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(54) **ELECTRIC LOCK DEVICE**

(57) An electric lock device is provided in order to enable a door to be opened through an operation performed on one operation target. Handle body (11) is moved between a first position of handle body (11) detected by a detector, a second position of a latch bolt in a released state, and a third position of the latch bolt in a latched state. First elastic member (6) exerts, on handle body (11) in the first position, resilient force for moving handle body (11) toward the third position. Second elastic member (7) exerts, on handle body (11) in the second position, resilient force for moving handle body (11) toward the third position. First elastic member (6) includes first arm (61) held by movable member (3). Second elastic member (7) includes first arm (71) held by a member of support (12) other than movable member (3).

FIG. 1A

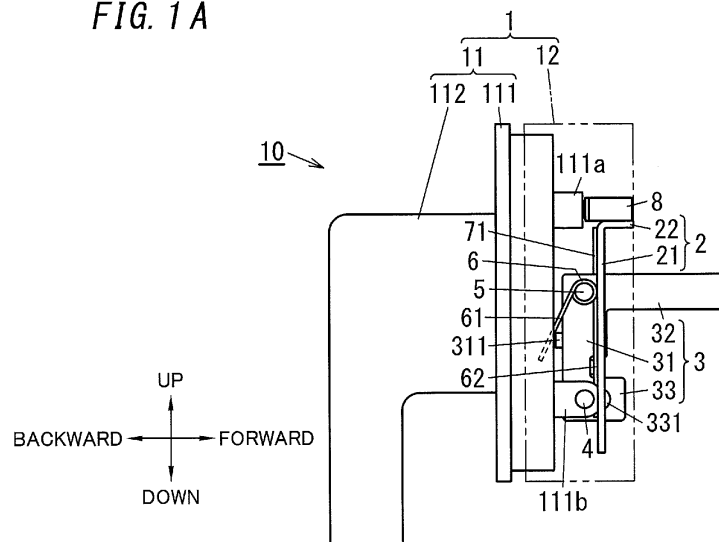
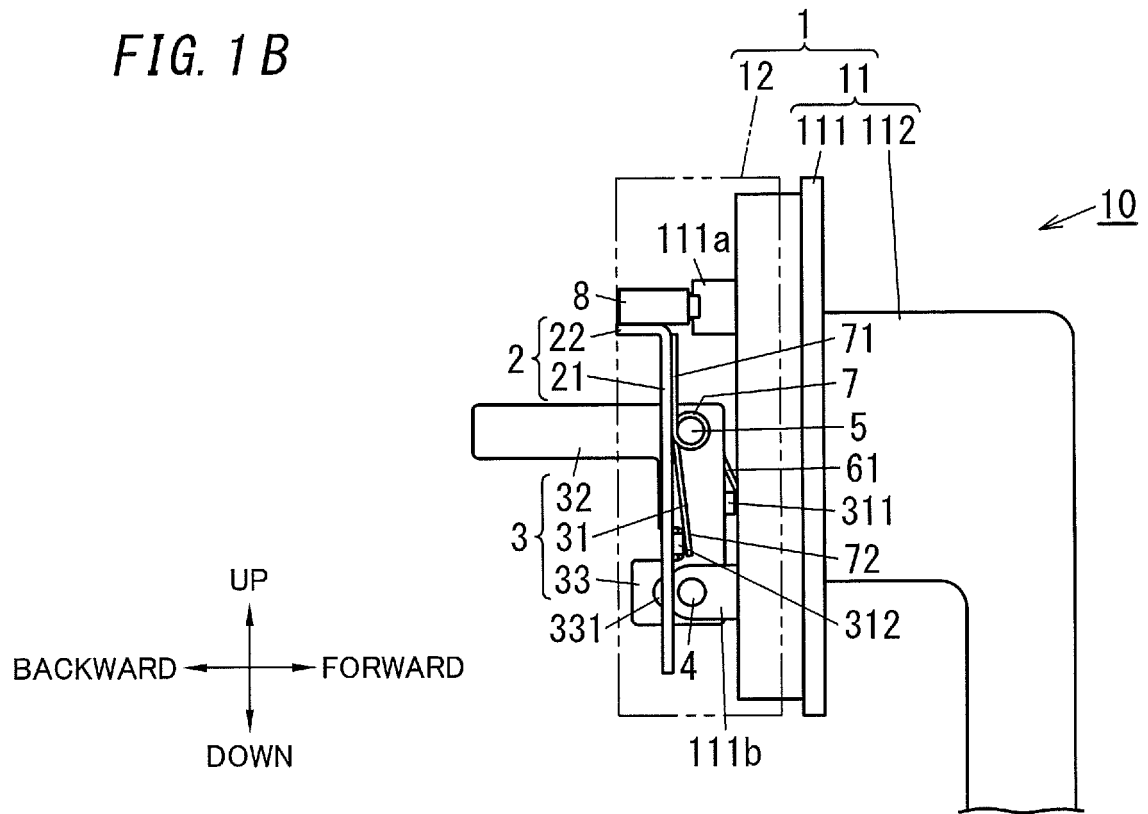


FIG. 1B



Description

Technical Field

[0001] The present invention relates to electric lock devices, and specifically, to an electric lock device configured to electrically lock or unlock a lock to be installed in a door of a building.

Background Art

[0002] An electric lock system for electrically locking or unlocking a lock installed in a door is known (see, for example, Patent Literature 1).

[0003] In an electric lock system described in Patent Literature 1, when a user carrying a contactless medium in which key ID information is recorded approaches the door, a receiver installed on a door surface reads the key ID information from the contactless medium and checks the key ID information which is read with information registered in advance. When the key ID information read from the contactless medium matches the information registered in advance, the receiver causes a display section of an unlock button to light for a predetermined time. When a user pushes the unlock button while the display section is lit, the receiver transmits an unlock instruction signal to an electric lock device to unlock the electric lock.

[0004] In the electric lock system described in Patent Literature 1, in order to open the door in a locked state, a user carrying the contactless medium approaches the door to perform authentication, and in a state where the authentication is successfully performed, the user operates the unlock button to unlock the electric lock, and then, the user grips a handle provided to the door to open the door. That is, the electric lock system requires, in order to open the door in the locked state, two operations, an operation of pushing the unlock button and an operation of gripping the handle to open the door.

Citation List

Patent Literature

[0005] Patent Literature 1: JP 2010-138579 A

Summary of Invention

[0006] In view of the foregoing, an object of the present invention is to provide an electric lock device which enables a door to be opened through operations performed on one operation target.

[0007] An electric lock device according to one aspect of the present invention includes a support, a handle body, an electric lock, a detector, an authentication section, and a controller. The support is to be fixed to a door. The door is provided with a latch bolt switchable between a latched state and a released state. The handle body is movably connected to the support and is configured to

be operated to open the door. The electric lock is configured to move a dead bolt between a locked position and an unlocked position. The dead bolt is disposed in movable relation to the door. The detector is configured to detect the handle body in position. The authentication section is configured to authenticate an identity of a person who is about to open the door. The controller is configured to control the electric lock to move the dead bolt to the unlocked position based on a sensing result by the detector and an authentication result by the authentication section. The handle body is configured to be moved between a first position, a second position, and a third position. The first position is a position in which the handle body is detected by the detector. The second position is a position in which the latch bolt is in the released state. The third position is a position in which the latch bolt is in the latched state. The support includes a connection shaft, a movable member, a first elastic member, and a second elastic member. The connection shaft is configured to move along with the handle body during operation thereof. The movable member has an oblong hole in which the connection shaft is inserted, the oblong hole allowing the movable member to move along with the connection shaft during movement thereof. The first elastic member is configured to exert, on the handle body in the first position, resilient force enabling the handle body to move in a direction toward the third position. The second elastic member is configured to exert, on the handle body in the second position, resilient force enabling the handle body to move in the direction toward the third position. The first elastic member includes a fixed end held by the movable member. The second elastic member includes a fixed end held by a member of the support. The member is other than the movable member.

Brief Description of Drawings

[0008]

FIG. 1A is a left side view illustrating an electric lock device according to one embodiment of the present invention, wherein part of the electric lock device is omitted, and FIG. 1B is a right side view illustrating the electric lock device, wherein part of the electric lock device is omitted;

FIG. 2A is another left side view illustrating the electric lock device, wherein part of the electric lock device is omitted, and FIG. 2B is another right side view illustrating the electric lock device, wherein part of the electric lock device is omitted;

FIG. 3A is still another left side view illustrating the electric lock device, wherein part of the electric lock device is omitted, and FIG. 3B is still another right side view illustrating the electric lock device, wherein part of the electric lock device is omitted;

FIG. 4 is a block diagram illustrating an electric lock system including the electric lock device;

FIG. 5 is a front view illustrating a door to which the

electric lock device is applied;

FIG. 6 is a perspective view illustrating the electric lock device, wherein part of the electric lock device is omitted;

FIG. 7 is a perspective view illustrating a handle body removed from a support of the electric lock device, wherein part of the handle body is omitted;

FIG. 8 is a front view illustrating the handle body removed from the support of the electric lock device, wherein part of the handle body is omitted; and

FIG. 9 is a flowchart illustrating operation of the electric lock device.

Description of Embodiment

[0009] As illustrated in FIGS. 1A to 5, an electric lock device 10 of the present embodiment includes supports 12, a handle body 11, electric locks 120 and 130, a detector 103 (push switch 8), an authentication section 1011, and a controller 1012. The supports 12 are fixed to a door 30. The door 30 is provided with a latch bolt 125 switchable between a latched state and a released state. The handle body 11 is movably connected to the supports 12 and is operated to open the door 30. The electric locks 120 and 130 respectively move dead bolts 124 and 134 between a locked position and an unlocked position. The dead bolts 124 and 134 are disposed in movable relation to the door 30. The detector 103 detects the handle body 11 in position. The authentication section 1011 authenticates an identity of a person who is about to open the door 30. The controller 1012 controls the electric locks 120 and 130 to move the dead bolts 124 and 134 to the unlocked position based on a sensing result by the detector 103 and an authentication result by the authentication section 1011. The handle body 11 is configured to be moved between a first position, a second position, and a third position. The first position is a position in which the handle body 11 is detected by the detector 103. The second position is a position in which the latch bolt 125 is in the released state. The third position is a position in which the latch bolt 125 is in the latched state. Each support 12 includes a connection shaft 4, a movable member 3, a first elastic member 6, and a second elastic member 7. The connection shaft 4 moves along with the handle body 11 during operation thereof. The movable member 3 has an oblong hole 331 in which the connection shaft 4 is inserted, the oblong hole allowing the movable member 3 to move along with the connection shaft 4 during movement thereof. The first elastic member 6 exerts, on the handle body 11 in the first position, resilient force enabling the handle body 11 to move in a direction toward the third position. The second elastic member 7 exerts, on the handle body 11 located in the second position, resilient force enabling the handle body 11 to move in a direction toward the third position. The first elastic member 6 includes a fixed end (first arm 61) held by the movable member 3. The second elastic member 7 includes a fixed end (first arm 71) held

by a member (fixing plate 2) of the support 12. The fixing plate 2 is a member other than the movable member 3.

