows a system **200** according to an alternate embodiment of the invention. Like parts are identified using like reference numerals. In addition to the personal sensors **104**, the system **200** in this embodiment includes environmental sensors **204**. The environmental sensors **204** may be configured to measure signals representative of temperature, humidity, air pressure, bank/camber of the bicycle B, situation awareness (e.g., cars, potholes, etc.), drafting/cross-wheeling of the bicycle B, traffic signals, dangerous intersections, and race/track history. The signal processor **108** is operatively coupled to the personal sensors **104** and the environmental sensors **204**, and configured to determine a diagnosis based on the measured signals.

[0047] An alert, alarm, or warning is generated substantially in real time in response to the diagnosis of the signal processor **108**. The alert may be in the form of automatically adjusting portions of the bicycle B. In some embodiments, the one or more of the following may be automatically adjusted substantially in real time in response to the diagnosis of the signal processor **108**: seat height, seat angle, tire pressure, and handlebar placement. In other embodiments, gears of the bicycle B may be shifted in response to the diagnosis of the signal processor **108**. Alternatively, the alert may prompt the user to manually adjust portions of the bicycle. The alert may preempt potentially deleterious effects on the performance of the cyclist C. In some embodiments, the one or more of the following may be manually adjusted in response to the diagnosis of the signal processor **108**: seat height, seat angle, tire

pressure, and handlebar placement. In other embodiments, gears of the bicycle B may be manually shifted in response to the diagnosis of the signal processor **108**.

[0048] Referring also to FIG. 11, the signal processor **108** may be configured to generate a comparison of the measured signal with a network of cyclists substantially in real time, and the display device **112** may generate a diagnostics display **216** listing physiological parameters in comparison with the network of cyclists. In the illustrated embodiment, the diagnostics display **216** comprises a listing of wattage output **220**, hydration **224**, and arterial pressure or force **228**, all in comparison with the network of cyclists. In other embodiments, the diagnostics display **216** may comprise a listing of at least one of arterial pressure or force, lung capacity, weight, wattage output, spine alignment, posture, respiratory rate, perspiration rate, heart rate, muscle group use, pedaling cadence, and hydration, all in comparison with the network of cyclists. In still other embodiments, the diagnostics display **216** may comprise a listing of at least one environmental parameter, such as temperature, humidity, air pressure, bank/camber of the bicycle B, traffic signals, dangerous intersections, and race/track history. Referring also to FIG. 12, the display device **216** may generate a diagnostics display **232** of various physiological parameters such as wattage output **220**, hydration **224**, and arterial pressure or force **228**, all in comparison with the network of cyclists in a group race.

3. Method of Monitoring a Physiological Parameter of a Cyclist

[0049] The present disclosure is also directed to a method of using the systems **100**, **200** to monitor a physiological parameter of the cyclist C. The method comprises measuring a signal representative of the physiological parameter during pedaling. The physiological parameters may comprise at least one of arterial pressure or force, lung capacity, weight, wattage output, spine alignment, posture, respiratory rate, perspiration rate, heart rate, muscle group use, pedaling cadence, and hydration. In some embodiments, the signal is measured from at least one of a crotch portion, a sole portion, a palm portion, a forearm portion, and a torso rib portion of the cyclist C. In other embodiments, the signal may be measured from any other desired locations suitable to monitor a dynamic pressure or force while the cyclist C is pedaling or moving. In some embodiments, the signal is measured at predetermined intervals.

[0050] The measured signal is processed with the signal processor **108** to determine a diagnosis. The alert is generated substantially in real time in response to the diagnosis. In some embodiments, the alert may comprise the diagnostics display **128**, **216**, **232** listing at least one physiological parameter, such as arterial pressure or force, lung capacity, weight, wattage output, spine alignment, posture, respiratory rate, perspiration rate, heart rate, muscle group use, pedaling cadence, and hydration. In further embodiments, the alert may comprise the diagnostics display **216**, **232** listing at least one environmental parameter, such as temperature, humidity, air pressure, bank/camber of the bicycle B, traffic signals, dangerous intersections, and race/track history. In some embodiments, a comparison of the measured signal with a network of cyclists may be generated substantially in real time. The diagnostics display may be positioned anywhere. For example, the diagnostics display may be in the form of a wrist watch, a computer, a mobile phone, or a television.

[0051] The foregoing has been provided for illustrative purposes only and is not intended to limit the scope of the invention as set forth in the claims.

