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(54) **WEARABLE ELECTRONIC APPARATUS INCLUDING STRAP FASTENING DEVICE**

(57) An electronic apparatus according to an embodiment comprises: a body housing; a first strap connected to one end of the body housing; a second strap connected to the other end of the body housing; and a fastening device for integrally fastening or separating the first and second straps. The fastening device includes: a first fastening member which can move along the first strap and includes a first surface oriented in a first direction, a second surface oriented in a second direction opposite to the first direction, and a first side surface oriented in a first lateral direction perpendicular to each of the first and second directions, wherein a first magnetic body having a first polarity is disposed on the first surface; and a second fastening member which includes a third surface oriented in a third direction, a fourth surface oriented in a fourth direction opposite to the third direction, and a second side surface oriented in a second lateral direction perpendicular to each of the third and fourth directions, wherein a second magnetic body having a second polarity opposite to the first polarity is disposed on the second fastening member, and the second fastening member is integrally fastened to or separated from the first fastening member and is rotatably connected to the second strap. Various other embodiments that can be understood through the specification are also possible.

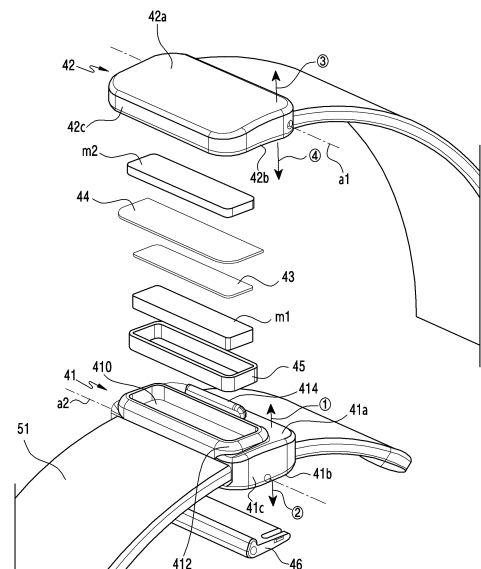


FIG.5

Description**[Technical Field]**

[0001] The disclosure relates to a wearable electronic apparatus including a strap fastening device which allows a main body to be worn on wrist.

[Background Art]

[0002] An electronic apparatus, for example, a wearable electronic apparatus, may require a separate wearing device to be worn on user's body. For example, a wrist-wearable electronic apparatus may include two straps to allow a main body to be worn on wrist, and a fastening device for fastening the two straps.

[0003] The fastening device may include a fixing member disposed on one strap, and fixing holes formed on the other strap, and the two straps may be fastened to each other by inserting the fixing member into one selected hole, so that the main body is worn on wrist.

[0004] Alternatively, magnetic substances having different polarities may be disposed at ends of the straps, and the two straps may be fastened to each other by an attractive force between the magnetic substances, so that the main body is worn on wrist.

[Disclosure of Invention]**[Technical Problem]**

[0005] The fastening device using the fixing member and the fixing hole may be inconvenient in fastening or unfastening the straps.

[0006] In the case of the fastening device using the magnetic substance, the fastening state may be unstable and there may be a risk that the main body unintentionally drops down, and if the fastening state by the magnetic substances is strengthened, it may be inconvenient to unfasten.

[0007] The disclosure provides a wearable electronic apparatus including a strap fastening device, which applies a semi-open/semi-closed structure, so that relatively less user force is required to attach or detach and it is easy to fasten/unfasten straps.

[0008] The disclosure provides a wearable electronic apparatus including a strap fastening device which is capable of fastening/unfastening straps with a simple operation.

[0009] The disclosure provides a wearable electronic apparatus including a strap fastening device which has a separate locking structure to prevent straps from being unintentionally released.

[0010] The disclosure provides a wearable electronic apparatus including a strap fastening device which enables a user to intuitively recognize a fastening or unfastening operation of a fastening device.

[Solution to Problem]

[0011] According to an embodiment of the disclosure, a wearable electronic apparatus may include: a main body housing; a first strap connected to one end of the main body housing; a second strap connected to the other end of the main body housing; and a fastening device configured to integrally fasten the first, second straps to each other or to separate the first, second straps from each other, and the fastening device may include: a first fastening member including: a first surface facing in a first direction; a second surface facing in a second direction which is opposite to the first direction; and a first side surface facing in a first lateral direction which is perpendicular to the first, second directions, wherein a first magnetic substance of a first polarity is disposed on the first surface, and the first fastening member is movable along the first strap; and a second fastening member including: a third surface facing in a third direction; a fourth surface facing in a fourth direction which is opposite to the third direction; and a second side surface facing in a second lateral direction which is perpendicular to the third, fourth directions, wherein a second magnetic substance of a second polarity which is opposite to the first polarity is disposed in the second fastening member, and the second fastening member is integrally coupled with or is decoupled from the first fastening member, and is rotatably connected to the second strap.

[Advantageous Effects of Invention]

[0012] According to various embodiments of the disclosure, a relatively less user force is exerted in fastening/unfastening, and thus it is easy to fasten/unfasten straps.

[0013] According to various embodiments of the disclosure, it is possible to fasten/unfasten the straps with a simple operation.

[0014] According to an embodiment of the disclosure, the straps may be prevented from being released inadvertently due to a locking structure, and a damage caused by dropping of the main body may be prevented.

[0015] According to an embodiment of the disclosure, the main body may be prevented from dropping down by the connection device of the first, second fastening members when the fastening device performs a fastening/unfastening operation.

[0016] According to an embodiment of the disclosure, fastening of the fastening device may be enhanced by a stopper formed at an end of the second strap.

[Brief Description of Drawings]**[0017]**

FIG. 1 is a perspective view illustrating a front surface of a mobile electronic apparatus according to an embodiment;

FIG. 2 is a perspective view illustrating a rear surface of the electronic apparatus of FIG. 1;

FIG. 3 is an exploded perspective view of the electronic apparatus of FIG. 1;

FIG. 4A is a perspective view illustrating a fastening device in a state in which first, second fastening members are fastened to each other according to an embodiment of the disclosure;

FIG. 4B is a perspective view illustrating the fastening device in a state in which the first, second fastening members are released from each other according to an embodiment of the disclosure;

FIG. 5 is an exploded perspective view illustrating a fastening device according to an embodiment of the disclosure;

FIG. 6A is a cross-sectional view illustrating a fastening device with first, and second fastening members being fastened to each other according to an embodiment of the disclosure;

FIG. 6B is a perspective view illustrating the first fastening member according to an embodiment of the disclosure;

FIG. 7A is a perspective view illustrating a fastening device with first, second fastening member being fastened to each other as viewed from the bottom according to an embodiment of the disclosure;

FIGS. 7B to 7D are views illustrating a process of releasing a fastened state according to an embodiment, wherein FIG. 7B is a side view illustrating the fastening device with the first, second fastening members being fastened to each other according to an embodiment of the disclosure;

FIG. 7C is a side view illustrating a semi-open state achieved by rotation of the second fastening member according to an embodiment of the disclosure;

FIG. 7D is a side view illustrating a state in which the second fastening member is separated from the first fastening member according to an embodiment of the disclosure;

FIGS. 8A to 8C are views illustrating a fastening process according to an embodiment of the disclosure, wherein FIG. 8A is a side view illustrating the fastening device with first, second fastening members are separated according to an embodiment of the disclosure;

FIG. 8B is a side view illustrating a semi-closed state achieved by rotation of the second fastening member according to an embodiment of the disclosure;

FIG. 8C is a side view illustrating a state in which the second fastening member is fastened to the first fastening member according to an embodiment of the disclosure;

FIG. 9 is a cross-sectional view illustrating a state in which a pressed state of a first strap is released by rotation of a strap length adjustment member according to an embodiment of the disclosure;

FIG. 10 is a cross-sectional view illustrating a state in which the first strap is pressed by rotation of the strap

length adjustment member according to an embodiment of the disclosure;

FIG. 11A is a perspective view illustrating a fastening device with first, second fastening member being fastened to each other according to an embodiment of the disclosure;

FIG. 11B is a perspective view illustrating the fastening device with the first, second fastening members being unfastened from each other according to an embodiment of the disclosure;

FIG. 12 is an exploded perspective view illustrating a fastening device according to an embodiment of the disclosure;

FIG. 13 is a perspective view illustrating a state in which a strap length adjustment member is rotated from a rotation opening of a first fastening member according to an embodiment of the disclosure;

FIG. 14 is a cross-sectional view illustrating a fastening device according to an embodiment of the disclosure;

FIG. 15 is a cross-sectional view illustrating a fastening device according to an embodiment of the disclosure;

FIG. 16A is a cross-sectional view illustrating a fastening device in a state in which fastening is enhanced by a stopper according to an embodiment of the disclosure;

FIG. 16B is a cross-sectional view illustrating the fastening device when the fastening device is worn on wrist according to an embodiment of the disclosure;

FIG. 17 is a perspective view illustrating a hook according to an embodiment of the disclosure;

FIG. 18 is a cross-sectional view illustrating a hook according to an embodiment of the disclosure; and FIG. 19 is a cross-sectional view illustrating a hook according to an embodiment of the disclosure.

[0018] Regarding explanation of the drawings, the same or like reference numerals may be used to refer to the same or like components.

[Best Mode for Carrying out the Invention]

[0019] Hereinafter, various embodiments of the disclosure will be described with reference to the accompanying drawings. It should be appreciated that various embodiments are not intended to limit the disclosure to particular embodiments and include various modifications, equivalents, and/or alternatives of embodiments of the disclosure.

[0020] FIG. 1 is a perspective view illustrating a front surface of a mobile electronic apparatus according to an embodiment, and FIG. 2 is a perspective view illustrating a rear surface of the electronic apparatus of FIG. 1.

[0021] Referring to FIGS. 1 and 2, the electronic apparatus 100 according to an embodiment may include a housing 110 which includes a first surface (or a front

surface) 110A, a second surface (or a rear surface) 110B, and a side surface 110C surrounding a space between the first surface 110A and the second surface 110B, and fastening members 150, 160 which are connected to at least a part of the housing 110 and are configured to allow the electronic apparatus 100 to be removably fastened to a part of user's body (for example, a wrist, an ankle, etc.). In another embodiment (not shown), the housing may refer to a structure that forms a part of the first surface 110A, the second surface 110B, and the side surface 110C of FIG. 1. According to an embodiment, the first surface 110A may be formed by a front surface plate 101 having at least a part substantially transparent (for example, a glass plate including various coating layers, or a polymer plate). The second surface 110B may be formed by a rear surface plate 107 which is substantially opaque. The rear surface plate 107 may be formed by, for example, coated or colored glass, ceramic, a polymer, metal (for example, aluminum, stainless steel (STS), or magnesium), or a combination of at least two of the above-mentioned materials. The side surface 110C may be formed by a side surface bezel structure 106 (or a "side surface member") which is coupled with the front surface plate 101 and the rear surface plate 107 and includes metal and/or a polymer. In a certain embodiment, the rear surface plate 107 and the side surface bezel structure 106 may be integrally formed with each other, and may include the same material (for example, a metallic material such as aluminum). The fastening members 150, 160 may be formed of various materials in various shapes. The fastening members 150, 160 may be formed in an integrated type with a woven material, leather, rubber, urethane, metal, ceramic or a combination of at least two of the aforementioned materials, or may be formed of a plurality of unit links movable relative to one another.

[0022] According to an embodiment, the electronic apparatus 100 may include at least one of a display 120 (see FIG. 3), audio modules 105, 108, a sensor module 111, key input devices 102, 103, 104, and a connector hole 109. In a certain embodiment, the electronic apparatus 100 may omit at least one of the components (for example, the key input devices 102, 103, 104, the connector hole 109, or the sensor module 111) or may additionally include other components.

[0023] According to an embodiment, the display 100 may be exposed through a corresponding portion of the front surface plate 101, for example. The display 120 may have a shape corresponding to the shape of the front surface plate 101, or may be formed in various shapes such as a circular shape, an elliptical shape, or a polygonal shape. The display 120 may be coupled with or may be disposed adjacent to a touch sensing circuit, a pressure sensor for measuring an intensity (pressure) of a touch, and/or a fingerprint sensor.

[0024] According to an embodiment, the audio modules 105, 108 may include a microphone hole 105 and a speaker hole 108. The microphone hole 105 may have a

microphone disposed therein to acquire an external sound, and in a certain embodiment, the microphone hole may have a plurality of microphones disposed therein to detect a direction of a sound. The speaker hole 108 may be used as an external speaker or a receiver for communication. In a certain embodiment, the speaker holes 108 and the microphone hole 105 may be implemented by one hole or a speaker may be included without the speaker holes 108 (for example, a piezo speaker).

[0025] According to an embodiment, the sensor module 111 may generate an electric signal or a data value corresponding to an internal operation state or an external environment state of the electronic apparatus 100. The sensor module 111 may include, for example, a biometric sensor module 111 (for example, an HRM sensor) disposed on the second surface 110B of the housing 110. The electronic apparatus 100 may further include a sensor module (not shown), for example, at least one of a gesture sensor, a gyro sensor, an atmospheric pressure sensor, a magnetic sensor, an acceleration sensor, a grip sensor, a color sensor, an infrared (IR) sensor, a biometric sensor, a temperature sensor, a humidity sensor, or an illuminance sensor.

[0026] According to an embodiment, the key input devices 102, 103, 104 may include a wheel key 102 which is disposed on the first surface 110A of the housing 110 and is rotatable in at least one direction, and/or a side key button 102, 103 which is disposed on the side surface 110C of the housing 110. The wheel key may have a shape corresponding to the shape of the front surface plate 102. In another embodiment, the electronic apparatus 100 may not include a part or entirety of the key input devices 102, 103, 104 mentioned above, and the key input device 102, 103, 104 that is not included may be implemented on the display 120 in other forms such as a soft key. The connector hole 109 may include other connector holes (not shown) to accommodate a connector (for example, a USB connector) for exchanging power and/or data with an external electronic apparatus and a connector for exchanging an audio signal with an external electronic apparatus. The electronic apparatus 100 may further include a connector cover (not shown) to cover at least a part of the connector hole 109 and to prevent entrance of external foreign substances to the connector hole.