[0010] With reference to the drawings, an electric lock system including the electric lock device 10 according to the one embodiment of the present invention will be described below. Note that the configuration described below is a mere example of the present invention, and the present invention is not limited to the embodiment described below. Thus, even in configurations other than that illustrated in the embodiment, various modifications may be made depending on design and the like without departing from the technical idea of the present invention.

[0011] In the following description, unless otherwise particularly indicated, up, down, left, and right directions are defined as up, down, left, and right directions when a handle 1 of the electric lock device 10 attached to the door 30 is viewed from the front. Moreover, in the following description, a direction orthogonal to the door 30 is the forward-and-backward direction (the rear faces the viewer in FIG. 5). That is, in FIG. 1A and other figures, the up, down, left, right, forward, and backward directions are defined as indicated by arrows denoted by "up", "down", "left", "right", "forward", and "backward". Note that these directions are not to specify directions in which the electric lock device 10 is used. Moreover, the arrows indicating the respective directions in the drawings are shown merely for the sake of description and have no entity.

[0012] As illustrated in FIG. 4, the electric lock system includes the electric lock device 10 and a response apparatus 20 (a so-called tag key). The electric lock device 10 includes a lock control device 100, the electric locks 120 and 130, an opening and closing sensor 140, and the handle 1 (see FIG. 5).

[0013] As illustrated in FIG. 5, the electric lock system is a system for electrically locking or unlocking the door 30 of a building (e.g., a detached dwelling house and a flat of an apartment block). The door 30 is, for example, an entrance door and is openably/closably attached to a door frame 40 via a pair of hinges 50. In the present embodiment, an example in which the door 30 is an outward openable door will be described, but the door 30 may be an inward openable door.

[0014] Recently, in order to improve the crime-prevention performance of a building, a plurality of locks are generally attached to the door 30. In the present embodiment, the two electric locks 120 and 130 are attached to a door edge of the door 30. Note that the number of electric locks is not limited to two, but one electric lock or three or more electric locks may be provided.

[0015] First, the handle 1 will be described with reference to FIGS. 5 to 8. As illustrated in FIG. 5, the handle 1 is attached to a surface (rear surface) on an outdoor side of the door 30 and is operated to open the door 30. As illustrated in FIG. 6, the handle 1 includes the handle body 11 and the supports 12 in a pair (only an upper support 12 is shown in FIG. 6). The pair of supports 12 are fixed to the back surface (the surface on the outdoor

side) of the door 30 with a space provided between the pair of supports 12 in the up-and-down direction. The handle body 11 is connected to the pair of supports 12 fixed to the door 30 such that the handle body 11 is movable in the forward-and-backward direction.

[0016] In a state where the handle body 11 is not operated, the latch bolt 125 is held in a protruding state from the door edge of the door 30 (see FIG. 5). At this time, the latch bolt 125 is inserted into a latch bolt strike formed in the door frame 40 to temporarily fix the door 30 so that the door 30 is not opened by, for example, wind. Here, in the present embodiment, a state where the latch bolt 125 is held at an inserted position in the strike is the latched state. In other words, the latched state is a state where the latch bolt 125 is held so as not to rotate. Moreover, the position of the handle body 11 in the case of the latch bolt 125 being in the latched state is the third position (position shown in FIGS. 1A and 1B).

[0017] When the handle body 11 which is in a non-operation state is pulled backward (to a side opposite to the door 30), the latch bolt 125 is released from the latched state and transitions to a state where the latch bolt 125 is rotatable in the forward-and-backward direction (in a direction perpendicular to the plane of FIG. 5). When the handle body 11 in this state is further pulled backward, the latch bolt 125 is pushed by the door frame 40, is turned, and is pulled into an inner side of the door 30, and thereby, the door 30 comes into an open state. Here, in the present embodiment, a state where the latch bolt 125 is released from the latched state and the latch bolt 125 is rotatable is the released state. That is, the latch bolt 125 is switchable between the latched state and the released state along with the handle body 11 during operation thereof. Moreover, the position of the handle body 11 with the latch bolt 125 being in the released state is the second position (position illustrated in FIGS. 3A and 3B).

[0018] Here, a latch driver is arranged in a location (the front) where the latch driver is pushed by a second piece 32 (which will be described later) of the movable member 3. In a state where the latch driver is not pushed by the second piece 32, the latch bolt 125 is held in a protruding state from the door edge of the door 30 toward the door frame 40, and the latch bolt 125 is inserted into the strike, thereby the door 30 is temporarily fixed. In contrast, when the latch driver is pushed by the second piece 32, the latch driver releases the latch bolt 125 from the latched state so that the latch bolt 125 transitions to a rotatable state (the released state). That is, the latch driver is configured to switch the latch bolt 125 between the latched state and the released state according to the operation performed on the handle 1. The latched state is a state where the latch bolt 125 is held in a protruding state from the door edge. The released state is a state where the latch bolt 125 is released from the latched state and is rotatable.

[0019] Moreover, when the handle body 11 which is in a non-operation state is pushed forward (toward the door

30), a projection 111a (which will be described later) pushes a push switch 8 (which will be described later) along with the handle body 11 during movement thereof, and thereby, an authentication process of the response apparatus 20 is started. That is, the handle body 11 of the present embodiment is movable between three positions with respect to the pair of supports 12 fixed to the door 30. Here, in the present embodiment, the position of the handle body 11 sensed by the push switch 8 is the first position (position shown in FIGS. 2A and 2B). Configurations of the handle body 11 and the support 12 will be specifically described below.

[0020] The handle body 11 is made of, for example, metal and includes a pair of base sections 111 (in FIGS. 6 to 8, only upper base section 111 is shown) and a grip 112. Each of the pair of base sections 111 has a thin box shape having an opening in a front surface thereof. Moreover, the shape of each of the pair of base sections 111 viewed from the front is a rectangular shape which is elongated in the up-and-down direction. The upper base section 111 of the pair of base sections 111 includes the projection 111a and a bearing 111b.

[0021] The projection 111a has a shape of a rectangular parallelepiped which is elongated in the forward-and-backward direction. The projection 111a protrudes forward from a front surface of a bottom plate of the base section 111. The projection 111a has such a dimension in the forward-and-backward direction that the projection 111a is not in contact with a lever 81 (which will be described later) of the push switch 8 with the handle body 11 being located in the third position, and the lever 81 is pushed by the projection 111a with the handle body 11 being located in the first position.

[0022] The bearing 111b protrudes forward from the front surface of the bottom plate of the base section 111. The bearing 111b has a groove 111c (see FIG. 8) which is formed in a location further on the right in the right and left direction and in which a third piece 33 (which will be described later) of the movable member 3 is arranged. The connection shaft 4 (which will be described later) whose axial direction is the right and left direction is attached to the bearing 111b such that the connection shaft 4 penetrates through the bearing 111b in the right and left direction.

[0023] The grip 112 has a hollow prism shape which is elongated in the up-and-down direction. The grip 112 has an upper end which is integrally provided with the upper base section 111. The grip 112 has a lower end which is integrally provided with a lower base section 111 (see FIG. 5).

[0024] The support 12 is made of, for example, metal and, as illustrated in FIG. 6, has a rectangular box shape which is elongated in the up-and-down direction respective openings in a front surface and a rear surface thereof. A partition wall 12a dividing the inner space of the support 12 in the forward-and-backward direction is provided substantially in the middle of the support 12 in the forward-and-backward direction. The partition wall 12a has

a first through hole through which the projection 111a is inserted and a second through hole through which the bearing 111b and the movable member 3 are inserted.

[0025] As illustrated in FIGS. 6 to 8, the support 12 includes the fixing plate 2, the movable member 3, the connection shaft 4, a support shaft 5, the first elastic member 6, the second elastic member 7, and the push switch 8.

[0026] The fixing plate 2 is made of, for example, metal and includes a body section 21 having a rectangular plate shape which is elongated in the up-and-down direction and a bent piece 22 bent forward from an upper edge of the body section 21. The body section 21 has a first opening 211 and a second opening 212. The first opening 211 has a rectangular shape and is formed in a lower portion of the body section 21. The second opening 212 has a slit shape which is elongated in the up-and-down direction, and the second opening 212 is in communication with the first opening 211 and extends upward from an upper edge of the first opening 211. The bearing 111b and the third piece 33 of the movable member 3 are inserted into the first opening 211 in the forward-and-backward direction when the handle body 11 is operated. A first piece 31 of the movable member 3 is inserted into the second opening 212 in the forward-and-backward direction when the handle body 11 is operated.

[0027] The movable member 3 is made of, for example, metal and includes the first piece 31, the second piece 32, and the third piece 33. The first piece 31 has a rectangular plate shape which is elongated in the up-and-down direction. The second piece 32 has a rectangular plate shape which is elongated in the forward-and-backward direction. The second piece 32 protrudes forward from an upper edge of the first piece 31. The third piece 33 has a rectangular plate shape and protrudes forward from a lower edge of the first piece 31. The dimension in the forward-and-backward direction of the second piece 32 is larger than the dimension in the forward-and-backward direction of the third piece 33, and the second piece 32 protrudes forward beyond the third piece 33.

[0028] The first piece 31 has a rear edge integrally provided with a first projection piece 311 protruding leftward. Moreover, the first piece 31 has a front edge integrally provided with a second projection piece 312 protruding rightward. The first projection piece 311 is provided at a higher location than the second projection piece 312 in the up-and-down direction. A connection portion of the first piece 31 and the second piece 32 has a through hole in which the support shaft 5 is inserted. The third piece 33 has an oblong hole 331 having an oval shape which is elongated in the forward-and-backward direction. The movable member 3 is configured to be rotatable around the support shaft 5 as the center, the support shaft 5 being inserted in the through hole.

[0029] The connection shaft 4 is made of, for example, metal and has a round bar shape which is elongated in the right and left direction. The connection shaft 4 is attached to the bearing 111b of the base section 111 in a

state where the connection shaft 4 is inserted into the oblong hole 331 formed in the third piece 33 of the movable member 3. Thus, the connection shaft 4 is movable in the oblong hole 331 in the forward-and-backward direction when the handle body 11 is operated.

[0030] The support shaft 5 is made of, for example, metal and has a round bar shape which is elongated in the right and left direction. The support shaft 5 is held by the support 12 in a state where the support shaft 5 is inserted into the through hole formed in the movable member 3. That is, the support shaft 5 rotatably supports the movable member 3 in a state where the support shaft 5 is held by the support 12. Moreover, the first elastic member 6 and the second elastic member 7 are attached to the support shaft 5. The first elastic member 6 is attached on the left side of the movable member 3, and the second elastic member 7 is attached on the right side of the movable member 3 (see FIG. 8).

