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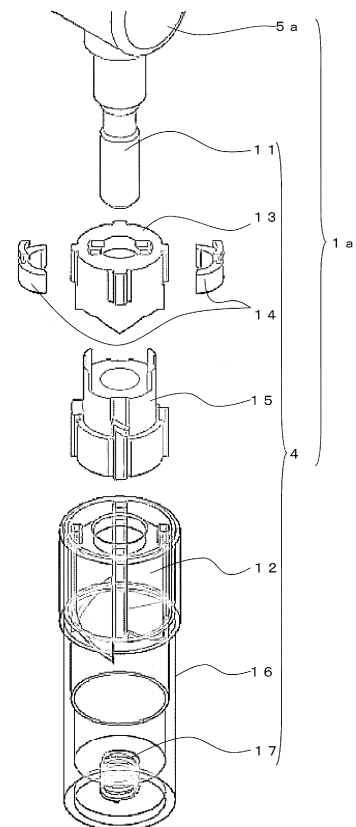
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(54) **ATTACHING/DETACHING DEVICE AND HINGE DEVICE USING SAME**

(57) Provided are a mounting and dismounting device capable of easily mounting and dismounting an object on one side on and from an object on the other side without performing a cumbersome and difficult operation, and a hinge device using the mounting and dismounting device. In the present invention, mounting and removal of a toilet seat/toilet lid unit 2 on and from a toilet bowl 3 are performed by gripping the toilet seat/toilet lid unit 2, inserting the other end of a shaft 11 mounted on the toilet seat/toilet lid unit 2 into a first insertion opening 12a of a stationary core 12 fixed to a housing 16 mounted on the toilet bowl 3, and pressing the toilet seat/toilet lid unit 2 against the toilet bowl 3. Insertion and extraction of the shaft 11 into and from the housing 16 are performed by sliding sliders 14 in a direction orthogonal to an insertion direction of the shaft 11 and performing locking by causing a fixing groove 11a1 of the shaft 11 and embracing portions 14a of the sliders 14 to be engaged with each other, or performing unlocking by releasing the engagement between the fixing groove 11a1 and the embracing portions 14a.

Fig. 4



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Description

Technical Field

[0001] The present invention relates to a mounting and dismounting device for detachably mounting an object on one side, on an object on the other side, and a hinge device using the mounting and dismounting device.

Background Art

[0002] In the related art, as this type of mounting and dismounting device and a hinge device using the mounting and dismounting device, there are devices for a toilet seat, which are disclosed in PTL 1.

[0003] The mounting and dismounting device disclosed in PTL 1 detachably mounts a toilet seat/toilet lid unit on a toilet bowl, and the hinge device supports the toilet seat/toilet lid unit mounted on the toilet bowl by the mounting and dismounting device so as to be opened and closed with respect to the toilet bowl. The mounting and dismounting device is provided with a case which is mounted on the toilet seat/toilet lid unit side, and a pin which is provided on the toilet bowl side. The pin is provided to be erect on a fixed member which is mounted on the toilet bowl, and has a groove formed on the outer periphery of the tip thereof. The case coaxially accommodates a locking mechanism which is connected to a pressing member, a shaft formed with a hole into which the pin is inserted, and a core which is rotatably mounted on the case. In the case, an elongated opening for exposing a hole of the shaft is formed in a side portion. The locking mechanism has a holding member which is engaged with the groove of the tip of the pin, and the holding member is urged to a position crossing the hole of the shaft by a spring member.

[0004] When mounting the toilet seat/toilet lid unit on the toilet bowl, the pin is inserted into the hole of the shaft through an opening of the case, and the tip of the pin slides the holding member against the biasing force of the spring member, whereby the holding member is engaged with the groove of the pin. With this engagement, the toilet seat/toilet lid unit is fixed to the toilet bowl, so that a locked state is created. On the other hand, when removing the toilet seat/toilet lid unit from the toilet bowl, the pressing member is pushed against the biasing force of the spring member, whereby the holding member is separated from the groove of the pin. In this way, the engagement between the holding member and the pin is released, and thus the pin can be pulled out from the hole of the shaft, so that an unlocked state is created where the toilet seat/toilet lid unit can be removed from the toilet bowl.

Citation List

Patent Literature

5 **[0005]** [PTL 1] EP 2324745A

Summary of Invention

Technical Problem

10 **[0006]** However, in the mounting and dismounting device of the related art disclosed in PTL 1, when removing the toilet seat/toilet lid unit from the toilet bowl, an unlocking operation to insert the hand to a position inside the toilet seat/toilet lid unit and push the pressing member against the biasing force of the spring member is required. The toilet seat/toilet lid unit is mounted on the toilet bowl by the mounting and dismounting devices provided at two locations, and therefore, this unlocking operation of pushing the pressing member needs to be simultaneously performed on the respective mounting and dismounting devices configuring two hinge devices with both hands. Therefore, in the mounting and dismounting device of the related art and the hinge device using the mounting and dismounting devices, an operation of removing the toilet seat/toilet lid unit from the toilet bowl is cumbersome and difficult. For this reason, in the related art, cleaning or maintenance of a western-style toilet, or work of replacing a toilet seat/toilet lid unit is not easily performed. Further, in addition to the western-style toilet, in other devices having a structure in which an object on one side is detachably mounted on an object on the other side by using the mounting and dismounting device having such a configuration and the hinge device using the mounting and dismounting device, the same problem also occurs.

Solution to Problem

40 **[0007]** The present invention has been made to solve such problems and provides a mounting and dismounting device for detachably mounting an object on one side, on an object on the other side by mounting the object on one side, on the object on the other side by engagement between the object on one side and the object on the other side and separating the object on one side from the object on the other side by releasing the engagement between the object on one side and the object on the other side, the device including:

50 a shaft which has a first shaft portion with a fixing groove formed therein, and a second shaft portion having a larger diameter than the first shaft portion, and in which one end on the second shaft portion side is mounted on the side of the object on one side; 55 a housing which has a first space facing one end face and is mounted on the side of the object on the other side;

a fixed member having a first insertion opening formed on one end face with a diameter to allow insertion of the first shaft portion and the second shaft portion, a second space communicating with the first insertion opening, a plurality of guide grooves formed on an inner periphery surrounding the second space along an insertion direction of the shaft through the first insertion opening, and a guide wall which is formed by causing a wall surface of the inner periphery to protrude from a terminal end of the guide groove on the other end face side which the second space faces, and of which a protruding height gradually decreases toward the neighboring guide groove, the fixed member being accommodated in and fixed to the first space with the first insertion opening exposed;

a slide member having an embracing portion which is engaged with the fixing groove to embrace the shaft, and a slide guide portion formed to be continuous with the embracing portion;

a linear movement member having a second insertion opening which is formed on one end face with a diameter in which the first shaft portion is inserted and the second shaft portion is not inserted, and is disposed to be continuous with the first insertion opening when the linear movement member accommodated in the second space, a third space communicating with the second insertion opening, a first guided strip which is formed to protrude on an outer periphery and fitted to the guide groove, the other end face which is formed in a mountain shape with an end face portion in a formation direction of the first guided strip as a top and which the third space faces, and a slide groove formed to communicate with the second insertion opening so as to slidably hold the slide guide portion in a direction orthogonal to the insertion direction of the shaft, the linear movement member being accommodated in the second space so as to be linearly movable in the insertion direction of the shaft while the first guided strip is guided by the guide groove;

a rotating member which has a control piece which rotates, thereby coming into contact with the embracing portion, and thereby causing the slide member with the slide guide portion held in the slide groove to slide in a direction toward an axial center and causing the embracing portion to be engaged with the fixing groove formed in the inserted first shaft portion, a small diameter portion which is formed with the control piece and fitted to the third space, a second guided strip which has an inclined end face which is pushed by the top of a mountain-shaped form formed on the other end face of the linear movement member beyond the protruding height of the guide wall to deviate from the guide groove, thereby coming into contact with an inclined end of the mountain-shaped form formed on the other end face of the linear movement member and a protruding end of the guide wall,

and is fitted to the guide groove in a predetermined length, a large diameter portion with the second guided strip formed to protrude on an outer periphery, and an insertion hole which is disposed to be continuous with the second insertion opening when the small diameter portion is fitted to the third space, and has a diameter to allow insertion of the first shaft portion, and in which the large diameter portion is accommodated in the second space so as to be linearly movable in a predetermined length in the insertion direction of the shaft while the second guided strip is guided in a predetermined length by the guide groove; and

an elastic member which biases the linear movement member and the rotating member toward the side of the fixed member fixed to the housing.

[0008] The mounting and dismounting device in this configuration is configured of the shaft having one end which is mounted on the side of the object on one side, and the housing which is mounted on the side of the object on the other side. The fixed member is fixed to the first space of the inside of the housing, and the linear movement member and the rotating member are accommodated in the second space of the inside of the fixed member with the first and second insertion openings and the insertion hole communicating with each other. The small diameter portion of the rotating member is fitted to the third space of the inside of the linear movement member accommodated in the second space. The rotating member and the linear movement member are urged toward the fixed member side by the elastic member.

[0009] The mounting of the object on one side, on the object on the other side is performed by gripping the object on one side or the object on the other side, inserting the other end of the shaft mounted on the object on one side into the first insertion opening of the fixed member fixed to the housing mounted on the object on the other side, and pressing the object on one side or the object on the other side against the object on the other side or the object on one side. The other end of the shaft inserted into the first insertion opening of the fixed member passes through the first insertion opening. However, the second shaft portion cannot pass through the second insertion opening formed in the linear movement member, so that the second shaft portion pushes the linear movement member by a force of pressing the object on one side or the object on the other side against the object on the other side or the object on one side. With the pressing force, the linear movement member linearly moves toward the other end face side of the housing against the biasing force of the elastic member while the first guided strip formed on the outer periphery is guided by the guide groove provided in the fixed member.

[0010] With the linear movement of the linear movement member, the rotating member linearly moves together with the linear movement member toward the other end face side of the housing against the biasing force

of the elastic member while the inclined end face of the second guided strip is pushed by the top of the mountain-shaped form formed on the other end face of the linear movement member and the second guided strip is guided by the guide groove provided in the fixed member. At this time, the second guided strip is fitted to the guide groove only in a predetermined length, and therefore, if the rotating member linearly moves by being pushed beyond the protruding height of the guide wall provided in the fixed member, the second guided strip deviates from the guide groove. If the second guided strip deviates from the guide groove, the rotating member becomes rotatable around the axial center thereof while being guided by the third space of the linear movement member, to which the small diameter portion is fitted. For this reason, the inclined end face of the second guided strip slides up on the inclined surface of the mountain-shaped other end face of the linear movement member, so that the rotating member rotates with the inclined other end face of the linear movement member as a raceway surface.

[0011] Thereafter, if the force of pressing the object on one side or the object on the other side against the object on the other side or the object on one side becomes equal to or less than the biasing force of the elastic member, the rotating member is pushed back toward the one end face side of the housing by being urged by the elastic member. If the rotating member is pushed back, the inclined end face of the second guided strip comes into contact with the protruding end of the guide wall provided to protrude toward the other end face side of the fixed member.

[0012] The protruding height of the guide wall gradually decreases toward the neighboring guide groove, and therefore, the rotating member is pushed back toward the one end face side of the housing by being urged by the elastic member, whereby the rotating member further rotates while the inclined end face of the second guided strip is guided by the protruding end of the guide wall. With this rotation, the control piece which is formed at the small diameter portion of the rotating member and exists in the third space of the linear movement member also rotates. The slide guide portion of the slide member is slidably held in the slide groove of the linear movement member, and the rotating control piece comes into contact with the embracing portion of the slide member, thereby sliding the slide member along the slide groove in a direction toward the axial center of the linear movement member.

[0013] If the rotating member rotates such that the inclined end face of the second guided strip reaches the neighboring guide groove, the embracing portion of the slide member is engaged with the fixing groove formed in the first shaft portion of the shaft inserted into the first and second insertion openings and the insertion hole. The embracing portion of the slide member is engaged with the fixing groove of the shaft, whereby the shaft does not come out of the housing and a locked state is created where the object on one side is mounted on and fixed to

the object on the other side. If the inclined end face of the second guided strip reaches the neighboring guide groove, the second guided strip is pushed back by being urged by the elastic member and returns to the initial state where it is fitted to the neighboring guide groove in a predetermined length.

[0014] Further, the removal of the object on one side from the object on the other side is performed by pressing the object on one side or the object on the other side against the object on the other side or the object on one side again. With the pressing force, the linear movement member is pushed by the second shaft portion of the shaft and linearly moves again toward the other end face side of the housing against the biasing force of the elastic member while the first guided strip is guided by the guide groove. With the linear movement of the linear movement member, the rotating member also linearly moves again toward the other end face side of the housing together with the linear movement member against the biasing force of the elastic member. If the rotating member linearly moves by being pushed beyond the protruding height of the guide wall provided in the fixed member, the second guided strip deviates from the guide groove again.

[0015] If the second guided strip deviates from the guide groove, the rotating member becomes rotatable around the axial center thereof again while being guided by the third space to which the small diameter portion is fitted. For this reason, the rotating member rotates with the inclined other end face of the linear movement member as a raceway surface. Thereafter, if the force of pressing the object on one side or the object on the other side against the object on the other side or the object on one side becomes equal to or less than the biasing force of the elastic member again, the rotating member is pushed back toward the one end face side of the housing by being urged by the elastic member, and the inclined end face of the second guided strip comes into contact with the protruding end of the guide wall. Therefore, the rotating member rotates again while the inclined end face of the second guided strip is guided by the protruding end of the guide wall.

[0016] With this rotation, the control piece formed at the small diameter portion of the rotating member also rotates, and the control piece moves from a rotational position where the control piece comes into contact with the embracing portion, thereby causing the embracing portion to be engaged with the fixing groove. Therefore, the slide member becomes slidable in a direction away from the axial center, in which the embracing portion is separated from the fixing groove, and an unlocked state is created where it is possible to pull the shaft out from the housing. If the rotating member rotates again, so that the inclined end face of the second guided strip reaches the neighboring guide groove, the second guided strip is pushed back by being urged by the elastic member and returns again to the initial state where it is fitted to the neighboring guide groove in a predetermined length.

[0017] Therefore, according to the mounting and dis-

mounting device having this configuration, the mounting of the object on one side, on the object on the other side and the removal of the object on one side from the object on the other side are performed merely by simply pressing the object on one side or the object on the other side against the object on the other side or the object on one side. For this reason, it is possible to easily remove the toilet seat/toilet lid unit from the toilet bowl without performing a cumbersome and difficult operation in which an unlocking operation of pushing a pressing member is performed simultaneously with both hands with respect to the respective mounting and dismounting devices configuring two hinge devices, as in the mounting and dismounting device of the related art, which is used for a western-style toilet. Therefore, it becomes possible to easily perform cleaning or maintenance of the western-style toilet, or work of replacing the toilet seat/toilet lid unit. Further, the mounting and dismounting device having this configuration is not limited to a mounting and dismounting device which is used for the western-style toilet, and can also be likewise applied to other mounting and dismounting devices, and the same operation and effects are exhibited.

