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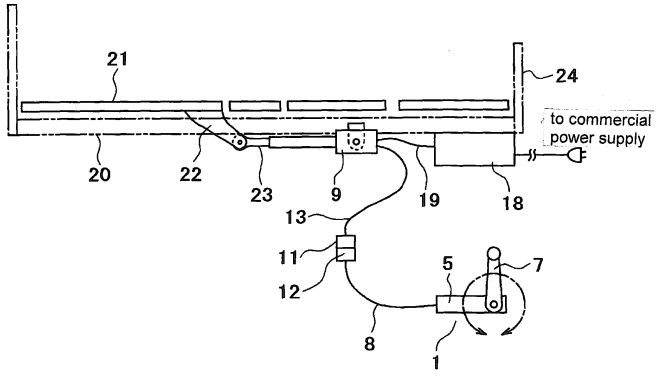
# (54) ELECTRIC BED

(57) [Problem to be solved] In the conventional motor-driven bed, the degree of freedom of design including the location where the crank handle is installed is low, and the object of the present invention is to increase the degree of freedom.

[Solution] The present invention is a motor-driven bed, in which the bed bottom is vertically moved and pivotally moved by using an actuator (9) having a rotation-linear motion converting mechanism, characterized in that the rotation side of the rotation-linear motion converting mechanism of the actuator comprises a DC motor and a speed reducing mechanism, and that the power is supplied to the DC motor selectively by either a controller (18) connected with the commercial power supply or a manual power generator (1) driven by a crank handle (7). The manual power generator is configured to ensure that a DC motor capable of acting reversely and a speed increasing mechanism are respectively housed in a device body (5), and that a crank handle connected with the input shaft of the speed increasing mechanism and a power supply cable (8) are provided outside the device body, and the speed increasing mechanism is configured as a worm gear mechanism provided with a worm wheel on the crank handle side and a worm as a multiple-threaded screw on the DC motor side, in order to greatly decrease the size and weight.

FIG.7

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## Description

[Technical field]

**[0001]** The present invention relates to a motor-driven bed, particularly a motor-driven bed in which the bed bottom can be vertically moved and pivotally moved even on an emergency such as power failure.

[Background art]

**[0002]** For the motor-driven bed in which the bed bottom is vertically moved and pivotally moved by an actuator comprising a DC motor, a speed reducing mechanism and a rotation-linear motion converting mechanism, various constitutions have been proposed and used so far. Such a motor-driven bed is provided with a controller for operating the DC motor of the actuator using the commercial power supply, and a predetermined DC voltage is obtained from the commercial power supply by the controller and is applied to the DC motor. As the DC voltage, for example, 24 V is widely used.

**[0003]** Many of these motor-driven beds employ any method for allowing the bed bottom to be vertically moved and pivotally moved even if the commercial power supply fails.

**[0004]** For example, in the invention described in patent document 1, at the rear of an actuator, a connection hole for allowing the end of a crank handle to be detachably connected is formed in order that the output shaft of a motor can be rotated by a manual handle.

**[0005]** Further, in the invention described in patent document 2, a main drive shaft extending from the output shaft of a motor to a threaded shaft as a component of a rotation-linear motion converting mechanism is provided with a gear transmission mechanism, and a sub drive shaft allowing the connection of a crank handle is provided in the direction crossing the main drive shaft.

**[0006]** The inventions described in patent documents 1 and 2 employ a constitution wherein a crank handle is installed at the place of an actuator. Consequently the location where the crank handle is installed is limited, and hence the location where the actuator is installed is also limited. Therefore, the crank handle may have to be installed at a place where the operation of the crank handle is difficult, as the case may be.

**[0007]** Further, in the invention described in patent document 3, a battery is provided for supplying power at the time of power failure. Another document proposes the use of solar cells as the battery.

**[0008]** A bed using a battery at the time of power failure is costly, and in the case where it is necessary to charge the battery, if the charging is forgotten, the battery may not be able to be used on an emergency as the case may be. Further, the use of a battery is troublesome since the charged amount must be monitored. Furthermore, it is difficult to obtain necessary power by using solar cells.

[Prior art documents]

[Patent documents]

**[0009]**

[Patent document 1] JP 2670759 B
[Patent document 2] JP 58-196648 U
[Patent document 3] JP 2832908 B

[Summary of the invention]

[Problem to be solved by the invention]

**[0010]** The conventional motor-driven beds are low in the degree of freedom of design including the location where the crank handle is installed for manual operation at the time of power failure, etc. The object of this invention is to increase the degree of freedom.

[Means for solving the problem]

**[0011]** The present invention for solving the abovementioned problem proposes a motor-driven bed, in which the bed bottom is vertically moved and pivotally moved by using an actuator having a rotation-linear motion converting mechanism, characterized in that the rotation side of the rotation-linear motion converting mechanism of the actuator comprises a DC motor and a speed reducing mechanism, and that the power is supplied to the DC motor selectively by either a controller connected with the commercial power supply or a manual power generator driven by a crank handle.

**[0012]** Further, this invention proposes a motor-driven bed with the abovementioned constitution, wherein multiple actuators are installed in correspondence to the places where the bed bottom is vertically moved and pivotally moved, and the power is supplied to the DC motors of the multiple actuators respectively by the controller connected with the commercial power supply or selectively by one common manual power generator via a changeover switch.

**[0013]** Furthermore, this invention proposes a motor-driven bed with the above constitution, wherein the manual power generator is configured in such a manner that a DC motor capable of acting reversely and a speed increasing mechanism connected with the rotating shaft of the DC motor are housed in a device body, that the crank handle connected with the input shaft of the speed increasing mechanism and a power supply cable connected with the power supply side of the DC motor are provided outside the device body, and that a connector connectable with the power supply side connector of the DC motor is provided on the tip side of the power supply cable.

**[0014]** Moreover, this invention proposes a motor-driven bed with the above constitution, wherein the speed increasing mechanism is provided with a worm wheel on

the crank shaft side and a worm on the DC motor side. Further, this invention proposes a motor-driven bed wherein the worm is a multiple-threaded screw.

**[0015]** Furthermore, this invention proposes a motor-driven bed with the above constitution, wherein the DC motor and the speed increasing mechanism of the manual power generator have the same configuration as that of the DC motor and the speed reducing mechanism of the actuator.

