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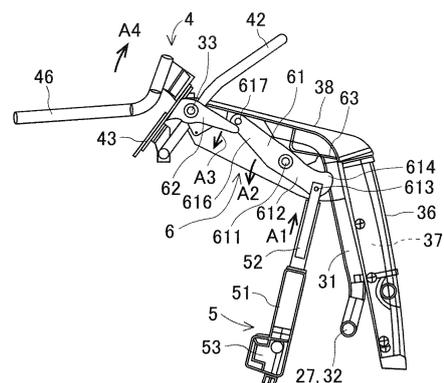
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(54) **ASSISTIVE DEVICE**

(57) An assistive device configured to assist in boarding a care receiver onto the assistive device, the assistive device comprising: a base; an arm, provided on the base, swingable in a front-rear direction; a support section, supporting a part of a body of the care receiver and provided on the arm, swingable in a front-rear direction; an actuator having a main body section provided on the base and tiltable in a front-rear direction and a movable section configured to extend and retract from the main body section; and a linking mechanism having a first linking member swingably provided on the arm and connected to the movable section, and a second linking member fixed to the support section and engaged with the first linking member; wherein the linking mechanism transfers a first motion, in which the movable section is extended from a shortened position to a predetermined intermediate position, to a forward swinging motion of the support section; and transfers a second motion, in which the movable section is extended from the intermediate position to a fully-extended position, to a forward swinging motion of the arm.

Fig. 5



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## Description

### Technical Field

**[0001]** The present specification relates to an assistive device configured to assist in transferring a care receiver.

### Background Art

**[0002]** The need for assisting devices has increased with the aging of society. Assistive devices are generally driven by an actuator to move a support section supporting a part of the care receiver's body. The introduction of assistive devices reduces the physical burden on caregivers and care receivers, thereby mitigating shortages in caregiver staff. As an example of an assistive device, there is a device configured to assist in transferring a care receiver from a sitting posture. Examples of techniques relating to this type of assistive device are disclosed in Patent Literature 1 and 2.

**[0003]** The body transferring device of Patent Literature 1 includes a traveling section equipped with wheels, a support section positioned above the traveling section to support the care receiver, and a driving section to drive the support section in the height direction. Further, the arc-shaped swinging operation of the support section is performed by driving by a driving section equivalent to an actuator. With this, the caregiver can easily and quickly transfer the care receiver while preventing injury to the caregiver's back.

**[0004]** Further, the assisting robot of Patent Literature 2 includes a lifting and lowering section that moves in an up-down direction with respect to a base, an arm that is swingably provided in the lifting and lowering section, and a support section that is provided at the distal end of the arm. The lifting and lowering section and the arm are driven by separate actuators to perform a two-stage operation. With this, the lifting and lowering section and the arm can be operated in coordination with each other, and discomfort to the care receiver can be suppressed.

### Patent Literature

#### [0005]

Patent Literature 1: JP-A-2016-165313

Patent Literature 2: WO 2017/060964

### Summary of the Invention

#### Technical Problem

**[0006]** In Patent Literature 1, since the support section only swings in an arc, it is not always possible for the care receiver to use it comfortably. On the other hand, in Patent Literature 2, since the lifting and lowering section and the arm are independently operated with the use of two actuators, transferring the care receiver becomes

smooth and more comfortable. However, the use of two actuators leads to increased costs.

**[0007]** It is an object of the present specification to solve the problem of providing an assistive device in which multiple members are operated by using one actuator to make using the device more comfortable for the care receiver.

#### Solution to Problem

**[0008]** The present specification discloses an assistive device configured to assist in transferring a care receiver, the assistive device comprising: a base; an arm, being provided on the base, swingable in a front-rear direction; a support section, supporting a part of a body of the care receiver, which is provided on the arm to be swingable in a front-rear direction; an actuator having a main body section, which is provided on the base and tiltable in a front-rear direction, and a movable section configured to extend and retract from the main body section; and a linking mechanism having a first linking member, which is swingably provided on the arm and connected to the movable section, and a second linking member, which is fixed to the support section and engaged with the first linking member; wherein the linking mechanism transfers a first motion, in which the movable section is extended from a shortened position to a predetermined intermediate position, to a forward swinging motion of the support section; and transfers a second motion, in which the movable section is extended from the intermediate position to a fully-extended position, to a forward swinging motion of the arm.

#### Advantageous Effect of the Invention

**[0009]** With the assistive device disclosed in this specification, a single actuator can be used to drive the forward swinging of the support section and the forward swinging of the arm. As a result, transferring the care receiver becomes smooth and more comfortable for the care receiver. Also, the cost is low compared to the prior art using two actuators.

#### Brief Description of Drawings

##### [0010]

[Fig. 1] A perspective view of an assistive device of an embodiment as viewed obliquely from the rear.

[Fig. 2] A side cross-sectional view of the assistive device showing an initial state when assisting in transferring a care receiver.

[Fig. 3] A side cross-sectional view of the assistive device showing an intermediate state when assisting in transferring the care receiver.

[Fig. 4] A side cross-sectional view of the assistive device showing a final state when assisting in transferring the care receiver.

[Fig. 5] A partial enlarged view of the assistive device in the initial state, showing a configuration and operation of the linking mechanism.

[Fig. 6] A partial enlarged view of the assistive device in the intermediate state, showing a configuration and operation of the linking mechanism.

[Fig. 7] A partial enlarged view of the assistive device in the initial state, showing a configuration of an arm restricting mechanism.

[Fig. 8] A partial enlarged view of the assistive device in the intermediate state, showing a configuration and operation of the arm restricting mechanism.

[Fig. 9] A perspective view of an upper portion of the arm from above at an oblique angle.

[Fig. 10] A side cross-sectional view showing an unexpected swinging motion of the arm with the movable section in an intermediate position.

## Description of Embodiments

### 1. Configuration of assistive device 1 of the embodiment

**[0011]** Assistive device 1 of the embodiment will be described with reference to Figs. 1 to 10. Fig. 1 is a perspective view of assistive device 1 of the embodiment as viewed obliquely from the rear. Fig. 2 is a side cross-sectional view of assistive device 1 showing an initial state when assisting in transferring care receiver M. Fig. 3 is a side cross-sectional view of assistive device 1 showing an intermediate state when assisting in transferring care receiver M. Fig. 4 is a side cross-sectional view of assistive device 1 showing a final state when assisting in transferring care receiver M.

**[0012]** Assistive device 1 assists in transferring care receiver M between two different places, for example, between a bed and a wheelchair or between a wheelchair and a toilet seat. Assistive device 1 supports the trunk of care receiver M and assists in transferring of care receiver M from a sitting posture to an in-transit posture, and in seating of care receiver M from the in-transit posture to the sitting posture. Here, the in-transit posture is a posture in which the buttocks are separated from the seat surface and includes a standing posture and a stooping posture. That is, the in-transit posture includes a state in which the upper body stands upright, a state in which the upper body is bent forward, and the like. Further, in cases where the two places between which transferring takes place are separated from each other, assistive device 1 can transfer care receiver M in the in-transit posture.