[0031] The first elastic member 6 is a torsion spring formed of a metal bar made of, for example, stainless steel and includes a first arm 61 serving as a fixed end and a second arm 62 serving as a free end. The first elastic member 6 is held by the support shaft 5 with the support shaft 5 being inserted into a center pore thereof. The first arm 61 of the first elastic member 6 is hooked from the rear over the first projection piece 311 provided to the first piece 31 of the movable member 3 (see FIG. 1A). The second arm 62 of the first elastic member 6 is hooked from the front over the connection shaft 4 held by the bearing 111b of the base section 111 (see FIG. 8).

[0032] Similarly to the first elastic member 6, the second elastic member 7 is a torsion spring formed of a metal bar made of, for example, stainless steel and includes a first arm 71 serving as a fixed end and a second arm 72 serving as a free end. The second elastic member 7 is held by the support shaft 5 with the support shaft 5 being inserted into a center pore thereof. The first arm 71 of the second elastic member 7 is hooked over a rear surface of the body section 21 of the fixing plate 2 (see FIG. 1B). In other words, the first arm 71 is held by a member (in this embodiment, the fixing plate 2) of the support 12. The member is other than movable member 3. The second arm 72 of the second elastic member 7 is hooked from the rear over the second projection piece 312 provided to the first piece 31 of the movable member 3 (see FIG. 1B).

[0033] The push switch 8 includes the lever 81 having a band-plate shape extending in the right and left direction. The push switch 8 is attached to the bent piece 22 of the fixing plate 2. The projection 111a provided to the base section 111 pushes the lever 81 forward, thereby inverting the contact state of the push switch 8. Here, since the push switch 8 constituting the detector 103 is provided to the support 12 fixed to the door 30, it is not necessary to provide the handle body 11 with the detector 103, and the degree of freedom for selecting the handle body 11 increases.

[0034] Next, configurations of the electric locks 120

and 130 will be described with reference to FIGS. 4 and 5. The electric lock 120 includes a lock 121, a driving device 122, and a sensor 123. The electric lock 130 includes a lock 131, a driving device 132, and a sensor 133. In this embodiment, since the configuration of the electric lock 120 and the configuration of the electric lock 130 are similar to each other, the electric lock 120 is described below, and the description of the electric lock 130 is omitted. The lock 121 includes the dead bolt 124 and the latch bolt 125 to be inserted into respective strikes formed in the door frame 40. A cylinder 9 (see FIG. 5) is provided to the back surface (the surface on the outdoor side) of the door 30 in a location corresponding to the lock 121. When a user inserts a normal key into the cylinder 9 and turns the key which is inserted, the cylinder 9 is rotated, and the lock 121 is locked or unlocked.

[0035] The driving device 122 includes a motor or the like for moving the dead bolt 124 in the right and left direction. The driving device 122 rotates the motor in accordance with a drive signal received from the lock control device 100 so as to move the dead bolt 124 leftward or rightward. When the dead bolt 124 is moved leftward, and the dead bolt 124 is inserted into a dead bolt strike formed in the door frame 40, the door 30 is locked. When the dead bolt 124 moves rightward, and the dead bolt 124 leaves the dead bolt strike, the door 30 is unlocked. Here, in the present embodiment, positions in which the dead bolts 124 and 134 are inserted into the strikes are the locked positions, and positions in which the dead bolts 124 and 134 are removed from the strikes are unlocked positions.

[0036] The sensor 123 senses whether the lock 121 is in a locked state or in an unlocked state.

[0037] Note that the electric locks 120 and 130 may be configured as motor-type electric locks for driving dead bolts (or strikes) with an electric motor or have a configuration including an electric thumb turn configured to be turned by an electric motor and a mechanical lock device in combination.

[0038] Subsequently, the configuration of the lock control device 100 will be described with reference to FIG. 4. The lock control device 100 includes an arithmetic processor 101, a communication section 102, the detector 103, a display section 104, drive circuits 105 and 106, and a power supply 107.

[0039] The arithmetic processor 101 includes, for example, a microcomputer as a main component. The microcomputer executes a program stored in memory of the microcomputer by a processor such as a central processing unit (CPU) to realize a function as the arithmetic processor 101. In the present embodiment, the arithmetic processor 101 functions as the authentication section 1011 for authenticating the response apparatus 20 and functions as the controller 1012 for controlling locking and unlocking of the electric locks 120 and 130. The program may be stored in the memory of the microcomputer in advance, provided as a recording medium such as a memory card storing the program, or provided

over a telecommunications network.

[0040] Moreover, the arithmetic processor 101 includes storage 1013. The storage 1013 is memory including electrically rewritable nonvolatile memory such as electrically erasable and programmable read only memory (EEPROM). The storage 1013 stores identification information of the response apparatus 20 which is allowed to perform unlocking or locking. Note that the response apparatus 20 whose identification information is stored in the storage 1013 is a response apparatus allowed to perform an operation for unlocking or locking the electric locks 120 and 130, and such a response apparatus 20 is referred to as a normal response apparatus.

[0041] The communication section 102 includes a communication circuit 1021 and an antenna 1022. The antenna 1022 is an antenna having a coil shape and is attached to the door 30 on the outdoor side. The communication circuit 1021 transmits and receives a radio signal via the antenna 1022. Note that the communication section 102 of the present embodiment transmits and receives the radio signal to and from the response apparatus 20, but a communication specification between the communication section 102 and the response apparatus 20 is accordingly changeable.

[0042] The detector 103 includes the push switch 8 provided to the handle 1 and detects the handle 1 in position (first position) based on the contact state of the push switch 8.

[0043] The display section 104 includes light emitting diodes (LEDs), a liquid crystal display, and the like. The display section 104 is disposed on the outdoor side of the door 30 and displays an operational state of the electric lock device 10 (e.g., locked and unlocked states of the electric locks 120 and 130 and an authentication result of the response apparatus 20).

[0044] The drive circuit 105 outputs a drive signal for locking or unlocking the electric lock 120 to the electric lock 120 in accordance with the control signal received from the arithmetic processor 101.

[0045] The drive circuit 106 outputs a drive signal for locking or unlocking the electric lock 130 to the electric lock 130 in accordance with the control signal received from the arithmetic processor 101.

[0046] The power supply 107 adopts, for example, a battery as a power supply thereof and supplies operating power to components in the electric lock device 10. Note that the power supply 107 includes an electricity receiver configured to be supplied with electric power based on a contactless power supply system from an electricity transmitter provided to the door frame 40 and may be configured to operate based on the electric power which is externally supplied.

[0047] The opening and closing sensor 140 includes, for example, a magnet attached to the door frame 40 and a magnetic detector disposed on the door 30 to face the magnet with the door 30 being closed. The opening and closing sensor 140 senses opening and closing states of the door 30 based on a detection result of magnetism

by the magnetic detector and outputs a sensing result to the arithmetic processor 101.

[0048] Next, the response apparatus 20 will be described with reference to FIG. 4.

[0049] The response apparatus 20 includes a controller 201, a communication circuit 202, an antenna 203, a display section 204, a handle body 205, and a power supply 206.

[0050] The controller 201 includes, for example, a microcomputer as a main component. The microcomputer executes a program stored in memory of the microcomputer by a processor such as a CPU to realize a function as the controller 201. The program may be stored in the memory of the microcomputer in advance, provided as a recording medium such as a memory card storing the program, or provided over a telecommunications network.

[0051] Moreover, the memory holds identification information assigned to the response apparatus 20. When the communication circuit 202 receives an inquiry signal transmitted from the lock control device 100, the controller 201 creates a response signal including the identification information stored in the memory and transmits the response signal from the communication circuit 202.

[0052] The communication circuit 202 transmits and receives a radio signal to and from the lock control device 100 via the antenna 203 having a coil shape.

[0053] The antenna 203 has, for example, a 3-axis configuration including three independent coils arranged orthogonal to one another. Thus, stable communication with the lock control device 100 is possible in any orientation of the response apparatus 20.

[0054] The display section 204 includes LEDs, a liquid crystal display, and the like and displays the operational state and the like of the response apparatus 20 by light and/or characters.

[0055] For example, the handle body 205 is configured to turn on/off the power supply of the response apparatus 20.

[0056] The power supply 206 includes, for example, a lithium battery having a coin shape and supplies electric power for driving each component.

[0057] Next, operation when the handle body 11 is operated will be described with reference to FIGS. 1A to 3B.

[0058] FIG. 1A is a left side view illustrating a state where the handle body 11 is not operated, that is, a state where the handle body 11 is located in the third position, wherein part of the handle body 11 is omitted. Moreover, FIG. 1B is a right side view illustrating a state where the handle body 11 is located in the third position, wherein part of the handle body 11 is omitted.

[0059] In this state, the lever 81 of the push switch 8 is not pushed by the projection 111a. Moreover, the movable member 3 is held in an orientation in which the second piece 32 is horizontal due to frontward resilient force from the second arm 72 of the second elastic member 7. Moreover, the connection shaft 4 is located at a rear edge of the oblong hole 331 provided to the movable

member 3 due to backward resilient force from the second arm 62 of the first elastic member 6.

[0060] When the handle body 11 in the state shown in FIGS. 1A and 1B is pushed forward, the handle body 11 moves from the third position to the first position (see FIGS. 2A and 2B). At this time, the bearing 111b moves forward along with the handle body 11 during movement thereof. Moreover, the connection shaft 4 moves forward in the oblong hole 331 along with the bearing 111b during movement thereof.

[0061] In this state, the lever 81 of the push switch 8 is pushed forward by the projection 111a, and the detector 103 detects that the handle body 11 is in the first position (see FIGS. 2A and 2B). Moreover, the second arm 62 of the first elastic member 6 is displaced forward along with the connection shaft 4 during movement thereof (see FIG. 2A). That is, the second arm 62 of the first elastic member 6 generates the backward resilient force. Note that when the handle body 11 in position is detected by the detector 103 (the push switch 8), the authentication section 1011 of the arithmetic processor 101 starts the authentication process of the response apparatus 20. The authentication process will be described later.

[0062] Next, when the handle body 11 in the state shown in FIGS. 2A and 2B is pulled backward, the handle body 11 moves from the first position via the third position to the second position (see FIGS. 3A and 3B). At this time, the bearing 111b moves backward along with the handle body 11 during movement thereof. Moreover, the connection shaft 4 moves backward in the oblong hole 331 along with the bearing 111b during movement thereof. Furthermore, since the third piece 33 moves backward along with the connection shaft 4 during movement thereof, the movable member 3 rotates around the support shaft 5 as the center (see FIGS. 3A and 3B). When the movable member 3 rotates, the latch driver is pushed by the second piece 32, and the latch bolt 125 transitions to the released state. Moreover, when the response apparatus 20 has successfully been authenticated, the dead bolts 124 and 134 have moved to the unlocked position, thus, allowing the door 30 to open. In this state, rotation of the movable member 3 displaces the second arm 72 of the second elastic member 7 backward (see FIG. 3B). That is, the second arm 72 of the second elastic member 7 generates the frontward resilient force.

