

SPECIFICATION

BED APPARATUS

TITLE OF THE INVENTION:

Technical Field

5 [0001] The present invention relates to a bed apparatus with which electric power can be supplied to electric power use devices such as electric actuators by a hand-crank generator.

Background Art

Disclosure of Invention

10 [0002] In the bed apparatuses for nursing use, medical use and the like, various kinds of electric power use devices such as electric actuators for bed drivers, measuring instruments for care receivers and patients (which will be referred to hereinbelow as 'the care receivers and others')
15 are provided.

As to the posture of care receivers and others on the bed apparatus, caregivers and nurses (which will be referred to hereinbelow as 'the caregivers and others') carry out a back raising operation to raise a back bottom in order to
20 make the care receiver sit up and carry out a leg raising operation to raise a knee bottom and a leg bottom to ease the legs.

[0003] Since caregivers and others will receive a burden if the back raising and other operations of the bed apparatus
25 are done by use of a mechanical rotation handle by hand, usually

such the operation is done by motor driving. The electric power source for driving in such a case generally uses the power outlets in the facility in which the bed apparatus is installed, such as nursing home, hospital, etc., as described in Japanese Patent Application Laid-open 2008-220603 (which will be called "Patent Document 1").

[0004] Since the electric power sources inside facilities are often disposed on the walls near the floor, the electric power cable touches the floor surface, producing unbeneficial condition to the health and there is a risk of the electric power cable getting caught by the lifting mechanism of the bed. In order to prevent these problems from occurring, Japanese Patent Application Laid-open 2011-160888 (which will be called "Patent Document 2") proposed a cordless electric power supply device that generates electricity by means of solar batteries (solar panels).

[0005] However, when solar batteries are used, the setting place is limited since it is necessary to secure a sufficient amount of electric power generation in the room where the sunshine is hard to get. Further, the device becomes bulky because it is necessary to provide a battery that can charge (store) generated electric power.

Prior Art Document

Patent Document

[0006]

Patent Document 1:

Japanese Patent Application Laid-open 2008-220603

Patent Document 2:

Japanese Patent Application Laid-open 2011-160888

5 Summary of the Invention

Problems to be Solved by the Invention

[0007] To deal with this, the inventors hereof have contrived
to use a generator worked manually by hand (which will be
referred to herein below as "hand-crank generator") for the
10 electric power source of the bed apparatus.

[0008] However, since the hand-crank generator is driven by
hand by the caregivers and others, there is a demand that
the generator should be manually driven at a place where it
does not cause any burden on the work of caregivers and others.

15 [0009] Further, it is also necessary to reduce the temporal
and physical burden during the connecting work of wire between
the electric power use devices such as electric actuators
etc. and the hand-crank generator. When the electric actuator
is simply connected to the hand-DAN generator, the person
20 (operator) who performs the connecting work needs to get under
the bed to connect the dedicated connectors, which is a work
that requires a lot of time and physical burden.

[0010] Further, it is necessary take safety measures so that
those (children and cognitively disease patients) who do not
25 understand the uses and purposes (which will be referred to

hereinbelow as "uses and others.") of the hand-crank generator will be prevented from GUse.

Moreover, there has been a demand for a bed apparatus in which the hand-crank generator can supply electric power to electric power use devices as the power supply destinations other than the electric actuators provided for the bed apparatus so as to be able to supply electricity to diverse measuring instrument in case of a power failure.

[0011] The present invention has been devised in view of the above circumstances, it is therefore an object of the present invention to provide a bed apparatus that facilitates the operator to work on electric generation in generating electricity with a hand-crank generator, can reduce the temporal and physical burden on the operator and can secure safety for those who do not understand uses and others.

Means for Solving the Problems

[0012] According to the present invention, a bed apparatus includes: an electric power use device that is operated by an electric power, and wherein the electric power can be supplied by a hand-crank generator, and at least one end of an electric power path for delivering the electric power to the electric power use device is arranged at a position on an outer side surface of a head side, lateral sides, or a foot side of the bed apparatus.

[0013] It is preferable in the present invention that the

hand-crank generator is provided outside the bed apparatus,
as the electric power paths, the first electric power path
connected to the hand-crank generator and a single or a
plurality of second electric power paths for supplying the
5 electric power to a single or a plurality of electric power
use devices are provided, input side ends of the single or
a plurality of second electric power paths are provided in
a relay box while an output-side end of the first electric
power path can be connected to the input side ends of the
10 second electric power paths provided in the relay box, whereby
when the hand-crank generator is operated to generate
electricity in a state that the first electric power path
is connected to the second electric power path, the electric
power use device can operate, and, the relay box is arranged
15 at a place on a horizontal outer side surface of the head
side, the lateral sides, or the foot side of the bed apparatus
within reach of user's hands.

[0014] It is preferable in the present invention that a
plurality of electric power use devices are provided, the
20 relay box is provided with a plurality of input-side ends
of the plurality of second electric power paths each connected
to the plurality of electric power use devices, and, the output
side of the first electric power path can be selectively
connected to any one of the input-side ends of the plurality
25 of second electric power paths, and when the external

hand-crank generator is operated to generate electricity in a state that the first electric power path is connected to a selected second electric power path, electric power can be supplied to the electric power use device connected to the selected second electric power path.

[0015] It is preferable in the present invention that the relay box is provided with a switching means that turns on and off connection of the second electric power path with the first electric power path from the hand-crank generator or switches connection between the first electric power path and the plurality of second electric power paths.

[0016] It is preferable in the present invention that the hand-crank generator is provided on the bed apparatus itself, and, the hand-crank generator is arranged at the position on the outer side surface of the head side, the lateral sides, or the foot side of the bed apparatus so as to be able to supply electric power from the first electric power path connected to the hand-crank generator to the ends of the second electric power paths for supplying the electric power to a single or a plurality of electric power use devices.

[0017] It is preferable in the present invention that a handle for operating the hand-crank generator to generate electricity can be accommodated in the bed apparatus, and can be turned round from an outside of the hand-crank generator when the handle is used.

[0018] It is preferable in the present invention that a plurality of electric power use devices are provided, an output side of the first electric power paths from a single or a plurality of hand-crank generators can be selectively
5 connected to any one of the ends of the plurality of second electric power paths, and when the hand-crank generators are operated to generate electricity in a state that the first electric power path is connected to a selected second electric power path, electric power can be supplied to the electric
10 power use device connected to the selected second electric power path.

[0019] It is preferable in the present invention that the bed apparatus further includes a switching means adjacent to the hand-crank generator that turns on and off the connection
15 of the second electric power path with the first electric power path from the hand-crank generator or that switches connection between the first electric power path and the plurality of second electric power paths.

[0020] It is preferable in the present invention that the
20 switching means contains a switching mechanism that mechanically performs an on/off operation of the second electric power path or a switching operation of a power supply destination, by an operating force that is transmitted from a control portion for operation via a mechanical wire.

25 [0021] It is preferable in the present invention that the

switching means uses a relay circuit that performs an on/off operation of the electric power path or a switching operation of an electric power supply destination, based on electric signals transmitted from a control portion for operation.

5 [0022] It is preferable in the present invention that the bed apparatus further comprises a driver that drives a predetermined part of the bed apparatus by means of an electric actuator or a peripheral device of the bed apparatus, as the electric power use device.

10 Advantages of the Invention

[0023] According to the present invention, the bed apparatus comprising: an electric power use device that is operated by an electric power source, is constructed such that electric power can be supplied by a hand-crank generator, and at least
15 one end of the electric power path for delivering the electric power to the electric power use device is arranged at a position on an outer side surface of the head side, the lateral sides and the foot side of the bed apparatus. Accordingly, the operator can easily reach out their hand to the place on the
20 horizontal outer side surface, hence easily generate electricity when the generator is working on generation of electricity. Further, since the generation work becomes easy, it is possible to reduce the temporal and physical burden.

[0024] In the present invention, the hand-crank generator
25 is provided outside the bed apparatus, as the electric power

paths, the first electric power path connected to the hand-crank generator and the second electric power paths for supplying power to an electric actuator are provided, the input side ends of the single or plurality of second electric power paths are provided in a relay box while the output-side end of the first electric power path can be connected to the input side ends of the second electric power paths provided in the relay box, whereby when the hand-crank generator is operated to generate electricity in a state that the first electric power path is connected to the second electric power path, the electric power use device can operate, and, the relay box is arranged at the place on the horizontal outer side surface of the head side, the lateral sides or the foot side of the bed apparatus within reach of the user's hands. Accordingly, this arrangement facilitates connecting work.

[0025] In the present invention, a plurality of electric power use devices are provided, the relay box is provided with the plurality of input-side ends of the plurality of second electric power paths each connected to the plurality of electric power use devices, and, the output side of the first electric power path can be selectively connected to any one of the input-side ends of the plurality of second electric power paths, and when the external hand-crank generator is operated to generate electricity in a state the first electric power path is connected to a selected second electric power

path, electric power can be supplied to the electric power use device connected to the selected second electric power path. Accordingly, the first electric power path is selectively connected to the second electric power path so as to be able to easily select, and supply electric power to, the electric power use device that is wanted to operate, thus providing a high degree of convenience.

[0026] In the present invention, the relay box is provided with a switching means that turns on and off the connection of the second electric power path with the first electric power path from the hand-crank generator or switches connection between the first electric power path and the plurality of second electric power paths. Accordingly, the person who handles the hand-crank generator can easily operate the switching means while performing a connecting work of the hand-crank generator to the relay box, hence can easily switch operations of individual components. Further, even if the switching means is operated alone, no electric generation takes place unless the hand-crank generator is handled. Accordingly, even if a person who does not understand the use of the switching means operates the apparatus, it is possible to secure safety of the person.