[0018] Further, in the mounting and dismounting device according to the present invention, the guide grooves are provided at four locations at equal intervals around an axial center of the fixed member, the first guided strips and the tops of the mountain-shaped forms formed on the other end face of the linear movement member are provided at four locations at equal intervals around an axial center of the linear movement member, and the second guided strips are provided at four locations at equal intervals around an axial center of the rotating member.

[0019] According to this configuration, the linear movement member is guided with the first guided strips provided at four locations at equal intervals around the axial center thereof fitted to the guide grooves provided at four locations at equal intervals around the axial center of the fixed member, and therefore, the linear movement member stably linearly moves. The rotating member is guided by the four guide grooves due to the inclined end faces of the second guided strips provided at four locations at equal intervals around the axial center thereof being pushed by the tops of the mountain-shaped forms provided at four locations at equal intervals on the other end face of the linear movement member, whereby the rotating member stably linearly moves together with the linear movement member. Further, the rotation of the rotating member is performed by the respective second guided strips deviating from the guide grooves. The deviation of the respective second guided strips from the guide grooves is performed every time the rotating member rotates by one quarter, and thus the locked state and the unlocked state of the shaft alternately appear.

[0020] Further, in the mounting and dismounting device according to the present invention, a pair of the slide grooves is provided at two locations facing each other

with an opening center of the second insertion opening interposed therebetween, the slide member is configured of a pair of slide members formed symmetrically with respect to the opening center of the second insertion opening and symmetrically disposed in the respective slide grooves, and a pair of the control pieces is provided to be separated from each other by a distance to clamp the pair of embracing portions fitted to the fixing groove, at two locations facing each other with an axial center of the rotating member interposed therebetween.

[0021] According to this configuration, the respective slide guide portions of the pair of slide members are slidably held in the pair of slide grooves provided at two locations facing each other with the opening center of the second insertion opening of the linear movement member interposed therebetween. Therefore, the pair of slide members is held so as to be slidable in a direction in which the respective embracing portions are mutually headed toward the axial center of the linear movement member, and an opposite direction in which the respective embracing portions are mutually separated from the axial center of the linear movement member. The rotating member rotates by one quarter turn, so that the control pieces provided at two locations facing each other with the axial center of the rotating member interposing therebetween come into contact with the respective embracing portions of the pair of slide members, whereby the respective embracing portions slide in the direction toward the axial center of the linear movement member. With this sliding, the respective embracing portions are engaged with the fixing groove of the shaft inserted into the first and second insertion openings and the insertion hole in a form of interposing the fixing groove therebetween, and thus a locked state is created where it is not possible to pull the shaft out from the housing. The rotating member further rotates by one quarter turn, so that the control pieces provided at two locations facing each other with the axial center of the rotating member interposed therebetween move from a rotational position where the control pieces come into contact with the respective embracing portions, thereby causing the respective embracing portions to be engaged with the fixing groove, whereby the respective slide members becomes slidable along the respective slide grooves. For this reason, the respective embracing portions can slide in a direction in which the embracing portions are mutually separated from the axial center of the linear movement member, and the engagement between the fixing groove of the shaft and the respective embracing portions is released, and thus an unlocked state is created where it is possible to pull the shaft out from the housing.

[0022] Further, in the mounting and dismounting device according to the present invention, the fixing groove is formed such that a diameter of a part of the first shaft portion is smaller than a diameter of the other part and an axial length has a length to accommodate a height of the embracing portion, and the embracing portion has a circular arc surface along an outer periphery of the fixing

groove on a contact surface with the fixing groove.

[0023] According to this configuration, the fixing groove of the shaft and the embracing portion of the slide member are engaged with each other by the embracing portion having an outer shape conforming to the groove shape of the fixing groove being fitted to the fixing groove. For this reason, the engagement between the fixing groove and the embracing portion is firmly performed, and thus the shaft does not reliably come out of the housing.

[0024] Further, the present invention provides a hinge device including: the mounting and dismounting device according to any one of the above aspects; and a rotary damper which has a damper case which is mounted on the shaft or the housing, and a rotary shaft which is accommodated in the damper case and in which a shaft end protruding from the damper case is connected to the object on one side or the object on the other side, and provides resistance to rotation of the object on one side or the object on the other side to which the shaft end is connected.

[0025] According to this configuration, it is possible to configure a hinge device supporting an object on one side, on an object on the other side so as to be opened and closed freely, by using a mounting and dismounting device capable of easily mounting and dismounting the object on one side on and from the object on the other side without performing a cumbersome and difficult operation.

Advantageous Effects of Invention

[0026] According to the present invention, it is possible to provide a mounting and dismounting device capable of easily mounting and dismounting an object on one side on and from an object on the other side without performing a cumbersome and difficult operation, and a hinge device using the mounting and dismounting device.

Brief Description of Drawings

[0027]

Figs. 1(a) and 1(b) respectively are a front view and a side view showing a state where a toilet seat/toilet lid unit which is an object on one side is mounted on a toilet bowl which is an object on the other side by using a pair of hinge devices according to an embodiment of the present invention.

Fig. 2 is an exploded perspective view of the hinge device according to the embodiment.

Figs. 3(a), 3(b), and 3(c) respectively are a plan view, a side view, and a longitudinal sectional view of a housing configuring a mounting and dismounting device according to the embodiment.

Fig. 4 is a partially enlarged exploded perspective view when a stationary core and a spring are accommodated in a housing in the exploded perspective

view shown in Fig. 2.

Fig. 5 is a partially cut-away side view showing, in a cut-away manner, the mounting and dismounting device in an unlocked state where the toilet seat/toilet lid unit is mounted on the toilet bowl using the mounting and dismounting device according to the embodiment.

Figs. 6(a) and 6(b) respectively are a perspective view and a side view of a shaft configuring the mounting and dismounting device according to the embodiment.

Figs. 7(a), 7(b), 7(c), and 7(d) respectively are a perspective view, a side view, a bottom view, and a longitudinal sectional view of the stationary core configuring the mounting and dismounting device according to the embodiment.

Fig. 8(a) is a perspective view of a linear core and a slider configuring the mounting and dismounting device according to the embodiment, Figs. 8(b), 8(c), 8(d), and 8(e) respectively are a plan view, a side view, a bottom view, and a longitudinal sectional view of the linear core, and Figs. 8(f) and 8(g) respectively are a plan view and a side view of the slider.

Figs. 9(a), 9(b), 9(c), and 9(d) respectively are a perspective view, a plan view, a side view, and a longitudinal sectional view of a rotary core configuring the mounting and dismounting device according to the embodiment.

Fig. 10(a) is a plan view showing a state where embracing portions of slide members configuring the mounting and dismounting device according to the embodiment are clamped by control pieces of the rotary core and lock points of each of the embracing portions and each of the control pieces are matched with each other, Fig. 10(b) is a plan view showing a state where the control pieces are rotated, so that the lock points with the embracing portions are shifted by 90°, Fig. 10(c) is a perspective view when the mounting and dismounting device in which the embracing portions and the control pieces are in the state shown in Fig. 10(a) is viewed from obliquely above with the shaft removed, and Fig. 10(d) is a perspective view when the mounting and dismounting device in which the control pieces are rotated to the positions shown in Fig. 10(b), so that the embracing portions are separated from each other, is viewed from obliquely above with the shaft removed. Figs. 11(a) and 11(b) are perspective views showing a relative relationship between the embracing portions and a fixing groove when the mounting and dismounting device according to the embodiment is in a locked state, in which Fig. 11(a) is a perspective view when the locked state is viewed from obliquely above, and Fig. 11(b) is a perspective view as viewed from the bottom side.

Figs. 12(a) and 12(b) are perspective views showing a relative relationship between the embracing portions and the fixing groove when the mounting and

dismounting device according to the embodiment is in the unlocked state, in which Fig. 12(a) is a perspective view when the unlocked state is viewed from obliquely above, and Fig. 12(b) is a perspective view as viewed from the bottom side.

Fig. 13 is a partially cutaway side view showing, in a cut-away manner, the mounting and dismounting device according to the embodiment in a pushed state where a B-linear guide deviates from a guide groove by being pushed by the shaft.

Fig. 14 is a partial cutaway side view showing, in a cut-away manner, the mounting and dismounting device according to the embodiment in the locked state.

Description of Embodiments

[0028] Next, a mode for carrying out the present invention in which a mounting and dismounting device according to the present invention and a hinge device using the mounting and dismounting device are applied to a western-style toilet will be described.

[0029] Figs. 1(a) and 1(b) respectively are a front view and a side view showing a state where a toilet seat/toilet lid unit 2 which is an object on one side is mounted on a toilet bowl 3 which is an object on the other side by using a pair of hinge devices 1a and 1b according to an embodiment of the present invention.

[0030] The hinge device 1a is configured of a mounting and dismounting device 4 and a rotary damper 5a, the hinge device 1b is configured of a mounting and dismounting device 4 and a rotary damper 5b, and the hinge devices 1a and 1b support the toilet seat/toilet lid unit 2 so as to be opened and closed freely with respect to the toilet bowl 3. Each of the rotary dampers 5a and 5b is configured by accommodating each of rotary shafts 9a and 9b and a viscous fluid in a damper case 8 and provides resistance to the rotation of each of the rotary shafts 9a and 9b by the viscous fluid. In this embodiment, the rotary dampers 5a and 5b each having a finite angle in which the rotation angle of each of the rotary shafts 9a and 9b is limited are used. In the rotary shaft 9a, a shaft end thereof protruding from the damper case 8 is connected to a toilet lid 6 configuring the toilet seat/toilet lid unit 2, so that the rotary shaft 9a provides resistance to the rotation of the toilet lid 6 at the time of opening and closing thereof. Further, in the rotary shaft 9b, a shaft end thereof protruding from the damper case 8 is connected to a toilet seat 7 configuring the toilet seat/toilet lid unit 2, so that the rotary shaft 9b provides resistance to the rotation of the toilet seat 7 at the time of opening and closing thereof.

[0031] The mounting and dismounting device 4 detachably mounts the toilet seat/toilet lid unit 2 with the rotary dampers 5a and 5b mounted thereon on the toilet bowl 3. The mounting of the toilet seat/toilet lid unit 2 on the toilet bowl 3 is performed by performing the engagement between the toilet seat/toilet lid unit 2 and the toilet bowl 3 by using the mounting and dismounting device 4,

and the separation, that is, removal of the toilet seat/toilet lid unit 2 from the toilet bowl 3 is performed by releasing the engagement between the toilet seat/toilet lid unit 2 and the toilet bowl 3 by using the mounting and dismounting device 4.

[0032] Fig. 2 is an exploded perspective view of the hinge device 1a. The hinge device 1b has the same configuration as the hinge device 1a except that the rotary damper 5b serves as the rotary damper 5a.

[0033] As described above, the hinge device 1a is configured of the mounting and dismounting device 4 and the rotary damper 5a. The mounting and dismounting device 4 is configured of a shaft 11, a stationary core 12, a linear core 13, a slider 14, a rotary core 15, a housing 16, and a spring 17.

[0034] The mounting of the one end side of the shaft 11 on the damper case 8 is performed by passing a mounting screw 18 through a through-hole 8a formed in the damper case 8 and screwing the mounting screw 18 to a female screw hole 11a formed on the one end side of the shaft 11. The mounting of the housing 16 on the toilet bowl 3 is performed by inserting the smaller-diameter lower end side of the housing 16 into a mounting hole 3a of the toilet bowl 3 with washers 19 and 20 interposed therebetween and screwing the housing 16 and a mounting jig 21 to each other with the toilet bowl 3 interposed therebetween. The screwing is performed using a nut 22 and a washer-equipped mounting bolt 23, as will be described later.

[0035] Figs. 3(a), 3(b), and 3(c) respectively are a plan view, a side view, and a longitudinal sectional view of the housing 16. The housing 16 has a hollow cylindrical shape and is formed by making a first space 16a face on one end face on the open upper end side and making a screw hole 16b and a washer accommodation groove 16c face on the other end face of the closed lower end side. The first space 16a is formed by a first inner diameter portion 16a1 having the largest diameter, a second inner diameter portion 16a2 having a secondly large diameter, and a third inner diameter portion 16a3 having the smallest diameter. The spring 17 is accommodated in the third inner diameter portion 16a3, and the linear core 13 accommodating the rotary core 15 and the slider 14, and the stationary core 12 are stacked in this order on the spring 17, so that these members are stored in the first space 16a. A male screw is formed on the outer periphery of the stationary core 12, and the male screw is screwed to a female screw formed on the inner periphery of the first inner diameter part 16a1, whereby the stationary core 12 is fixed to the first inner diameter portion 16a1, as shown in a partially enlarged exploded perspective view of Fig. 4. In Fig. 4, the same portions as those in Fig. 2 are denoted by the same reference numerals, and description thereof is omitted.

[0036] The stationary core 12 is fixed to the housing 16 in this manner, whereby the linear core 13 and the rotary core 15 are accommodated in the housing 16 while being urged upward from below by the spring 17. At this

time, the linear core 13 is accommodated in the housing 16 so as to be linearly movable along an axial center direction of the housing 16, as will be described later, and configures a linear movement member. The rotary core 15 is accommodated in the housing 16 so as to be rotatable around an axial center of the housing 16, as will be described later, and configures a rotating member. Further, the stationary core 12 which is fixed to the housing 16 configures a fixed member. The fixing of the stationary core 12 to the housing 16 is not limited to the above-described screwing and may be performed by press fit, fitting, or the like to the housing 16. Further, at the time of the fixing, the fixing may also be assisted by applying an adhesive to a fixing location, welding the fixing location, or the like.

[0037] Fig. 5 is a partially cutaway side view showing, in a cutaway manner, the mounting and dismounting device 4 in a state where the toilet seat/toilet lid unit 2 is mounted on the toilet bowl 3. The mounting and dismounting device 4 in this state is in an unlocked state where the engagement between the toilet seat/toilet lid unit 2 and the toilet bowl 3 can be released. In Fig. 5, the same portions as those in Figs. 2 and 3 are denoted by the same reference numerals, and description thereof is omitted.

[0038] The screwing between the housing 16 and the mounting jig 21 is performed by fitting an upper end portion of the mounting jig 21 to the lower end outer periphery of the housing 16 projecting from the mounting hole 3a (refer to Fig. 2) and screwing a head portion of the washer-equipped mounting bolt 23 to the screw hole 16b (refer to Fig. 3) at the lower end of the housing 16. The lower end of the washer-equipped mounting bolt 23 is screwed in advance to the nut 22 fitted to the lower end of the mounting jig 21.