[0063] Here, when a user removes his/her hand from the handle body 11 with the handle body 11 being located in the first position, the connection shaft 4 moves backward due to the backward resilient force from the second arm 62 of the first elastic member 6. Moreover, the handle body 11 also moves backward along with the connection shaft 4 during movement thereof. That is, the backward resilient force from the first elastic member 6 moves the handle body 11 from the first position to the third position.

[0064] Moreover, when a user removes his/her hand from the handle body 11 with the handle body 11 being located in the second position, the frontward resilient force from the second arm 72 of the second elastic mem-

ber 7 rotates the movable member 3. The direction in which the movable member 3 is rotated is a direction opposite to a direction in which the movable member 3 is rotated when the handle body 11 moves from the third position to the second position. At this time, the connection shaft 4 moves forward along with the movable member 3 during rotation thereof, and thereby, the handle body 11 also moves forward. That is, the forward resilient force from the second elastic member 7 moves the handle body 11 from the second position to the third position.

[0065] The following problems may, however, occur in the electric lock system of the present embodiment having a structure in which the resilient force of the first elastic member 6 and the resilient force of the second elastic member 7 move the handle body 11 located in the first position or the second position to the third position. For example, it is assumed that the first arm 61 of the first elastic member 6 hooked over the first projection piece 311 is hooked over the fixing plate 2. In this case, in a state where the handle body 11 is located in the first position or the second position, both of the first elastic member 6 and the second elastic member 7 generate resilient force. That is, in this case, the movable member 3 receives both the resilient force of the first elastic member 6 and the resilient force of the second elastic member 7. As a result, when the handle body 11 moves from the first position or the second position to the third position, the handle body 11 may vibrate in the forward-and-backward direction (that is, a state where resilient force is exerted on one object in opposite directions by two elastic bodies).

[0066] To solve the problem, in the present embodiment, the first arm 61 of the first elastic member 6 is hooked over the movable member 3, and the second arm 62 of the first elastic member 6 is hooked over the connection shaft 4. Moreover, the first arm 71 of the second elastic member 7 is hooked over the fixing plate 2, and the second arm 72 of the second elastic member 7 is hooked over the movable member 3. Thus, in a state where the handle body 11 is in the first position, as illustrated in FIGS. 2A and 2B, only the first elastic member 6 generates resilient force, and only the resilient force of the first elastic member 6 is exerted on the movable member 3. Moreover, in a state where the handle body 11 is in the second position, as illustrated in FIGS. 3A and 3B, only the second elastic member 7 generates resilient force, and only the resilient force of the second elastic member 7 is exerted on the movable member 3. Moreover, as illustrated in FIGS. 1A and 1B, in a state where the handle body 11 is located in the third position, neither the first elastic member 6 nor the second elastic member 7 generates resilient force. That is, in the present embodiment, in each of the first position, the second position, and the third position, the movable member 3 does not receive resilient force simultaneously from the first elastic member 6 and the second elastic member 7. This enables a reduction of vibration of the handle body 11 in

the forward-and-backward direction when the handle body 11 moves from the first position or the second position to the third position.

[0067] Next, operation when a person opens the door 30 outdoors and enters a room will be described with reference to FIG. 9.

[0068] When a user carrying a normal response apparatus 20 opens the door 30 outdoors, the user holds the grip 112 of the handle 1 and pushes the handle body 11 including the grip 112 forward (in a direction opposite to a direction in which the door 30 is opened) (step S1).

[0069] As illustrated in FIGS. 2A and 2B, when the grip 112 is pushed forward, the projection 111a provided to the base section 111 pushes the lever 81 of the push switch 8 forward, thereby inverting the contact state of the push switch 8, for example, from an off-state to an on-state. A contact signal of the push switch 8 is input to the detector 103. The detector 103 detects, with reference to the inversion from the off-state to the on-state of the contact state of the push switch 8, that the handle 1 is operated and is in the first position, and the detector 103 outputs a sensing signal to the arithmetic processor 101. When the sensing signal is input from the detector 103 to the arithmetic processor 101, the sensing signal triggers the authentication section 1011 to start the authentication process of the response apparatus 20 (step S2).

[0070] The authentication section 1011 causes the communication section 102 to transmit an inquiry signal for requesting the response apparatus 20 to transmit identification information. When the response apparatus 20 carried by a user receives the inquiry signal transmitted from the communication section 102, the response apparatus 20 transmits a response signal in response to the inquiry signal. When receiving the response signal transmitted from the response apparatus 20, the communication section 102 outputs the response signal, which is received, to the arithmetic processor 101.

[0071] When the response signal is input from the communication section 102 to the arithmetic processor 101, the authentication section 1011 checks identification information included in the response signal with identification information stored in the storage 1013, thereby authenticating the response apparatus 20 (step S3).

[0072] If the authentication in the authentication process in step S3 fails (NO in step S3), the authentication section 1011 determines that a person who operates the handle 1 does not carry the normal response apparatus 20. The authentication section 1011 does not cause the controller 1012 to unlock the electric locks 120 and 130, and the electric locks 120 and 130 maintain the locked state (step S7). At this time, the arithmetic processor 101 controls the display section 104 to, for example, flash a lamp or to ring a buzzer to notify that the authentication fails.

[0073] In contrast, in the authentication process in step S3, if the identification information included in the response signal matches the identification information

stored in the storage 1013 (YES in step S3), the authentication section 1011 determines that the response apparatus 20 is normal (the authentication is successfully performed). When the authentication section 1011 determines that the response apparatus 20 is normal, the controller 1012 outputs an unlock command to the drive circuits 105 and 106. When the unlock command is input to the drive circuits 105 and 106, the drive circuit 105 unlocks the electric lock 120 (strictly speaking, the dead bolt 124), and the drive circuit 106 unlocks the electric lock 130 (strictly speaking, the dead bolt 134) (step S4). When the electric lock 120 unlocks the lock 121, the sensor 123 senses the unlocked state, and the sensing result is output to the arithmetic processor 101. Similarly, when the electric lock 130 unlocks the lock 131, the sensor 133 senses the unlocked state, and the sensing result is output to the arithmetic processor 101.

[0074] When the electric locks 120 and 130 are unlocked, and then, the grip 112 is pulled backward (to outdoor), the second piece 32 of the movable member 3 of the handle 1 pushes the latch driver, and the latch bolt 125 transitions to the released state (a state where the latch bolt 125 is rotatable in the forward-and-backward direction). When the grip 112 in this state is further pulled backward (step S5), the door 30 is opened (step S6). When the door 30 is opened, the opening and closing sensor 140 senses the open state of the door 30 and outputs a sensing signal to the arithmetic processor 101.

[0075] When a user carrying the response apparatus 20 goes indoors with the door 30 being open and then closes the door 30, the opening and closing sensor 140 senses the closed state of the door 30 and outputs a sensing signal to the arithmetic processor 101. When after unlocking the electric locks 120 and 130, the controller 1012 determines, based on the sensing signals from the opening and closing sensor 140, that the door 30 is opened and is then closed, the controller 1012 outputs a lock command to the drive circuits 105 and 106 after a definite time period. When the lock command is input to the drive circuits 105 and 106, the drive circuit 105 locks the electric lock 120, and the drive circuit 106 locks the electric lock 130.

[0076] Variations of the present embodiment will be described below.

[0077] While the electric lock device 10 of battery type has been described in the present embodiment, the electric lock device 10 may be configured to be supplied with electric power from, for example, an AC power supply. This configuration does not involve the problem of battery capacity unlike the electric lock device 10 of battery type. Thus, this configuration enables the authentication section 1011 to perform constant authentication and to start the authentication process when a user approaches the door 30. When the authentication by the authentication section 1011 has successfully been performed, a sensing signal from the detector 103 serves as a trigger for locking and unlocking operations by the electric locks 120 and 130, and at a time point at which the sensing signal is

input to the arithmetic processor 101, the dead bolts 124 and 134 are moved to the unlocked position.

[0078] Moreover, while the handle 1 provided to the outdoor side of the door 30 has been described in the present embodiment, a similar handle may be provided to the indoor side of the door 30. Further, while an example in which the first elastic member 6 and the second elastic member 7 are torsion springs has been described in the present embodiment, the first elastic member 6 and the second elastic member 7 are not limited to the torsion springs but may be, for example, leaf springs. Alternatively, the first elastic member 6 and the second elastic member 7 may be formed of a component other than springs as long as the first elastic member 6 and the second elastic member 7 have resilience. Furthermore, while the handle body 11 in position is detected by the push switch 8 in the present embodiment, a toggle switch, a slide switch, or the like may detect the handle body 11 in position.

[0079] While an example in which a dedicated tag key is the response apparatus has been described in the present embodiment, the response apparatus is not limited to the dedicated tag key but may be a portable terminal such as a smartphone or personal digital assistant (PDA).

[0080] As can be seen from the above-described embodiment, an electric lock device 10 of a first aspect according to the present invention includes a support 12, a handle body 11, electric locks 120 and 130, a detector 103, an authentication section 1011, and a controller 1012. The support 12 is to be fixed to a door 30. The door 30 is provided with a latch bolt 125 switchable between a latched state and a released state. The handle body 11 is movably connected to the support 12 and is configured to be operated to open the door 30. The electric locks 120 and 130 are configured to move dead bolts 124 and 134 between a locked position and an unlocked position, the dead bolts 124 and 134 being disposed in movable relation to the door 30. The detector 103 is configured to detect the handle body 11 in position. The authentication section 1011 is configured to authenticate an identity of a person who is about to open the door 30. The controller 1012 is configured to control the electric locks 120 and 130 to move the dead bolts 124 and 134 to the unlocked position based on a sensing result by the detector 103 and an authentication result by the authentication section 1011. The handle body 11 is configured to be moved between a first position, a second position, and a third position. The first position is a position in which the handle body 11 is detected by the detector 103. The second position is a position in which the latch bolt 125 is in the released state. The third position is a position in which the latch bolt 125 is in the latched state. The support 12 includes a connection shaft 4, a movable member 3, a first elastic member 6, and a second elastic member 7. The connection shaft 4 is configured to move along with the handle body 11 during operation thereof. The movable member 3 has an oblong hole 331 in which the

connection shaft 4 is inserted, the oblong hole allowing the movable member 3 to move along with the connection shaft 4 during movement thereof. The first elastic member 6 is configured to exert, on the handle body 11 in the first position, resilient force enabling the handle body 11 to move in a direction toward the third position. The second elastic member 7 is configured to exert, on the handle body 11 in the second position, resilient force enabling the handle body 11 to move in the direction toward the third position. The first elastic member 6 includes a first arm (fixed end) 61 held by the movable member 3. The second elastic member 7 includes a first arm (fixed end) 71 held by a fixing plate (a member) 2 of the support 12. The fixing plate 2 is a member other than the movable member 3.

