

## Aid Device

### Technical Field

[0001]

- 5    The present specification relates to an aid device for assisting the transfer of a care receiver.

### Background Art

[0002]

- 10   The need for aid devices has increased with the aging of society. Aid devices are generally driven by an actuator for moving a support portion which supports a part of a care receiver's body. The introduction of aid devices reduce the physical burden on caregivers and care receivers, and also mitigates the shortage of caregivers. As an example of an aid device, there is a device for
- 15   assisting the transfer of a care receiver from a sitting posture. Examples of techniques relating to this type of aid device are disclosed in Patent Literatures 1 and 2.

[0003]

- 20   The human body transfer device of Patent Literature 1 includes a traveling portion equipped with wheels, a support portion positioned above the traveling portion for supporting the care receiver, and a driving portion for driving the human body support portion in the height direction. Further, the arc-shaped swinging operation of the support portion is performed by driving by the driving portion corresponding to an actuator. With this configuration, a caregiver, while

preventing injury to his/her back, can easily and quickly carry out the transfer of the care receiver.

[0004]

Further, the aid robot of Patent Literature 2 includes a lifting and lowering

- 5 portion that moves in an up-down direction with respect to a base, an arm that is swingably provided in the lifting and lowering portion, and a support portion that is provided to the distal end of the arm. The lifting and lowering portion and the arm are driven by separate actuators in a two-stage operation. With this configuration, the lifting and lowering portion and the arm can be operated in
- 10 association with each other, and discomfort to the care receiver can be suppressed.

Patent Literature

[0005]

- 15 Patent Literature 1: JP-A-2016-165313

Patent Literature 2: WO 2017/060964

Summary of the Invention

Technical Problem

- 20 [0006]

In Patent Literature 1, since the support portion only swings in an arc shape, 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 portion and the arm are operated by using two actuators, transferring the care receiver becomes

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

[0007]

For this reason, it is desirable to make use of a single actuator to operate  
5 multiple members. However, in order to drive multiple members with a single actuator, some kind of linking mechanism is required. If a degree of freedom remains in the linking mechanism, an unexpected movement may occur, making the care receiver feel less comfortable.

[0008]

10 It is therefore an object of the present specification to solve the problem of providing an aid device in which unexpected movements are restricted to ensure comfortable use by the care receiver with a configuration in which multiple members are operated by one actuator via a linking mechanism.

15 Solution to Problem

[0009]

The present specification discloses an aid device configured to assist a transfer operation of a care receiver, the aid device comprising: a base; an arm provided on the base in a front-rear swingable manner; a support portion, being provided  
20 on the arm in a front-rear swingable manner, which is configured to support a part of the care receiver's body; an actuator, having a main body portion provided on the base in a front-rear tiltable manner and a movable portion extending and contracting from the main body portion; a linking mechanism which is configured to transmit a first operation to the forward swing of the

support portion, and is configured to transmit a second operation to the forward swing of the arm, the first operation being an operation in which the movable portion extends from a contracted position to a predetermined intermediate position, while the second operation being an operation in which the movable  
5 portion extends from the intermediate position to an extended position; and an arm restricting mechanism configured to bias the upper portion of the arm toward the movable portion.

[0010]

Further, the present specification discloses an aid device configured to assist a  
10 transfer operation of a care receiver, the aid device comprising: a base; an arm provided on the base in a front-rear swingable manner; a support portion, being provided on the arm in a front-rear swingable manner, which is configured to support a part of the care receiver's body; an actuator, having a main body portion provided on the base in a front-rear tiltable manner and a movable  
15 portion extending and contracting from the main body portion; a linking mechanism which is configured to transmit a first operation to the forward swing of the support portion, and is configured to transmit a second operation to the forward swing of the arm, the first operation being an operation in which the movable portion extends from a contracted position to a predetermined  
20 intermediate position, while the second operation being an operation in which the movable portion extends from the intermediate position to an extended position; and an arm restricting mechanism configured to restrict the forward swing of the arm with an external force other than the actuator.