[0027] In the present invention, the hand-crank generator is provided on the bed apparatus itself, and, the hand-crank generator is arranged at a position on the outer side surface

of the head side, the lateral sides, or the foot side of the bed apparatus so as to be able to supply electric power from the first electric power path connected to the hand-crank generator to the ends of the second electric power paths for supplying the electric power to the single or the plurality of electric power use devices. This arrangement makes it possible to integrate the hand-crank generator with the bed apparatus, hence make the bed apparatus with a hand-crank generator compact.

[0028] In the present invention, a handle for operating the hand-crank generator to generate electricity can be accommodated in the bed apparatus, and can be turned round from the outside of the hand-crank generator when the handle is used. This arrangement can realize both compact storage and easy handling.

[0029] In the present invention, the plurality of electric power use devices are provided, the output side of the first electric power paths from the single or the plurality of hand-crank generators can be selectively connected to any one of the ends of the plurality of second electric power paths, and when the hand-crank generators are operated to generate electricity in a state that the first electric power path is connected to a selected second electric power path, electric power can be supplied to the electric power use device connected to the selected second electric power path. This

configuration enables easy selection and operation of an electric power use device when selecting the second electric power path to be connected.

[0030] In the present invention, the bed apparatus further includes a switching means adjacent to the hand-crank generator that turns on and off the connection of the second electric power path with the first electric power path from the hand-crank generator or that switches connection between the first electric power path and the plurality of second electric power paths. Accordingly, the person who handles the hand-crank generator can easily operate the switching means while performing power generation work with the hand-crank generator, hence can easily switch operations of individual components. Further, even if the switching means is operated alone, no electric power use device will operate unless the hand-crank generator is handled. Accordingly, even if a person who does not understand the use of the switching means operates the apparatus, it is possible to secure safety of the person.

[0031] In the present invention, the switching means contains a switching mechanism that mechanically performs an on/off operation of the second electric power path or a switching operation of a power supply destination, by an operating force that is transmitted from a control portion for operation via a mechanical wire. Accordingly, it is not necessary to

provide an electric power source such as a battery or the like for switching operations, hence it is possible to readily take an action in a case of an electric power failure.

[0032] In the present invention, the switching means uses
5 a relay circuit that performs an on/off operation of the electric power path or a switching operation of an electric power supply destination, based on electric signals transmitted from a control portion for operation. This configuration provides excellent operation and advantage such
10 as capability of producing a light operational feeling in the control portion.

[0033] In the present invention, since the bed apparatus further includes as an electric power use device a driver that drives a predetermined part of the bed apparatus by means
15 of an electric actuator or a peripheral device of the bed apparatus, it is possible by the hand-crank generator to supply electric power to drive an electric power use device other than the electric actuators.

Brief Description of Drawings

20 [0034]

[FIG. 1] An illustrative view of a bed apparatus according to the first embodiment of the present invention, viewed from the foot side.

[FIG. 2] An illustrative view of the same bed apparatus,
25 viewed from the head side.

[FIG. 3] A perspective illustrative view of the same bed apparatus with its bottom set flat.

[FIG. 4] A perspective view of the same bed apparatus with the back bottom and leg bottom raised.

5 [FIG. 5] An illustrative view of the same bed apparatus, viewed from one side.

[FIG. 6] An illustrative view of the underside of the same bed apparatus, viewed from the bottom side.

10 [FIG. 7] An illustrative side view of the same bed apparatus, viewed from the opposite to that of FIG. 5.

[FIG. 8] An illustrative view of the same bed apparatus, viewed from the top.

[FIG. 9] Illustrative views of the same bed apparatus with a hand-crank generator arranged outside thereof, (a) showing
15 a state where the handle is folded, (b) showing a use state where the handle is assembled, and (c) showing a state where the cable of the hand-crank generator is going to be connected to a relay box.

[FIG. 10] Illustrative views of wiring examples showing power
20 supply paths in the same bed apparatus, (a) the first example, (b) the second example, and (c) the third example.

[FIG. 11] An illustrative view showing a variational example 1 of a relay box mounted in the same bed apparatus, in which the relay box is embedded in the side rail.

25 [FIG. 12] A perspective illustrative view of a bed apparatus

according to the second embodiment of the present invention.

[FIG. 13] Illustrative views of a foot board of the same bed apparatus, (a) a plan view, (b) a front view, (c) an illustrative view showing an operated state of a hand-crank generator.

5 [FIG. 14] Illustrative views of wiring examples showing power supply paths in the same bed apparatus, (a) the first example, (b) the second example, and (c) the third example.

[FIG. 15] Illustrative views showing a configurational example of a relay box according to the third embodiment A
10 of the present invention, (a) a front view of the connector inserted side of the relay box, (b) a side view of the same relay box, (c) a view of the rear side of the same relay box from which the second electric power paths are drawn out, and (d) an enlarged illustrative view of a state where the
15 same relay box has been attached to the frame.

[FIG. 16] Illustrative views of wiring examples showing power supply paths in the same bed apparatus, (a) the first example, (b) the second example, and (c) the third example.

[FIG. 17] Illustrative views of wiring examples showing power
20 supply paths in a bed apparatus according to the third embodiment B of the present invention, (a) the first example, (b) the second example, and (c) the third example.

[FIG. 18] Illustrative views of a foot board equipped with hand-crank generators of the same bed apparatus, (a) showing
25 a case with two hand-crank generators, (b) showing a case

with a single hand-crank generator, and (c) an illustrative enlarged view of the outside cover with handle insert holes.

[FIG. 19] Illustrative views of a relay box of a bed apparatus according to the fourth embodiment A of the present invention,

5 (a) a perspective enlarged view, and (b) a view from the front.

[FIG. 20] Illustrative views of wiring examples showing power supply paths in the same bed apparatus, (a) the first example, (b) the second example, and (c) the third example.

10 [FIG. 21] An illustrative view of the mounted position and therearound of a hand-crank generator in a foot board of a bed apparatus according to the fourth embodiment B.

[FIG. 22] Illustrative views of wiring examples showing power supply paths in the same bed apparatus, (a) the first example, (b) the second example, and (c) the third example.

15 [FIG. 23] An illustrative view of a variational example of attachment of a hand-crank generator in the fourth embodiment B, (a) an illustrative view showing a state where the outer cover is removed from the foot board, and (b) a view showing a state where the outer cover is attached.

20 Mode for Carrying Out the Invention

[0035] Next, the embodiments of the present invention will be described with reference to the accompanying drawings.

25 [0036] FIGS. 1 to 8 are illustrative views of the overall configuration of a bed apparatus 1 according to the first embodiment; FIGS. 9(a) to 9(c) are illustrative views of the

same bed apparatus with a hand-crank generator arranged outside thereof; FIGS. 10(a) to 10(c) are illustrative views of wiring examples (the first to third examples) showing electric power supply paths in the same bed apparatus; and, FIG. 11 is an illustrative view showing a variational example of a site of a relay box in the same bed apparatus, in which the relay box is embedded in a side rail.

Here in the drawings, description hereinbelow will be given by referring to the head side (the side to which the head is directed) as the H-direction and the foot side (the side to which the legs are directed) as the F-direction when the user of the bed apparatus lies on the bed.

[0037] As shown in FIG. 4, bed apparatus 1 is configured so that a bed frame 3 is supported on the base truck 4 so as to movable up and down by two elevation linking mechanisms 4h, 4f (without detailed illustration) on the head and foot sides. Bed frame 3 is structured more or less like a ladder such that a plurality of frame members are arranged in the width direction between bar-like frame members (side frame parts 3S) arranged longitudinally on both sides of bed apparatus 1.

[0038] Further, as shown in FIGS. 3 to 5, a bottom 2 is provided for bed frame 3. Bottom 2 includes back bottom 22, hip bottom 24, knee bottom 25 and leg bottom 26, split one from another and arranged in this order from the head side to the foot

side.

[0039] The back bottom 22 is connected to the hip bottom 24 side and set on bed frame 3 in a rotatable manner. Knee bottom 25 and leg bottom 26 are also set on bed frame 3 rotatably. Further, hip bottom 24 is flexible as a whole, and is connected on its head side to the back bottom while the foot side end is fixed to the foot side of bed frame 3.

The head side end of knee bottom 25 is connected to the foot side end of the hip bottom 24 while the knee bottom 25 and leg bottom 26 are arranged so as to be rotatable and movable up and down over bed frame 3. Usually, a mattress is placed on bottom 2, but no mattress is illustrated in the drawings.

[0040] Wheels 5 are arranged at around the corners of base truck 4 so that that base truck 4 (bed apparatus 1) can be moved in arbitrary directions.

[0041] Side rails that are arranged on both left and right sides of the user on bed apparatus 1 and prevent the user from falling may be provided removably.

Bed apparatus 1 further includes a head board 8 on the head side end and a foot board 9 on the foot side end, both fixed to bed frame 3.

[0042] The bed apparatus 1 of the first embodiment is usually supplied with the commercial electric power supply from the electric power supply equipment, i.e., the outlet and the like in the facility where bed apparatus 1 is installed, to

drive and operate the electric power use devices (which is referred to as "electricity-driven mode"). Further, the bed apparatus is configured to operate in a mode (which is referred to as "hand-driven mode") in which part of electric power use devices are supplied with electricity from hand-crank generator 52 (see FIG. 9) that is a power supply source mounted outside of bed apparatus 1. It should be noted that the bed apparatuses in the second embodiment and can be also supplied with electricity in both the electricity-driven mode and the hand-driven mode.

[0043] FIGS. 9 are illustrative views of the bed apparatus 1 of the first embodiment with a hand-crank generator arranged outside thereof as an electric power source, (a) showing a state where the handle is folded, (b) showing a use state where the handle is assembled, and (c) showing a state where the cable of the hand-crank generator is connected to a relay box. FIG. 10 is an illustrative view of wiring examples showing power supply paths and control paths in the same bed apparatus.

[0044] As the electric power use devices that are operated by electric power source, the bed apparatus 1 of the first embodiment is provided with a plurality of electric actuators as the drive apparatus for driving the moving parts.