[0081] The first aspect provides the advantage that an operation switch for starting an authentication process does not have to be separately provided because an operation (push operation) performed on the handle 1 on which the operation for opening the door 30 outdoors is performed starts the authentication process. In addition, the handle 1 is pushed to start the authentication process, and the handle 1 is then pulled to open the door 30, and therefore, an operation of starting the authentication process and an operation of opening the door 30 can be performed through the one handle 1. In other words, unlike the conventional electric lock system, it is not necessary to perform, in order to open the door, two operations, an operation of pushing an unlock button and an operation of holding a handle to open the door, but the operations performed on one operation target (handle 1) enables the door 30 to be opened. Moreover, the first arm (fixed end) 61 of the first elastic member 6 is held by the movable member 3, and the first arm (fixed end) 71 of the second elastic member 7 is held by a member (in the present embodiment, the fixing plate 2) of the support 12. The member is other than the movable member 3. Thus, even when the handle body 11 is in any of the first position, the second position, and the third position, resilient force is not applied to the movable member 3 simultaneously from both the first elastic member 6 and the second elastic member 7. This enables vibration caused during operation of the handle body 11 to be reduced.

[0082] In an electric lock device 10 of a second aspect according to the present invention referring to the first aspect, the handle body 11 is preferably configured to move from the third position to the first position when pushed in a direction toward the door 30 and move from the third position to the second position when pulled in a direction away from the door 30.

[0083] According to the second aspect, simple operations of pushing and pulling the handle body 11 enable the door 30 to be opened. Note that this configuration is not essential for the electric lock device. For example, a turning operation of turning the handle body and a pushing operation of pushing the handle body may be combined with each other, or only the turning operation may

be performed.

[0084] In an electric lock device 10 of a third aspect according to the present invention referring to the first or second aspect, the first elastic member 6 includes the second arm (free end) 62 preferably held by the connection shaft 4, and the second elastic member 7 includes the second arm (free end) 72 preferably held by the movable member 3.

[0085] The third aspect enables vibration caused during operation of the handle body 11 to be reduced. Note that this configuration is not essential for the electric lock device. For example, the free end of the first elastic member may be held by the fixing plate, and the free end of the second elastic member may be held by the movable member.

Reference Signs List

[0086]

2	Fixing Plate (Another Member)
3	Movable Member
4	Connection Shaft
6	First Elastic Member
7	Second Elastic Member
10	Electric Lock Device
11	Handle body
12	Support
30	Door
61	First Arm (Fixed End)
62	Second Arm (Free End)
71	First Arm (Fixed End)
72	Second Arm (Free End)
103	Detector
120, 130	Electric Lock
124, 134	Dead Bolt
125	Latch Bolt
331	Oblong Hole
1011	Authentication Section
1012	Controller

Claims

1. An electric lock device, comprising:
 - a support to be fixed to a door provided with a latch bolt switchable between a latched state and a released state;
 - a handle body movably connected to the support and configured to be operated to open the door;
 - an electric lock configured to move a dead bolt between a locked position and an unlocked position, the dead bolt being disposed in movable relation to the door;
 - a detector configured to detect the handle body in position;
 - an authentication section configured to authen-

ticate an identity of a person who is about to
 open the door; and
 a controller configured to control the electric lock
 to move the dead bolt to the unlocked position
 based on a sensing result by the detector and
 an authentication result by the authentication
 section,
 the handle body being configured to be moved
 between a first position where the handle body
 is sensed by the detector, a second position
 where the latch bolt is in the released state, and
 a third position where the latch bolt is in the
 latched state,
 the support including

a connection shaft configured to move
 along with the handle body during operation
 thereof;
 a movable member having an oblong hole
 in which the connection shaft is inserted,
 the oblong hole allowing the movable mem-
 ber to move along with the connection shaft
 during movement thereof;
 a first elastic member configured to exert,
 on the handle body in the first position, re-
 silient force enabling the handle body to
 move in the direction toward the third posi-
 tion; and
 a second elastic member configured to ex-
 ert, on the handle body in the second posi-
 tion, resilient force enabling the handle body
 to move in a direction toward the third posi-
 tion,

the first elastic member including a fixed end
 held by the movable member,
 the second elastic member including a fixed end
 held by a member of the support, the member
 being other than the movable member.

2. The electric lock device according to claim 1, wherein the handle body is configured to

move from the third position to the first position
 when pushed in a direction toward the door and
 move from the third position to the second po-
 sition when pulled in a direction away from the
 door.

3. The electric lock device according to claim 1 or 2, wherein the first elastic member includes a free end held by the connection shaft, and the second elastic member includes a free end held by the movable member.

