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(71) Applicant: **Mitsubishi Heavy Industries Thermal Systems, Ltd.**
Minato-ku, Tokyo 108-8215 (JP)

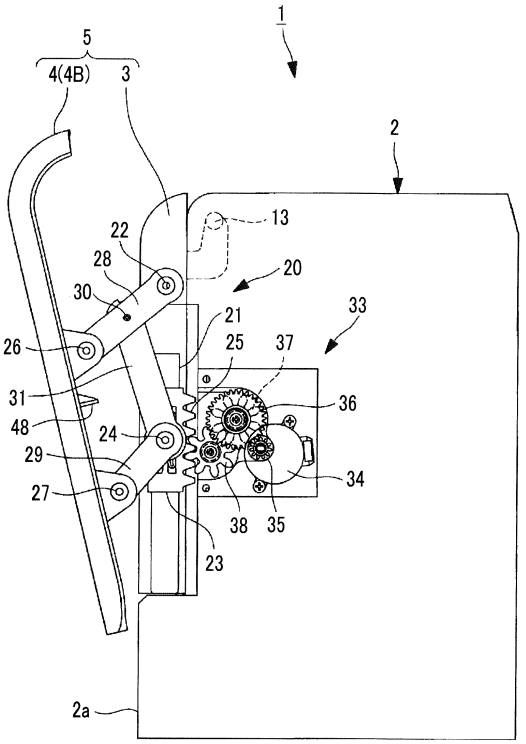
(72) Inventors:
- **HIGASHIURA, Kunihiro**
  Tokyo 108-8215 (JP)
- **OKAMURA, Kazumi**
  Tokyo 108-8215 (JP)
- **YAMAGUCHI, Tomomitsu**
  Tokyo 108-8215 (JP)

(74) Representative: **Henkel, Breuer & Partner Patentanwälte**
Maximiliansplatz 21
80333 München (DE)

(54) AIR CONDITIONER

(57) An air conditioner (1) is provided with a front panel (3) covering the front face of a body housing (2) such that the front face can be opened/closed, an openable/closable panel (4) openable/closable between a closed position and an open position (4B) relative to the front panel (3), and an opening/closing mechanism (20) which opens/closes the openable/closable panel (4), wherein the opening/closing mechanism (20) is provided with: a slide rail (21) which is provided to the front panel (3); a fixed pivot part (22); a slider (23) which slides along the slide rail (21) and which includes a movable pivot part (24) and a rack gear (25); an upper pivot part (26); a lower pivot part (27); an upper link (28); a lower link (29); an intermediate link (31) which connects the movable pivot part (24) and an intermediate pivot part (30) that is provided to an intermediate section of the upper link (28); and a drive part (33) provided with a pinion gear (38) which is engaged with the rack gear (25) of the slider (23).

FIG. 4



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Description

Technical Field

[0001] The present invention relates to an air conditioner, and more particularly, to an air conditioner of which a front panel is opened so as to be tilted forward for an increase in a suction area.

Background Art

[0002] As shown in Fig. 1 of PTL 1, a grill part 2 is openably and closably provided on a front surface 1a of an air conditioner body 1 of an air conditioner disclosed in PTL 1. The grill part 2 includes a front panel 2b that is openably and closably provided on the front surface 1a so as to cover the front surface 1a of the air conditioner body 1, and an openable/closable panel 2a that is provided on the front panel 2b to be capable of being opened and closed with respect to the front panel 2b.

[0003] During the operation of the air conditioner, the openable/closable panel 2a is opened forward so as to be tilted forward with respect to the front panel 2b. Accordingly, since a large amount of room air is sucked through intake ports that are provided on both the upper surface and the front surface 1a of the air conditioner, the amount of heat to be exchanged between a refrigerant of a heat exchanger 5 built in the air conditioner and the room air is increased. As a result, heating and cooling efficiency can be improved. It is preferable that the opening angle of the openable/closable panel 2a is large.

[0004] On the other hand, the lower edge portion of the front panel 2b is raised up and rotated with respect to the front surface 1a of the air conditioner body 1 during the stop of the air conditioner, so that the openable/closable panel 2a and the front panel 2b, that is, the entire grill part 2 is opened with respect to the front surface 1a. Accordingly, maintenance work, such as the cleaning and attachment/detachment of a filter 4 provided on the front surface 1a and the washing of the heat exchanger 5, can be performed.

[0005] In order to allow the openable/closable panel 2a to be opened with respect to the front panel 2b as described above, link mechanisms 60 that include a plurality of links made of a resin, drive units 30 in which motors and gears for driving the link mechanisms 60 are built, and the like are mounted on the inner surfaces of both end portions of the front panel 2b in a longitudinal direction as shown in Fig. 2 of PTL 1.

[0006] The link mechanism 60 includes a cross link 606 that is driven and rotated by the drive unit 30 and is made of a resin, a first link 608, a second link 610, and a third link 613; and the first link 608 is inserted into a hole-shaped insertion portion 614 formed at the intermediate portion of the second link 610. In a case in which the cross link 606 is rotated in a predetermined direction, the first link 608 is pushed out and the second link 610 and the third link 613 are pulled up. Accordingly, the openable/closable panel 2a is opened.

Citation List

Patent Literature

[0007] [PTL 1] Japanese Unexamined Patent Application Publication No. 2013-122326

Summary of Invention

Technical Problem

[0008] The link mechanism 60 for opening the openable/closable panel 2a includes the cross link 606, the first link 608, the second link 610, and the third link 613 as described above; and the length of the first link 608 should be made long to take a large opening angle of an upper portion of the openable/closable panel 2a in this structure.

[0009] However, the second link 610 should also be made long to make the first link 608 long. Accordingly, since a large space in which the respective links 608, 610, and 613 are stored below the openable/closable panel 2a should be secured in a case in which the openable/closable panel 2a is closed, the size of the air conditioner body 1 is forced to be increased.

[0010] In a case in which the second link 610 is made long and the openable/closable panel 2a is opened, the lower portion of the openable/closable panel 2a is separated from the front surface 1a of the air conditioner body 1. In this case, since air-conditioned air, which is discharged from a discharge outlet 11 provided at the lower portion of the front surface 1a, is suddenly sucked to an intake port, which is provided on the front surface 1a, from a gap between the lower end of the openable/closable panel 2a and the front surface 1a, there is a concern that heating and cooling efficiency may be lowered and dew condensation may occur in the air conditioner during a cooling operation.

[0011] In addition, since all the drive units 30 and the link mechanisms 60, which open the openable/closable panel 2a, are mounted on the front panel 2b, the front panel 2b is heavy. For this reason, in a case in which maintenance work, such as the cleaning and attachment/detachment of the filter 4 and the washing of the heat exchanger 5, is performed in a state in which the entire grill part 2 is opened with respect to the front surface 1a as described above, it is difficult to continue to support the heavy front panel 2b. Accordingly, there is a problem that workability is poor. Moreover, since the openable/closable panel 2a is moved alone with respect to the front panel 2b and shakes in a case in which the entire grill part 2 is opened with respect to the front surface 1a, there is a concern that workability deteriorates in this regard.

[0012] The invention has been made in consideration of the above-mentioned circumstances, and an object of

the invention is to provide an air conditioner of which an openable/closable panel provided on a front surface is opened so as to be tilted forward, opening/closing mechanisms for an openable/closable panel can be made to have a simple and light structure, an opening angle of an upper portion of the openable/closable panel can be made large to allow the amount of sucked air to increase, and workability during maintenance work, which is to be performed in a state in which the openable/closable panel and a front panel are opened, can be improved.

Solution to Problem

[0013] The invention employs the following means to achieve the object.

[0014] That is, an air conditioner according to the invention includes a front panel that covers a front surface of a body housing and is openably and closably provided so as to be opened up about a hinge portion provided at an upper side of the front panel as an axis, an openable/closable panel that is mounted on the front panel to be capable of being opened and closed with respect to the front panel, and opening/closing mechanisms that open and close the openable/closable panel between a closed position where the openable/closable panel closes an intake opening of the front panel and an open position where the openable/closable panel is opened forward so as to be tilted forward with respect to the front panel. The opening/closing mechanisms include slide rails that are provided on both side portions of the front panel and extend in a vertical direction, fixed pivot parts that are provided above the slide rails, sliders that are provided so as to be slidable along the slide rails and include movable pivot parts and rack gears, upper pivot parts and lower pivot parts that are provided on both side portions of the openable/closable panel, upper links that connect the fixed pivot parts to the upper pivot parts, lower links that connect the movable pivot parts to the lower pivot parts and are shorter than the upper links, intermediate links that connect the intermediate pivot parts, which are provided at intermediate portions of the upper links, to the movable pivot parts, and drive units that include pinion gears meshing with the rack gears of the sliders.

[0015] According to the air conditioner having the above-mentioned structure, the pinion gears of the drive units are rotated to push the sliders up. Accordingly, the intermediate links, which are connected to the movable pivot parts of the sliders, push the intermediate portions of the upper links, which connect the fixed pivot parts of the body housing to the upper pivot parts of the openable/closable panel, up. For this reason, the upper links are rotated up, so that the upper portion of the openable/closable panel placed at the closed position is separated from the front panel and the entire openable/closable panel is raised up. Since the openable/closable panel is raised up, the lower links are rotated up and the lower portion of the openable/closable panel is separated from the front panel. Since the lower links are shorter than the upper links, the openable/closable panel is opened forward so as to be tilted forward with respect to the front panel. Accordingly, the openable/closable panel is placed at the open position.

[0016] According to this structure, since the length of the upper link can be made longer than the length of the lower link, a large opening angle of the openable/closable panel at the open position can be taken. Accordingly, since a large amount of room air is sucked through intake ports provided on the front surface of the body housing, the amount of sucked air is increased. As a result, heating and cooling efficiency can be improved. Moreover, the opening/closing mechanism can be made to have a simple and light structure.

[0017] Since the front panel can be opened up with respect to the front surface of the body housing together with the openable/closable panel, maintenance work, such as the cleaning and attachment/detachment of filters of the intake ports provided on the front surface of the body housing and the washing of the heat exchanger, can be performed.

[0018] In the air conditioner, the drive units are installed in the body housing, and the pinion gears of the drive units may mesh with the rack gears in a case in which the front panel is closed with respect to the body housing.

[0019] According to the above-mentioned structure, in a case in which the front panel is opened up with respect to the front surface of the body housing together with the openable/closable panel and the opening/closing mechanisms, the heavy drive units remain in the body housing. For this reason, the weight of the entire front panel can be reduced, so that workability during maintenance work, which is to be performed in a state in which the front panel is opened, can be improved.

[0020] In the air conditioner, each slider is relatively movable with respect to the movable pivot part in a sliding direction of the slider, and is urged to a neutral position of a movement range thereof relative to the movable pivot part by an urging portion.

[0021] According to the above-mentioned structure, in a case in which the front panel is opened up with respect to the front surface of the body housing and is closed again, the positions of the teeth of the rack gear are made to match the positions of the teeth of the pinion gear by the movement of the rack gear of the slider relative to the movable pivot part in the sliding direction even though the positions of the teeth of the rack gear of the slider deviate from the positions of the teeth of the pinion gear of the drive unit.

[0022] For this reason, since the rack gear and the pinion gear are made to reliably mesh with each other in a case in which the front panel is to be closed, the front panel can be smoothly closed and workability during maintenance work, which is to be performed in a state in which the front panel is opened, can be improved.

[0023] The air conditioner may further include locking mechanisms that lock an operation for opening/closing

the openable/closable panel with respect to the front panel in a case in which the front panel is opened with respect to the front surface of the body housing.

[0024] According to the above-mentioned structure, in a case in which the front panel is opened with respect to the front surface of the body housing, an operation for opening/closing the openable/closable panel with respect to the front panel is locked by the action of the locking mechanisms. For this reason, the openable/closable panel is not moved alone with respect to the front panel, and the workability of maintenance can be improved.

[0025] In the air conditioner, each of the locking mechanism includes: a hook through-hole that is perforated in the front panel; an annular hook that protrudes from a rear surface of the openable/closable panel and is to be inserted into the hook through-hole in a case in which the openable/closable panel is placed at the closed position; a latch member that is provided on a rear surface of the front panel, slides between a locked position where a tip portion of the latch member protrudes so as to overlap the hook through-hole and an unlocked position where the tip portion does not overlap the hook through-hole, includes a swash plate cam formed on a back surface thereof, and is normally urged toward the locked position; and a release protrusion that protrudes from the front surface of the body housing, and comes into contact with the swash plate cam of the latch member to allow the latch member to slide toward the unlocked position in a case in which the front panel is closed with respect to the front surface of the body housing.