Specifically, this bed apparatus 1 includes, as shown in FIG. 6, a back drive electric actuator 31 for raising and

lowering back bottom 22 (so-called back raising and lowering operations), an electric elevating actuator 32 for moving up and down bed frame 3 relative to base truck 4 and an electric leg drive actuator 34 for raising and lowering knee bottom 25 and leg bottom 26.

[0045] The first embodiment is a bed apparatus that is provided with electric power use devices operated by the electric power source and supplies electric power to one output destination (one electric power use device) from a hand-crank generator provided separately from bed apparatus 1. In the bed apparatus, a relay box 50 (see FIG. 1) is provided at, at least, one end of the electric power path to deliver electricity to the output destination, and this relay box 50 is arranged at a place on a horizontal outer side surface of the head side, the lateral sides, or the foot side of the bed apparatus within reach of the user's hands.

More specifically, in the first embodiment, among the plurality of the electric actuators, the electric power source of electric back drive actuator 31 can be supplied by hand-crank generator 52 (see FIG. 9), and relay box 50 for the end of the electric power path for delivering electric power to the electric back drive actuator 31 is deployed at a place on an outer side surface of foot board 9 on the foot side of bed apparatus 1.

[0046] In other words, in the bed apparatus 1 of the first

embodiment, as shown in FIG. 10, hand-crank generator 52 is installed appropriately outside bed apparatus 1, and the electric power source of electric back drive actuator 31 among the plurality of electric actuators can be supplied by
5 hand-crank generator 52.

As the electric power supply path, a first electric power path 52d connected to the hand-crank generator 52 and a single second electric power path 58 to supply electric power to electric back drive actuator 31 as a single electric power
10 use device are provided.

The input-side end of the single second electric power path 58 is arranged in relay box 50 while the output-side end of the first electric power path 52d can be connected by a plug or the like to the input-side end of second electric
15 power path 58 provided in this relay box 50. When the hand-crank generator 52 is operated to generate electricity in a state that first electric power path 52d and second electric power path 58 are connected, the electric power use device, or electric back drive actuator 31 can be operated.

This relay box 50 may be embedded, projected or arranged in other way, at a position on a horizontal outer side surface of foot board 9 on the foot side of bed apparatus 1, within reach of the user's hands, as shown in FIGS. 1, 3 and 4.

Though any kinds of electric power use devices may be
25 included within the scope of the present invention, in

particular, enabling hand-crank generator 52 to supply the electric power to electric back drive actuator 31 can improve convenience because the actuator is most frequently used. Further, the mounted places of relay box 50 other than foot board 9 may also be included within the scope of the present invention, but the first embodiment gave an example where relay box 50 is mounted in foot board 9 because this arrangement enables operation while checking from the feet side of the user in bed apparatus 1.

[0047] FIGS. 9(a) to 9(c) are illustrative views of a configurational example of hand-crank generator 52.

As shown in FIG. 9(a), hand-crank generator 52 has an approximately bar-like main body 52a with a spherical distal end so as to allow one-handed gripping and a projected insert shaft 52c to which a handle (which is called 'crank') 52b is fitted. To make handy hand-crank generator 52 to carry when unused, handle 52b can be removed from insert shaft 52c. The detached handle 52b can be folded and fixed to the side of main body 52a. A cable comes out from main body 52a, forming first electric power path 52d whose distal end is provided with a plug.

[0048] When hand-crank generator 52 is used, handle 52b is fitted to shaft 52c and the hand-grip is unfolded, as shown in FIG. 9(b).

Then, as shown in FIG. 9(c), the plug of first electric

power path 52d is plugged and connected into an insert socket 50a of relay box 50 and fixed by turning. In the thus plugged connected condition, electric power generated by hand-crank generator 52 is supplied to electric back drive actuator 31 (see FIG. 10) via electric power path 58 of relay box 50.

[0049] When this hand-crank generator 52 is operated to generate electricity, the operator holds main body 52a in one hand and handle 52b in the other hand, and turns handle 52b to generate electricity to thereby enable drive of electric back drive actuator 31.

[0050] In the electric power supply path of the first embodiment, the first electric power path 52d from hand-crank generator 52 separately provided outside bed apparatus 1 is connected to relay box 50 so as to supply the electric power generated by the hand-crank generator 52 from relay box 50 to electric back drive actuator 31 as an output destination example by way of the second electric power path (electric power supply cable) 58. Various changes may be added to the electric power supply paths, such as addition of a mode changeover switch between the hand-driven mode and the electricity-driven mode (hand-driven/electricity-driven switching means 61) or the like, and these modifications should be also included within the scope of the first embodiment.

[0051] FIGS. 10 are illustrative views of wiring examples showing electric power supply paths included in the first

embodiment, (a) the first example, (b) the second example, and (c) the third example.

[0052] In the first example shown in FIG. 10(a), in order to enable supply of electric power from control box 40 provided in bed apparatus 1 to electric back drive actuator 31, electric elevating actuator 32 and an electric leg drive actuator 34 in the electricity-driven mode, electric power paths for the electricity-driven mode are connected correspondingly; the electric power path to the electric back drive actuator 31 in the electricity-driven mode is wired from electricity-driven line 40a to second electric power path 58 via relay box 50.

[0053]

(1) Relay box 50 incorporates hand-driven/electricity-driven switching means 61 therein.

(2) This hand-driven/electricity-driven switching means 61 may use a mechanical switch or an electric switch.

[0054]

(3) When a mechanical switch is used for hand-driven/electricity-driven switching means 61, it is possible to provide one configuration in which insertion of the feeder plug of first electric power path 52d from hand-crank generator 52 into socket 50a of relay box 50 gives the function of switching connection from electricity-driven line 40a extended from control box 40 to the hand-driven line (the

second electric power path 58). For example, a tact switch or the like may be arranged around socket 50a in the plug insert port so as to perform switching between the hand-driven line and the electricity-driven line.

5 [0055] As another configuration, an exposed control switch portion including rotary and toggle switches and the like may be provided in relay box 50 as

hand-driven/electricity-driven switching means 61, so that hand-driven/electricity-driven switching means 61 can switch
10 between the electricity-driven mode and the hand-driven mode by operating the control switch portion.

[0056]

(4) Though the output destination in the hand-driven mode is assumed to be the single electric back drive actuator 31,
15 it is possible to provide a configuration in which the single output destination may be selected appropriately from the electric actuators and other electric power use devices. This also applies similarly to the second and third examples.

[0057] In the second example shown in FIG. 10(b), two relay
20 boxes (a first relay box 50A and a second relay box 50B) are provided.

[0058]

(1) First relay box 50A integrates an actuator line 31a, a feeder line (electricity-driven line 40a) from control box
25 40, and a feeder line (second electric power path 58) from

hand-crank generator 52, and includes

hand-driven/electricity-driven switching means 61 therein.

(2) Second relay box 50B has a plug insert port (socket 50a) for connecting the plug at the connecting end of first electric power path 52d from hand-crank generator 52. Second relay box 50B is exposed and provided on foot board 9.

[0059]

(3) The hand-driven/electricity-driven switching means 61 may use a mechanical switch or an electric switch.

(4) When a mechanical switch structure is used for the hand-driven/electricity-driven switching means 61, it is possible to switch connection from the electricity-driven line to the hand-driven line by insertion of the feeder plug of hand-crank generator 52. For example, a tact switch or the like may be arranged around the plug insert port (socket 50a) to switch the hand-driven/electricity-driven switching means 61 from the electricity-driven mode to the hand-driven mode.

[0060] As another configuration, an uncovered (exposed)

control switch portion including rotary and toggle switches may be provided in second relay box 50B as a part of hand-driven/electricity-driven switching means 61 so that hand-driven/electricity-driven switching means 61 of first relay box 50A can be changed over between the

electricity-driven mode and hand-driven mode by the operation

of the control switch portion.

[0061] Here, since first relay box 50A and second relay box 50B are positioned at a distance, the operating force acting on second relay box 50B may be transmitted through a mechanical

5 wire 66 or the like to thereby turn on/off

hand-driven/electricity-driven switching means 61 as a mechanical switch inside first relay box 50A.

[0062] In the third example shown in FIG. 10(c), in order to enable supply of electric power from control box 40 provided in bed apparatus 1 to electric back drive actuator 31, electric elevating actuator 32 and electric leg drive actuator 34 in the electricity-driven mode, electric power paths for the electricity-driven mode are connected correspondingly.

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[0063] Second electric power path 58 extending from relay box 50 is connected by a branch cable 58c to electricity-driven line 40a going forward to the electric back drive actuator 31.

15

If an electricity-driven operation is performed in a state where hand-crank generator 52 is connected, the motor on the hand-crank generator 52 side will also rotate because second electric power path 58 is electrically connected. As a result, there is a risk that an unintentional operation could occur depending on the situation. When the electricity-driven operation is performed, it is preferred that hand-crank generator 52 is unconnected.

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25

[0064] As described above, in the first embodiment, electric power path (electric power cable) 58 is laid from relay box 50 to electric back drive actuator 31 for back bottom 22 so as to supply electric power therethrough.

5 [0065] According to the first embodiment, since relay box 50 (50B in the second example) at the end of the electric power path is arranged at a place on an outer side surface of foot board 9 of bed apparatus 1, easily accessible by hand, the operator can easily reach out their hand and easily generate
10 electricity when working on generation of electricity with hand-crank generator 52. Since the generation work becomes easy, it is possible to reduce the temporal and physical burden. Further, since relay box 50 (50B) is arranged at a position on a horizontal outer side surface within reach of the user's
15 hands, this arrangement facilitates connecting work.

[0066] Here, during the ordinary use (electricity-driven mode) unusing hand-crank generator 52, electric back drive actuator 31, electric elevating actuator 32, electric leg drive actuator 34 and other electric power use devices can
20 be power supplied via an electric power supply path including control box 40 and unillustrated relay boxes from a power outlet in the room and driven thereby.