FIG. 1A

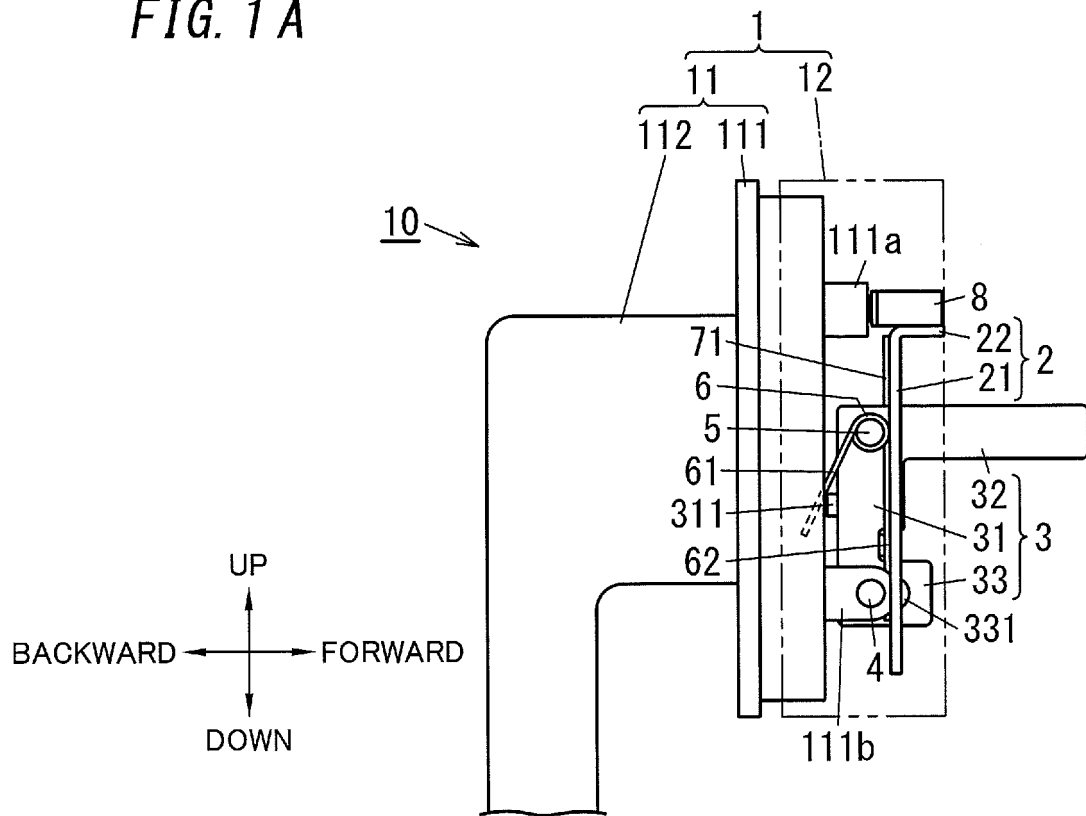


FIG. 1B

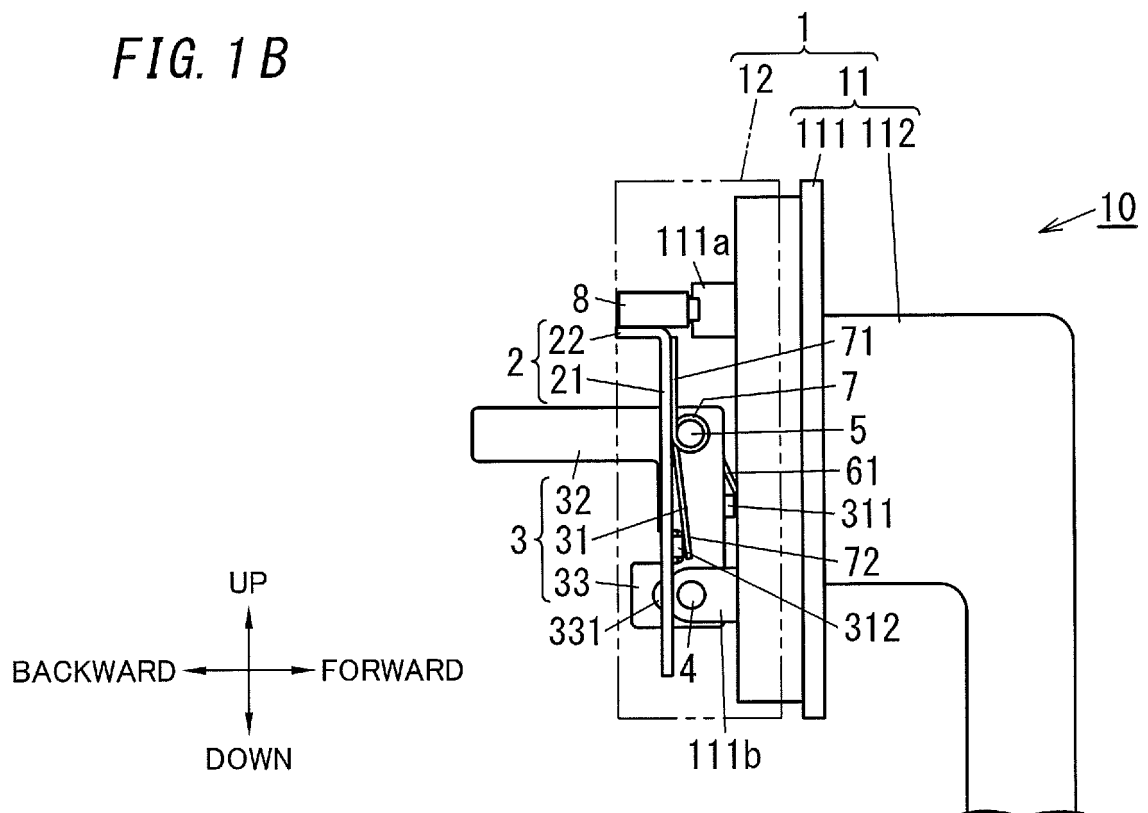


FIG. 2A

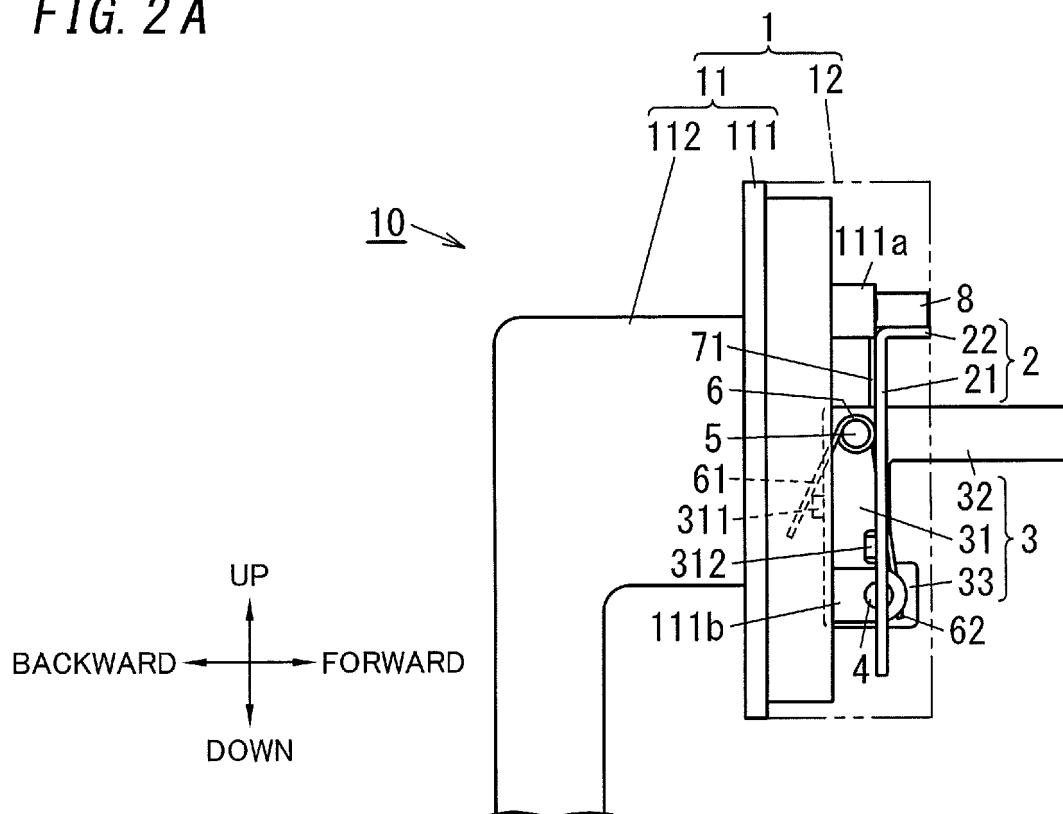


FIG. 2B

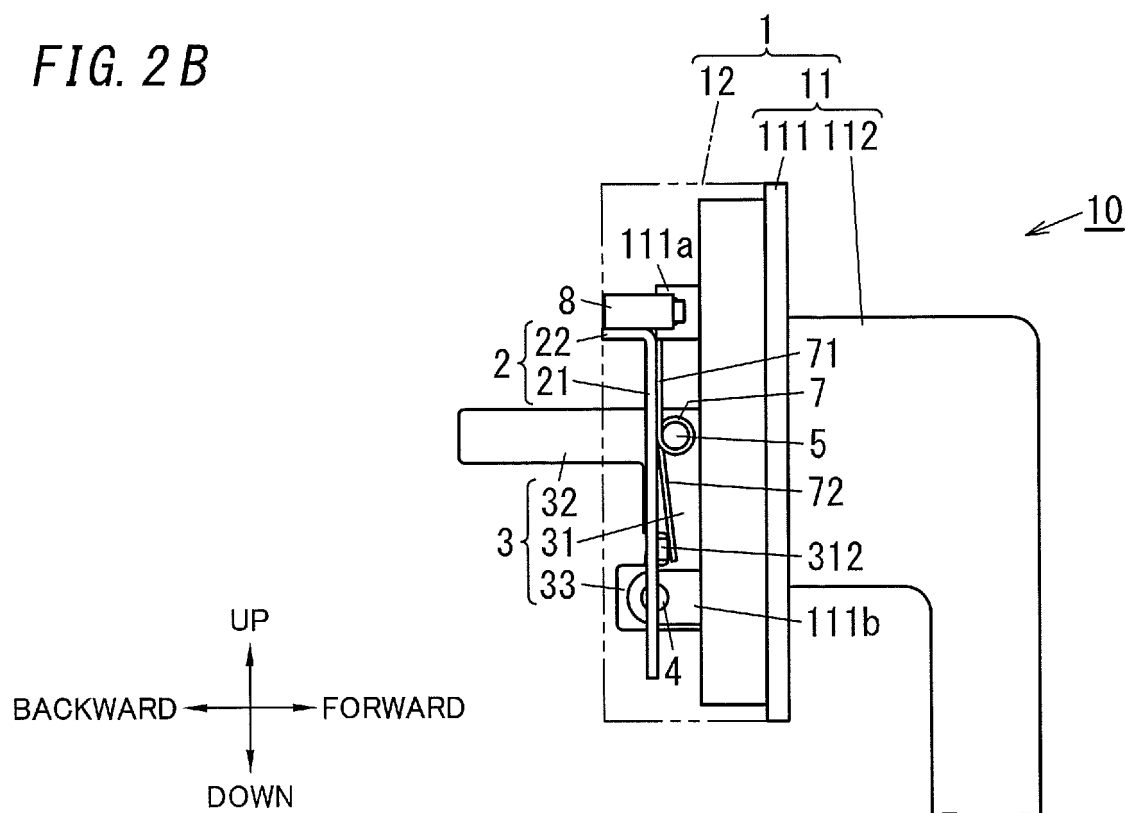


FIG. 3 A