## Advantageous Effect of the Invention

[0011]

With the aid device disclosed in this specification, the arm restricting mechanism restricts unexpected movement of the arm even with a degree of freedom remaining in the linking mechanism. In this way, unexpected movement of the arm is restricted to ensure comfortable use by the care receiver.

## Brief Description of Drawings

10 [0012]

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

[Fig. 2] A cross-sectional side view showing an initial state of the aid device assisting the transfer of a care receiver.

15 [Fig. 3] A cross-sectional side view showing an intermediate state of the aid device assisting the transfer of the care receiver.

[Fig. 4] A cross-sectional side view showing a final state of the aid device assisting the transfer of care receiver M.

20 [Fig. 5] A partial enlarged view showing the configuration and operation of a linking mechanism, corresponding to the initial state of the aid device.

[Fig. 6] A partial enlarged view showing the configuration and operation of the linking mechanism, corresponding to the intermediate state of the aid device.

[Fig. 7] A partial enlarged view showing the configuration of the arm restricting mechanism, corresponding to the initial state of the aid device.

[Fig. 8] A partial enlarged view showing the configuration and operation of the arm restricting mechanism, corresponding to the intermediate state of the aid device.

[Fig. 9] A perspective view of the upper portion of the arm as viewed obliquely  
5 from above.

[Fig. 10] A cross-sectional side view showing an intermediate position of the movable portion, demonstrating an unexpected swinging movement of the arm.

#### Description of Embodiments

10 [0013]

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

Aid device 1 of the embodiment will be described with reference to Figs. 1 to 10.

Fig. 1 is a perspective view of aid device 1 of the embodiment as viewed obliquely from the rear. Fig. 2 is a cross-sectional side view showing an initial  
15 state of aid device 1 assisting the transfer of care receiver M. Fig. 3 is a cross-sectional side view showing an intermediate state of aid device 1 assisting the transfer of care receiver M. Fig. 4 is a cross-sectional side view showing a final state of aid device 1 assisting the transfer of care receiver M.

[0014]

20 Aid device 1 assists the transfer of care receiver M between two different locations, for example, the transfer between a bed and a wheelchair, or the transfer between a wheelchair and a toilet seat. Aid device 1 supports the trunk of care receiver M and assists a transfer operation from a sitting posture to an in-transit posture and a seating operation from the in-transit posture to the

sitting posture. The in-transit posture is a posture in which the buttocks are separated from a 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 body is bent forward, and the like. Further,  
5 aid device 1 can transfer care receiver M in the in-transit posture in cases where the two locations between which transferring is to occur are separated from each other.

[0015]

Aid device 1 includes base 2, arm 3, support portion 4, actuator 5, linking  
10 mechanism 6, arm restricting mechanism 7, control section (not shown), and the like. Base 2 is composed of footrest 21, rear wheels 23, base rods 24, lower leg contact 25, mounting plate 26, front wheels 28, and the like. Footrest 21 is positioned near floor surface F in a substantially horizontal manner. Actuator support portion 22 protrudes upward from the front of the top face of footrest 21.  
15 The pair of left and right rear wheels 23 are provided on the left and right at the rear of footrest 21.

[0016]

The pair of left and right base rods 24 are provided from the left and right sides of the front face of footrest 21 so as to face forward. Base rods 24 are bent  
20 upward from the front and then extended so as to be inclined slightly backward. Lower leg contact 25 is provided on the upper portion of the two base rods 24 so as to face backward. Lower leg contact 25 is positioned above the front of footrest 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.

[0017]

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. Each mounting plate 26  
5 extends forward from base rod 24. Arm support fitting 27 is provided on the upper portions of the pair of right and left mounting plates 26. A 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 aid device 1 to not only move straight and turn but also move sideways  
10 and spin in place. Further, front wheels 28 have a locking function for restricting movement.

[0018]

Arm 3 is formed from rod-shaped member 31, front cover 36, upper cover 38, various structural materials (not shown), and the like. Rod-shaped member 31  
15 is a substantially U-shaped rod-shaped member having an open lower side. The lower ends 32 on both sides of rod-shaped member 31 are swingably supported by arm support fitting 27 of mounting plate 26. As a result, arm 3 can swing in the front-rear direction with respect to base 2.