[0027] According to an embodiment, the fastening members 150, 160 may be attachably and detachably fastened to at least some areas of the housing 110 by using locking members 151, 161. The fastening members 150, 160 may include one or more of a fixing member 152, a fixing member fastening hole 153, a band guide member 154, and a band fixing loop 155.

[0028] According to an embodiment, the fixing member 152 may be configured to fix the housing 110 and the fastening members 150, 160 to a part of user's body (for example, a wrist, an ankle, etc.) The fixing member fastening hole 153 may fix the housing 110 and the fastening members 150, 160 to a part of the user's body

in response to the fixing member 152. The band guide member 154 may be configured to restrict a movement range of the fixing member 152 when the fixing member 152 is fastened to the fixing member fastening hole 153, so that the fastening members 150, 160 are fastened in close contact with a part of the user's body. The band fixing loop 155 may restrict a movement range of the fastening members 150, 160 while the fixing member 152 and the fixing member fastening hole 153 are fastened to each other.

[0029] FIG. 3 is an exploded perspective view of the electronic apparatus of FIG. 1.

[0030] Referring to FIG. 3, the electronic apparatus 300 may include a side bezel structure 310, a wheel key 320, a front surface plate 101, a display 120, a first antenna 350, a second antenna 355, a support member 360 (for example, a bracket), a battery 370, a printed circuit board 380, a sealing member 390, a rear surface plate 393, and fastening members 395, 397. At least one of the components of the electronic apparatus 300 may be the same as or similar to at least one of the components of the electronic apparatus 100 of FIG. 1 or 2, and a redundant explanation thereof will be omitted. The support member 360 may be disposed in the electronic apparatus 300 to be connected with the side bezel structure 310 or may be integrally formed with the side bezel structure 310. The support member 360 may be formed of a metallic material and/or a non-metallic material (for example, a polymer). The support member 360 may have one surface coupled with the display 120 and the other surface coupled with the printed circuit board 380. A processor, a memory, and/or an interface may be mounted on the printed circuit board 380. The processor may include, for example, one or more of a central processing device, an application processor, a graphic processing unit (GPU), an application processor, a sensor processor, or a communication processor.

[0031] According to an embodiment, the memory may include, for example, a volatile memory or a non-volatile memory. The interface may include, for example, a high definition multimedia interface (HDMI), a universal serial bus (USB) interface, an SD card interface and/or an audio interface. The interface may electrically or physically connect the electronic apparatus 300 with an external electronic apparatus, and may include a USB connector, an SD card/MMC connector, or an audio connector.

[0032] According to an embodiment, the battery 370 is a device for supplying power to at least one component of the electronic apparatus 300, and for example, may include a primary battery which is not rechargeable, or a rechargeable secondary battery or a fuel cell. At least a part of the battery 370 may be disposed on substantially the same plane as the printed circuit board 380. The battery 370 may be integrally disposed in the electronic apparatus 100, or may be attachably and detachably disposed in the electronic apparatus 100.

[0033] According to an embodiment, the first antenna 350 may be disposed between the display 120 and the

support member 360. The first antenna 350 may include, for example, a near field communication (NFC) antenna, a wireless charging antenna, and/or a magnetic secure transmission (MST) antenna. The first antenna 350 may perform short-range communication with an external device, or may wirelessly transmit and receive power necessary for charging, and may transmit a magnetism-based signal including a short-range communication signal or payment data. In another embodiment, an antenna structure may be formed by a part of the side bezel structure 310 and/or the support member 360 or a combination thereof.

[0034] According to an embodiment, the second antenna 355 may be disposed between the circuit board 380 and the rear surface plate 393. The second antenna 355 may include, for example, a near field communication (NFC) antenna, a wireless charging antenna, and/or a magnetic secure transmission (MST) antenna. The second antenna 355 may perform short-range communication with an external device, or may wirelessly transmit and receive power necessary for charging, and may transmit a magnetism-based signal including a short-range communication signal or payment data. In another embodiment, an antenna structure may be formed by a part of the side bezel structure 310 and/or the rear surface plate 393 or a combination thereof.

[0035] According to an embodiment, the sealing member 390 may be positioned between the side bezel structure 310 and the rear surface plate 393. The sealing member 390 may be configured to block moisture and foreign substances from entering a space surrounded by the side bezel structure 310 and the rear surface plate 393 from the outside.

[0036] FIG. 4A is a perspective view illustrating a fastening device in a state in which first, second fastening members are fastened to each other according to an embodiment of the disclosure. FIG. 4B is a perspective view illustrating the fastening device in a state in which the first, second fastening members are released from each other according to an embodiment of the disclosure.

[0037] Referring to FIGS. 4A and 4B, an electronic apparatus (for example, the electronic apparatus 100 illustrated in FIG. 1) in which a fastening device 40 according to an embodiment is disposed may be a wearable electronic apparatus which is worn on user's body, and for example, may be a wearable electronic apparatus of a watch type which is worn on user's wrist (hereinafter, referred to as an "electronic apparatus").

[0038] According to an embodiment, the electronic apparatus may include a main body housing (for example, the housing 110 illustrated in FIG. 1), and may include first, second straps 51, 52 and the fastening device 40 for allowing the main body housing to be worn on wrist.

[0039] According to an embodiment, the electronic apparatus may include the first strap 51 connected to one end of the main body housing and the second strap 52 connected to the other end of the main body housing, and the fastening device 40 which integrally fastens or

separates the first, second straps 51, 52. The electronic apparatus may be worn on wrist or may be separated from wrist by the fastening device 40.

[0040] According to an embodiment, the fastening device 40 may include a first fastening member 41 disposed on the first strap 51, and a second fastening member 42 disposed on the second strap 52. According to an embodiment, the first fastening member 41 may be movable along the first strap 51, and the second fastening member 42 may be disposed on the second strap 52 to be rotatable about a first rotation axis a1. The fastening device 40 according to an embodiment may integrally fasten the first, second fastening members 41, 42 by using an attractive force generated between magnetic substances, or may separate the first, second fastening members 41, 42 by applying a predetermined force. According to an embodiment, when the first fastening member 41 and the second fastening member 42 are positioned within a specific distance due to a magnetic force of the magnetic substances, the first fastening member 41 and the second fastening member 42 may be fastened to each other by an attractive force generated between the magnetic substances.

[0041] FIG. 5 is an exploded perspective view illustrating a fastening device according to an embodiment of the disclosure. FIG. 6A is a cross-sectional view illustrating the fastening device with first, second fastening members being fastened to each other according to an embodiment of the disclosure. FIG. 6B is a perspective view illustrating the second fastening member according to an embodiment of the disclosure.

[0042] Referring to FIGS. 5 to 6B, the fastening device 40 according to an embodiment may include a first fastening member 41, a second fastening member 42, a first magnetic substance m1, and a second magnetic substance m2. According to an embodiment, the first magnetic substance m1 may be disposed in the first fastening member 41 and the second magnetic substance m2 may be disposed in the second fastening member 42. For example, the first magnetic substance m1 and the second magnetic substance m2 may include a magnetic material of a chip size. According to an embodiment, the first magnetic substance m1 may be a first polarity and the second magnetic substance m2 may be a second polarity which is opposite to the first polarity. For example, when the first magnetic substance m1 is the N-polarity, the second magnetic substance m2 may be the S-polarity, and, when the first magnetic substance m1 is the S-polarity, the second magnetic substance m2 may be the N-polarity. According to an embodiment, the first fastening member 41 and the second fastening member 42 may be fastened to each other in close contact with each other by an attractive force generated between the first magnetic substance m1 and the second magnetic substance m2, and may maintain the fastened state.

[0043] According to an embodiment, the first fastening member 41 may include a first surface 41a facing in a first direction ① (for example, an upward direction), a second

surface 41b facing in a second direction ② (for example, a downward direction) which is opposite to the first direction, and a first side surface 41c facing in a first lateral direction which is perpendicular to the first, second directions ①, ②. For example, the first fastening member 41 may have a box-like shape. According to an embodiment, the first fastening member 41 may have the first magnetic substance m1 disposed on the side of the first surface 41a, and a strap length adjustment member 46 formed on the side of the second surface 41b. According to an embodiment, the first magnetic substance m1 may be fixed to the first fastening member 41 by using a rubber packing 45. According to an embodiment, a first magnet cover 43 may be attached to an outer surface of the first magnetic substance m1 disposed in the first fastening member 41, so that the first magnetic substance may be protected from the outside.

[0044] According to an embodiment, the second fastening member 42 may include a third surface 42a facing in a third direction ③ (for example, an upward direction), a fourth surface 42b facing in a fourth direction ④ (for example, a downward direction) which is opposite to the third direction ③, and a second side surface 42c facing in a second lateral direction which is perpendicular to the third, fourth directions ③, ④. For example, the second fastening member 42 may have a substantially box-like shape. According to an embodiment, the second fastening member 42 may have the second magnetic substance m2 disposed on the side of the fourth surface 42b. According to an embodiment, a second magnet cover 44 may be attached to an outer surface of the second magnetic substance m2 disposed in the second fastening member 42, so that the second magnetic substance may be protected from the outside.

[0045] According to an embodiment, the first fastening member 41 may have a second rotation axis a2 to which the strap length adjustment member 46 is rotatably connected, and the second fastening member 42 may have a first rotation axis a1 to which an end of the second strap 52 is rotatably connected.

[0046] According to an embodiment, the first fastening member 41 may have a first accommodation opening 410 formed on the first surface 41a to accommodate the first magnetic substance m1. According to an embodiment, the first accommodation opening 410 may accommodate the first magnetic substance m1 and the rubber packing 45. According to an embodiment, a hook 414 which is a part of a locking structure may be formed on a circumference of the first accommodation opening 410. According to an embodiment, the hook 414 has a shape protruding in the first direction ① and may extend along the circumference (for example, an edge) of the first accommodation opening 410.

[0047] According to an embodiment, the first fastening member may include a penetrating opening 416 through which the first strap 51 penetrates. According to an embodiment, the penetrating opening 416 may extend in the first lateral direction. According to an embodiment,

the first accommodation opening 410 may have a shape recessed from the first surface 41a in the second direction, and may be formed at a position spaced apart from the penetrating opening 416. According to an embodiment, the first accommodation opening 410 may be formed in such a shape that it is opened in the first direction.

[0048] According to an embodiment, the second fastening member 42 may include a second accommodation opening 420 formed on the fourth surface 42b to accommodate at least a part of the first fastening member 41, and a third accommodation opening 421 to accommodate the second magnetic substance m2. According to an embodiment, a projection 422 may be formed to protrude further than one end of the first fastening member 41 when the first fastening member 41 and the second fastening member 42 are fastened to each other. According to an embodiment, the projection 412 may be formed at one end of the second fastening member 42, and a first rotation opening 424 may be formed at the other end. According to an embodiment, the first rotation opening 424 may be formed on the second side surface 42c to be opened in the second lateral direction. According to an embodiment, the first rotation opening 424 may have a first hinge h1 formed therein to rotatably connect the second fastening member 42 and an end of the second strap 52. According to an embodiment, the first hinge h1 may provide the first rotation axis a1. According to an embodiment, the first rotation opening 424 may be formed in the proximity of the second, third accommodation openings 420, 421 and may be opened in the second lateral direction.

[0049] According to an embodiment, the second accommodation opening 420 may be formed on the fourth surface 42b and may be opened in the fourth direction, and the hook 414 of the first fastening member may be inserted into the second accommodation opening.

[0050] According to an embodiment, the first rotation opening 424 may further include a locking groove 425. According to an embodiment, the locking groove 425 may be disposed between the third accommodation opening 421 and the first rotation opening 424. According to an embodiment, a locking structure may be formed to prevent a horizontal movement of the first fastening member 41 or the second fastening member 42 when the first fastening member 41 and the second fastening member 42 are fastened to each other. According to an embodiment, the locking structure may include the locking groove 425 and the hook 414. According to an embodiment, when the first fastening member 41 and the second fastening member 42 are fastened to each other, at least a part of the hook 414 may be inserted into the locking groove 425, so that the first fastening member 41 and the second fastening member 42 may be prevented from moving in the horizontal direction. For example, the horizontal movement may be a movement in a direction in which the first strap 51 or the second strap 52 is pulled when the electronic apparatus is worn on wrist. Accord-

ing to an embodiment, when the first fastening member 41 and the second fastening member 42 are fastened to each other, the first fastening member 41 or the second fastening member 42 may be prevented from being released from each other in the vertical direction due to an attractive force between the first magnetic substance m1 and the second magnetic substance m2. According to an embodiment, the locking structure may be disposed between the third accommodation opening 421 and the first hinge h1.

[0051] According to an embodiment, a second hinge h2 may be disposed in a second rotation opening 418. According to an embodiment, the second hinge h2 may provide the second rotation axis a2.

[0052] Sequential unfastening operations of the fastening device 40 according to an embodiment will be described with reference to FIGS. 7A to 7D.

[0053] FIG. 7A is a perspective view illustrating the fastening device with the first, second fastening members being fastened to each other according to an embodiment, as viewed from the bottom. FIG. 7B is a side view illustrating the fastening device with the first, second fastening members being fastened to each other according to an embodiment of the disclosure. FIG. 7C is a side view illustrating a semi-open state achieved by rotation of the second fastening member according to an embodiment of the disclosure. FIG. 7D is a side view illustrating a state in which the second fastening member is separated from the first fastening member according to an embodiment of the disclosure.

[0054] Referring to FIGS. 7A and 7B, according to an embodiment, when the first fastening member 41 and the second fastening member 42 are fastened to each other, the projection 422 of the second fastening member 42 may protrude from one end of the first fastening member 41.