**[0016]** Further, this invention proposes a motor-driven bed with the above constitution, wherein the manual power generator is installed at an adequate place of the bed where the crank handle can be operated, or is supported at an adequate place of the bed in such a manner that it can be attached to or detached from the adequate place.

[Effects of the invention]

**[0017]** In the motor-driven bed of this invention, at an ordinary time, the DC power supplied from the commercial power supply via the controller is supplied to the DC motor of the actuator, to vertically move or to pivotally move the bed bottom. Therefore, like an ordinary motor-driven bed, a remote controller can be used to vertically move or to pivotally move the bed bottom.

**[0018]** On the other hand, in the case where the commercial power supply fails or in the case where the power cannot be or should not be supplied to the DC motor of the actuator via the controller, for example, as in the case where the person lying on the bed bottom is prevented from using the remote controller for vertically moving or pivotally moving the bed bottom, the crank handle of the manual power generator is rotated to generate DC power, so that the DC power can be used to rotate and drive the DC motor constituting the actuator, for vertically moving or pivotally moving the bed bottom via the rotation-linear motion converting mechanism.

**[0019]** In such vertical movement or pivotal movement of the bed bottom, the movement is merely required to obtain predetermined displacement, and controlled certain movement such as constant speed movement is not necessarily required. Consequently the manual power generator can be used to operate the actuator, for vertically moving or pivotally moving the bed bottom without allowing the person lying on the bed bottom to feel uneasy.

**[0020]** The actuator and the manual power generator provided with a crank handle are only required to be connected with each other by a power supply cable. Therefore, both the actuator and the manual power generator are high in the degree of freedom of installation. In particular, the manual power generator can be installed at an adequate place of a bed or can also be supported at an adequate place in such a manner that it can be attached to or detached from the adequate place and hence can be held by hand when used. Thus, the crank handle can be very easily operated by the operator.

**[0021]** In the case where the motor-driven bed of this invention has multiple places where the bed bottom is vertically moved and pivotally moved, the manual power generator may be installed for each of the places, or if the connection of the power supply cable with the manual power generator can be made by connecting connectors, the common manual power generator can be used for the operation at each of the multiple places by connecting the corresponding connector. Further, the connection of the common manual generator with each of DC motors of multiple actuators can be easily made by using a changeover switch.

**[0022]** In this invention, the speed increasing mechanism constituting the manual power generator can be configured as a worm gear mechanism provided with a worm wheel on the crank handle side and a worm on the DC motor side, so that the size and weight can be greatly decreased.

**[0023]** In this case, the worm can be configured as a two- or more-threaded screw, i.e., a multiple-threaded screw with a large helix angle, in order to reduce the effect of friction. In general, the rotational speed necessary as a power generator is, for example, 1500 rpm (25 Hz) or more at the minimum. Further, as for the rotational speed that can be inputted by a manual device, 120 rpm (2 Hz) is considered to be close to a limit value, and in this case, a speed increasing ratio of 12.5 or more is necessary. In this invention, if the worm is a two- or more-threaded screw, a high speed increasing ratio and a higher transmission efficiency can be achieved. In the size and structure that can be easily operated, a manual power generator complying with the aforementioned requirements can be realized.

**[0024]** In this invention, the DC motor and the speed increasing mechanism of the manual power generator can have the same configuration as that of the DC motor and the speed reducing mechanism of the actuator, in order to greatly reduce the cost.

**[0025]** Further, in this invention, if an abnormal load acts on the actuator, for example, because any part of a person's body is caught in any clearance between bed bottom parts in the state where the bed bottom is vertically moved or pivotally moved, the rise of the load appears as the rise in the required torque of the crank handle of the manual power generator. Consequently the abnormal load can be detected due to the rise of the torque. In addition, since the crank handle and the actuator are not mechanically directly connected with each other, safety is high.

[Brief description of the drawings]

**[0026]**

[Fig. 1] Fig. 1 is an illustration for conceptually showing the constitution and action of an example of the manual power generator used in the motor-driven bed of this invention.

[Fig. 2] Fig. 2 is an illustration showing the appear-

ance of the main body of an example of the manual power generator used in the motor-drive bed of this invention.

[Fig. 3] Fig. 3 is a longitudinal sectional illustration showing an example of the manual power generator used in the motor-driven bed of this invention.

[Fig. 4] Fig. 4 is a front view showing the constitution of a DC motor and a speed increasing mechanism as components of an example of the manual power generator used in the motor-driven bed of this invention.

[Fig. 5] Fig. 5 is a plan view showing the constitution of a DC motor and a speed increasing mechanism as components of an example of the manual power generator used in the motor-driven bed of this invention.

[Fig. 6] Fig. 6 is a left side view showing the constitution of a DC motor and a speed increasing mechanism as components of an example of the manual power generator used in the motor-driven bed of this invention.

[Fig. 7] Fig. 7 is an illustration showing conceptually an embodiment of the motor-driven bed of this invention.

[Fig. 8] Fig. 8 is an illustration showing conceptually another embodiment of the motor-driven bed of this invention.

[Fig. 9] Fig. 9 is an illustration showing conceptually a state where the manual power generator is installed on a bed in an embodiment of the motor-driven bed of this invention.

[Fig. 10] Fig. 10 is an illustration showing conceptually another state where the manual power generator is installed on a bed in an embodiment of the motor-driven bed of this invention.

[Fig. 11] Fig. 11 is an illustration showing conceptually a further other embodiment of the motor-driven bed of this invention.

[Fig. 12] Fig. 12 is an illustration showing conceptually a further other embodiment of the motor-driven bed of this invention.

[Modes for carrying out the invention]

**[0027]** Next, the modes for carrying out the motor-driven bed of this invention will be explained below in reference to the attached drawings. At first, the motor-driven bed of this invention and the manual power generator used for the bed will be explained. In the drawings, symbol (1) generally denotes a manual power generator, and in the manual power generator (1), a DC motor (2) capable of acting reversely and a speed increasing mechanism (4) connected with the rotating shaft (3) of the DC motor (2) are housed in a device body (5). A crank handle (7) connected with the input shaft (6) of the aforementioned speed increasing mechanism (4) and a power supply cable (8) connected on the power supply side of the DC motor (2) are provided outside the device body (5). In the motor-driven bed of this invention, a power supply connector (12) connectable with the power supply side connector (11) of the DC motor (10) constituting the actuator (9) for vertically moving and pivotally moving the bed bottom is provided on the tip side of the power supply cable (8). Symbol (13) denotes a power receiving cable, and symbol (14) denotes a speed reducing mechanism as a component of the actuator (9). Further, symbol (18) denotes a controller connected with the commercial power supply, and the power supply cable (19) from the controller (18) is connected with the DC motor (10) constituting the actuator (9). Meanwhile, in this embodiment, the device body (5) of the manual power generator (1) is a pair of shells divided in the longitudinal direction and combined together by screws (not shown in the drawings), to support and house the respective components.