[0019]

20 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 backward and upward in the middle, and merges at the upper portion in the rear. The overall shape of arm 3 includes arm front portion 34, extending upward from arm

support fitting 27, and arm upper portion 35, connected to arm front portion 34, extending obliquely upward toward the rear.

[0020]

Front cover 36 constitutes arm front portion 34. Front cover 36 is disposed at a  
5 distance from the front of rod-shaped member 31. Front cover 36 is formed by folding both sides backward, thereby defining an inner space. Battery 37 is accommodated in the inner space of front cover 36. Battery 37 serves as a power source for actuator 5 and the control section.

[0021]

10 Upper cover 38 is formed so as to be continuous with front cover 36 and constitutes arm upper portion 35. Upper cover 38 is disposed close to the upper side of rod-shaped member 31. Upper cover 38 is formed by bending both side surfaces downward, thereby defining an inner space. Arm restricting mechanism 7, linking mechanism 6, and support portion mounting fitting 33 are  
15 provided in that order from the front lower side to the rear upper side of the inner space of upper cover 38. In Fig. 1, upper cover 38 is not shown.

[0022]

Support portion 4 is composed of trunk support portion 41 and a pair of right and left underarm support portions 45. Trunk support portion 41 is swingably  
20 supported by support portion mounting fitting 33 of arm upper portion 35. As a result, support portion 4 can swing in the front-rear direction with respect to arm 3. Trunk support portion 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 aid device 1.

[0023]

Trunk support section 41 consists of base plate 43 (see Fig. 5), trunk contact member 44, and the like. Base plate 43 is formed in a substantially rectangular shape using a plate material made of metal or resin and having high rigidity.

- 5    Base plate 43 is provided with handle 42, a part to be attached to support portion mounting fitting 33 and second linking member 62, which will be described later.

[0024]

- Trunk contact member 44, made of a flexible material, is larger than base plate
- 10    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 a surface layer and a base layer. Examples of a material for forming the surface layer include a polyurethane foam having low resilience, and examples of a material for forming the base layer include a polyurethane foam having low combustibility. Trunk
- 15    support portion 41 supports the area from the chest to the abdomen of the trunk which is a part of the body of care receiver M.

[0025]

- The pair of right and left underarm support portions 45 are attached to the right and left chest areas of trunk support portion 41. Each underarm support section
- 20    45 has an L-shape that bends at an obtuse angle. Underarm support portion 45 is composed of core member 46 (see Fig. 5) and outer peripheral member 47. Core member 46 is formed, for example, by bending a circular rod or pipe made of metal or hard resin into an L-shape.

[0026]

Outer peripheral member 47 is formed with a cushion material in a cylindrical shape covering the outer periphery of core member 46. The short straight portion from the proximal end of each underarm support portion 45, which is the attachment side, to the bending point becomes a shoulder receiving portion, and the long straight portion from the bending point to the distal end becomes a underarm entry portion. The shoulder receiving portion supports the front surface of the shoulder of care receiver M. The side entry portions enter both sides of the trunk of care receiver M. Trunk support portion 41 and underarm support portion 45 may be provided with a detachable cover made of cloth or leather.

[0027]

Actuator 5 includes main body portion 51, movable portion 52, motor 53, and the like. Main body portion 51 is supported by actuator support portion 22 of base 2 in a tiltable manner. As a result, actuator 5 tilts in the front-rear direction. Movable portion 52 expands and contracts from main body portion 51. Specifically, movable portion 52 extends from a contracted position to an extended position via a predetermined intermediate position, and contracts in the opposite direction. The first operation is performed while movable portion 52 extends from the contracted position to the intermediate position, and the second operation is performed while movable portion 52 extends from the intermediate position to the extended position.