[0067] In the above first embodiment, arrangement of relay box 50 in foot board 9 is one example of the present invention.
25 Other than this, any arrangement as appropriate may be included

within the scope of the present invention as long as relay box 50 is arranged at a position on a horizontal outer side surface of the foot side, head side, or the lateral sides of bed apparatus 1, within reach of the user's hands.

5 [0068] For example, relay box 50 may be arranged at a place on the foot side of bed frame 3. Alternatively, as a variational example 1, the relay box may be embedded (or may be arranged projected) in side rail 7 on the lateral side as in the bed apparatus 1 in FIG. 11.

10 [0069] In the bed apparatus 1 of variational example shown in FIG. 11, side rails 7 on both sides are arranged on both lateral side portions of bed frame 3 in a side-openable manner to prevent the user from falling out of the bed. In this side rail 7, other than relay box 50 a control monitor 7a for the
15 bed apparatus is provided. The other components are allotted with the same reference numerals as those in the bed apparatus 1 of the first embodiment shown in FIGS. 1 to 8, and description is omitted.

[0070] Next, the second embodiment of the present invention
20 will be described with reference to FIGS. 12 to 14.

FIG. 12 is a perspective illustrative view of a bed apparatus according to the second embodiment; FIGS. 13(a) to 13(c) are illustrative views of a foot board of the same bed apparatus, (a) a plan view, (b) a front view, and (c)
25 an illustrative view showing an operated state of a hand-crank

generator; and FIGS. 14(a) to 14(c) are illustrative views of wiring examples (the first to third examples) showing electric power supply paths in the same bed apparatus.

[0071] The bed apparatus 1 according to the second embodiment has the same basic configuration as that of the first embodiment. Bottom 2 (back bottom 22, hip bottom 24, knee bottom 25, leg bottom 26), bed frame 3 and others corresponding to those in FIGS. 1 to 10 are allotted with the same reference numerals. Herein, platform truck 4 and wheels 5 are omitted from the drawings.

[0072] The second embodiment is to supply electric power from a hand-crank generator integrally provided with bed apparatus 1 to a single output destination (single electric power use device), and the hand-crank generator can supply electric power from the first power path connected from the hand-crank generator to the end of the second electric power path to supply electric power to the single electric power use device, and is arranged at a place on an outer side surface of the head side, lateral sides, or foot side of the bed apparatus.

[0073] Specifically, the bed apparatus 1 according to the second embodiment is different from the first embodiment in that, as shown in FIGS. 12 to 14, hand-crank generator 52 can be disposed at various places of bed apparatus 1 itself without providing any relay box. In the following description, an example in which the hand-crank generator is arranged in

foot board 9 will be given.

[0074] As to the electric power supply paths, in order to be able to supply the electric power from the first electric power path (not illustrated) connected to the hand-crank generator 52 to the end of the second electric power path 58 for supplying electric power to the single electric power use device or electric back drive actuator 31, the hand-crank generator 52 is arranged at a place on the outside surface of foot board 9 on the foot side of bed apparatus 1 so as to be operable from the outside in the horizontal direction.

[0075] A handle 52b for operating hand-crank generator 52 to generate electricity is provided so that the handle 52b can be accommodated in bed apparatus 1 and can be turned from the outside of hand-crank generator 52 when in operation.

[0076] The specific arrangement of hand-crank generator 52 is such that, as shown in FIGS. 13(a) and 13(b), hand-crank generator 52 is built in foot board 9 on the foot side of the bed apparatus 1 while the hand-crank generator 52 (see FIG. 9) is covered by an outer cover 60. This outer cover 60 is vertically extended and attached across the approximately full height of foot board 9, and hand-crank generator 52 is mounted vertically inside the outer cover 60. In the second embodiment, the accommodation space for hand-crank generator 52 enclosed by the outer cover is called a relay box 70.

[0077] Hand-crank generator 52 uses that shown in FIG. 9, so that handle 52b is detachable from hand-crank generator 52. Formed in the lower part of outer cover 60 is an indented portion 60a for accommodating handle 52b. A hole 60b with shaft 52c of hand-crank generator 52 exposed is formed in the upper part of outside cover 60. When hand-crank generator 52 is unused, handle 52b can be fitted and stored in indented portion 60a as shown in FIG. 13(b), whereas when the hand-crank generator 52 is used, handle 52b can be fitted to shaft 52c that is exposed from the hole 60b, and turned round so that the hand-crank generator 52 will generate electricity, as shown in FIG. 13(c).

[0078] The electric power supply path of the bed apparatus 1 of the second embodiment is to supply electric power from the hand-crank generator integrally provided with bed apparatus 1 to a single output destination (single electric power use device).

[0079] Hand-crank generator 52 as relay box 70 supplies electric power generated by the hand-crank generator 52 to the single output destination, e.g., electric back drive actuator 31 via the second electric power path (electric power supply cable) 58. Various changes can be added to the electric power supply paths, such as addition of a changeover switch (hand-driven/electricity-driven switching means 61) between the hand-driven mode and the electricity-driven mode, or the

like, and these modifications should also be included within the scope of the second embodiment.

[0080] FIGS. 14 are illustrative views of wiring examples showing electric power supply paths included in the second embodiment, (a) the first example, (b) the second example, and (c) the third example.

[0081] In the first example shown in FIG. 14(a), in order to enable supply of electric power from control box 40 provided in bed apparatus 1 to electric back drive actuator 31, electric elevating actuator 32 and electric leg drive actuator 34 in the electricity-driven mode, electric power paths for the electricity-driven mode are connected correspondingly; the electric power path to the electric back drive actuator 31 in the electricity-driven mode is wired from electricity-driven line 40a to second electric power path 58 via relay box 70.

[0082]

(1) Hand-crank generator 52 as relay box 70 is built in foot board 9 and hand-driven/electricity-driven switching means 61 is also incorporated therein.

[0083]

(2) This hand-driven/electricity-driven switching means 61 may use a mechanical switch or an electric switch.

[0084]

(3) When a mechanical switch is used for

hand-driven/electricity-driven switching means 61, it is possible to provide a mechanism in which attachment of handle 52b of hand-crank generator 52 gives the function of switching connection from electricity-driven line 40a extended from control box 40 to the hand-driven line (the first electric power path). For example, a tact switch or any other means may be arranged around the handle 52b attachment port to perform switching between the hand-driven line and the electricity-driven line.

[0085] As another configuration, an uncovered control switch portion such as rotary and toggle switches may be provided in hand-driven/electricity-driven switching means 61, so that hand-driven/electricity-driven switching means 61 can perform switching between the electricity-driven mode and hand-driven mode when the control switch portion is operated.

[0086]

(4) Though the output destination in the hand-driven mode is assumed to be the single electric back drive actuator 31, it is possible to provide a configuration in which the single output destination may be selected as appropriate from the electric actuators and other electric power use devices. This also applies similarly to the second and third examples.

[0087] In the second example shown in FIG. 14(b), two relay boxes 70A and 70B are provided. These first relay box 70A and second relay box 70B are arranged apart from each other.

First relay box 70A is disposed in the course of the second electric power path while second relay box 70B functions to incorporate hand-crank generator 52 in foot board 9 and for other purposes.

5 [0088]

(1) First relay box 70A is arranged at a suitable place in the bed apparatus, integrating an actuator line 31a, a feeder line (electricity-driven line 40a) from control box 40, and a feeder line (second electric power path 58) from hand-crank generator 52 and including hand-driven/electricity-driven switching means 61 therein.

[0089]

(2) Second relay box 70B includes hand-crank generator 52 and a control portion for driving
15 hand-driven/electricity-driven switching means 61 or the switches of first relay box 70A, and is built in foot board 9.

[0090]

(3) The hand-driven/electricity-driven switching means 61
20 may use a mechanical switch or an electric switch.

[0091]

(4) When a mechanical switch is used for
hand-driven/electricity-driven switching means 61, it is possible to provide one configuration in which attachment
25 of handle 52b of hand-crank generator 52 gives the function

of switching connection from electricity-driven line 40a extended from control box 40 to the hand-driven line (second electric power path 58). For example, a tact switch or the like may be provided around the handle 52b attachment port to perform switching between the hand-driven line and the electricity-driven line.

[0092] As another configuration, an exposed operation switch portion such as rotary and toggle switches may be provided in hand-driven/electricity-driven switching means 61, so that hand-driven/electricity-driven switching means 61 can switch mode between the electricity-driven mode and hand-driven mode when the operation switch portion is operated.

[0093] Here, since first relay box 70A and second relay box 70B are positioned at a distance, the operating force acting on second relay box 70B may be transmitted through a mechanical wire 66 or the like to thereby turn on/off hand-driven/electricity-driven switching means 61 as a mechanical switch in first relay box.

[0094] In the third example shown in FIG. 14(c), in order to enable supply of electric power from control box 40 provided in bed apparatus 1 to electric back drive actuator 31, electric elevating actuator 32 and electric leg drive actuator 34 in the electricity-driven mode, electric power paths for the electricity-driven mode are connected correspondingly.

[0095]

(1) Second electric power path 58 from relay box 70 is connected by a branch cable 58c to electricity-driven line 40a extending from control box 40 to the electric back drive actuator 31.

5 [0096] If an electrically-powered operation is performed in a state where hand-crank generator 52 is connected, the motor on the hand-crank generator 52 side will also rotate because second electric power path 58 is electrically connected. As a result, there is a risk that an unintentional operation
10 could occur depending on the situation. Therefore, it is preferred that handle 52b is removed.

[0097] According to the second embodiment, since the hand-crank generator 52 is arranged at a position on the outside surface of foot board 9 on the foot side of the bed apparatus
15 so as to be operable from the outside, the hand-crank generator 52 can be integrated with bed apparatus 1 and the configuration of bed apparatus 1 provided with hand-crank generator 52 can be made compact.