**[0013]** Assistive device 1 includes base 2, arm 3, support section 4, actuator 5, linking mechanism 6, arm restricting mechanism 7, a control section (not shown), and the like. Base 2 is has foot mount 21, rear wheels 23, base rods 24, lower leg contact 25, mounting plates 26, front wheels 28, and the like. Foot mount 21 is disposed in a substantially horizontal manner in the vicinity of floor F. Actuator bearing section 22 protrudes upward at the front of the upper face of foot mount 21. A pair of left and

right rear wheels 23 are provided on the left and right at the rear of foot mount 21.

**[0014]** The pair of left and right base rods 24 are provided so as to face forward from the left and right sides of the front face of foot mount 21. Base rods 24 are bent upward from the front and then extend backward in a slightly inclined manner. Lower leg contact 25 is provided on the upper portion of the two base rods 24 so as to face rearward. Lower leg contact 25 is positioned above the front side of foot mount 21. Lower leg contact 25 is made of a cushion material and designed to come in contact with the lower leg vicinity of care receiver M.

**[0015]** The pair of right and left mounting plates 26 are fixed at positions slightly upward along the bent portions which bend upward from the front of each base rod 24 and are each disposed facing each other. Mounting plates 26 extend forward from base rod 24. Arm support fitting 27 is provided at the upper portions of the pair of right and left mounting plates 26. The pair of left and right front wheels 28 are provided at the lower front portion of the pair of left and right mounting plates 26. Steering functions of front wheels 28 and rear wheels 23 allow assistive device 1 to not only move straight and turn but also move sideways and spin in place. Further, front wheels 28 have a locking function for restricting movement.

**[0016]** Arm 3 is made of rod-shaped member 31, front cover 36, upper cover 38, various structural materials (not shown), and the like. Rod-shaped member 31 is a substantially U-shaped rod-shaped member having an opening at the bottom. Both sides of lower end 32 of rod-shaped member 31 are swingably supported by arm support fitting 27 of mounting plates 26. As a result, arm 3 can swing in the front-rear direction with respect to base 2.

**[0017]** In order to restrict the swing angle of arm 3, a stopper mechanism (not shown) is provided in the vicinity of arm support fitting 27. Rod-shaped member 31 extends upward from the left and right lower ends 32, bends rearward and upward in at an intermediate point, and merges with the upper portion toward the rear. The overall shape of arm 3 includes arm front section 34 extending upward from arm support fitting 27, and arm upper section 35, connected to arm front section 34, extending obliquely upward toward the rear.

**[0018]** Front cover member 36 constitutes arm front section 34. Front cover member 36 is disposed in front of rod-shaped member 31 with a space therebetween. Front cover member 36 is formed by folding both side surfaces toward the rear, thereby defining an interior cavity. Battery 37 is accommodated in the interior cavity of front cover member 36. Battery 37 serves as a power source for actuator 5 and the control section.

**[0019]** Upper cover member 38 is formed so as to be continuous with front cover member 36 and constitutes arm upper section 35. Upper cover member 38 is disposed close to the upper side of rod-shaped member 31. Upper cover member 38 is formed by folding both side

surfaces downward, thereby defining an interior cavity. Arm restricting mechanism 7, linking mechanism 6, and support section mounting fitting 33 are provided in that order from the front lower side to the rear upper side in the interior cavity of upper cover member 38. In Fig. 1, upper cover member 38 is not shown.

**[0020]** Support section 4 has trunk support section 41 and a pair of right and left underarm support sections 45. Trunk support section 41 is swingably supported by support section mounting fitting 33 of arm upper section 35. As a result, support section 4 can swing in the front-rear direction with respect to arm 3. Trunk support section 41 has handle 42. Handle 42 has a substantially rectangular frame shape. Handle 42 is a part grasped by care receiver M and is also a part grasped by the caregiver to move assistive device 1.

**[0021]** Trunk support section 41 consists of base plate 43 (see Fig. 5), trunk contact member 44, and the like. Base plate 43 consists of a highly rigid base plate material of metal or resin and is formed in a substantially rectangular shape. Base plate 43 is provided with handle 42, a part to be attached to support section attachment fitting 33 and second link member 62, which will be described later.

**[0022]** Trunk contact member 44, made of a flexible material, is larger than base plate 43 and is attached to the upper face of base plate 43. Trunk contact member 44 may have, for example, a two-layer structure including an outer layer and a base layer. An example of an outer layer material is polyurethane foam having low resilience, and an example of a base layer material is polyurethane foam having low combustibility. Trunk support section 41 supports the area from the chest to the abdomen of the trunk which is a part of the body of care receiver M.

**[0023]** The pair of right and left underarm support sections 45 are attached to the right and left chest areas of trunk support section 41. Underarm support sections 45 each have an L-shape that bends at an obtuse angle. Each underarm support section 45 has core member 46 (see Fig. 5), outer peripheral member 47, and the like. Core member 46 is formed, for example, by bending a circular rod or pipe, made of metal or hard resin, into an L-shape.

**[0024]** Outer peripheral member 47, made of a cushion material, has a cylindrical shape and covers the outer periphery of core member 46. The short linear portion from the proximal attachment end to the bending point of underarm support section 45 becomes the shoulder receiving portion, and the long linear portion from the bending point to the distal end is the underarm inserting portion. The shoulder receiving portion supports the front surface of the shoulder of care receiver M. The underarm inserting portions of the pair of underarm support sections 45 are each inserted into both sides of the trunk of care receiver M. Trunk support section 41 and underarm support sections 45 may be provided with a detachable cover made of cloth or leather.

**[0025]** Actuator 5 includes main body section 51, mov-

able section 52, motor 53, and the like. Main body section 51 is tiltably supported by actuator support section 22 of base 2. As a result, actuator 5 tilts in the front-rear direction. Movable section 52 expands and contracts from main body section 51. More specifically, movable section 52 extends from the shortened position to the fully-extended position through a predetermined intermediate position, and contracts in the opposite direction. The first operation consists of movable section 52 extending from the shortened position to the intermediate position, and the second operation consists of movable section 52 extending from the intermediate position to the fully-extended position.

**[0026]** For example, the stroke length of the first operation can be 30 mm, and the stroke length of the second operation can be 60 mm. The distal end of movable section 52 is connected to connecting pin 613 of linking mechanism 6, which will be described later. Motor 53 is provided in main body section 51. Motor 53 is controlled in the direction of the current flowing by the control section (not shown in the drawings) so as to drive the expanding and contracting operation of movable section 52. Instead of motor 53, another type of driving source, such as a pressure driving source using oil pressure or air pressure, can be used.

**[0027]** Linking mechanism 6 includes first linking member 61, second linking member 62, restricting member 63, and the like. Fig. 5 is a partial enlarged view of assistive device 1 in an initial state, showing a configuration and operation of linking mechanism 6. Fig. 6 is a partial enlarged view of assistive device 1 in an intermediate state, showing a configuration and operation of linking mechanism 6.

**[0028]** First linking member 61 is an elongated member having support point 611, forearm section 612, and posterior arm section 616. Support point 611 is disposed near the center of arm upper section 35. Support point 611 is supported by a structural member of arm 3 so as to be swingable. As a result, first linking member 61 swings about support point 611.