[0028]

For example, the stroke length of the first operation can be 30mm and the stroke length of the second operation can be 60mm. The distal end of movable

portion 52 is coupled to coupling pin 613 of linking mechanism 6, which will be described later. Motor 53 is provided in main body portion 51. Motor 53, with the direction of the current being controlled by the control section (not shown), drives the expanding and contracting of movable portion 52. Instead of motor  
5 53, another type of driving source can be used, such as a pressure driving source using oil pressure or air pressure.

[0029]

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 showing  
10 the configuration and operation of linking mechanism 6, and corresponds to the initial state of aid device 1. Fig. 6 is a partial enlarged view showing the configuration and operation of linking mechanism 6, and corresponds to the intermediate state of aid device 1.

[0030]

15 First linking member 61 is an elongated member having support point 611, forearm portion 612, and posterior arm portion 616. Support point 611 is disposed near the center of arm upper portion 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.

20 [0031]

Forearm portion 612 extends forward from support point 611. Connecting pin 613 is provided at a lower portion of forearm portion 612 near the front. Connecting pin 613 connects forearm portion 612 and the distal end of movable portion 52. Restricting protrusion 614 is formed on the upper portion of forearm

portion 612 toward the front. Rear arm portion 616 extends rearward from support point 611. Engagement pin 617 is provided at the rear of rear arm portion 616 so as to extend in the left-right direction. Engagement pin 617 engages with second linking member 62, from the counterclockwise direction in

5 Fig. 5, and pushes second linking member 62.

[0032]

Second linking member 62 is fixed to base plate 43 of support portion 4. As a result, support portion 4 and second linking member 62 swing together about support portion mounting fitting 33. Restricting member 63 is fixed to a

10 structural member in front of arm upper portion 35. Restricting protrusion 614 of first linking member 61 can come in contact with restricting member 63.

[0033]

In the initial state shown in Fig. 5, movable portion 52 of actuator 5 is in the contracted position. First linking member 61 swings clockwise, and second

15 linking member swings counterclockwise. There is a gap between restricting protrusion 614 of first linking member 61 and restricting member 63. Movable portion 52, which has started the first operation, extends as indicated by arrow A1. Then, forearm portion 612 of first linking member 61 is pushed via connecting pin 613. As a result, first linking member 61 swings

20 counterclockwise as indicated by arrow A2.

[0034]

As first linking member 61 swings counterclockwise, and engagement pin 617 of rear arm portion 616 swings and drives second linking member 62. Second linking member 62 swings in the clockwise direction as indicated by arrow A3,

and support portion 4 also swings, in the forward direction as indicated by arrow A4. That is, linking mechanism 6 transmits the first operation to the forward swinging motion of support portion 4, where the first operation is an operation in which movable portion 52 extends from the contracted position to the predetermined intermediate position. This operation is continued until movable portion 52 extends to the predetermined intermediate position and the state shown in Fig. 6 is reached.

[0035]

In the intermediate state shown in Fig. 6, restricting protrusion 614 of first linking member 61 just abuts restricting member 63. This restricts further swinging of first linking member 61. Thereafter, movable portion 52, which has started the second operation, extends as indicated by arrow A5. Then, forearm portion 612 of first linking member 61 directly transmits the second operation of movable portion 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 progresses, actuator 5 tilts forward as indicated by arrow A7. That is, linking mechanism 6 transmits the second operation to the forward swinging motion of arm 3, where the second operation is an operation in which movable portion 52 extends from the intermediate position to the extended position.

[0036]

Arm restricting mechanism 7 includes restricting guide member 71, biasing member 75, and the like. Fig. 7 is a partial enlarged view showing the configuration of arm restricting mechanism 7 and corresponds to the initial state of aid device 1. Fig. 8 is a partial enlarged view showing the configuration and

operation of arm restricting mechanism 7 and corresponds to the intermediate position of aid device 1.

[0037]

Restricting guide member 71 is a member having support point 72 at one end  
5 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 biasing point 73. Support point 72 is disposed at predetermined position 3A near the upper portion of arm front portion 34 and is supported by a structural member in a swingable manner.  
10 Elongated hole 74 accommodates connecting pin 613 in a movable manner, that is, elongated hole 74 accommodates the distal end of movable portion 52 in a movable manner.

