

Assistance device

Technical Field

[0001]

- 5 The present specification relates to an assistance device.

Background Art

[0002]

- 10 Various assistance devices for assisting in transferring a care receiver are known. One type of assistance device supports the upper body or the like of the care receiver, and assists the care receiver in moving from a sitting posture to an in-transit posture in which the buttocks are raised from a seat surface.

[0003]

- 15 Patent Literature 1 discloses an assistance device having a support section for supporting the forearms of the care receiver. The assistance device includes a base, a lifting and lowering section provided on the base and capable of moving up and down, and a support section provided on the lifting and lowering section and capable of swinging about a first axis. In this assistance device, a first actuator raises and lowers the lifting and lowering section with respect to the base, and a second actuator swings the support section with respect to the lifting and lowering section. When the care receiver is made to stand and the centroid position of the care receiver is out of a predetermined range upon starting the standing process, starting of the lifting operation is prohibited.

[0004]

- 25 Patent Literature 2 discloses an assistance device in which a support section supporting the upper body of the care receiver is swung forward with a single linear movement actuator. Patent Literature 3 discloses an assistance device including a wheeled table, a frame provided on the wheeled table so as to be swingable about a first axis, and a support section provided on the frame so as to be swingable about a second axis. In this assistance device, the first linear actuator swings the frame with respect to the wheeled table, and 30 the second linear actuator swings the support section with respect to the frame.

[0005]

Patent Literature 4 discloses an assistance device having a wheeled table, a frame

provided so as to be swingable with respect to the wheeled table, and a support section provided so as to be slidable on the frame. In this assistance device, the first linear actuator swings the frame relative to the wheeled table, and the second linear actuator slides the support section relative to the frame.

5 [0006]

Patent Literature 5 discloses an assistance device including a wheeled table, a lower leg frame swingably provided on the wheeled table, an upper body frame swingably provided on the lower leg frame, and a support section slidably provided on the upper body frame. In this assistance device, a first linear actuator swings the lower leg frame with respect to
10 the wheeled table, and a second linear actuator swings and slides the support section with respect to the lower leg frame. Here, by driving the second linear actuator, the support section slides with respect to the lower leg frame while the support section swings.

Patent Literature

15 [0007]

Patent Literature 1: WO 2015/145756

Patent Literature 2: JP-A-2016-165313

Patent Literature 3: JP-A-2017-23298

Patent Literature 4: JP-A-2017-23299

20 Patent Literature 5: JP-A-2017-23300

Summary of the Invention

Technical Problem

[0008]

25 As described in Patent Literature 1, for example, when the care receiver is not on the support section in a proper posture, the operation of the assistance device is stopped on the assumption that the centroid position is outside of a predetermined range at the start of the standing process. Further, the assistance device is in an operation-suspended state due to various alarm triggers. Alarm triggers may include a failure of an actuator, a failure
30 of a sensor, a disconnection, an abnormality of a control device, a communication abnormality, a detection of abnormal operation, a shortage of power supply voltage, and the like.

[0009]

For example, when an alarm trigger is a care receiver who is not on the support section in a proper posture, the alarm trigger is eliminated as long as the care receiver gets into a proper posture. Even in a case where an alarm trigger is a communication abnormality, the abnormality is usually restored immediately as long as the abnormality is temporary. In a case where an alarm trigger is a power supply voltage becoming insufficient due to insufficient charging, the alarm trigger is eliminated by simply charging. On the other hand, in a case where an alarm trigger is a failure or disconnection of a component, recovery is not easy.

[0010]

Thus, depending on the cause for the alarm trigger, there are some alarms that are easy to recover from while others are not easy to recover from. Once the assistance device is in the operation-suspended state, regardless of the alarm trigger, the caregiver first turns on the power again and presses the reset button to perform an operation for cancelling the operation-suspended state. If the operation-suspended state is not canceled by this operation, an engineer from the manufacturer is asked to perform a repair.

[0011]

However, as described above, even if the alarm trigger can be easily restored, in order for the caregiver to perform the operation to cancel the operation-suspended state as described above, it is necessary for the caregiver to temporarily stop the assisting operation and move the care receiver to a position away from the assistance device. If the alarm trigger is one in which the care receiver is not in a proper posture, it is desirable to cancel the operation-suspended state by just putting the care receiver in a proper posture without performing a complicated cancelling operation as described above.

[0012]

It is an object of the present specification to provide an assistance device in which it is very easy to perform an operation for cancelling the operation-suspended state.

Solution to Problem

[0013]

The present specification discloses an assistance device configured to assist in transferring a care receiver, the assistance device comprising: an actuator configured to

execute an assisting operation; an input device configured to receive an instruction to execute an assistance-related operation from an operator; and a control section configured to control the actuator based on the instruction to execute the assistance-related operation received by the input device.