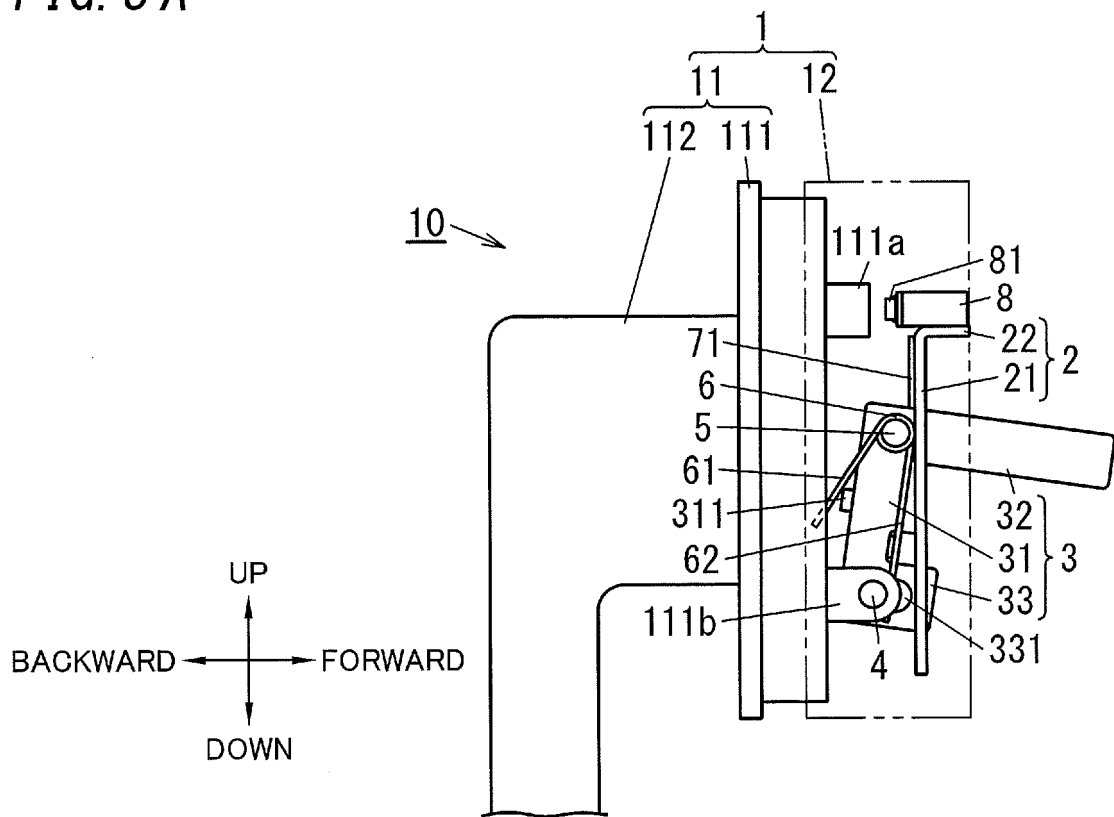


FIG. 3B

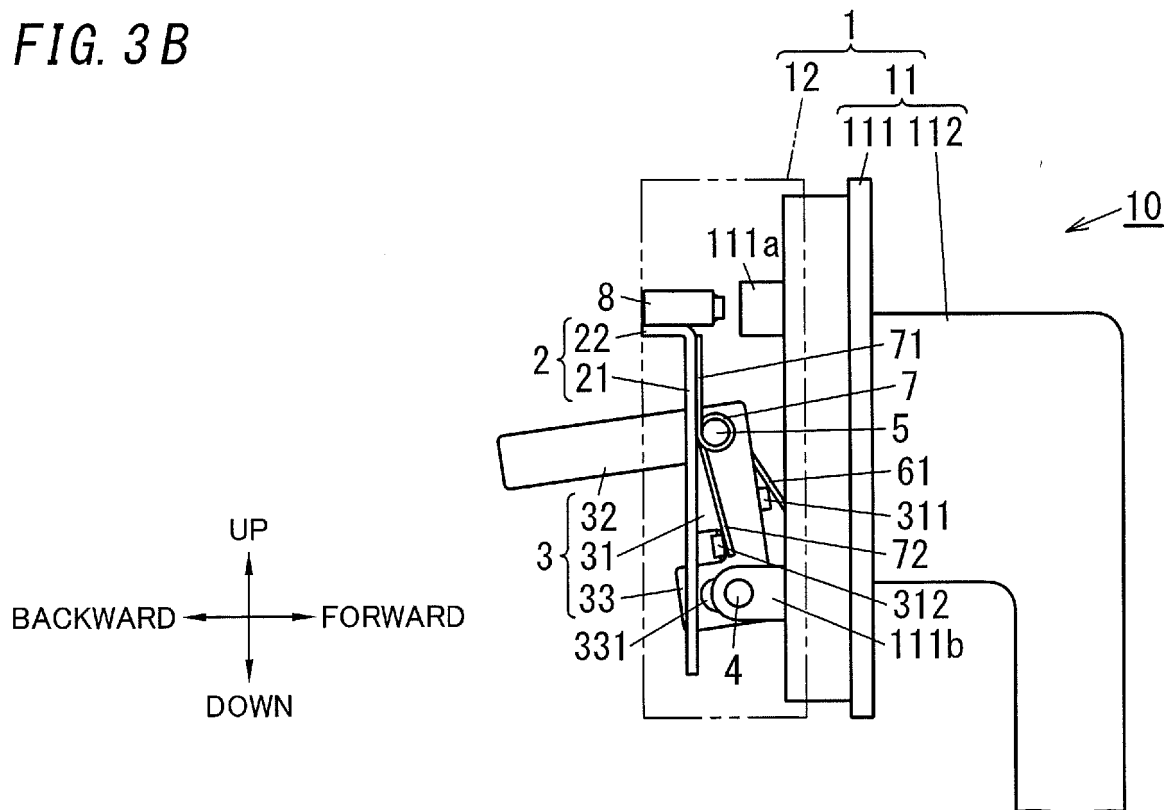


FIG. 4

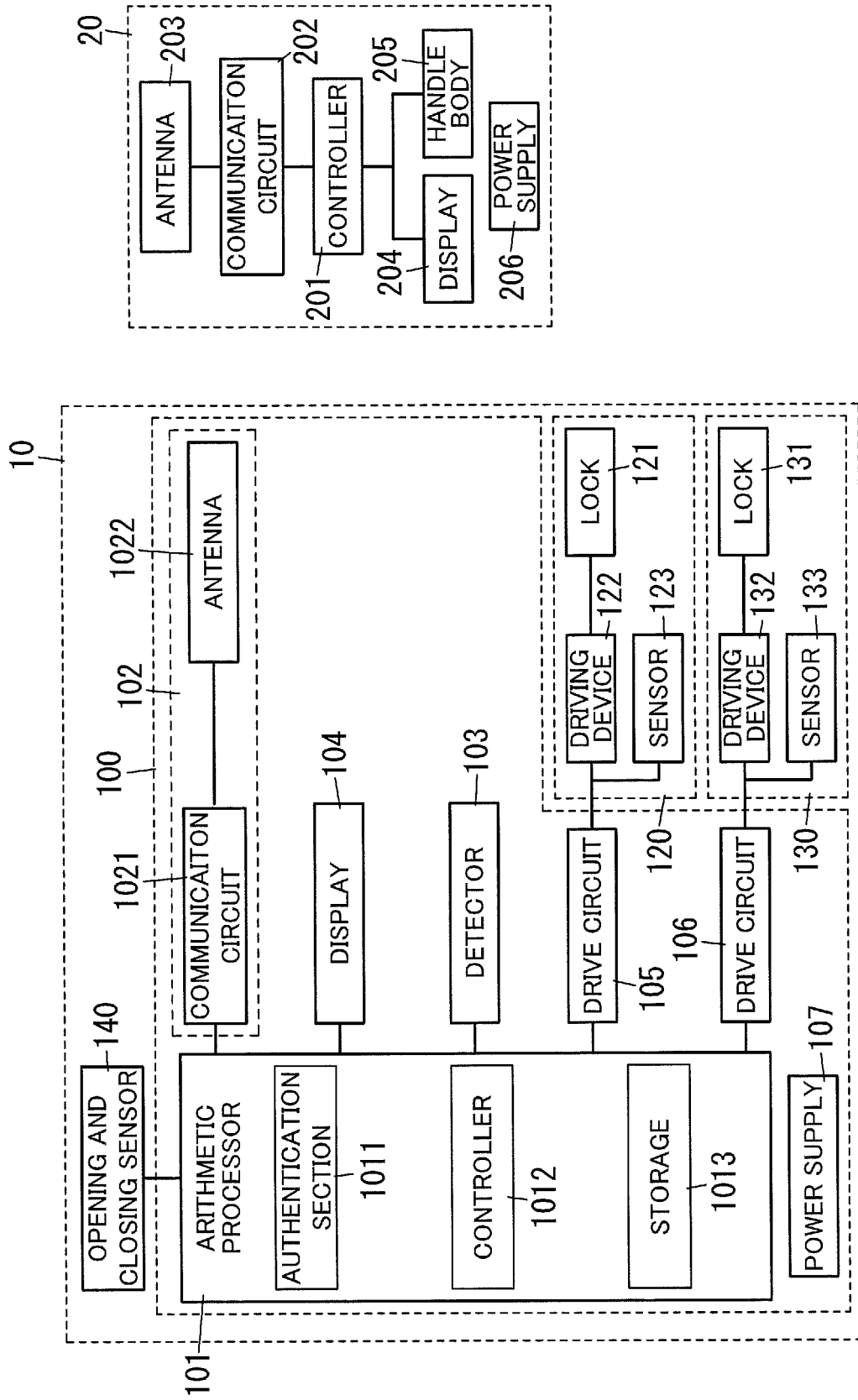
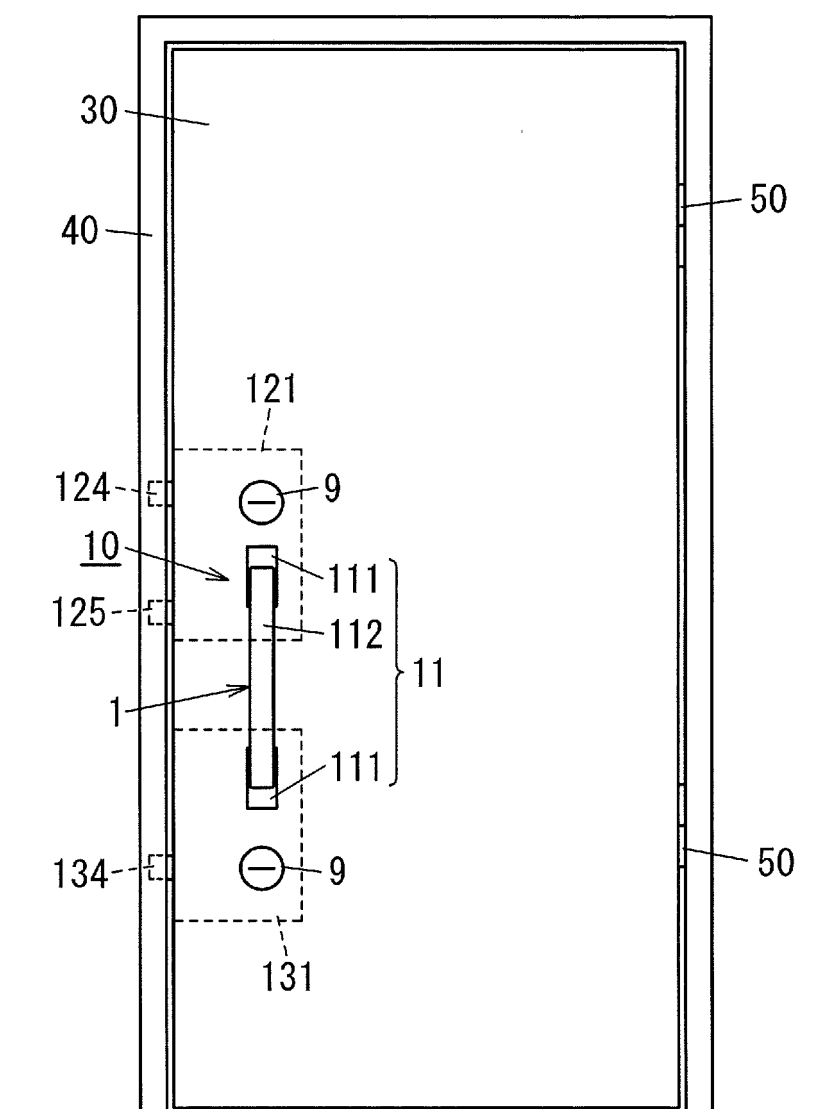
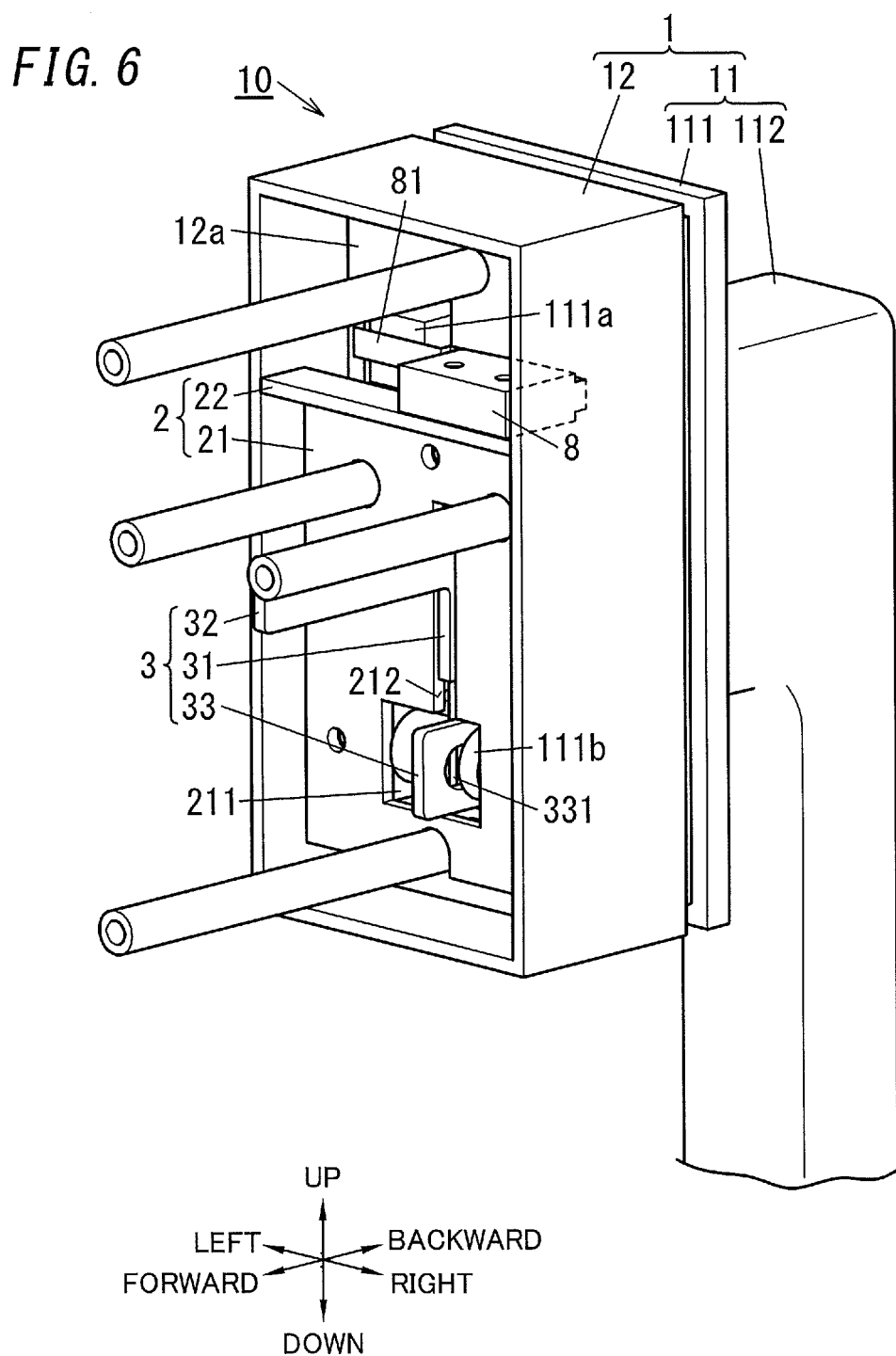