**[0029]** Forearm section 612 extends forward from support point 611. Connecting pin 613 is provided at a lower portion near the front of forearm section 612. Connecting pin 613 connects forearm section 612 and the distal end of movable section 52. Restricting protrusion 614 is formed on an upper portion of forearm section 612 toward the front. Posterior arm section 616 extends rearward from support point 611. Engagement pin 617 is provided at the rear of posterior arm section 616 so as to extend in the left-right direction. Engagement pin 617 engages with second link member 62 by pushing second link member 62 from the counterclockwise direction in Fig. 5.

**[0030]** Second link member 62 is fixed to base plate 43 of support section 4. As a result, support section 4 and second link member 62 swing integrally about support section mounting fitting 33. Restricting member 63 is fixed to a structural member in the front of arm upper section 35. Restricting protrusion 614 of first linking mem-

ber 61 is able to come in contact with restricting member 63.

**[0031]** In the initial state shown in Fig. 5, movable section 52 of actuator 5 is in the shortened position. First linking member 61 swings clockwise, and second linking member 62 swings counterclockwise. There is a gap between restricting protrusion 614 of first linking member 61 and restrictive member 63. Movable section 52, which has started the first operation, extends as indicated by arrow A1. Consequently, forearm section 612 of first linking member 61 is pushed via connecting pin 613. As a result, first linking member 61 swings counterclockwise as indicated by arrow A2.

**[0032]** As first linking member 61 swings counterclockwise, engagement pin 617 of posterior arm section 616 swings and drives second linking member 62. Second link member 62 swings in the clockwise direction as indicated by arrow A3, and support section 4 swings in the forward direction as indicated by arrow A4. That is, linking mechanism 6 transfers the first motion, in which movable section 52 extends from the shortened position to the predetermined intermediate position, to the forward swinging motion of support section 4. This operation is continued until movable section 52 extends to a predetermined intermediate position, and the state shown in Fig. 6 is reached.

**[0033]** In the intermediate state shown in Fig. 6, restricting protrusion 614 of first linking member 61 abuts restricting member 63. This restricts further swinging of first linking member 61. Thereafter, movable section 52 which has started the second motion extends as indicated by arrow A5. Forearm section 612 of first linking member 61 then directly transfers the second motion of movable section 52 to arm 3. As a result, arm 3 swings forward about arm support fitting 27 as indicated by arrow A6. As the swinging of arm 3 continues, actuator 5 tilts forward as indicated by arrow A7. That is, linking mechanism 6 transfers the second motion in which movable section 52 extends from the intermediate position to the fully-extended position to the forward swinging motion of arm 3.

**[0034]** Arm restricting mechanism 7 includes restricting guide member 71, biasing member 75, and the like. Fig. 7 is a partial enlarged view of assistive device 1 in the initial state, showing a configuration of arm restricting mechanism 7. Fig. 8 is a partial enlarged view of assistive device 1 in the intermediate state, showing a configuration and operation of arm restricting mechanism 7.

**[0035]** Restricting guide member 71 is a member having support point 72 at one end on the front upper side and biasing point 73 at the other end on the rear lower side. Restricting guide member 71 further has elongated hole 74 extending obliquely between support point 72 and urging point 73. Support point 72 is disposed at predetermined position 3A near the upper portion of arm front section 34 and is supported by the structural member so as to be swingable. Elongated hole 74 movably accommodates connecting pin 613, that is, elongated hole 74 movably accommodates the distal end of mov-

able section 52.

**[0036]** A coil spring can be used as biasing member 75. One end 751 of the rear upper side of biasing member 75 is locked to upper position 3B of arm 3. Upper position 3B of arm 3 is located above predetermined position 3A. The other end 752 of the front lower side of biasing member 75 is engaged with urging point 73 of restricting guide member 71. Biasing member 75 urges upper position 3B of arm 3 toward restricting guiding member 71, as indicated by arrow F1. In other words, biasing member 75 urges upper position 3B of arm 3 toward movable section 52.

**[0037]** In the initial state shown in Fig. 7, movable section 52 of actuator 5 is in the shortened position. At this time, connecting pin 613 is positioned at the rear lower end of elongated hole 74. Here, when movable section 52 starts the first motion, connecting pin 613 moves forward and upward in elongated hole 74 in parallel with the swinging motion of first linking member 61. Further, restricting guide member 71 swings clockwise about support point 72. In the configuration of the present embodiment, restricting guide member 71 swings 24 degrees in the first motion of movable section 52. This motion continues until movable section 52 extends to a predetermined intermediate position and restricting protrusion 614 comes into contact with restricting member 63, and the state shown in Fig. 8 is reached.

**[0038]** In the intermediate state shown in Fig. 8, connecting pin 613 is positioned at the front upper end of elongated hole 74. Thereafter, when movable section 52 starts the second motion, arm 3 swings, but the relative positional relationship between arm 3 and arm restricting mechanism 7 does not change. From the initial state to the final state of assistive device 1, biasing member 75 urges upper position 3B of arm 3 toward movable section 52.

**[0039]** The control section (not shown) is composed of an operating device, a control main body section, and the like. The operating device has an up-button and a down-button for operating actuator 5, and is operated by the caregiver. The control main body section is configured by a computer device having a CPU and is operated with software. The control main body section controls the direction of the current flowing through motor 53 of actuator 5 in accordance with operation information acquired from the operation device.

2. Operation, action, and effect of assistive device 1 of the embodiment

**[0040]** Next, the operation, action, and effect of assistive device 1 of the embodiment will be described. Hereinafter, the control and operation of the lifting mode for assisting in transferring care receiver M will be described. In the lifting mode, assistive device 1 operates from the initial state shown in Fig. 2, through the intermediate state shown in Fig. 3, to the final state shown in Fig. 4. When assisting in seating care receiver M, assistive device 1

operates in the reverse direction in substantially the reverse order of transferring.

**[0041]** First, the caregiver returns movable section 52 of actuator 5 to the shortened position shown in Fig. 2. Next, the caregiver grasps handle 42 and moves assistive device 1 toward care receiver M in the sitting posture. Care receiver M inserts the lower body into the region below support section 4 and places both feet on foot mount 21. Care receiver M can obtain a stable posture by allowing a portion of the lower legs to come in contact with lower leg contact 25.

**[0042]** Next, care receiver M tilts the trunk forward to bring the trunk in contact with trunk support section 41, and rests both underarms on underarm support sections 45. At this time, since trunk support section 41 is swung into an upright direction, the forward inclination angle of the body can be small. Further, since underarm support sections 45 are substantially horizontal or slightly lowered to the rear, care receiver M can easily rest on underarm support sections 45. At this time, the posture of care receiver M is the initial posture. The series of motions of care receiver M described above may be assisted by the caregiver. In the initial posture, the buttocks of care receiver M are seated on the seating surface. Thus, care receiver M is in a comfortable posture because the load due to body weight is supported by the buttocks.