5 [0014]

The control section enacts an operation-suspended state in which the actuator is stopped when an alarm trigger occurs; the control section cancels the operation-suspended state when the input device receives the instruction to execute the assistance-related operation in the operation-suspended state if the alarm trigger has been eliminated; and the control
10 section maintains the operation-suspended state when the input device receives the instruction to execute the assistance-related operation in the operation-suspended state if the alarm trigger has not been eliminated.

Advantageous Effect of the Invention

15 [0015]

When the input device receives the instruction to execute the assistance-related operation in the operation-suspended state and the alarm trigger has already been eliminated, the control section cancels the operation-suspended state. For example, when an alarm trigger that can be easily eliminated occurs, the operator can cancel the operation-suspended state
20 by operating the input device to input an instruction to execute an assistance-related operation. The caregiver can then cause the assistance device to resume performing assistance-related operations.

[0016]

On the other hand, if the input device receives an instruction to execute an assistance-related operation in the operation-suspended state but the alarm trigger has not been
25 eliminated yet, the control section maintains the operation-suspended state. That is, when an alarm trigger that cannot be easily eliminated occurs, the operator cannot cancel the operation-suspended state even if the operator operates the input device.

[0017]

30 The input device is a device used when giving instructions to execute assistance-related operations of the assistance device. Thus, the operator does not perform a special operation to cancel the operation-suspended state. Accordingly, when an alarm trigger

that can be easily eliminated occurs, the operator can perform an operation to cancel the operation-suspended state very easily, and operability is improved.

Brief Description of Drawings

5 [0018]

[Fig. 1] A perspective view of an assistance device from an oblique rear angle.

[Fig. 2] A side view showing the assistance device supporting a care receiver in a sitting posture.

10 [Fig. 3] A side view showing the assistance device supporting the care receiver in an intermediate posture between the sitting posture and an in-transit posture.

[Fig. 4] A side view showing the assistance device supporting the care receiver in the in-transit posture.

[Fig. 5] A flow chart showing a control process by a control section.

15 [Fig. 6] A flow chart illustrating a process for cancelling an operation-suspended state in the control process by the control section.

Description of Embodiments

[0019]

1. Overview of assistance device 1

20 Assistance device 1 assists in transferring care receiver M. For example, assistance device 1 is used to assist in transferring care receiver M between two different places, such as transferring between a bed and a wheelchair, transferring between a wheelchair and a toilet seat, and the like. Further, with assistance device 1 supporting care receiver M while moving to a target location, assistance device 1 can also be applied to cases where the
25 two places between which transferring takes place are located far from each other.

[0020]

Assistance device 1 supports a part of the body of care receiver M, the upper half body for example, and assists care receiver M from the sitting posture to the in-transit posture or from the in-transit posture to the sitting posture. Here, the in-transit posture is a posture
30 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.

[0021]

2. Configuration of assistance device 1

The configuration of assistance device 1 will be described with reference to Figs. 1 and

2. Assistance device 1 performs an assisting operation by raising and lowering support
5 section 60 supporting a part of the upper body of care receiver M and swinging forward
and rearward.

[0022]

As shown in Fig. 1, assistance device 1 includes base 10. Base 10 is a member located at
the lowest portion of assistance device 1. Base 10 includes frame 11, foot mount 12, six
10 wheels 16 to 18, and the like. Frame 11 is provided in an approximately horizontal
orientation in the vicinity of floor F. Foot mount 12 is fixed to the rear of the upper surface
of frame 11 and is provided in an approximately horizontal orientation. Foot-shaped mark
12a for guiding the position on which care receiver M places his/her feet are drawn on
the upper surface of foot mount 12.

15 [0023]

Three wheels 16 to 18 are provided on the right and left on the lower side of frame 11.
Each of wheels 16 to 18 has a steering function for changing the moving direction.
Foremost wheel 16 has a locking function for regulating movement. The steering function
of six wheels 16 to 18 enables assistance device 1 not only to move straight in the front-
20 rear direction and turn, but also to move laterally and spin in place.

[0024]

Assistance device 1 further includes column section 20 erected from base 10. Column
section 20 is provided so as to extend upward in the vertical direction from the center in
the left-right direction toward the front of frame 11. In the present embodiment, column
25 section 20 is provided so as to extend upward in the vertical direction, but may be
provided so as to extend in a direction slightly inclined to the front or rear from the vertical
direction. Column section 20 has a mechanism for raising and lowering the upper end.
Further, in the present embodiment, assistance device 1 includes one column section 20,
but may include multiple column sections 20.