FIG. 5





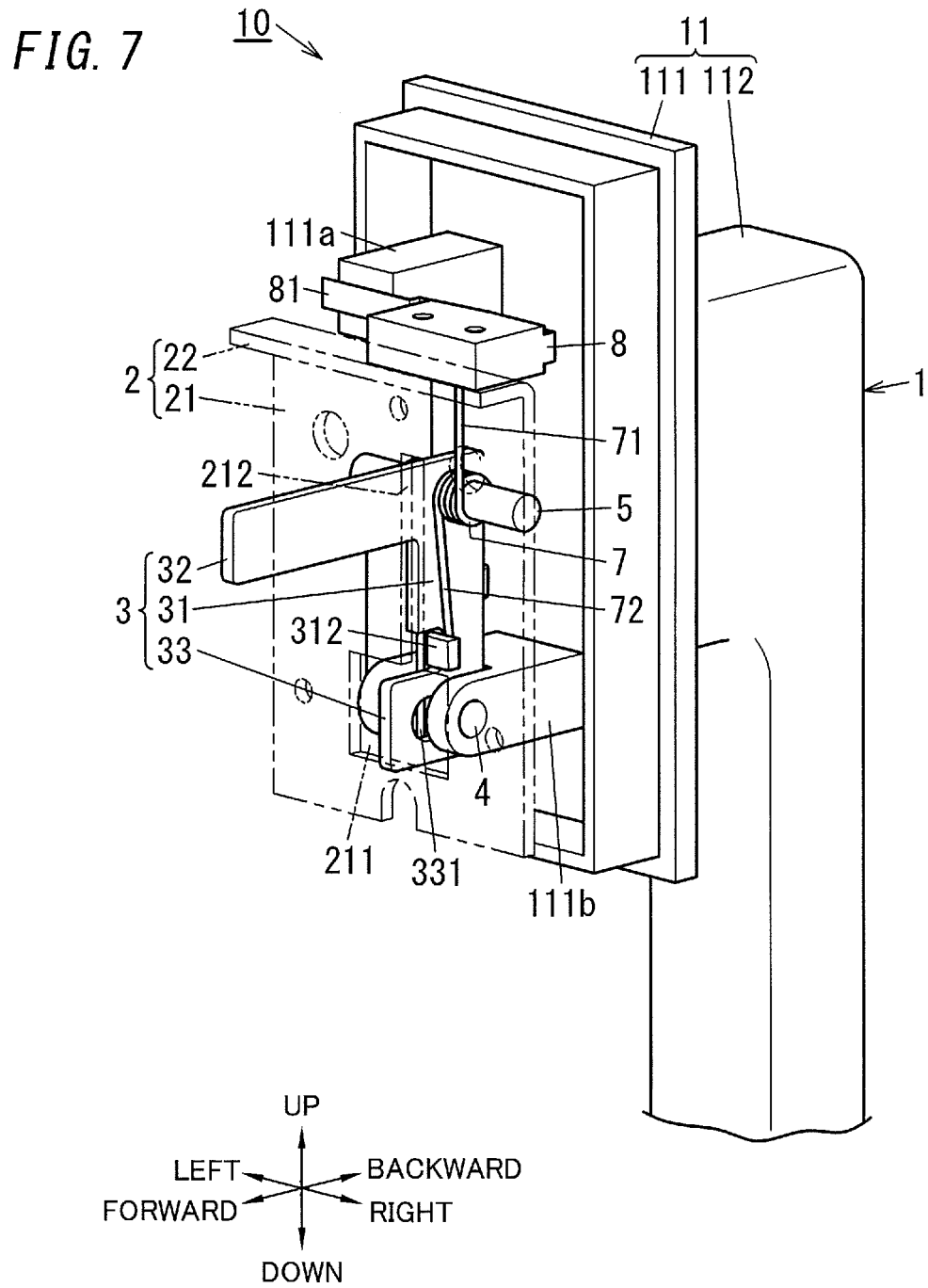


FIG. 8

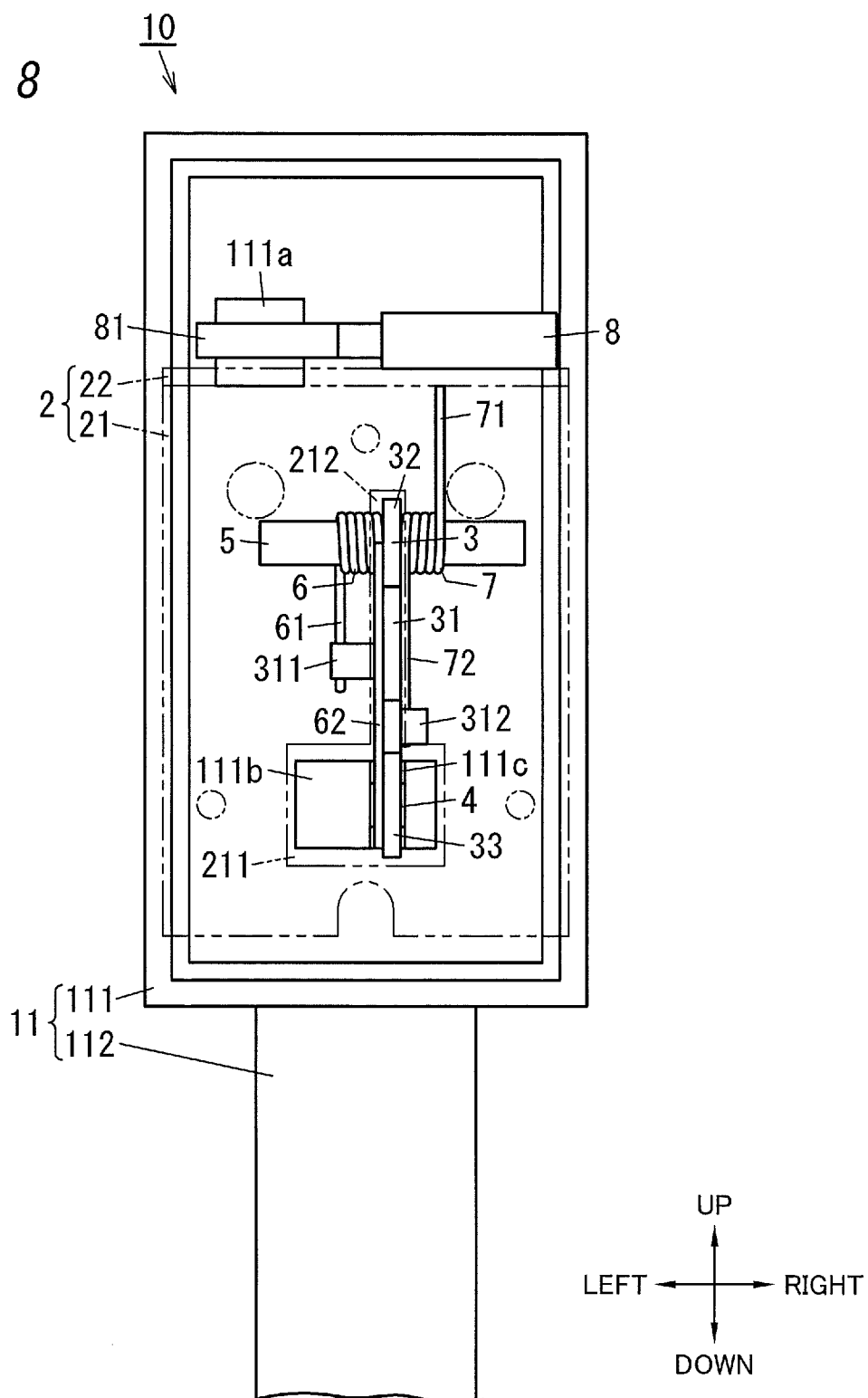
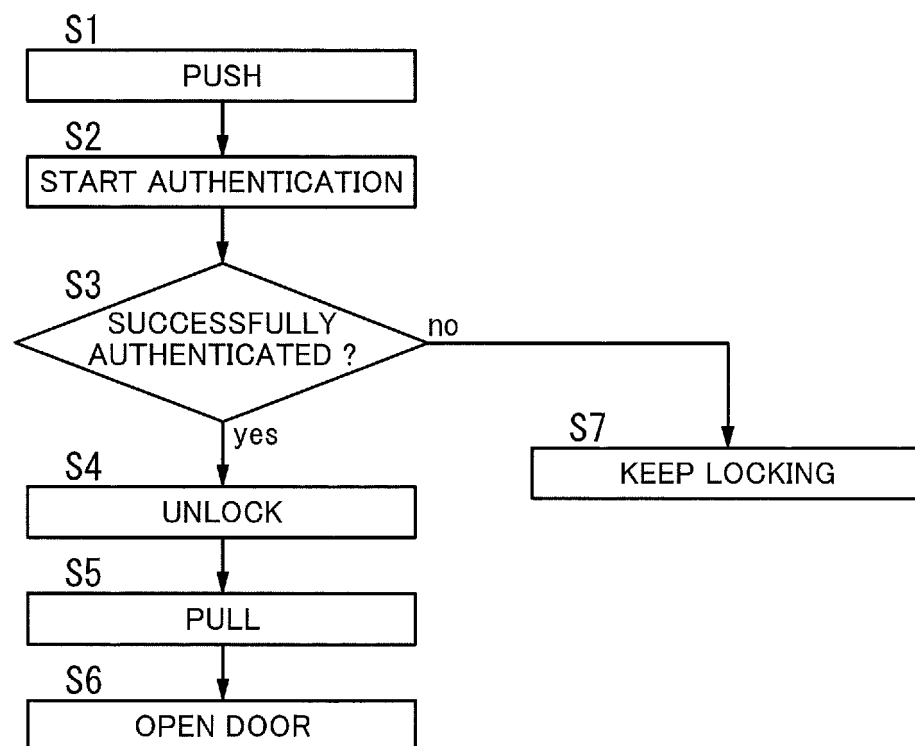


FIG. 9



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2017/008067

A. CLASSIFICATION OF SUBJECT MATTER

E05B47/00(2006.01)i, E05B49/00(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)

E05B1/00, E05B47/00, E05B49/00

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2017
Kokai Jitsuyo Shinan Koho	1971-2017	Toroku Jitsuyo Shinan Koho	1994-2017

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2015-129399 A (Miwa Lock Co., Ltd.), 16 July 2015 (16.07.2015), entire text; all drawings (Family: none)	1-3
A	JP 2007-75305 A (Hitachi, Ltd.), 29 March 2007 (29.03.2007), entire text; all drawings & US 2007/0058841 A1 entire text; all drawings & EP 1764724 A2 & DE 602006006952 D & CN 1932845 A & KR 10-2007-0031217 A & SG 131000 A & MY 145546 A & TW 200714257 A	1-3

☐ Further documents are listed in the continuation of Box C.
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Date of the actual completion of the international search
17 May 2017 (17.05.17)Date of mailing of the international search report
30 May 2017 (30.05.17)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

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Telephone No.

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REFERENCES CITED IN THE DESCRIPTION

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