[0055] Referring to FIG. 7C, according to an embodiment, a user may lift the second fastening member 42 in the arrow direction by placing user's finger on the projection 422 in order to separate the second fastening member 42 from the first fastening member 41. According to an embodiment, the second fastening member 42 may rotate about the first rotation axis a1, and the hook 414 disposed in the first fastening member 41 may be caught in the locking groove formed in the second fastening member 42, thereby entering a semi-open state.

[0056] Referring to FIG. 7D, according to an embodiment, in the semi-open state of the first fastening member 41 and the second fastening member 42, when a greater force than the force to enter the semi-open state is applied to the second fastening member 42, the hook 414 is completely released from the locking groove (for example, the locking state 425 of FIG. 6A), and then, the second fastening member 42 is completely separated from the first fastening member 41.

[0057] Referring to FIGS. 8A to 8C, sequential fastening operations of the fastening device 40 according to an embodiment of the disclosure will be described.

[0058] FIG. 8A is a side view illustrating the fastening device with the first, second fastening members being separated from each other according to an embodiment of the disclosure. FIG. 8B is a side view illustrating a semi-closed state achieved by rotation of the second fastening member according to an embodiment of the disclosure. FIG. 8C is a side view illustrating a state in which the second fastening member is fastened to the first fastening member according to an embodiment of the disclosure.

[0059] Referring to FIG. 8A, the first fastening member 41 and the second fastening member 42 may be positioned to substantially face each other to be fastened to each other according to an embodiment.

[0060] Referring to FIG. 8B, when the first fastening member 41 and the second fastening member 42 which face each other are positioned within a specific distance, the first fastening member 41 and the second fastening member 42 may enter the semi-closed state due to an attractive force between the first magnetic substance m1 and the second magnetic substance m2. According to an embodiment, the first fastening member 41 may have a first protrusion 412 formed on the first surface 41a along the circumference of the first accommodation opening (for example, the first accommodation opening 410 shown in FIG. 6). According to an embodiment, the first protrusion 412 of the first fastening member 41 may be inserted into the second accommodation opening 420 of the second fastening member 42, such that a coupling position of the first, second fastening members 41, 42 is guided.

[0061] According to an embodiment, the second fastening member 42 may go into the semi-closed state due to the first protrusion 412.

[0062] Referring to FIG. 8C, according to an embodiment, when a user presses the third surface 42a of the second fastening member 42 with a predetermined force or more, the second fastening member 42 may be naturally rotated by an angle such that the hook (for example, the hook 414 of FIG. 6) is caught into the locking groove (for example, the locking groove 425 shown in FIG. 6A), and then, the first fastening member 41 and the second fastening member 42 may be completely fastened to each other with a clicking sound.

[0063] FIG. 9 is a cross-sectional view illustrating a state in which a strap length adjustment member rotates and a first strap is released from a pressed state according to an embodiment of the disclosure. FIG. 10 is a cross-sectional view illustrating a state in which the strap length adjustment member rotates and the first strap goes into a pressed state according to an embodiment of the disclosure.

[0064] Referring to FIGS. 9 and 10, the fastening device 40 according to an embodiment may include the strap length adjustment member 46. According to an embodiment, the first fastening member 41 may be assembled to be slidable along the first strap 51, and the first fastening member 41 may be fixed to a desired position of

the first strap 51 according to an operation of the strap length adjustment member 46.

[0065] According to an embodiment, the first fastening member 41 may include the second rotation opening 418 to accommodate the strap length adjustment member 46. According to an embodiment, the strap length adjustment member 46 may include one end portion 461 and the other end portion 462. According to an embodiment, the one end portion 461 of the strap length adjustment member 46 may have a hinge hole to allow the second hinge h2 to be assembled therethrough to rotate, and a third protrusion 463. According to an embodiment, the one end portion 461 of the strap length adjustment member 46 may be a free end.

[0066] According to an embodiment, the third protrusion 463 may protrude from the second hinge h2 in a circumferential direction. According to an embodiment, the strap length adjustment member 46 may have the second hinge h2 assembled therewith, such that the strap length adjustment member 46 can perform a restricted rotational movement with reference to the second hinge h2. According to an embodiment, the second hinge h2 may provide the second rotation axis a2.

[0067] According to an embodiment, when the strap length adjustment member 46 is in a closed state, that is, the third protrusion 463 presses the first strap 51, the third protrusion 463 may be positioned to protrude toward the penetrating opening 416. According to an embodiment, the third protrusion 463 may press the first strap 51, such that the first fastening member 41 is fixed to the first strap 51.

[0068] According to an embodiment, when the strap length adjustment member 46 is in an open state, that is, the third protrusion does not press the first strap 51 and rotates by about 80 degrees, the third protrusion 463 may be positioned within the first rotation opening 416.

[0069] FIG. 11A is a perspective view illustrating a fastening device with first, second fastening members being fastened to each other according to an embodiment of the disclosure. FIG. 11B is a perspective view illustrating the fastening device with the first, second fastening members being separated from each other according to an embodiment of the disclosure. FIG. 12 is an exploded perspective illustrating the fastening device according to an embodiment of the disclosure.

[0070] Referring to FIGS. 11A to 12, the same components of the fastening device according to an embodiment as those of the fastening device 40 illustrated in FIGS. 4A to 5 will not be described to avoid redundant descriptions and only the different parts will be described. According to an embodiment, the fastening device may include a connection device 60 to physically connect a first fastening member 41 and a second fastening member 42.

[0071] According to an embodiment, the connection device 60 may include a first connection member 61, a second connection member 62, and a hinge portion 63. The first connection member 61 may integrally extend

from the first fastening member 41. According to an embodiment, the second connection member 62 may be connected to the first rotation axis a1 of the second fastening member 42 to be rotatable coaxially. According to an embodiment, the hinge portion 63 may include a first hinge arm 631 formed at an end of the first connection member 61, a second hinge arm 632 formed at an end of the second connection member 62, and a hinge pin 64 rotatably connecting the first hinge arm 631 and the second hinge arm 632. According to an embodiment, a third rotation axis a3 provided by the hinge pin 64 may be parallel to the first rotation axis (for example, the first rotation axis a1 shown in FIG. 6A).

[0072] According to an embodiment, when the first fastening member 41 and the second fastening member 42 are fastened to each other, the first connection member 61 and the second connection member 62 may be close to each other to the maximum, or may be disposed on the same plane. Reference numeral 633 may indicate a rotation arm formed at the other end of the second connection member 62 and providing the first rotation axis a1, and reference numeral 634 may indicate a rotation arm formed at an end of the second strap 52.

[0073] FIG. 13 is a perspective view illustrating a state in which the strap length adjustment member rotates from the rotation opening of the first fastening member according to an embodiment of the disclosure.

[0074] Referring to FIG. 13, according to an embodiment, a fixing device may be disposed in the strap length adjustment member 46 to fix the strap length adjustment member 46 within the first rotation opening 416 without releasing. According to an embodiment, the fixing device may include at least one locking protrusion 465 and at least one locking groove 417. According to an embodiment, due to the coupling between the locking protrusion 465 and the locking groove 417, the strap length adjustment member 46 may remain accommodated in the first rotation opening 424. According to an embodiment, the locking protrusion 465 may be formed on the strap length adjustment member 46 and the locking groove 417 may be formed on the first rotation opening 424 of the first fastening member 41. According to an embodiment, one pair of locking protrusions 465 may be formed and may be formed on both side surfaces of the strap length adjustment member 46, respectively, and one pair of locking grooves 417 may be formed on the second rotation opening 424 of the first fastening member.

[0075] According to an embodiment, the first fastening member 41 may include one or more slits 464. For example, the slits 464 may include first, second slits 464 symmetrically formed on the first fastening member 41. According to an embodiment, the first, second slits 464 may be symmetrically formed between the first, second locking protrusions 465. According to an embodiment, the fixing device of the strap length adjustment member 46 may be elastically fixed or unfixed by the first, second slits 464.

[0076] FIG. 14 is a cross-sectional view illustrating a

fastening device according to an embodiment.

[0077] Referring to FIG. 14, the same components of the fastening device according to an embodiment as those of the fastening device 40 illustrated in FIGS. 4A to 5 will not be described to avoid redundant descriptions and only the different parts will be described. The fastening device according to an embodiment may have a structure in which the second fastening member 42 and an end 520 of the second strap 52 are connected by a fixing portion 521, rather than being connected to be rotatable about the first rotation axis a1.

[0078] According to an embodiment, the fixing portion 521 may be formed of a material so that the fixing portion 521 may fix the end 520 of the second strap 52 within a rotation opening 416 of the second fastening member 42 and has the same mobility as the first rotation axis (for example, the first rotation axis a1 shown in FIG. 5). For example, the material of the fixing portion may be a material that has softness and elasticity, and may be any one of rubber, fabric, leather, and mesh metal or a combination thereof.

[0079] FIG. 15 is a cross-sectional view illustrating a fastening device according to an embodiment of the disclosure. FIG. 16A is a cross-sectional view illustrating a fastening device in a state in which fastening is enhanced by a stopper 522 according to an embodiment. FIG. 16B is a cross-sectional view illustrating the fastening device when the electronic apparatus is worn on wrist according to an embodiment.

[0080] Referring to FIGS. 15 to 16B, the same components of the fastening device according to an embodiment as those of the fastening device 40 illustrated in FIGS. 4A to 5 will not be described to avoid redundant descriptions and only the different parts will be described.

[0081] The fastening device according to an embodiment may include at least one stopper 522 formed at an end of the second strap 52. According to an embodiment, the stopper 522 may have a shape protruding from the first hinge h1 in a circumferential direction, and may have a substantially mountain shape.

[0082] According to an embodiment, the stopper 522 may be a portion for enhancing the fastening of the fastening device, and may have a structure to contact and support a rear portion 414a of the hook 414, thereby enhancing the fastening of the second strap 52.

[0083] Referring to FIG. 16B, when the wearable electronic apparatus according to an embodiment is worn on wrist, the second strap 52 may be subject to a force in the state shown in FIG. 16B. In this state, fastening of the second strap 52 may be strengthened by the stopper 522. For example, fastening may refer to a coupling force that is generated by an insertion structure between a protruding portion (for example, the stopper) and a recessed portion (a recessed space on the rear of the hook).

[0084] FIG. 17 is a perspective view illustrating a hook according to an embodiment of the disclosure. FIG. 18 is a cross-sectional view illustrating the hook according to an embodiment of the disclosure.

[0085] Referring to FIGS. 17 and 18, the same components of the fastening device according to an embodiment as those of the fastening device 40 illustrated in FIGS. 4A to 5 will not be described to avoid redundant descriptions and only the different parts will be described.

[0086] The fastening device according to an embodiment may have a hook 47 integrally formed with a rubber packing (for example, the rubber packing 45 shown in FIG. 5) and formed of the same material as the rubber packing. According to an embodiment, the hook 47 may be formed of the same material as the rubber packing 45, such that the hook may have softness and elasticity provided by rubber.

[0087] According to an embodiment, the hook 47 may be formed of the same material as the rubber packing 45, such that fastening sensitivity between the first fastening member 41 and the second fastening member (for example, the second fastening member 42 shown in FIG. 5) may be enhanced. For example, the hook 47 may be formed of any one material of a soft material of polycarbonate (PC), metal having elasticity, and rubber having rigidity.

[0088] FIG. 19 is a cross-sectional view illustrating a hook according to an embodiment.

[0089] Referring to FIG. 9, the same components of the fastening device according to an embodiment as those of the fastening device 40 illustrated in FIGS. 4A to 5 will not be described to avoid redundant descriptions and only the different parts will be described. The fastening device 40 according to an embodiment may include a linear hook 48.

[0090] According to an embodiment, the hook 48 may have a shape linearly extending from the first fastening member (for example, the first fastening member 41 shown in FIG. 5) in the first direction (for example, the first direction ① shown in FIG. 5). The hook 414 shown in FIG. 5 has a bent end and thus may require a relatively greater force to perform a fastening or unfastening operation. The linear hook 48 according to an embodiment may provide convenience to a user when a semi-opening or semi-closing operation is performed, and makes it possible to fasten or unfasten with less force.

[0091] For example, a bending angle of the hook of the fastening device according to an embodiment may be between 135 degrees and 180 degrees. The hook 414 shown in FIGS. 4A to 5 may be bent by about 135 degrees, and the hook 48 shown in FIG. 19 may be bent by about 180 degrees, that is, may be linear.

[0092] In the hook 48 structure for the semi-open or semi-closed state of the fastening device according to an embodiment, not only the shape of the end but also the length of the hook 48 may be important.

[0093] According to an embodiment, a wearable electronic apparatus may include: a main body housing; a first strap connected to one end of the main body housing; a second strap connected to the other end of the main body housing; and a fastening device configured to integrally fasten the first, second straps to each other or to separate

the first, second straps from each other, and the fastening device may include: a first fastening member including: a first surface facing in a first direction; a second surface facing in a second direction which is opposite to the first direction; and a first side surface facing in a first lateral direction which is perpendicular to the first, second directions, wherein a first magnetic substance of a first polarity is disposed on the first surface, and the first fastening member is movable along the first strap; and a second fastening member including: a third surface facing in a third direction; a fourth surface facing in a fourth direction which is opposite to the third direction; and a second side surface facing in a second lateral direction which is perpendicular to the third, fourth directions, wherein a second magnetic substance of a second polarity which is opposite to the first polarity is disposed in the second fastening member, and the second fastening member is integrally coupled with or is decoupled from the first fastening member, and is rotatably connected to the second strap.

[0094] According to an embodiment, the first fastening member may include: a penetrating opening which extends in the third direction and through which the first strap penetrates; a first accommodation opening which is formed on the first surface to be opened in the first direction, is spaced apart from the penetrating opening, and has the first magnetic substance disposed thereon; and a first protrusion which protrudes in the first direction along a circumference of the first accommodation opening.

