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(54) **SHOELACE ADJUSTING DEVICE AND SHOE INCLUDING THE SAME**

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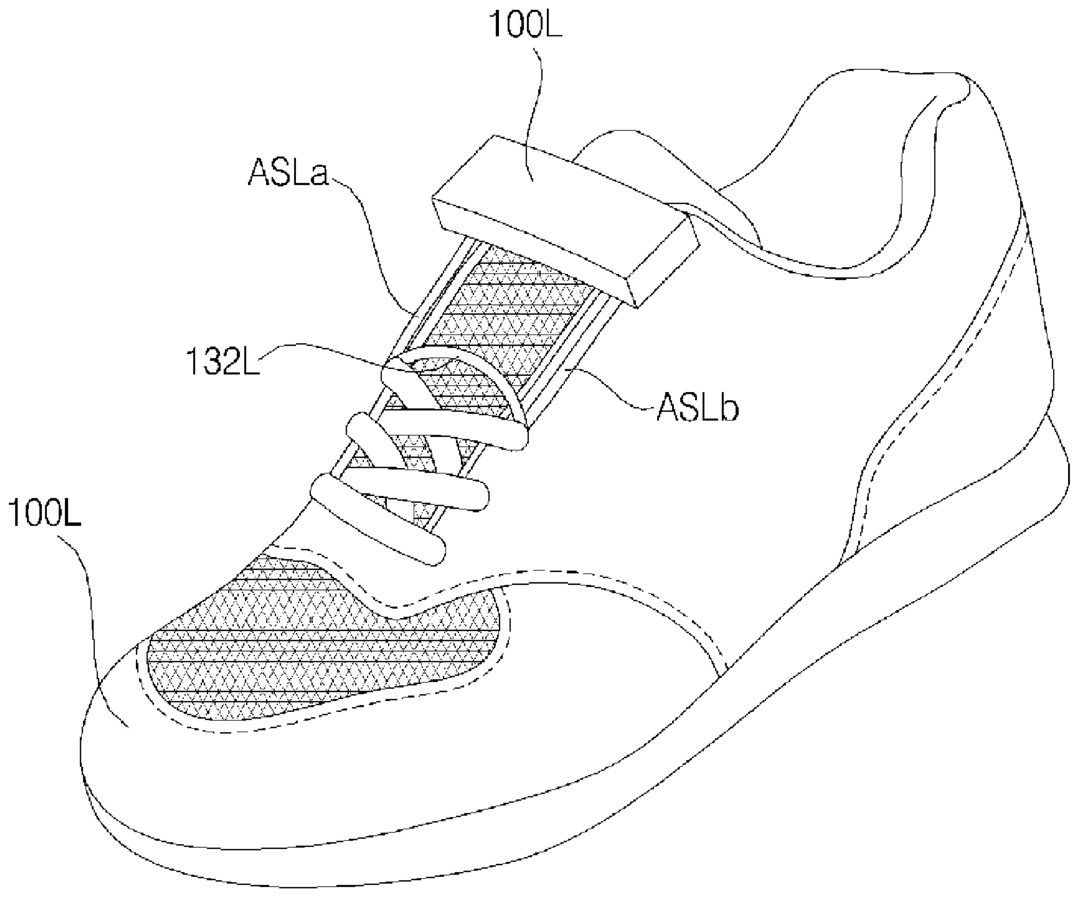
(52) **U.S. Cl.**

CPC ***A43C 11/165*** (2013.01); ***A61B 5/6807*** (2013.01); *A61B 2503/12* (2013.01); ***A61B 5/1038*** (2013.01); ***A43B 3/0005*** (2013.01)

(57) **ABSTRACT**

The present disclosure relates to a shoelace adjusting device and a shoe including the same. The shoelace adjusting device and the shoe including the same based on an embodiment of the present disclosure include a motor configured to operate to adjust at least one part of the shoelace, a sensor including a motion sensor, and a processor configured to determine whether the shoe is being used in a running state, a walking state, or a sitting state based on sensing information from the motion sensor and to change a level for tightening the shoelace based on the respective states. Accordingly, the tightness of the shoelace may be automatically adjusted based on the state of the user wearing the shoes.



(a)

FIG. 1

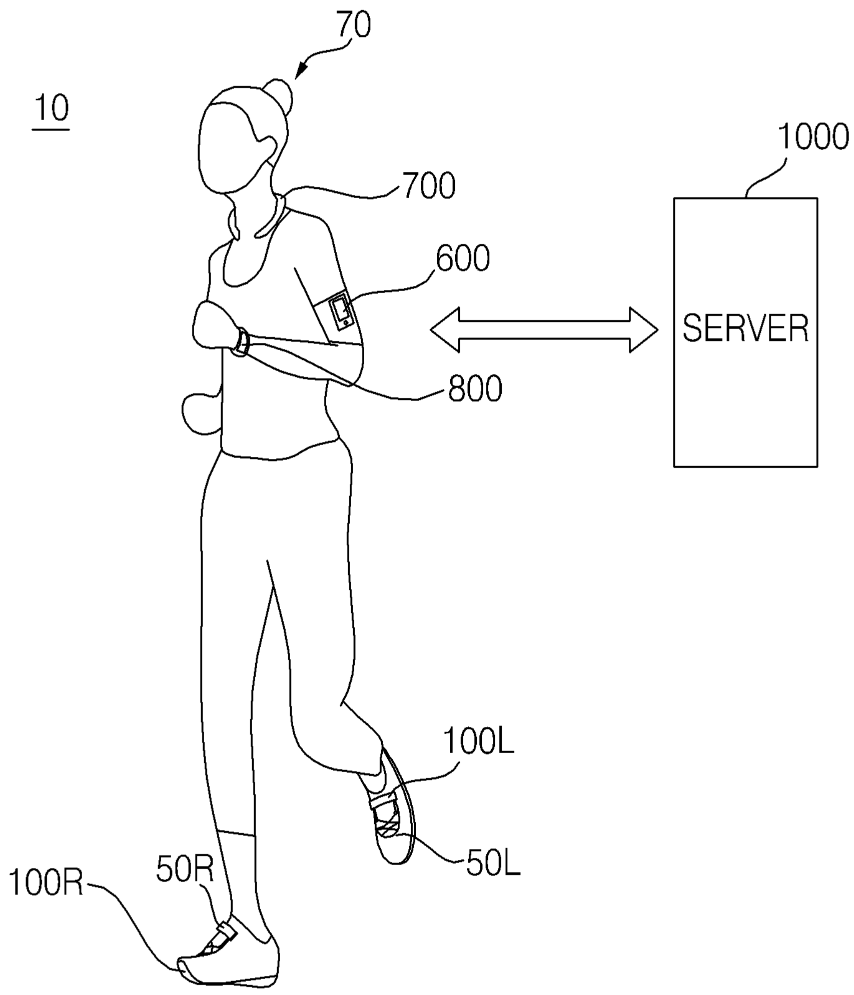


FIG. 2

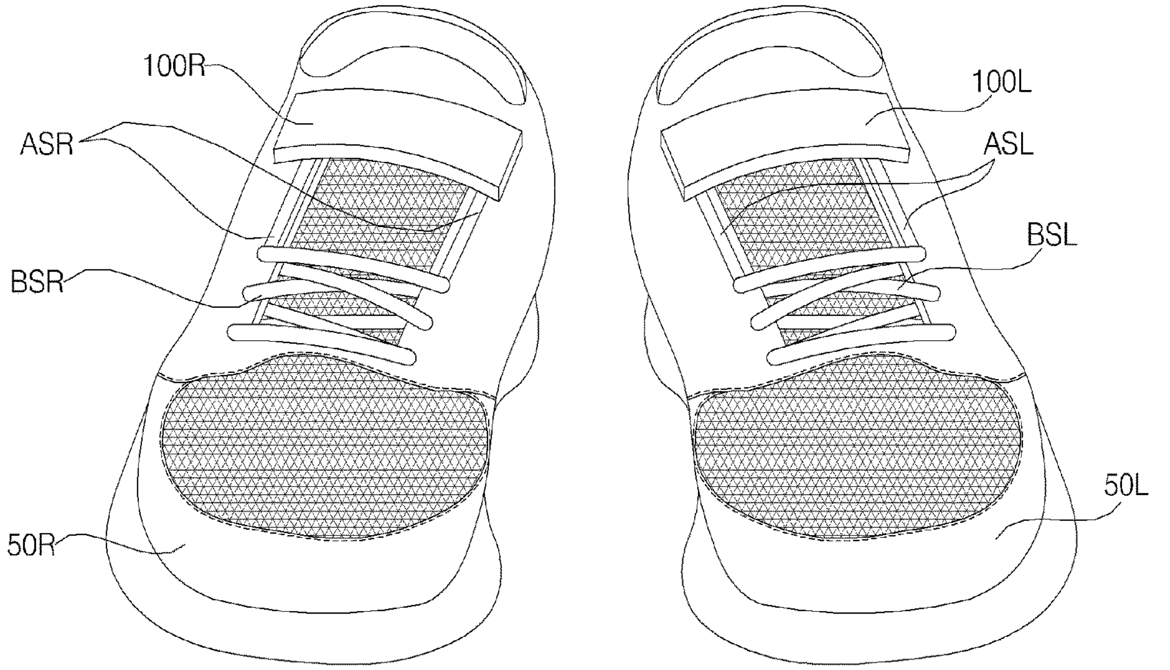


FIG. 3

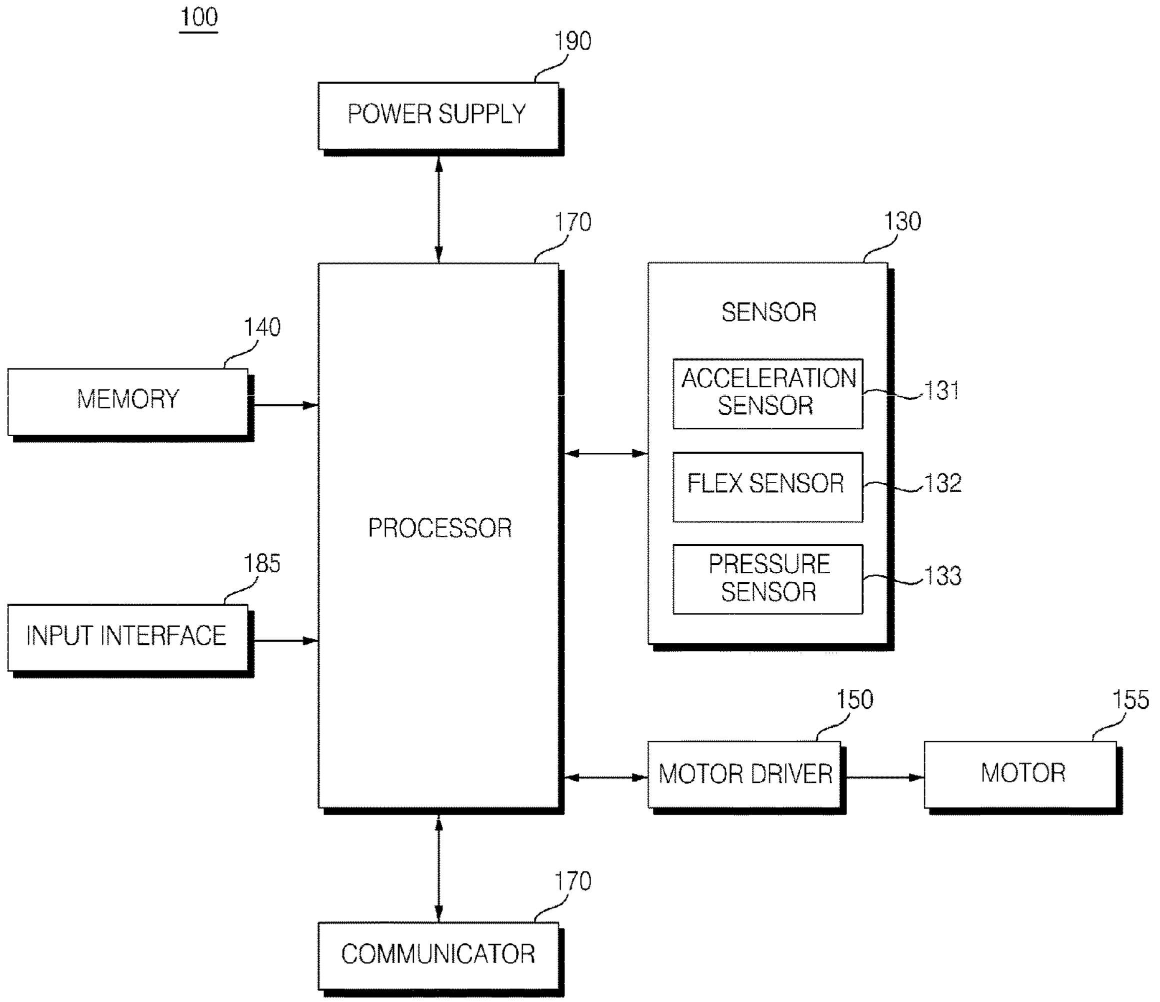

100
190
POWER SUPPLY
170
PROCESSOR
130
SENSOR
ACCELERATION SENSOR
131
FLEX SENSOR
132
PRESSURE SENSOR
133
140
MEMORY
185
INPUT INTERFACE
150
MOTOR DRIVER
155
MOTOR
170
COMMUNICATOR

FIG. 4

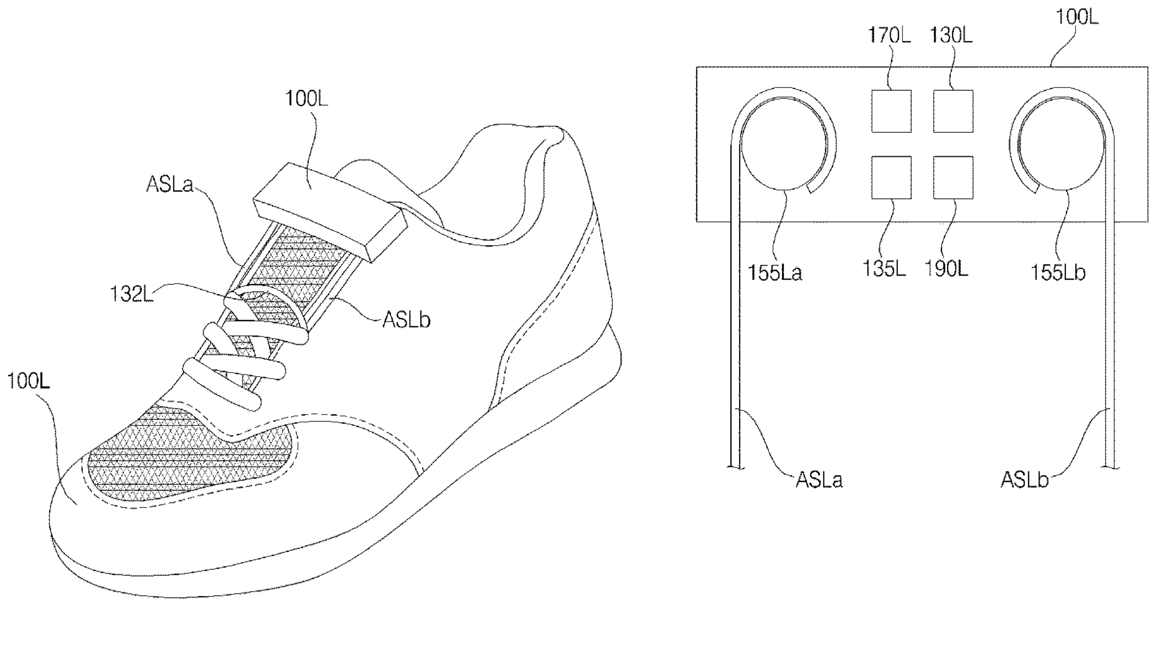

100L
ASLa
132L
ASLb
100L
(a)
100L
170L
130L
155La
135L
190L
155Lb
ASLa
ASLb
(b)