[0038]

A coil spring can be used as biasing member 75. One end 751 of the rear upper  
15 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 biasing point 73 of restricting guide member 71. Biasing member 75 biases upper position 3B of arm 3 toward restricting guide member 71, as indicated by arrow F1. In other  
20 words, biasing member 75 biases upper position 3B of arm 3 toward movable portion 52.

[0039]

In the initial state shown in Fig. 7, movable portion 52 of actuator 5 is in the contracted position. At this time, connecting pin 613 is positioned at the rear

lower end of elongated hole 74. Here, when movable portion 52 starts the first operation, coupling 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  
5 of the present embodiment, restricting guide member 71 swings 24 degrees as a result of the first operation of movable portion 52. This operation is continued until movable portion 52 extends to the predetermined intermediate position and restricting protrusion 614 comes in contact with restricting member 63 and the state shown in Fig. 8 is reached.

10 [0040]

In the intermediate state shown in Fig. 8, coupling pin 613 is positioned at the front upper end of elongated hole 74. Thereafter, when movable portion 52 starts the second operation, arm 3 swings, but the relative positional relationship between arm 3 and arm restricting mechanism 7 does not change.

15 Biasing member 75 biases upper position 3B of arm 3 toward movable portion 52, from the initial state to the final state of aid device 1.

[0041]

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

[0042]

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

Next, the operation, action, and effect of aid device 1 of the embodiment will be described. Hereinafter, the control and operation of the ascending mode for

5 assisting the transfer operation of care receiver M will be described. In the ascending mode, aid 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 the seating operation of care receiver M, aid device 1 operates in the reverse direction in substantially the reverse order of the  
10 transfer operation.

[0043]

First, the caregiver returns movable portion 52 of actuator 5 to the contracted position shown in Fig. 2. Subsequently, the caregiver grasps handle 42 and moves aid device 1 close to care receiver M in the sitting posture. Care receiver  
15 M enters his/her own lower body into the region below support portion 4 and places both feet on footrest 21. Care receiver M can obtain a stable posture by bringing a part of his/her lower legs in contact with lower leg contact 25.

[0044]

Subsequently, care receiver M tilts his/her trunk forward to bring his/her trunk in  
20 surface contact with trunk support portion 41 and rests both of his/her underarms on underarm support portion 45. At this time, since trunk support portion 41 is tilted upright, the forward inclination angle of the body can be small. Further, since underarm support portions 45 are substantially horizontal or slightly lowered in the rearward direction, care receiver M can easily rest on

underarm support portions 45. At this time, the posture of care receiver M is the initial posture. The series of operations of care receiver M described above may be assisted by a caregiver. In the initial posture, the buttocks of care receiver M rest on a seat surface. Therefore, care receiver M is in a comfortable posture  
5 because the weight-induced load is supported by the buttocks.

[0045]

Subsequently, the caregiver starts to control the ascending mode. As a result, movable portion 52 of actuator 5 starts the first movement and extends and first linking member 61 swings counterclockwise in Fig. 2. Arm 3 maintains the rear  
10 position of the initial state. As first linking member 61 swings, support portion 4 swings forward together with second linking member 62. At this time, since underarm support portion 45 is lowered in the forward direction, care receiver M is restricted from moving backward and does not fall off from support portion 4.

[0046]

15 By the swinging motion of support portion 4, the upper body of care receiver M gradually progresses in the forward tilted state. When movable portion 52 extends to the predetermined intermediate position, the state shown in Fig. 3 is obtained. In the state shown in Fig. 3, restricting protrusion 614 comes in contact with restricting member 63, and the swinging of first linking member 61  
20 is completed. Therefore, the swinging of support portion 4 is also completed.

The buttocks of care receiver M are then momentarily separated from the seat surface.

[0047]

Further, when movable portion 52 starts the second operation, arm 3 is driven

by movable portion 52 to swing in the clockwise direction in Fig. 3. At the same time, actuator 5 tilts forward. In addition, support portion 4 maintains a constant orientation with respect to arm 3. This operation is continued until the final state of Fig. 4 in which movable portion 52 extends to the extended position and arm 3 reaches the front position. This causes care receiver M to tilt further forward while moving his/her upper body obliquely upward and forward. As a result, as shown in Fig. 4, care receiver M assumes the in-transit posture in which the buttocks are greatly elevated from the seat surface and the legs are extended.