**[0028]** The speed increasing mechanism (4) is explained below in detail. As shown in Figs. 3 through 6, the speed increasing mechanism (4) is provided with a worm wheel (15) on the crank handle (7) side, and the input shaft (6) is projected from the worm wheel (15). The speed increasing mechanism (4) is also provided with a worm (16) engaged with the worm wheel (15) on the DC motor (2) side. Further, the worm (16) is configured as a two-threaded screw, and the helix angle of thereof is larger than the friction angle. Consequently the worm gear mechanism can act reversely. Furthermore, the worm gear mechanism can easily obtain a large speed increasing ratio (speed reducing ratio), for example, of 1/32. Meanwhile, the member of symbol (17) indicated by a two-dot dash line in the drawings is a support member for the input shaft (6), the worm wheel (15) and the worm (16).

**[0029]** Fig. 7 is an illustration showing conceptually an embodiment of the motor-driven bed of this invention. In the drawing, the bed bottom part (21) corresponding to the back of the user and pivotally supported by the bed bottom support frame (20) is pivotally rotated by the linear motion member (23) of the actuator (9), connected with a press-up arm (22) provided below the pivotal fulcrum side of the bed bottom part (21).

**[0030]** In the motor-driven bed of this invention as described above, in an ordinary time, the DC power obtained from the commercial power supply via the controller (18) is supplied to the DC motor (10) of the actuator (9) by the power supply cable (19), to vertically move or pivotally move the bed bottom. Therefore, like an ordinary motor-driven bed, a remote controller can be used to vertically move or pivotally move the bed bottom part (21), etc.

**[0031]** On the other hand, in the case where the commercial power supply fails, or in the case where the power supply to the DC motor (10) of the actuator (9) via the controller (18) cannot or should not be performed, for example, as in the case where the person lying on the bed bottom is prevented from vertically moving or pivotally moving the bed bottom by a remote controller, the power supply connector (12) of the power supply cable

(8) is connected with the power supply side connector (11) of the DC motor (10) constituting the actuator (9) as shown in Figs. 1 and 7. Subsequently the device body (5) is held by hand, and the crank handle (7) is rotated for driving.

**[0032]** The rotation of the crank handle (7) is increased in speed by the speed increasing mechanism (4), to rotate the rotor of the DC generator (2), for generating electromotive force. The DC power generated in this manner is supplied through the power supply cable (8), the connectors (12) and (11) and the power receiving cable (13) to the DC motor (10) constituting the actuator (9), to operate the actuator (9).

**[0033]** In this manner, the linear motion member (23) of the actuator (9) can be moved, for example, leftward in Fig. 7, to pivotally raise the bed bottom part (21) by the press-up arm (22). Further, if the crank handle (7) is reversely rotated, the bed bottom part (21) can be pivotally lowered by the action reverse to the abovementioned action.

**[0034]** In the vertical movement or pivotal movement of the bed bottom as described above, suitable displacement may only be obtained as the movement, and the controlled certain movement such as constant speed movement is not necessarily required. Therefore, if the actuator (9) is operated by using the manual power generator (1), the bed bottom part (21) can be smoothly moved without allowing the user on the bed to feel uneasy.

**[0035]** In the motor-driven bed of this invention, it is only required that the actuator (9) and the manual power generator (1) provided with the crank handle (7) are connected with each other by the power supply cable (8). Consequently the degree of freedom in installing both the actuator (9) and the manual power generator (1) is high. Meanwhile, in this case, the power supply cable (8) can be attached or detached by using the abovementioned connectors, and in addition, can also be connected without the connectors as shown in Fig. 8.

**[0036]** The manual power generator (1) can be installed at one end in the longitudinal direction of the bed in such a manner that the crank handle (7) can be operated, for example, outside the foot board (24) of the bed on the leg side as shown in Fig. 9, or on one lateral side in the width direction in such a manner that the crank handle (7) can be operated from the lateral side of the bed as shown in Fig. 10, or any other appropriate place of the bed. Furthermore, instead of fixedly installing the manual power generator at any appropriate place of the bed, the manual power generator can also be supported at an adequate stowing place of the bed in such a manner that it can be attached to or detached from the stowing place, so that the manual power generator can be detached from the stowing place when used, for being held by hand. Thus the operator can very easily operate the crank handle (7).

**[0037]** Further, the motor-driven bed of this invention may have such a constitution that the bed bottom must be vertically moved and pivotally moved at multiple places. For example, Fig. 11 typically shows a case where there are two bed bottom parts to be pivotally rotated, i.e., the bed bottom part (21) corresponding to the back portion of the user and a bed bottom part (26) corresponding to the thigh portions. In such a case, multiple manual power generators (1) may be installed in correspondence to the places. In the abovementioned particular case, one each manual power generator may be installed for each of the bed bottom parts (21) and (26). Further, in the case where the power supply cable (8) is connected with each of actuators (9) via the power supply connector (12) as described before, if the actuator (9) to be connected with the power supply connector (12) is selected, one common manual power generator (1) can be used for vertical movement and pivotal movement at multiple places. Furthermore, as shown in Fig. 12, the connection between one common manual power generator (1) and either of the DC motors of multiple actuators (9) by either of power supply cables (8) can be easily made by using a changeover switch (27).

[Example 1]

**[0038]** Specifications in one example of the manual power generator described above are explained below.
Manual input: 10 to 50 [N]
Manual rotational speed of input shaft: 30 to 120 [rpm]
Speed reducing ratio (speed increasing ratio): 1/15.5
Rotational speed of rotating shaft: 456 to 1860 [rpm]
Generated power: 10 to 30 [VA]

**[0039]** In this example, if the speed increasing mechanism (4) constituting the manual power generator (1) is configured as a worm gear mechanism having the worm wheel (15) on the crank handle (7) side and a worm (16) as a two-threaded screw on the DC motor (2) side, the size and the weight can be greatly decreased. Consequently, a manual power generator (1) allowing components to be housed in a device body (5) with a size that can be handheld and satisfying the abovementioned specifications can be realized.