[0026] According to the above-mentioned structure, in a case in which the front panel is closed with respect to the front surface of the body housing, the release protrusion comes into contact with the swash plate cam of the latch member and the latch member slides toward the unlocked position. For this reason, the openable/closable panel can be moved relative to the front panel between the closed position and the open position.

[0027] In a case in which the front panel is opened with respect to the front surface of the body housing, the release protrusion is separated from the swash plate cam of the latch member and the latch member is made to slide toward the locked position by an urging force to be normally applied. For this reason, an operation for opening/closing the openable/closable panel with respect to the front panel is locked.

[0028] According to this structure, the locking mechanisms included in the opening/closing mechanisms for the openable/closable panel can be made to have a simple and light structure.

[0029] The air conditioner may further include a support lever that is rotatably provided on the front surface of the body housing and is bridged between the front panel and the front surface of the body housing to hold the front panel in an open state in a case in which the front panel is opened with respect to the front surface of the body housing.

[0030] According to the above-mentioned structure, since the support lever is bridged in a state in which the front panel is opened, the front panel can be held in an open state. Accordingly, the workability of maintenance can be improved.

[0031] In the air conditioner, a drawing hook, which draws the support lever to a functional position in a case in which the front panel is opened with respect to the front surface of the body housing, may be provided on the rear surface of the front panel.

[0032] According to the above-mentioned structure, since the drawing hook provided on the rear surface of the front panel draws the support lever to the functional position in a case in which the front panel is opened, worker's efforts to draw the support lever can be reduced. Accordingly, the workability of maintenance can be improved.

Advantageous Effects of Invention

[0033] According to the air conditioner of the invention, as described above, the openable/closable panel provided on the front surface is opened so as to be tilted forward, the opening/closing mechanisms for the openable/closable panel can be made to have a simple and light structure, an opening angle of the upper portion of the openable/closable panel can be made large to allow the amount of sucked air to increase, and workability during maintenance work, which is to be performed in a state in which the openable/closable panel and the front panel are opened, can be improved.

Brief Description of Drawings

[0034]

Fig. 1 is a perspective view of an air conditioner according to an embodiment of the invention.

Fig. 2 is a perspective view of the air conditioner of which a front panel is opened.

Fig. 3 is a side view of the air conditioner of which the front panel is closed.

Fig. 4 is a side view of the air conditioner of which an openable/closable panel is opened.

Fig. 5 is a side view of the air conditioner of which the front panel is opened.

Fig. 6 is a perspective view of a front panel assembly viewed from a rear surface.

Fig. 7 is an exploded perspective view of the front panel assembly viewed from the rear surface.

Fig. 8 is a side view of an opening/closing mechanism.

(A) of Fig. 9 is a side view of an opening/closing mechanism before a rack gear and a pinion gear mesh with each other and (B) of Fig. 9 is a side view of an opening/closing mechanism showing a state in which the rack gear and the pinion gear have meshed with each other.

Fig. 10A is a front view of a locking mechanism of which latch members are present at a locked position.

Fig. 10B is a front view of the locking mechanism of which the latch members are present at an unlocked position.

Fig. 11 is a perspective view of the locking mechanism of which the latch members are present at the locked position.

Fig. 12A is a longitudinal sectional view of the locking mechanism showing a state in which the front panel is closed and the latch members are present at the locked position by a longitudinal section taken along line XIIA-XIIA of Fig. 10A.

Fig. 12B is a longitudinal sectional view of the locking mechanism showing a state in which the front panel is opened and the latch members are present at the unlocked position by a longitudinal section taken along line XIIB-XIIB of Fig. 10B.

Fig. 13 is a side view of the air conditioner showing a state in which the front panel is opened and a support lever is bridged between.

Fig. 14A is a diagram showing another embodiment of the support lever and is a side view of the air conditioner showing a state in which the front panel is closed.

Fig. 14B is a diagram showing another embodiment of the support lever and is a side view of the air conditioner showing a state in which the front panel is opened and the support lever is bridged between.

Fig. 15 is a perspective view of the support lever shown in Figs. 14A and 14B.

Fig. 16 is an enlarged view of a portion XVI of Fig. 15.

Fig. 17 is a diagram viewed in the direction of an arrow XVII of Fig. 15.

Description of Embodiments

[0035] An embodiment of the invention will be described below with reference to the drawings.

[0036] Figs. 1 to 5 show an air conditioner according to an embodiment of the invention. The air conditioner 1 is installed indoors as an indoor unit of an air conditioning system that compresses a refrigerant to perform heating and cooling. The air conditioner 1 includes a rectangular body housing 2 that is molded with a resin, a front panel 3 that covers a front surface 2a of the body housing 2, and an openable/closable panel 4 that serves as an appearance design surface mounted on the front panel 3 to be capable of being opened and closed with respect to the front panel 3. The front panel 3 and the openable/closable panel 4 form a front panel assembly 5 (see also Figs. 6 and 7). The left and right side surfaces and the like of the body housing 2 are covered with decorative cover members (not shown), so that an appearance is formed.

[0037] A plurality of intake ports 7 and 8 are provided on the front surface 2a and an upper surface 2b of the body housing 2, and a blower fan 9, a heat exchanger (not shown), and the like are installed in the body housing 2 (see Fig. 2). A discharge outlet 11 is provided on a lower surface 2c of the body housing 2. At the time of the heating and cooling operation, room air is sucked through the intake ports 7 and 8 by the operation of the blower fan 9 and this air exchanges heat with a cooled or heated refrigerant by passing through the heat exchanger and is discharged to a room from the discharge outlet 11 as air-conditioned air for cooling or heating. The intake ports 7 and 8 are provided with filters (not shown) that collect dust from sucked air.

[0038] As shown in Figs. 2 to 4 and the like, the front panel 3 is provided on the front surface 2a of the body housing 2 to be capable of being opened and closed with respect to the front surface 2a of the body housing 2. That is, hinge portions 13 are provided at both end portions of the upper side of the front panel 3, and the front panel 3 can be opened up about the hinge portions 13 as an axis. As shown in Figs. 2, 6, and 7, a plurality of intake openings 15, which match the intake ports 7 of the body housing 2 in a case in which the front panel 3 is closed with respect to the front surface 2a of the body housing 2, are formed at the front panel 3.

[0039] In a case in which the front panel 3 is closed with respect to the front surface 2a of the body housing 2, latch hooks 16 (see Figs. 2, 3, and 5 to 7), which are provided near the left and right lower end portions of the front panel 3, are inserted into hook insertion holes 17 (see Fig. 2) formed at the front surface 2a of the body housing 2 and are engaged with receiving-side hooks 18 (see Fig. 3) that are molded with a resin in the hook insertion holes 17 and has a substantially U-shape in side view. Since the receiving-side hooks 18 are elastically deformed in a case in which the latch hooks 16 are engaged with the receiving-side hooks 18, the front panel 3 is closed with a click feeling. In a case in which the left and right lower end portions of the front panel 3 are pulled with a predetermined force, the engagement of the hooks 16 and 18 can be released and the front panel 3 can be opened.

[0040] The openable/closable panel 4 is operated to be opened and closed between a closed position 4A (see Figs. 2, 3, and 5) where the openable/closable panel 4 overlaps the front side of the front panel 3 and closes the intake openings 15 of the front panel 3 and an open position 4B (see Figs. 1 and 4) where the openable/closable panel 4 is opened forward so as to be tilted forward with respect to the front panel 3. Opening/closing mechanisms 20, which open and close the openable/closable panel 4 between the closed position 4A and the open position 4B, are provided at both side portions of the front panel 3 and the openable/closable panel 4.

[0041] As shown in Fig. 4 and 6 to 8, and the like, the opening/closing mechanisms 20 include slide rails 21 that are provided on both side portions of the front panel 3 and extend in a vertical direction, fixed pivot parts 22 that are provided above the slide rails 21, and sliders 23

are provided so as to be slidable along the slide rails 21. The slider 23 is provided with a movable pivot part 24, and a rack gear 25 is formed on the vertical side of the slider 23 facing the body housing 2.

[0042] The opening/closing mechanisms 20 include upper pivot parts 26 and lower pivot parts 27 that are provided on both side portions of the openable/closable panel 4, upper links 28, lower links 29, and intermediate links 31. The upper link 28 is connected to the fixed pivot part 22 and the upper pivot part 26, and the lower link 29 is connected between the movable pivot part 24 and the lower pivot part 27. The lower link 29 is shorter than the upper link 28. In addition, the intermediate link 31 is connected to an intermediate pivot part 30, which is provided at the intermediate portion of the upper link 28, and the movable pivot part 24.

[0043] Moreover, drive units 33, which drive the opening/closing mechanisms 20, are installed in the body housing 2. As shown in Fig. 4, each drive unit 33 includes a drive motor 34 that is fixed to the side surface of, for example, the body housing 2, a first gear 35 that is provided on the rotating shaft of the drive motor 34, a second gear 36 that meshes with the first gear 35, a third gear 37 that is integrally provided on the back surface of the second gear 36, and a pinion gear 38 that meshes with the third gear 37. The drive unit 33 may be replaced with a servo motor where the drive motor 34 and the respective gears 35 to 38 are integrated as a single body.

[0044] As shown in Figs. 3 and 4, the pinion gear 38 of the drive unit 33 is adapted to mesh with the rack gear 25 in a case in which the front panel 3 is closed with respect to the front surface 2a of the body housing 2. That is, in a case in which the front panel 3 is opened as shown in Fig. 5, the rack gear 25 is separated from the pinion gear 38 and the mesh of both the gears 25 and 38 is released.

[0045] At the time of the heating and cooling operation of the air conditioner 1 having this structure, the pinion gears 38 of the drive units 33 are rotated to push the sliders 23 up in a state in which the front panel 3 is closed with respect to the front surface 2a of the body housing 2. Accordingly, the intermediate links 31, which are connected to the movable pivot parts 24 of the sliders 23, push the intermediate portions of the upper links 28, which connect the fixed pivot parts 22 of the body housing 2 to the upper pivot parts 26 of the openable/closable panel 4, up.

[0046] For this reason, the upper links 28 are rotated up, so that the upper portion of the openable/closable panel 4 having been placed at the closed position 4A is separated from the front panel 3 and the entire openable/closable panel 4 is raised up. Since the openable/closable panel 4 is raised up, the lower links 29 are rotated up and the lower portion of the openable/closable panel 4 is separated from the front panel 3. Since the lower links 29 are shorter than the upper links 28, the openable/closable panel 4 is opened forward so as to be tilted forward with respect to the front panel 3. Accordingly, the openable/closable panel 4 is placed at the open position 4B.

[0047] According to this structure, since the length of the upper link 28 can be made longer than the length of the lower link 29, a large opening angle of the openable/closable panel 4 at the open position 4B can be taken. Accordingly, since a large amount of room air is sucked through the intake ports 7 provided on the front surface 2a of the body housing 2, the amount of sucked air is increased. As a result, heating and cooling efficiency can be improved. On the other hand, in a case in which the lower link 29 is set to the required minimum length, the lower end portion of the openable/closable panel 4 is not significantly away from the front surface 2a of the body housing 2 at the time of opening of the openable/closable panel 4. Accordingly, it is possible to prevent air-conditioned air, which is to be discharged from the discharge outlet 11, from being suddenly sucked to the intake ports. The opening/closing mechanisms 20 can be made to have a simple and light structure.

[0048] Since the front panel 3 forms the front panel assembly 5 together with the openable/closable panel 4 and the front panel assembly 5 is opened up with respect to the front surface 2a of the body housing 2 as shown in Figs. 2 and 5, maintenance work, such as the cleaning and attachment/detachment of the filters of the intake ports 7 provided on the front surface 2a of the body housing 2 and the washing of the heat exchanger, can be performed.

[0049] In the air conditioner 1, the drive units 33 for the opening/closing mechanisms 20 for the openable/closable panel 4 are installed in the body housing 2, and the pinion gears 38 of the drive units 33 are adapted to mesh with the rack gears 25 in a case in which the front panel 3 is closed with respect to the body housing 2.

[0050] For this reason, in a case in which the front panel 3 is opened up with respect to the front surface 2a of the body housing 2 together with the openable/closable panel 4 and the opening/closing mechanisms 20, the heavy drive units 33 remain in the body housing 2. Accordingly, the weight of the entire front panel 3 can be reduced, so that workability during maintenance work, which is to be performed in a state in which the front panel 3 is opened, can be improved.