30 [0025]

Column section 20 includes column main body 21 erected on frame 11. Column main
body 21 is fixed to frame 11 in a state in which column main body 21 extends upward

from the center in the left-right direction at the front of frame 11 of base 10. Column section 20 further includes lifting and lowering section 22 supported by column main body 21 so as to be reciprocally movable in the extending direction of column main body 21. That is, lifting and lowering section 22 reciprocates in the up-down direction (i.e., the gravitational and counter-gravitational directions) with respect to base 10 and column main body 21. Lifting and lowering section 22 has a long shape in the up-down direction. Lifting and lowering section 22 is located to the rear of column main body 21.

[0026]

Assistance device 1 further includes lower leg contact 30. Lower leg contact 30 is fixed to a fixed portion of column section 20 (i.e., a portion fixed to frame 11) with a pair of L-shaped left and right support arms 31, 31. Lower leg contact 30 is provided in front of and slightly above mark 12a. The main part of lower leg contact 30 is a cushion member disposed over the upright portions of the left and right support arms 31 and extends in the left-right direction. Lower leg contact 30 is in contact with the lower leg of care receiver M. The placement height of lower leg contact 30 is adjustable.

[0027]

Assistance device 1 further includes rocking arm 40 provided near the upper end of lifting and lowering section 22 and supported so as to be swingable about a horizontal axis in the left-right direction. When assistance device 1 provides assistance from the sitting posture to the in-transit posture, the rear end of rocking arm 40 pivots forward. On the other hand, when assistance device 1 provides assistance from the in-transit posture to the sitting posture, the rear end of rocking arm 40 pivots rearward.

[0028]

Assistance device 1 includes first handle 50 fixed to the rear end of rocking arm 40, that is, the end of the portion extending rearward from the swinging center of rocking arm 40. First handle 50 has a substantially rectangular frame shape. First handle 50 extends, from the vicinity of the rear end of rocking arm 40, in the forward and upward direction. The side portions of first handle 50 are utilized by being grasped with both hands of care receiver M. Further, the side portions and the front portion of first handle 50 are utilized by being grasped by the caregiver to move assistance device 1.

[0029]

Assistance device 1 further comprises support section 60 supporting a part of the upper

body of care receiver M. Support section 60 is supported by rocking arm 40 and supports a part of the upper body of care receiver M. When rocking arm 40 swings with respect to column section 20, support section 60 swings with respect to column section 20 in the front-rear direction.

5 [0030]

Support section 60 includes trunk support section 61, a pair of underarm support sections 62, 62, second handle 63, and the like. Trunk support section 61 has a surface shape close to the trunk shape of care receiver M and can be flexibly deformed. The support surface of trunk support section 61 is in surface contact with the front surface of the trunk of the
10 upper body of care receiver M to support the trunk. More specifically, the support surface of trunk support section 61 supports care receiver M from below covering a range from the chest to the abdomen. Trunk support section 61 is attached to rocking arm 40.

[0031]

Further, trunk support section 61 is supported so as to be freely tiltable in the front-rear
15 direction with respect to rocking arm 40. Specifically, trunk support section 61 is configured to freely tilt in a predetermined angular range clockwise when assistance device 1 is viewed from the right from the state shown in Fig. 2. "Freely tilt" refers to tilting by moving manually and not tilting which is driven by an actuator or the like.

[0032]

20 The pair of underarm support sections 62, 62 are supported by trunk support section 61 and support the underarms of care receiver M. More specifically, the pair of underarm support sections 62, 62 are provided on the right and left sides of trunk support section 61. Each underarm support section 62 is swingably supported by trunk support section 61. Each underarm support section 62 is a rod-shaped member having an L-shape. The
25 surface of underarm support section 62 is covered with a flexible deformable material. Second handle 63 is integrally provided on the front face of trunk support section 61. Second handle 63 has a laterally elongated U-shape. Second handle 63 has a base shaft section fixed to a lower portion of trunk support section 61 and extends in the left-right direction, and gripping sections extending from both ends of the base shaft section toward
30 the first handle 50.

[0033]

As shown in Fig. 2, assistance device 1 further includes multiple actuators 71, 72 for

driving support section 60. More specifically, assistance device 1 includes lifting and lowering actuator 71 and rocking actuator 72. Lifting and lowering actuator 71 and rocking actuator 72 are disposed inside column section 20. Lifting and lowering actuator 71 is configured by, for example, a linear actuator and lifts and lowers lifting and lowering section 22 with respect to column main body 21. For example, a screw mechanism, a rack and pinion mechanism, a cylinder mechanism, or the like is applied in lifting and lowering actuator 71.