[0039] Figs. 6(a) and 6(b) respectively are a perspective view and a side view of the shaft 11. The shaft 11 has a first shaft portion 11a in which a fixing groove 11a1 is formed, and a second shaft portion 11b having a larger diameter than the first shaft portion 11a. And a third shaft portion 11c having a larger diameter than the second shaft portion 11b, and a fourth shaft portion 11d having the same diameter as the second shaft portion 11b are provided on the second shaft portion 11b side. The fourth shaft portion 11d at one end on the second shaft portion 11b side is fixed to the damper case 8 with the mounting screw 18, as described above, whereby the shaft 11 is mounted on the toilet seat/toilet lid unit 2 side. The diameter of the third shaft portion 11c is arbitrary. However, in this embodiment, the diameter of the third shaft portion 11c is set to be larger than the diameters of the second and fourth shaft portions 11b and 11d. Further, an end face which is formed at a step protruding from the first shaft portion 11a, of the second shaft portion 11b, serves as a pressing surface 11b1 which comes into contact with one end face of the linear core 13 and presses the linear core 13.

[0040] Figs. 7(a), 7(b), 7(c), and 7(d) respectively are

a perspective view, a side view, a bottom view, and a longitudinal sectional view of the stationary core 12.

[0041] The stationary core 12 has a hollow cylindrical shape, and on one end face at the upper end thereof, a first insertion opening 12a serving as an entrance and exit for the shaft 11 is formed to have a diameter to allow insertion of the first shaft portion 11a and the second shaft portion 11b of the shaft 11. The stationary core 12 is accommodated in the first space 16a of the housing 16 with the first insertion opening 12a exposed, and is fixed thereto, as described above.

[0042] A second space 12b is formed in the hollow interior of the stationary core 12 to communicate with the first insertion opening 12a. Further, on the inner periphery surrounding the second space 12b, a plurality of guide grooves 12c are formed along the insertion direction of the shaft 11 through the first insertion opening 12a, that is, along an axial center direction of the stationary core 12. In this embodiment, four guide grooves 12c are respectively provided at four locations at equal intervals around the axial center of the shaft 11 and in the same length. Further, the stationary core 12 has, on the other end face side where the second space 12b faces, a guide wall 12d formed by making the wall surface of the inner periphery protrude from a terminal end of the guide groove 12c. The protruding height of the guide wall 12d from the other end face of the stationary core 12 is the maximum at the terminal end portion of one guide groove 12c, gradually decreases toward the neighboring guide groove 12c, and becomes minimum at a location reaching the neighboring guide groove 12c. The guide wall 12d configures a guide cam, and the protruding end face of the guide wall 12d comes into contact with an inclined end face 15e of a B-linear guide 15d (described later) of the rotary core 15, thereby serving as a raceway surface for guiding the rotation of the rotary core 15.

[0043] Fig. 8(a) is a perspective view of the linear core 13 and the slider 14, Figs. 8(b), 8(c), 8(d), and 8(e) respectively are a plan view, a side view, a bottom view, and a longitudinal sectional view of the linear core 13, and Figs. 8(f) and 8(g) respectively are a plan view and a side view of the slider 14.

[0044] The slider 14 configures a slide member having an embracing portion 14a and a slide guide portion 14b. The embracing portion 14a has a semicircular arc shape when viewed in a planar view and is engaged with the fixing groove 11a1 of the shaft 11 to embrace the shaft 11. The slide guide portion 14b has a T-shape when viewed in a side view and is formed integrally with the embracing portion 14a to be continuous with the embracing portion 14a and protrude from an upper end face of the embracing portion 14a. The fixing groove 11a1 (refer to Fig. 6) is formed by making the diameter of a part of the first shaft portion 11a smaller than the diameter of the other part of the first shaft portion 11a, and the depth of the groove is set to be a depth which accommodates the thickness of the embracing portion 14a of the slider 14. Further, the axial length of the fixing groove 11a1 is

formed to have a length which accommodates the height of the embracing portion 14a.

[0045] The embracing portion 14a has a circular arc surface along the outer periphery of the fixing groove 11a1 on the inner periphery which is a contact surface with the fixing groove 11a1, and the radius of the inner periphery has the same size as the radius of the shaft 11 at the portion of the fixing groove 11a1. Therefore, the embracing portion 14a of the slider 14 is engaged with the fixing groove 11a1 in close contact therewith and embraces the shaft 11. The embracing portion 14a of the slider 14 is engaged with the fixing groove 11a1 in close contact therewith, whereby fixing surfaces 14c and 14c which are formed on the upper and lower end faces of the embracing portion 14a come into contact with fixing surfaces 11a2 and 11a2 of the shaft 11, which stand up at both ends of the fixing groove 11a1, and thus the movement in the axial center direction of the shaft 11 is restricted.

[0046] The linear core 13 also has a hollow cylindrical shape, and a second insertion opening 13a which serves as an entrance and exit for the shaft 11 is formed on one end face of the closed upper end. The second insertion opening 13a is set to have a diameter slightly larger than the diameter of the first shaft portion 11a, into which the first shaft portion 11a of the shaft 11 is inserted and the second shaft portion 11b is not inserted, and is disposed to be continuous with the first insertion opening 12a when the linear core 13 is accommodated in the second space 12b of the stationary core 12. The second insertion opening 13a is formed in a shape and strength capable of supporting the shaft 11 in a case where a load in a radial direction is applied to the inserted shaft 11. A third space 13b is formed in the hollow interior of the linear core 13 to communicate with the second insertion opening 13a. The embracing portion 14a of the slider 14 is accommodated in the third space 13b.

[0047] Further, a slide groove 13c is formed at the second insertion opening 13a of the linear core 13 to communicate with the second insertion opening 13a. The slide groove 13c accommodates the slide guide portion 14b of the slider 14 and is fitted to the slide guide portion 14b. Further, the slide groove 13c holds the slide guide portion 14b so as to be slidable in a direction orthogonal to the insertion direction of the shaft 11, that is, in the radial direction of the linear core 13 from the axial center of the linear core 13. In this embodiment, a pair of slide grooves 13c is provided at two locations facing each other with the opening center of the second insertion opening 13a interposed therebetween. The slider 14 is configured of a pair of members having a shape in which a cylindrical member is divided into two parts in a diametrical direction with respect to the central axis thereof, formed symmetrically in a mirror image with respect to the opening center of the second insertion opening 13a, and disposed symmetrically in the respective slide grooves 13c. Therefore, the embracing portions 14a of the sliders 14 embrace the fixing groove 11a1 from both sides with the axial center

of the shaft 11 interposed therebetween. At this time, the slide guide portion 14b of the slider 14 comes into close contact with the outer periphery of the first shaft portion 11a on the upper side of the fixing groove 11a1.

[0048] Further, an A-linear guide 13d configuring a first guided strip is formed on the outer periphery of the linear core 13 to protrude therefrom. The A-linear guide 13d has a protruding shape which is fitted to the groove shape of the guide groove 12c formed on the inner periphery of the stationary core 12. That is, the protruding width dimension of the A-linear guide 13d is narrower than the groove width dimension of the guide groove 12c, and the protruding height dimension of the A-linear guide 13d is set to be slightly lower than the groove depth dimension of the guide groove 12c. Further, the protruding length dimension of the A-linear guide 13d is set to be shorter than the groove length dimension of the guide groove 12c. In this embodiment, four A-linear guides 13d are respectively provided at four locations at equal intervals around the axial center of the linear core 13 and in the same shape and parallel to the axial center of the linear core 13. With this configuration, the linear core 13 is accommodated in the second space 12b of the stationary core 12, whereby the A-linear guides 13d are respectively guided by the guide grooves 12c to be linearly movable in the insertion direction of the shaft 11 along the guide grooves 12c.

[0049] Further, the third space 13b faces on the other end face 13e of the linear core 13, which is open. The other end face 13e is formed to have a mountain shape having, as the top thereof, an end face portion in a formation direction of each of the A-linear guides 13d, that is, an extension line direction of each of the A-linear guides 13d. The A-linear guides 13d are provided at four locations, and therefore, the tops of mountain-shaped forms are formed at four locations on the other end face 13e. The other end face 13e configures a mountain-shaped cam and comes into contact with the inclined end face 15e of the B-linear guide 15d (described later) of the rotary core 15, thereby serving as a raceway surface for guiding the rotation of the rotary core 15.

[0050] Figs. 9(a), 9(b), 9(c), and 9(d) respectively are a perspective view, a plan view, a side view, and a longitudinal sectional view of the rotary core 15.

[0051] The rotary core 15 has a cylindrical shape having a small diameter portion 15a with a small outer diameter and a large diameter portion 15b with a large outer diameter, and an insertion hole 15c penetrates and is open along the axial center thereof. The insertion hole 15c is disposed to be continuous with the second insertion opening 13a of the linear core 13 when the small diameter portion 15a is fitted to the third space 13b of the linear core 13. The diameter of the insertion hole 15c is set to the same diameter as that of the second insertion opening 13a and has a dimension to allow insertion of the first shaft portion 11a of the shaft 11.

[0052] The B-linear guide 15d configuring a second guided strip is formed on the outer periphery of the large

diameter portion 15b to protrude therefrom. In this embodiment, four B-linear guides 15d are respectively provided at four locations at equal intervals around the axial center of the rotary core 15 and in the same shape and parallel to the axial center of the rotary core 15. The B-linear guide 15d has a shape which is fitted in a predetermined length to the guide groove 12c of the stationary core 12, and the protruding width and protruding height dimensions of the B-linear guide 15d are made to be the same as those of the A-linear guide 13d of the linear core 13. The upper end face of the B-linear guide 15d is made to be the inclined end face 15e. The inclined end face 15e is inclined at the same angle as the inclination angle of the mountain-shaped form which is formed on the other end face 13e of the linear core 13 and the inclination angle of the guide wall 12d which is formed in the stationary core 12, and functions as a slide cam.

[0053] The bottom surface of the large diameter portion 15b is set as a biasing surface which is urged by the spring 17. The spring 17 configures an elastic member which biases the linear core 13 and the rotary core 15 toward the one end face side of the stationary core 12. The spring 17 exerts a resilient force along the central axes of the rotary core 15, the linear core 13, the stationary core 12, and the shaft 11. In this embodiment, a compression coil spring is used as the spring 17. However, there is no limitation thereto.

[0054] In a state where the small diameter portion 15a of the rotary core 15 is fitted to the third space 13b of the linear core 13 and the linear core 13 and the rotary core 15 are accommodated in the stationary core 12, the A-linear guide 13d is accommodated in the guide groove 12c, and the B-linear guide 15d is partially accommodated in the guide groove 12c. In this state, the distance between the A-linear guide 13d and the B-linear guide 15d is the shortest and the B-linear guide 15d is fitted in a predetermined length to the guide groove 12c. At this time, in the rotary core 15, the large diameter portion 15b is accommodated in the second space 12b of the stationary core 12 such that the B-linear guide 15d is guided in a predetermined length by the guide groove 12c and is linearly movable in a predetermined length in the insertion direction of the shaft 11.

[0055] The B-linear guide 15d is set to have a protruding length dimension to make it deviate from the guide groove 12c if the inclined end face 15e is pushed by the top of the mountain-shaped form which is formed on the other end face 13e of the linear core 13 beyond the protruding height of the guide wall 12d, so that the inclined end face 15e is separated from the linear core 13 beyond the protruding height of the guide wall 12d. When the B-linear guide 15d deviates from the guide groove 12c, the rotary core 15 becomes rotatable relative to the linear core 13 while the small diameter portion 15a is rotatably fitted to the third space 13b of the linear core 13.

[0056] Further, on the upper end face of the small diameter portion 15a, a control piece 15f is formed in a projection shape to extend from the upper end face. The

outer periphery of the control piece 15f is formed as a circular arc surface flush with the outer periphery of the small diameter portion 15a, and the end face of the control piece 15f on the side facing the axial center of the rotary core 15 is formed as a plane. The control piece 15f rotates, thereby coming into contact with the outer periphery of the embracing portion 14a of the slider 14, whereby the slider 14 with the slide guide portion 14b held in the slide groove 13c is slid in a direction toward the axial center of the linear core 13. Then, the embracing portion 14a is engaged with the fixing groove 11a1 formed in the first shaft portion 11a inserted into the first and second insertion openings 12a and 13a and the insertion hole 15c.

[0057] The shaft 11 shown in Fig. 6 is set to have a length dimension in which, when the other end of the shaft 11 is inserted into the housing 16, the long first shaft portion 11a further on the lower side than the fixing groove 11a1 is located in the insertion hole 15c, the fixing groove 11a1 is located in the third space 13b of the linear core 13, and the short first shaft portion 11a further on the upper side than the fixing groove 11a1 is located in the second insertion opening 13a of the linear core 13.

[0058] In this embodiment, a pair of control pieces 15f is provided at two locations facing each other by 180° with the axial center of the rotary core 15 interposed therebetween. The planes facing each other, of the control pieces 15f, are separated from each other by a distance W to clamp the pair of embracing portions 14a fitted to the fixing grooves 11a1, and the space between the planes serves as a lock restricting space. If the rotary core 15 rotates together with the control pieces 15f such that the respective embracing portions 14a are located in the lock restricting space, as shown in the plan view of Fig. 10 (a), and the planes of the control pieces 15f come into contact with the circular arc-shaped outer peripheral surfaces of the embracing portions 14a, the embracing portions 14a are in a close contact state of being fitted to the fixing groove 11a1. In this state, the fixing surfaces 14c of the embracing portion 14a come into contact with the fixing surfaces 11a2 of the shaft 11, so that the movement in the axial direction of the shaft 11 is restricted. The contact location between the circular arc-shaped outer peripheral surface of the embracing portion 14a and the planes of the control piece 15f is regarded as a lock point (a point L) and shown as a point L in Figs. 8(a) and 9(a).

[0059] The lock point of the embracing portion 14a is at the center position of the arc of the outer periphery and the lock point of the control piece 15f is at the center position in the width direction on the plane. If the rotary core 15 rotates together with the control pieces 15f from this state where the lock points are matched with each other, so that the lock points of the control pieces 15f rotate by 90° to the positions shown in the plan view of Fig. 10(b), the movement of the embracing portions 14a which have been confined in the restricting space is released. For this reason, the embracing portions 14a can

move in directions away from each other indicated by arrows in the drawing. Therefore, the embracing portions 14a are separated from the fixing groove 11a1, whereby the movement in the axial direction of the shaft 11 is allowed.

[0060] Figs. 10(c) and 10(d) are perspective views when the mounting and dismounting device 4 is viewed from obliquely above with the shaft 11 removed, in which Fig. 10(c) shows a state where the control pieces 15f are at the rotational positions shown in Fig. 10(a), and Fig. 10(d) shows a state in which the control pieces 15f are rotated by 90° to be at the rotational positions shown in Fig. 10(b) and the embracing portions 14a are separated from each other.