[0051] As shown in Figs. 8 and 9, the slider 23 is relatively movable with respect to the movable pivot part 24 in a sliding direction thereof (a direction along the slide rail 21). For example, a rectangular sliding hole 41, which extends in the sliding direction, is perforated in the slider 23, and a sliding piece 42 is slidably fitted to the sliding hole 41 and is provided with the movable pivot part 24. Substantially V-shaped buffers (urging portions) 42a and 42b are formed at both end portions of the sliding piece 42 in the sliding direction, and the buffers 42a elastically hold center plates 41a and 41b that protrude from both end portions of the sliding hole 41 in the sliding direction and have rounded tip portions.

[0052] As shown in (A) of Fig. 9, the slider 23 is normally

urged by the urging action of the buffers 42a and 42b, which are provided at both end portions of the sliding piece 42, so as to be held at a neutral position C of a movement range thereof relative to the movable pivot part 24. Accordingly, in a case in which a relative force in the direction along the slide rail 21 is not applied between the slider 23 and the sliding piece 42, the position of the central portion of the sliding hole 41 in a longitudinal direction matches the position of the movable pivot part 24 of the sliding piece 42.

[0053] For example, in a case in which a force F for pushing the slider 23 down is applied, the slider 23 is moved down relative to the position of the sliding piece 42 (movable pivot part 24) (neutral position C) by L as shown in (B) of Fig. 9. In this case, the upper center plate 41a is caught between the upper buffers 42a of the sliding piece 42 and the upper buffers 42a are pushed and spread. In a case in which the force F is removed, the upper center plate 41a is pushed out by the elastic forces of the upper buffers 42a and the slider 23 returns to the neutral position C. On the contrary, in a case in which a force for pushing the slider 23 up is applied, the lower center plate 41b is caught between the lower buffers 42b and the same action is exhibited by the elastic forces of the lower buffers 42b.

[0054] According to this structure, in a case in which the front panel 3 is opened up with respect to the front surface 2a of the body housing 2 and is closed again, the positions of the teeth of the rack gear 25 are made to match the positions of the teeth of the pinion gear 38 by the movement of the rack gear 25 of the slider 23 relative to the movable pivot part 24 in the sliding direction even though the positions of the teeth of the rack gear 25 of the slider 23 deviate from the positions of the teeth of the pinion gear 38 of the drive unit 33 (a synchronization action is exhibited).

[0055] For this reason, since the rack gear 25 and the pinion gear 38 are made to reliably mesh with each other in a case in which the front panel 3 is to be closed, the front panel 3 can be smoothly closed and workability during maintenance work, which is to be performed in a state in which the front panel 3 is opened, can be improved.

[0056] Locking mechanisms 46 shown in Figs. 7, 10A to 12B, and the like are provided between the front panel 3 and the openable/closable panel 4. Each locking mechanism 46 is a mechanism that locks an operation for opening/closing the openable/closable panel 4 with respect to the front panel 3 in a case in which the front panel 3 is opened with respect to the front surface 2a of the body housing 2.

[0057] Each locking mechanism 46 includes a hook through-hole 47 that is perforated in the front panel 3, an annular hook 48 (see also Fig. 4) that protrudes from the rear surface of the openable/closable panel 4 and is to be inserted into the hook through-hole 47 in a case in which the openable/closable panel 4 is placed at the closed position 4A, a pair of left and right latch members 50 that is disposed on the rear surface of the front panel 3, and a pair of left and right release protrusions 52 (see also Fig. 5) that protrudes from the front surface 2a of the body housing 2.

[0058] As shown in Figs. 7 and 10A to 12B, each latch member 50 is a substantially cross-shaped small component molded with a resin, and is fitted to a slide guide 51 formed on the rear surface of the front panel 3 and can slide in a vertical direction. A pair of left and right leaf spring portions 50a, which horizontally protrudes, is formed on each latch member 50, and tips of the pair of left and right leaf spring portions 50a are in contact with inclined surfaces 53a of a pair of stoppers 53 formed on both sides of the slide guide 51. The inclined surfaces 53a of both the stoppers 53 face each other, and approach each other toward the lower side.

[0059] As shown in Figs. 10A, 11, and 12A, each latch member 50 can slide between a locked position 50A where a tip portion 50b of the latch member 50 protrudes so as to overlap the hook through-hole 47 and a position where the tip portion 50b does not overlap the hook through-hole 47 as shown in Figs. 10B and 12B, that is, an unlocked position 50B that is present below the locked position 50A. At the locked position 50A, the leaf spring portions 50a extend linearly without being deformed and tips of the leaf spring portions 50a are in slight contact with the inclined surfaces 53a of the stoppers 53. At the unlocked position 50B, the leaf spring portions 50a are elastically deformed upward and the tips of the leaf spring portions 50a are in pressure contact with the inclined surfaces 53a of the stoppers 53. The latch member 50 is normally urged toward the locked position 50A by the urging force of the leaf spring portions 50a and the inclined surfaces 53a of the stoppers 53. That is, in a case in which the latch member 50 is pushed down to the unlocked position 50B from the locked position 50A, the leaf spring portions 50a are elastically deformed and the latch member 50 is returned to the locked position 50A by the reaction force of the leaf spring portions 50a.

[0060] A swash plate cam 50c is formed on the back surface of the latch member 50. The inclined surface of the swash plate cam 50c ascends toward the unlocked position 50B (lower side) from the locked position 50A of the latch member 50 (upper side). The sliding direction of the latch member 50 may not necessarily be a vertical direction unlike in this embodiment, and may be a horizontal direction or another direction.

[0061] In a case in which the openable/closable panel 4 is placed at the closed position 4A, the front panel 3 is opened with respect to the front surface 2a of the body housing 2, and a gap S between the front panel 3 and the front surface 2a of the body housing 2 is increased as shown in Fig. 12A, each of the pair of left and right release protrusions 52 protruding from the front surface 2a of the body housing 2 does not press the swash plate cam 50c of the latch member 50. For this reason, since each latch member 50 is placed at the locked position 50A by the urging force of the leaf spring portions 50a and the tip portion 50b of each latch member 50 overlaps

the hook through-hole 47, the tip portion 50b is inserted into an annular hole of the annular hook 48 inserted into the hook through-hole 47 (see also Fig. 10A). Accordingly, the annular hook 48 is not separated from the hook through-hole 47, so that the openable/closable panel 4 is locked at the closed position 4A and cannot be moved to the open position 4B.

[0062] In a case in which the openable/closable panel 4 is placed at the closed position 4A, the front panel 3 is closed with respect to the front surface 2a of the body housing 2, and a gap between the front panel 3 and the front surface 2a of the body housing 2 is reduced to Sa from S as shown in Fig. 12B, each of the release protrusions 52 protruding from the front surface 2a of the body housing 2 comes into contact with the swash plate cam 50c of the latch member 50 and presses the swash plate cam 50c. For this reason, since each latch member 50 is made to slide toward the unlocked position 50B by a distance H with a thrust force, which is generated by the swash plate cam 50c, and the tip portion 50b of each latch member 50 does not overlap the hook through-hole 47, the tip portion 50b is separated from the annular hole of the annular hook 48 (see also Fig. 10B). Accordingly, the annular hook 48 can be separated from the hook through-hole 47, so that the openable/closable panel 4 can be moved to the open position 4B from the closed position 4A.

[0063] Since the locking mechanisms 46 having this structure are provided, an operation for opening/closing the openable/closable panel 4 with respect to the front panel 3 is locked by the action of the locking mechanisms 46 in a state in which the front panel 3 is opened with respect to the front surface 2a of the body housing 2. For this reason, the openable/closable panel 4 is not moved alone with respect to the front panel 3, and workability during maintenance work, which is to be performed in a state in which the front panel 3 (front panel assembly 5) is opened, can be improved. Moreover, the locking mechanism 46 can be made to have a very simple and light structure.

[0064] As shown in Figs. 2, 5, and 13, a support lever 57 is provided on the front surface 2a of the body housing 2. Since the support lever 57 is provided so as to rotate up and down about a hinge portion 58 as an axis, the support lever 57 is placed at a position where the support lever 57 hangs down in a case in which the front panel 3 (front panel assembly 5) is closed (see Figs. 2 and 5) .

[0065] In a case in which the front panel 3 is opened with respect to the front surface 2a of the body housing 2, the support lever 57 is rotated up as shown in Fig. 13 and the tip of the support lever 57 is latched on a latch protrusion 59 (see also Figs. 7, 10A, and 10B) formed on the rear surface of the front panel 3. Accordingly, since the support lever 57 is bridged between the front surface 2a of the body housing 2 and the front panel 3, the front panel 3 is held in a state in which the front panel 3 (front panel assembly 5) is opened.

[0066] Since the support lever 57 is provided, the front panel 3 can be held in an open state. Accordingly, workability during maintenance work, which is to be performed in a state in which the front panel 3 (front panel assembly 5) is opened, can be significantly improved. Since the support lever 57 is stored along the front surface 2a of the body housing 2 in a case in which the support lever 57 is not in use, the support lever 57 can also be stored in a narrow space between the front surface 2a of the body housing 2 and the front panel 3. Accordingly, the support lever 57 does not occupy a large space.

[0067] Figs. 14A to 17 show another embodiment of the support lever. Since a support lever 61 is provided on the front surface 2a of the body housing 2 so as to be freely rotatable about a hinge portion 62 as in the case of the above-mentioned support lever 57, the support lever 61 is stored along the front surface 2a of the body housing 2 in a posture where the support lever 61 faces up as shown in Fig. 14A in a case in which the support lever 61 is not in use. Since a drawing hook 63 is provided on the rear surface of the front panel 3, the drawing hook 63 is latched on an upper end portion of the support lever 61 in a case in which the front panel 3 is closed.

[0068] In a case in which the front panel 3 is opened with respect to the front surface 2a of the body housing 2 as shown in Fig. 14B, the support lever 61 is drawn to a functional position where the support lever 61 is tilted forward by the drawing hook 63 provided on the rear surface of the front panel 3. Since rotation-regulating protrusions 64 are provided at the base end portion of the support lever 61 as shown in Figs. 15 and 16, the support lever 61 is held at a predetermined angle. Since the support lever 61 is bridged between the front surface 2a of the body housing 2 and the front panel 3, the front panel 3 can be held in an open state.

[0069] In a case in which the front panel 3 is closed, the support lever 61 is pushed by the rear surface of the front panel 3 and is returned to a storage position where the support lever 61 is stored along the front surface 2a of the body housing 2. Positioning protrusions 65, which protrude laterally, are provided on both sides of the base end portion of the support lever 61 as shown in Figs. 15 and 17, and the positioning protrusions 65 are fitted to positioning recessed portions 66 formed at the hinge portion 62 in a case in which the support lever 61 is placed at the storage position. Accordingly, the support lever 61 is held at the storage position. For this reason, the natural rotation of the support lever 61 to the functional position or the generation of the abnormal noise, which is caused by resonance during the heating and cooling operation, is prevented.

[0070] According to the above-mentioned structure, since the drawing hook 63 provided on the rear surface of the front panel 3 draws the support lever 61 to the functional position in a case in which the front panel 3 is opened, worker's efforts to draw the support lever 61 can be reduced. Accordingly, the workability of maintenance can be improved.

[0071] According to the air conditioner 1 of this embod-

iment, as described above, the openable/closable panel 4 provided on the front surface is opened so as to be tilted forward, the opening/closing mechanisms 20 for the openable/closable panel 4 can be made to have a simple and light structure, an opening angle of the upper portion of the openable/closable panel 4 can be made large to allow the amount of sucked air to increase, and workability during maintenance work, which is to be performed in a state in which the openable/closable panel 4 and the front panel 3 are opened, can be improved.

[0072] The invention is not limited to only the structure of the embodiment and can be appropriately modified or improved, and embodiments, which have been modified or improved in this way, are also included in the scope of the right of the invention.

[0073] For example, the position of each pivot part, the length and shape of each link, and the like of the opening/closing mechanism 20 are not necessarily limited to those of the embodiment. The drive units 33 have only to be installed in the body housing 2, and the structure and the like of the drive unit 33 may be modified.