[0034]

Rocking actuator 72 is, for example, a rotary actuator, and swings rocking arm 40 with respect to lifting and lowering section 22. Rocking actuator 72 may be configured by a linear actuator and a power conversion mechanism for converting the linear motion into rotation. Therefore, lifting and lowering actuator 71 and rocking actuator 72 change the height of trunk support section 60 and the orientation (i.e., the inclination) of trunk support section 60 in the front-rear direction. Here, lifting and lowering actuator 71 and rocking actuator 72 can operate independently or in conjunction with each other.

[0035]

Assistance device 1 further includes input device 80, to be used by an operator such as the care giver, for performing assistance. Input device 80 is a wired or wireless remote control device. Input device 80 is a device for accepting instructions to execute assistance-related operations from the operator. Instructions to execute assistance-related operations include an instruction, in an assistance mode, in which an assistance operation is performed, and an instruction, in a height adjustment mode, in which the height is adjusted in preparation for an assisting operation.

[0036]

Thus, input device 80 has an adjust-up button and an adjust-down button in the height adjustment mode. In the height adjustment mode, only lifting and lowering actuator 71 operates independently. Further, input device 80 has an assist-up button and an assist-down button in the assistance mode. In the assistance mode, lifting and lowering actuator 71 and rocking actuator 72 operate in coordination with each other.

[0037]

Assistance device 1 further includes control unit 90. Control unit 90 is provided toward the front and to the right, above frame 11. Control unit 90 includes control section 91 and

the like for controlling lifting and lowering actuator 71 and rocking actuator 72. Control section 91 has assistance-related operation modes: an assistance mode in which care receiver M is assisted by controlling the multiple actuators 71, 72 in a coordinated manner, and a height adjustment mode in which the height of support section 60 is adjusted in preparation for the assisting operation by controlling at least one of the multiple actuators 71, 72.

[0038]

Control section 91 controls lifting and lowering actuator 71 and rocking actuator 72 based on instructions to execute assistance-related operations inputted from the operator with input device 80. Inputted execution instructions include an adjust-up instruction and an adjust-down instruction in the height adjustment mode, and an assist-up instruction and an assist-down instruction in the assistance mode.

[0039]

When an alarm trigger occurs in assistance device 1, control section 91 enacts the operation-suspended state. That is, when an alarm trigger occurs while assistance device 1 is operating in the height adjustment mode or the assistance mode, control section 91 stops actuators 71, 72, thereby enacting the operation-suspended state.

[0040]

A computer device operated by software can be used as control section 91. As software, an operation program corresponding to an adjust-up instruction, an adjust-down instruction, an assist-up instruction, and an assist-down instruction are stored. A battery power source (not shown) capable of being repeatedly charged and discharged is attached to the lower side of control section 91. The battery power source is also attached to the front left side of the upper face of frame 11. The battery power source is also shared by lifting and lowering actuator 71 and rocking actuator 72.

[0041]

Control unit 90 includes display device 92 on its upper face. When an alarm trigger occurs in assistance device 1 and assistance device 1 enacts the operation-suspended state, display device 92 displays the alarm trigger. The displayed alarm trigger may be the name of the alarm trigger or a symbol associated with the alarm trigger. Further, display device 92 displays whether the generated alarm trigger is a trigger that can be continuously controlled by control section 91. Classification of alarm triggers that can be continuously

controlled by control section 91 and alarm triggers that cannot be continuously controlled will be described later.

[0042]

Assistance device 1 further includes detector 100 (shown in Fig. 2) for detecting whether
5 the in-transit posture of care receiver M is an abnormal posture. Detector 100 is provided,
for example, in the vicinity of trunk support section 61 of support section 60, detects the
load applied to trunk support section 61, and determines whether the posture is abnormal
based on the detection result. When lifting and lowering actuator 71 and rocking actuator
72 have motors, detector 100 can also detect a drive current supplied to the motors, detect
10 a load applied to trunk support section 61 based on the drive current, and determine
whether the posture is abnormal based on the detection result.

[0043]

3. Operation of assistance device 1

Next, the operation of assistance device 1 will be described with reference to Figs. 2 to 4.
15 Hereinafter, as an example of the operation of assistance device 1, a case will be described
in which the buttocks of care receiver M in the sitting posture are raised and care receiver
M is put into the in-transit posture. Note that the assisting operation from the in-transit
posture to the sitting posture of care receiver M is the reverse of the assisting operation
from the sitting posture to the in-transit posture.