FIG. 5

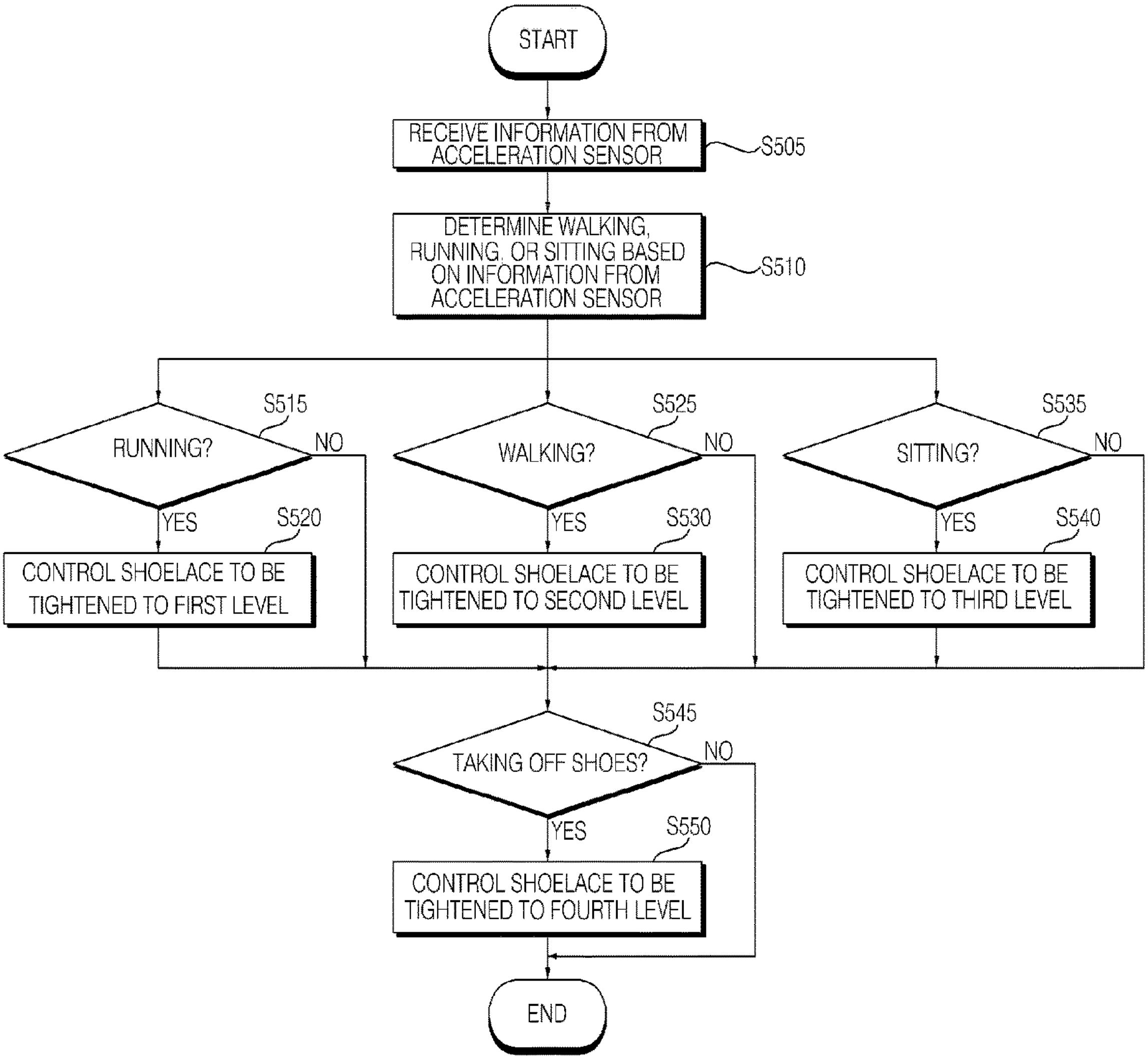

START
RECEIVE INFORMATION FROM ACCELERATION SENSOR
S505
DETERMINE WALKING, RUNNING, OR SITTING BASED ON INFORMATION FROM ACCELERATION SENSOR
S510
RUNNING?
S515
NO
YES
S520
CONTROL SHOELACE TO BE TIGHTENED TO FIRST LEVEL
WALKING?
S525
NO
YES
S530
CONTROL SHOELACE TO BE TIGHTENED TO SECOND LEVEL
SITTING?
S535
NO
YES
S540
CONTROL SHOELACE TO BE TIGHTENED TO THIRD LEVEL
TAKING OFF SHOES?
S545
NO
YES
S550
CONTROL SHOELACE TO BE TIGHTENED TO FOURTH LEVEL
END

FIG. 6

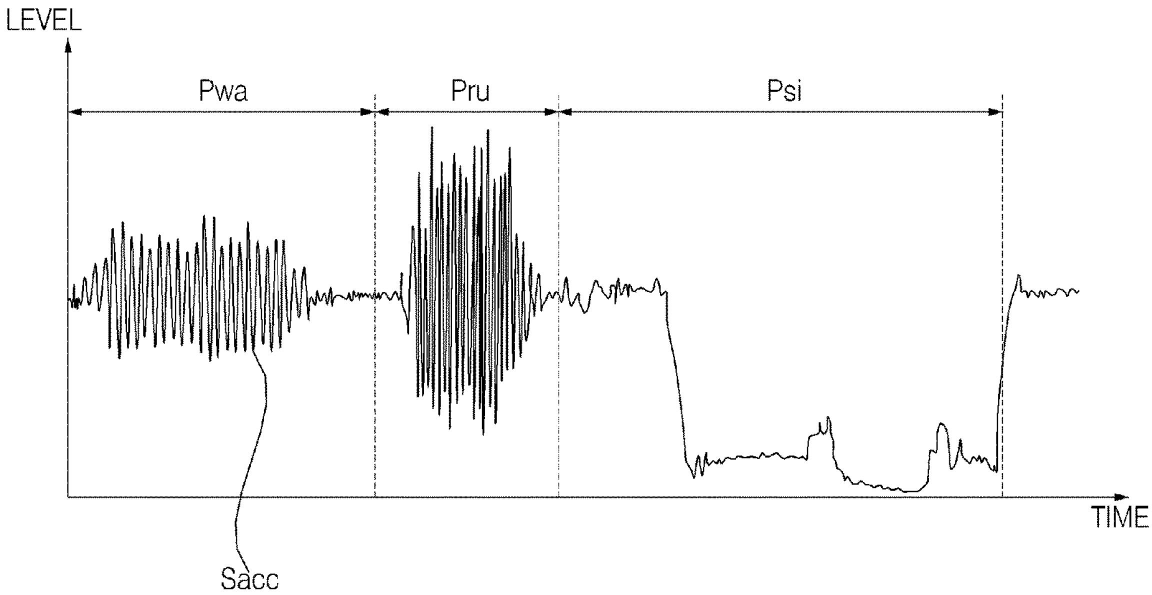
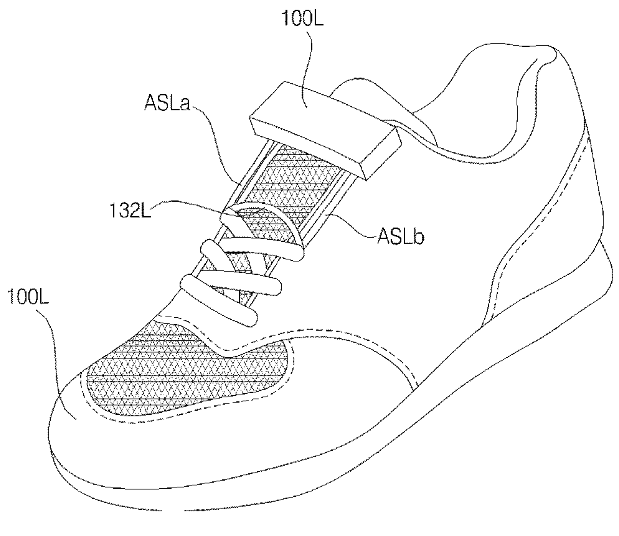
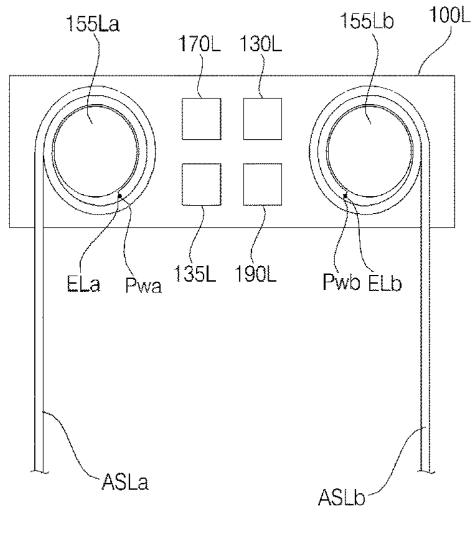


FIG. 7A

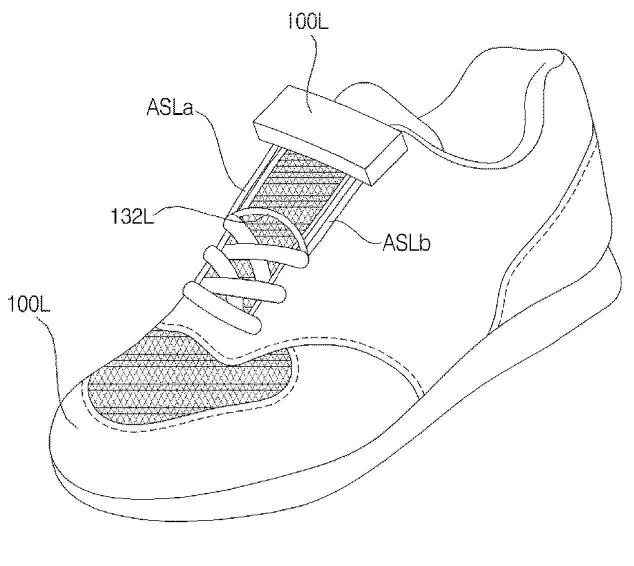

100L
ASLa
132L
ASLb
100L

(a)

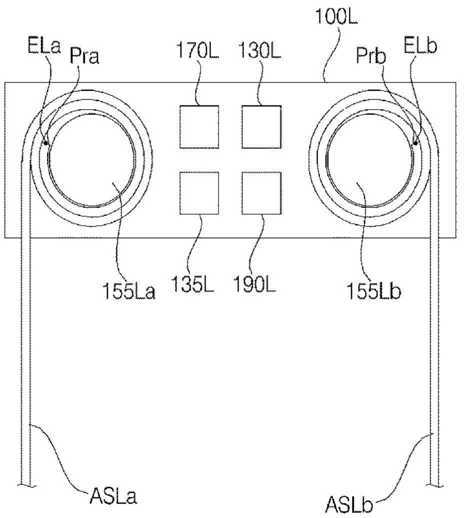

155La
170L
130L
155Lb
100L
ELa
Pwa
135L
190L
Pwb
ELb
ASLa
ASLb

(b)

FIG. 7B

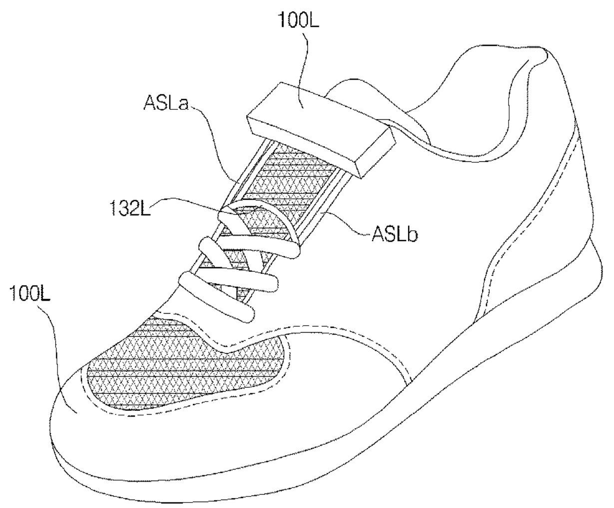

100L
ASLa
132L
ASLb
100L

(a)

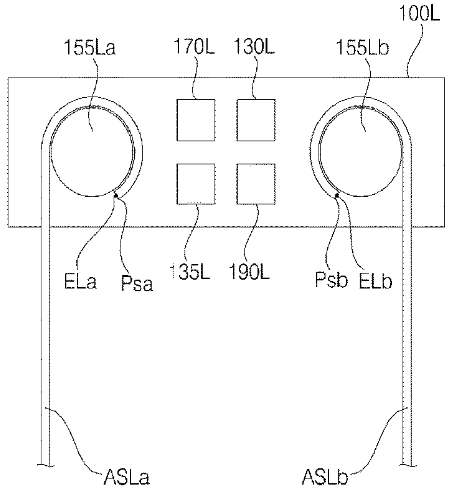

100L
ELa
Pra
170L
130L
Prb
ELb
155La
135L
190L
155Lb
ASLa
ASLb

(b)

FIG. 7C



(a)



(b)