Reference Signs List

[0074]

1: air conditioner
2: body housing
2a: front surface of body housing
3: front panel
4: openable/closable panel
4A: closed position of openable/closable panel
4B: open position of openable/closable panel
13: hinge portion
15: intake opening
20: opening/closing mechanism
21: slide rail
22: fixed pivot part
23: slider
24: movable pivot part
25: rack gear
26: upper pivot part
27: lower pivot part
28: upper link
29: lower link
30: intermediate pivot part
31: intermediate link
33: drive unit
38: pinion gear
42a, 42b: buffer (urging portion)
46: locking mechanism
47: hook through-hole
48: annular hook
50: latch member
50A: locked position of latch member
50B: unlocked position of latch member
50b: tip portion of latch member
50c: swash plate cam
52: release protrusion
57: support lever
61: support lever
63: drawing hook
C: neutral position

Claims

1. An air conditioner comprising:

a front panel that covers a front surface of a body housing and is openably and closably provided so as to be opened up about a hinge portion provided at an upper side of the front panel as an axis;
an openable/closable panel that is mounted on the front panel to be capable of being opened and closed with respect to the front panel; and
opening/closing mechanisms that open and close the openable/closable panel between a closed position where the openable/closable panel closes an intake opening of the front panel and an open position where the openable/closable panel is opened forward so as to be tilted forward with respect to the front panel,
wherein the opening/closing mechanisms include

slide rails that are provided on both side portions of the front panel and extend in a vertical direction,
fixed pivot parts that are provided above the slide rails,
sliders that are provided so as to be slidable along the slide rails and include movable pivot parts and rack gears,
upper pivot parts and lower pivot parts that are provided on both side portions of the openable/closable panel,
upper links that connect the fixed pivot parts to the upper pivot parts,
lower links that connect the movable pivot parts to the lower pivot parts and are shorter than the upper links,
intermediate links that connect the intermediate pivot parts, which are provided at intermediate portions of the upper links, to the movable pivot parts, and
drive units that include pinion gears meshing with the rack gears of the sliders.

2. The air conditioner according to Claim 1,
wherein the drive units are installed in the body housing, and the pinion gears of the drive units mesh with the rack gears in a case in which the front panel is closed with respect to the body housing.

3. The air conditioner according to Claim 2, wherein each slider is relatively movable with respect to the movable pivot part in a sliding direction of the slider, and is urged to a neutral position of a movement range thereof relative to the movable pivot part by an urging portion.

4. The air conditioner according to any one of Claims 1 to 3, further comprising:
locking mechanisms that lock an operation for opening/closing the openable/closable panel with respect to the front panel in a case in which the front panel is opened with respect to the front surface of the body housing.

5. The air conditioner according to Claim 4, wherein each of the locking mechanism includes

a hook through-hole that is perforated in the front panel,
an annular hook that protrudes from a rear surface of the openable/closable panel and is to be inserted into the hook through-hole in a case in which the openable/closable panel is placed at the closed position,
a latch member that is provided on a rear surface of the front panel, slides between a locked position where a tip portion of the latch member protrudes so as to overlap the hook through-hole and an unlocked position where the tip portion does not overlap the hook through-hole, includes a swash plate cam formed on a back surface thereof, and is normally urged toward the locked position, and
a release protrusion that protrudes from the front surface of the body housing, and comes into contact with the swash plate cam of the latch member to allow the latch member to slide toward the unlocked position in a case in which the front panel is closed with respect to the front surface of the body housing.

6. The air conditioner according to any one of Claims 1 to 5, further comprising:
a support lever that is rotatably provided on the front surface of the body housing and is bridged between the front panel and the front surface of the body housing to hold the front panel in an open state in a case in which the front panel is opened with respect to the front surface of the body housing.

7. The air conditioner according to Claim 6, wherein a drawing hook, which draws the support lever to a functional position in a case in which the front panel is opened with respect to the front surface of the body housing, is provided on the rear surface of the front panel.