20 [0044]

As shown in Fig. 2, the caregiver can grasp first handle 50 or second handle 63 of
assistance device 1 to bring assistance device 1 closer to care receiver M in the sitting
posture. The caregiver causes the lower body of care receiver M to enter the region above
base 10 and below support section 60. The caregiver places the feet of care receiver M on
25 mark 12a of foot mount 12. A portion of the lower leg of care receiver M comes in contact
with lower leg contact 30, stabilizing the entire lower leg of care receiver M.

[0045]

At this time, the caregiver checks whether the height of support section 60 is appropriate.
If the height of support section 60 is not appropriate, the caregiver operates the adjust-up
30 button or the adjust-down button of input device 80 to adjust the height of support section
60 to care receiver M. When input device 80 receives the adjust-up instruction or the
adjust-down instruction, control section 91 controls actuators 71, 72 in the height

adjustment mode. That is, control section 91 executes the height adjustment mode in which the height adjustment operation of support section 60 is performed in preparation for the assisting operation. In the height adjustment mode, control section 91 changes the height of support section 60 while maintaining the orientation (i.e., the inclination) of support section 60 by independently operating only lifting and lowering actuator 71. It should be noted that rocking actuator 72 does not operate in the height adjustment mode. [0046]

Next, after adjusting the height of support section 60, the caregiver brings the trunk of care receiver M into surface contact with trunk support section 61 and places each underarm of care receiver M on each of underarm support sections 62, 62. At this time, care receiver M assumes the sitting posture at the beginning of the assisting operation. In the sitting posture, as shown in Fig. 2, the buttocks are in contact with the seat surface and the trunk is inclined slightly forward. [0047]

Next, the caregiver operates the assist-up button of input device 80 to start assisting care receiver M from the sitting posture to the in-transit posture. When input device 80 receives the assist-up instruction, control section 91 controls the lifting and lowering actuator 71 and rocking actuator 72 in an assist-up mode. In the assist-up mode, control section 91 controls lifting and lowering actuator 71 and rocking actuator 72 in a coordinated manner. That is, in the assist-up mode, rocking actuator 72 swings forward while lifting and lowering actuator 71 moves up and down. [0048]

More specifically, when the assist-up mode is started, as shown in Fig. 3, control section 91 causes lifting and lowering actuator 71 to lower lifting and lowering section 22 from the initial state and causes rocking actuator 72 to swing rocking arm 40 forward from the initial state. As a result, support section 60 is moved downward from the initial state and inclined forward. That is, while maintaining a state in which the buttocks of care receiver M are in contact with the seat surface, the upper body is inclined forward significantly. [0049]

Next, as the assist-up mode is continued, as shown in Fig. 4, control section 91 causes lifting and lowering actuator 71 to raise the lifting and lowering section 22 and causes rocking actuator 72 to swing rocking arm 40 forward. As a result, support section 60 is

moved upward and is further inclined forward. That is, the buttocks of care receiver M are separated from the seat surface, the legs are extended, and the upper body is further inclined forward. In this manner, care receiver M assumes the in-transit posture.

[0050]

- 5 When the caregiver operates the assist-down button of input device 80, input device 80 receives the assist-down instruction, and control section 91 controls lifting and lowering actuator 71 and rocking actuator 72 in an assist-down mode. In the assist-down mode, control section 91 controls lifting and lowering actuator 71 and rocking actuator 72 in a coordinated manner. That is, in the assist-down mode, rocking actuator 72 swings
10 rearward while lifting and lowering actuator 71 moves up and down.

[0051]

4. Alarm triggers

- Assistance device 1 is brought into the operation-suspended state by various alarm triggers. The alarm triggers include triggers that cause the control by control section 91
15 to be reset, such as a trigger that can be eliminated by a repair performed by a technician of the manufacturer and a trigger that can be eliminated by temporarily turning off the power. Further, the alarm triggers include a trigger due to a temporary malfunction of assistance device 1, which can be automatically eliminated by assistance device 1 itself, and a trigger that does not cause the control by control section 91 to be reset, such as a
20 trigger caused by the posture of care receiver M. That is, the alarm triggers are classified into triggers that cannot be continuously controlled by control section 91 and triggers that can be continuously controlled by control section 91.

[0052]

- Alarm triggers that require repair by a technician include a failure of actuators 71, 72, a
25 failure of a sensor, a disconnected wire, an abnormality of control section 91, a shortage of power supply voltage, and aging of any components. These triggers cannot be restored by assistance device 1 itself or the operator himself/herself. Further, a failure of actuators 71, 72, an abnormality of control section 91, or the like may be resolved by temporarily turning off the power.