FIG. 8

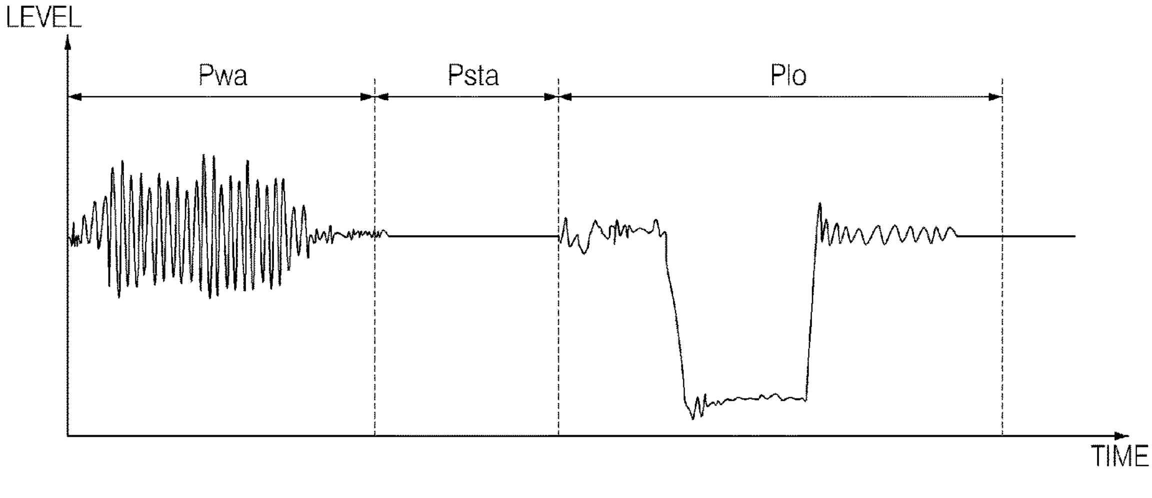
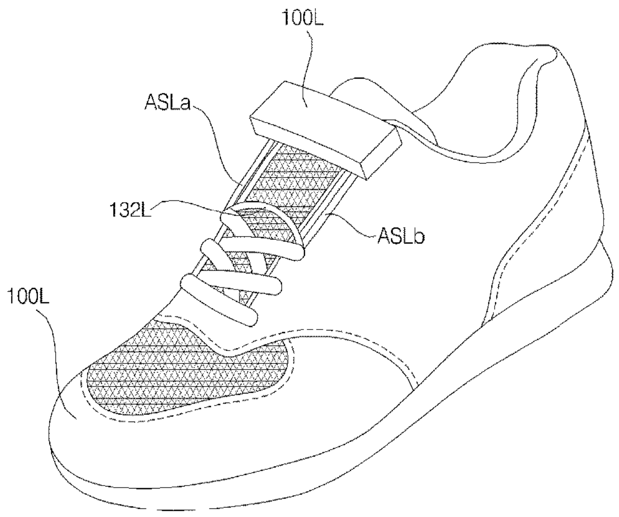
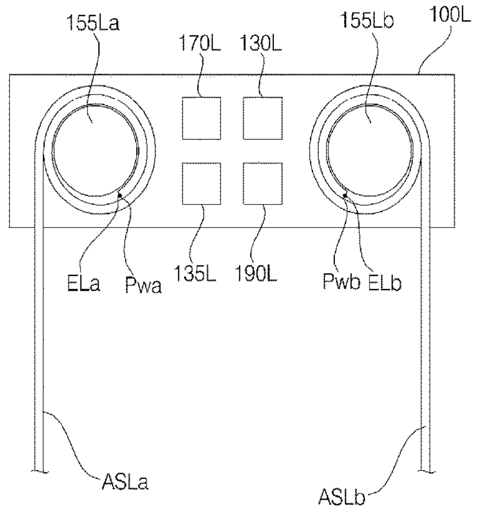


FIG. 9A

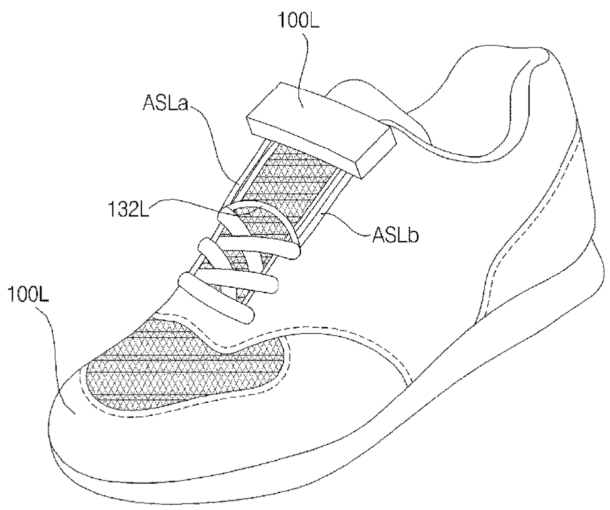

100L
ASLa
132L
ASLb
100L

(a)

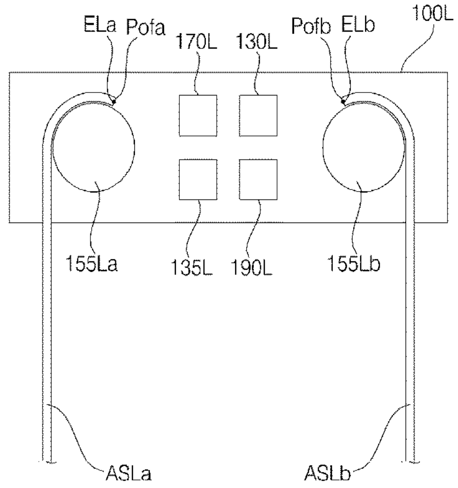

155La
170L
130L
155Lb
100L
ELa
Pwa
135L
190L
Pwb
ELb
ASLa
ASLb

(b)

FIG. 9B



(a)



(b)

FIG. 10

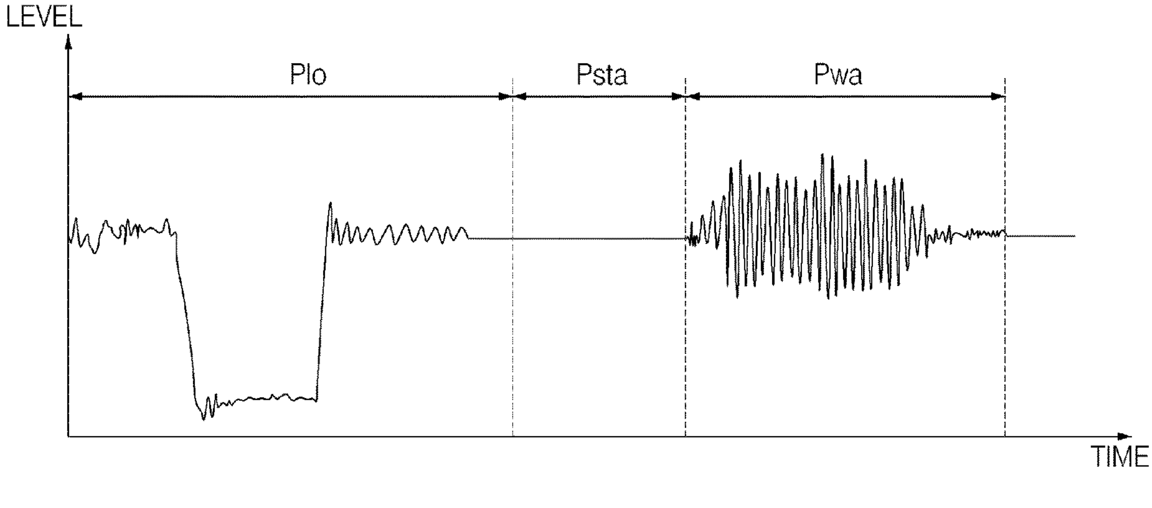
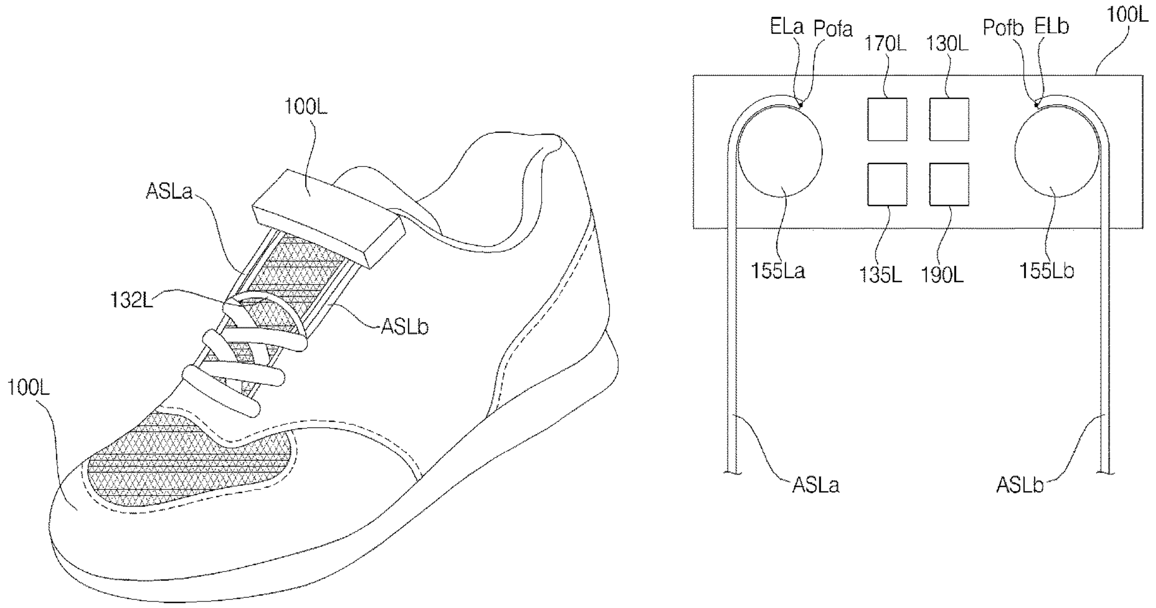


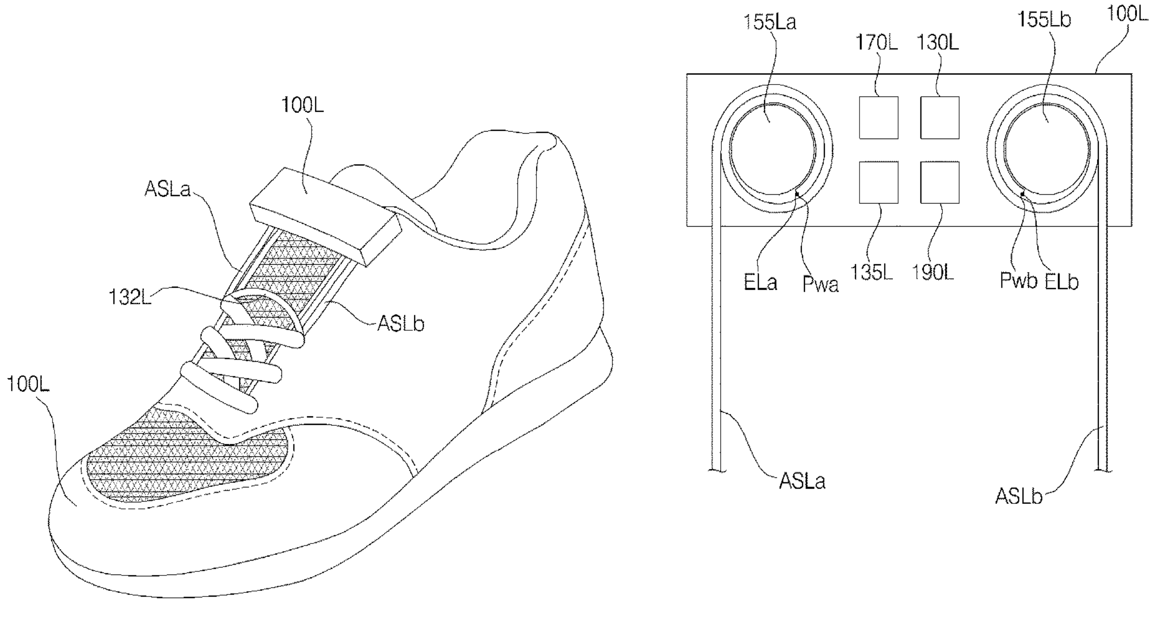
FIG. 11A


100L
ASLa
132L
ASLb
100L
ELa
Pofa
170L
130L
Pofb
ELb
100L
155La
135L
190L
155Lb
ASLa
ASLb

(a)

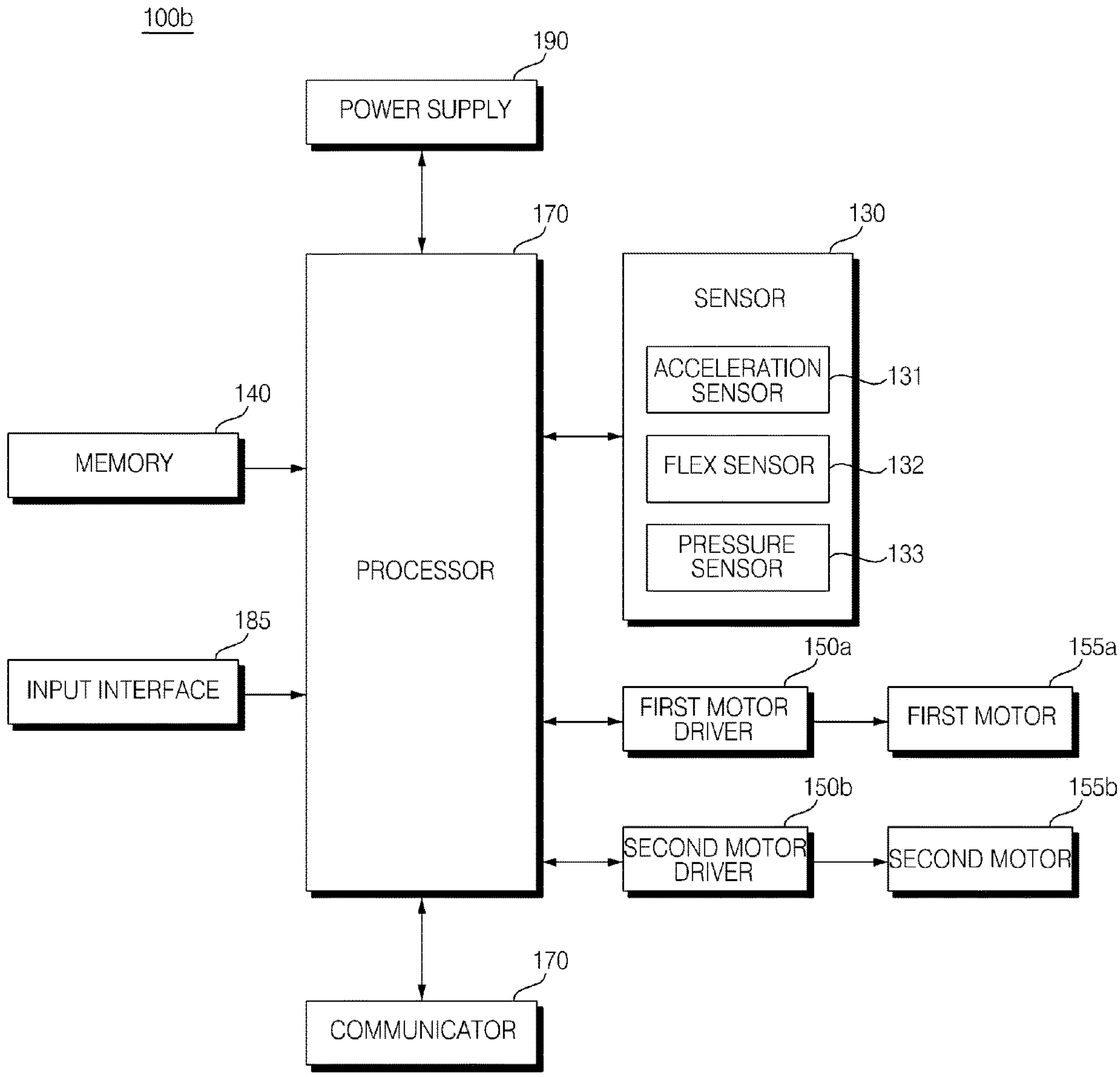
(b)