[0095] According to an embodiment, the second fastening member may include: a second accommodation opening which is formed on the fourth surface, is opened in the fourth direction, and allows the first protrusion to be inserted therein; a third accommodation opening which is opened in the first direction in the second accommodation opening, and has the second magnetic substance disposed therein; and a first rotation opening which is close to the second, third accommodation openings, and is opened in the second lateral direction.

[0096] According to an embodiment, the second fastening member may further include a projection that protrudes from the first fastening member in the second lateral direction when the first fastening member and the second fastening member are fastened to each other, and the projection may be formed at a longest distance from the rotation opening.

[0097] According to an embodiment, the wearable electronic apparatus may further include a locking structure configured to prevent a movement of the first fastening member or the second fastening member in a horizontal direction in a state in which the first fastening member and the second fastening member are fastened to each other, and the locking structure may include: a hook formed on the first fastening member and protruding in the first direction; and a locking groove formed on the second fastening member and allowing at least a part of the hook to be inserted therein.

[0098] According to an embodiment, the hook may be positioned between the first accommodation opening and the first rotation opening in the state in which the first fastening member and the second fastening member are fastened to each other.

[0099] According to an embodiment, the first fastening member may further include: a second rotation opening spatially connected with the penetrating opening; and a strap length adjustment member rotatably disposed in the second rotation opening, and the strap length adjustment member may include a second protrusion which is formed at one end thereof to press a part of the first strap according to an opening operation and to fix the first fastening member to the first strap.

[0100] According to an embodiment, the wearable electronic apparatus may further include a fixing device configured to fix the strap length adjustment member to the first fastening member in a closed state of the strap length adjustment member.

[0101] The fixing device may include: at least one locking protrusion formed on a side surface of the strap length adjustment member; and at least one locking groove formed in the second rotation opening to allow the locking protrusion to be coupled therewith.

[0102] According to an embodiment, the wearable electronic apparatus may further include a connection device configured to physically connect the first fastening member and the second fastening member.

[0103] According to an embodiment, the wearable electronic apparatus may further include a stopper formed at an end of the second strap which is connected with the second fastening member to be rotatable, and the stopper may protrude from the hinge in a circumferential direction, and may be in contact with a rear surface of the hook.

Claims

1. A wearable electronic apparatus comprising:

a main body housing;
a first strap connected to one end of the main body housing;
a second strap connected to the other end of the main body housing; and
a fastening device configured to integrally fasten the first, second straps to each other or to separate the first, second straps from each other, wherein the fastening device comprises:

a first fastening member comprising: a first surface facing in a first direction; a second surface facing in a second direction which is opposite to the first direction; and a first side surface facing in a first lateral direction which is perpendicular to the first, second directions, wherein a first magnetic sub-

stance of a first polarity is disposed on the first surface, and the first fastening member is movable along the first strap; and
a second fastening member comprising: a third surface facing in a third direction; a fourth surface facing in a fourth direction which is opposite to the third direction; and a second side surface facing in a second lateral direction which is perpendicular to the third, fourth directions, wherein a second magnetic substance of a second polarity which is opposite to the first polarity is disposed in the second fastening member, and the second fastening member is integrally coupled with or is decoupled from the first fastening member, and is rotatably connected to the second strap.

2. The wearable electronic apparatus of claim 1, wherein the first fastening member comprises:

a penetrating opening which extends in the third direction and through which the first strap penetrates;

a first accommodation opening which is formed on the first surface to be opened in the first direction, is spaced apart from the penetrating opening, and has the first magnetic substance disposed thereon; and

a first protrusion which protrudes in the first direction along a circumference of the first accommodation opening.

3. The wearable electronic apparatus of claim 2, wherein the second fastening member comprises:

a second accommodation opening which is formed on the fourth surface, is opened in the fourth direction, and allows the first protrusion to be inserted therein;

a third accommodation opening which is opened in the first direction in the second accommodation opening, and has the second magnetic substance disposed therein; and

a first rotation opening which is close to the second, third accommodation openings, and is opened in the second lateral direction.

4. The wearable electronic apparatus of claim 3, wherein the second fastening member further comprises a projection that protrudes from the first fastening member in the second lateral direction when the first fastening member and the second fastening member are fastened to each other, and the projection is formed at a longest distance from the rotation opening.

5. The wearable electronic apparatus of claim 3, further

comprising a locking structure configured to prevent a movement of the first fastening member or the second fastening member in a horizontal direction in a state in which the first fastening member and the second fastening member are fastened to each other, 5
 wherein the locking structure comprises: a hook formed on the first fastening member and protruding in the first direction; and a locking groove formed on the second fastening member and allowing at least a part of the hook to be inserted therein. 10

6. The wearable electronic apparatus of claim 5, wherein the hook is positioned between the first accommodation opening and the first rotation opening in the state in which the first fastening member and the second fastening member are fastened to each other. 15
7. The wearable electronic apparatus of claim 2, wherein the first fastening member further comprises: a second rotation opening spatially connected with the penetrating opening; and a strap length adjustment member rotatably disposed in the second rotation opening, and 20 25
 wherein the strap length adjustment member comprises a second protrusion which is formed at one end thereof to press a part of the first strap according to an opening operation and to fix the first fastening member to the first strap. 30
8. The wearable electronic apparatus of claim 7, further comprising a fixing device configured to fix the strap length adjustment member to the first fastening member in a closed state of the strap length adjustment member, 35
 wherein the fixing device comprises: at least one locking protrusion formed on a side surface of the strap length adjustment member; and at least one locking groove formed in the second rotation opening to allow the locking protrusion to be coupled therewith. 40
9. The wearable electronic apparatus of claim 1, further comprising a connection device configured to physically connect the first fastening member and the second fastening member. 45
10. The wearable electronic apparatus of claim 5, further comprising a stopper formed at an end of the second strap which is connected with the second fastening member to be rotatable about a hinge, the stopper protruding from the hinge in a circumferential direction, 50
 wherein the stopper is in contact with a rear surface of the hook. 55