[0098] Further, since handle 52b for actuating hand-crank
20 generator 52 to generate electricity is designed so as to freely fit into indented portion 60a of outer cover 60 provided in bed apparatus 1 and so that the handle 52b can be turned round from the outside of hand-crank generator 52 when the handle 52b is used, it is possible to achieve both compact
25 storage and easy handling.

[0099] Though in the second embodiment the arrangement position of the hand-crank generator 52 is on foot board 9 on the foot side, it is obvious in the present invention that the hand-crank generator 52 may be arranged on any of the head side, the lateral sides and the foot side of the bed apparatus as long as it is at a position on the outside surface of them, not limited to foot board 9 as mentioned above. Further, outer cover 60 is formed vertically long but the outer cover may be formed in an appropriate shape, for example, outer cover 60 may be formed laterally long.

[0100] Next, the third embodiment A of the present invention will be described.

[0101] FIGS. 15 are illustrative views showing a configurational example of a relay box according to the third embodiment A, (a) a front view of the connector socket side of the relay box, (b) a side view of the same relay box, (c) a view of the rear side of the same relay box from which the second electric power paths are drawn out, and (d) an enlarged illustrative view of a state where the same relay box is attached to the frame. FIGS. 16(a) to 16(c) are illustrative views of wiring examples (the first to third examples) in the same bed apparatus. The configuration of the bed apparatus 1 is the same as that shown in FIGS. 1 to 8, so that illustration is omitted.

[0102] In this third embodiment A, the hand-crank generator

is provided outside the bed apparatus, and as the electric power route, the first electric power path connected to the hand-crank generator and a single or a plurality of second electric power paths for supplying electric power to a plurality of electric power use devices are provided. The input-side ends of the plurality of the second electric power paths are provided in a relay box. The output-side end of the first electric power path can be connected to the input-side ends of the second electric power paths provided in the relay box. When the hand-crank generator is operated to generate electricity in a state that the first electric power path and the second electric power path are connected, the electric power use device will be able to operate. The relay box is arranged at a position on a horizontal outer side surface of the head side, the lateral sides, or the foot side of the bed apparatus within reach of the user's hands.

[0103] Specifically, the bed apparatus 1 of the third embodiment A includes a plurality of electric actuators. Among these, one of two (an example of plurality) devices, or electric back drive actuator 31 and electric leg drive actuator 34 is supplied with electric power. In relay box 50, the input-side ends of two electric power paths 58a and 58b respectively connected to the plurality of electric actuators 31 and 34 are formed with insert sockets 50a and 50b, respectively (see FIG. 16).

[0104] The output side of first electric power path 52d of hand-crank generator 52 can be connected selectively to any one of insert sockets 50a and 50b. When electricity is generated by hand-crank generator 52 outside of bed apparatus 1 in a state that the first electric power path 52d is connected to the selected second electric power path 58a or 58b, the power can be supplied to one of electric actuators 31 and 34 as the electric power use devices that is connected to the selected second electric power path 58.

[0105] The relay box 50 includes, as shown in FIG. 15(a), insert socket 50a for supplying electric power to electric back drive actuator 31 and insert socket 50b for supplying electric power to electric leg drive actuator 34. By selecting one of insert sockets 50a and 50b of this relay box 50 and connecting hand-crank generator 52 to the selected one, it is possible to supply electric power to either electric actuator 31 or 34 to be operated selectively to thereby operate the selected portion (the back bottom, or the knee and leg bottoms).

[0106] In the third embodiment A, as shown in FIG. 15(a), relay box 50 has insert socket 50a for supplying electric power to electric back drive actuator 31 and insert socket 50b for supplying electric power to electric leg drive actuator 34, arranged side by side. By selecting one of insert sockets 50a and 50b of this relay box 50 and connecting hand-crank

generator 52 to the selected one, it is possible to supply electric power to either electric back drive actuator 31 or electric leg drive actuator 34 and thereby operate the selected portion (the back bottom, or the leg bottom, for example).

5 [0107] Further, in the third embodiment A, as shown in FIG. 15(b), relay box 50 has an L-shaped section in a side view so as to fit in with bed frame 3, and the rear side is attached to the bed frame and screw-fixed. Further, as shown in FIG. 15(d), the relay box can be attached to bed frame 3 on the
10 lateral side etc. Here, as shown in FIG. 15(c), relay box 50 is provided on its rear side with cable extracting ports 54, ... toward electric actuators, and can be screw-fitted to bed frame 3 by fixing screws through screw holes 56. As to attachment of the relay box, an attachment metal plate
15 may be fixed to the frame or any other appropriate place of bed apparatus 1 by means of screws or fasteners so that the relay box can be fixed to the metal plate by use of magnets or an adhesive.

[0108] In the third embodiment A, relay box 50 is arranged
20 at an exposed position on a horizontal outer side surface of the foot side bed frame, or the lateral side bed frame of bed apparatus 1 within reach of the user's hands so as to facilitate connection work.

[0109] As to the electric power supply paths in the third
25 embodiment A, connection of the electric power path from

hand-crank generator 52 separately provided from the bed apparatus to a plurality of output destinations (a plurality of electric power use devices) is switched to supply electric power to one of the output destinations.

5 [0110] For example, the output side of first electric power path 52d of hand-crank generator 52 can be selectively connected to one of insert sockets 50a and 50b. When hand-crank generator 52 outside bed apparatus 1 is operated to generate electricity in a state that first electric power
10 path 52d is connected to the selected second electric power path 58a or 58b (see FIG. 16), the electric power use device connected to the selected second electric power path 58a or 58b, that is, one of electric actuators 31 and 34, is supplied with electric power.

15 [0111] Various changes may be added to the electric power supply paths, such as addition of a changeover switch between the hand-driven mode and the electricity-driven mode (hand-driven/electricity-driven switching means 61) or the like, and these modifications should be included within the
20 scope of the third embodiment A.

[0112] FIGS. 16 are illustrative views of wiring examples showing electric power supply paths included in the third embodiment A, (a) the first example, (b) the second example, and (c) the third example.

25 [0113] In the first example shown in FIG. 16(a), in order

to enable supply of electricity-driven from control box 40 provided in bed apparatus 1 to electric back drive actuator 31, electric elevating actuator 32 and an electric leg drive actuator 34 in the electricity-driven mode, electric power paths (electricity-driven lines 40a and 40b) for the electricity-driven mode are connected correspondingly; the electric power paths to the electric back drive actuator 31 and electric leg drive actuator 34 in the electricity-driven mode go forward from electricity-driven lines 40a and 40b to second electric power paths 58a and 58b that are also used as the electric power paths in the electricity-driven mode, via relay box 50.

[0114]

(1) Relay box 50 incorporates a hand-driven/electricity-driven switching means 61 therein. (2) This hand-driven/electricity-driven switching means 61 may use a mechanical switch or an electric switch.

[0115]

(3) When a mechanical switch is used for hand-driven/electricity-driven switching means 61, it is possible to provide one configuration in which insertion of the feeder plug of first electric power path 52d from hand-crank generator 52 into socket 50a or 50b of relay box 50 gives the function of switching connection from electricity-driven line 40a or 40b from control box 40 to the hand-driven line

(first electric power path 52d). For example, a tact switch etc. may be arranged around sockets 50a and 50b in plug insert ports to perform switching between the hand-driven line and the electricity-driven line.

5 [0116] As another configuration, an exposed control switch portion such as rotary and toggle switches may be provided for hand-driven/electricity-driven switching means 61 in the relay box, so that hand-driven/electricity-driven switching means 61 can perform switching between the electricity-driven
10 mode and hand-driven mode when the control switch portion is operated.

[0117]

(4) Though two output destinations, namely, electric back drive actuator 31 and electric leg drive actuator 34, are
15 prepared in the hand-driven mode, it is possible to provide a configuration in which two or more output destinations may be selected appropriately from the electric actuators and other electric power use devices. This also applies similarly to the second and third examples.

20 [0118] In the second example shown in FIG. 16(b), two relay boxes 50A and 50B are provided. These first relay box 50A and second relay box 50B are arranged apart from each other, and second relay box 50B is provided, for example, on the foot board (not illustrated) for providing the function of
25 connecting hand-crank generator 52 and other purposes.

[0119]

(1) First relay box 50A integrates actuator lines 31a and 34a connected to the aforementioned respective actuators 31 and 34, feeder lines (electricity-driven lines 40a and 40b) from control box 40, and feeder lines (second electric power paths 58a and 58b) from hand-crank generator 52, and includes hand-driven/electricity-driven switching means 61 therein.

[0120]

(2) Second relay box 50B includes a plug insert ports (sockets 50a and 50b) for connecting the plug at the connecting end of first electric power path 52d from hand-crank generator 52. Second relay box 50B is exposed and provided on the foot board (not illustrated).

[0121]

(3) The aforementioned hand-driven/electricity-driven switching means 61 may use a mechanical switch or an electric switch...

[0122]

(4) When a mechanical switch is used for the aforementioned hand-driven/electricity-driven switching means 61, it is possible to switch connection from the electricity-driven line to the hand-driven line by inserting the feeder plug of hand-crank generator 52. For example, a tact switch or the like may be arranged around sockets 50a and 50b of the plug insert ports to switch over the

hand-driven/electricity-driven switching means 61 by the insertion.

[0123] As another configuration, an exposed control switch portion such as rotary and toggle switches may be provided for second relay box 50B as hand-driven/electricity-driven switching means 61 so that hand-driven/electricity-driven switching means 61 of the first relay box 50A can change over the mode between the electricity-driven mode and hand-driven mode by the operation of the control switch portion.

[0124] Here, since first relay box 50A and second relay box 50B are positioned at a distance, the operating force acting on second relay box 50B may be transmitted through a mechanical wire 66 or the like to thereby turn on/off hand-driven/electricity-driven switching means 61 as a mechanical switch in first relay box 50A.