FIG. 11B


100L
ASLa
132L
ASLb
100L
155La
170L
130L
155Lb
100L
ELa
Pwa
135L
190L
Pwb
ELb
ASLa
ASLb

(a) (b)

FIG. 12



100b
190
POWER SUPPLY
170
130
SENSOR
ACCELERATION SENSOR
131
FLEX SENSOR
132
PRESSURE SENSOR
133
140
MEMORY
PROCESSOR
185
INPUT INTERFACE
150a
FIRST MOTOR DRIVER
155a
FIRST MOTOR
150b
SECOND MOTOR DRIVER
155b
SECOND MOTOR
170
COMMUNICATOR

FIG. 13

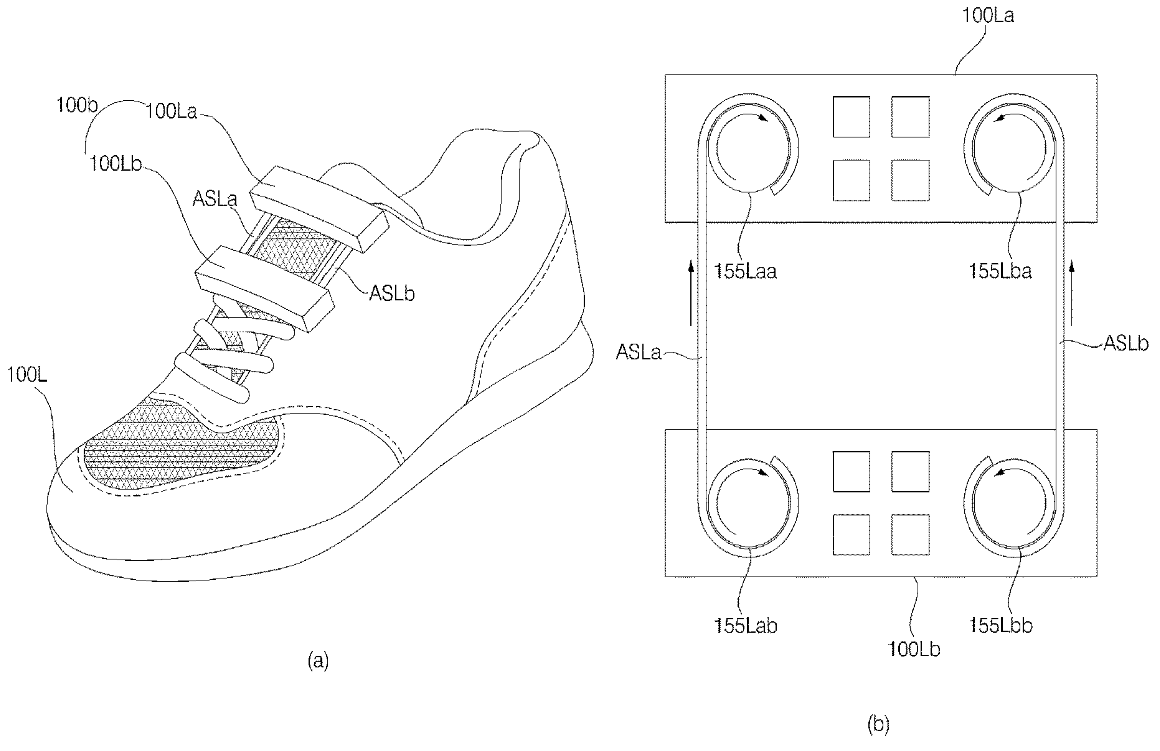
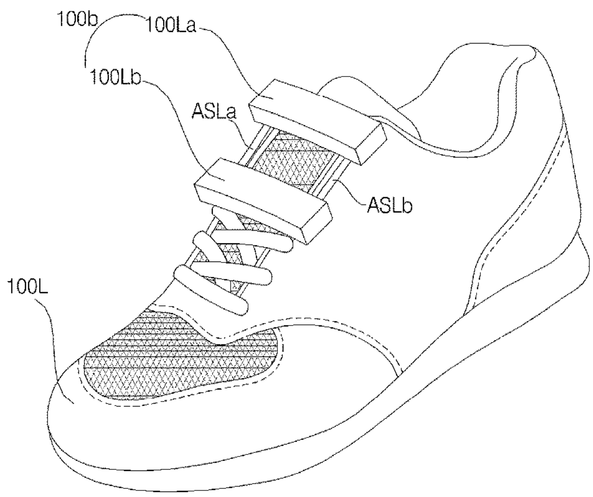
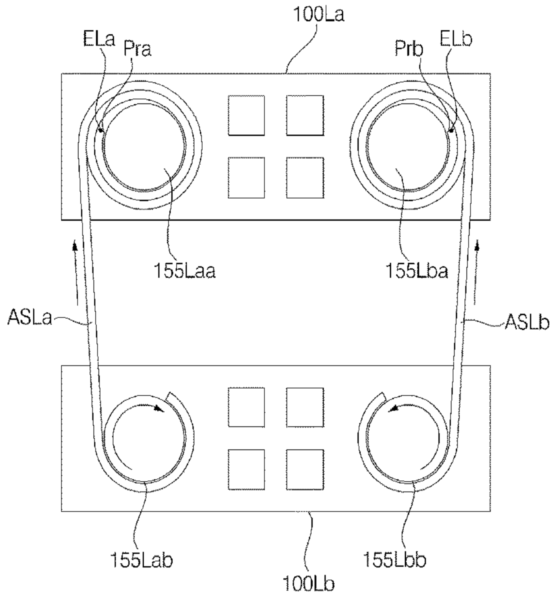

100b
100La
100Lb
ASLa
ASLb
100L
(a)
100La
155Laa
155Lba
ASLa
ASLb
155Lab
155Lbb
100Lb
(b)

FIG. 14A

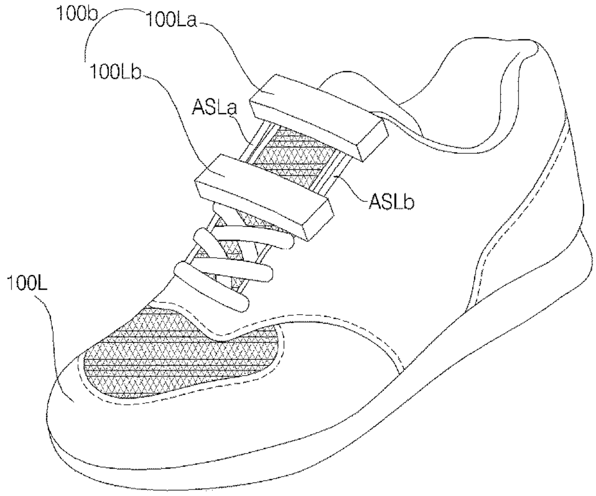

100b
100La
100Lb
ASLa
ASLb
100L

(a)

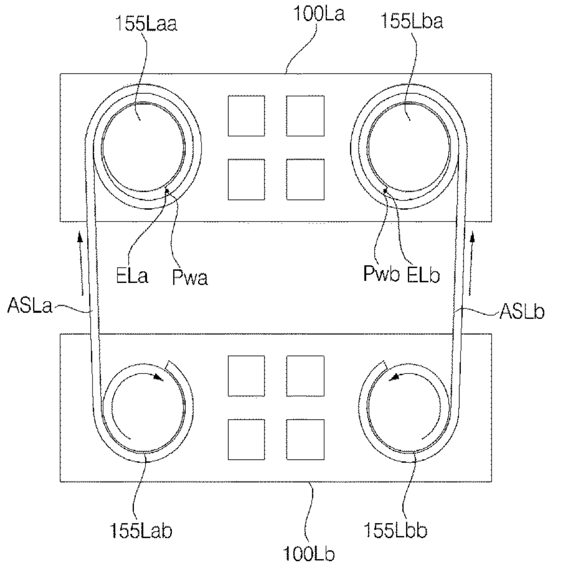

100La
ELa
Pra
Prb
ELb
155Laa
155Lba
ASLa
ASLb
155Lab
155Lbb
100Lb

(b)

FIG. 14B


100b
100La
100Lb
ASLa
ASLb
100L

(a)


155Laa
100La
155Lba
ELa
Pwa
Pwb
ELb
ASLa
ASLb
155Lab
100Lb
155Lbb

(b)

FIG. 14C

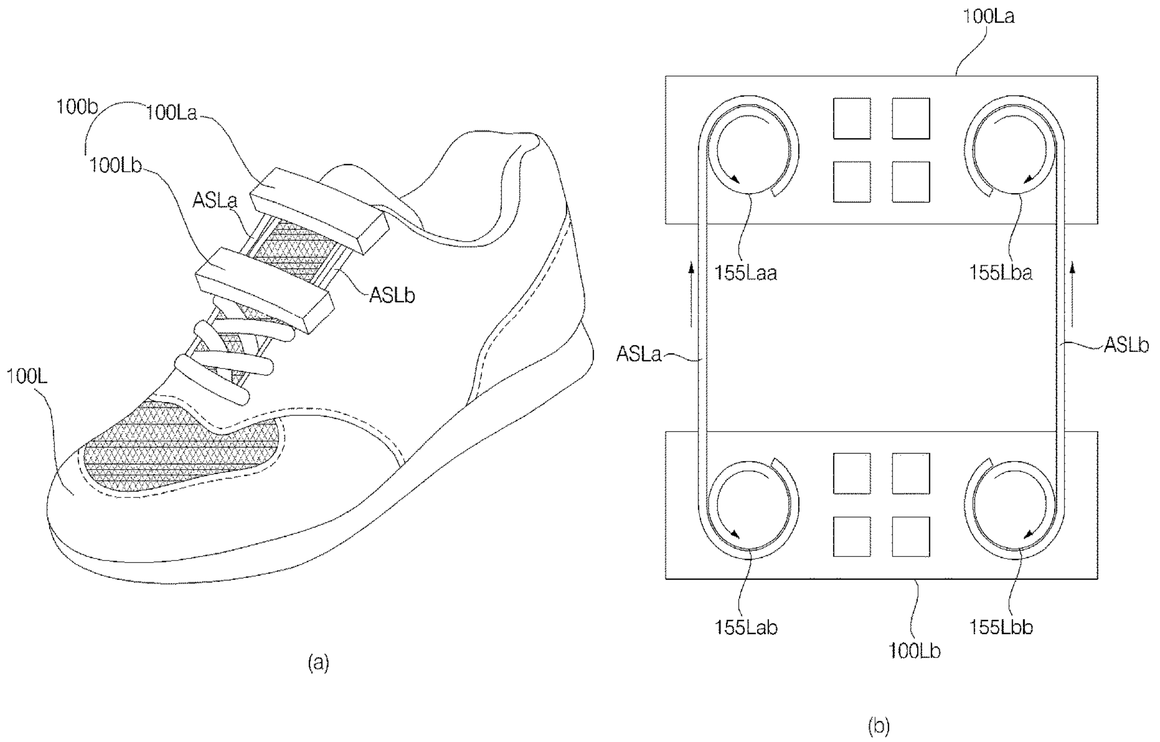

100b
100La
100Lb
ASLa
ASLb
100L
(a)
100La
155Laa
155Lba
ASLa
ASLb
155Lab
155Lbb
100Lb
(b)

FIG. 15

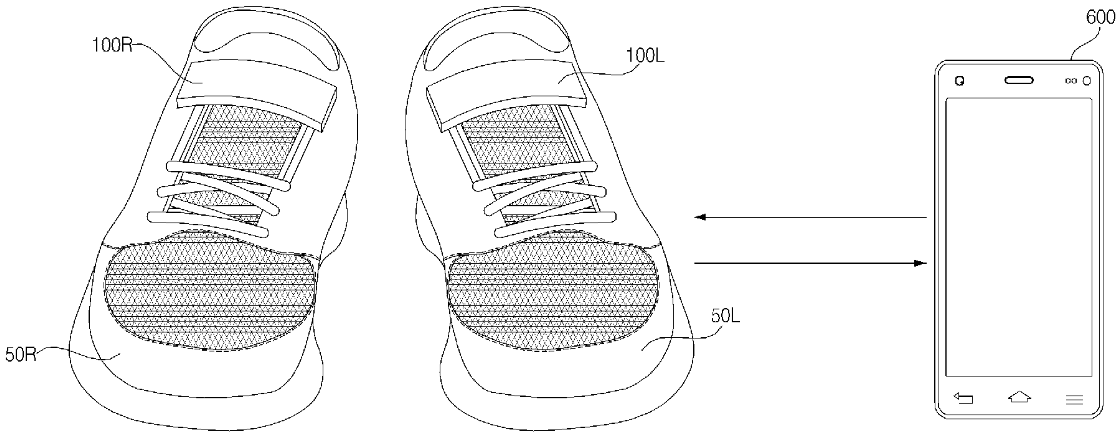
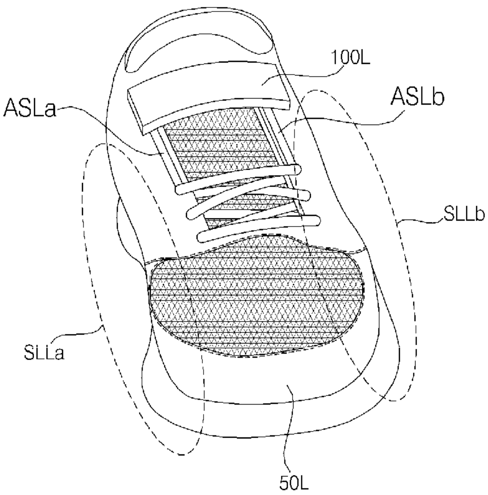
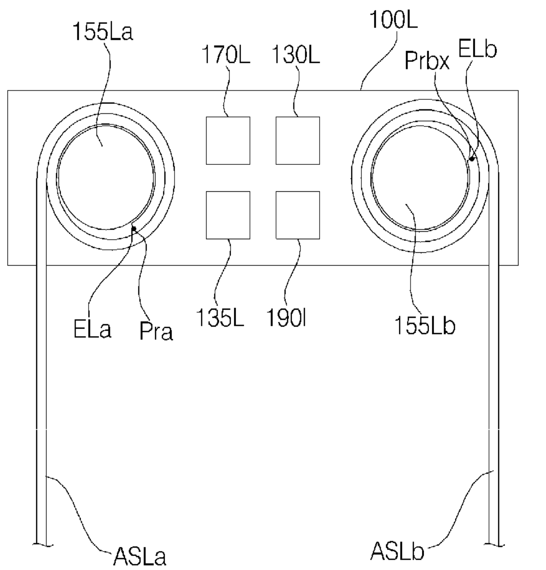