**[0040]** Further, in the motor-driven bed of this invention, the DC motor (2) and the speed increasing mechanism (4) of the manual power generator (1) can have the same configuration as that of the DC motor (10) and the speed reducing mechanism (14) of the actuator (9) used for vertically moving or pivotally moving the bed bottom, and consequently the cost can be greatly decreased.

[Industrial applicability]

**[0041]** This invention is as described above. Therefore, in the motor-driven bed, the degree of freedom of design including the location where the manually operated crank handle is installed for the failure of the commercial power supply is very high, and a highly safe high-performance motor-driven bed can be presented at low cost. The motor-driven bed is very highly applicable in

hospitals and households.

[Meanings of symbols]

**[0042]**

1 Manual power generator
2 DC motor
3 Rotating shaft
4 Speed increasing mechanism
5 Device body
6 Input shaft
7 Crank handle
8 Power supply cable
9 Actuator
10 DC motor
11 Power supply side connector
12 Power supply connector
13 Power receiving cable
14 Speed reducing mechanism
15 Worm wheel
16 Worm
17 Support member
18 Controller
19 Power supply cable
20 Bed bottom support frame
21 Bed bottom part
22 Press-up arm
23 Linear motion member
24 Foot board
26 Bed bottom part
27 Changeover switch

## Claims

**1.** A motor-driven bed, in which the bed bottom is vertically moved and pivotally moved by using an actuator having a rotation-linear motion converting mechanism, **characterized in that** the rotation side of the rotation-linear motion converting mechanism of the actuator comprises a DC motor and a speed reducing mechanism, and that the power is supplied to the DC motor selectively by either a controller connected with the commercial power supply or a manual power generator driven by a crank handle.

**2.** A motor-driven bed, according to claim 1, wherein multiple actuators are installed in correspondence to the places where the bed bottom is vertically moved and pivotally moved, and the power is supplied to the DC motors of the multiple actuators respectively by the controller connected with the commercial power supply and selectively by one common manual power generator via a changeover switch.

**3.** A motor-driven bed, according to claim 1 or 2, wherein the manual power generator is configured to ensure that a DC motor capable of acting reversely and a speed increasing mechanism connected with the rotating shaft of the DC motor are housed in a device body, that the crank handle connected with the input shaft of the speed increasing mechanism and a power supply cable connected with the power supply side of the DC motor are provided outside the device body, and that a connector connectable with the power supply side connector of the DC motor is provided on the tip side of the power supply cable.

**4.** A motor-driven bed, according to claim 3, wherein the speed increasing mechanism is provided with a worm wheel on the crank handle side and a worm on the DC motor side.

**5.** A motor-driven bed, according to claim 4, wherein the worm is a multiple-threaded screw.

**6.** A motor-driven bed, according to any one of claims 1 through 5, wherein the DC motor and the speed increasing mechanism of the manual power generator have the same configuration as that of the DC motor and the speed reducing mechanism of the actuator.

**7.** A motor-driven bed, according to any one of claims 1 through 6, wherein the manual power generator is installed at an adequate place of the bed where the crank handle can be operated.

**8.** A motor-driven bed, according to any one of claims 1 through 6, wherein the manual power generator is supported at an adequate place of the bed in such a manner that it can be attached to and detached from the adequate place.