[0125] In the third example shown in FIG. 16(c), in order to enable supply of electric power from control box 40 provided in bed apparatus 1 to electric back drive actuator 31, electric elevating actuator 32 and electric leg drive actuator 34 in the electricity-driven mode, electric power paths (electricity-driven lines) for the electricity-driven mode are connected correspondingly.

[0126]

(1) A branch cable 58c1 is connected to electricity-driven line 40a to the electric back drive actuator 31 and second

electric power path 58a from relay box 50. Further, a branch cable 58c2 is connected to electricity-driven line 40b to the electric leg drive actuator 34 and second electric power path 58b from relay box 50.

5 [0127] If an operation in the electricity-driven mode is performed in a state where hand-crank generator 52 is connected, the motor on the hand-crank generator 52 side will also rotate because second electric power paths 58a and 58b are electrically connected. As a result, there is a risk that
10 an unintentional operation could occur depending on the situation. Therefore, it is preferred that hand-crank generator 52 is not connected in the electricity-driven mode.

[0128] According to the third embodiment A, providing a configuration in which when the external hand-crank generator
15 52 is operated to generate electricity in a state where first power path 52d is connected to the selected second electric power path 58a or 58b, the electric power use device connected to the selected second electric power path 58a or 58b, i.e., electric back drive actuator 31 or electric leg drive actuator
20 34 can be supplied with electric power, makes it possible to selectively connect first electric power path 52d to second electric power path 58a or 58b and thereby facilitate selection and power supply of the desired electric power use device to be operated, hence this configuration is excellent in
25 operativity.

[0129] Though in the third embodiment A, relay box 50 is provided with two insert sockets 50a and 50b for two electric actuators 31 and 34, it is possible in the present invention to provide three or more plugs for the relay box that are connected to second electric power paths 58 for three or more electric actuators, so as to be able to select and drive one of the electric actuators by selectively connecting first electric power path 52d from hand-crank generator 52 to one of these plugs.

[0130] Further, relay box 50 is arranged at an exposed position on the foot side or the bed frame 3 on the lateral side of bed apparatus 1, but may be arranged at an appropriate place on a horizontal outer side surface of the head side or the like within reach of the user's hands. Further, though relay box 50 is mounted to bed apparatus 1 in an exposed manner, the relay box may be embedded in foot board 9 as in FIG. 1, in side rail 7 as in FIG. 11 or in any other appropriate place.

[0131] Next, the third embodiment B will be described.

[0132] FIGS. 17 are illustrative views of wiring examples in a bed apparatus according to the third embodiment B, (a) the first example, (b) the second example, and (c) the third example. FIGS. 18 are illustrative views of a foot board provided with hand-crank generators of the bed apparatus according to the third embodiment B, (a) showing a case with two hand-crank generators, (b) showing a case with a single

hand-crank generator, and (c) an illustrative view of handle insert holes.

[0133] Here, the same components as those in the second embodiment shown in FIGS. 12 to 14 and the third embodiment A shown in FIGS. 15 to 16 are allotted with the same reference numerals.

[0134] This third embodiment B includes a plurality of electric power use devices, the output side of the first electric power paths from the single or the plurality of hand-crank generators can be selectively connected to any of the ends of a plurality of second electric power paths, and when the hand-crank generator is operated to generate electricity in a state that the first electric power path is connected to the selected second electric power path, the generated electric power can be supplied to the electric power use device to which the selected second electric power path is connected.

[0135] Specifically, differing from the above third embodiment A, this third embodiment B has hand-crank generator 52 in the bed apparatus 1 itself so that from the first electric power path as the power output of the hand-crank generator, the electric power can be supplied to the electric power use device that is selected by insertion of handle 52b, via the second electric power path.

[0136] Hand-crank generator 52 is built inside foot board

9 of bed apparatus 1, and in the bed apparatus 1, two (an example of plurality) electric power use devices as a plurality of output destinations, electric back drive actuator 31 and electric leg drive actuator 34 can be supplied with electric power by electric power generation of hand-crank generator 52. Here, similarly to the second embodiment, hand-crank generator 52 is vertically built in foot board 9 on the foot side of bed apparatus 1 and covered with an outer cover. The storage space of hand-crank generator 52 covered by outer cover 60 is called a relay box 70. The other configurations are the same as in the second embodiment.

[0137] Various changes may be added to the electric power supply paths, such as addition of a changeover switch between the hand-driven mode and the electricity-driven mode (hand-driven/electricity-driven switching means 61) or the like, and these modifications should be included within the scope of the third embodiment B.

[0138] With reference to FIGS. 17(a) to 17(c) and FIGS. 18(a) to 18(c), wiring examples (the first to third examples) of electric power supply paths included in the third embodiment B will be described.

[0139] In the first example shown in FIG. 17(a), in order to be able to supply electric power from control box 40 provided in bed apparatus 1 to electric back drive actuator 31, electric elevating actuator 32 and an electric leg drive actuator 34

in the electricity-driven mode, electric power paths for the electricity-driven mode are connected correspondingly. That is, the electric power paths to electric actuators 31 and 34 in the electricity-driven mode supply electric power from electricity-driven lines 40a and 40b to second electric power paths 58a and 58b, respectively, via relay box 70.

[0140]

(1) As relay box 70, hand-crank generator 52 is built in foot board 9 and a hand-driven/electricity-driven switching means 61 is also incorporated in foot board 9.

[0141]

(2) This hand-driven/electricity-driven switching means 61 may use a mechanical switch or an electric switch.

[0142]

(3) When a mechanical switch is used for hand-driven/electricity-driven switching means 61, it is possible to provide one configuration in which attachment of handle 52b of hand-crank generator 52 gives the function of switching connection from electricity-driven line 40a or 40b extended from control box 40 to the hand-driven line. For example, a tact switch or the like may be arranged around the handle 52b attachment port to perform switching between the hand-driven line and the electricity-driven line.

[0143] As another configuration, an exposed control switch portion as such rotary and toggle switches may be provided

in hand-driven/electricity-driven switching means 61, so that hand-driven/electricity-driven switching means 61 can perform switching between the electricity-driven mode and hand-driven mode when the control switch portion is operated.

5 [0144]

(4) Though it is assumed that two output destinations are prepared in the hand-driven mode, namely, electric back drive actuator 31 and electric leg drive actuator 34, it is possible to provide a configuration in which the two or more output destinations may be selected appropriately from the electric actuators and other electric power use devices. This also applies similarly to the second and third examples.

[0145]

(5) A plurality of insert holes (insert ports) 60b for handle 52b are provided correspondingly for a plurality of output destinations.

[0146] As an example, it is possible to adopt a configuration in which a plurality of hand-crank generators 52 corresponding to the plurality of output destinations are built in foot board 9 and formed with respective insert holes 60b1 and 60b2 for handle 52d, as shown in FIG. 18(a).

[0147] As shown in FIG. 18(a), hand-crank generators 52 for electric back drive actuator 31 and electric leg drive actuator 34 are arranged in the portions covered by outer covers 60A and 60B, respectively. By selecting one of insert holes 60b1

and 60b2 of hand-crank generator 52 to output electric power to the electric actuator desired to operate and fitting handle 52 into the selected hole to generate electricity, it is possible to operate the desired electric actuator.

5 [0148] Here, hand-crank generators 52 are covered by outer covers 60A and 60B, forming relay box 70. Further, outer covers 60A and 60B each has an indented portion 60a that handle 52b is fitted into.

10 [0149] As another example, it is also possible to adopt a configuration in which a single hand-crank generator is built in foot board 9 while a plurality of insert holes for handle 52d are provided in accordance with a plurality of output destinations, as shown in FIGS. 18(b) and 18(c).

15 [0150] Specifically, it is possible to provide a function of operating a desired electric actuator by electric power generation, by forming outer cover 60 with a handle insert hole 60b1 for back driving and a handle insert hole 60b2 for leg driving and making the electric power path from hand-crank generator 52 connect to the electric power path of the desired
20 electric actuator when handle 52b is fitted to the hole corresponding to the electric actuator desired to be operate, as shown in FIG. 18(b) and 18(c). By generating electricity by inserting handle 52b into the selected hole, it is possible to actuate the desired electric actuator.

25 [0151] In the second example shown in FIG. 17(b), two relay

boxes 70A and 70B are provided. These first relay box 70A and second relay box 70B are arranged apart from each other, second relay box 70B being provided to incorporate hand-crank generator 52 in foot board 9 and for other functions.

5 [0152]

(1) First relay box 70A is arranged at a suitable place in the bed apparatus, integrating actuator lines 31a and 34a connected to the aforementioned actuators 31 and 34, feeder lines (electricity-driven lines 40a and 40b) from control
10 box 40 and the feeder lines (second electric power paths 58a and 58b) from hand-crank generator 52 and including hand-driven/electricity-driven switching means 61 therein.

[0153]

(2) Second relay box 70B includes hand-crank generator 52
15 and a control portion for driving hand-driven/electricity-driven switching means 61 or the switch of first relay box 70A, and is built in foot board 9.

[0154]

20 (3) The hand-driven/electricity-driven switching means 61 may use a mechanical switch or an electric switch.

[0155]

(4) When a mechanical switch is used for
hand-driven/electricity-driven switching means 61, it is
25 possible to provide one configuration in which attachment

of handle 52b of hand-crank generator 52 gives the function of switching connection from the electricity-driven line 40a from control box 40, to the hand-driven line (the first electric power path). For example, a tact switch or the like may be arranged around attachment port of the handle 52b to perform switching between the hand-driven line and the electricity-driven line.

[0156] As another configuration, an exposed control switch portion such as rotary and toggle switches may be provided in hand-driven/electricity-driven switching means 61, so that hand-driven/electricity-driven switching means 61 can switch a mode between the electricity-driven mode and hand-driven mode when the control switch portion is operated.

[0157] Here, since first relay box 70A and second relay box 70B are positioned at a distance, the operating force acting on second relay box 70B may be transmitted through a mechanical wire 66 or the like to thereby turn on/off hand-driven/electricity-driven switching means 61 as a mechanical switch in first relay box 70A.