[0061] In the state shown in Fig. 10(c), a distance V_a between the inner peripheries facing each other, of the embracing portions 14a, is smaller than a diameter ϕ of the second insertion opening 13a of the linear core 13 ($V_a < \phi$). For this reason, a state is created where the inner peripheries of the respective embracing portions 14a enter inside the inner periphery of the second insertion opening 13a, so that the respective embracing portions 14a have contracted. In this state, the respective embracing portions 14a are engaged with the fixing grooves 11a1 in close contact therewith. Figs. 11(a) and 11(b) are perspective views showing the relative relationship between the embracing portions 14a and the fixing groove 11a1 in the locked state, in which Fig. 11(a) is a perspective view when the locked state is viewed from obliquely above and Fig. 11(b) is a perspective view as viewed from the bottom side. In Figs. 11(a) and 11(b), the same portions as those in Figs. 6 and 10 are denoted by the same reference numerals, and description thereof is omitted.

[0062] On the other hand, in the state shown in Fig. 10(d), a distance V_b between the inner peripheries facing each other, of the embracing portions 14a, is larger than the diameter ϕ of the second insertion opening 13a of the linear core 13 ($V_b > \phi$). For this reason, a state is created where the inner peripheries of the respective embracing portions 14a protrude to the outside of the inner periphery of the second insertion opening 13a, so that the respective embracing portions 14a have expanded. In this state, the respective embracing portions 14a are separated from the fixing groove 11a1, so that the engagement between the embracing portions 14a and the fixing groove 11a1 is released. Fig. 12(a) and 12(b) are perspective views showing the relative relationship between the embracing portions 14a and the fixing groove 11a1 in the unlocked state, in which Fig. 12(a) is a perspective view when the unlocked state is viewed from obliquely above and Fig. 12(b) is a perspective view as viewed from the bottom side. In Figs. 12(a) and 12(b), the same portions as those in Figs. 6 and 10 are denoted by the same reference numerals, and description thereof is omitted.

[0063] The mounting and dismounting device 4 according to this embodiment is configured of the shaft 11 having one end which is mounted on the toilet seat/toilet

lid unit 2 side, and the housing 16 which is mounted on the toilet bowl 3 side, as described above. The stationary core 12 is fixed to the first space 16a of the inside of the housing 16, and the linear core 13 and the rotary core 15 are accommodated in series in the second space 12b of the inside of the stationary core 12 with the first and second insertion openings 12a and 13a communicating with the insertion hole 15c. The small diameter portion 15a of the rotary core 15 is fitted to the third space 13b of the inside of the linear core 13 accommodated in the second space 12b. The rotary core 15 and the linear core 13 are urged toward the one end face side of the stationary core 12 by the spring 17.

[0064] In a locking operation in which the toilet seat/toilet lid unit 2 is mounted on and fixed to the toilet bowl 3, the following first operation is performed, whereby a second operation and a third operation are performed consecutively.

(First Operation)

[0065] The mounting of the toilet seat/toilet lid unit 2 on the toilet bowl 3 is performed by gripping the toilet seat/toilet lid unit 2, inserting the other end of the shaft 11 mounted on the toilet seat/toilet lid unit 2 into the first insertion opening 12a of the stationary core 12 fixed to the housing 16 mounted on the toilet bowl 3, and pressing the toilet seat/toilet lid unit 2 against the toilet bowl 3. The other end of the shaft 11 inserted into the first insertion opening 12a of the stationary core 12 passes through the first insertion opening 12a. However, the second shaft portion 11b cannot pass through the second insertion opening 13a formed in the linear core 13 and the pressing surface 11b1 of the second shaft portion 11b comes into contact with one end face of the linear core 13 around the second insertion opening 13a. Here, if the toilet seat/toilet lid unit 2 is pushed vertically downward with a certain force exceeding the resilient force of the spring 17 and pressed against the toilet bowl 3, the second shaft portion 11b pushes the linear core 13.

(Second Operation)

[0066] The operation of the linear core 13 in a rectilinear movement direction parallel to the insertion direction of the shaft 11 is restricted by the A-linear guide 13d and the guide groove 12c. Therefore, with the force of pushing the toilet seat/toilet lid unit 2 to the toilet bowl 3, the linear core 13 linearly moves toward the other end face side of the housing 16 against the resilient force of the spring 17 while the A-linear guide 13d is guided by the guide groove 12c. The rotary core 15 is operably disposed in contact with the other end face 13e of the linear core 13.

[0067] A partial range in a predetermined length of the B-linear guide 15d of the rotary core 15 is accommodated in the guide groove 12c, and in this partial range, the operation in the rectilinear movement direction parallel to the insertion direction of the shaft 11 is restricted.

Therefore, the inclined end face 15e of the rotary core 15 is pushed by the top of the mountain-shaped form formed on the other end face 13e of the linear core 13 by the above-described linear movement of the linear core 13, so that the rotary core 15 linearly moves together with the linear core 13 to the other end face side of the housing 16 against the resilient force of the spring 17. At this time, the B-linear guide 15d is fitted to the guide groove 12c only in a partial range of a predetermined length, and therefore, if the rotary core 15 linearly moves by being pushed beyond the protruding height of the guide wall 12d, the B-linear guide 15d deviates from the guide groove 12c.

[0068] Fig. 13 is a partially cutaway side view showing, in a cut-away manner, the mounting and dismounting device 4 in the pushed state where the B-linear guide 15d has deviated from the guide groove 12c by being pushed by the shaft 11. In Fig. 13, the same portions as those in Fig. 5 are denoted by the same reference numerals, and description thereof is omitted. In this pushed state, as shown in the drawing, the linear core 13 and the rotary core 15 are driven under the first internal space 12b of the stationary core 12 and the inclined end face 15e of the B-linear guide 15d is located at a position lower than the protruding height of the guide wall 12d indicated by the broken line.

[0069] If the B-linear guide 15d deviates from the guide groove 12c, the rotary core 15 becomes rotatable around the axial center thereof while being guided by the third space 13b of the linear core 13, to which the small diameter portion 15a is fitted. For this reason, the inclined end face 15e of the rotary core 15 slides up on the inclined surface of the mountain-shaped other end face 13e of the linear core 13, so that the rotary core 15 rotates with the inclined other end face 13e of the linear core 13 as a raceway surface.

[0070] Thereafter, if the force of pressing the toilet seat/toilet lid unit 2 against the toilet bowl 3 becomes equal to or less than the resilient force of the spring 17, the rotary core 15 is urged by the spring 17, thereby being pushed back toward the one end face side of the housing 16. If the rotary core 15 is pushed back, the inclined end face 15e comes into contact with the protruding end of the guide wall 12d. Since the protruding height of the guide wall 12d gradually decreases toward the neighboring guide groove 12c, the rotary core 15 is pushed back toward the one end face side of the housing 16 by being urged by the spring 17, whereby the rotary core 15 further rotates while the inclined end face 15e is guided by the protruding end of the guide wall 12d. In this embodiment, since the guide grooves 12c are provided at four locations at equal intervals around the axial center of the stationary core 12, the rotary core 15 rotates by 90°.

(Third Operation)

[0071] With this rotation, the control pieces 15f which exist in the third space 13b of the linear core 13 also

rotate. The slide guide portions 14b of the sliders 14 are slidably held in the slide grooves 13c of the linear core 13, and the rotating control pieces 15f come into contact with the embracing portions 14a of the sliders 14, thereby sliding the sliders 14 along the slide grooves 13c in a direction toward the axial center of the linear core 13. If the rotary core 15 rotates such that the inclined end face 15e reaches the neighboring guide groove 12c, and the rotary core 15 rotates by 90°, the control pieces 15f also rotate by 90°, so that the lock points of the control pieces 15f and the embracing portions 14a are matched with each other, as shown in Fig. 10(a).

[0072] For this reason, the embracing portions 14a of the sliders 14 are engaged with the fixing groove 11a1 formed in the first shaft portion 11a of the shaft 11, in a form of interposing the fixing groove 11a1 therebetween, as shown in Fig. 11. The embracing portions 14a are engaged with the fixing groove 11a1, whereby the shaft 11 cannot come out of the housing 16, and thus the locked state is created where the toilet seat/toilet lid unit 2 is mounted on and fixed to the toilet bowl 3. If the rotary core 15 rotates by 90°, so that the inclined end face 15e reaches the neighboring guide groove 12c, the B-linear guide 15d is pushed back by being urged by the spring 17 and returns to the initial state where the B-linear guide 15d is fitted to the neighboring guide groove 12c in a predetermined length.

[0073] Fig. 14 is a partially cutaway side view showing, in a cutaway manner, the mounting and dismounting device 4 in this locked state. In Fig. 14, the same portions as those in Fig. 13 are denoted by the same reference numerals, and description thereof is omitted. In the locked state, as shown in the drawing, the control pieces 15f clamp the outer peripheries of the embracing portions 14a and the inner peripheries of the embracing portions 14a interpose the fixing groove 11a1 therebetween.

[0074] Further, an operation of removing the toilet seat/toilet lid unit 2 from the toilet bowl 3 is performed by releasing the locked state by the next fourth operation and continuing a fifth operation and a sixth operation.

(Fourth Operation)

[0075] The toilet seat/toilet lid unit 2 mounted on the toilet bowl 3 is gripped and pressed vertically downward against the toilet bowl 3 again.

(Fifth Operation)

[0076] The fifth operation is the same as the second operation at the time of the locking operation. That is, the linear core 13 is pushed by the second shaft portion 11b of the shaft 11 with the force of pressing the toilet seat/toilet lid unit 2 against the toilet bowl 3, thereby linearly moving toward the other end face side of the housing 16 again. The rotary core 15 also linearly moves toward the other end face side of the housing 16 again together with the linear core 13 with the linear movement of the linear

core 13. If the rotary core 15 linearly moves by being pushed beyond the protruding height of the guide wall 12d, the B-linear guide 15d deviates from the guide groove 12c again.

[0077] If the B-linear guide 15d deviates from the guide groove 12c, the rotary core 15 becomes rotatable around the axial center thereof again. For this reason, the rotary core 15 rotates with the inclined other end face 13e of the linear core 13 as a raceway surface. Thereafter, if the force of pressing the toilet seat/toilet lid unit 2 against the toilet bowl 3 becomes equal to or less than the resilient force of the spring 17 again, the rotary core 15 is pushed back toward the one end face side of the housing 16 by being urged by the spring 17, and the rotary core 15 rotates again by 90° while the inclined end face 15e is guided by the protruding end of the guide wall 12d.

(Sixth Operation)

[0078] With this rotation, the control piece 15f also rotates, and the control piece 15f moves from a rotational position where the embracing portion 14a is engaged with the fixing groove 11a1. If the control piece 15f rotates by 90°, so that the lock point of the control piece 15f is separated by 90° from the lock point of the embracing portion 14a, as shown in Fig. 10(b), the slider 14 becomes slidable in a direction in which the embracing portion 14a is separated from the fixing groove 11a1. As a result, the shaft 11 is pulled out from the housing 16, whereby the embracing portions 14a move away from each other by being pushed by the shaft 11, and thus the unlocked state shown in Fig. 12 is created where it is possible to pull the shaft 11 out from the housing 16. If the rotary core 15 rotates by 90°, so that the inclined end face 15e reaches the neighboring guide groove 12c, the B-linear guide 15d is pushed back by being urged by the spring 17, thereby returning again to the initial state where the B-linear guide 15d is fitted to the neighboring guide groove 12c in a predetermined length.

[0079] Fig. 5 described above shows the mounting and dismounting device 4 in this unlocked state. In this drawing, the control piece 15f is not seen by being shaded by the shaft 11. However, in the unlocked state, the control piece 15f does not exist in a sliding direction of the embracing portion 14a, so that the slider 14 becomes slidable along the slide groove 13c.

[0080] The B-linear guides 15d provided at four locations at equal intervals around the axial center of the rotary core 15 deviate from the guide grooves 12c provided at four locations at equal intervals around the axial center of the stationary core 12, whereby the rotation of the rotary core 15 described above is performed. Therefore, the deviation of the B-linear guide 15d from the guide groove 12c is performed every time the rotary core 15 rotates by one quarter, and thus the locked state and the unlocked state of the shaft 11 alternately appear.

[0081] In this manner, according to the mounting and dismounting device 4 of this embodiment, the operation

of mounting the toilet seat/toilet lid unit 2 on the toilet bowl 3 and the operation of removing the toilet seat/toilet lid unit 2 from the toilet bowl 3 are performed merely by simply pressing the toilet seat/toilet lid unit 2 against the toilet bowl 3. For this reason, it becomes possible to easily remove the toilet seat/toilet lid unit 2 from the toilet bowl 3 without performing a cumbersome and difficult operation in which an unlocking operation of pushing a pressing member is performed simultaneously with both hands with respect to the respective mounting and dismounting devices configuring two hinge devices, as in the mounting and dismounting device of the related art disclosed in PTL 1, which is used for a western-style toilet. Therefore, it becomes possible to easily perform cleaning or maintenance of the western-style toilet, or work of replacing the toilet seat/toilet lid unit 2.

[0082] Further, according to the mounting and dismounting device 4 of this embodiment, insertion and extraction of the shaft 11 into and from the housing 16 are performed by sliding the sliders 14 in a direction orthogonal to the insertion direction of the shaft 11, thereby causing the fixing groove 11a1 of the shaft 11 and the embracing portions 14a of the sliders 14 to be engaged with each other or releasing the engagement between the fixing groove 11a1 and the embracing portions 14a. For this reason, the locking operation of creating a state of causing the shaft 11 not to be pulled out from the housing 16, and the unlocking operation of creating a state of causing the shaft 11 to be pulled out from the housing 16 are performed regardless of the rotational position of the shaft 11 and the rotational position of each member on the housing 16 side, and the mounting and dismounting of the toilet seat/toilet lid unit 2 on and from the toilet bowl 3 can be easily performed without considering the rotational position of each member. Therefore, regardless of the rotational position of the shaft 11 or the rotary core 15 at the time of insertion of the shaft 11 into the housing 16, it is possible to easily insert the shaft 11 into the housing 16 which is a mating member.

[0083] Further, according to the mounting and dismounting device 4 of this embodiment, the linear core 13 is guided with the A-linear guides 13d provided at four locations at equal intervals around the axial center thereof fitted to the guide grooves 12c provided at four locations at equal intervals around the axial center of the stationary core 12, and therefore, the linear core 13 stably linearly moves. Further, the rotary core 15 is also guided by the four guide grooves 12c due to the inclined end faces 15e of the B-linear guides 15d provided at four locations at equal intervals around the axial center of the rotary core 15 being pushed by the tops of the mountain-shaped forms provided at four locations at equal intervals on the other end face 13e of the linear core 13, and therefore, the rotary core 15 stably linearly moves together with the linear core 13.

[0084] Further, according to the mounting and dismounting device 4 of this embodiment, the fixing groove 11a1 of the shaft 11 and the embracing portion 14a of

the slider 14 are engaged with each other by the embracing portion 14a having an outer shape conforming to the groove shape of the fixing groove 11a1 being fitted to the fixing groove 11a1. For this reason, the engagement between the fixing groove 11a1 and the embracing portion 14a is firmly performed, so that the shaft 11 does not reliably come out of the housing 16.