FIG. 16


100L
ASLa
ASLb
SLLb
SLLa
50L

(a)


155La
170L
130L
100L
Prbx
ELb
ELa
Pra
135L
190l
155Lb
ASLa
ASLb

(b)

FIG. 17

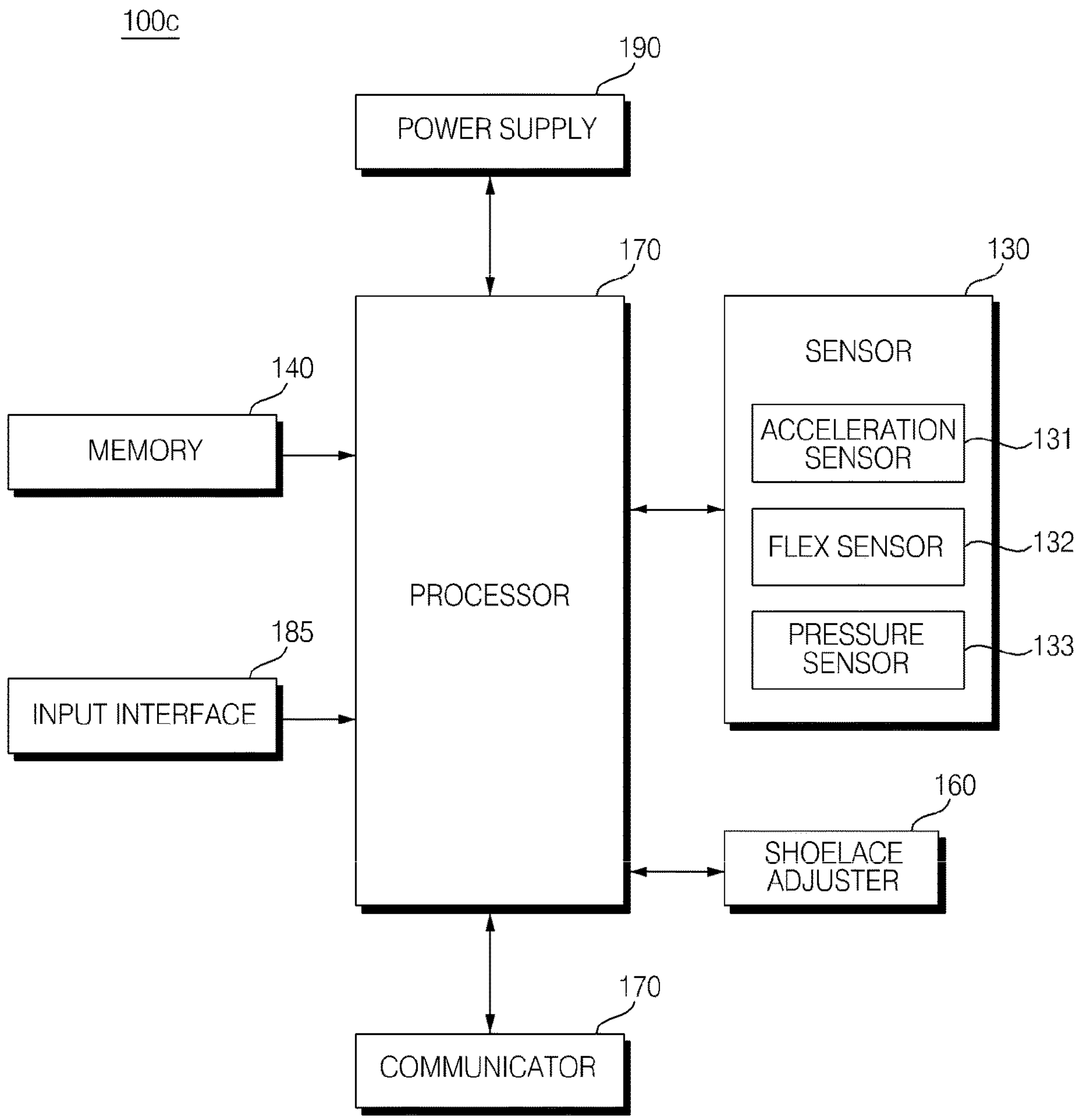
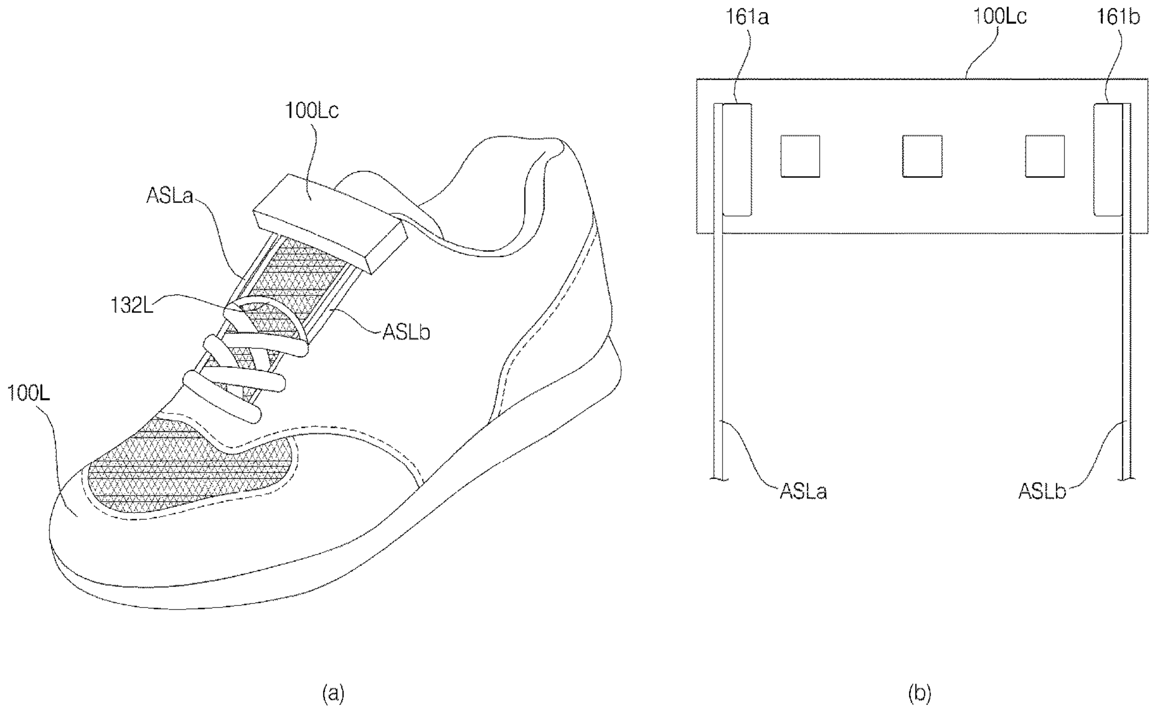

100c
190
POWER SUPPLY
170
PROCESSOR
130
SENSOR
ACCELERATION SENSOR
131
FLEX SENSOR
132
PRESSURE SENSOR
133
140
MEMORY
185
INPUT INTERFACE
160
SHOELACE ADJUSTER
170
COMMUNICATOR

FIG. 18



SHOELACE ADJUSTING DEVICE AND SHOE INCLUDING THE SAME

TECHNICAL FIELD

[0001] The present disclosure relates to a shoelace adjusting device and a shoe including the same, and more particularly to a shoelace adjusting device capable of automatically adjusting the tightness of a shoelace based on the state of the user wearing the shoes and to a shoe including the same.

BACKGROUND ART

[0002] Various kinds of wearable devices for providing convenience to users are being developed.

[0003] Meanwhile, shoes are products that users wear daily, and users wearing shoes perform various motions, such as walking, running, etc.

[0004] Meanwhile, a shoelace is used for a shoe in order to fasten a shoe, and the tightness of a shoelace is typically adjusted manually.

DISCLOSURE

Technical Problem

[0005] It is an object of the present disclosure to provide a shoelace adjusting device capable of automatically adjusting the tightness of a shoelace based on the state of the user wearing the shoes and a shoe including the same.

Technical Solution

[0006] In order to accomplish the above object, a shoelace adjusting device and a shoe including the same based on an embodiment of the present disclosure include a motor configured to operate to adjust at least one part of the shoelace, a sensor including a motion sensor, and a processor configured to determine whether the shoe is being used in a running state, a walking state, or a sitting state based on sensing information from the motion sensor and to change a level for tightening the shoelace based on the respective states.

[0007] Meanwhile, in order to accomplish the above abject, a shoelace adjusting device and a shoe including the same based on another embodiment of the present disclosure include a first motor configured to operate to move at least one part of the shoelace, a second motor configured to rotate in the same direction as the first motor and to operate to move the at least one part of the shoelace, a sensor including a motion sensor, and a processor configured to determine whether the shoe is being used in a running state, a walking state, or a sitting state based on sensing information from the motion sensor and to change a level for tightening the shoelace based on the respective states.

[0008] Meanwhile, in order to accomplish the above abject, a shoelace adjusting device and a shoe including the same based on still another embodiment of the present disclosure include a shoelace adjuster configured to operate to adjust at least one part of the shoelace, a sensor including a motion sensor, and a processor configured to determine whether the shoe is being used in a running state, a walking state, or a sitting state based on sensing information from the motion sensor and to change a level for tightening the shoelace based on the respective states.

Advantageous Effects

[0009] A shoelace adjusting device and a shoe including the same based on an embodiment of the present disclosure include a motor configured to operate to adjust at least one part of the shoelace, a sensor including a motion sensor, and a processor configured to determine whether the shoe is being used in a running state, a walking state, or a sitting state based on sensing information from the motion sensor and to change a level for tightening the shoelace based on the respective states, thereby automatically adjusting the tightness of the shoelace based on the state of the user wearing the shoes.

[0010] Meanwhile, the change in the level to which the shoelace is tightened is controlled based on flex-sensing information from a flex sensor, which detects the bent state of the shoelace, and state information of the shoe, thereby automatically adjusting the tightness of the shoelace so as to be suitable for the state of the user.

[0011] Meanwhile, whether the user is in a sitting state is further determined based on sensing information from the motion sensor and pressure sensing information from a pressure sensor, thereby automatically adjusting the tightness of the shoelace based on any of various states of the user wearing the shoes.

[0012] Meanwhile, in order to accomplish the above abject, a shoelace adjusting device and a shoe including the same based on another embodiment of the present disclosure include a first motor configured to operate to move at least one part of the shoelace, a second motor configured to rotate in the same direction as the first motor and to operate to move the at least one part of the shoelace, a sensor including a motion sensor, and a processor configured to determine whether the shoe is being used in a running state, a walking state, or a sitting state based on sensing information from the motion sensor and to change a level for tightening the shoelace based on the respective states, thereby automatically adjusting the tightness of the shoelace based on the state of the user wearing the shoes.

[0013] Meanwhile, in order to accomplish the above abject, a shoelace adjusting device and a shoe including the same based on still another embodiment of the present disclosure include a shoelace adjuster configured to operate to adjust at least one part of the shoelace, a sensor including a motion sensor, and a processor configured to determine whether the shoe is being used in a running state, a walking state, or a sitting state based on sensing information from the motion sensor and to change a level for tightening the shoelace based on the respective states, thereby automatically adjusting the tightness of the shoelace based on the state of the user wearing the shoes.

DESCRIPTION OF DRAWINGS

[0014] FIG. **1** is a diagram showing a system that includes a shoelace adjusting device and a shoe including the same based on an embodiment of the present disclosure.

[0015] FIG. **2** is an enlarged view of the shoelace adjusting device and the shoe including the same in FIG. **1**.

[0016] FIG. **3** is a schematic exemplary internal block diagram of the shoelace adjusting device in FIG. **2**.

[0017] FIG. **4** is a view schematically illustrating the internal structure of the shoelace adjusting device in FIG. **2**.

[0018] FIG. **5** is a flowchart illustrating a method of operating the shoelace adjusting device based on an embodiment of the present disclosure.

[0019] FIGS. **6** to **11**B are views referenced to describe the method of operating the shoelace adjusting device in FIG. **5**.

[0020] FIG. **12** is a schematic internal block diagram of another example of the shoelace adjusting device in FIG. **2**.

[0021] FIGS. **13** to **16** are views referenced to describe the method of operating the shoelace adjusting device in FIG. **12**.

[0022] FIG. **17** is a schematic internal block diagram of still another example of the shoelace adjusting device in FIG. **2**.

[0023] FIG. **18** is a view referenced to describe the method of operating the shoelace adjusting device in FIG. **17**.

BEST MODE

[0024] Hereinafter, the present disclosure will be described in detail with reference to the accompanying drawings.

[0025] As used herein, the terms with which the names of components are suffixed, such as "module" and "unit", are assigned to facilitate preparation of this specification, and are not intended to suggest unique meanings or functions. Accordingly, the terms "module" and "unit" may be used interchangeably.

[0026] FIG. **1** is a diagram showing a system that includes a shoelace adjusting device and a shoe including the same based on an embodiment of the present disclosure.

[0027] Referring to the drawings, a system **10** in FIG. **1** is a shoelace-related system, and may include shoelace adjusting devices **100**L and **100**R disposed on respective shoes **50**L and **50**R of a user **70**, a mobile terminal **600** configured to exchange data with the shoelace adjusting devices **100**L and **100**R, a smart watch **800**, a wireless earphone **700**, a server **1000**, and the like.