[0048]

10 With aid device 1 of the embodiment, it is possible to drive the forward swing of support portion 4 and the forward swing of arm 3 with the use of one actuator 5. As a result, the transfer operation of care receiver M becomes smooth and more comfortable for care receiver M. Also, the cost is low compared to the conventional art involving the use of two actuators.

15 [0049]

Further, in aid device 1 of the embodiment, second linking member 62 can be disengaged from first linking member 61. 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 portion 4 swings forward freely. Therefore, it is possible to increase the size of the space below support portion 4, making it easier for care receiver M to enter with his or her lower body. Further, care receiver M may be relieved from strong pressure on the thighs.

[0050]

Fig. 9 is a perspective view of the upper portion of arm 3 as viewed obliquely

from above. As shown in the figure, the movable first linking member 61 and second linking member 62 are covered by upper cover 38. As a result, in addition to improving safety, the appearance is simplified and the aesthetics are improved. Further, arm 3 is formed by linking arm front portion 34 and arm upper portion 35, and actuator 5 is disposed close to arm front portion 34. Therefore, a spacious region is secured below support portion 4 and care receiver M does not feel cramped.

[0051]

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

Next, the action and effect of arm restricting mechanism 7 will be described. In aid device 1 of the embodiment, base 2, arm 3, actuator 5, and first linking member 61 constitute a four-jointed link with a degree of operational freedom remaining. In other words, when an external force is applied, the shape of the four-jointed link described above may change. Arm restricting mechanism 7 eliminates the degree of freedom of the four-jointed link and restricts unexpected forward swinging of arm 3. Fig. 10 is a side cross-sectional view showing the intermediate position of movable portion 52, demonstrating an unexpected swinging movement of arm 3.

[0052]

As shown in Fig. 10, it is assumed that an external force is applied in the forward direction to support portion 4 in a configuration in which arm restricting mechanism 7 is not provided. In this case, first, support portion 4 swings forward freely. Even in this case, arm 3 swings forward if a residual force remains. That is, arm 3 swings without operating movable portion 52. As can be

seen by comparing Figs. 3 and 10, arm 3 swings by an angle  $\alpha$  due to the unexpected movement. This phenomenon occurs when care receiver M vigorously boards support portion 4. At this time, care receiver M will feel anxious from the unexpected swinging motion of arm 3 and feel less comfortable.

[0053]

Arm restricting mechanism 7, shown by a broken line in Fig. 10, restricts unexpected swinging motion of arm 3 by constantly accommodating connecting pin 613 inside elongated hole 74. With the present embodiment, even if a degree of freedom remains in linking mechanism 6, arm restricting mechanism 7 eliminates the degree of freedom of linking mechanism 6 and restricts unexpected movement of arm 3. Therefore, with aid device 1 of the embodiment, it is possible to restrict the unexpected movement of arm 3 and ensure care receiver M feels comfortable.

[0054]

Further, arm restricting mechanism 7 does not hinder the driving by actuator 5. In order to simply restrict swinging of arm 3 in the forward direction, arm 3 may be biased rearward by using a biasing member. In this case, however, the rearward biasing force would hinder the driving by actuator 5. On the other hand, with the present embodiment, it is possible to restrict unexpected movement of arm 3 without requiring an increase in the output of actuator 5.

[0055]

#### 4. Modifications and applications of the embodiments

It should be noted that various modifications and applications are possible with

the present embodiment, including changes in the shapes and sizes of the constituent members.