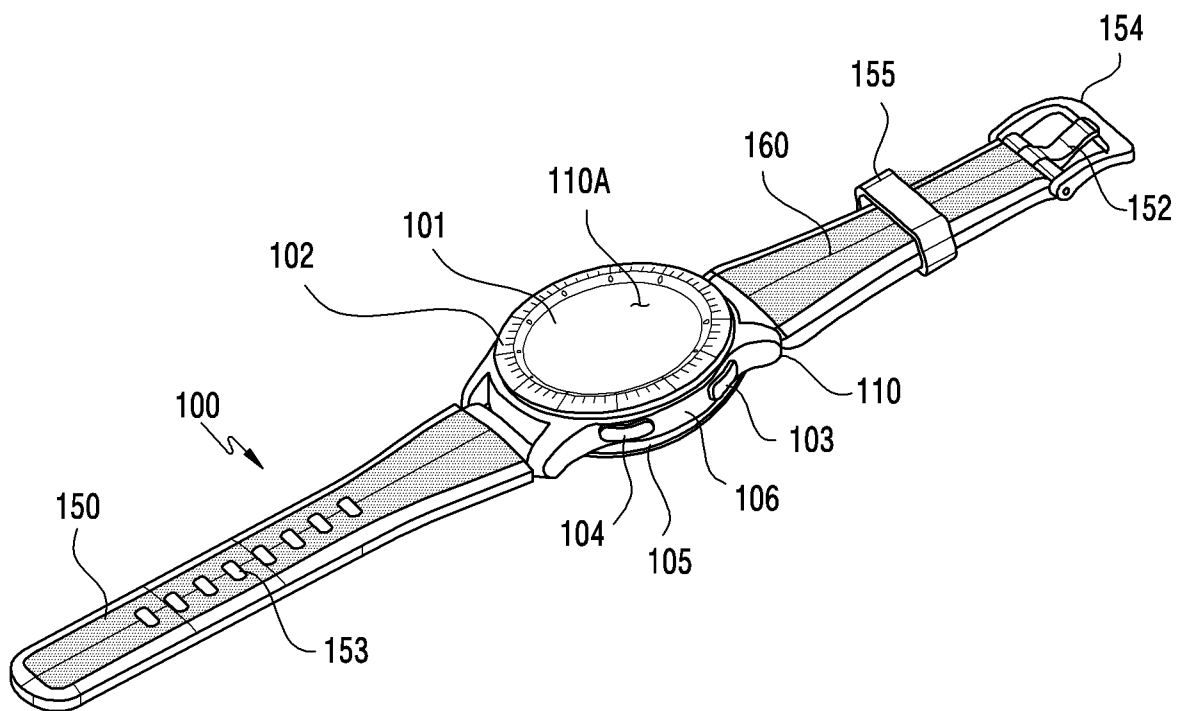


FIG.1

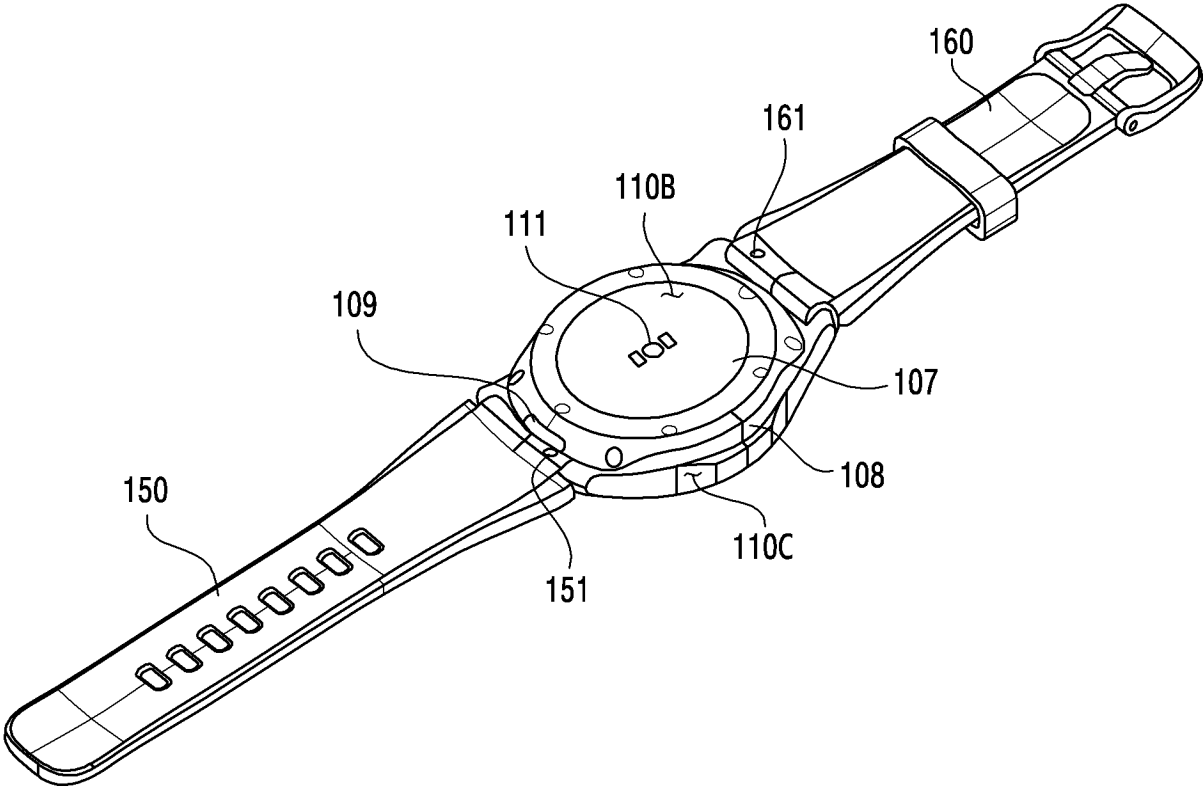


FIG.2

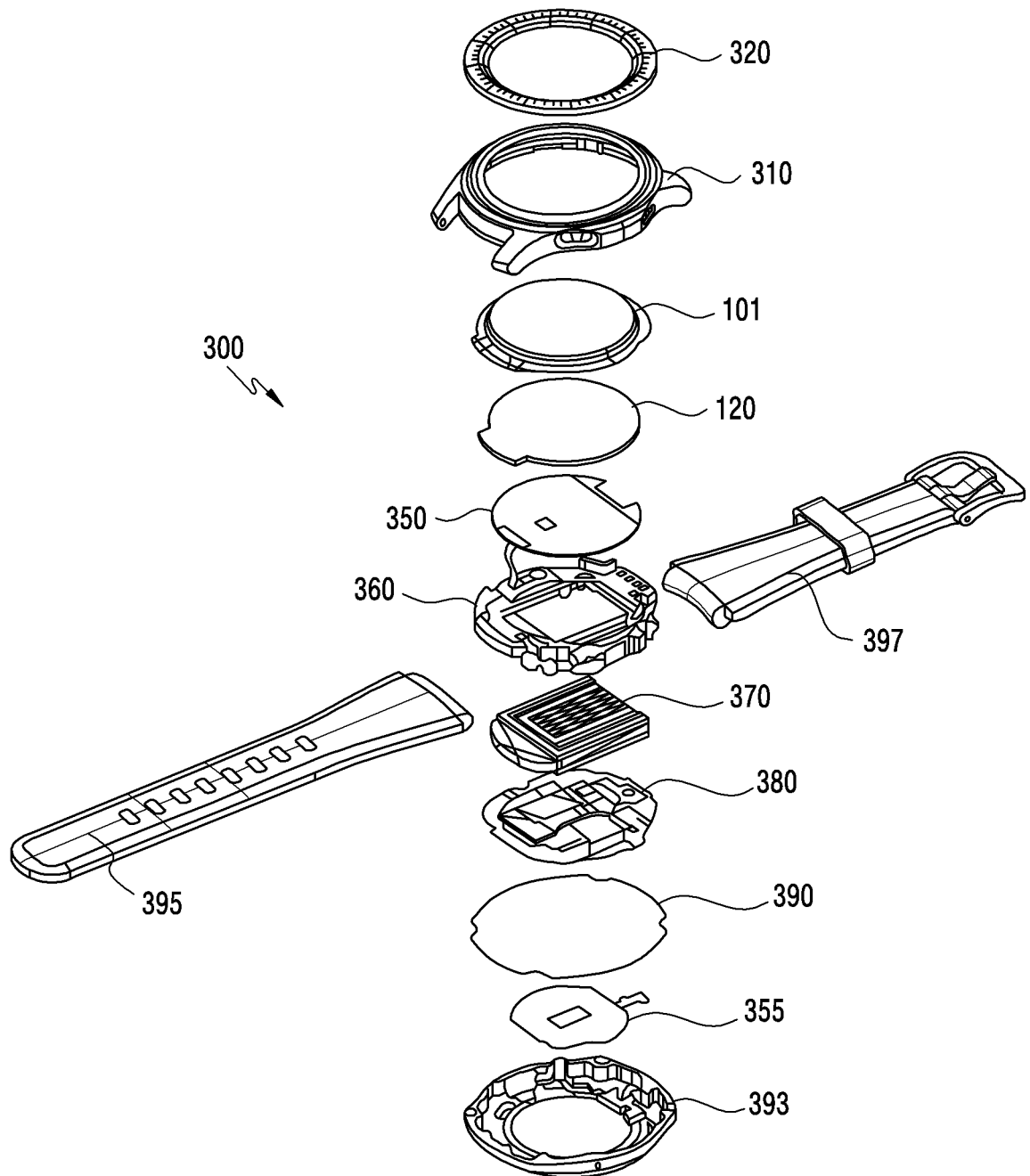


FIG.3

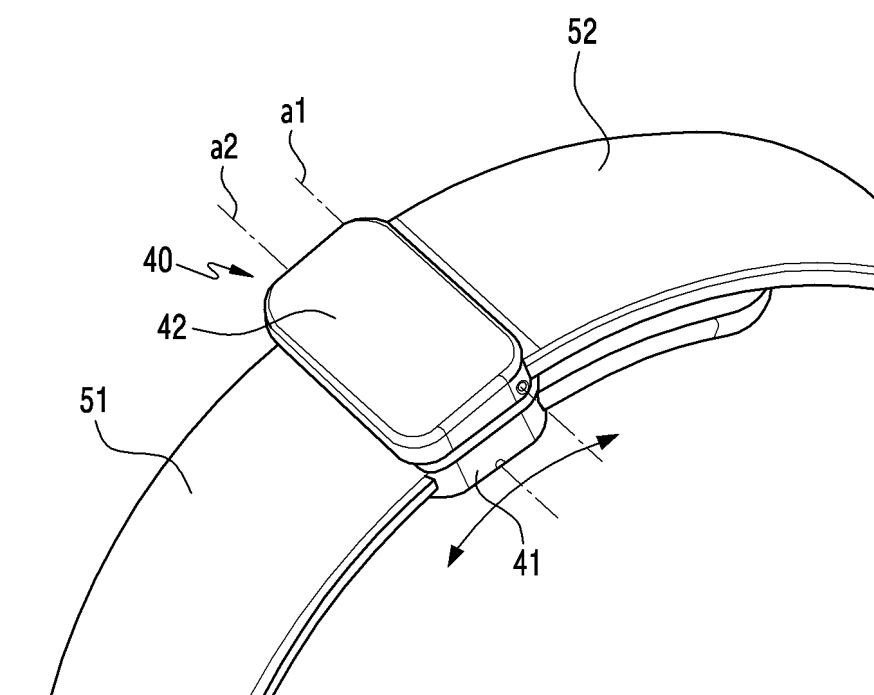


FIG.4A

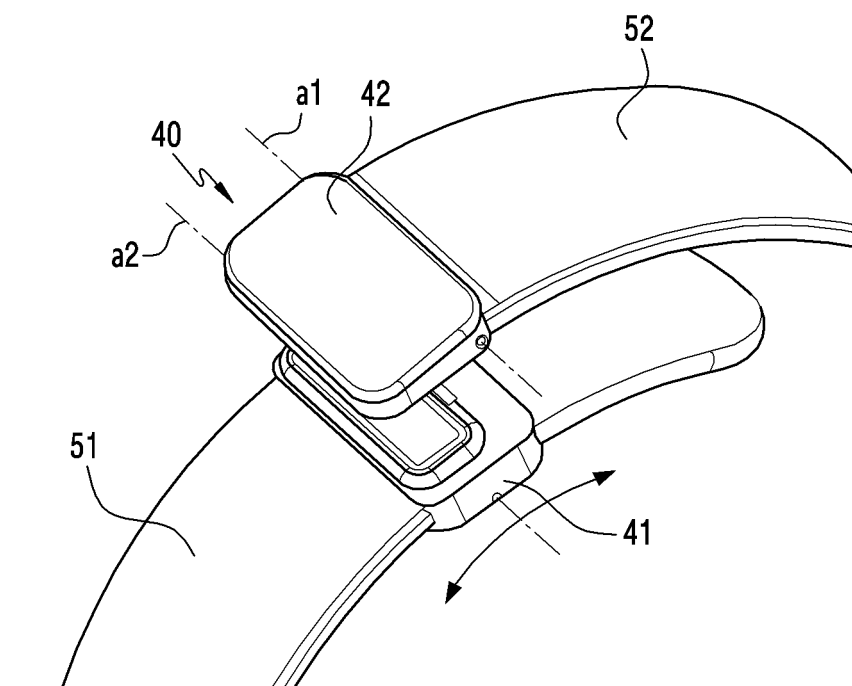


FIG.4B

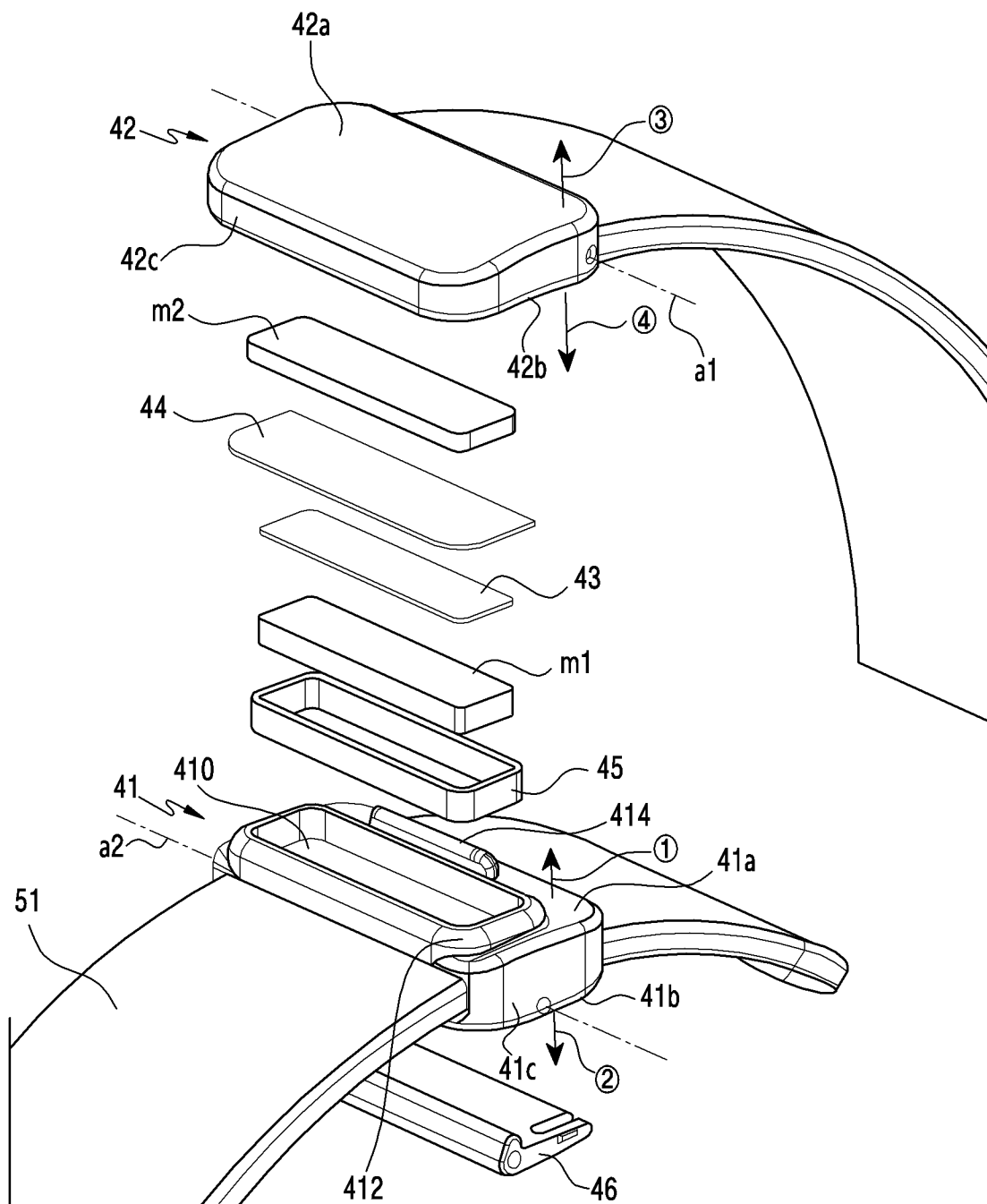


FIG.5

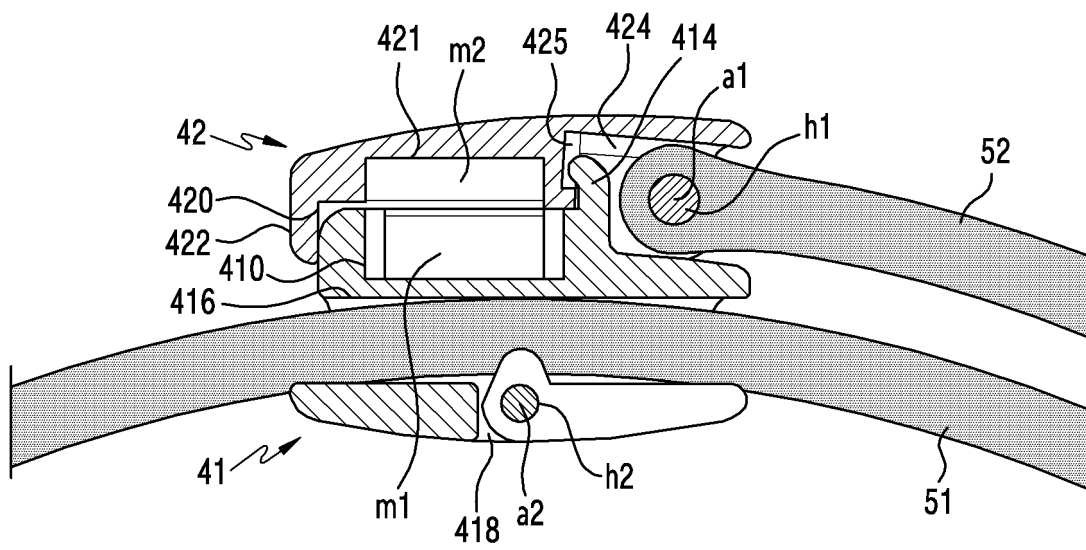


FIG.6A

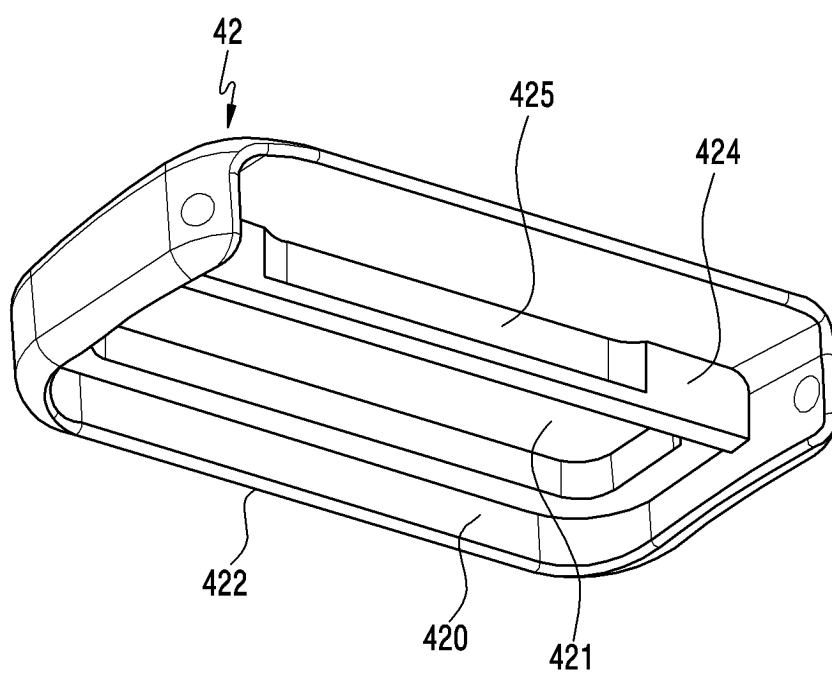


FIG. 6B

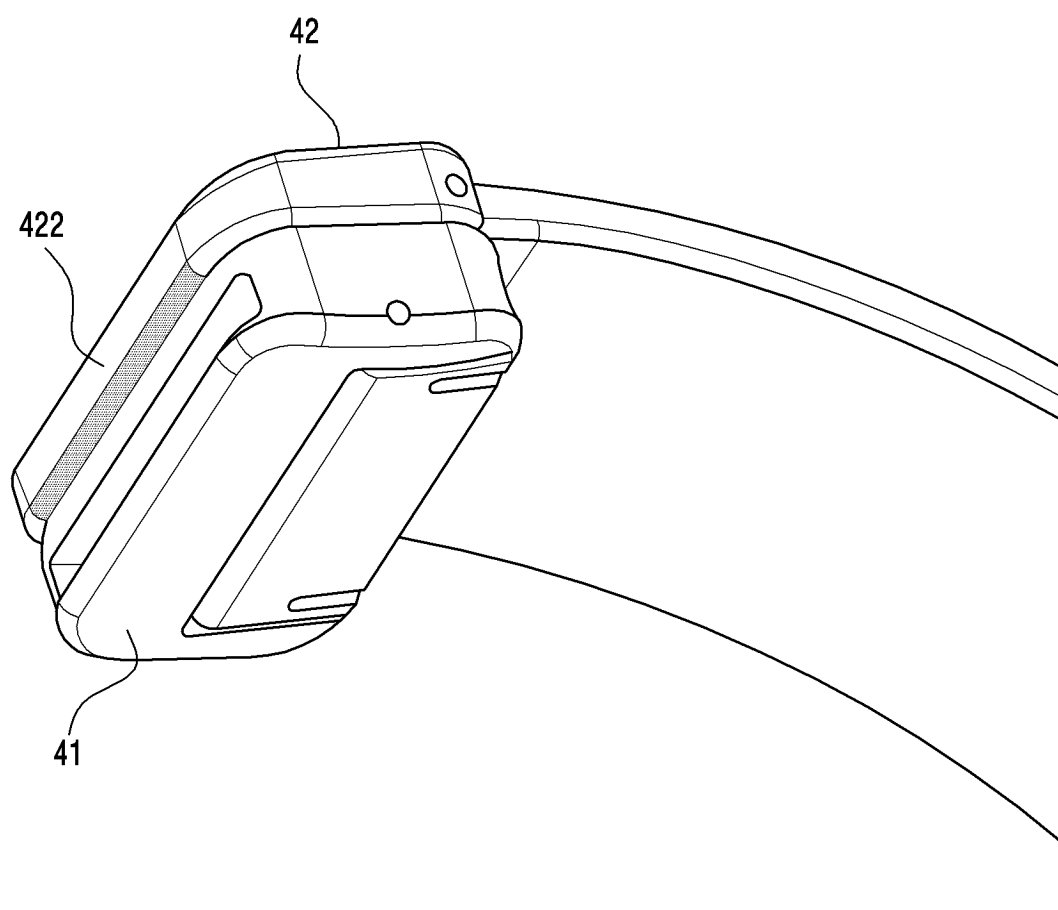


FIG.7A

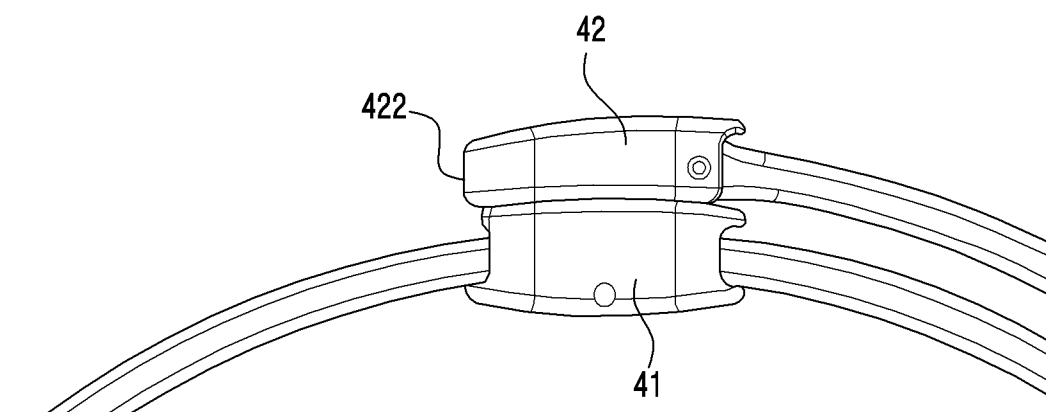


FIG.7B

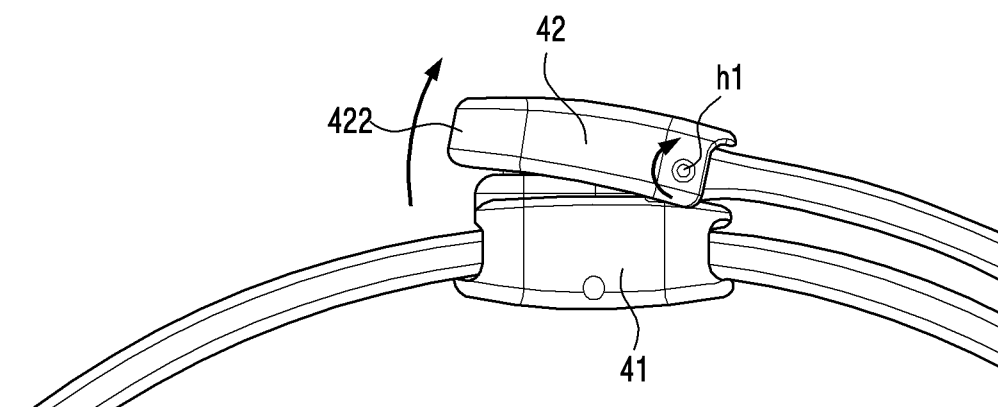


FIG.7C

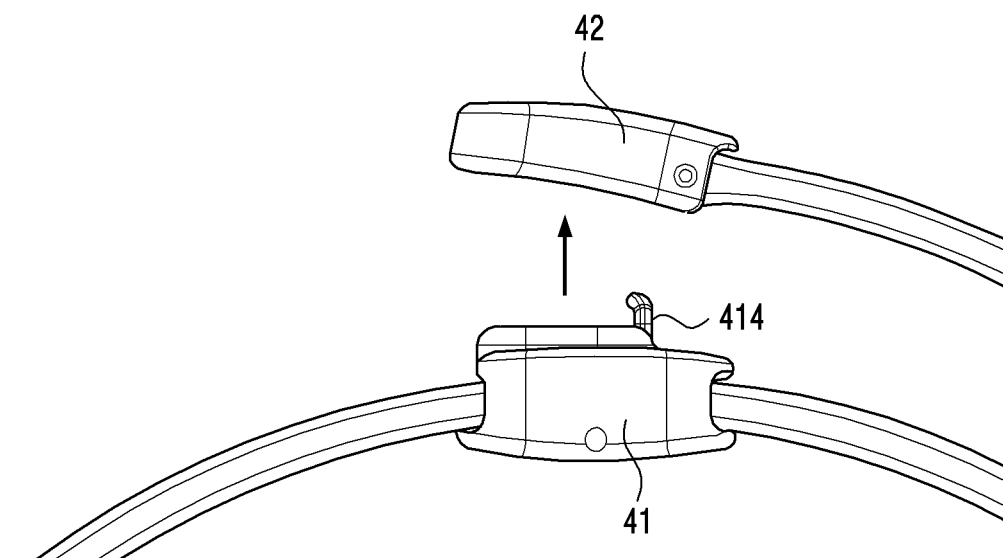


FIG.7D

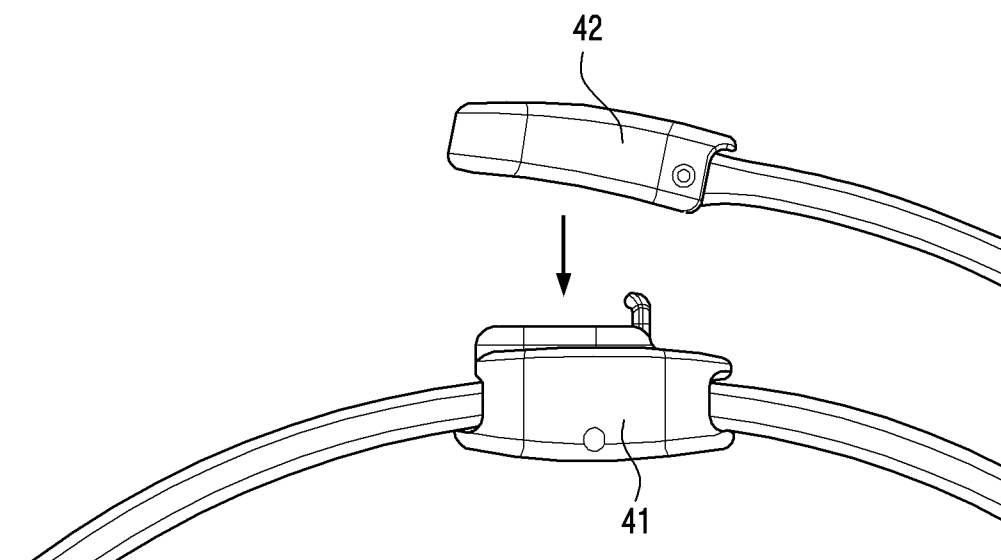


FIG.8A

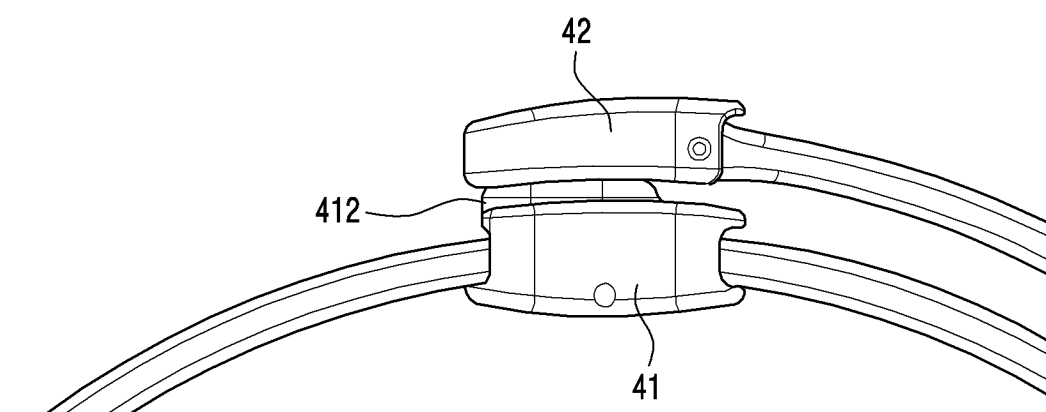


FIG.8B

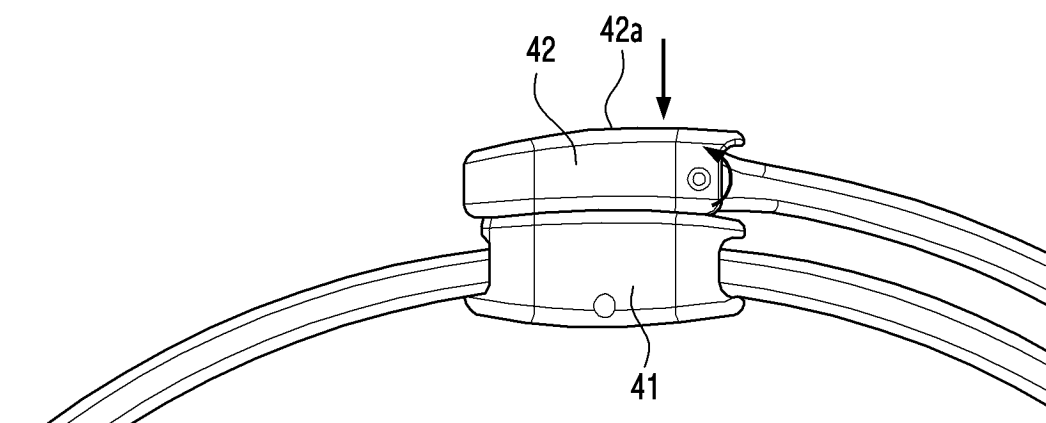


FIG.8C