[0028] The shoelace adjusting devices **100**L and **100**R are devices that may automatically adjust the shoelaces of the shoes **50**L and **50**R worn by the user **70** and may exchange data with at least one of the mobile terminal **600**, the smart watch **800**, or the wireless earphone **700**, which is carried by the user.

[0029] Meanwhile, the server **1000** may exchange data with at least one of the mobile terminal **600**, the smart watch **800**, or the wireless earphone **700**, which is carried by the user.

[0030] Meanwhile, each of the shoelace adjusting devices **100**L and **100**R based on the embodiment of the present disclosure may include a motor **155** configured to operate to adjust at least one part of the shoelace ASL, a sensor portion **130** including an acceleration sensor **134**, and a processor **170** configured to determine whether the shoes **50** are being used in a running state, a walking state, or a sitting state based on sensing information from the acceleration sensor **134** and to change a level for tightening the shoelace ASL based on the respective states. Accordingly, the tightness of the shoelace ASL may be automatically adjusted based on the state of the user wearing the shoes **50**.

[0031] Meanwhile, each of the shoelace adjusting devices **100**L and **100**R based on the embodiment of the present disclosure may change a level for tightening the shoelace ASL based on flex-sensing information from a flex sensor **132**, which detects the bent state of the shoelace ASL, and state information of the shoes **50**, thereby automatically adjusting the tightness of the shoelace ASL so as to be suitable for the state of the user.

[0032] Meanwhile, each of the shoelace adjusting devices **100**L and **100**R based on the embodiment of the present disclosure may further determine whether the user is in a sitting state based on sensing information from the acceleration sensor **134** and pressure sensing information from a pressure sensor **133**, thereby automatically adjusting the tightness of the shoelace ASL based on any of various states of the user wearing the shoes **50**.

[0033] Meanwhile, each of shoelace adjusting devices **100**L and **100**R based on another embodiment of the present disclosure may include a first motor **155** configured to operate to move at least one part of the shoelace ASL, a second motor **155** configured to rotate in the same direction as the first motor **155** and to operate to move the at least one part of the shoelace ASL, a sensor portion **130** including an acceleration sensor **134**, and a processor **170** configured to determine whether the shoes **50** are being used in a running state, a walking state, or a sitting state based on sensing information from the acceleration sensor **134** and to change a level for tightening the shoelace ASL based on the respective states, thereby automatically adjusting the tightness of the shoelace ASL based on the state of the user wearing the shoes **50**.

[0034] Meanwhile, each of shoelace adjusting devices **100**L and **100**R based on still another embodiment of the present disclosure may include a shoelace adjuster configured to operate to adjust at least one part of the shoelace ASL, a sensor portion **130** including an acceleration sensor **134**, and a processor **170** configured to determine whether the shoes **50** are being used in a running state, a walking state, or a sitting state based on sensing information from the acceleration sensor **134** and to change a level for tightening the shoelace ASL based on the respective states, thereby automatically adjusting the tightness of the shoelace ASL based on the state of the user wearing the shoes **50**.

[0035] Meanwhile, each of the shoelace adjusting devices **100**L and **100**R based on the embodiment of the present disclosure may calculate a stride speed, a gait angle, and a gait, and accordingly may provide various pieces of information.

[0036] Meanwhile, each of the shoelace adjusting devices **100**L and **100**R based on the embodiment of the present disclosure may transmit the behavior pattern of the user to the mobile terminal **600**, may measure the amount of exercise, or may measure a gait.

[0037] Meanwhile, each of the shoelace adjusting devices **100**L and **100**R based on the embodiment of the present disclosure may automatically adjust the tightness of the shoelace based on a shoelace tightening level set through the mobile terminal **600**.

[0038] Meanwhile, each of the shoelace adjusting devices **100**L and **100**R based on the embodiment of the present disclosure may adjust the shoelace tightening level and may store the current shoelace tightening level in the mobile terminal **600**.

[0039] Meanwhile, each of the shoelace adjusting devices **100**L and **100**R based on the embodiment of the present disclosure may identify the tightening level based on the type of shoe, and may change the tightening level based on the type of shoe.

[0040] Meanwhile, each of the shoelace adjusting devices **100**L and **100**R based on the embodiment of the present disclosure may identify the shoe wearer, and may change the tightening level based on the type of shoe and on the wearer.

[0041] Meanwhile, each of the shoelace adjusting devices **100**L and **100**R based on the embodiment of the present disclosure may generate vibration in order to prevent separation of the mobile terminal **600**, particularly, prevent loss thereof when the distance to the mobile terminal **600** is equal to or greater than a predetermined value, i.e. when the intensity of wireless signals exchanged with the paired mobile terminal **600** is equal to or less than a reference value.

[0042] Meanwhile, based on the embodiment of the present disclosure, in the state in which the shoes are taken off, the mobile terminal **600** may generate vibration in order to prevent separation of the shoelace adjusting devices **100**L and **100**R, particularly, prevent loss thereof when the distance to the shoelace adjusting devices **100**L and **100**R is equal to or greater than a predetermined value, i.e. when the intensity of wireless signals exchanged with the paired shoelace adjusting devices **100**L and **100**R is equal to or less than a reference value.

[0043] Meanwhile, in the state in which the wearer takes off the shoes, each of the shoelace adjusting devices **100**L and **100**R based on the embodiment of the present disclosure may tighten the shoelace to the maximum extent in order to prevent other persons from putting on the shoes.

[0044] Meanwhile, each of the shoelace adjusting devices **100**L and **100**R based on the embodiment of the present disclosure may automatically adjust the tightness of the shoelace based on position information, such as GPS information, received from the mobile terminal **600** or the like.

[0045] In one example, when the current position is an intersection, each of the shoelace adjusting devices **100**L and **100**R may perform control such that the shoelace is tightened.

[0046] In another example, when the current position is near the home, each of the shoelace adjusting devices **100**L and **100**R may perform control such that the shoelace is loosened.

[0047] Meanwhile, each of the shoelace adjusting devices **100**L and **100**R based on the embodiment of the present disclosure may automatically adjust the tightness of the shoelace based on the surrounding environment.

[0048] In one example, when an obstacle is present ahead, each of the shoelace adjusting devices **100**L and **100**R may perform control such that the shoelace is tightened.

[0049] In another example, when it is time for the user to get out of a subway, a bus, a car, or the like, each of the shoelace adjusting devices **100**L and **100**R may tighten the shoelace, which is in a loosened state, so that the user recognizes that it is time to get out.

[0050] Meanwhile, each of the shoelace adjusting devices **100**L and **100**R based on the embodiment of the present disclosure may automatically adjust the tightness of the shoelace in order to correct a gait or the like.

[0051] For example, upon detecting an out-toed gait, an in-toed gait, or the like, each of the shoelace adjusting devices **100**L and **100**R may automatically adjust the tightness of the shoelace in order to correct a gait or the like. Specifically, the tightness of the shoelace may be automatically adjusted in the manner of asymmetrically tightening one part and the other part of the shoelace.

[0052] Meanwhile, each of the shoelace adjusting devices **100**L and **100**R based on the embodiment of the present disclosure may automatically adjust the tightness of the shoelace based on the exercise state of the wearer. Accordingly, it may be helpful for managing the pace of the user.

[0053] Meanwhile, the mobile terminal **600** based on the embodiment of the present disclosure may receive data from the shoelace adjusting devices **100**L and **100**R and may store the data. In particular, the shoelace adjustment levels and the like may be stored.

[0054] Meanwhile, the mobile terminal **600** based on the embodiment of the present disclosure may identify the behavior pattern of the user, may measure the amount of exercise of the user, or may measure the gait of the user using data received from the shoelace adjusting devices **100**L and **100**R.

[0055] In addition, the mobile terminal **600** based on the embodiment of the present disclosure may provide the current position information, the generated map, the stride speed, the gait angle, and the gait using data received from the shoelace adjusting devices **100**L and **100**R, and accordingly, various pieces of information may be provided. Thus, the convenience of the user may be enhanced.

[0056] Meanwhile, the mobile terminal **600** based on the embodiment of the present disclosure may transmit information about the set shoelace tightening levels to the shoelace adjusting devices **100**L and **100**R.

[0057] FIG. **2** is an enlarged view of the shoelace adjusting device and the shoe including the same in FIG. **1**.

[0058] Referring to the drawing, a left shoelace ASL and a right shoelace ASR are attached to the left shoe **50**L and the right shoe **50**R, respectively.

[0059] Meanwhile, based on the embodiment of the present disclosure, a left shoelace adjusting device **100**L and a right shoelace adjusting device **100**R are respectively provided to automatically adjust the left shoelace ASL and the right shoelace ASR.

[0060] The left shoelace adjusting device **100**L and the right shoelace adjusting device **100**R may be, respectively, in contact with one part of the left shoelace ASL and one part of the right shoelace ASR.

[0061] Meanwhile, in the drawing, the shoelaces are exemplarily illustrated as being divided into fixed-type shoelaces BSL and BSR, which are crossed and are difficult to adjust, and adjustable shoelaces ASL and ASR.

[0062] The left shoelace adjusting device **100**L and the right shoelace adjusting device **100**R are provided with the adjustable shoelaces ASL and ASR.

[0063] Hereinafter, any one of the left shoelace adjusting device **100**L and the right shoelace adjusting device **100**R will be described with reference to FIG. **3**.

[0064] FIG. **3** is a schematic exemplary internal block diagram of the shoelace adjusting device in FIG. **2**.

[0065] Referring to the drawing, the shoelace adjusting device **100** may include a sensor portion **130**, a communicator **135**, a memory **140**, a motor driver **150**, a motor **155**, a processor **170**, an input interface **185**, and a power supply **190**. When these components are implemented in practice, two or more components may be combined into a single component, or one component may be subdivided into two or more components, if necessary.

[0066] The sensor portion **130** may include a motion sensor **131**, a flex sensor **132**, a pressure sensor **133**, and the like.

[0067] The motion sensor **131** may include an acceleration sensor, a gyro sensor, a gravity sensor, and the like. In particular, the motion sensor **131** may include a six-axis sensor.

[0068] The motion sensor **131** may output motion information of the shoelace adjusting device **100**, e.g. motion information (acceleration information or angular velocity information) or position information on the basis of x-, y- and z-axes.

[0069] The flex sensor **132** may detect the bent state of the shoelace ASL.

[0070] The pressure sensor **133** may detect pressure applied to the shoelace adjusting device **100**. For example, the pressure sensor **133** may detect pressure generated by the top of the foot of the shoe wearer.

[0071] Meanwhile, the communicator **135** may exchange data with an external electronic device.

[0072] In particular, the communicator **135** may exchange data with the mobile terminal **600**. To this end, the communicator **135** may undergo pairing with the mobile terminal **600**.

[0073] Meanwhile, the communicator **135** may provide an interface for communication with an external device. To this end, the communicator **135** may include at least one of a mobile communication module (not shown), a wireless Internet module (not shown), a short-range communication module (not shown), or a GPS module (not shown).

[0074] For example, the communicator **135** may perform Bluetooth communication, Wi-Fi communication, low-power wide-area communication, and the like, and may thus transmit information sensed by the shoelace adjusting device **100** to the paired mobile terminal **600**.

[0075] The memory **140** may store a program for the processing or control of the processor **170** of the shoelace adjusting device **100**, and may also function to temporarily store input/output data.

[0076] In addition, the memory **140** may store shoelace adjustment level information, stride information, stride speed information, gait angle information, gait information, and the like.

[0077] The motor driver **150** drives the motor **155** such that the motor **155** rotates. For example, as shown in FIG. **4**, when two motors **155**La and **155**Lb are provided, the motor driver **150** may perform control such that the two motors rotate in opposite directions.

[0078] The processor **170** may control the operation of each unit in the shoelace adjusting device **100** so as to control the overall operation of the shoelace adjusting device **100**.

[0079] Meanwhile, the processor **170** may determine whether the shoes **50** are being used in a running state, a walking state, or a sitting state based on sensing information from the motion sensor **131**, and may change a level for tightening the shoelace ASL based on the respective states.

[0080] Meanwhile, the processor **170** may change a level for tightening the shoelace ASL based on flex-sensing information from the flex sensor **132** and state information of the shoe **50**.

[0081] Meanwhile, the processor **170** may determine whether the shoes **50** are being used in a running state, a walking state, or a sitting state based on sensing information from the motion sensor **131** and pressure sensing information from the pressure sensor **133**, and may change a level for tightening the shoelace ASL based on the respective states.

[0082] Meanwhile, when the pressure sensing information is equal to or greater than a first reference value for a predetermined period of time, the processor **170** may determine that the feet of the wearer of the shoes **50** are in a swollen state, and may change a level for tightening the shoelace ASL in response to the swollen state.

[0083] Meanwhile, the processor **170** may further determine whether the user is taking off the shoes **50** or putting on the shoes **50** based on sensing information from the motion sensor **131**, and may change a level for tightening the shoelace ASL based on the taking-off state or the putting-on state.

[0084] Meanwhile, the processor **170** may compare state information of the wearer of the shoes **50**, received from the mobile terminal **60**, with state information, determined based on sensing information from the motion sensor **131**, may calculate final state information, and may change a level for tightening the shoelace ASL based on the final state information.

[0085] Meanwhile, the processor **170** may receive temperature information from the mobile terminal **600**, and may change the level to which the shoelace ASL is tightened based on the received temperature information.

[0086] Meanwhile, the processor **170** may receive temperature information from the mobile terminal **600**, and may change a level for tightening the shoelace ASL based on the received temperature information.

[0087] Meanwhile, the processor **170** may receive humidity information from the mobile terminal **600**, and may change a level for tightening the shoelace ASL based on the received humidity information.

[0088] Meanwhile, when the motor **155** includes the first motor and the second motor, the processor **170** may perform control such that the left side of the shoelace ASL and the right side of the shoelace ASL are tightened differently based on sensing information from the motion sensor **131**.

[0089] Meanwhile, the processor **170** may change a level for tightening the shoelace ASL based on the moving speed of the shoe **50**.

[0090] Meanwhile, the processor **170** may determine whether the shoelace ASL is the shoelace ASL of the left shoe **50** or the shoelace ASL of the right shoe **50** based on sensing information from the motion sensor **131**, and may change a level for tightening the shoelace ASL based on the determined information.

[0091] Meanwhile, the processor **170** may receive tightness information of the shoelace ASL from the mobile terminal **600**, and may change a level for tightening the shoelace ASL based on the received tightness information of the shoelace ASL.

[0092] Meanwhile, the processor **170** may calculate a stride speed, a gait angle, and a gait, and accordingly may provide various pieces of information.

[0093] Meanwhile, the processor **170** may transmit the behavior pattern of the user to the mobile terminal **600**, may measure the amount of exercise, or may measure a gait.