FIG. 1

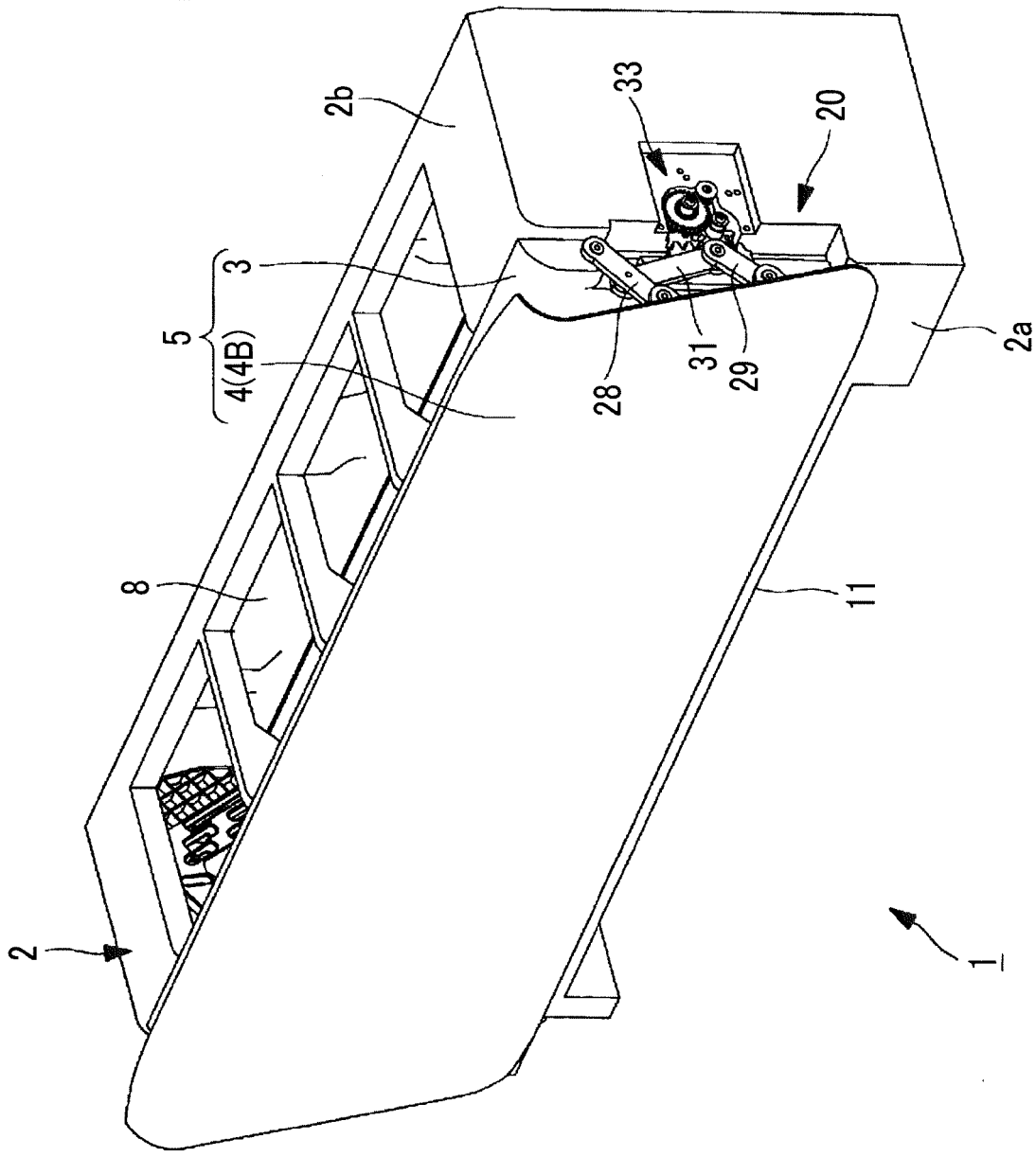

FIG. 2

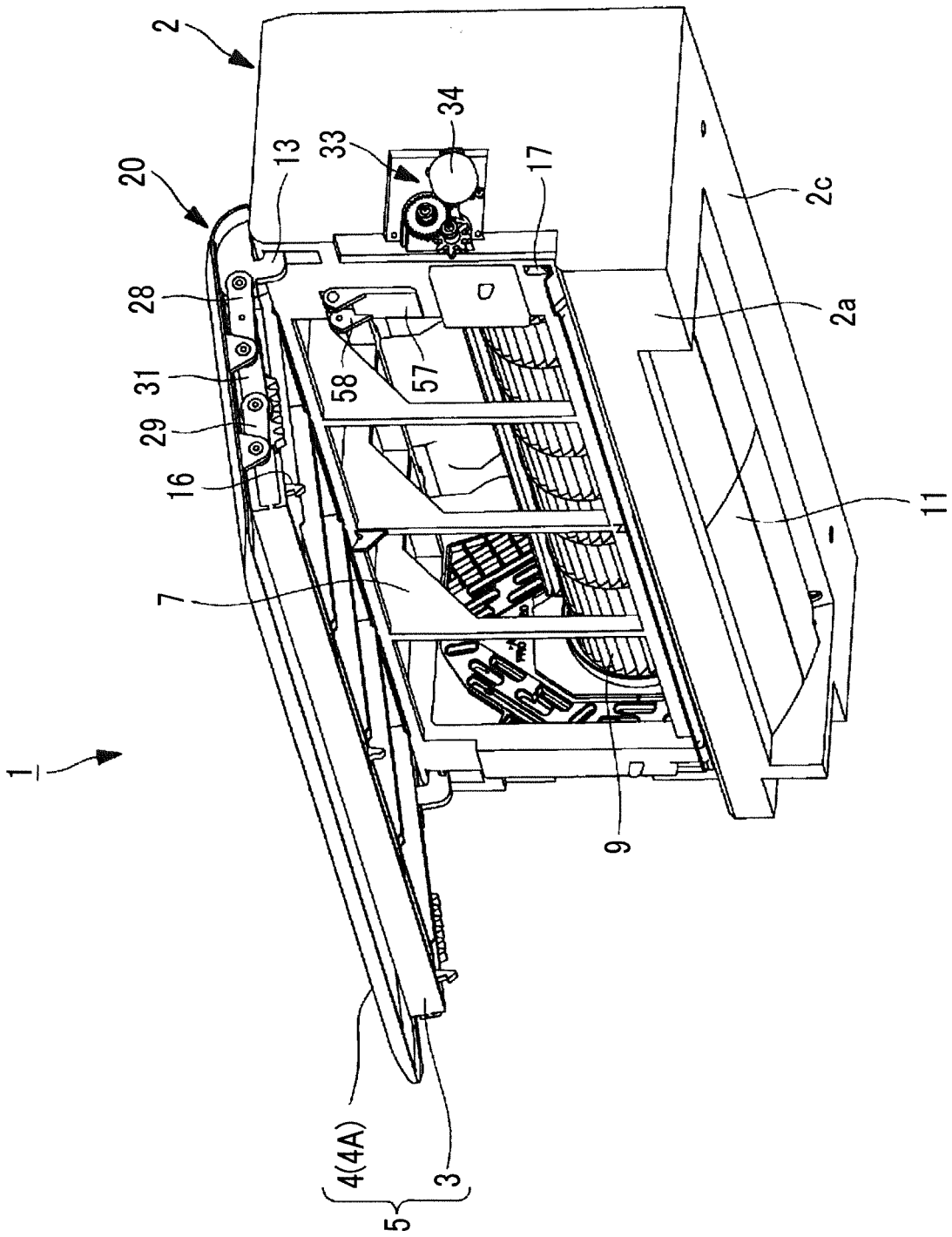

FIG. 3

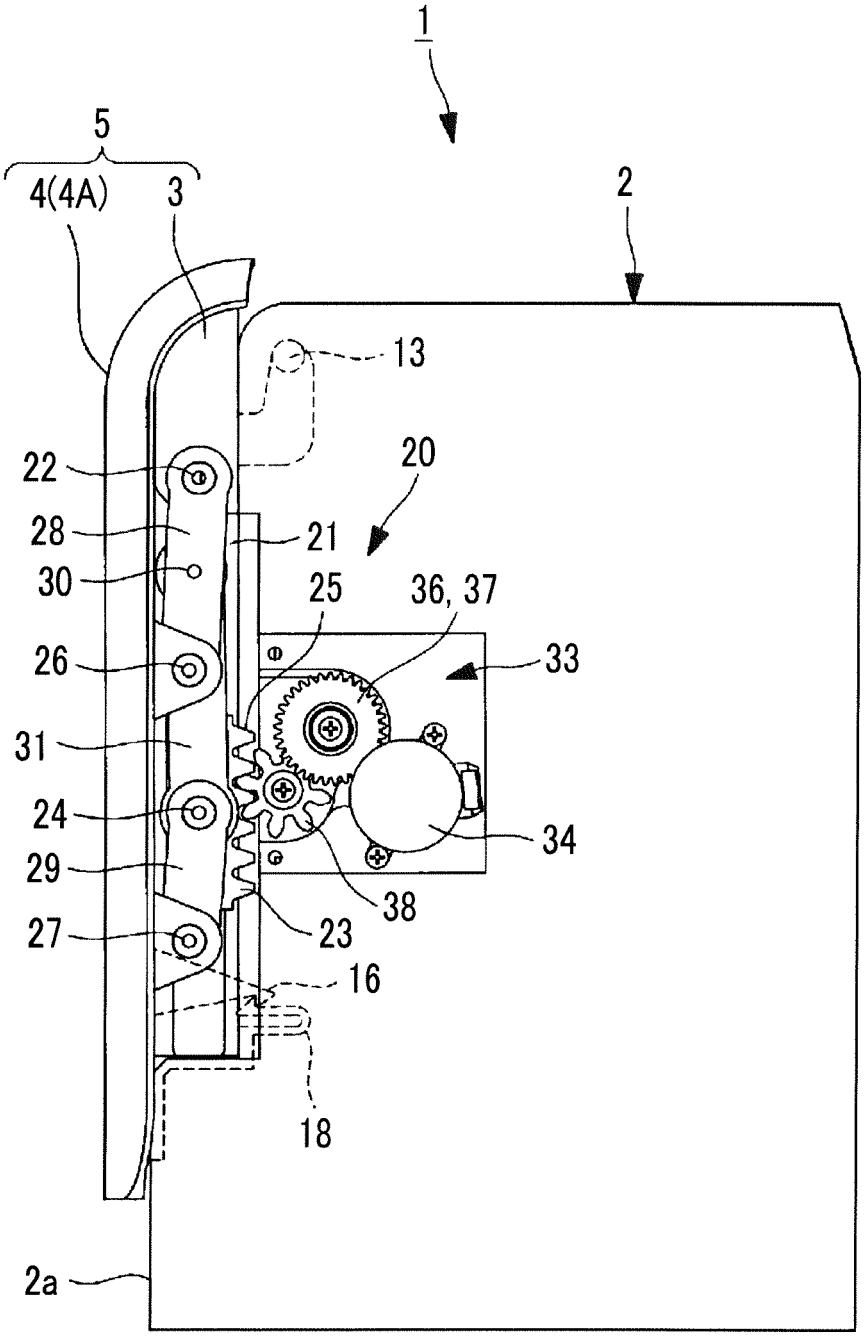

FIG. 4

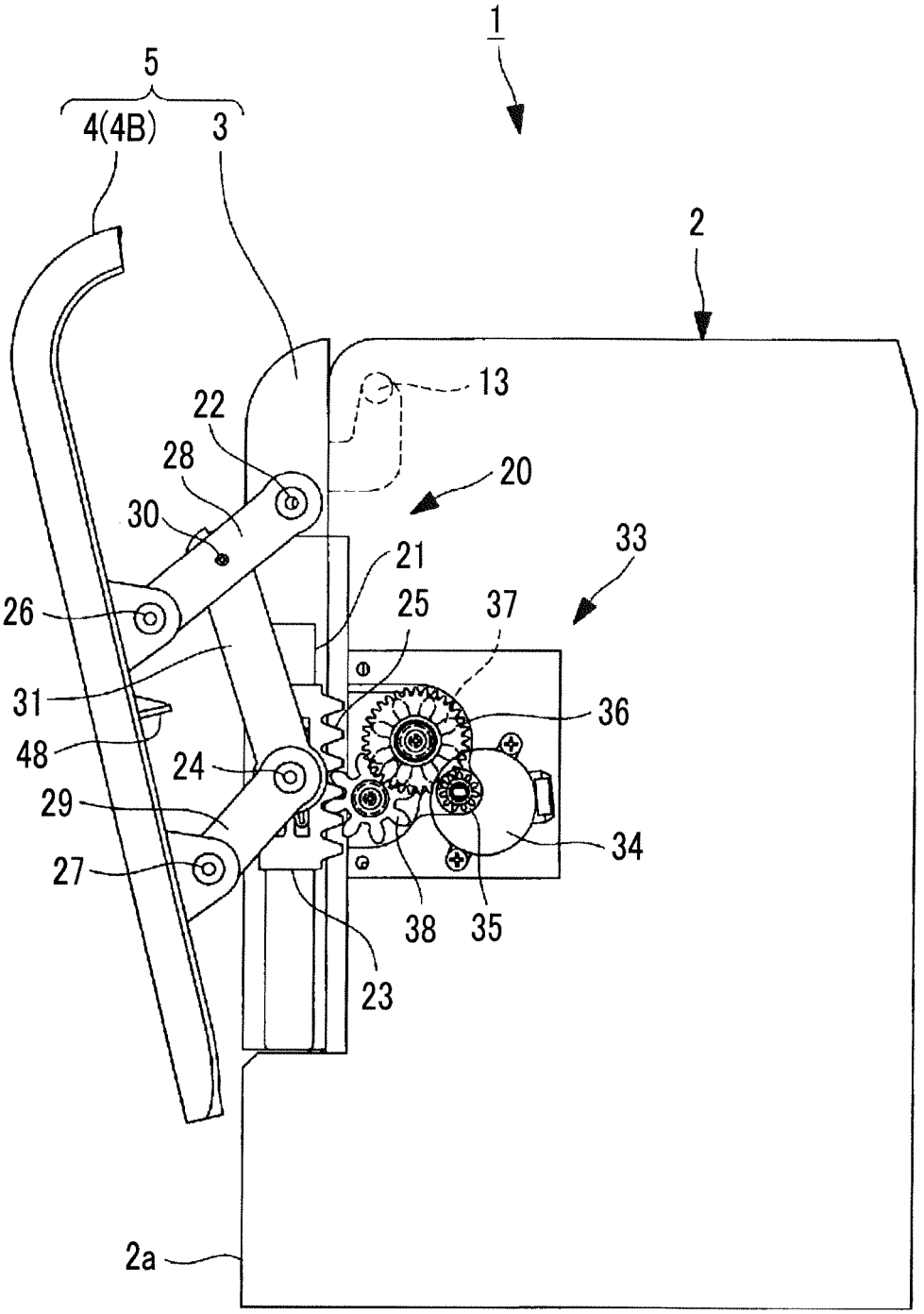

FIG. 5

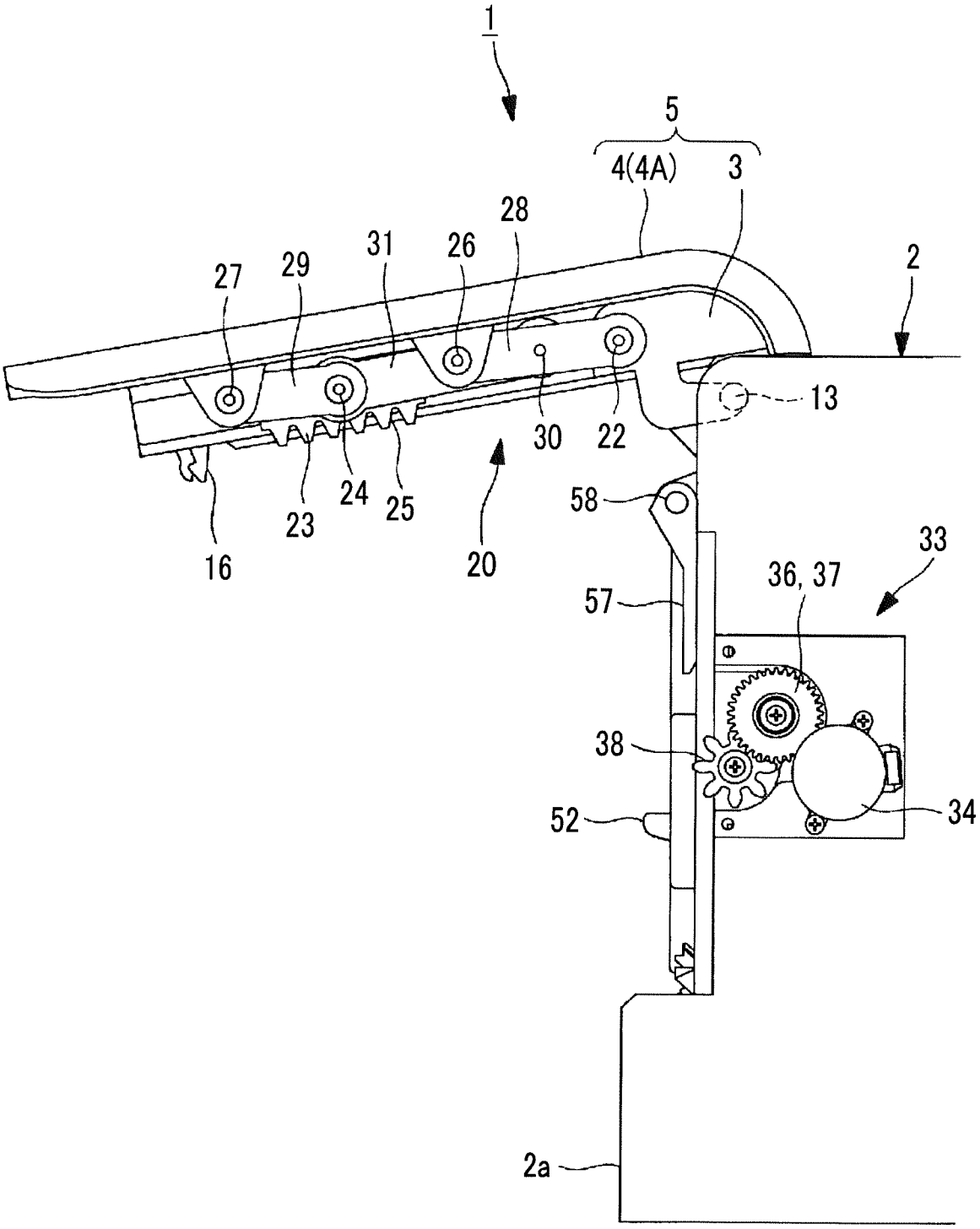
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FIG. 6