FIG.1

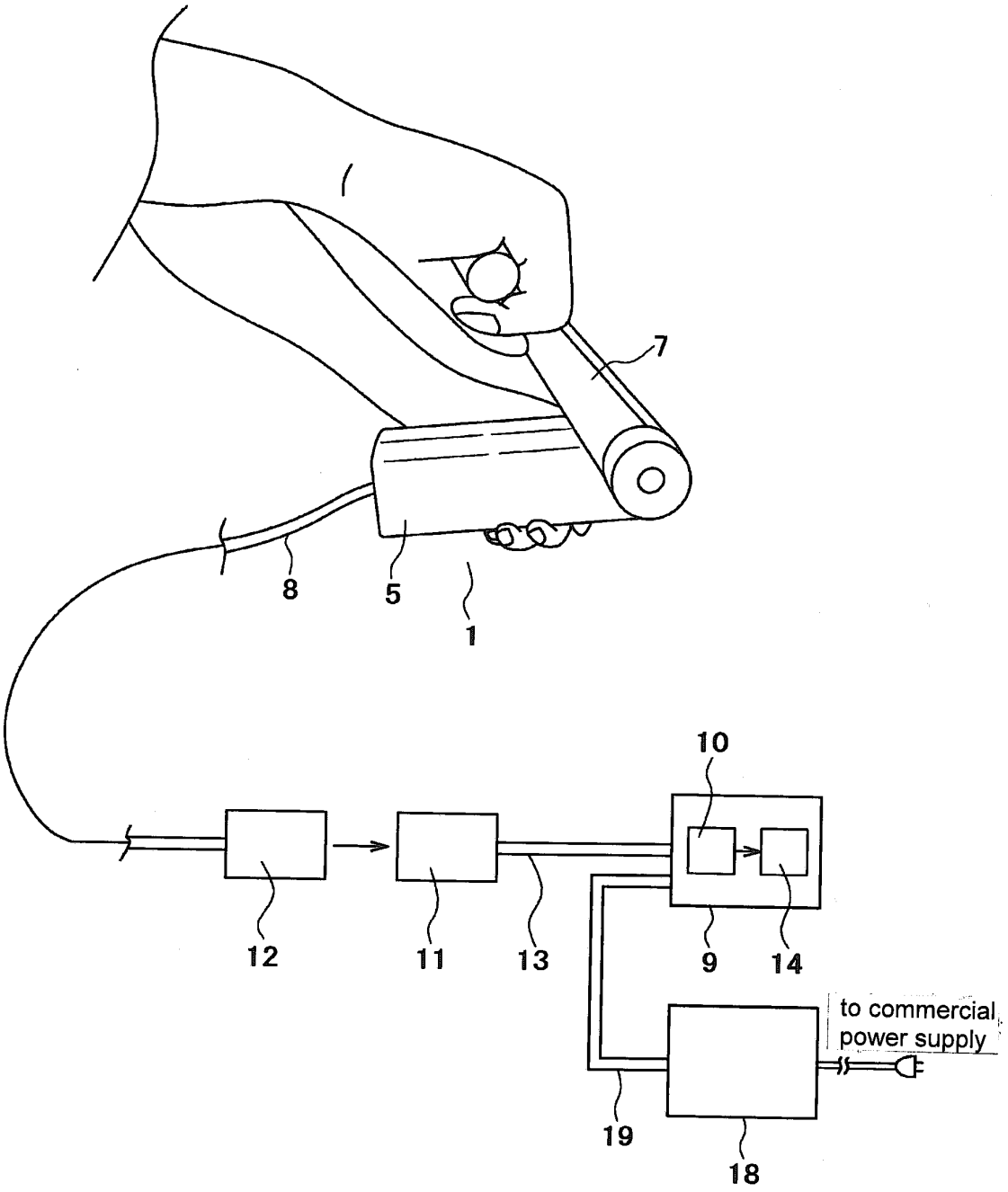

FIG.2

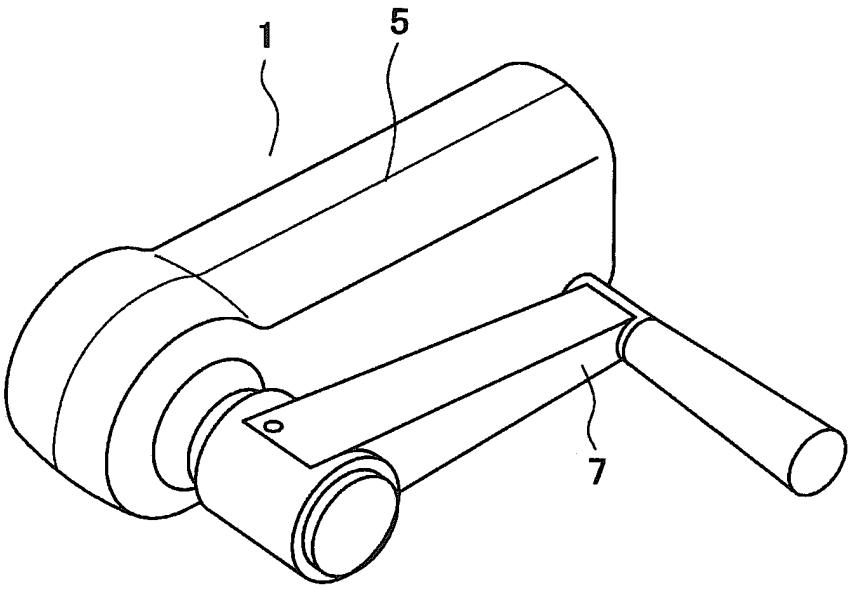


FIG.3

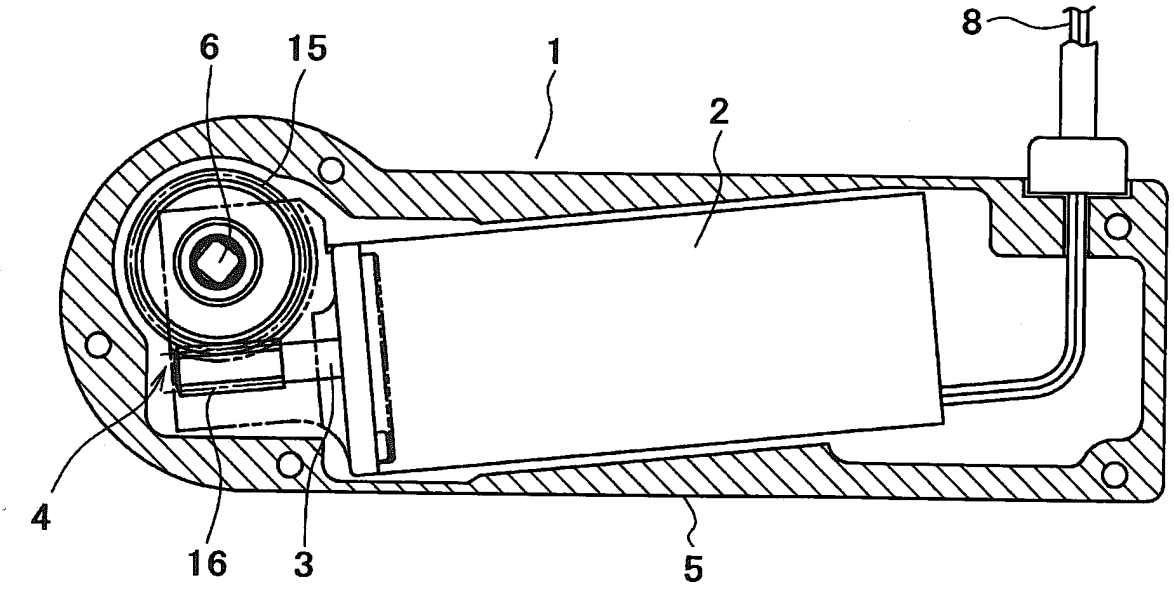

FIG.4

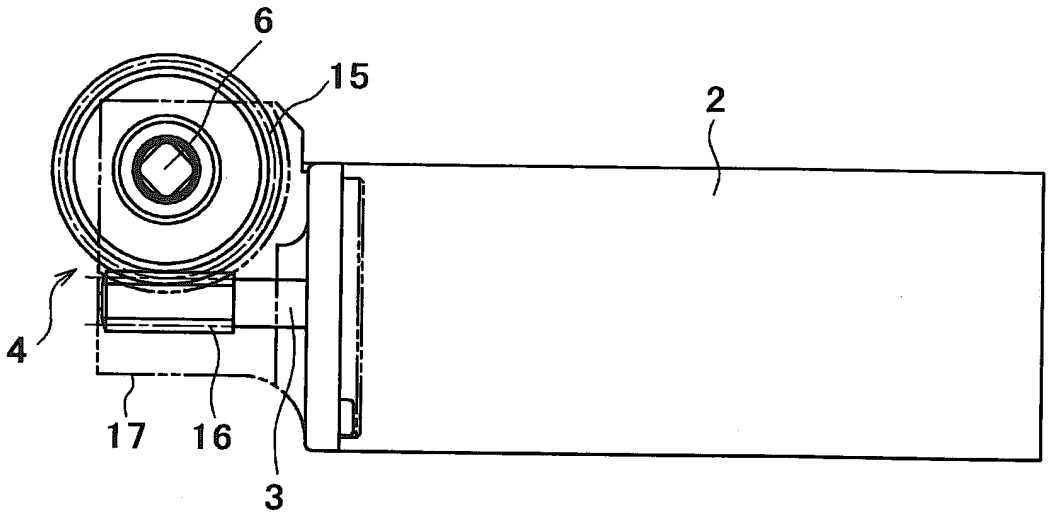


FIG.5

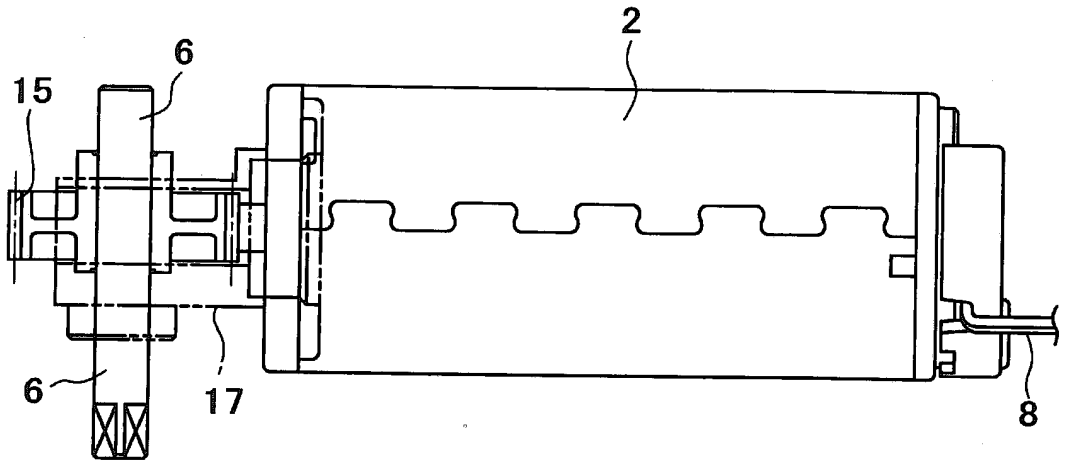


FIG.6

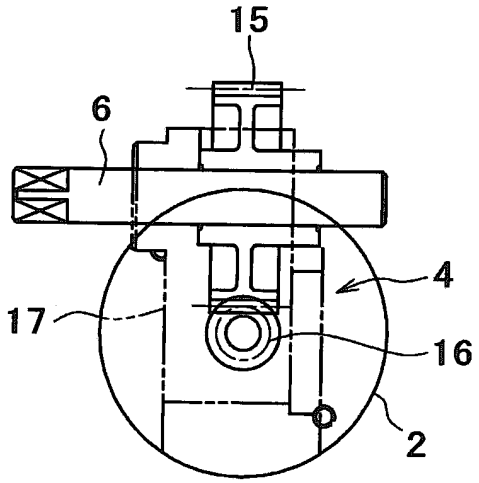

FIG.7