30 [0053]

Among the alarm triggers that can be continuously controlled by control section 91 and automatically eliminated by assistance device 1 itself, there are temporary

communication abnormalities or the like. Temporary communication abnormalities may be immediately restored. Further, for example, when care receiver M having a large body weight boards support section 60 of assistance device 1 in an inappropriate posture, lifting and lowering section 22 may not operate even if lifting and lowering actuator 71 is driven.

5 In such a case, the difference between the instructed position of lifting and lowering actuator 71 and the current position of lifting and lowering actuator 71 detected by a detector becomes large. When the difference between the instructed position and the current position becomes equal to or larger than a predetermined value, assistance device 1 takes the event as an alarm trigger and enacts the operation-suspended state. The above-
10 mentioned alarm trigger is eliminated by properly setting the in-transit posture of care receiver M so as to reduce the load applied to lifting and lowering actuator 71.

[0054]

Further, when lifting and lowering actuator 71 and rocking actuator 72 are not driven, an external force acting on support section 60 may cause support section 60 or lifting and
15 lowering actuator 22 to become unstable. In this case, assistance device 1 may enact the operation-suspended state as a result of an alarm trigger in which control limits of lifting and lowering actuator 71 are exceeded. Also in this case, the alarm trigger is eliminated as long as no external force is applied. As described above, alarm triggers caused by the posture of care receiver M, the generation of external force, or the like can be easily
20 eliminated.

[0055]

When an abnormal posture of care receiver M is detected by detector 100, assistance device 1 takes the abnormal posture detected by the detector as an alarm trigger and enacts the operation-suspended state. In this case, the alarm trigger is eliminated when care
25 receiver M assumes a proper posture.

[0056]

5. Control process by control section 91

Next, the alarm-trigger control process by control section 91 will be described with reference to Figs. 5 and 6. Control section 91 determines whether an alarm trigger has
30 occurred (S1), and if an alarm trigger has not occurred (S1: N), control section 91 checks whether an instruction has been inputted to input device 80 to execute an assistance-related operation (S2). If an instruction to execute the assistance-related operation has not

been inputted to input device 80 (S2: N), control section 91 repeats the process from step S1.

[0057]

On the other hand, if an instruction to execute an assistance-related operation has been
5 inputted to input device 80 (S2: Y), control section 91 performs control according to the
instruction to execute the assistance-related operation (S3). That is, when the caregiver
presses the assist-up button, control section 91 controls actuators 71, 72 in the assist-up
mode as a result of input device 80 receiving the assist-up instruction. Control section 91
performs a corresponding control operation when an instruction to execute an assistance-
10 related operation, such as an assist-down, adjust-up, or adjust-down instruction, is
inputted.

[0058]

Next, control section 91 determines whether the input of the instruction to execute the
assistance-related operation has been stopped (S4). That is, it is determined whether the
15 caregiver has released his/her hand from the button of input device 80 (S4). If the
caregiver continues to press the button of input device 80 (S4: N), control section 91
repeats the process from step S1. On the other hand, if the input of the instruction to
execute the assistance-related operation has stopped (S4: Y), control section 91 stops the
corresponding assistance-related operation (S5) and repeats the process from S1. That is,
20 while the caregiver presses the button of input device 80, the corresponding assistant-
related operation is being executed, and when the assistant releases the hand from the
button, the assistant-related operation that has been executing is stopped.

[0059]

Next, in step S1, when an alarm trigger occurs (S1: Y), assistance device 1 immediately
25 enacts the operation-suspended state (S11). The operation-suspended state is enacted in
the case of all alarm triggers. Control section 91 causes display device 92 to display the
alarm trigger (S12). Control section 91 determines whether the alarm trigger is a trigger
that can be continuously controlled by control section 91 (S13). If it is a trigger for which
continuous control is possible (S13: Y), it is displayed on display device 92 that
30 continuous control is possible (S14).

[0060]

On the other hand, when the alarm trigger is a trigger that cannot be continuously

controlled by control section 91 (S13: N), control section 91 does not cause display device 92 to display that the continuation control is possible. When the alarm trigger is a trigger for which continuous control is not possible (S13: N), control section 91 may cause display device 92 to display that continuous control is not possible.

5 [0061]

Control section 91 performs a process of cancelling the operation-suspended state (S15). After assistance device 1 enters the operation-suspended state, the process of cancelling the operation-suspended state is executed without turning off the power of assistance device 1. The process of cancelling the operation-suspended state will be described with
10 reference to Fig. 6. Control section 91 checks whether an instruction has been inputted from input device 80 to execute an assistance-related operation (S21). The instruction to execute an assistance-related operation in this case may be any of one of the adjust-up, adjust-down, assist-up, and assist-down instructions. This is because the instruction to execute an assistance-related operation operated here is not an instruction to execute an
15 assistance-related operation of assistance device 1, rather the instruction of the operation intended to cancel the operation-suspended state.