[0094] Meanwhile, the processor **170** may automatically adjust the tightness of the shoelace based on a shoelace tightening level set through the mobile terminal **600**.

[0095] Meanwhile, the processor **170** may identify the tightening level based on the type of shoe, and may change the tightening level based on the type of shoe.

[0096] Meanwhile, the processor **170** may identify the shoe wearer, and may change the tightening level based on the type of shoe and on the wearer.

[0097] Meanwhile, the processor **170** may generate vibration in order to prevent separation of the mobile terminal **600**, particularly, prevent loss thereof when the distance to the mobile terminal **600** is equal to or greater than a predetermined value, i.e. when the intensity of wireless signals exchanged with the paired mobile terminal **600** is equal to or less than a reference value.

[0098] Meanwhile, in the state in which the wearer takes off the shoes, the processor **170** may tighten the shoelace to the maximum extent in order to prevent other persons from putting on the shoes.

[0099] Meanwhile, the processor **170** may automatically adjust the tightness of the shoelace based on position information, such as GPS information, received from the mobile terminal **600** or the like.

[0100] In one example, when the current position is an intersection, each shoelace adjusting device **100** may perform control such that the shoelace is tightened.

[0101] In another example, when the current position is near the home, each shoelace adjusting device **100** may perform control such that the shoelace is loosened.

[0102] Meanwhile, the processor **170** may automatically adjust the tightness of the shoelace based on the surrounding environment.

[0103] In one example, when an obstacle is present ahead, each shoelace adjusting device **100** may perform control such that the shoelace is tightened.

[0104] In another example, when it is time for the user to get out of a subway, a bus, a car, or the like, each shoelace adjusting device **100** may tighten the shoelace, which is in a loosened state, so that the user recognizes that it is time to get out.

[0105] Meanwhile, the processor **170** may automatically adjust the tightness of the shoelace in order to correct a gait or the like.

[0106] For example, upon detecting an out-toed gait, an in-toed gait, or the like, each shoelace adjusting device **100** may automatically adjust the tightness of the shoelace in order to correct a gait or the like. Specifically, the tightness of the shoelace may be automatically adjusted in the manner of asymmetrically tightening one part and the other part of the shoelace.

[0107] Meanwhile, the processor **170** may automatically adjust the tightness of the shoelace based on the exercise state of the wearer. Accordingly, it may be helpful for managing the pace of the user.

[0108] Meanwhile, the input interface **185** may include a button for initializing the shoelace adjusting device **100** or inputting an operation.

[0109] The power supply **190** may supply power required for operation of the respective components under the control of the processor **170**.

[0110] Meanwhile, the power supply **190** may include a battery for storing and outputting DC power.

[0111] FIG. **4** is a view schematically illustrating the internal structure of the shoelace adjusting device in FIG. **2**.

[0112] Referring to the drawing, the left shoe **50**L may be provided with shoelaces ASLa and ASLb, and the left shoelace adjusting device **100**L may be disposed at part portions of the shoelaces ASLa and ASLb.

[0113] Meanwhile, the flex sensor **132**L for detecting bending may be disposed at the other part portions of the shoelaces ASLa and ASLb.

[0114] The left shoelace adjusting device **100**L may include therein a processor **170**L, a sensor portion **130**L, a communicator **135**L, a power supply **190**L, and motors **155**La and **155**Lb configured to rotate in opposite directions.

[0115] Meanwhile, one part portion of each of the shoelaces ASLa and ASLb is connected to a corresponding one of the motors **155**La and **155**Lb, and the shoelaces ASLa and ASLb are loosened or tightened based on rotation of the motors **155**La and **155**Lb.

[0116] For example, the shoelaces ASLa and ASLb are tightened by rightward rotation of the motor **155**La and leftward rotation of the motor **155**Lb, and are loosened by leftward rotation of the motor **155**La and rightward rotation of the motor **155**Lb.

[0117] FIG. **5** is a flowchart illustrating a method of operating the shoelace adjusting device based on an embodiment of the present disclosure, and FIGS. **6** to **11**B are views referenced to describe the method of operating the shoelace adjusting device in FIG. **5**.

[0118] Referring to the drawing, the processor **170** receives sensing information from the motion sensor **131** (S**505**). In detail, motion information may be received.

[0119] The motion information may conceptually include acceleration information from the acceleration sensor, angular velocity information from the gyro sensor, and the like.

[0120] Subsequently, the processor **170** determines whether the shoes **50** are being used in a running state, a walking state, or a sitting state based on sensing information from the motion sensor **131** (S**510**).

[0121] For example, in the motion information Sacc shown in FIG. **6**, the motion information corresponding to the section PWa indicates a walking state, the motion information corresponding to the section Pru indicates a running state, and the motion information corresponding to the section Psi indicates a sitting state.

[0122] Accordingly, the processor **170** may determine the section in FIG. **6** to which the sensing information from the motion sensor **131** corresponds, and may determine whether the shoes **50** are being used in a running state, a walking state, or a sitting state.

[0123] Subsequently, when the shoes **50** are being used in the running state (S**515**), the processor **170** may perform control such that the shoelaces are tightened to a first level (S**520**).

[0124] For example, as shown in FIG. **7**B, the processor **170** may perform control such that the motor **155**La rotates to the right and the motor **155**Lb rotates to the left. In particular, the processor **170** may perform control such that the part portions ELA and ELb of the shoelaces ASLa and ASLb are, respectively, wound to the positions Pra and Prb. Accordingly, the shoelaces are tightly wound automatically.

[0125] Subsequently, when the shoes **50** are being used in the walking state (S**525**), the processor **170** may perform control such that the shoelaces are tightened to a second level (S**530**).

[0126] For example, as shown in FIG. **7**A, the processor **170** may perform control such that the motor **155**La rotates to the right and the motor **155**Lb rotates to the left. In particular, the processor **170** may perform control such that the part portions ELA and ELb of the shoelaces ASLa and ASLb are, respectively, wound to the positions Pwa and Pwb. Accordingly, the shoelaces are slightly tightly wound automatically.

[0127] Subsequently, when the user is in the sitting state (S**535**), the processor **170** may perform control such that the shoelaces are tightened to a third level (S**540**).

[0128] For example, as shown in FIG. **7**C, the processor **170** may perform control such that the motor **155**La rotates to the right and the motor **155**Lb rotates to the left. In particular, the processor **170** may perform control such that the part portions ELA and ELb of the shoelaces ASLa and ASLb are, respectively, wound to the positions Psa and Psb. Accordingly, the shoelaces are automatically loosened.

[0129] Comparing FIGS. **7**A to **7**C, the shoelaces are loosened so as to have the longest length in the sitting state shown in FIG. **7**C, the shoelaces are wound so as to have an intermediate length in the walking state shown in FIG. **7**A, and the shoelaces are most tightly wound so as to have the shortest length in the running state shown in FIG. **7**A. As such, the shoelace tightening level is automatically changed, thereby enhancing the convenience of the user.

[0130] Meanwhile, the processor **170** may change the level for tightening the shoelaces ASL based on flex-sensing information from the flex sensor **132** and state information of the shoe **50**. In particular, fine tightening may be performed.

[0131] For example, the processor **170** may determine that when the level of the flex-sensing information from the flex sensor **132** increases, the shoelaces are further loosened, and when the level of the flex-sensing information decreases, the shoelaces are further tightened.

[0132] Meanwhile, whether the user is in a sitting state may be determined based on sensing information from the motion sensor **131**, such as the section Psi in FIG. **6**, and in addition, whether the shoes **50** are being used in a running state, a walking state, or a sitting state may be determined based on pressure sensing information from the pressure sensor **133**.

[0133] For example, in the running state, the pressure generated by the top of the foot is large, and in the sitting state, the pressure generated by the top of the foot is small. Using this, the processor **170** may distinguish among the running state, the walking state, and the sitting state.

[0134] In addition, the processor **170** may determine whether the shoes **50** are being used in the running state, the walking state, or the sitting state based on sensing information from the motion sensor **131** and pressure sensing information from the pressure sensor **133**, and may control a change in the level for tightening the shoelaces ASL based on the respective states. Accordingly, it is possible to more accurately identify the respective states and to change the level for tightening the shoelaces ASL so as to be suitable for the respective states.

[0135] Meanwhile, when the pressure sensing information is equal to or greater than the first reference value for a predetermined period of time, the processor **170** may determine that the feet of the wearer of the shoes **50** are in a swollen state, and may control a change in the level for tightening the shoelaces ASL in response to the swollen state.

[0136] Meanwhile, when the user takes off the shoes (S**545**), the processor **170** may perform control such that the shoelaces are tightened to a fourth level, at which the shoelaces are in the maximally loosened state (S**550**).

[0137] In one example, the processor **170** may further determine whether the user is taking off the shoes **50** or putting on the shoes **50** based on sensing information from the motion sensor **131**, and may control a change in the level for tightening the shoelaces ASL based on the taking-off state or the putting-on state.

[0138] In another example, the processor **170** may further determine whether the user is taking off the shoes **50** or putting on the shoes **50** based on sensing information from the motion sensor **131** and pressure sensing information from the pressure sensor **133**, and may control a change in the level for tightening the shoelaces ASL based on the taking-off state or the putting-on state.

[0139] FIG. **8** illustrates motion information when the user walks and takes off the shoes.

[0140] Referring to the drawing, the motion information corresponding to the section PWa indicates a walking state, the motion information corresponding to the section Psta indicates a stationary state, and the motion information corresponding to the section Plo indicates a state of taking off the shoes.

[0141] Accordingly, the processor **170** may determine the section in FIG. **8** to which the sensing information from the motion sensor **131** corresponds, and may determine whether the shoes **50** are being used in a walking state or a stationary state or are being taken off.

[0142] For example, as indicated by the section PWa, in the walking state, the processor **170**, as shown in FIG. **9**A, may perform control such that the motor **155**La rotates to the right and the motor **155**Lb rotates to the left. In particular, the processor **170** may perform control such that the part portions ELA and ELb of the shoelaces ASLa and ASLb are, respectively, wound to the positions Pwa and Pwb. Accordingly, the shoelaces are slightly tightly wound automatically.

[0143] Meanwhile, as indicated by the section Plo, in the state of taking off the shoes, the processor **170**, as shown in FIG. **9**B, may perform control such that the motor **155**La rotates to the right and the motor **155**Lb rotates to the left. In particular, the processor **170** may perform control such that the part portions ELA and ELb of the shoelaces ASLa and ASLb are, respectively, wound to the positions Pofa and Pofb. Accordingly, the shoelaces are automatically loosened to the maximum extent.

[0144] FIG. **10** illustrates motion information when the user puts on the shoes and walks.

[0145] Referring to the drawing, the motion information corresponding to the section Plo indicates a state of putting on the shoes, the motion information corresponding to the section Psta indicates a stationary state, and the motion information corresponding to the section PWa indicates a walking state.

[0146] Accordingly, the processor **170** may determine the section in FIG. **10** to which the sensing information from the motion sensor **131** corresponds, and may determine whether the shoes **50** are being put on or are being used in a stationary state or a walking state.

[0147] For example, as indicated by the section Plo, in the state of putting on the shoes, the processor **170**, as shown in FIG. **11**A, may perform control such that the motor **155**La rotates to the right and the motor **155**Lb rotates to the left. In particular, the processor **170** may perform control such that the part portions ELA and ELb of the shoelaces ASLa and ASLb are, respectively, located to the positions Pofa and Pofb. Accordingly, the shoelaces are automatically loosened to the maximum extent.

[0148] Subsequently, as indicated by the section PWa, in the walking state, the processor **170**, as shown in FIG. **9**B, may perform control such that the motor **155**La rotates to the right and the motor **155**Lb rotates to the left. In particular, the processor **170** may perform control such that the part portions ELA and ELb of the shoelaces ASLa and ASLb are, respectively, wound to the positions Pwa and Pwb. Accordingly, the shoelaces are slightly tightly wound automatically.

[0149] Meanwhile, the processor **170** may control a change in the level for tightening the shoelaces ASL based on the moving speed of the shoe **50**.

[0150] Meanwhile, the processor **170** may determine whether the shoelaces ASL are the shoelaces ASL of the left shoe **50** or the shoelaces ASL of the right shoe **50** based on sensing information from the motion sensor **131**, and may control a change in the level for tightening the shoelaces ASL based on the determined information.

[0151] Meanwhile, the processor **170** may identify the tightening level based on the type of shoe, and may change the tightening level based on the type of shoe.

[0152] Meanwhile, the processor **170** may identify the shoe wearer, and may change the tightening level based on the type of shoe and on the wearer.

[0153] Meanwhile, in the state in which the wearer takes off the shoes, the processor **170** may tighten the shoelaces to the maximum extent in order to prevent other persons from putting on the shoes.

[0154] FIG. **12** is a schematic internal block diagram of another example of the shoelace adjusting device in FIG. **2**, and FIGS. **13** to **16** are views referenced to describe the method of operating the shoelace adjusting device in FIG. **12**.

[0155] Referring to FIG. **12**, the shoelace adjusting device **100***b* in FIG. **12** is similar to the shoelace adjusting device **100** in FIG. **3**, but is different in that a first motor driver **150***a* for driving the first motor **155***a* and a second motor driver **150***b* for driving the second motor **155***b* are further provided.

[0156] Here, the second motor **155***b* is characterized in that it is rotated in the same manner as the first motor **155***a*.

[0157] That is, as shown in FIG. **13**, the shoelace adjusting device **100***b* may include a first portion **100**La, in which the first motor **155***a* is disposed, and a second portion **100**Lb, in which the second motor **155***b* is disposed. The first portion **100**La and the second portion **100**Lb may be spaced apart from each other.

[0158] Unlike FIG. **4**, referring to FIG. **13**, in order to adjust the shoelaces ALSla and ASLb, the first motor **155***a* and the second motor **155***b*, which are disposed at opposite ends of the shoelaces ALSla and ASLb, are rotated in the same direction. Accordingly, the shoelace tightening level may be more rapidly changed.

[0159] Meanwhile, the shoelace adjusting device **100***b* may determine whether the shoes **50** are being used in a running state, a walking state, or a sitting state based on sensing information from the motion sensor **131**, and may control a change in the level for tightening the shoelaces ASL based on the respective states. Accordingly, the tightness of the shoelaces ASL may be automatically adjusted based on the state of the user wearing the shoes **50**.

[0160] For example, when the shoes **50** are being used in the running state, the processor **170** may perform control such that the shoelaces are tightened to the first level.

[0161] For example, as shown in FIG. **14**B, the processor **170** may perform control such that the motors **155**Laa and **155**Lab rotate to the right and the motors **155**Lba and **155**Lbb rotate to the left. In particular, the processor **170** may perform control such that the part portions ELA and ELb of the shoelaces ASLa and ASLb are, respectively, wound to the positions Pra and Prb. Accordingly, the shoelaces are tightly wound automatically.