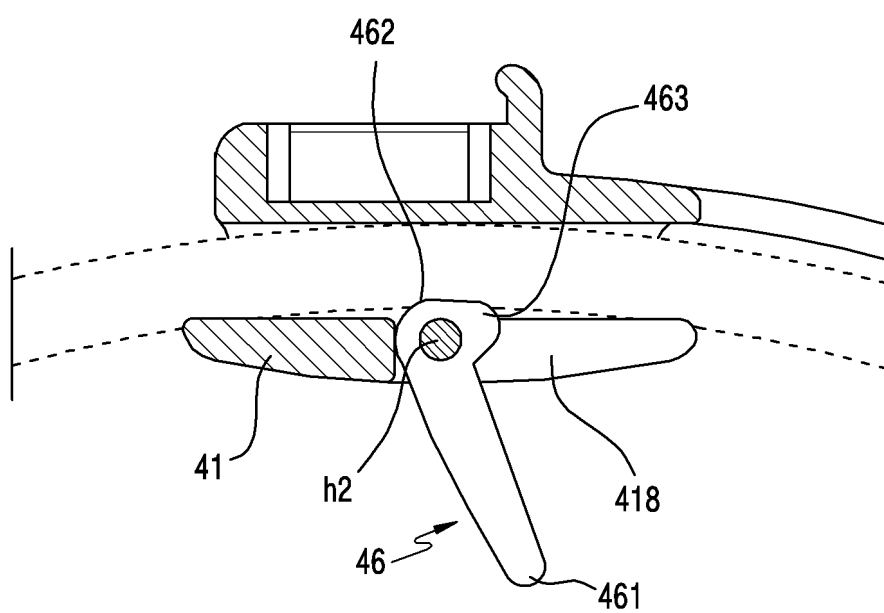


FIG.9

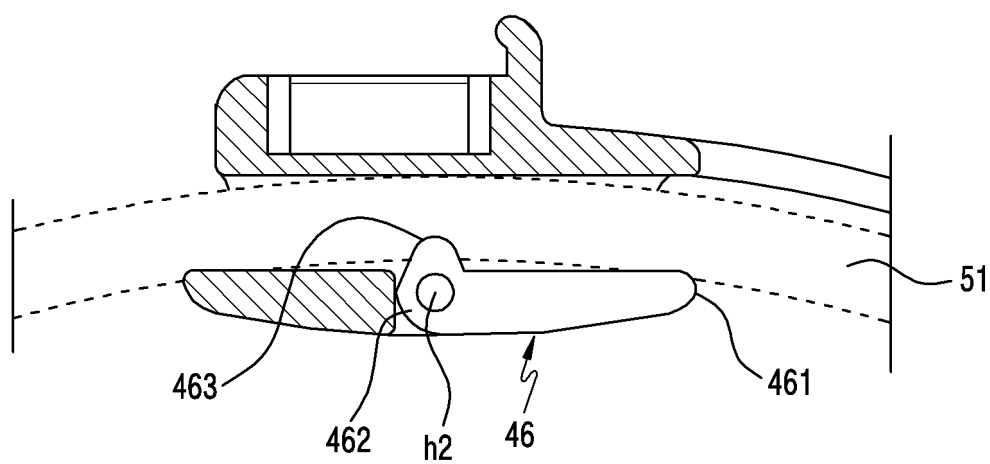


FIG.10

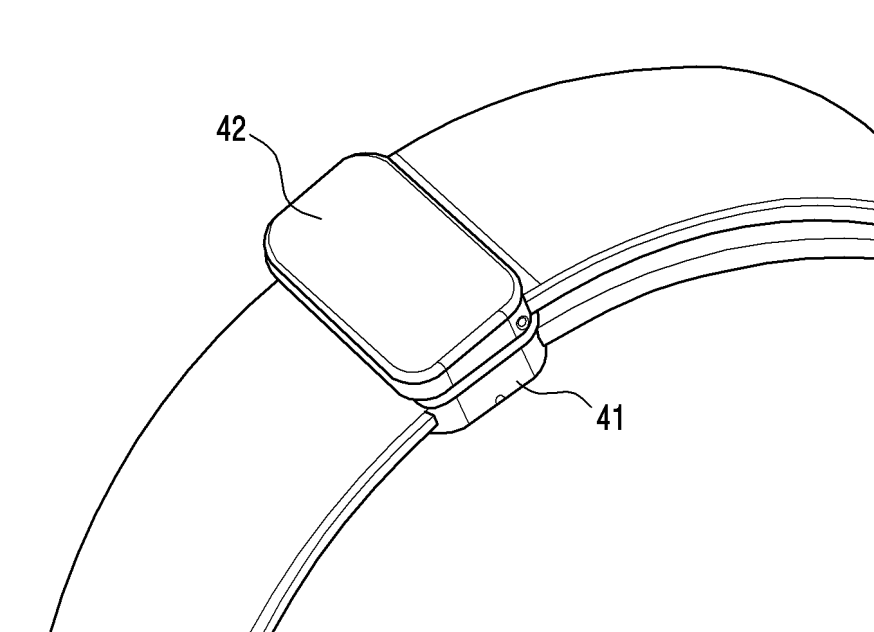


FIG.11A

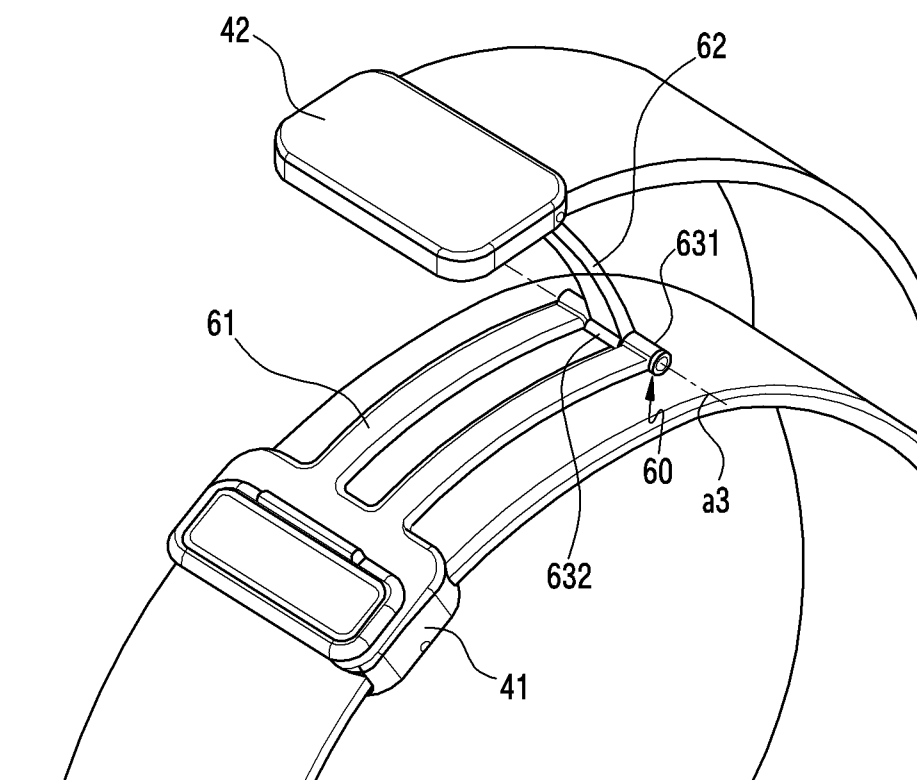


FIG.11B

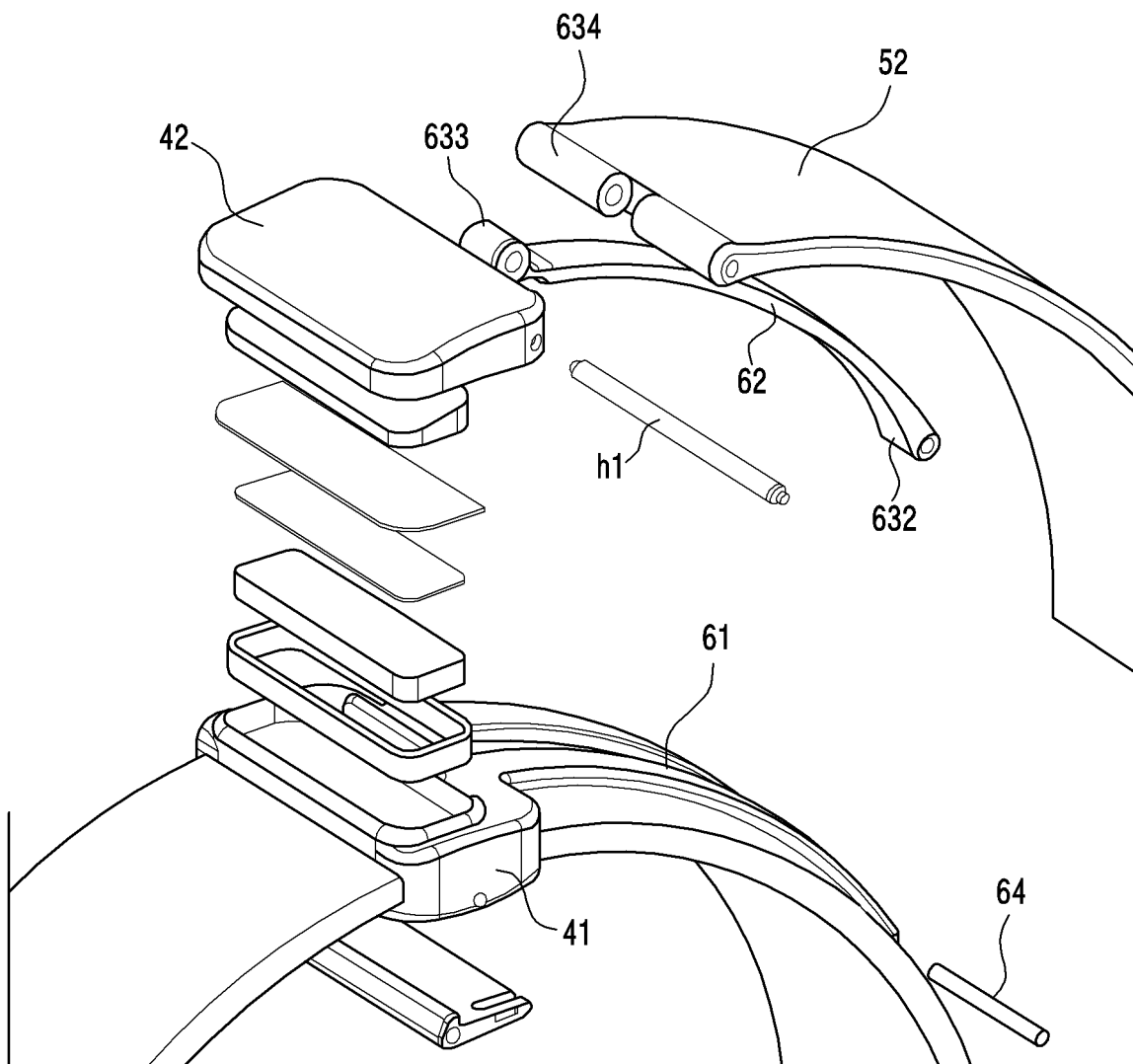


FIG.12

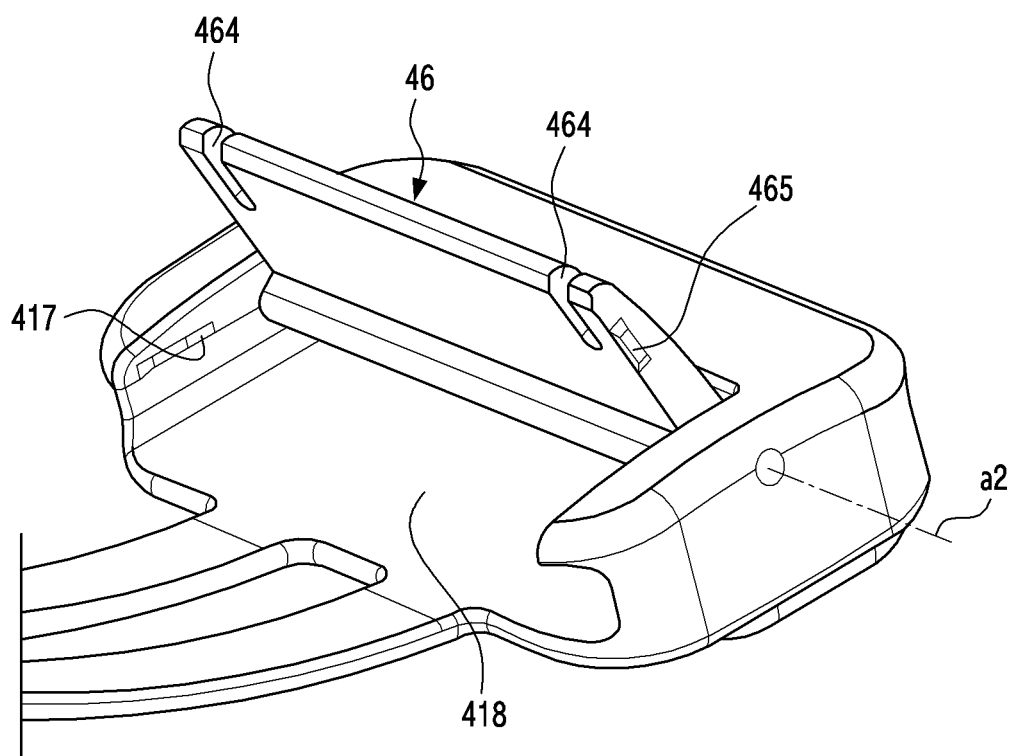


FIG.13

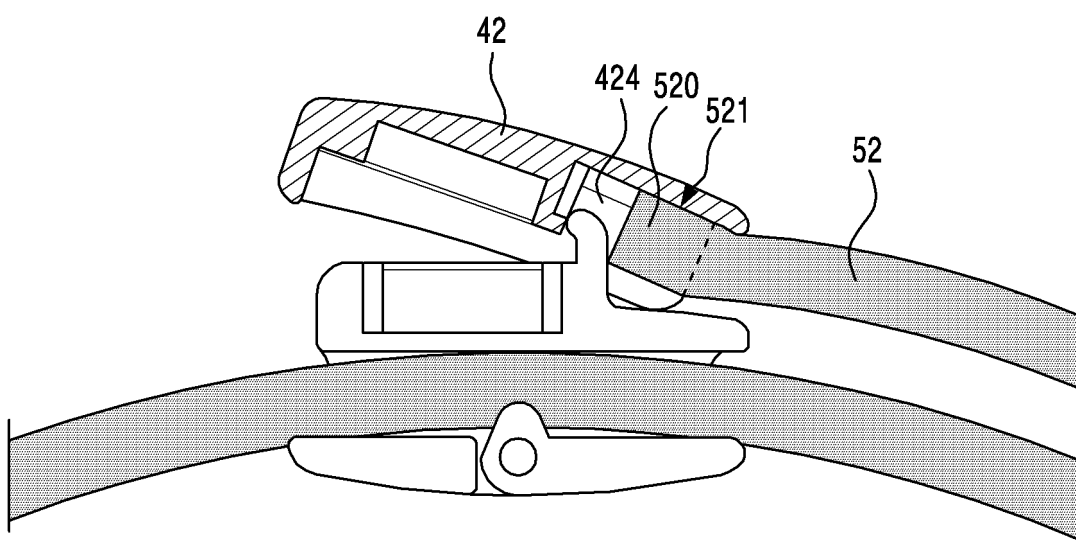


FIG.14

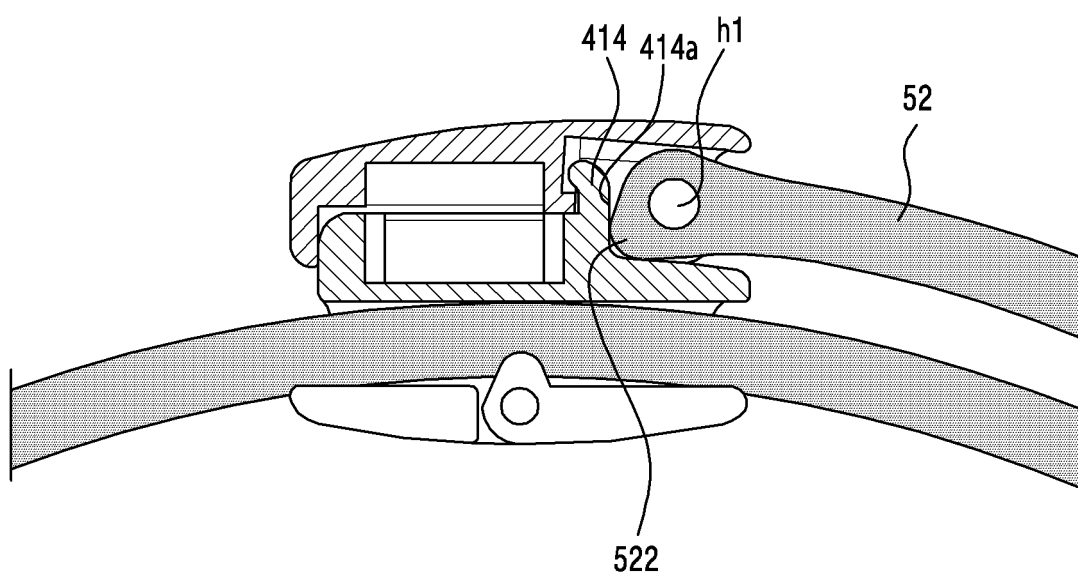


FIG.15

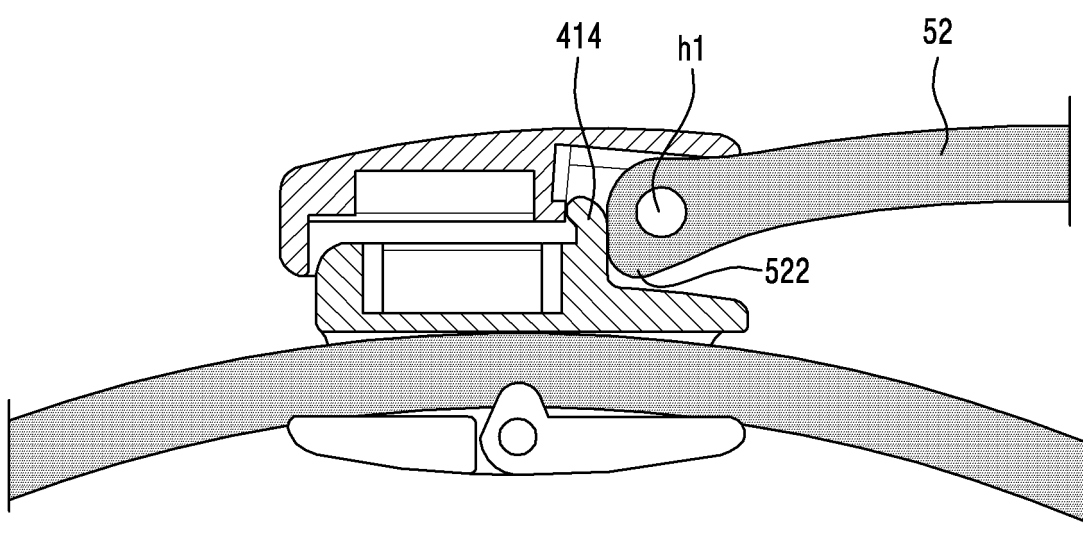


FIG.16A

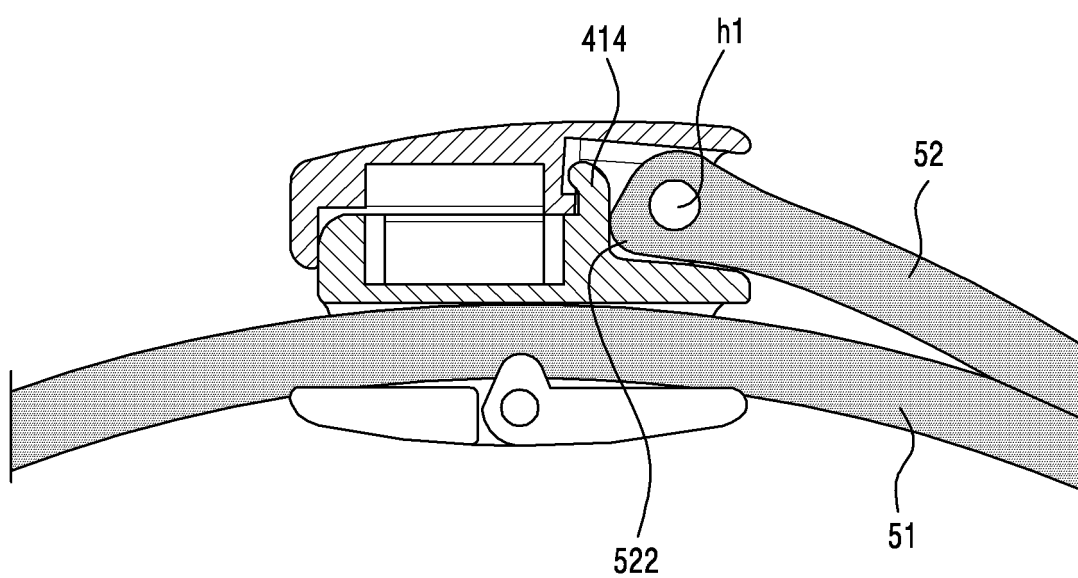


FIG.16B

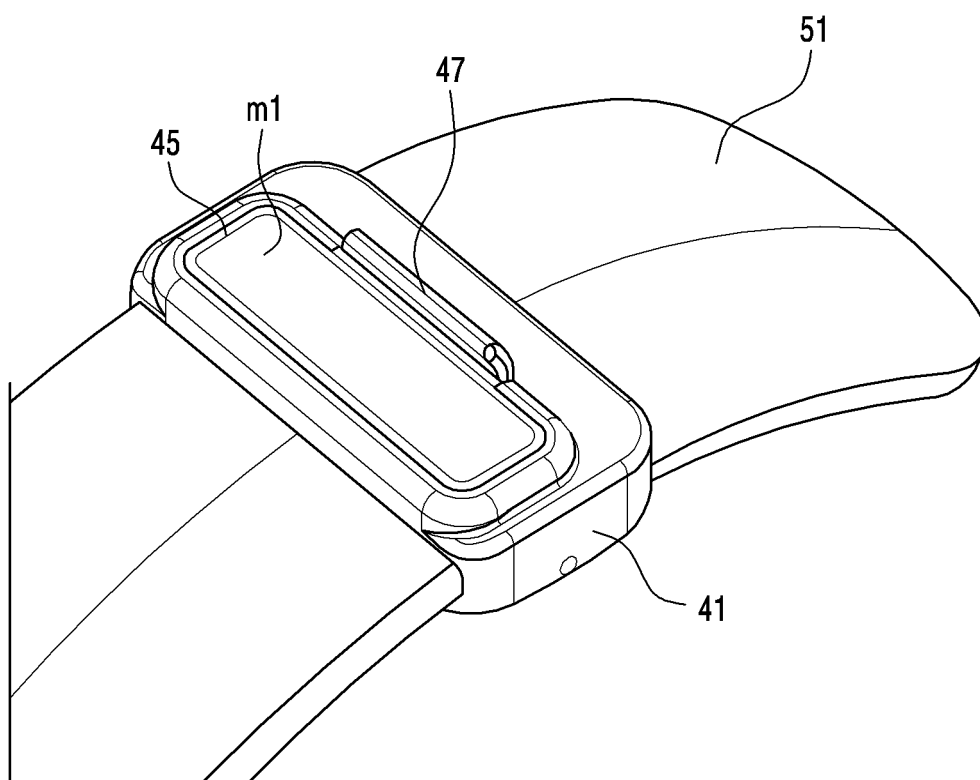


FIG.17

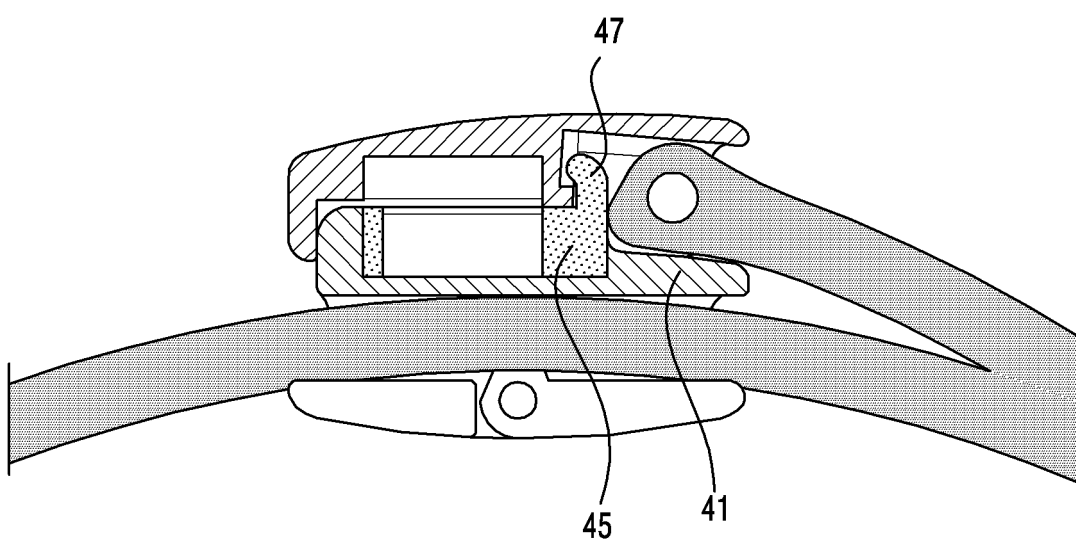


FIG.18

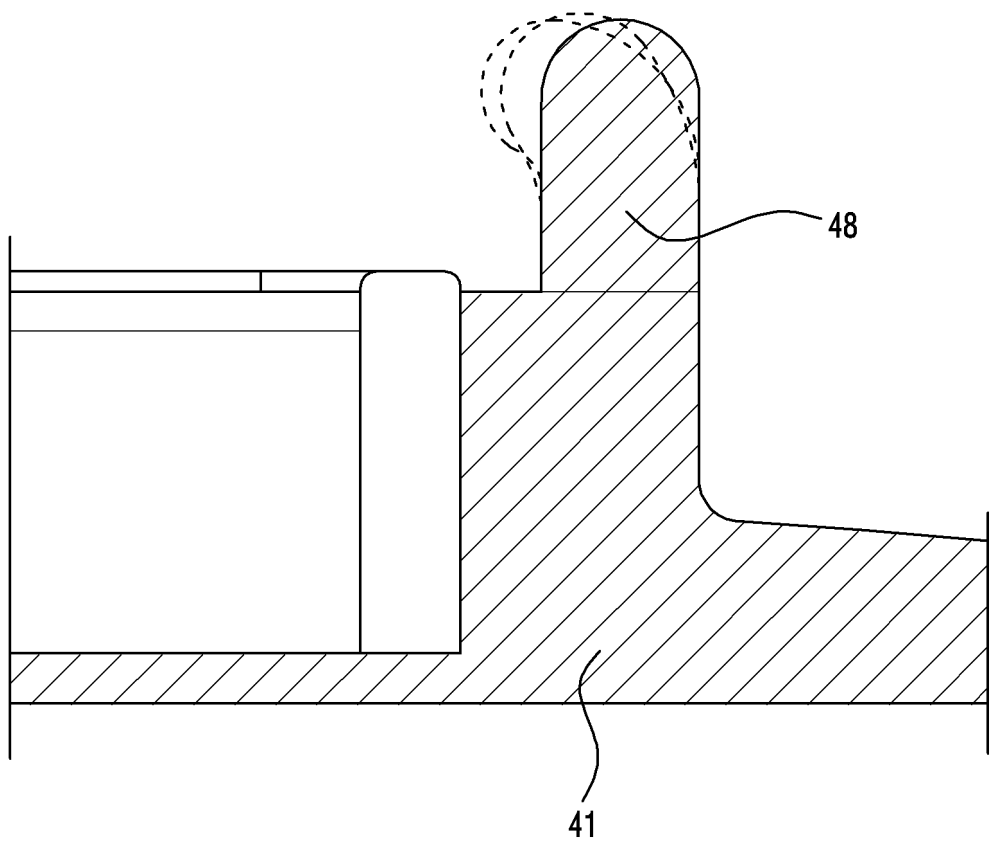


FIG.19

INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2023/003956

A. CLASSIFICATION OF SUBJECT MATTER