[0085] Further, according to this embodiment, it is possible to provide the hinge devices 1a and 1b supporting the toilet seat/toilet lid unit 2 on the toilet bowl 3 so as to be opened and closed freely, by using the mounting and dismounting devices 4 capable of easily mounting and dismounting the toilet seat/toilet lid unit 2 on and from the toilet bowl 3 without performing a cumbersome and difficult operation.

[0086] In the embodiment described above, a case where the mounting and dismounting device 4 is configured by mounting the shaft 11 on the damper case 8 and mounting the housing 16 on the toilet bowl 3 has been described. However, contrary to this, it is also possible to configure the mounting and dismounting device 4 by mounting the housing 16 on the damper case 8 and mounting the shaft 11 on the toilet bowl 3.

[0087] Further, the mounting of the shaft 11 on the damper case 8 is performed using the mounting screw 18, and the mounting of the housing 16 on the toilet bowl 3 is performed using the mounting jig 21. However, these mounting manners are not limited to the manners of the embodiment described above. As long as the shaft 11 is fixed to the damper case 8 and the housing 16 is fixed to the toilet bowl 3, the same operation and effects as those in the embodiment described above can be exhibited even in other mounting methods.

Industrial Applicability

[0088] In the embodiment described above, a case where the mounting and dismounting device according to the present invention and the hinge device using the mounting and dismounting device are applied to a western-style toilet has been described. However, the mounting and dismounting device according to the present invention and the hinge device using the mounting and dismounting device are not limited to the western-style toilet and can also be likewise applied to other devices having a structure in which an object on one side is detachably mounted on an object on the other side, and the same operation and effects are exhibited.

Reference Signs List

[0089]

- 1a, 1b: hinge device
- 2: toilet seat/toilet lid unit (object on one side)
- 3: toilet bowl (object on the other side)
- 4: mounting and dismounting device
- 5a, 5b: rotary damper

- 6: toilet lid
- 7: toilet seat
- 8: damper case
- 9a, 9b: rotary shaft
- 11: shaft
- 11a: first shaft portion
- 11a1: fixing groove
- 11a2: fixing surface
- 11b: second shaft portion
- 11b1: pressing surface
- 11c: third shaft portion
- 11d: fourth shaft portion
- 12: stationary core (fixed member)
- 12a: first insertion opening
- 12b: second space
- 12c: guide groove
- 12d: guide wall
- 13: linear core (linear movement member)
- 13a: second insertion opening
- 13b: third space
- 13c: slide groove
- 13d: A-linear guide (first guided strip)
- 13e: other end face of linear core 13
- 14: slider (slide member)
- 14a: embracing portion
- 14b: slide guide portion
- 14c: fixing surface
- 15: rotary core (rotating member)
- 15a: small diameter portion
- 15b: large diameter portion
- 15c: insertion hole
- 15d: B-linear guide (second guided strip)
- 15e: inclined end face
- 15f: control piece
- 16: housing
- 16a: first space
- 17: spring (elastic member)
- L: lock point

Claims

1. A mounting and dismounting device (4) for detachably mounting an object (2) on one side, on an object (3) on the other side by mounting the object (2) on one side, on the object (3) on the other side by engagement between the object (2) on one side and the object (3) on the other side and separating the object (2) on one side from the object (3) on the other side by releasing the engagement between the object (2) on one side and the object (3) on the other side,
characterized in that;
the device (3) comprises:

a shaft (11) which has a first shaft portion (11a) with a fixing groove (11a1) formed therein, and a second shaft portion (11b) having a larger di-

ameter than the first shaft portion (11a), and in which one end on the second shaft portion (11b) side is mounted on the side of the object (2) on one side;

a housing (16) which has a first space (16a) facing one end face and is mounted on the side of the object (3) on the other side;

a fixed member (12) having a first insertion opening (12a) formed on one end face with a diameter to allow insertion of the first shaft portion (11a) and the second shaft portion (11b), a second space (12b) communicating with the first insertion opening (12a), a plurality of guide grooves (12c) formed on an inner periphery surrounding the second space (12b) along an insertion direction of the shaft (11) through the first insertion opening (12a), and a guide wall (12d) which is formed by causing a wall surface of the inner periphery to protrude from a terminal end of the guide groove (12c) on the other end face side which the second space (12b) faces, and of which a protruding height gradually decreases toward the neighboring guide groove (12c), the fixed member (12) being accommodated in and fixed to the first space (16a) with the first insertion opening (12a) exposed;

a slide member (14) having an embracing portion (14a) which is engaged with the fixing groove (11a1) to embrace the shaft (11), and a slide guide portion (14b) formed to be continuous with the embracing portion (14a);

a linear movement member (13) having a second insertion opening (13a) which is formed on one end face with a diameter in which the first shaft portion (11a) is inserted and the second shaft portion (11b) is not inserted, and is disposed to be continuous with the first insertion opening (12a) when the linear movement member (13) accommodated in the second space (12b), a third space (13b) communicating with the second insertion opening (13a), a first guided strip (13d) which is formed to protrude on an outer periphery and fitted to the guide groove (12c), the other end face (13e) which is formed in a mountain shape with an end face portion in a formation direction of the first guided strip (13d) as a top and which the third space (13b) faces, and a slide groove (13c) formed to communicate with the second insertion opening (13a) so as to slidably hold the slide guide portion (14b) in a direction orthogonal to the insertion direction of the shaft (11), the linear movement member (13) being accommodated in the second space (12b) so as to be linearly movable in the insertion direction of the shaft (11) while the first guided strip (13d) is guided by the guide groove (12c);

a rotating member (15) which has a control piece

(15f) which rotates, thereby coming into contact with the embracing portion (14a), and thereby causing the slide member (14) with the slide guide portion (14b) held in the slide groove (13c) to slide in a direction toward an axial center and causing the embracing portion (14a) to be engaged with the fixing groove (11a1) formed in the inserted first shaft portion (11a), a small diameter portion (15a) which is formed with the control piece (15f) and fitted to the third space (13b), a second guided strip (15d) which has an inclined end face (15e) which is pushed by the top of a mountain-shaped form formed on the other end face of the linear movement member (13) beyond the protruding height of the guide wall (12d) to deviate from the guide groove (12c), thereby coming into contact with an inclined end of the mountain-shaped form formed on the other end face of the linear movement member (13) and a protruding end of the guide wall (12d), and is fitted to the guide groove (12c) in a predetermined length, a large diameter portion (15b) with the second guided strip (15d) formed to protrude on an outer periphery, and an insertion hole (15c) which is disposed to be continuous with the second insertion opening (13a) when the small diameter portion (15a) is fitted to the third space (13b), and has a diameter to allow insertion of the first shaft portion (11a), and in which the large diameter portion (15b) is accommodated in the second space (12b) so as to be linearly movable in a predetermined length in the insertion direction of the shaft (11) while the second guided strip (15d) is guided in a predetermined length by the guide groove (12c); and

an elastic member (17) which biases the linear movement member (13) and the rotating member (15) toward the side of the fixed member (12) fixed to the housing (16).

2. The mounting and dismounting device (4) according to claim 1,

characterized in that;

the fixed member (12) has the guide grooves (12c) provided at four locations at equal intervals around an axial center thereof,

the linear movement member (13) has the first guided strips (13d) and the tops of the mountain-shaped forms formed on the other end face (13e), which are provided at four locations at equal intervals around an axial center thereof, and

the rotating member (15) has the second guided strips (15d) provided at four locations at equal intervals around an axial center thereof.

3. The mounting and dismounting device (4) according to claim 2,

characterized in that;

a pair of the slide grooves (13c) is provided at two locations facing each other with an opening center of the second insertion opening (13a) interposed therebetween, 5

the slide member (14) is configured of a pair of slide members (14) formed symmetrically with respect to the opening center of the second insertion opening (13a) and symmetrically disposed in the respective slide grooves (13c), and 10

a pair of the control pieces (15f) is provided to be separated from each other by a distance to clamp the pair of embracing portions (14a) fitted to the fixing groove (11a1), at two locations facing each other with an axial center of the rotating member (15) interposed therebetween. 15

4. The mounting and dismounting device according to any one of claims 1 to 3,

characterized in that; 20

the fixing groove (11a1) is formed such that a diameter of a part of the first shaft portion (11a) is smaller than a diameter of the other part and an axial length has a length to accommodate a height of the embracing portion (14a), and 25

the embracing portion (14a) has a circular arc surface along an outer periphery of the fixing groove (11a1) on a contact surface with the fixing groove (11a1). 30

5. A hinge device (1a,1b) **characterized in that** comprises;
- the mounting and dismounting device (4) according to any one of claims 1 to 4; and
- a rotary damper (5a,5b) which has a damper case (8) which is mounted on the shaft (11) or the housing (16), and a rotary shaft (9a,9b) which is accommodated in the damper case (8) and in which a shaft end protruding from the damper case (8) is connected to the object (2) on one side or the object (3) on the other side, and provides resistance to rotation of the object (2) on one side or the object (3) on the other side to which the shaft end is connected. 35 40 45