**[0043]** Next, the caregiver starts to control the lifting mode. As a result, movable section 52 of actuator 5 starts the first motion and expands, and first linking member 61 swings counterclockwise in Fig. 2. Arm 3 maintains the rear position of the initial state. As first linking member 61 swings, support section 4 swings forward in a coordinated manner with second linking member 62. At this time, since underarm support sections 45 are lowered forward, care receiver M is restricted from moving backward and does not fall off support section 4.

**[0044]** By the swinging motion of support section 4, the forward tilted state of the upper body of care receiver M gradually progresses. When movable section 52 extends to a predetermined intermediate position, the state shown in Fig. 3 is obtained. In the state shown in Fig. 3, restricting protrusion 614 comes into contact with restricting member 63, and the swinging of first linking member 61 is completed. Accordingly, the swinging of support section 4 is also completed. At this time, the buttocks of care receiver M have just separated from the seating surface.

**[0045]** Further, when movable section 52 starts the second motion, arm 3 is driven by movable section 52 to swing in the clockwise direction in Fig. 3. At the same time, actuator 5 tilts forward. Further, support section 4 maintains a constant orientation with respect to arm 3. This operation is continued until the final state of Fig. 4 in which movable section 52 expands to the fully-extended position and arm 3 reaches the front position. As a result, care receiver M tilts further forward while the upper body moves obliquely forward and upward. As a result, as shown in Fig. 4, care receiver M assumes transferring

posture in which the buttocks are greatly elevated from the seating surface and the legs are extended.

**[0046]** With assistive device 1 of the embodiment, it is possible to drive the forward swinging of support section 4 and the forward swinging of arm 3 using one actuator 5. As a result, transferring care receiver M becomes smooth and more comfortable. Also, the cost is low compared to the prior art using two actuators.

**[0047]** Further, in assistive device 1 of the embodiment, disengaging second linking member 62 from first linking member 61 is allowed. That is, second linking member 62 can swing clockwise away from engagement pin 617 of first linking member 61 (see Fig. 10). As a result, support section 4 freely swings forward. Therefore, it is possible to enlarge the region below support section 4, and care receiver M can easily insert the lower body. Further, the thighs of care receiver M will never be held by strong force.

**[0048]** Fig. 9 is a perspective view of the upper portion of arm 3 from above at an oblique angle. As shown, the movable first linking member 61 and second linking member 62 are covered by upper cover member 38. As a result, safety is improved, and the appearance is simplified and the aesthetic appearance is improved. Further, arm 3 is formed by connecting arm front section 34 and arm upper section 35, and actuator 5 is disposed close to arm front section 34. Thus, a spacious region is secured below support section 4, and care receiver M does not feel cramped.

### 3. Action and effect of arm restricting mechanism 7

**[0049]** Next, the action and effect of arm restricting mechanism 7 will be described. In assistive device 1 of the embodiment, base 2, arm 3, actuator 5, and first linking member 61 constitute a four-node link, and the degree of freedom of motion remains. In other words, when an external force is applied, the shape of the four-node link described above may change. Arm restricting mechanism 7 eliminates the degree of freedom of the four-node link and restricts unexpected forward swinging of arm 3. Fig. 10 is a side cross-sectional view showing an unexpected swinging motion of arm 3 with movable section 52 in an intermediate position.

**[0050]** As shown in Fig. 10, it is assumed that an external force is applied in a forward direction to support section 4 in a configuration in which arm restricting mechanism 7 is not provided. In this case, first, support section 4 freely swings forward. Nevertheless, if a residual force remains, arm 3 swings forward. That is, arm 3 swings without operating movable section 52. As can be seen by comparing Figs. 3 and 10, arm 3 swings by an angle  $\alpha$  in an unexpected motion. This occurs when care receiver M vigorously rides on support section 4. As a result, care receiver M feels uneasy about the unexpected swinging motion of arm 3 and feels less comfortable.

**[0051]** Arm restricting mechanism 7 shown by a broken line in Fig. 10 restricts the unexpected swinging motion

of arm 3 by always accommodating the position of connecting pin 613 inside elongated hole 74. With the present embodiment, even if the degree of freedom remains in linking mechanism 6, arm restricting mechanism 7 eliminates the degree of freedom of linking mechanism 6 and restricts the unexpected motion of arm 3. Therefore, with assistive device 1 of the embodiment, it is possible to restrict the unexpected motion of arm 3 and ensure the comfort of care receiver M.

**[0052]** Further, arm restricting mechanism 7 does not hinder the driving by actuator 5. If the swinging of arm 3 in the forward direction is merely restricted, arm 3 may be biased in the rearward direction by using the biasing member. In this case, however, the rearward urging force hinders the driving by actuator 5. On the other hand, with the present embodiment, it is possible to restrict the unexpected motion of arm 3 without requiring an increase in the output of actuator 5.

4. Modifications and applications of the embodiments

**[0053]** Various modifications and applications of the present embodiment are possible including changes in the shapes and sizes of the constituent members.

Reference Signs List

**[0054]** 1: Assistive device, 2: Base, 22: Actuator bearing section, 27: Arm support seat, 3: Arm, 31: Rod-shaped member, 33: Support section attachment seat, 38: Upper cover member, 3A: Predetermined position, 3B: Upper position, 4: Support section, 5: Actuator, 51: Main body section, 52: Movable section, 53: Motor, 6: Linking mechanism, 61: First linking member, 611: Support point, 612: Forearm section, 613: Connecting pin, 614: Restricting protrusion, 616: Posterior arm section, 617: Engagement pin, 62: Second linking member, 63: Restricting member, 7: Arm restricting mechanism, 71: Restricting guide member, 74: Elongated hole, 75: Biasing member

Claims

1. An assistive device configured to assist in transferring care receiver, the assistive device comprising:
  - a base;
  - an arm, being provided on the base, swingable in a front-rear direction;
  - a support section, supporting a part of a body of the care receiver, which is provided on the arm to be swingable in a front-rear direction;
  - an actuator having a main body section, which is provided on the base and tiltable in a front-rear direction, and a movable section configured to extend and retract from the main body section;
  - and

a linking mechanism having a first linking member, which is swingably provided on the arm and connected to the movable section, and a second linking member, which is fixed to the support section and engaged with the first linking member; wherein the linking mechanism transfers a first motion, in which the movable section is extended from a shortened position to a predetermined intermediate position, to a forward swinging motion of the support section; and transfers a second motion, in which the movable section is extended from the intermediate position to a fully-extended position, to a forward swinging motion of the arm.

2. The assistive device of claim 1, wherein the first linking member is driven to swing by the first motion of the movable section and directly transfers the second motion of the movable part to the arm without being driven to swing by the second motion of the movable part.
3. The assistive device of claim 1 or 2, wherein the first linking member has: a support point swingably supported by the arm; a forearm section, extending forward from the support point, which is connected to the movable section and abutable to a restricting member provided on the arm, and a rear arm section extending rearward from the support point; wherein the rear arm section, when driven by the first motion of the movable section, swings and drives the support section through the engaged second linking member, and wherein the forearm section, when driven by the second motion of the movable section, swings and drives the arm through the abutting restricting member.
4. The assistive device of any one of claims 1 to 3, wherein the support section is made to freely swing forward by allowing the second linking member to disengage from the first linking member.
5. The assistive device of any one of claims 1 to 4, further comprising a cover member covering the first linking member and the second linking member.