A44C 5/20(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A44C 5/20(2006.01); G06F 1/16(2006.01); H01F 7/02(2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models: IPC as above

Japanese utility models and applications for utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & keywords: 자석(magnet), 스트랩(strap), 후크(hook), 스톱퍼(stopper)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 10-2016-0070998 A (LG ELECTRONICS INC.) 21 June 2016 (2016-06-21) See paragraphs [0051]-[0080] and [0098] and figures 2-10 and 19.	1-10
A	CN 107149220 A (CHICONY ELECTRONICS CO.) 12 September 2017 (2017-09-12) See paragraphs [0055]-[0065] and figures 1-4.	1-10
A	EP 1133936 B1 (MISEREZ, Bernard M., C/O BMG MISEREZ et al.) 21 April 2004 (2004-04-21) See claim 1 and figures 1-4.	1-10
A	US 11076661 B2 (DUNCAN et al.) 03 August 2021 (2021-08-03) See claim 1 and figures 2-3.	1-10
A	US 2021-0368949 A1 (PANDORA A/S et al.) 02 December 2021 (2021-12-02) See paragraphs [0096]-[0108] and figures 1-3.	1-10

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/KR2023/003956

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CN 107149220 A	12 September 2017	CN 107149220 B	04 January 2019
EP 1133936 B1	21 April 2004	EP 1133936 A1	19 September 2001
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		US 2021-0353015 A1	18 November 2021
US 2021-0368949 A1	02 December 2021	AU 2021-202790 A1	16 December 2021
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		EP 3915429 A1	01 December 2021
		US 11412820 B2	16 August 2022

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