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Fig.1

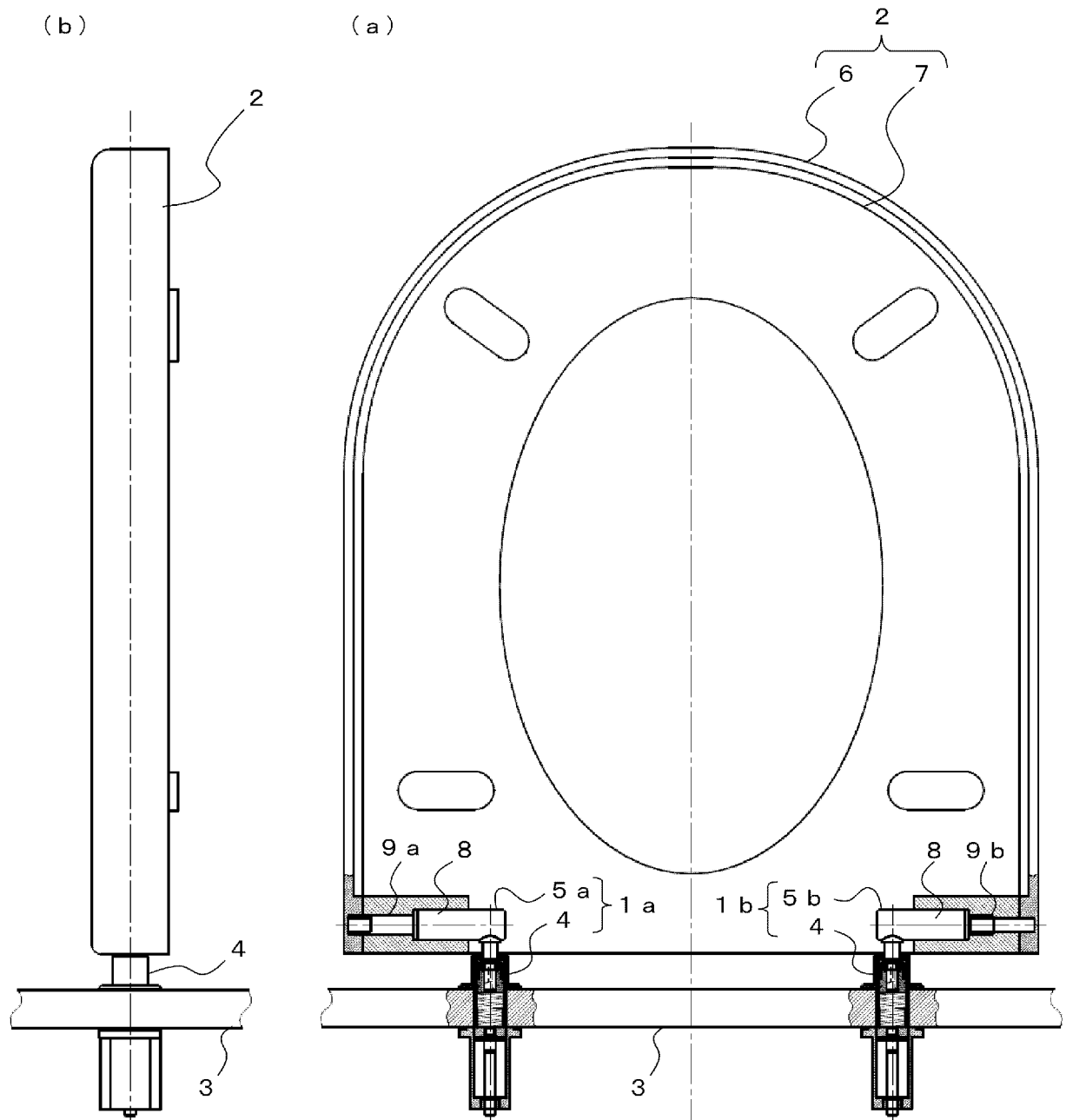


Fig.2

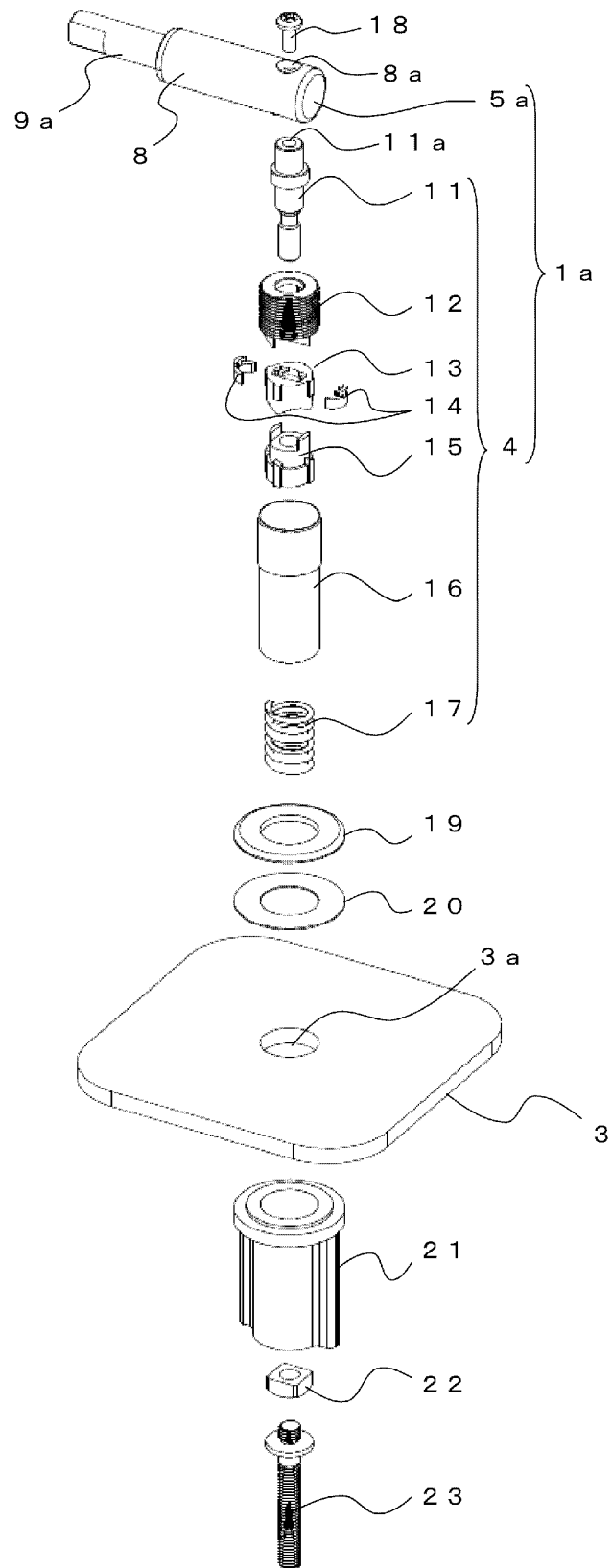


Fig.3

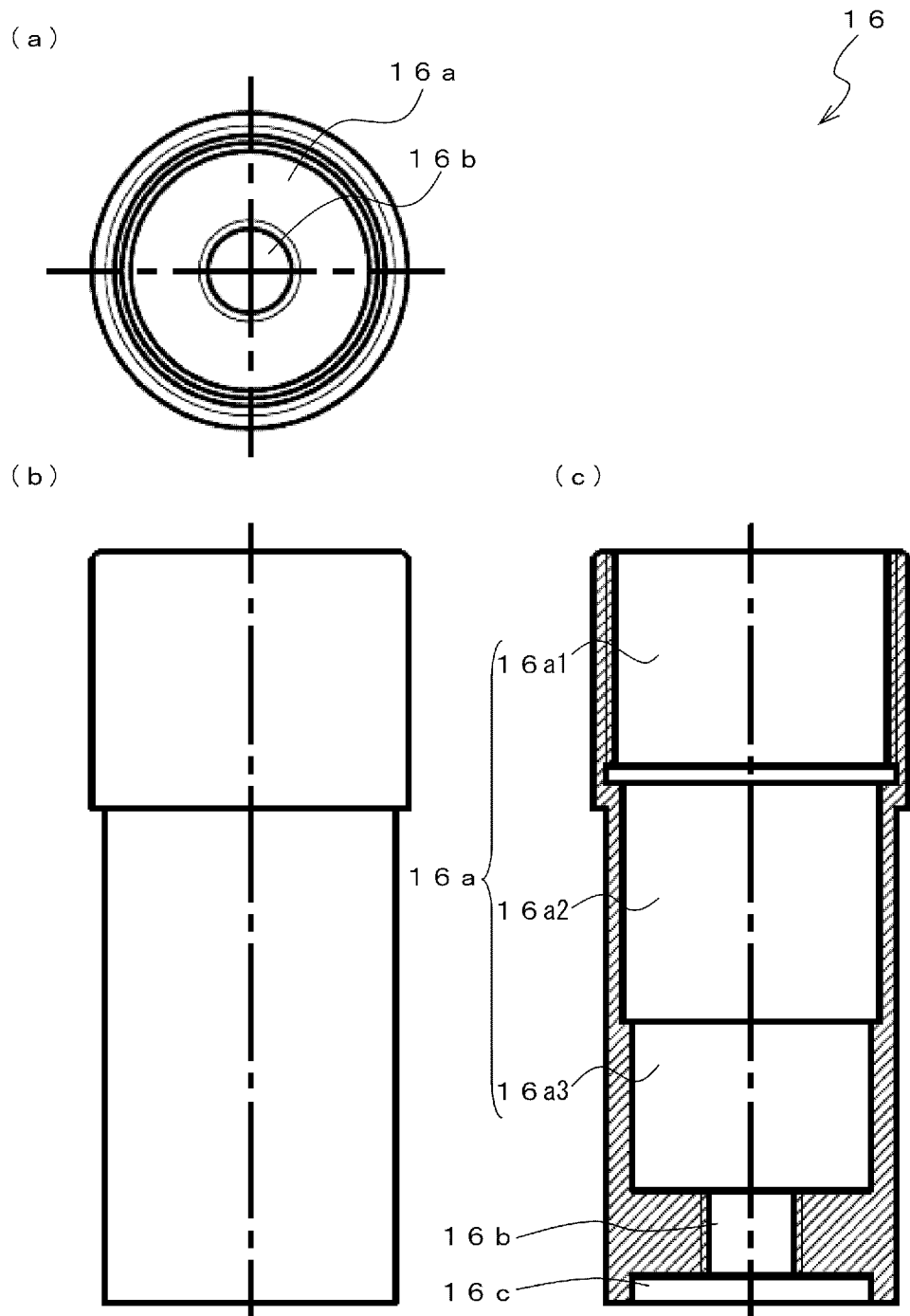


Fig.4

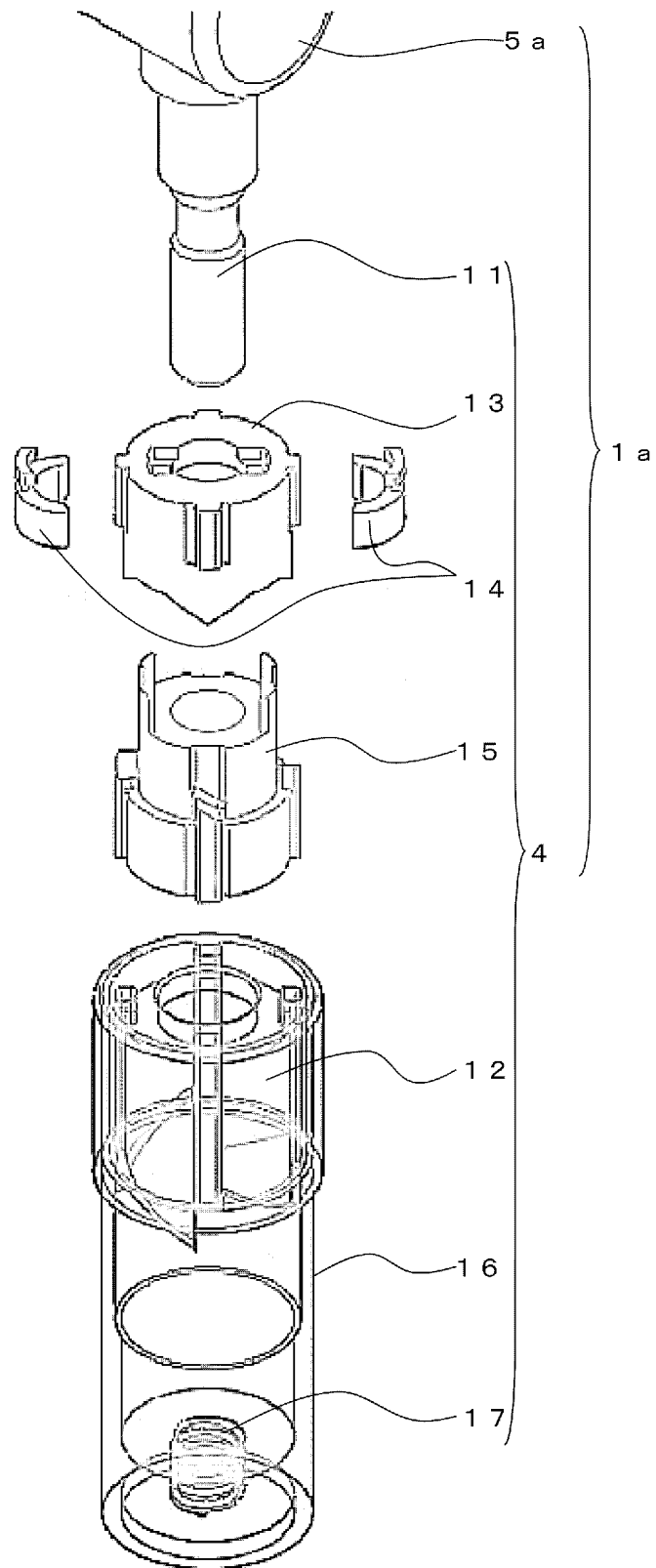


Fig.5

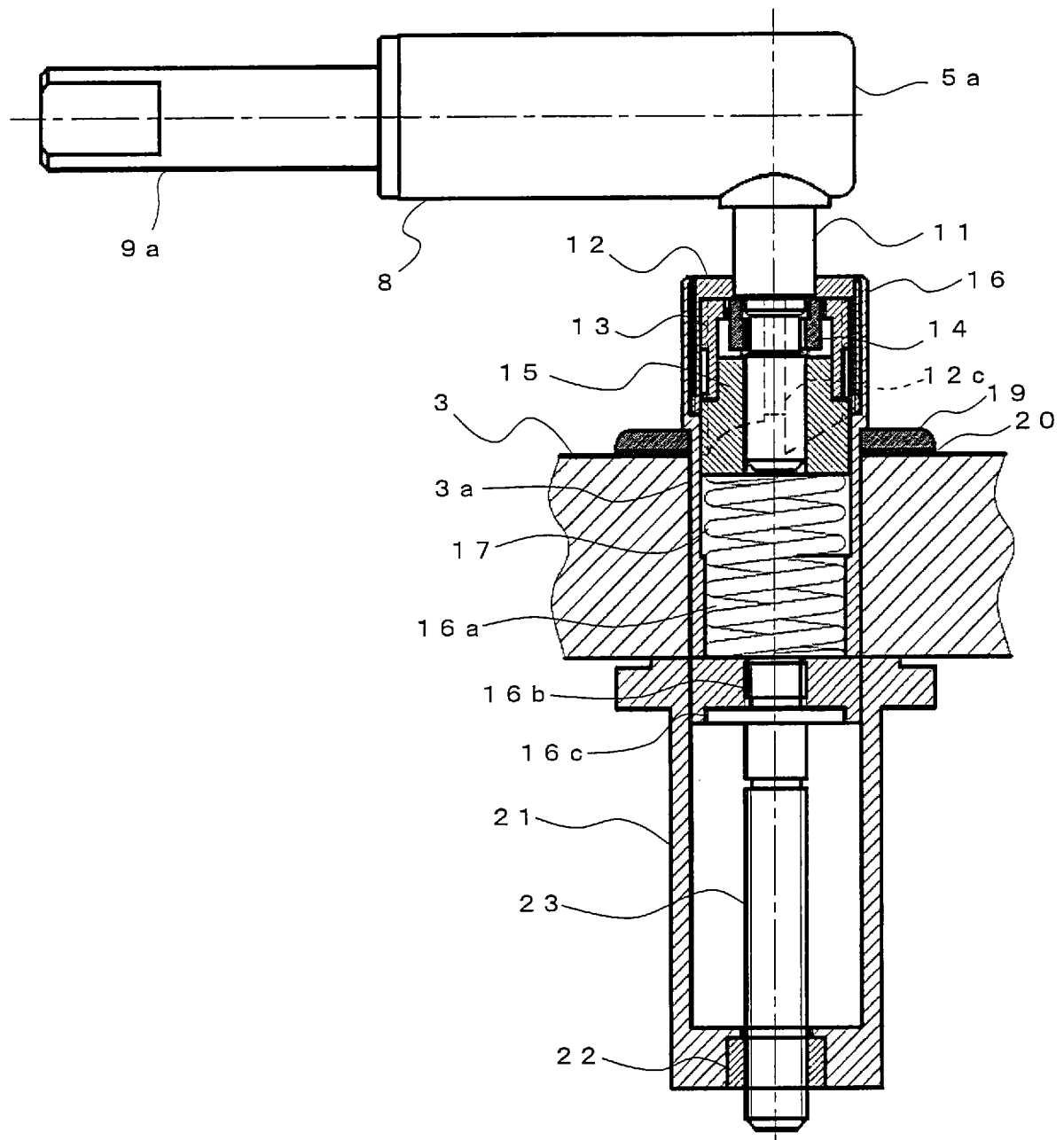


Fig.6

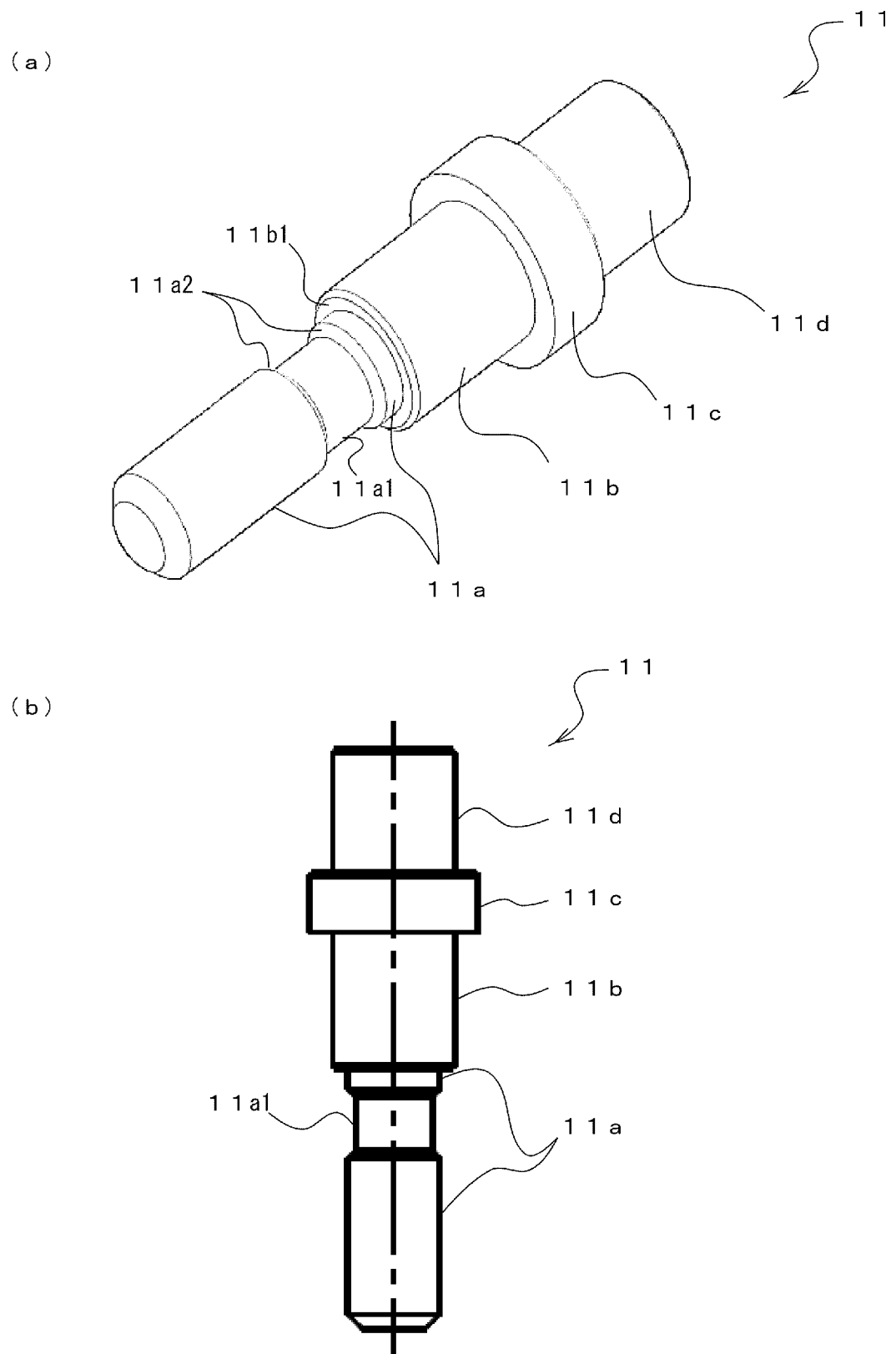


Fig.7

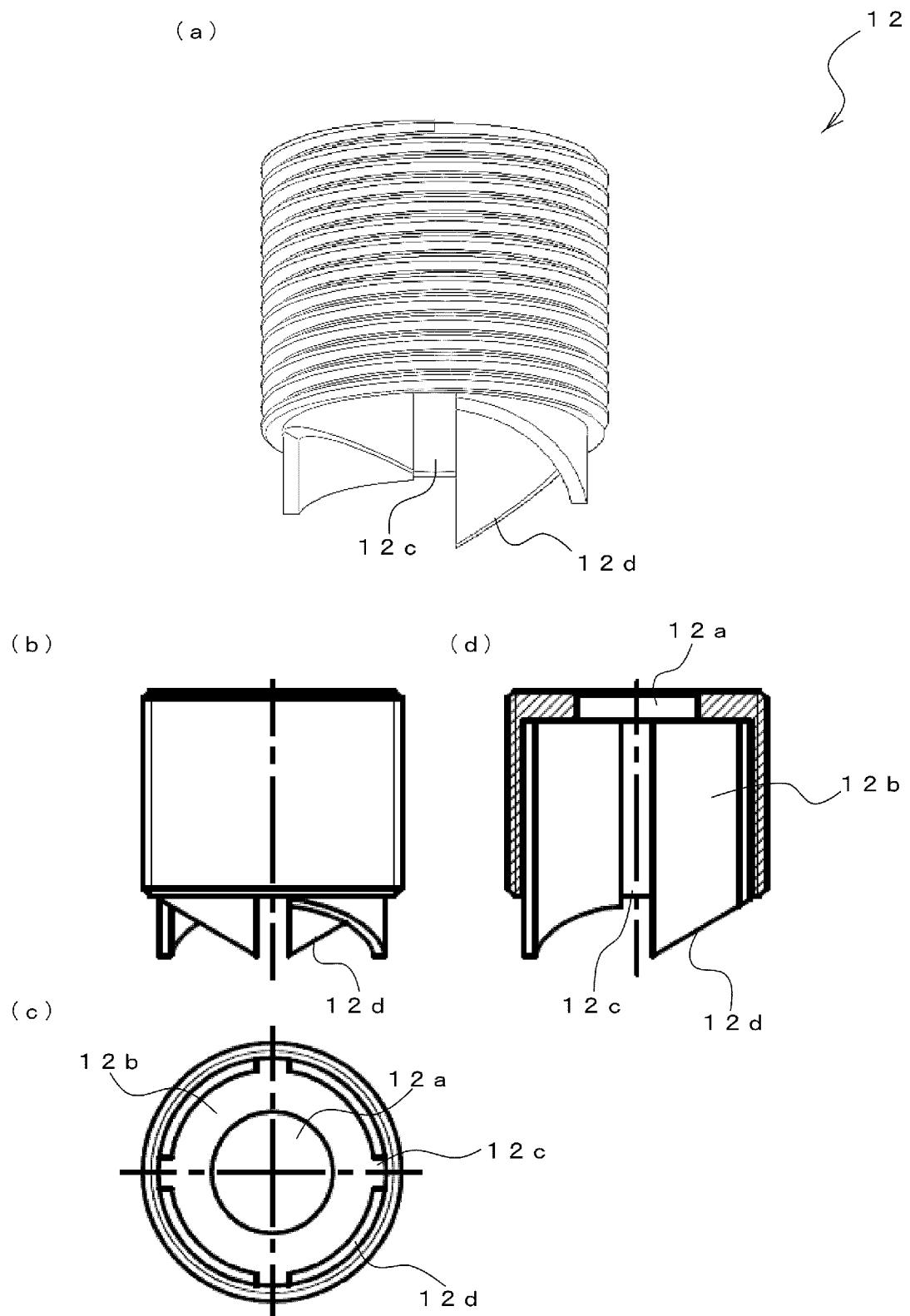


Fig.8

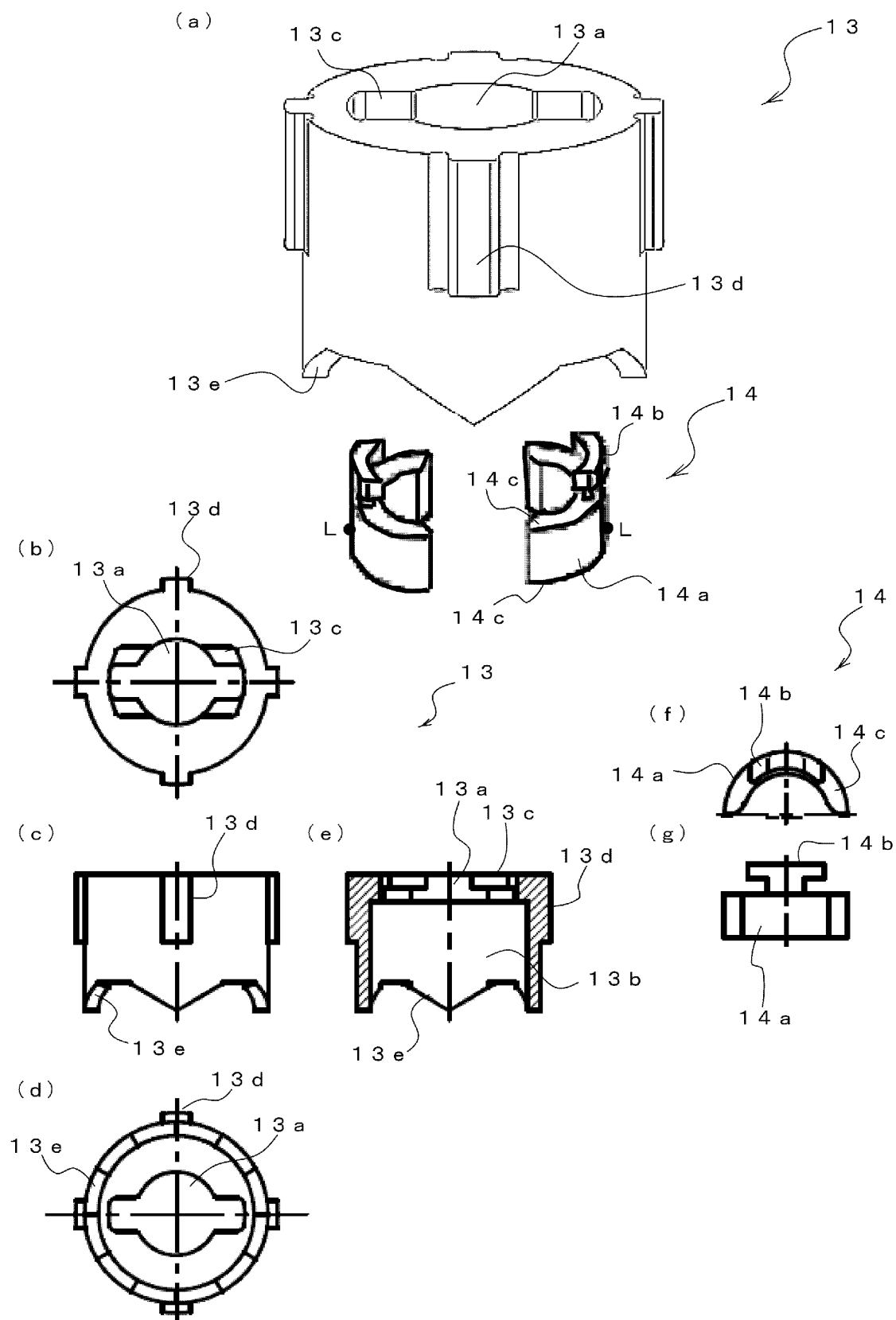


Fig.9

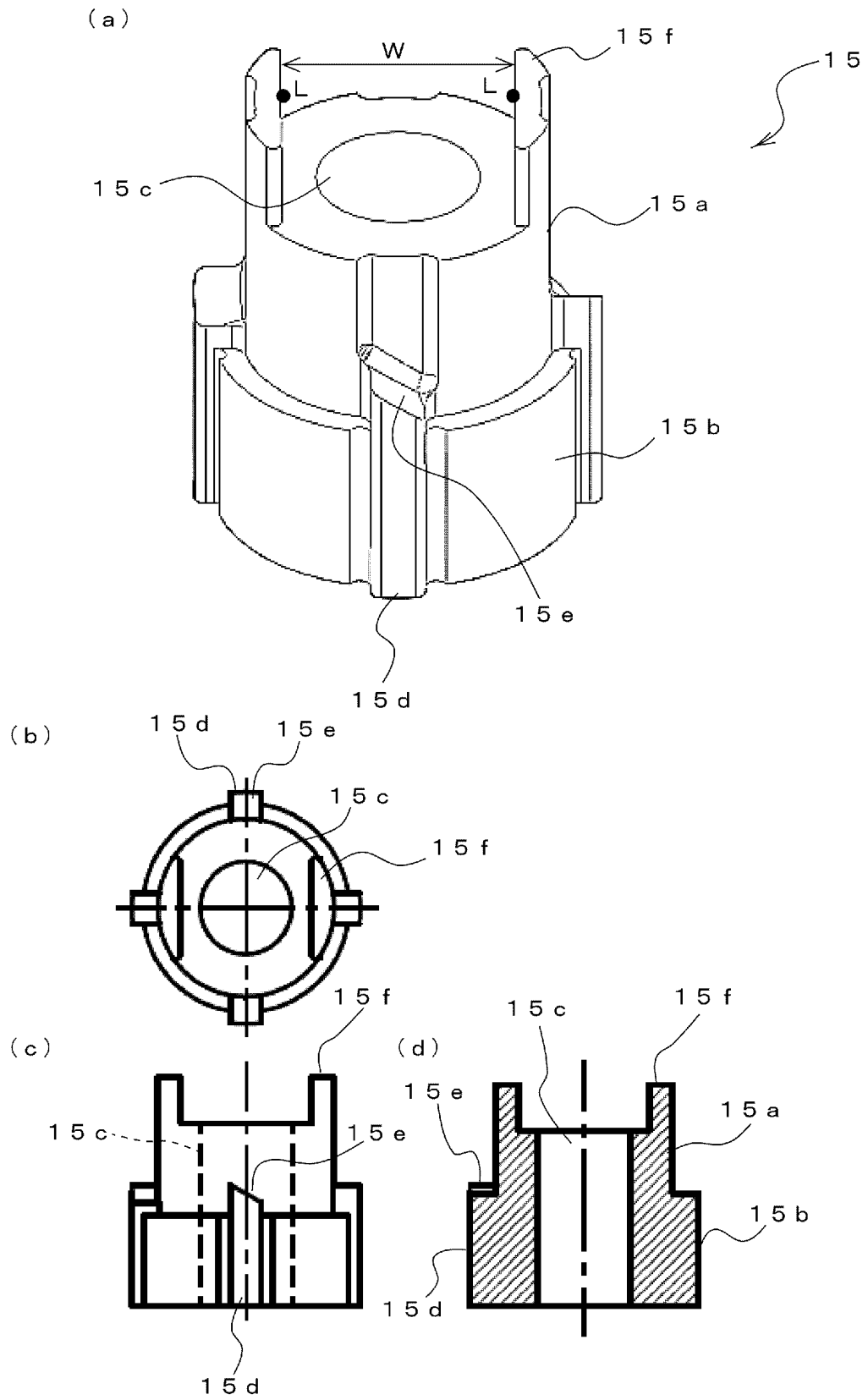


Fig.10

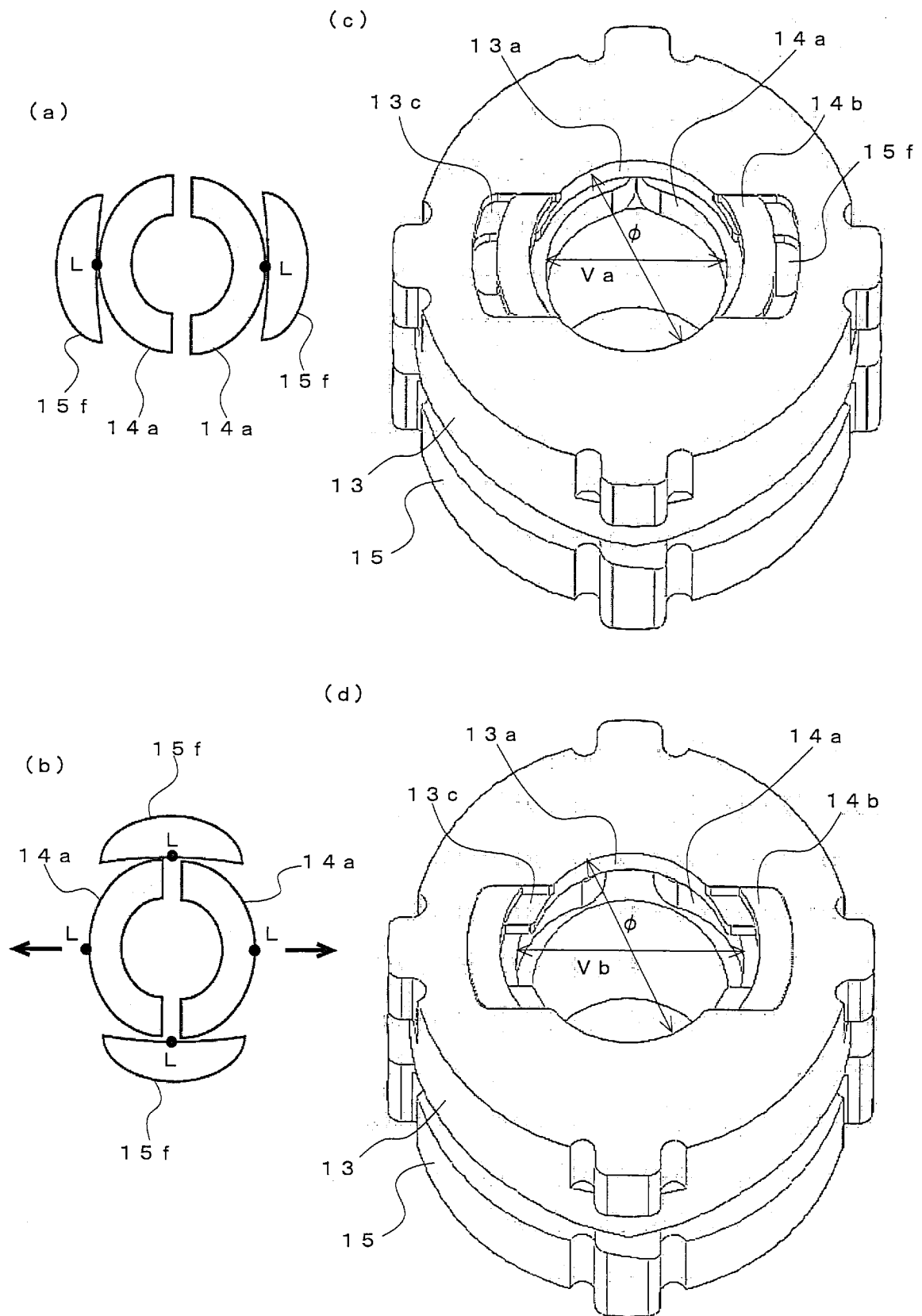


Fig.11

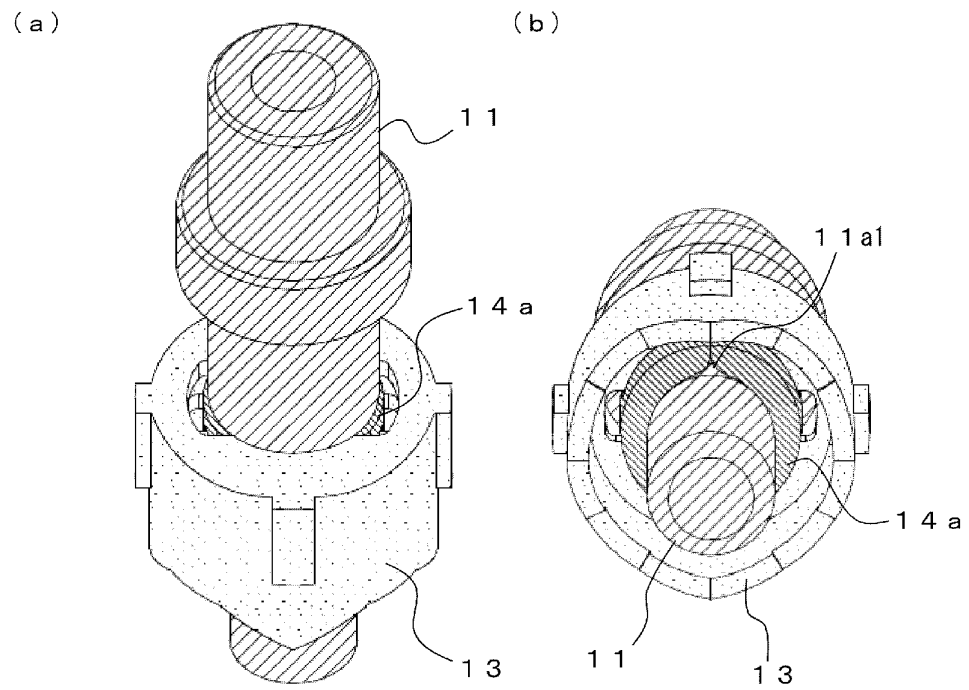


Fig.12

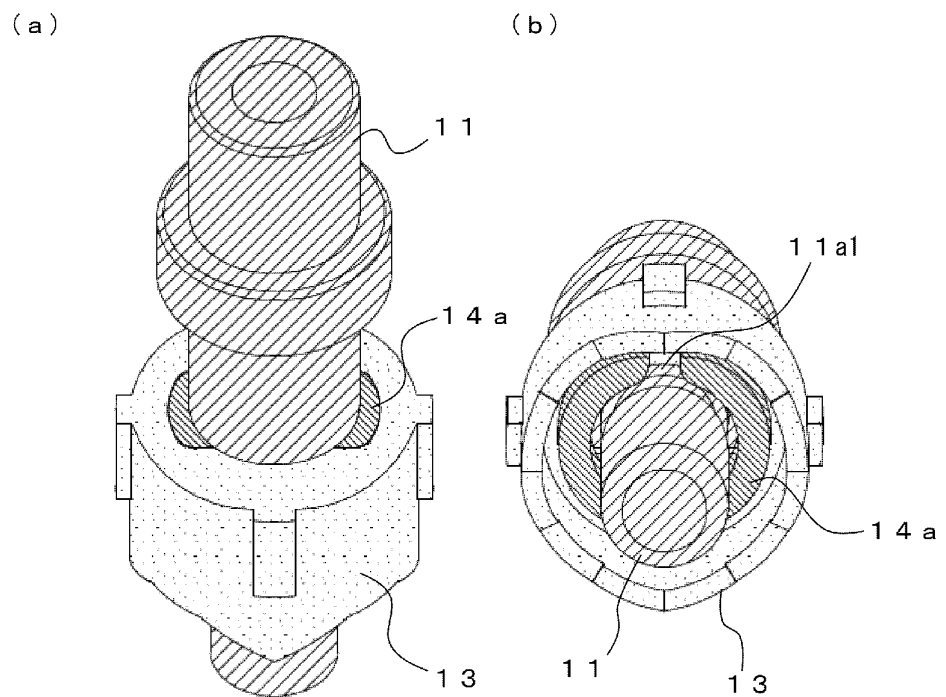


Fig.13

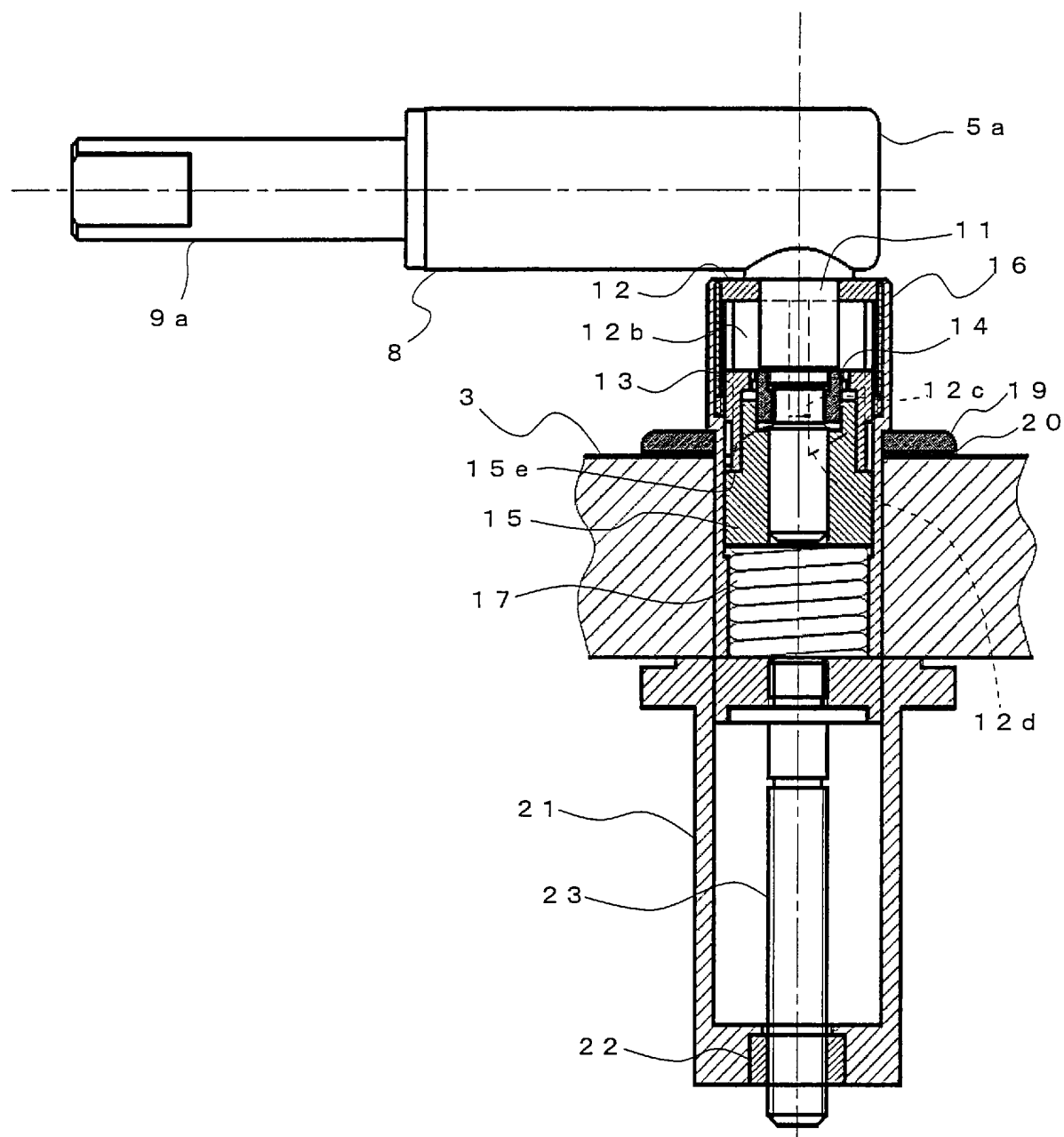
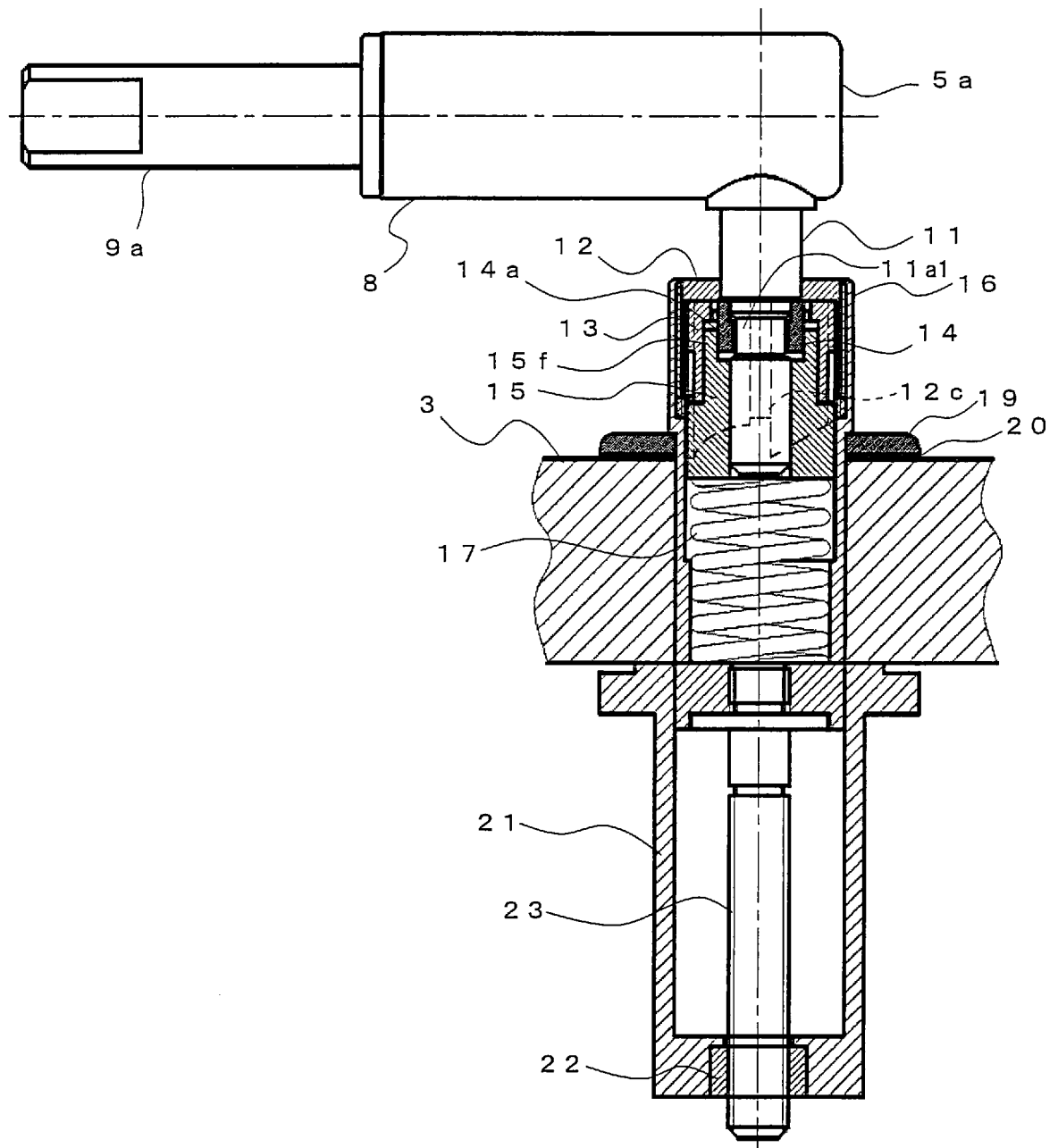


Fig.14



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/064197