[0062]

If an execution instruction has not been inputted (S21: N), control section 91 ends the cancellation process. On the other hand, if an execution instruction has been inputted
20 (S21: Y), that is, if an operator such as a caregiver presses any button of input device 80, control section 91 determines whether the alarm trigger has been eliminated at that point in time (S22).

[0063]

For example, if the alarm trigger is a temporary communication abnormality or the like,
25 the alarm trigger is possibly eliminated in between from the time assistance device 1 enters the operation-suspended state to the time at which an instruction to execute an assistance-related operation is received. Further, in the case of an alarm trigger in which the difference between the instructed position and the current position of lifting and lowering actuator 71 becomes equal to or larger than a predetermined value, for example,
30 in the case where the posture of care receiver M is not appropriate, the alarm trigger may be eliminated by temporarily stopping assistance device 1. Further, an alarm trigger in which the posture of care receiver M detected by detector 100 is an abnormal posture may

be eliminated by temporarily stopping assistance device 1 and putting care receiver M into a proper posture. Further, even when lifting and lowering actuator 71 or rocking actuator 72 exceeds the control limits due to an external force, the alarm trigger may be eliminated by assistance device 1 temporarily stopping. On the other hand, an alarm trigger such as a failure of actuators 71, 72 may not be eliminated during the above operation period.

[0064]

Therefore, if the alarm trigger has not been eliminated at the time of the determination (S22: N), control section 91 ends the cancellation process. On the other hand, if the alarm trigger has been eliminated at the time of the determination (S22: Y), control section 91 cancels the operation-suspended state (S23). That is, when an alarm trigger that can be continuously controlled by control section 91 is occurs, the operator cancels the operation-suspended state merely by operating an instruction to execute an assistance-related operation .

[0065]

Next, even when the cancellation process in S15 of Fig. 5 is executed, as long as the operation-suspended state has not been canceled (S16: N), control section 91 continues to execute the cancellation process (S15). On the other hand, if the alarm trigger is eliminated in the cancellation process (S16: Y), control section 91 ceases to display the alarm trigger displayed on display device 92 (S17).

[0066]

Next, control section 91 determines whether there is a re-input of an instruction to execute an assistance-related operation from input device 80 (S18). A re-input of an instruction to execute refers when an instruction to execute an assistance-related operation is inputted again to input device 80. In order to cancel the operation-suspended state, in S21 of Fig. 6, an instruction to execute an assistance-related operation should have been inputted for the purpose of cancelling the operation-suspended state. If an instruction to execute the assistance-related operation for the purpose of cancelling the operation-suspended state continues to be inputted, it is determined in S18 of Fig. 5 that there is no re-input of the instruction to execute the assistance-related operation. That is, when the input of an instruction to execute an assistance-related operation for the purpose of cancelling the operation-suspended state is temporarily stopped after the operation-suspended state has

been canceled, and then the instruction to execute the assistance-related operation is inputted again, it is determined that the instruction to execute has been re-inputted.

[0067]

When it is determined that the instruction to execute has been re-inputted, control section
5 91 performs control according to the re-inputted instruction to execute the assistance-related operation (S3). Thereafter, control section 91 performs the processes of step S4 and subsequent steps.

[0068]

As described above, when input device 80 receives the input of an instruction to execute
10 an assistance-related operation in the operation-suspended state and the alarm trigger has already been eliminated, control section 91 cancels the operation-suspended state. When an alarm trigger that can be easily eliminated and can be continuously controlled by control section 91 occurs, an operator such as the caregiver can cancel the operation-suspended state by operating input device 80 to input an instruction to execute an
15 assistance-related operation. The caregiver can then cause assistance device 1 to continue the assistance-related operation again without turning off the power of assistance device 1.

[0069]

Input device 80 is a device used when instructing assistance device 1 to execute an
20 assistance-related operation. Thus, the operator does not perform a special operation to cancel the operation-suspended state. Accordingly, when an alarm trigger that can be continuously controlled by control section 91 occurs, the operation to cancel the operation-suspended state is very easy and operability is improved.

[0070]

For example, in the case where the posture of care receiver M is not appropriate, it is
25 assumed that the operation-suspended state is enacted due to an alarm trigger in which the difference between the instructed position and the current position of actuators 71, 72 becomes equal to or larger than a predetermined value. In this case, when the caregiver inputs an instruction to execute an assistance-related operation to input device 80, the
30 operation-suspended state is canceled. Thereafter, the caregiver can assist care receiver M by putting the care receiver M into a proper posture or adjusting the height.