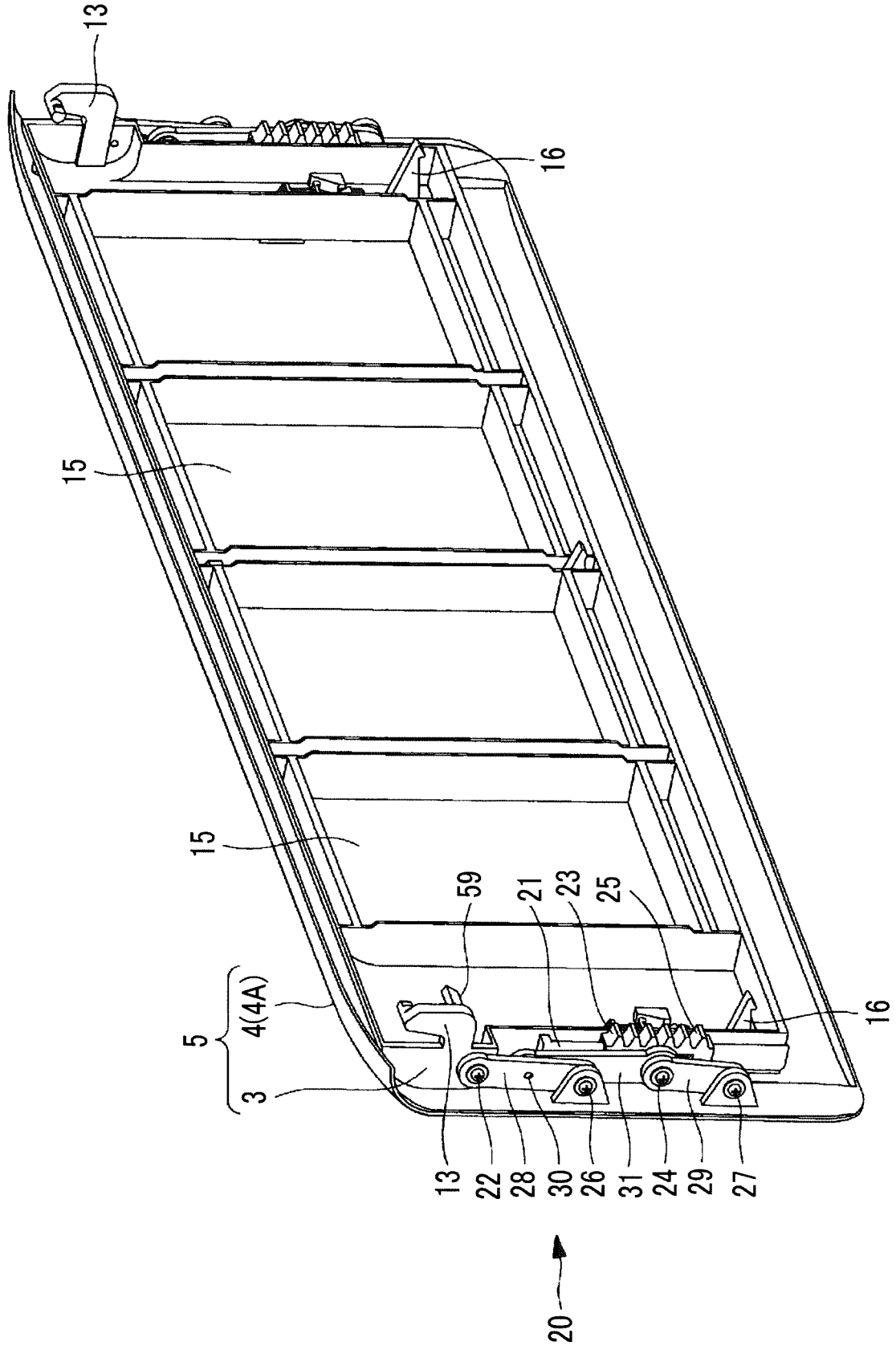
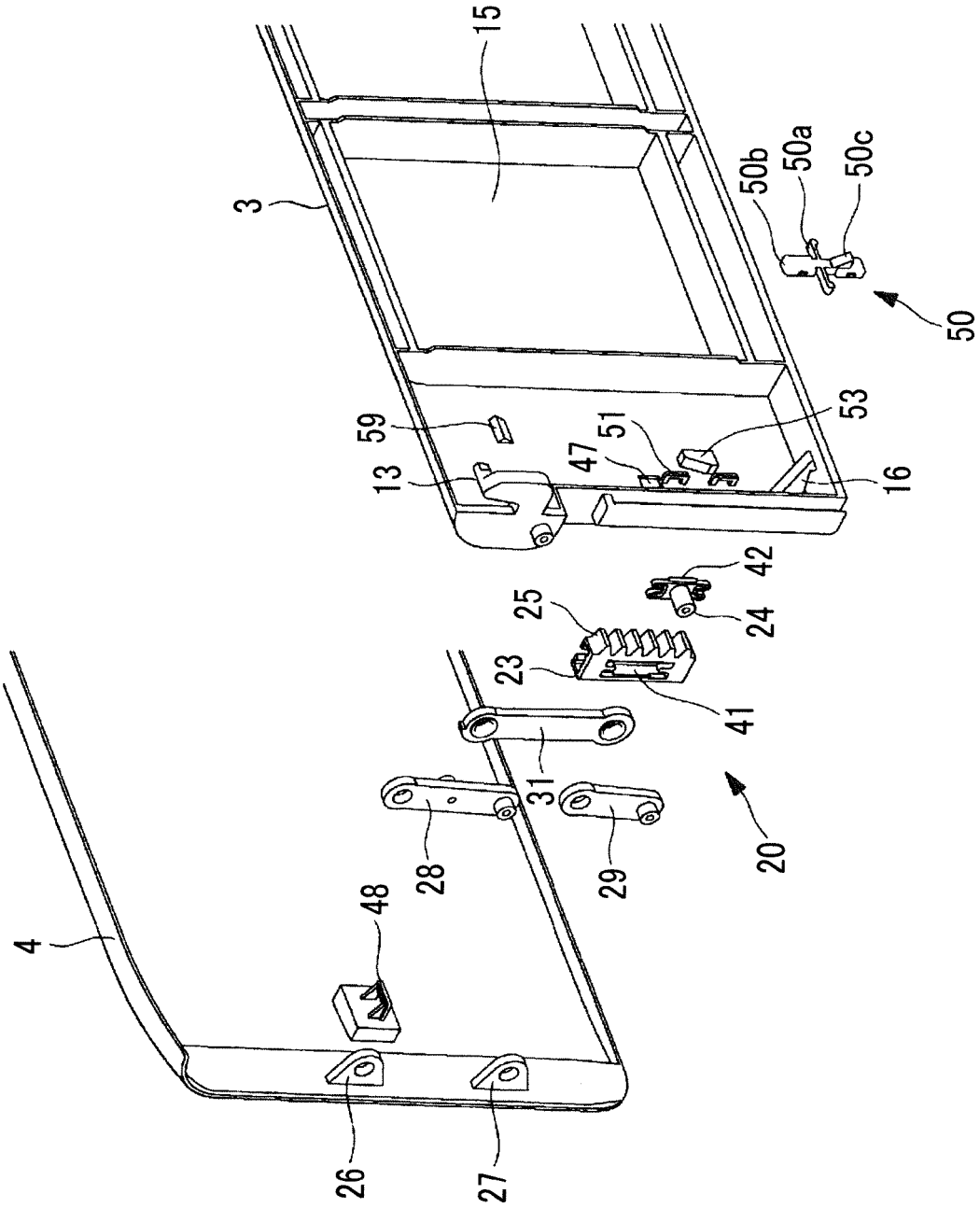


FIG. 7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50c
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FIG. 8

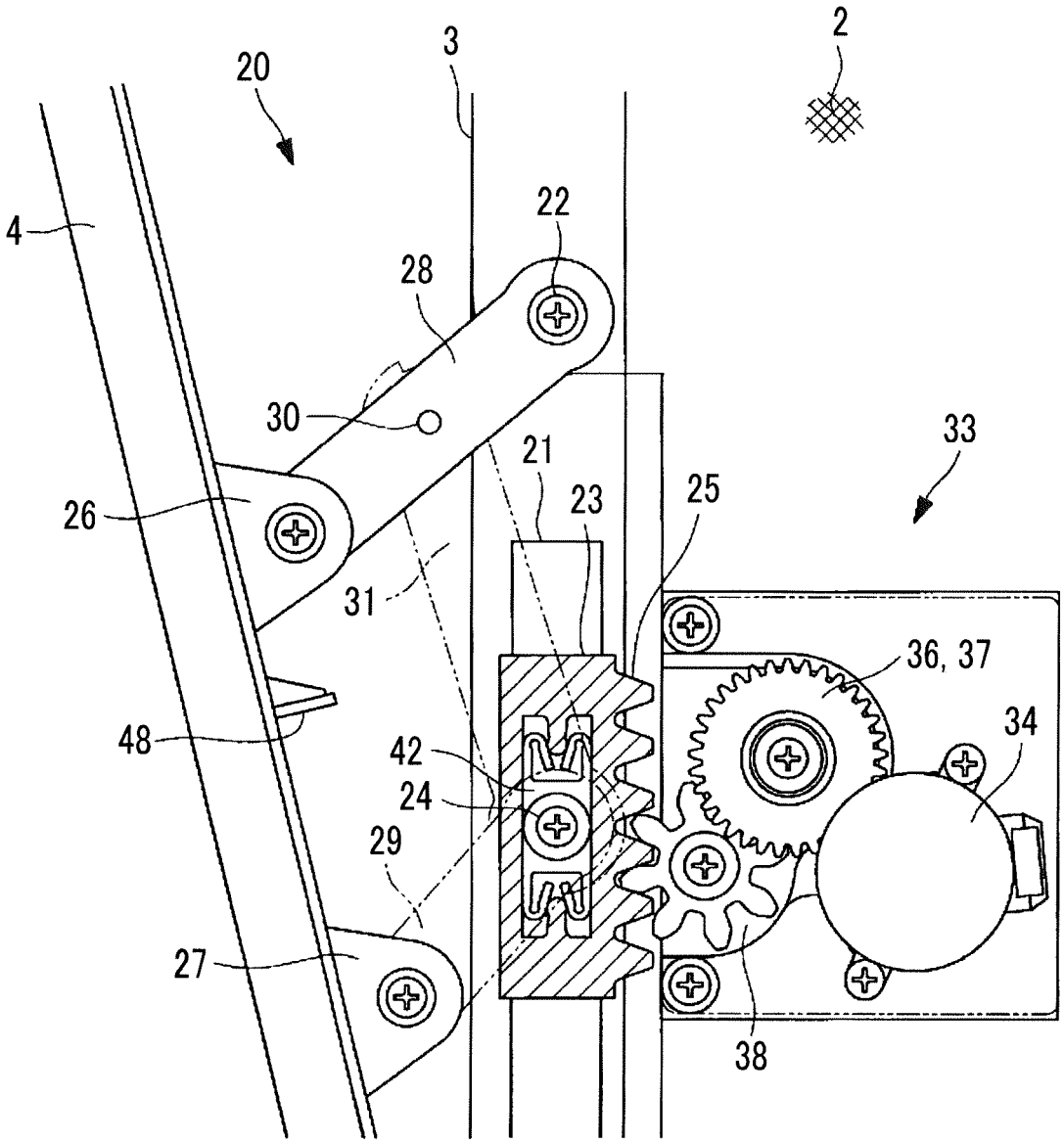


FIG. 9

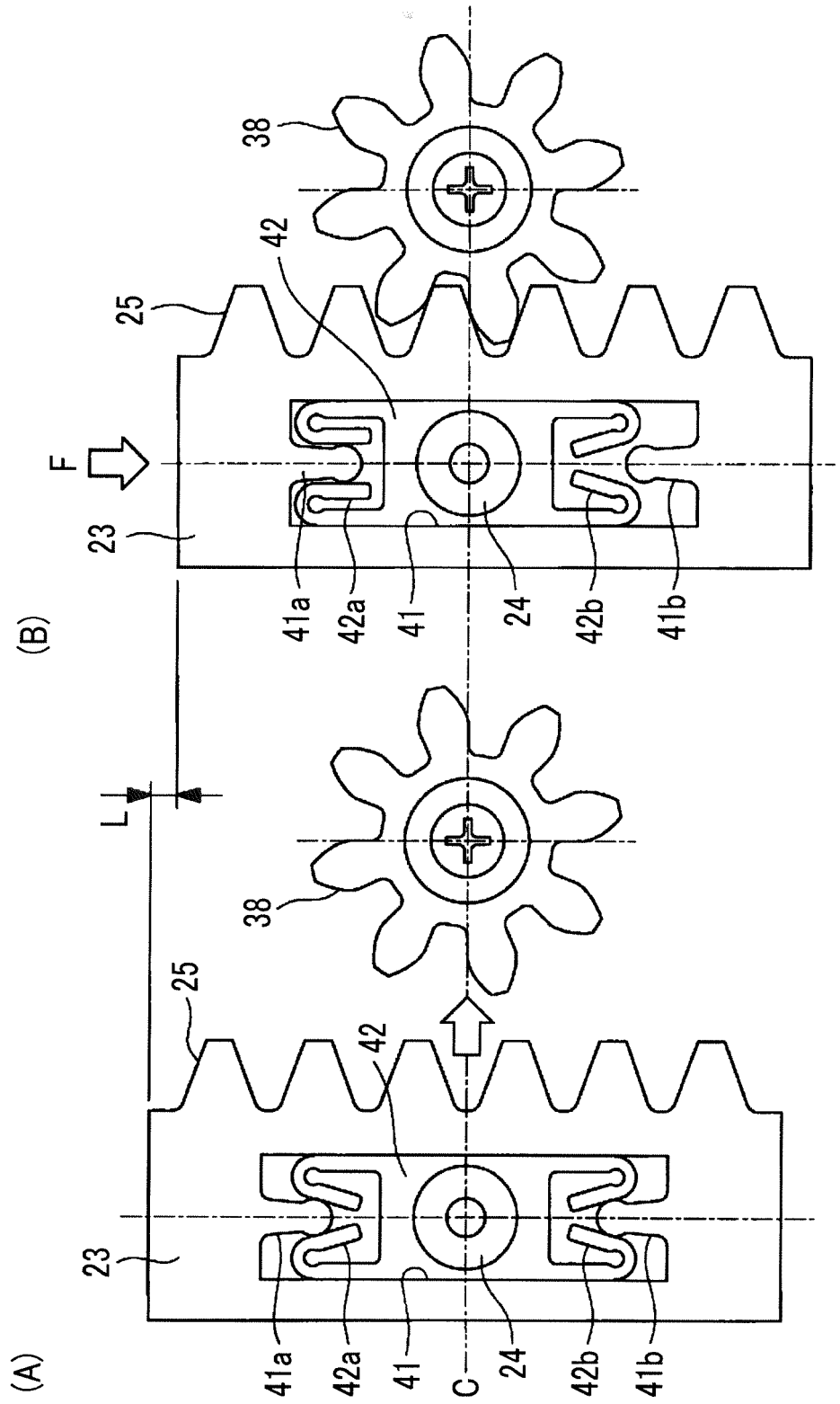
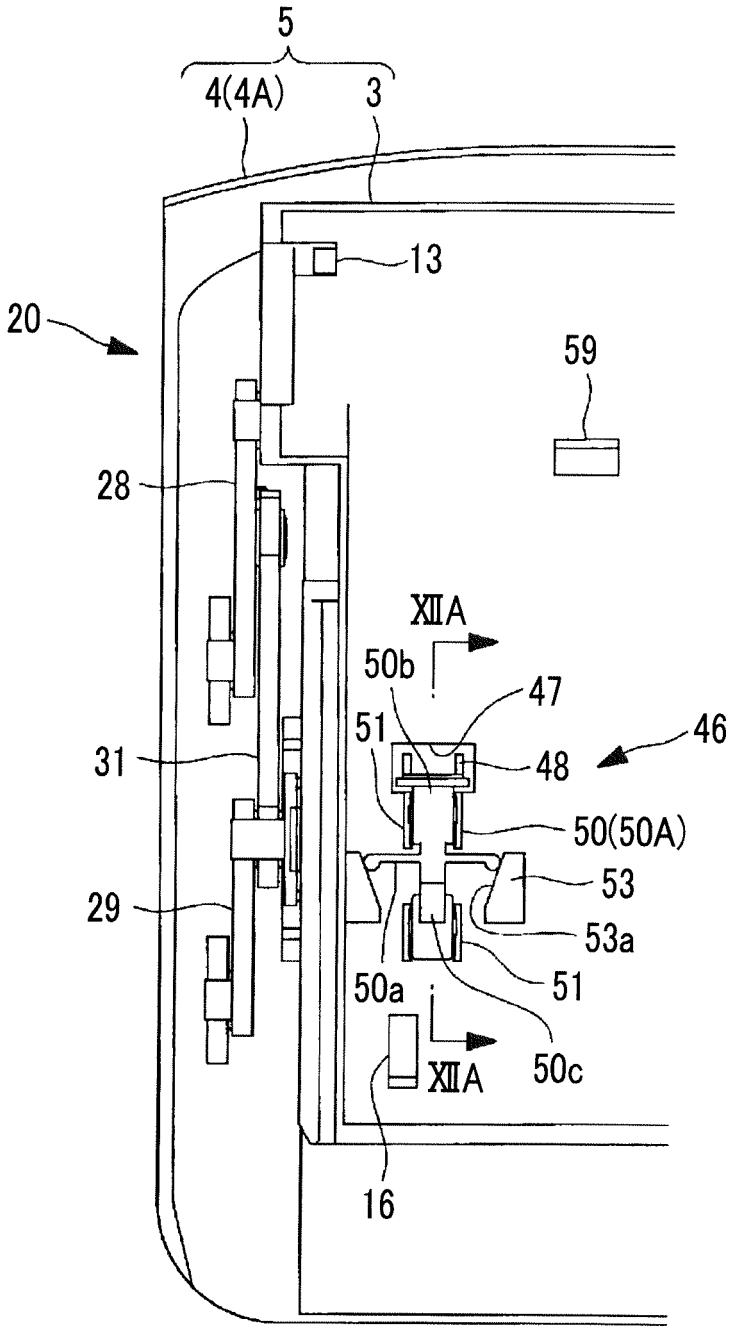