Fig. 1

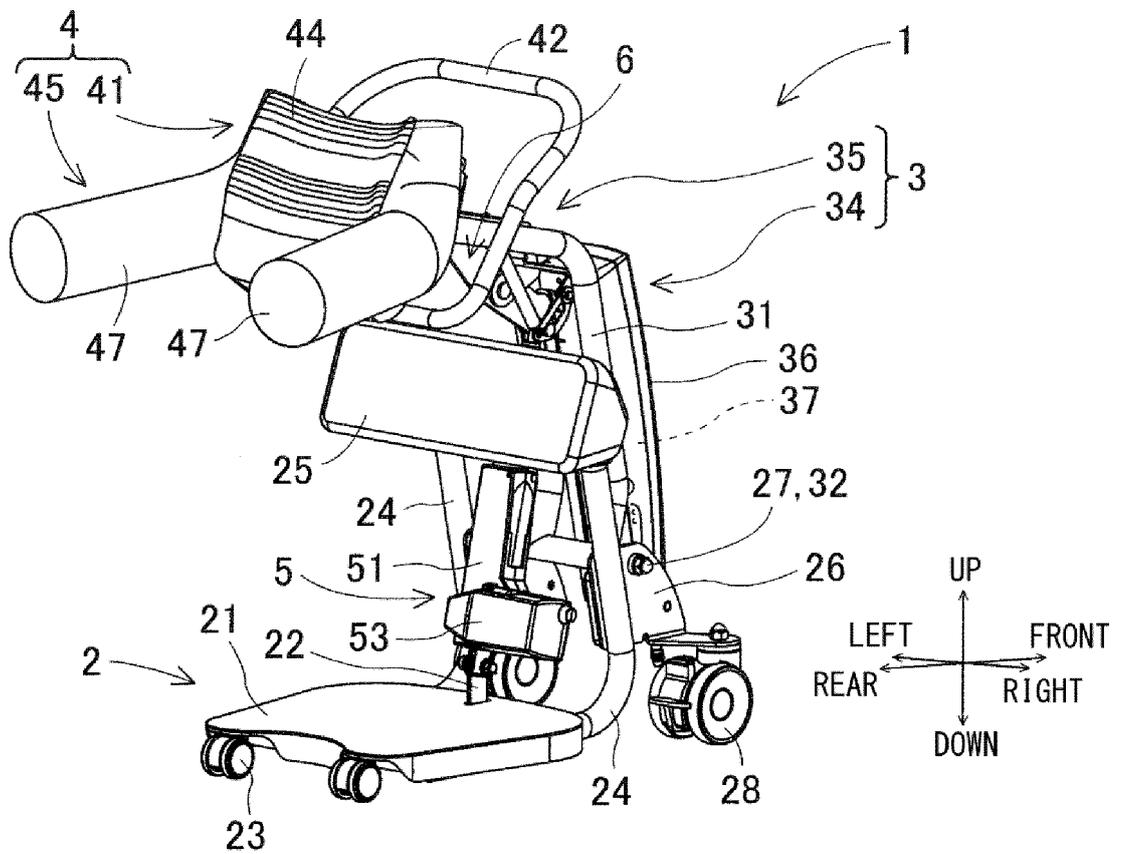


Fig. 2

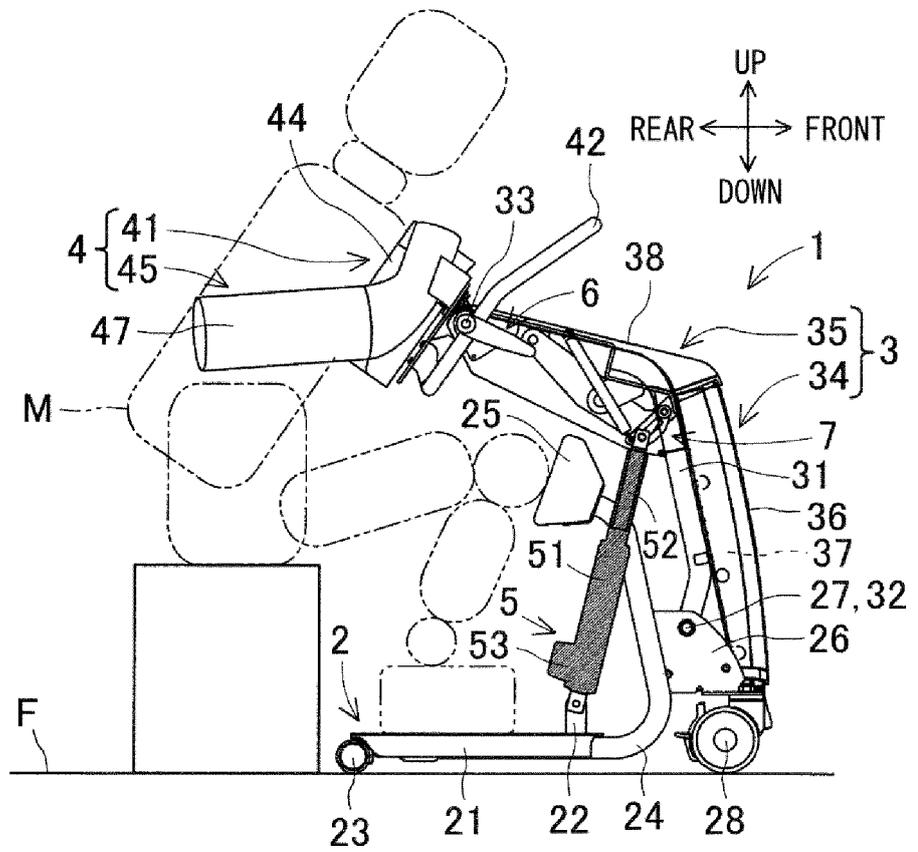


Fig. 3

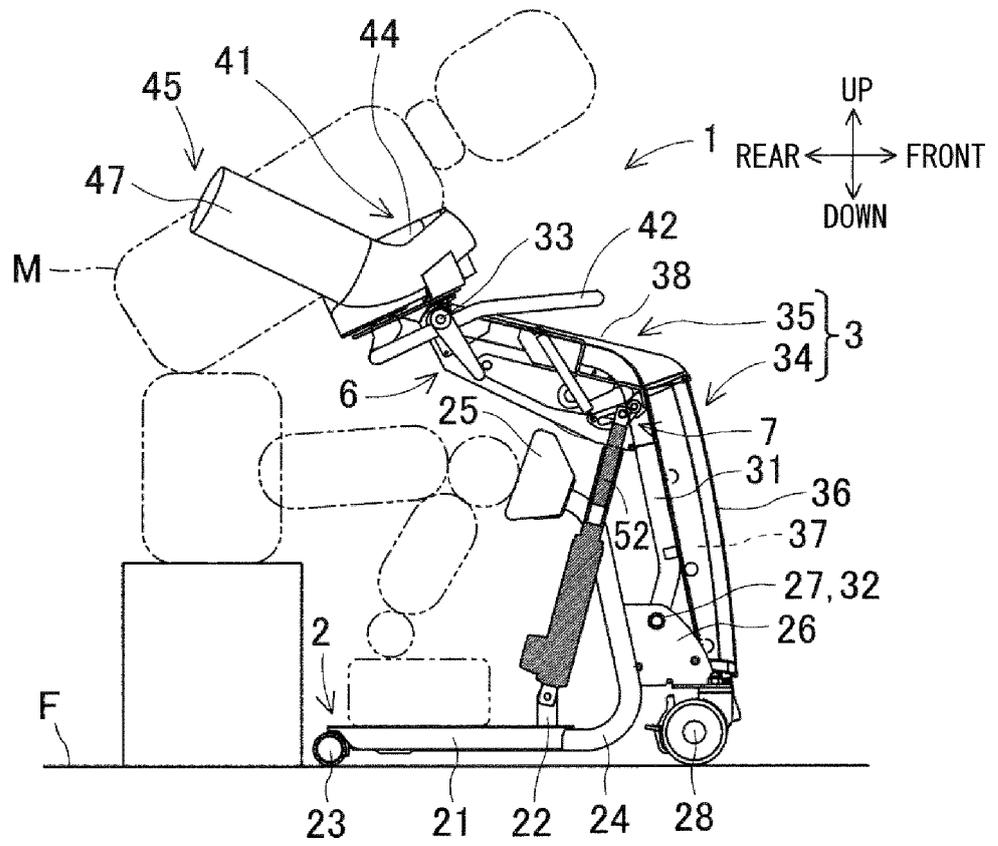


Fig. 4

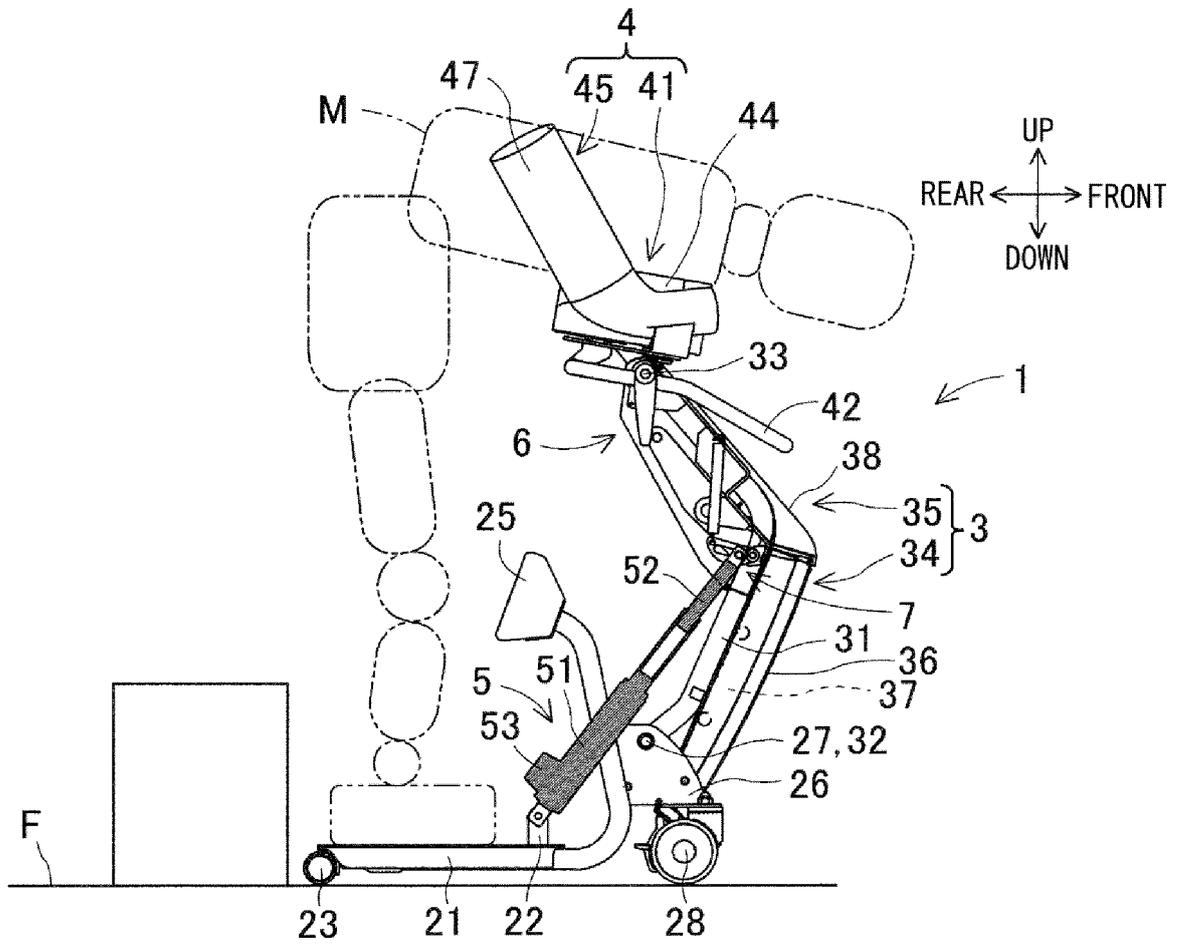


Fig. 5

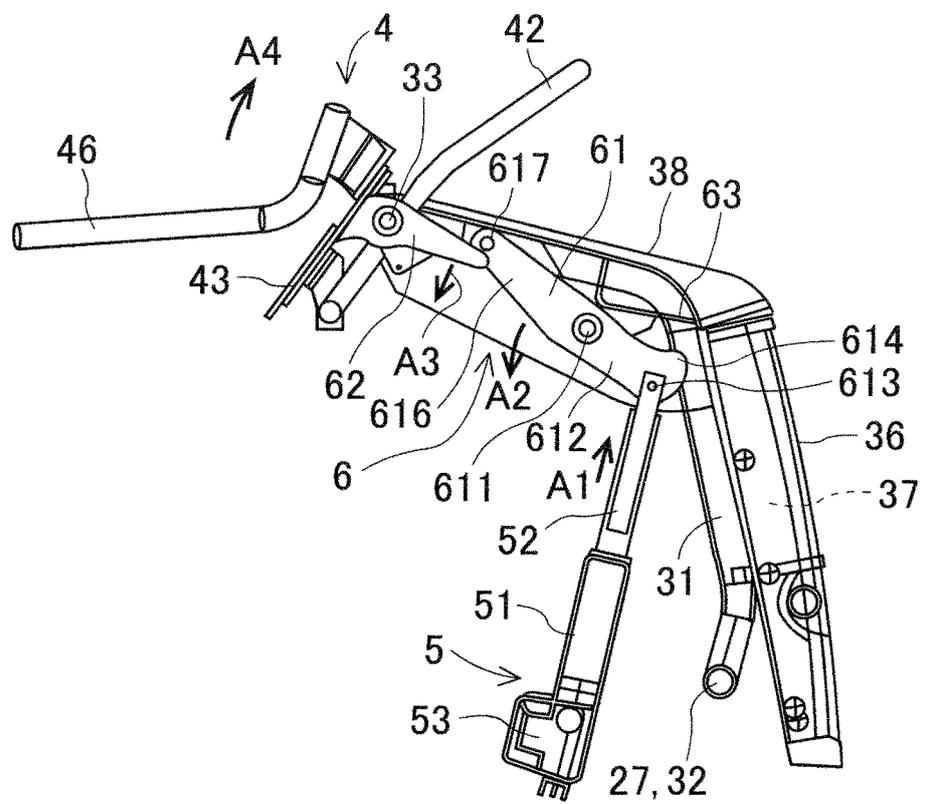


Fig. 6

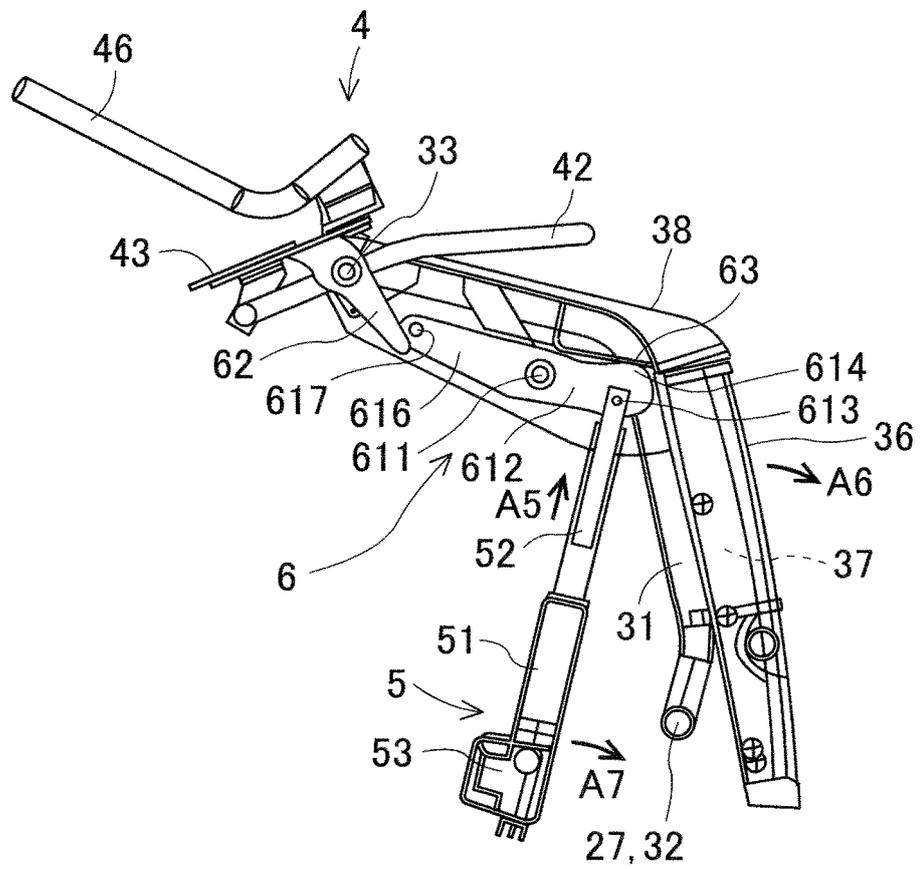


Fig. 7

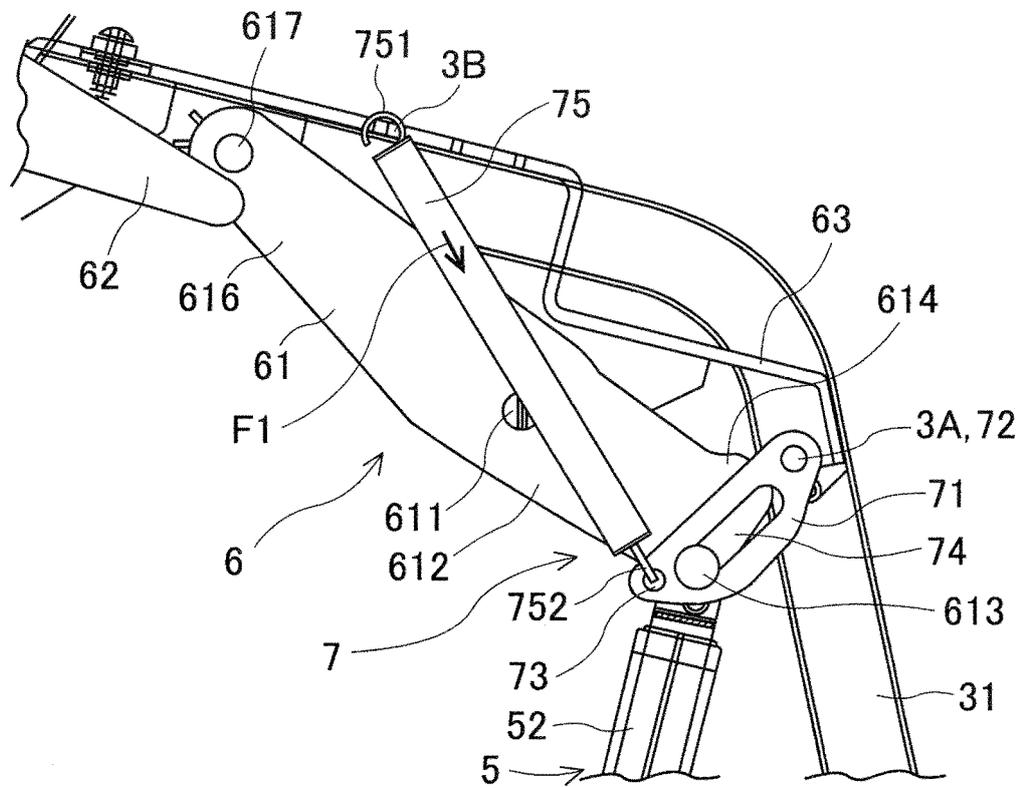


Fig. 8

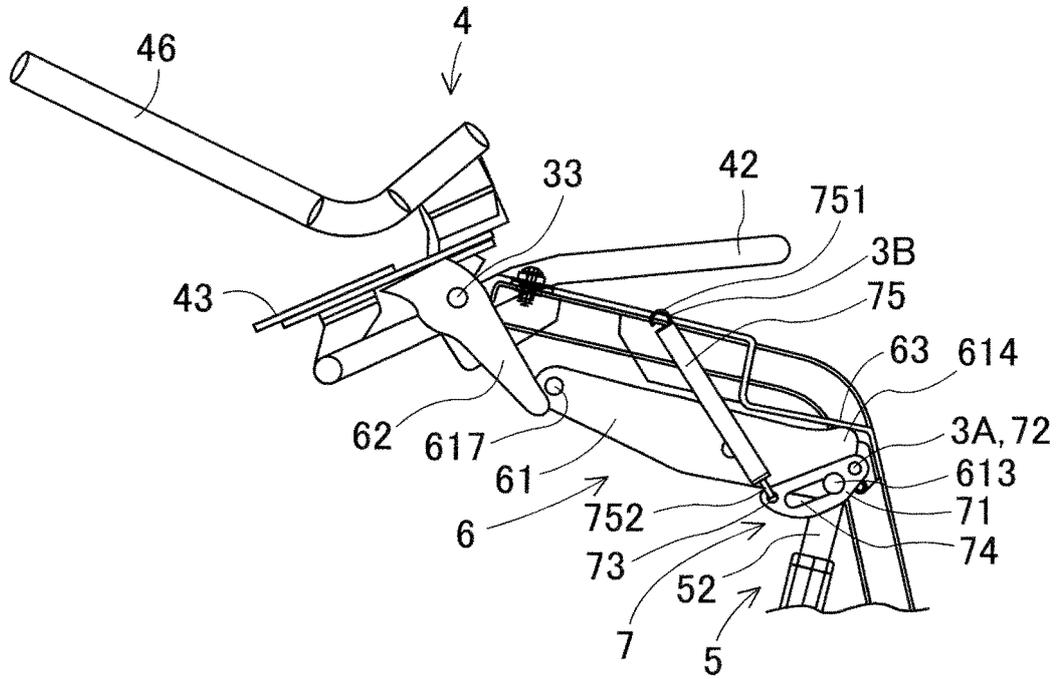


Fig. 9

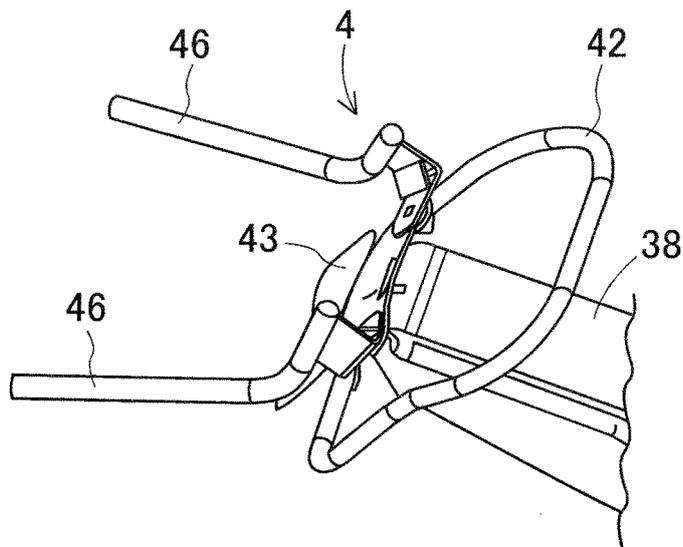
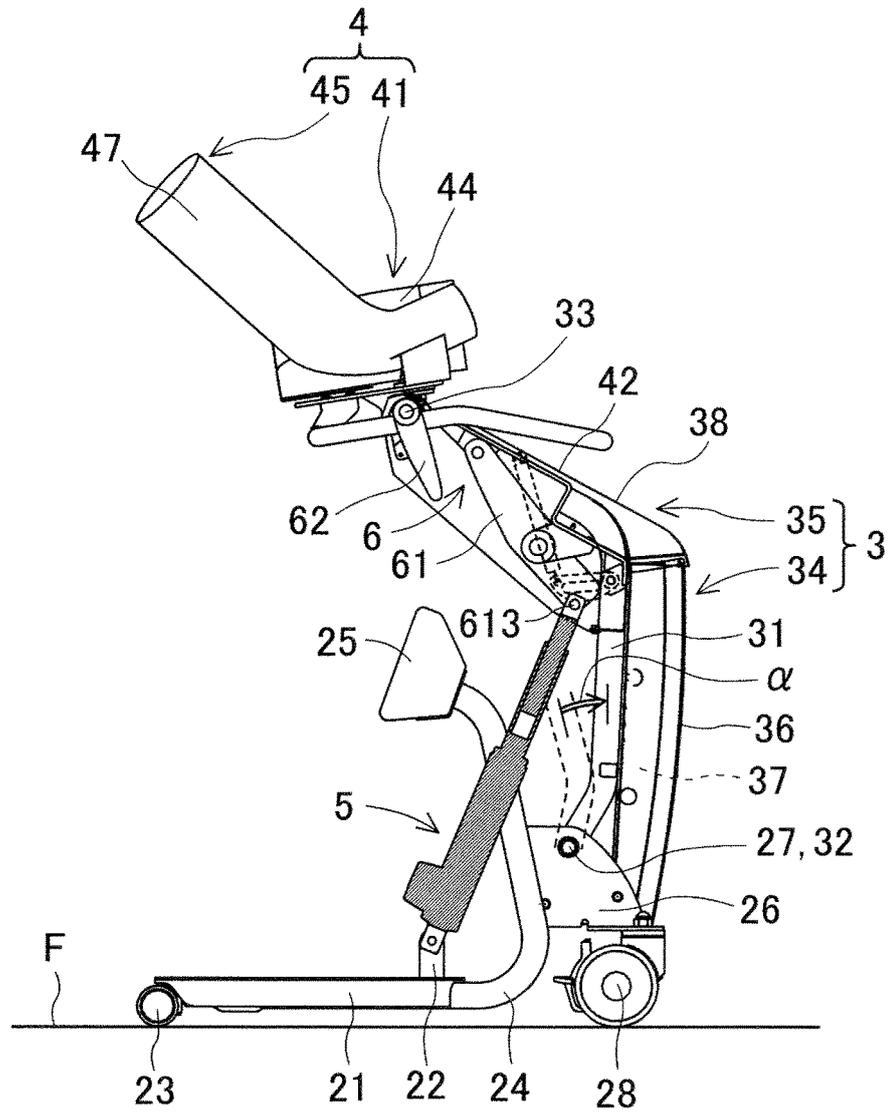


Fig. 10



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2017/043839

5 0A. CLASSIFICATION OF SUBJECT MATTER  
Int.Cl. A61G7/14 (2006.01) i

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

10 B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int.Cl. A61G7/14

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

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2018

15 Registered utility model specifications of Japan 1996-2018

Published registered utility model applications of Japan 1994-2018

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

20 C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2016-144628 A (SUMITOMO RIKO CO., LTD.) 12 August 2016 (Family: none)	1-5
25 A	JP 2003-180754 A (SUZUKI, Katsuji) 02 July 2003 (Family: none)	1-5
A	JP 10-192344 A (THE JAPAN STEEL WORKS, LTD.) 28 July 1998 (Family: none)	1-5
30 A	JP 2012-40200 A (PARAMOUNT BED CO., LTD.) 01 March 2012 (Family: none)	1-5
35		

40  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

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"&" document member of the same patent family

50 Date of the actual completion of the international search  
06 March 2018 (06.03.2018)

Date of mailing of the international search report  
13 March 2018 (13.03.2018)

55 Name and mailing address of the ISA/  
Japan Patent Office  
3-4-3, Kasumigaseki, Chiyoda-ku,  
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Telephone No.

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- JP 2016165313 A [0005]
- WO 2017060964 A [0005]