[0162] Subsequently, when the shoes **50** are being used in the walking state, the processor **170** may perform control such that the shoelaces are tightened to the second level.

[0163] For example, as shown in FIG. **14**A, the processor **170** may perform control such that the motors **155**Laa and **155**Lab rotate to the right and the motors **155**Lba and **155**Lbb rotate to the left. In particular, the processor **170** may perform control such that the part portions ELA and ELb of the shoelaces ASLa and ASLb are, respectively, wound to the positions Pwa and Pwb. Accordingly, the shoelaces are slightly tightly wound automatically.

[0164] Subsequently, when the user is in the sitting state, the processor **170** may perform control such that the shoelaces are tightened to the third level.

[0165] For example, as shown in FIG. **14**C, the processor **170** may perform control such that the motors **155**Laa and **155**Lab rotate to the right and the motors **155**Lba and **155**Lbb rotate to the left. In particular, the processor **170** may perform control such that the part portions ELA and ELb of the shoelaces ASLa and ASLb are, respectively, wound to the positions Psa and Psb. Accordingly, the shoelaces are automatically loosened.

[0166] Meanwhile, as shown in FIG. **15**, the left shoelace adjusting device **100**L and the right shoelace adjusting device **100**R may exchange data with the mobile terminal **600**.

[0167] Meanwhile, the processor **170** may compare state information of the wearer of the shoes **50**, received from the mobile terminal **60**, with state information, determined based on sensing information from the motion sensor **131**, may calculate final state information, and may control a change in the level for tightening the shoelaces ASL based on the final state information.

[0168] Meanwhile, the processor **170** may receive temperature information from the mobile terminal **600**, and may change the level for tightening the shoelaces ASL based on the received temperature information.

[0169] Meanwhile, the processor **170** may receive temperature information from the mobile terminal **600**, and may control a change in the level for tightening the shoelaces ASL based on the received temperature information.

[0170] Meanwhile, the processor **170** may receive humidity information from the mobile terminal **600**, and may control a change in the level for tightening the shoelaces ASL based on the received humidity information.

[0171] Meanwhile, the processor **170** may receive tightness information of the shoelaces ASL from the mobile terminal **600**, and may control a change in the level for tightening the shoelaces ASL based on the received tightness information of the shoelaces ASL.

[0172] Meanwhile, the processor **170** may calculate a stride speed, a gait angle, and a gait, and accordingly may provide various pieces of information.

[0173] Meanwhile, the processor **170** may transmit the behavior pattern of the user to the .mobile terminal **600**, may measure the amount of exercise, or may measure a gait.

[0174] Meanwhile, the processor **170** may automatically adjust the tightness of the shoelaces based on a shoelace tightening level set through the mobile terminal **600**.

[0175] Meanwhile, the processor **170** may generate vibration in order to prevent separation of the mobile terminal **600**, particularly, prevent loss thereof when the distance to the mobile terminal **600** is equal to or greater than a predetermined value, i.e. when the intensity of wireless signals exchanged with the paired mobile terminal **600** is equal to or less than a reference value.

[0176] Meanwhile, the processor **170** may automatically adjust the tightness of the shoelaces based on position information, such as GPS information, received from the mobile terminal **600** or the like.

[0177] In one example, when the current position is an intersection, each shoelace adjusting device **100** may perform control such that the shoelaces are tightened.

[0178] In another example, when the current position is near the home, each shoelace adjusting device **100** may perform control such that the shoelaces are loosened.

[0179] Meanwhile, the processor **170** may automatically adjust the tightness of the shoelaces based on the surrounding environment.

[0180] In one example, when an obstacle is present ahead, each shoelace adjusting device **100** may perform control such that the shoelaces are tightened.

[0181] In another example, when it is time for the user to get out of a subway, a bus, a car, or the like, each shoelace adjusting device **100** may tighten the shoelaces, which are in a loosened state, so that the user recognizes that it is time to get out.

[0182] Meanwhile, the processor **170** may automatically adjust the tightness of the shoelaces based on the exercise state of the wearer. Accordingly, it may be helpful for managing the pace of the user.

[0183] FIG. **16** illustrates that the left side and the right side of the shoelaces ALSa and ASLb of the shoe **50**L are tightened differently.

[0184] For example, similar to FIG. **12**, when the motor **155** includes the first motor **155***a* and the second motor **155***b*, the processor **170** may perform control such that the left side and the right side of the shoelaces ALSa and ASLb are tightened differently based on sensing information from the motion sensor **131**.

[0185] For example, when the user has an asymmetrical gait, the processor **170** may automatically adjust the tightness of the shoelaces in order to correct the gait or the like.

[0186] For example, upon detecting an out-toed gait, an in-toed gait, or the like, the processor **170** may perform control such that the left side and the right side of the shoelaces ALSa and ASLb are tightened differently in order to correct the gait or the like.

[0187] FIG. **17** is a schematic internal block diagram of still another example of the shoelace adjusting device in FIG. **2**, and FIG. **18** is a view referenced to describe the method of operating the shoelace adjusting device in FIG. **17**.

[0188] Referring to FIG. **17**, the shoelace adjusting device **100***c* in FIG. **17** is similar to the shoelace adjusting device **100** in FIG. **3**, but is different in that a shoelace adjuster **160**, which adjusts the shoelace tightening level using electro-stimulation, is provided in place of the motor **155**.

[0189] Specifically, as shown in FIG. **18**, the shoelace adjusting device **100***c* includes shoelace adjusters **161***a* and **161***b*, which are in contact with the part portions of the shoelaces ALSla and ASLb, respectively.

[0190] In one example, when a positive-polarity electric signal having the level a is applied to the shoelace adjusters **161***a* and **161***b*, the shoelaces may be tightened to the first level.

[0191] In another example, when a positive-polarity electric signal having the level b, which is lower than the level a, is applied to the shoelace adjusters **161***a* and **161***b*, the shoelaces may be tightened to the second level.

[0192] In another example, when a negative-polarity electric signal is applied to the shoelace adjusters **161***a* and **161***b*, the shoelaces may be tightened to the third level.

[0193] That is, the shoelace adjusting device **100***c* may determine whether the shoes **50** are being used in a running state, a walking state, or a sitting state based on sensing information from the motion sensor **131**, and may control a change in the level for tightening the shoelaces ASL based on the respective states. Accordingly, the tightness of the shoelaces ASL may be automatically adjusted based on the state of the user wearing the shoes **50**.

[0194] The shoelace adjusting device and the shoe including the same based on the embodiment of the present disclosure is not limited to the configurations and methods of the above-described embodiments, and all or some of the embodiments may be selectively combined to obtain various modifications.

[0195] In addition, it will be apparent that, although the preferred embodiments have been shown and described above, the present disclosure is not limited to the above-described specific embodiments, and various modifications and variations can be made by those skilled in the art without departing from the gist of the appended claims. Thus, it is intended that the modifications and variations should not be understood independently of the technical spirit or prospect of the present disclosure.

1. A shoelace adjusting device configured to adjust a shoelace attached to a shoe, the shoelace adjusting device comprising:
   - a motor configured to operate to adjust at least one part of the shoelace;
   - a sensor portion comprising a motion sensor; and
   - a processor configured to determine whether the shoe is being used in a running state, a walking state, or a sitting state based on sensing information from the motion sensor and to change a level for tightening the shoelace based on respective states.

2. The shoelace adjusting device of claim **1**, wherein the sensor portion further comprises:
   - a flex sensor configured to detect a bent state of the shoelace, and
   - wherein the processor is configured to change a level for tightening the shoelace based on flex-sensing information from the flex sensor and state information of the shoe.

3. The shoelace adjusting device of claim **1**, wherein the sensor portion further comprises:
   - a pressure sensor configured to detect a pressure, and
   - wherein the processor determines whether the shoe is being used in a running state, a walking state, or a

sitting state based on sensing information from the motion sensor and pressure sensing information from the pressure sensor, and is configured to change a level for tightening the shoelace based on respective states.

4. The shoelace adjusting device of claim **3**, wherein, when the pressure sensing information is equal to or greater than a first reference value for a predetermined period of time, the processor determines that a foot of a wearer of the shoe is in a swollen state, and is configured to change a level for tightening the shoelace in response to the swollen state.

5. The shoelace adjusting device of claim **1**, wherein the processor further determines whether the shoe is taken off or put on based on sensing information from the motion sensor, and is configured to change a level for tightening the shoelace based on the state of taking off the shoe or the state of putting on the shoe.

6. The shoelace adjusting device of claim **1**, further comprising:

a communicator configured to exchange data with a mobile terminal,

wherein the processor compares state information of a wearer of the shoe, received from the mobile terminal, with state information, determined based on sensing information from the motion sensor, calculates final state information, and is configured to change a level for tightening the shoelace based on the final state information.

7. The shoelace adjusting device of claim **6**, wherein the processor receives temperature information from the mobile terminal, and is configured to change a level for tightening the shoelace based on the received temperature information.

8. The shoelace adjusting device of claim **6**, wherein the processor receives humidity information from the mobile terminal, and is configured to change a level for tightening the shoelace based on the received humidity information.

9. The shoelace adjusting device of claim **1**, wherein the motor comprises:

a first motor configured to operate to move one part of the shoelace; and

a second motor configured to operate to move another part of the shoelace, and

wherein the processor performs control to differently tighten a left side and a right side of the shoelace based on sensing information from the motion sensor.

10. The shoelace adjusting device of claim **1**, wherein the processor is configured to change a level for tightening the shoelace based on a moving speed of the shoe.

11. The shoelace adjusting device of claim **1**, wherein the processor determines whether the shoelace is a shoelace of a left shoe or a shoelace of a right shoe based on sensing information from the motion sensor, and is configured to change a level for tightening the shoelace based on determination information.

12. The shoelace adjusting device of claim **1**, further comprising:

a communicator configured to exchange data with a mobile terminal,

wherein the processor receives shoelace tightness information from the mobile terminal and is configured to change a level for tightening the shoelace based on the received shoelace tightness information.

13. A shoelace adjusting device configured to adjust a shoelace attached to a shoe, the shoelace adjusting device comprising:

a first motor configured to operate to move at least one part of the shoelace;

a second motor configured to rotate in a same direction as the first motor and to operate to move the at least one part of the shoelace;

a sensor portion comprising a motion sensor; and

a processor configured to determine whether the shoe is being used in a running state, a walking state, or a sitting state based on sensing information from the motion sensor and to change a level for tightening the shoelace based on respective states.

14. The shoelace adjusting device of claim **13**, wherein the sensor portion further comprises:

a flex sensor configured to detect a bent state of the shoelace, and

wherein the processor is configured to change a level for tightening the shoelace based on flex-sensing information from the flex sensor and state information of the shoe.

15. The shoelace adjusting device of claim **13**, wherein the sensor portion further comprises:

a pressure sensor configured to detect a pressure, and

wherein the processor determines whether the shoe is being used in a running state, a walking state, or a sitting state based on sensing information from the motion sensor and pressure sensing information from the pressure sensor, and is configured to change a level for tightening the shoelace based on respective states.

16. The shoelace adjusting device of claim **13**, wherein the processor further determines whether the shoe is taken off or put on based on sensing information from the motion sensor, and is configured to change a level for tightening the shoelace based on the state of taking off the shoe or the state of putting on the shoe.

17. The shoelace adjusting device of claim **13**, further comprising:

a communicator configured to exchange data with a mobile terminal,

wherein the processor compares state information of a wearer of the shoe, received from the mobile terminal, with state information, determined based on sensing information from the motion sensor, calculates final state information, and is configured to change a level for tightening the shoelace based on the final state information.

18. A shoelace adjusting device configured to adjust a shoelace attached to a shoe, the shoelace adjusting device comprising:

a shoelace adjuster configured to operate to adjust at least one part of the shoelace;

a sensor portion comprising a motion sensor; and

a processor configured to determine whether the shoe is being used in a running state, a walking state, or a sitting state based on sensing information from the motion sensor and to change a level for tightening the shoelace based on respective states.

19. A shoe comprising the shoelace adjusting device configured to adjust a shoelace attached to a shoe,

wherein the shoelace adjusting device comprising:

a motor configured to operate to adjust at least one part of the shoelace;

a sensor portion comprising a motion sensor; and

a processor configured to determine whether the shoe is being used in a running state, a walking state, or a sitting state based on sensing information from the motion sensor and to change a level for tightening the shoelace based on respective states.

* * * * *

专利名称(译)	鞋带调节装置及具有该装置的鞋		
公开(公告)号	US20200163416A1	公开(公告)日	2020-05-28
申请号	US16/632832	申请日	2018-07-18
申请(专利权)人(译)	LG电子株式会社.		
当前申请(专利权)人(译)	LG电子株式会社.		
[标]发明人	KWON EUN		
发明人	KWON, EUN		
IPC分类号	A43C11/16 A61B5/00 A43B3/00 A61B5/103		
CPC分类号	A61B5/6807 A61B5/1038 A61B2503/12 A43C11/165 A43B3/0005 A43B3/0015 A43C11/20 A61B5/103 A61B5/11 A43B3/00 A43C11/14 A43C11/16 G06Q50/22		
优先权	1020170091681 2017-07-19 KR		
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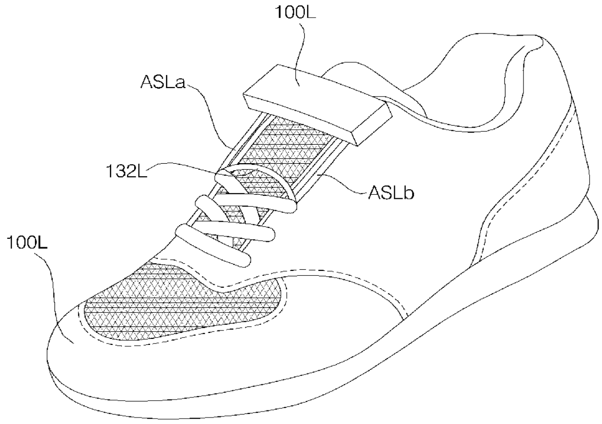
摘要(译)

本发明涉及一种鞋带调节装置和包括该鞋带调节装置的鞋。 基于本公开的实施例的鞋带调节装置和包括该鞋带调节装置的鞋包括：马达，被配置为操作以调节鞋带的至少一部分；传感器，其包括运动传感器；以及处理器，被配置为确定鞋是否 基于来自运动传感器的感测信息，在行驶状态，步行状态或就座状态下使用“鞋带”，并基于各个状态来改变用于收紧鞋带的水平。 因此，可以基于使用者穿鞋的状态来自动调节鞋带的松紧度。



(a)