FIG. 10A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53a
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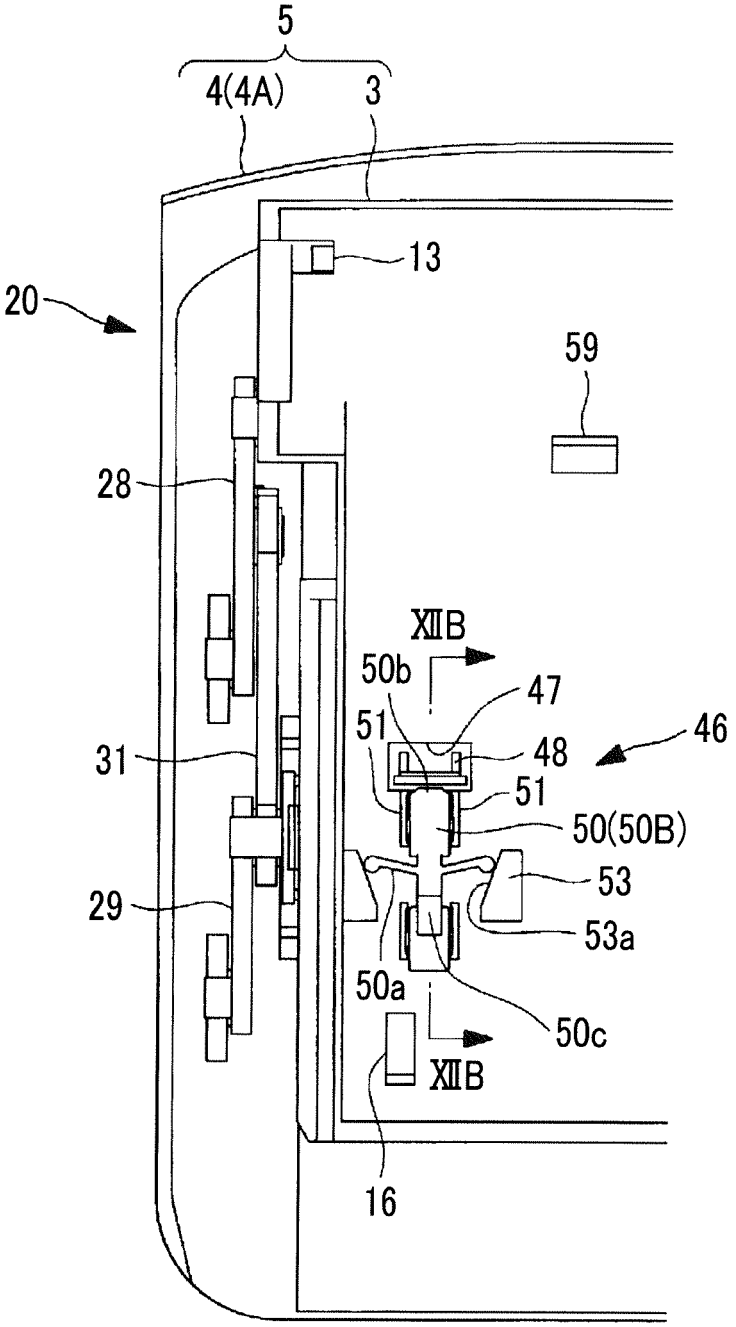
50a
XIIA
50c
16

FIG. 10B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50c
XIIB
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FIG. 11