#### Reference Signs List

5 [0056]

1: Aid device, 2: Base, 22: Actuator support portion, 27: Arm support fitting, 3: Arm, 31: Rod-shaped member, 33: Support portion mounting fitting, 38: Upper cover, 3A: Predetermined position, 3B: Upper position, 4: Support portion, 5: Actuator, 51: Main body portion, 52: Movable portion, 53: Motor, 6: Linking

10 mechanism, 61: First linking member, 611: Support point, 612: Forearm portion, 613: Connecting pin, 614: Restricting protrusion, 616: Rear arm portion, 617: Engagement pin, 62: Second linking member, 63: Restricting member, 7: Arm restricting mechanism, 71: Restricting guide member, 74: Elongated hole, 75: Biasing member

15

## Claims

1. An aid device configured to assist a transfer operation of a care receiver, the aid device comprising:

- 5           a base;
  - an arm provided on the base in a front-rear swingable manner;
  - a support portion, being provided on the arm in a front-rear swingable manner, which includes a trunk support portion configured to support a front part of the care receiver's trunk;
- 10          an actuator, having a main body portion provided on the base in a front-rear tiltable manner and a movable portion extending and contracting from the main body portion;
  - a linking mechanism including a first linking member provided on the arm in a swingable manner and connected to the moveable portion, a second
  - 15   linking member fixed to the support portion and configured to engage with the first linking member, and a restricting member fixed to the arm,
  - wherein the first linking member comprises:
    - a support point supported by the arm in a swingable manner;
    - a forearm portion, extending forward from the support point and
    - 20   connected to the movable portion, which is configured to abut a restricting member provided on the arm, and
    - a rear arm portion, extending rearward from the support point, which is configured to engage with the second linking member,

the linking mechanism being configured to transmit a first operation to the forward swing of the support portion, and the linking mechanism being configured to transmit a second operation to the forward swing of the arm when the first linking member abuts the restricting member, the first operation being  
5 an operation in which the movable portion extends from a contracted position to a predetermined intermediate position, while the second operation being an operation in which the movable portion extends from the intermediate position to an extended position; and

an arm restricting mechanism including a restricting guide member  
10 configured to restrict forward swinging of the arm and a biasing member configured to bias the upper position of the arm toward the movable portion, wherein the arm restricting mechanism biases the upper position of the arm toward the point of connection between the first linking member and the movable portion.

15

2. An aid device configured to assist a transfer operation of a care receiver, the aid device comprising:

a base;

an arm provided on the base in a front-rear swingable manner;

20

a support portion, being provided on the arm in a front-rear swingable manner, which includes a trunk support portion configured to support a front part of the care receiver's trunk;

an actuator, having a main body portion provided on the base in a front-

rear tiltable manner and a movable portion extending and contracting from the main body portion;

a linking mechanism including a first linking member provided on the arm in a swingable manner and connected to the moveable portion, a second  
5 linking member fixed to the support portion and configured to engage with the first linking member, and a restricting member fixed to the arm,

wherein the first linking member comprises:

a support point supported by the arm in a swingable manner;

a forearm portion, extending forward from the support point and  
10 connected to the movable portion, which is configured to abut a restricting member provided on the arm, and

a rear arm portion, extending rearward from the support point, which is configured to engage with the second linking member,

the linking mechanism configured to transmit a first operation to the  
15 forward swing of the support portion, and the linking mechanism being configured to transmit a second operation to the forward swing of the arm when the first linking member abuts the restricting member, the first operation being an operation in which the movable portion extends from a contracted position to a predetermined intermediate position, while the second operation being an  
20 operation in which the movable portion extends from the intermediate position to an extended position; and

an arm restricting mechanism configured to restrict the forward swing of the arm with an external force other than the actuator, wherein the arm

restricting mechanism biases the upper position of the arm toward the point of connection between the first linking member and the movable portion.

3. The aid device of claim 1, wherein the arm restricting mechanism does not  
5 hinder the driving by the actuator.

4. The aid device of claims 1 or 3, wherein  
the restricting guide member is provided to a predetermined position of  
the arm in swingable manner, which has a holding portion configured to hold a  
10 distal end of the movable portion; and

the biasing member is configured to bias an upper position toward the  
restricting guide member, the upper position being a position above the  
predetermined position of the arm.

15 5. The aid device of claim 4, wherein the holding portion of the restricting guide  
member is an elongated hole configured to accommodate the distal end of the  
movable portion in a movable manner.