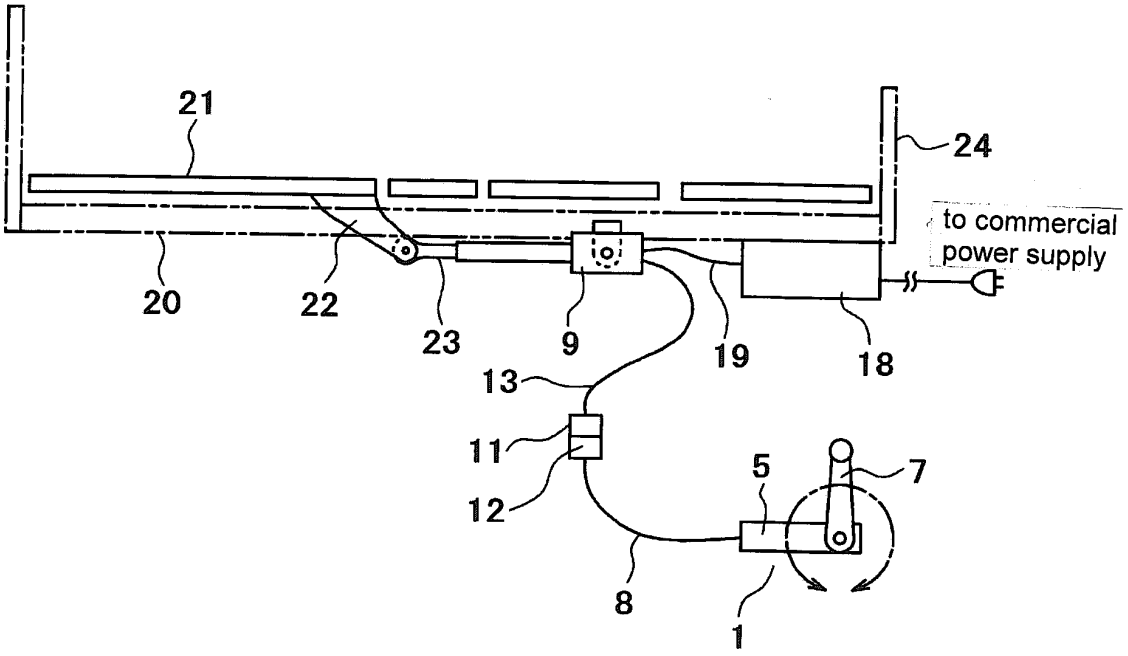
21
24
to commercial
power supply
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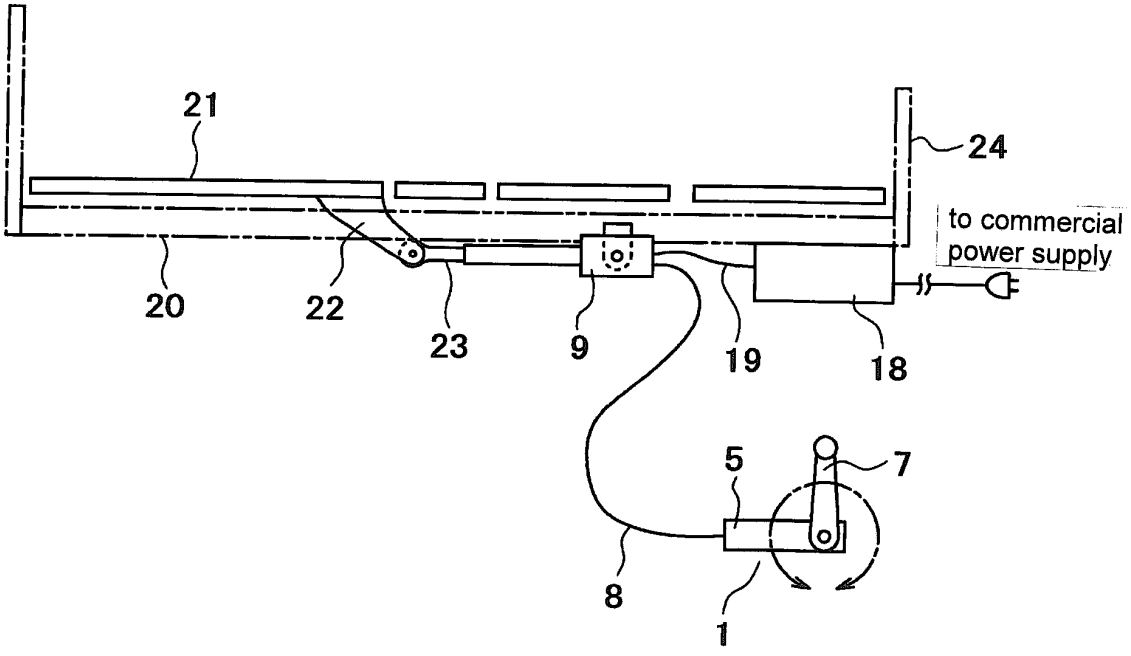
FIG.8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to commercial
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FIG.9