A. CLASSIFICATION OF SUBJECT MATTER

A47K13/26(2006.01)i, E05D7/10(2006.01)i, E05D7/12(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)

A47K13/26, E05D7/10, E05D7/12

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 1996-2016

Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

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	EP 2324745 A2 (WDI (XIAMEN) TECHNOLOGY INC.), 25 May 2011 (25.05.2011), entire text; all drawings & CN 201782694 U	1-5
A	US 2012/0284909 A1 (CHEN Guo-Bin), 15 November 2012 (15.11.2012), entire text; all drawings & WO 2010/022615 A1 & CN 201271201 Y	1-5
A	CN 202636818 U (XIAMEN RT PLUMBING TECHNOLOGY CO., LTD.), 02 January 2013 (02.01.2013), entire text; all drawings (Family: none)	1-5

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

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Date of the actual completion of the international search
21 July 2016 (21.07.16)Date of mailing of the international search report
02 August 2016 (02.08.16)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/064197

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 203252575 U (XU Xiaofeng), 30 October 2013 (30.10.2013), entire text; all drawings & EP 2803308 A1	1-5
A	JP 11-184395 A (Matsushita Electric Industrial Co., Ltd.), 09 July 1999 (09.07.1999), entire text; all drawings (Family: none)	1-5
A	JP 2011-208797 A (Japan Alpha Co., Ltd.), 20 October 2011 (20.10.2011), entire text; all drawings (Family: none)	1-5

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REFERENCES CITED IN THE DESCRIPTION

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- EP 2324745 A [0005]