6. The aid device of claims 1, 3 4, or 5, wherein the first linking member  
20 comprises a restricting protrusion configured to abut the restricting member  
when the moveable portion is extended to the predetermined intermediate  
position.

7. The aid device of claim 2, wherein the arm restricting mechanism does not hinder the driving by the actuator.

8. The aid device of claims 2 or 7, wherein the arm restricting mechanism

5 comprises:

a restricting guide member, provided to a predetermined position of the arm in swingable manner, which has a holding portion configured to hold a distal end of the movable portion; and

a biasing member configured to bias an upper position toward the  
10 restricting guide member, the upper position being a position above the predetermined position of the arm.

9. The aid device of claim 8, wherein the holding portion of the restricting guide member is an elongated hole configured to accommodate the distal end of the  
15 movable portion in a movable manner.

10. The aid device of claims 2, 7, 8 or 9, wherein the first linking member comprises a restricting protrusion configured to abut the restricting member when the moveable portion is extended to the predetermined intermediate  
20 position.

11. An aid device configured to assist a transfer operation of a care receiver, the aid device comprising:

a base;

an arm provided on the base in a front-rear swingable manner;

a support portion, being provided on the arm in a front-rear swingable manner, which is configured to support a part of the care receiver's body;

5 an actuator, having a main body portion provided on the base in a front-rear tiltable manner and a movable portion extending and contracting from the main body portion;

a linking mechanism includes a first linking member, provided on the arm in a swingable manner and connected to the movable portion, and a

10 second linking member, fixed to the support portion and configured to engage with the first linking member,

wherein the first linking member includes

a support point supported by the arm in a swingable manner,

a forearm portion, extending forward from the support point and

15 connected to the movable portion, which is configured to abut a restricting member provided on the arm, and

a rear arm portion, extending rearward from the support point,

which is configured to engage with the second linking member, and

wherein the linking mechanism is configured to transmit a first operation

20 to the forward swing of the support portion, and wherein the linking mechanism is configured to transmit a second operation to the forward swing of the arm when the first linking member abuts the restricting member, the first operation being an operation in which the movable portion extends from a contracted

position to a predetermined intermediate position, while the second operation being an operation in which the movable portion extends from the intermediate position to an extended position; and

an arm restricting mechanism including a restricting guide member  
5 configured to restrict the forward swing of the arm with an external force other than the actuator and a biasing member configured to bias the upper position of the arm toward the movable portion, wherein the arm restricting mechanism biases the upper position of the arm toward the point of connection between the first linking member and the movable portion.

10

12. An aid device configured to assist a transfer operation of a care receiver, the aid device comprising:

a base;

an arm provided on the base in a front-rear swingable manner;

15 a support portion, being provided on the arm in a front-rear swingable manner, which is configured to support a part of the care receiver's body;

an actuator, having a main body portion provided on the base in a front-rear tiltable manner and a movable portion extending and contracting from the main body portion;

20 a linking mechanism including a first linking member, provided on the arm in a swingable manner and connected to the movable portion, and a second linking member, fixed to the support portion and configured to engage with the first linking member,

wherein the first linking member includes:

a support point supported by the arm in a swingable manner,

a forearm portion, extending forward from the support point and  
connected to the movable portion, which is configured to abut a

5 restricting member provided on the arm, and

a rear arm portion, extending rearward from the support point,

which is configured to engage with the second linking member, and

wherein the linking mechanism is configured to transmit a first operation  
to the forward swing of the support portion,

10 and wherein the linking mechanism is configured to transmit a second

operation to the forward swing of the arm when the first linking member abuts

the restricting member, the first operation being an operation in which the

movable portion extends from a contracted position to a predetermined

intermediate position, while the second operation being an operation in which

15 the movable portion extends from the intermediate position to an extended

position; and

an arm restricting mechanism configured to restrict the forward swing of

the arm with an external force other than the actuator, wherein the arm

restricting mechanism biases the upper position of the arm toward the point of

20 connection between the first linking member and the movable portion.