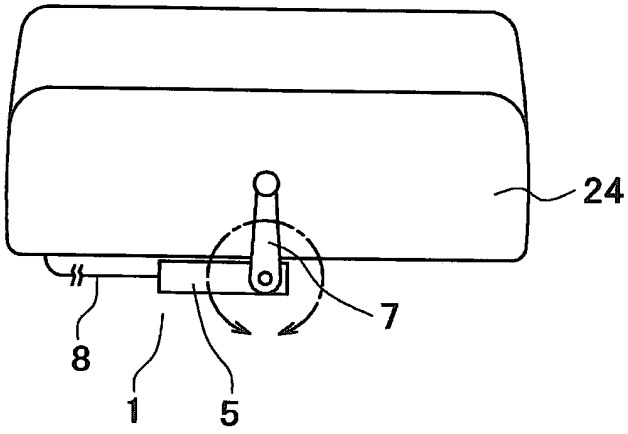



FIG.10

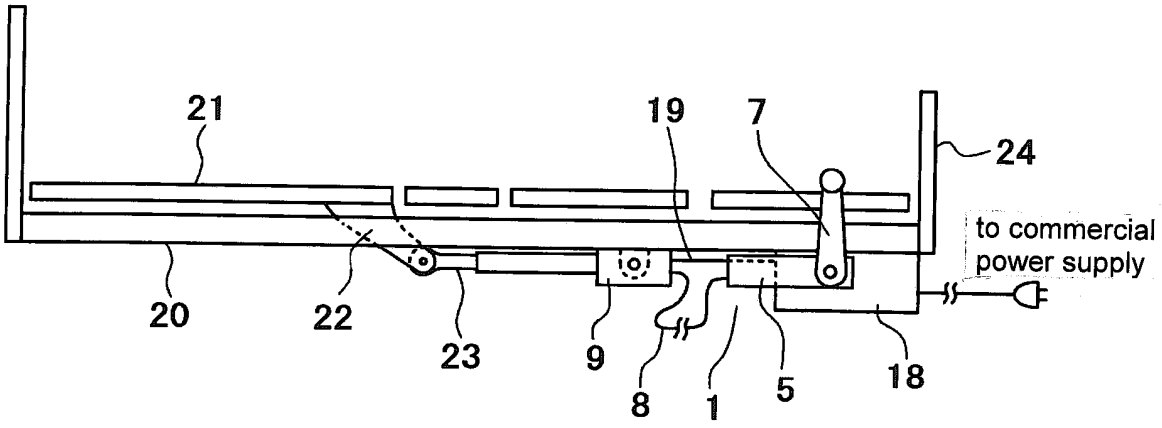
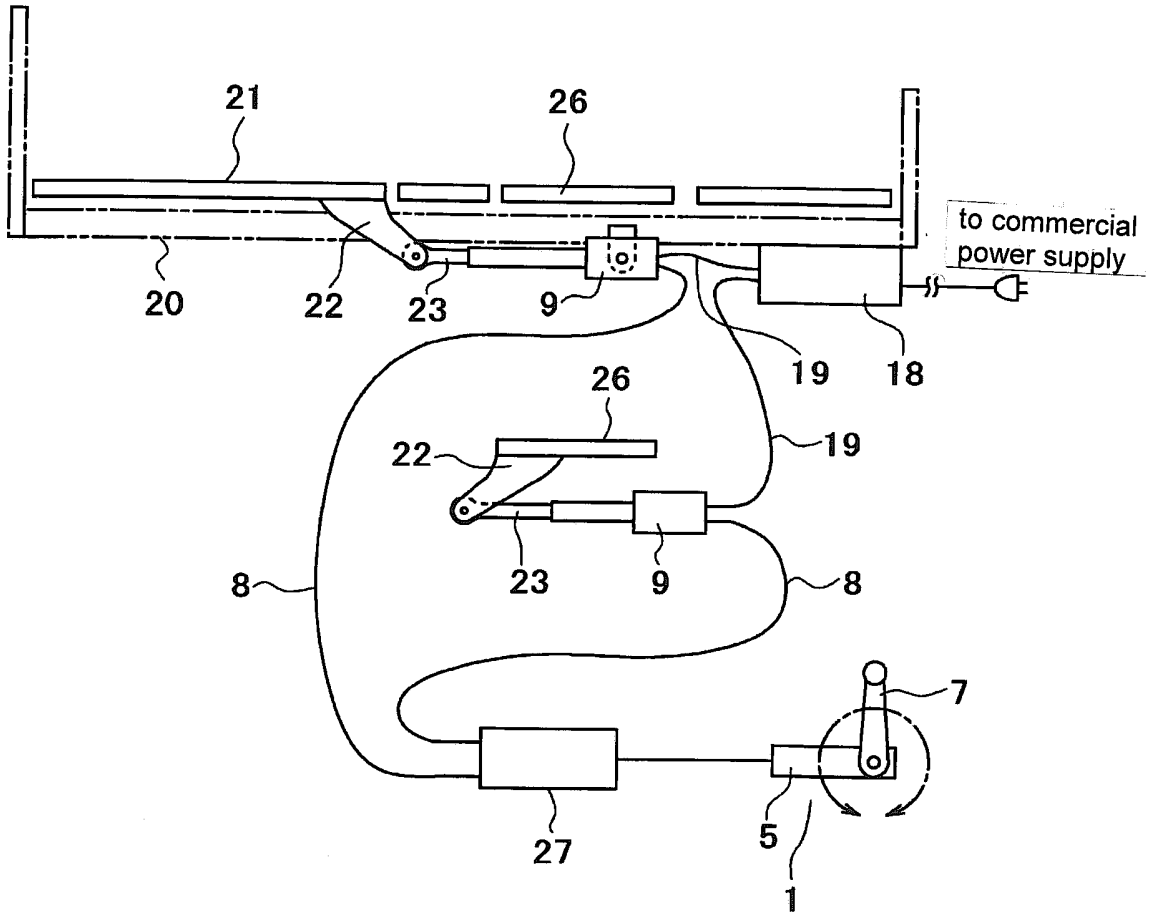