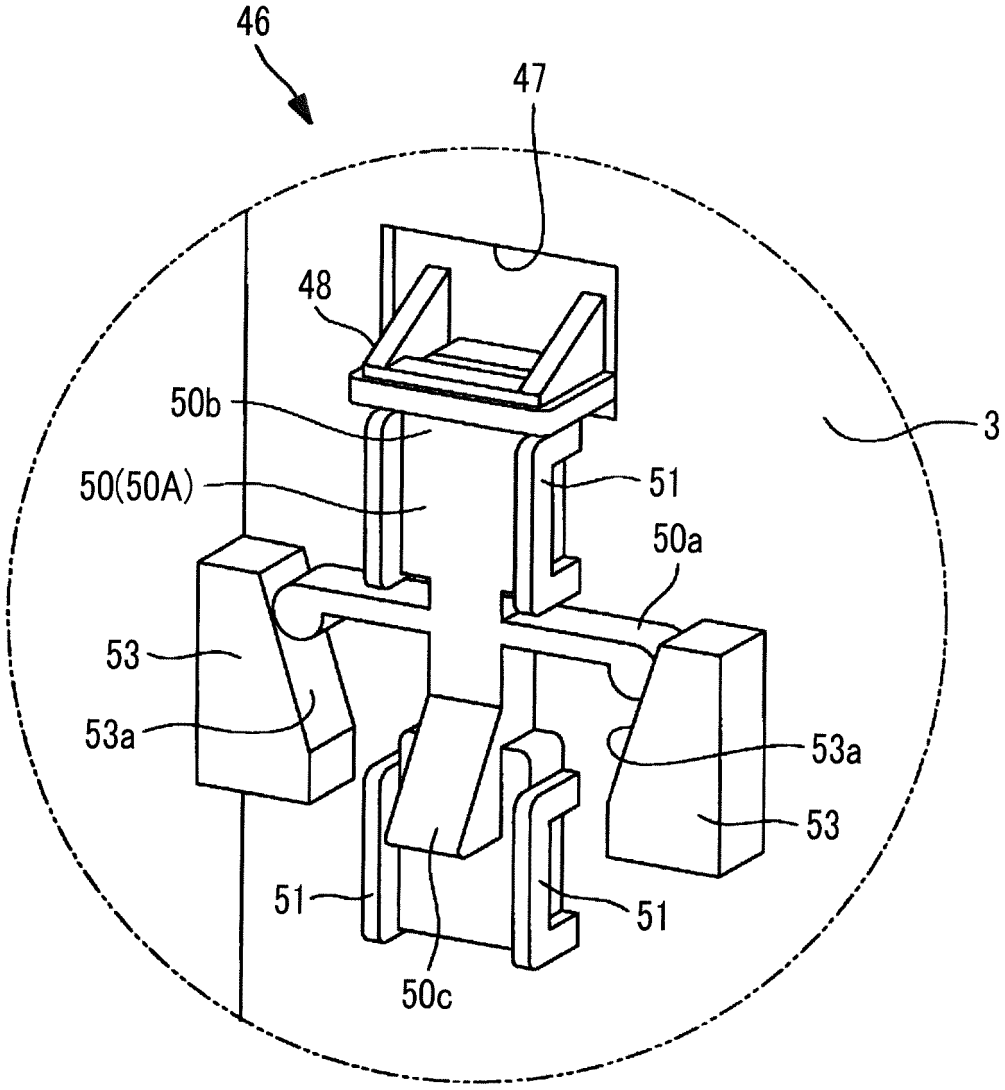


FIG. 12A

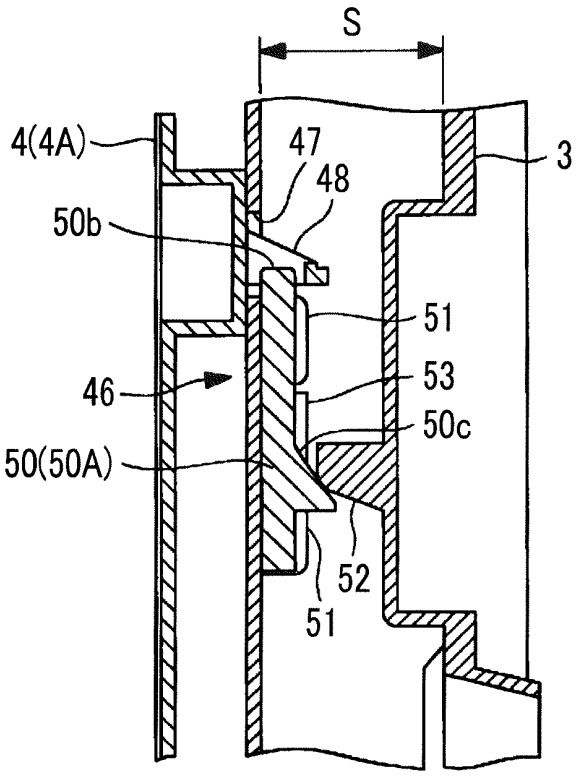


FIG. 12B

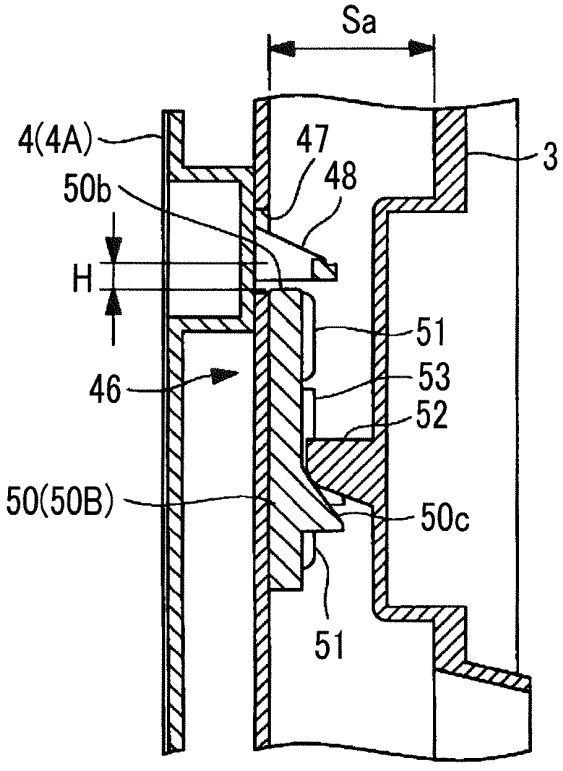


FIG. 13

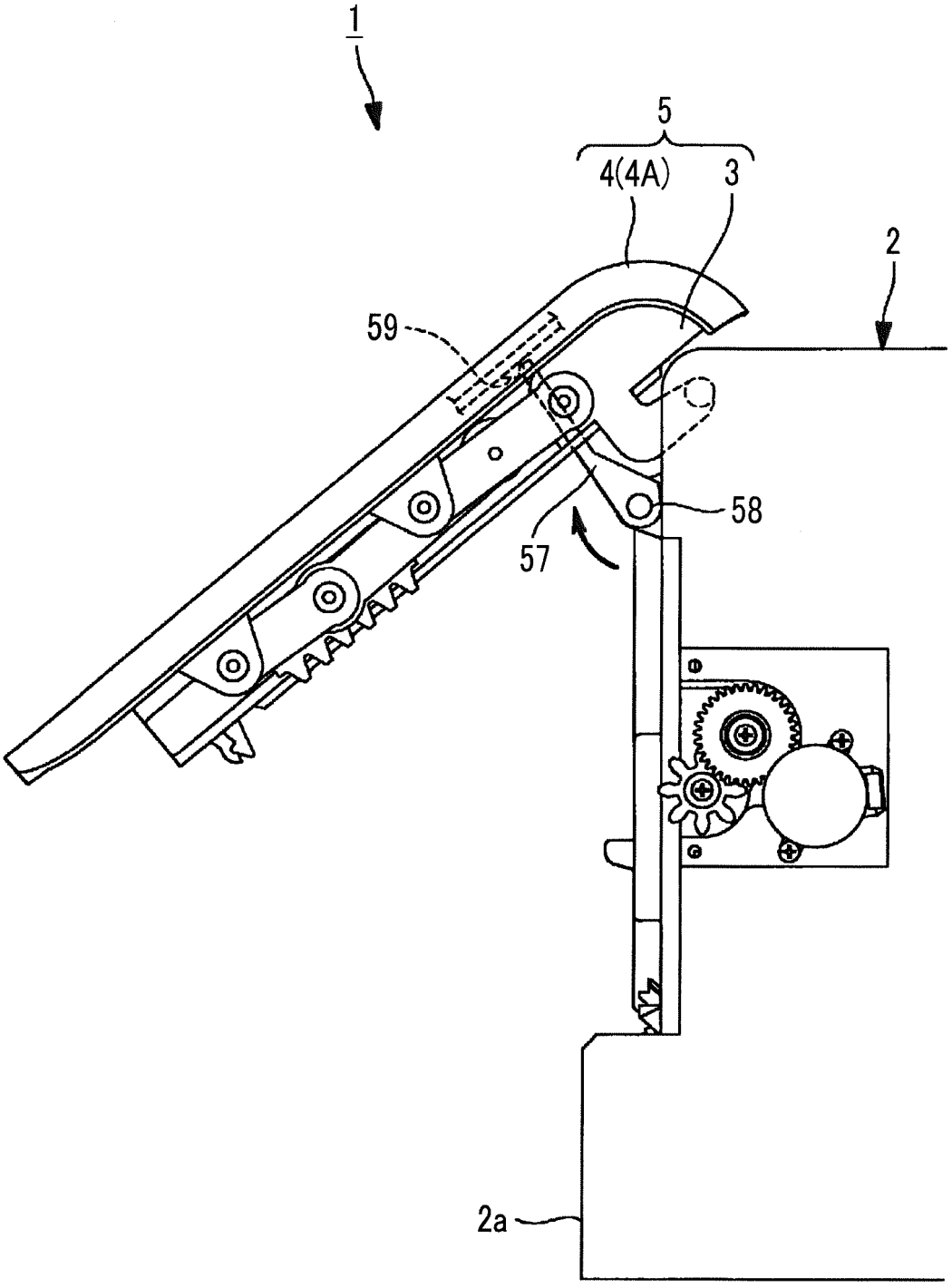


FIG. 14A

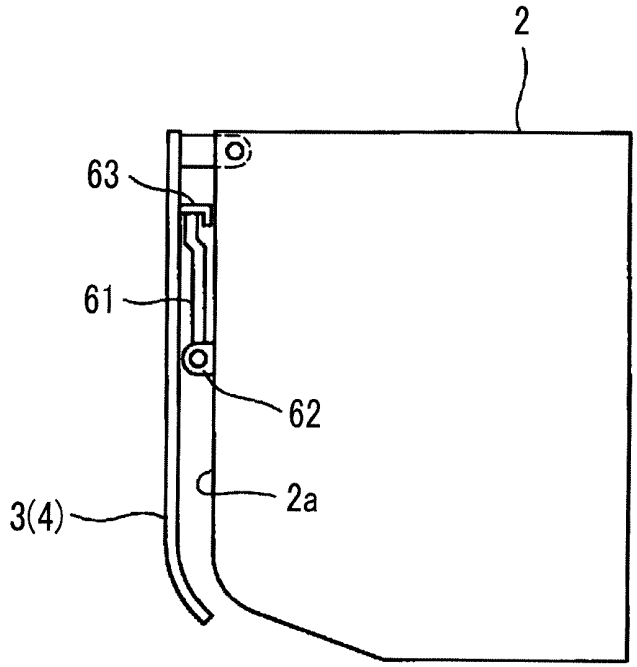


FIG. 14B

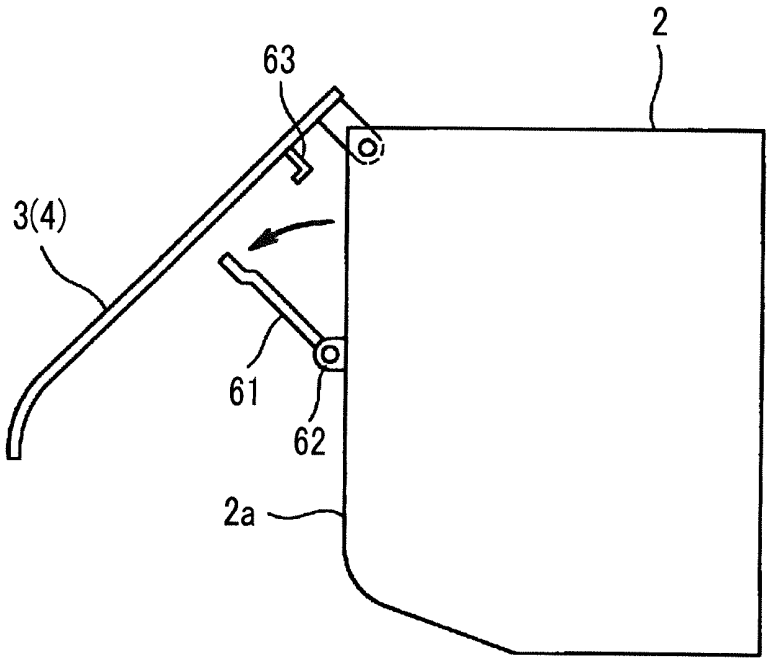


FIG. 15

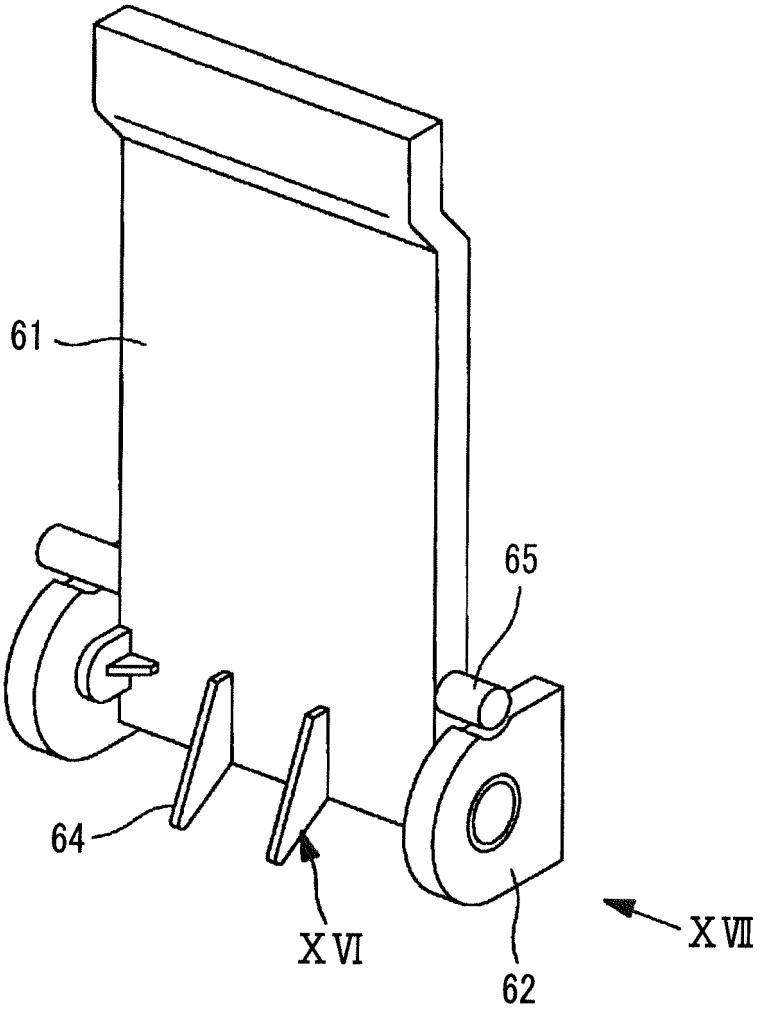


FIG. 16

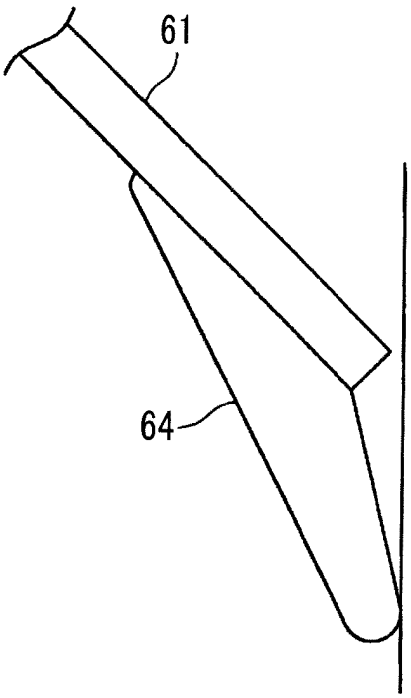
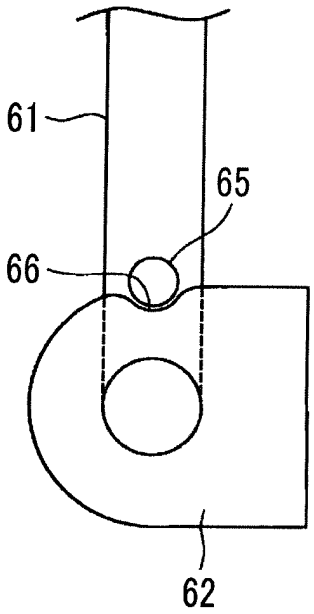


FIG. 17



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2017/005017

A. CLASSIFICATION OF SUBJECT MATTER
F24F13/20(2006.01)i, *F24F13/14*(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)
F24F13/20, F24F13/14

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 2010-32179 A (Panasonic Corp.), 12 February 2010 (12.02.2010), paragraphs [0002] to [0046]; fig. 1 to 19 (Family: none)	1-7
A	JP 2008-267777 A (Samsung Electronics Co., Ltd.), 06 November 2008 (06.11.2008), paragraphs [0001] to [0025]; fig. 1 to 4 & CN 101290156 A	1-7
A	EP 2383401 A2 (GLAZING VISION LTD.), 02 November 2011 (02.11.2011), paragraphs [0017] to [0027]; fig. 1 to 7 (Family: none)	1

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

* Special categories of cited documents:
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"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 March 2017 (30.03.17)	11 April 2017 (11.04.17)
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/JP2017/005017

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1837607 A2 (LG ELECTRONICS INC.), 26 September 2007 (26.09.2007), paragraphs [0002] to [0126]; fig. 1 to 15 & WO 2007/108584 A1 & KR 10-2007-0095140 A & CN 101042253 A	1
A	JP 2013-122326 A (Fujitsu General Ltd.), 20 June 2013 (20.06.2013), paragraphs [0001] to [0041]; fig. 1 to 4 (Family: none)	1-7
A	EP 2184551 A2 (LG ELECTRONICS INC.), 12 May 2010 (12.05.2010), paragraphs [0001] to [0047]; fig. 1 to 7 & KR 10-2010-0051956 A & CN 101737864 A & ES 2388316 T	1-7
A	CN 100587344 C (HAIXIN (SHANDONG) AIR CONDITIONER CO., LTD.), 03 February 2010 (03.02.2010), page 4, line 1 to page 8, line 20; fig. 1 to 3 (Family: none)	1-7

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2013122326 A **[0007]**