[0158]

(5) A plurality of insert holes (insert ports) for handle 52b are provided corresponding to a plurality of output destinations, so that the output destination to be supplied with electric power can be selected by insertion of handle. Because the case provided with a plurality of hand-crank

generators 52 and the case provided with a single hand-crank generator 52 are the same as in the above first example, detailed description is omitted.

[0159] In the third example shown in FIG. 17(c), in order to be able to supply electric power from control box 40 provided in bed apparatus 1 to electric back drive actuator 31, electric elevating actuator 32 and electric leg drive actuator 34 in the electricity-driven mode, electric power paths (electricity-driven lines 40a and 40b) for the electricity-driven mode are connected correspondingly.

[0160]

(1) Second electric power path 58a from relay box 70 is connected to electricity-driven line 40a to the electric back drive actuator 31 by a branch cable 58c1. A branch cable 58c2 of second electric power path 58b from relay box 50 is connected to electricity-driven line 40b going to the electric leg drive actuator 34.

[0161] If an electricity-driven operation is performed in a state where hand-crank generator 52 is connected, the motor on the hand-crank generator 52 side will also rotate because second electric power path 58a is electrically connected. As a result, there is a risk that an unintentional operation could occur depending on the situation. Therefore, it is preferred that handle 52 is detached.

[0162]

(2) A plurality of insert holes (insert ports) for handle 52b are provided correspondingly for a plurality of output destinations, so that it is possible to supply electric power by selecting the output destination by insertion of the handle.

5 Because the case provided with a plurality of hand-crank generators 52 and the case provided with a single hand-crank generator 52 are the same as in the above first example, detailed description is omitted.

[0163] Next, the fourth embodiment A will be described.

10 [0164] FIGS. 19 are a perspective view and a front view of a relay box provided for a bed apparatus according to the fourth embodiment A, and FIGS. 20(a) to 20(c) are illustrative views of wiring examples (the first to third examples) showing electric power supply paths in the bed apparatus.

15 [0165] In the bed apparatus according to this fourth embodiment A, a hand-crank generator is provided outside the bed apparatus, and as the electric power route, the first electric power path connected to the hand-crank generator and a plurality of second electric power paths for supplying
20 electric power to a plurality of electric power use devices are provided. The input-side ends of the plurality of second electric power paths are disposed in a relay box. The output-side end of the first electric power path can be connected to the input-side ends of the second electric power
25 paths provided in this relay box. When the hand-crank

generator is operated to generate electricity in a state that the first electric power path and the second electric power path are connected, the electric power use device will be able to operate. The relay box is arranged at a position on a horizontal outer side surface of the head side, the lateral sides, or the foot side of the bed apparatus within reach of the user's hands. Further, a selector switching means for switching connection between the first electric power path and a plurality of second electric power paths is arranged in the relay box.

[0166] As to the electric power supply path, connection of the electric power paths between hand-crank generator 52 separately provided from the bed apparatus and a plurality of output destinations (a plurality of electric power use devices) is changed by a selector switching means 62 so that electric power can be supplied to any one of the output destinations.

[0167] Specifically, the bed apparatus according to the fourth embodiment A is the same as the third embodiment A shown in FIGS. 15 to 16 in that a relay box 50 is provided in the electric power paths for a plurality of electric power use devices (e.g., electric back drive actuator 31 and electric leg drive actuator 34). However, differing from the third embodiment A in which the output destination is selected by switching connection from one socket to another, the fourth

embodiment is configured such that, as shown in FIGS. 19 and 20, a selector switching means 62 in relay box 50 changes connection between first electric power path 52d and a plurality of second electric power paths to thereby select the output destination.

[0168] FIGS. 20(a), 20(b) and 20(c) are illustrative views of wiring examples showing electric power supply paths included in the fourth embodiment A, (a) the first example, (b) the second example and (c) the third example.

[0169] In the first example shown in FIG. 20(a), in order to be able to supply electric power from control box 40 provided in bed apparatus 1 to electric back drive actuator 31, electric elevating actuator 32 and an electric leg drive actuator 34 in the electricity-driven mode, the electric power paths for the electricity-driven mode are routed from electricity-driven lines 40a and 40b to second electric power paths 58a and 58b that are also used as in the hand-driven mode, via relay box 50.

[0170] Further, when hand-driven/electricity-driven switching means 61 is switched into the hand-driven mode, electricity-driven lines 40a and 40b that are the electric power paths in the electricity-driven mode are shut off and the electric power paths are switched to the hand-driven line (first electric power path 52d). The first electric power path 52d from hand-crank generator 52 is connected to the

common insert socket 50a or the like, and this first electric power path 52d is selectively connected to second electric power paths 58a and 58b by selection and switch of selector switching means 62.

5 [0171] Here, the aspect of relay box 50 incorporating hand-driven/electricity-driven switching means 61 and the aspect of the hand-driven/electricity-driven switching means 61 using a mechanical switch or electric switch are the same as in the first example of the third embodiment A shown in
10 FIG. 16(a), so that the same components in FIG. 20(a) are allotted with the same reference numerals. FIG. 19 shows one example in which switch operating portions as one example of hand-driven/electricity-driven switching means 61 and selector switching means 62 are provided in relay box 50 in
15 an exposed manner.

[0172] As shown in FIG. 20(a), the first example of the fourth embodiment A, selector switching means 62 may use a mechanical switch or an electric switch to select the output destination in the hand-driven mode, similarly to
20 hand-driven/electricity-driven switching means 61.

[0173] As selector switching means 62, an exposed control switch portion, for example, such as rotary and toggle switches may be provided in relay box 50, so that the output destination can be selected and changed by the operation of the control
25 switch portion.

[0174] In the example shown in FIG. 19 where the exposed control switch portion of selector switching means 62 is provided in relay box 50, since the control switch portion is located next to the place (socket 50a) to which the feeder cable (first electric power path 52d) of hand-crank generator 52 is connected, this arrangement brings about ease of operation and enables easy confirmation of the output destination.

[0175] Though it is assumed that two output destinations are prepared in the hand-driven mode, namely, electric back drive actuator 31 and electric leg drive actuator 34, it is possible to provide a configuration in which two or more output destinations may be selected appropriately from the electric actuators and other electric power use devices. This also applies similarly to the second and third examples.

[0176] In the second example of the fourth embodiment A shown in FIG. 20(b), two relay boxes 50A and 50B are provided. These first relay box 50A and second relay box 50B are arranged apart from each other, and second relay box 50B is provided on the foot board 9 for connecting hand-crank generator 52 and other functions.

[0177] The second example of the fourth embodiment A is the same as the second example of the third embodiment A shown in FIG. 16(b), in that hand-driven/electricity-driven switching means 61 is built in first relay box 50A and that

the hand-driven/electricity-driven switching means 61 may use a mechanical switch or an electric switch. Accordingly, the same components are allotted with the same reference numeral without description.

5 [0178] This second example provides such a configuration, for example, that a single plug insert port (socket 50a) is provided in second relay box 50B, selector switching means 62 is built in second relay box 50B or first relay box 50A, and the selector switching means 62 can use either a mechanical
10 switch or an electric switch.

[0179] Though the structure of the selector switch can be configured in various ways, when, for example a mechanical switch is used for selector switching means 62, similarly to hand-driven/electricity-driven switching means 61 in that
15 case, selector switching means 62 is provided in first relay box 50A, and an exposed control switch portion such as rotary and toggle switches may be provided in second relay box 50B so that selector switching means 62 can be used to select the output destination by the operation of the control switch
20 portion.

[0180] In this case, since first relay box 50A and second relay box 50B are positioned at a distance, the operating force acting on second relay box 50B may be transmitted through a mechanical wire 66 or the like to thereby switch the output
25 destination of selector switching mechanism 62 as a mechanical

switch in first relay box 50A.

[0181] In the third example of the fourth embodiment A shown in FIG. 20(c), in order to be able to supply electric power from control box 40 provided in bed apparatus 1 to electric back drive actuator 31, electric elevating actuator 32 and electric leg drive actuator 34 in the electricity-driven mode in FIG. 20, electric power paths (electricity-driven lines 40a and 40b) for the electricity-driven mode are connected correspondingly.

[0182] Second electric power path 58a extended from relay box 50 is connected to electricity-driven line 40a going to the electric back drive actuator 31 by a branch cable 58c1. Further, second electric power path 58b extended from relay box 50 is connected to electricity-driven line 40b going to the electric leg drive actuator 34 by a branch cable 58c2.

[0183] Relay box 50 includes selector switching means 62 so as to enable a switch of connection of second electric power path 58a and 58b, and thereby supply output electric power from hand-crank generator 52 to one of the output destinations, e.g., either the aforementioned actuator 31 or 34.

[0184] As to attachment of relay box 50, similarly to the first embodiment and the third embodiment A, the relay box may be attached projectively on, or may be embedded in, foot board 9. As to the position of attachment, the relay box may be arranged in a projective or embedded manner, at a place

on a horizontal outer side surface of foot board 9, the head side, lateral sides, or foot side of bed apparatus 1 within reach of user's hands.

[0185] This embodiment is the same as the third embodiment shown in FIG. 16 except the on/off

hand-driven/electricity-driven switching means 61 and selector switching means 62, so that the same components are allotted with the same reference numerals without description.

[0186] Here, as to the switching means in the whole of the fourth embodiment A, in addition to the functions of on/off

hand-driven/electricity-driven switching means 61 and selector switching means 62, switches for other functions such as lock/unlock switches for regulating/deregulating the

operations of individual electric power use devices such as actuators should be also included within the scope of the present invention.

[0187] Next, the fourth embodiment B of the present invention will be described with reference to FIGS. 21 to 23.

[0188] FIG. 21 is an illustrative view of the mounted position and therearound of a hand-crank generator in a foot board of a bed apparatus according to the fourth embodiment B; FIGS.