FIG.11


21
26
20
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9
19
18
to commercial power supply
26
22
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27
5
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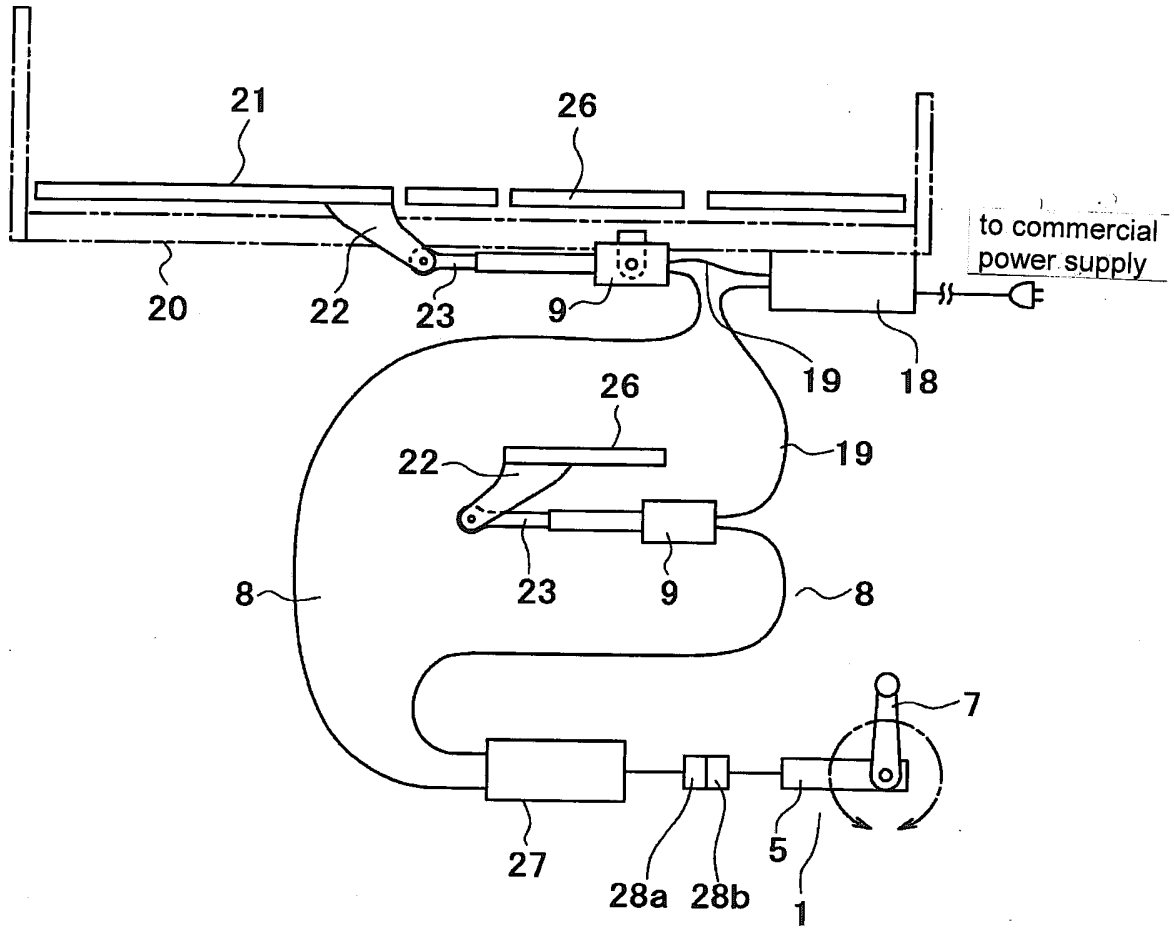
FIG.12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to commercial power supply
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**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/JP2012/069595

A. CLASSIFICATION OF SUBJECT MATTER
*A47C20/04*(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A47C20/04

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2012
Kokai Jitsuyo Shinan Koho 1971-2012 Toroku Jitsuyo Shinan Koho 1994-2012

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | JP 2670759 B2 (Paramount Bed Co., Ltd.), 29 October 1997 (29.10.1997), entire text; all drawings (Family: none) | 1,7,8 |
| Y | JP 2000-123229 A (Fuji Electric Co., Ltd.), 28 April 2000 (28.04.2000), paragraphs [0016] to [0021]; fig. 1 to 2 (Family: none) | 1,7,8 |
| A | JP 3121100 U (Grourmandise Inc.), 27 April 2006 (27.04.2006), entire text; all drawings (Family: none) | 2-6 |

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

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"E" earlier application or patent but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
"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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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 14 August, 2012 (14.08.12) | 21 August, 2012 (21.08.12) |
| Name and mailing address of the ISA/ Japanese Patent Office<br>Facsimile No. | Authorized officer<br>Telephone No. |

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**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/JP2012/069595

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | JP 2006-325383 A (Kabushiki Kaisha Seiyu), 30 November 2006 (30.11.2006), entire text; all drawings (Family: none) | 2-6 |
| A | Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 93934/1982(Laid-open No. 196648/1983) (Kimura Shindai Industry Co., Ltd.), 27 December 1983 (27.12.1983), entire text; all drawings (Family: none) | 1-8 |

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## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


- JP 2670759 B **[0009]**
- JP 58196648 U **[0009]**
- JP 2832908 B **[0009]**