What is claimed is:

1. A system for monitoring a physiological parameter of a cyclist, comprising:

- a garment configured to be worn by the cyclist;
- a sensor fixedly coupled to the garment and configured to measure a signal representative of the physiological parameter; and
- a signal processor operatively coupled to the sensor, wherein the signal processor is configured to determine a diagnosis based on the measured signal and to generate an alert substantially in real time in response to the diagnosis.

2. The system of claim 1, wherein the physiological parameter comprises at least one of arterial force, lung capacity, weight, wattage output, spine alignment, posture, respiratory rate, perspiration rate, heart rate, muscle group use, and hydration.

3. The system of claim 1 further comprising a data storage operatively coupled to the sensor and configured to record the signal.

4. The system of claim 1 further comprising a display device operatively coupled to the signal processor and configured to generate a diagnostics display in response to the diagnosis substantially in real time.

5. The system of claim 4, wherein the display device is coupled to a handlebar of a bicycle.

6. The system of claim 4, wherein the diagnostics display comprises a listing of at least one of arterial force, lung capacity, weight, wattage output, spine alignment, posture, respiratory rate, perspiration rate, heart rate, muscle group use, and hydration.

7. The system of claim 1, wherein the sensor is configured to measure the signal at predetermined intervals.

8. The system of claim 1 further comprising a signal transmission network operatively coupled to the sensor and the signal processor and configured to transmit the signal according to at least one of a wired interface and a wireless interface.

9. The system of claim 8, wherein the wireless interface includes at least one of ANT+, Bluetooth, ZigBee, WiFi, and cellular access technologies.

10. The system of claim 1, wherein the sensor is fixedly coupled to a crotch portion of the garment, positioned adjacent a perineum region of the cyclist when the garment is worn by the cyclist.

11. The system of claim 10, wherein the sensor is configured to measure a signal representative of a perineal arterial force.

12. The system of claim 1, wherein the sensor is fixedly coupled to a sole portion of the garment, positioned adjacent at least one of a center of a foot and an outermost point of the foot when the garment is worn by the cyclist.

13. The system of claim 1, wherein the sensor is fixedly coupled to a palm portion of the garment, positioned adjacent at least one point along a centerline of a hand when the garment is worn by the cyclist.

14. The system of claim 1, wherein the sensor is fixedly coupled to at least a forearm portion, a chest portion, a back portion, and a side rib portion of the garment.

15. The system of claim 1, wherein the signal processor is configured to generate a comparison of the measured signal with a network of cyclists substantially in real time.

16. A method of monitoring a physiological parameter of a cyclist, comprising:

- measuring a signal representative of the physiological parameter; and

- processing the measured signal with a signal processor to determine a diagnosis; and

- generating an alert substantially in real time in response to the diagnosis.

17. The method of claim 16, wherein the signal is measured from at least one of a crotch portion, a sole portion, a palm portion, a forearm portion, and a torso portion of the cyclist.

18. The method of claim 16, wherein the signal is measured at predetermined intervals.

19. The method of claim 16, wherein the physiological parameter comprises at least one of arterial force, lung capacity, weight, wattage output, spine alignment, posture, respiratory rate, perspiration rate, heart rate, muscle group use, and hydration.

20. The method of claim 16, wherein the alert comprises a diagnostics display listing at least one of arterial force, lung capacity, weight, wattage output, spine alignment, posture, respiratory rate, perspiration rate, heart rate, muscle group use, and hydration.

21. The method of claim 16, further comprising generating a comparison of the measured signal with a network of cyclists substantially in real time.

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专利名称(译)	监测骑车人的生理参数		
公开(公告)号	US20150374311A1	公开(公告)日	2015-12-31
申请号	US14/767346	申请日	2014-02-14
申请(专利权)人(译)	伊利诺伊大学的董事会		
当前申请(专利权)人(译)	伊利诺伊大学的董事会		
[标]发明人	NIEDERBERGER CRAIG PFANNER PETER HOTALING JAMES CLARK MATTHEW GRAHAM ANDREW PARADISE MICHAEL SCOTT MICHAEL		
发明人	NIEDERBERGER, CRAIG PFANNER, PETER HOTALING, JAMES CLARK, MATTHEW GRAHAM, ANDREW PARADISE, MICHAEL SCOTT, MICHAEL		
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其他公开文献	US9833201		
外部链接	USPTO		

摘要(译)

本发明涉及一种用于监测骑车者的生理参数的系统，以及使用该系统的方法。该系统包括服装，传感器和信号处理器。该服装被配置为由骑车人穿着。传感器固定地连接到衣服并且配置成在踩踏过程中测量代表生理参数的信号。信号处理器可操作地耦合到传感器并且被配置为基于测量的信号确定诊断。基本上实时地响应诊断生成警报。