[0071]

When detector 100 detects that care receiver M is in an abnormal posture, it is assumed that the operation-suspended state was enacted due to an abnormal posture as an alarm trigger. In this case, the caregiver puts the care receiver M into a proper posture and performs an instruction to execute an assistance-related operation to input device 80, thereby cancelling the operation-suspended state. At this point, since the care receiver M is put into a proper posture, the assisting of care receiver M can be performed.

[0072]

However, if input device 80 receives the input of an instruction to execute an assistance-related operation in the operation-suspended state but the alarm trigger has not been eliminated yet, control section 91 maintains the operation-suspended state. That is, when an alarm trigger that cannot be easily eliminated occurs, an operator such as the caregiver cannot cancel the operation-suspended state even if the operator operates input device 80. In such a case, the operator, such as a caregiver, turns off the power temporarily, or requests a repair by a technician of the manufacturer. Therefore, continuous control by control section 91 becomes impossible.

[0073]

When assistance device 1 is in the operation-suspended state, an alarm trigger is displayed on display device 92. For example, when an alarm trigger, causing a difference between the instructed position and the current position of actuators 71, 72 to be equal to or greater than a predetermined value, frequently occurs due to the inappropriate posture of the care receiver M, the caregiver can immediately recognize the alarm trigger displayed on display device 92. The caregiver can then continue to use assistance device 1 by changing the posture of care receiver M to a proper posture.

[0074]

When the alarm trigger is a trigger that can be continuously controlled by control section 91, display device 92 displays as such. If the caregiver cannot determine whether the alarm trigger is a continuously controllable trigger by looking at the display of only the alarm trigger, the caregiver can know that assistance device 1 can continue to be used by a display indicating that the alarm trigger is a continuously controllable trigger. Accordingly, the caregiver can recognize that assistance device 1 will continue to be used when the above is displayed.

[0075]

6. Other

In the above embodiment, assistance device 1 has a configuration in which lifting and lowering section 22 moves up and down with respect to base 10, and support section 60 swings back and forth with respect to lifting and lowering section 22. Further, assistance
5 device 1 may be configured such that support section 60 performs only one axial movement with respect to base 10, support section 60 performs multiple swinging motions with respect to base 10, support section 60 performs multiple linear translations with respect to base 10, and support section 60 is supported by a member, swinging with respect to base 10, so as to be translationally movable.

10

Reference Signs List

[0076]

1: Assistance device, 10: Base, 20: Column, 22: Lifting and lowering section, 40: Rocking
arm, 60: Support section, 61: Trunk support section, 62: Underarm support section, 71:
15 Lifting and lowering actuator, 72: Rocking actuator, 80: Input device, 90: Control unit,
91: Control section, 92: Display device, 100: Detector, M: Care receiver

Claims

1. An assistance device configured to assist in transferring a care receiver, the assistance device comprising:

- 5 an actuator configured to execute an assisting operation;
 an input device configured to receive an instruction to execute an assistance-related operation from an operator; and
 a control section configured to control the actuator based on the instruction to execute the assistance-related operation received by the input device;
- 10 wherein
 the control section enacts an operation-suspended state in which the actuator is stopped when an alarm trigger occurs;
 the control section cancels the operation-suspended state when the input device receives the instruction to execute the assistance-related operation in the
15 operation-suspended state if the alarm trigger has been eliminated; and
 the control section maintains the operation-suspended state when the input device receives the instruction to execute the assistance-related operation in the operation-suspended state if the alarm trigger has not been eliminated.

- 20 2. The assistance device of claim 1, wherein the control section controls the actuator based on a re-input instruction of an assistance-related operation when the input device receives re-input of the instruction to execute an assistance-related operation after cancelling the operation-suspended state.

- 25 3. The assistance device of claim 1 or 2, wherein the assistance device further comprises a display device configured to display the alarm trigger.

4. The assistance device of claim 3, wherein the display displays the alarm trigger and whether the alarm trigger is a trigger continuously controllable by the control section.

- 30 5. The assistance device of any one of claims 1 to 4, wherein the alarm trigger that can be continuously controlled by the control section is an alarm trigger in which the difference

between the instructed position and the current position of the actuator becomes equal to or greater than a predetermined value.

- 5 6. The assistance device of any one of claims 1 to 4, wherein the alarm trigger continuously controllable by the control section is an alarm trigger in which the posture of the care receiver detected by the detector is an abnormal posture.
- 10 7. The assistance device of any one of claims 1 to 6, wherein the assistance device further comprises a support section driven by the actuator and configured to support a part of the care receiver's body and put the care receiver from a sitting posture into an in-transit posture.