22(a) to 22(c) are illustrative views of wiring examples (the first to third examples) showing electric power supply paths in the same bed apparatus; and, FIGS. 23 are illustrative

views of a variational example of attachment of a hand-crank

generator, (a) an illustrative view showing a foot board with its outer cover removed and (b) an view showing a state with the outer cover attached.

[0189] The bed apparatus 1 according to the fourth embodiment
5 B has the same basic configuration as that of the fourth embodiment A, so that the same components as to the wiring diagram are allotted with the same reference numeral with those of FIG. 20.

[0190] The bed apparatus 1 of the fourth embodiment includes
10 a hand-crank generator integrally therewith, which is arranged at a position on the outer side of any of the head side, the lateral sides and the foot side of the bed apparatus, so as to supply electric power from the first electric power path connected to the hand-crank generator to the ends of the second
15 electric power paths for supplying electric power to a plurality of electric power use devices. Further, a switching means for switching connection between the first electric power path and a plurality of second electric power paths, is arranged next to the hand-crank generator.

[0191] Specifically, as shown in FIGS. 21 to 22, in the bed
20 apparatus of the fourth embodiment B, connection of electric power supply paths from hand-crank generator 52 integrally provided with the bed apparatus to a plurality of output destinations (a plurality of electric power use devices) are
25 switched by means of a selector switching means 62 to supply

electric power to one of the output destinations.

[0192] The hand-crank generator 52 is built in an appropriate position, for example on foot board 9 of bed apparatus 1 itself, and can supply electric power to a plurality of electric power use devices from the first electric power path as the output side of the hand-crank generator 52. As a plurality of electric power use devices, two (an example of plurality) devices, i.e., an electric back drive actuator 31 and an electric leg drive actuator 34, can be supplied with electric power by electric generation of the hand-crank generator 52. In the fourth embodiment B, the storage space of hand-crank generator 52 covered by an outer cover 60 is called a relay box 70.

[0193] Further, as shown in FIG. 21, in the bed apparatus 1 of the fourth embodiment B, similarly to the bed apparatus according to the second embodiment shown in FIG. 13, a handle 52d for driving hand-crank generator 52 to generator electric power can be accommodated in an indented portion 60a under outer cover 60. When the handle 52b is to be used, the handle 52b can be fitted to a shaft 52c from the outside of hand-crank generator 52 and turned round to generate electricity.

[0194] Moreover, in outer cover 60 of foot board 9, provided next to hand-crank generator 52 are a hand-driven/electricity-driven switching means 61 for performing on/off control of whether or not the first electric

power path on the output side of hand-crank generator 52 is connected to second electric paths 58a and 58b (see FIG. 22) and a selector switching means 62 for switching connection between first electric power path 52 and two (an example of plurality) second electric power paths 58a and 58b.

[0195] Specifically, the on/off hand-driven/electricity-driven switching means 61 and selector switching means 62 are arranged on the outer cover 60 between a hole 60b and an indented portion 60a so as to be operable from the outside.

[0196] FIGS. 22 are illustrative views of wiring examples showing electric power supply paths included in the fourth embodiment B, (a) the first example, (b) the second example and (c) the third example.

[0197] In the first example shown in FIG. 22(a), in order to be able to supply electric power from control box 40 provided in bed apparatus 1 to electric back drive actuator 31, electric elevating actuator 32 and an electric leg drive actuator 34 in the electricity-driven mode, the electric power paths for the electricity-driven mode are routed from electricity-driven lines 40a and 40b to second electric power paths 58a and 58b that are also used as in the hand-driven mode, via relay box 70 of foot board 9.

[0198] Further, when hand-driven/electricity-driven switching means 61 is switched into the hand-driven mode,

electricity-driven lines 40a and 40b that are the electric power paths in the electricity-driven mode are shut off and the electric power paths are switched to the hand-driven line (the first electric power path on the output side of the hand-crank generator). The first electric power path is adapted to be selectively connected to second electric power path 58a or 58b by the selection switch of selector switching means 62.

[0199] Here, hand-crank generator 52 is built as relay box 70 inside foot board 9, and the foot board 9 also incorporates hand-driven/electricity-driven switching means 61.

[0200] This hand-driven/electricity-driven switching means 61 uses a mechanical switch or electric switch. The aspect of the hand-driven/electricity-driven switching means 61 is the same as in the first example of the third embodiment B shown in FIG. 17(a).

[0201] Here, FIG. 21 shows a foot board 9 built in with hand-crank generator 52, in which an exemplary switch control portion of hand-driven/electricity-driven switching means 61 and selector switching means 62 is provided in an exposed manner.

[0202] As shown in FIG. 22(a), the first example of the fourth embodiment B, selector switching means 62 may use a mechanical switch or an electric switch to select the output destination in the hand-driven mode, similarly to

hand-driven/electricity-driven switching means 61.

[0203] As selector switching means 62, an exposed control switch portion such as rotary and toggle switches may be arranged on outer cover 60 so that the output destination
5 can be selected and changed by the operation of the control switch portion.

[0204] In the case shown in FIG. 21 where the exposed control switch portion of selector switching means 62 is provided for outer cover 60, since the control switch portion is arranged
10 next to the place where handle 52b of hand-crank generator 52 is operated, this arrangement brings about ease of operation and enables easy confirmation of the output destination.

[0205] Though two output destinations, namely, electric back drive actuator 31 and electric leg drive actuator 34, are
15 prepared in the hand-driven mode, it is possible to provide a configuration in which two or more output destinations may be selected appropriately from the electric actuators and other electric power use devices. This also applies similarly to the second and third examples.

[0206] In the second example of the fourth embodiment B shown
20 in FIG. 22 (b), two relay boxes 70A and 70B are provided. The first relay box 70A and second relay box 70B are arranged apart from each other, and first relay box 70A is arranged in the course of the second electric power path, second relay
25 box 70B being provided to play a role of incorporating

hand-crank generator 52 in foot board 9.

[0207]

(1) First relay box 70A integrates actuator lines 31a and 34a connected to the aforementioned respective actuators 31 and 34, electric feeder lines (electricity-driven lines 40a and 40b) from control box 40, and electric feeder lines (second electric power paths 58a and 58b) from hand-crank generator 52, and includes hand-driven/electricity-driven switching means 61 therein and is arranged at an appropriate position of the bed apparatus.

[0208]

(2) Second relay box 70B includes hand-crank generator 52 and a control portion that drives hand-driven/electricity-driven switching means 61 or the switches of first relay box 70A, and is incorporated in foot board 9.

[0209]

(3) The aforementioned hand-driven/electricity-driven switching means 61 may use a mechanical switch or an electric switch. This example is the same as the second example of the third embodiment B shown in FIG. 17(b) in the aspect of hand-driven/electricity-driven switching means 61, and the same components in FIG. 22(b) are allotted with the same reference numerals without description.

[0210] Though the structure of selector switching means 62

can be configured in various ways, when, for example a mechanical switch is used for selector switching means 62, similarly to hand-driven/electricity-driven switching means 61 in that case, the selector switching means 62 is provided in the first relay box 70A and an exposed control switch portion such as rotary and toggle switches may be provided as selector switching means 62 in second relay box 70B so that selector switching means 62 can be used to select the output destination by the operation of the control switch portion.

[0211] In this case, since first relay box 70A and second relay box 70B are positioned at a distance, the operating force acting on second relay box 70B may be transmitted through a mechanical wire 66 or the like to thereby switch the output destinations of selector switching mechanism 62 as a mechanical switch in first relay box 70A.

[0212] In the third example of the fourth embodiment B shown in FIG. 22(c), in order to be able to supply electric power from control box 40 provided in bed apparatus 1 to electric back drive actuator 31, electric elevating actuator 32 and electric leg drive actuator 34 in the electricity-driven mode, electric power paths (electricity-driven lines 40a and 40b) for the electricity-driven mode are connected correspondingly.

[0213] Second electric power path 58a extended from relay box 50 is connected to electricity-driven line 40a going to

the electric back drive actuator 31 by a branch cable 58c1. Further, second electric power path 58b extended from relay box 50 is connected to electricity-driven line 40b going to the electric leg drive actuator 34 by a branch cable 58c2.

5 [0214] Relay box 70 includes selector switching means 62 so as to be able to switch connections of second electric power paths 58a and 58b, and thereby to be able to select to supply output electric power from hand-crank generator 52 to one of the aforementioned actuator 31 or 34.

10 [0215] Relay box 70 may be mounted in foot board 9 with a hole 60b for the handle of hand-crank generator 52 exposed, similarly to the second embodiment and the third embodiment B. As to the position of attachment, the relay box may be arranged on any of the head side, lateral sides and foot side
15 of bed apparatus 1, as long as it is positioned on a horizontal outer side surface.

[0216] Here, as to the switching means in the whole of the fourth embodiment B, in addition to the functions of on/off hand-driven/electricity-driven switching means 61 and
20 selector switching means 62, provision of switches for other functions such as lock/unlock switches for regulating/deregulating the operations of individual electric power use devices such as actuators should also be included within the scope of the present invention.

25 [0217] In the present invention, the arrangement of the

hand-crank generator 52 and outer cover of the fourth embodiment B may be changed in various ways.

[0218] FIGS. 23 are illustrative views of a variational example of the bed apparatus of the fourth embodiment B, (a) a view with an outer cover removed and (b) an external illustrative view.

[0219] As shown in FIG. 23, in this variational example, a laterally long indented portion 60a enabling to store handle 52b of hand-crank generator 52 in a lateral direction, a hole 60b, an on/off hand-driven/electricity-driven switching means 61 and a selector switching means 62 are arranged in the upper part of an outer cover 60 of a foot board 9. Other configurations are the same as those of the fourth embodiment B shown in FIGS. 21 and 22.

[0220] Here, in the variational example, when outer cover 60 is removed from foot board 9, an approximately T-shaped depressed portion 64 is formed in the foot board, as shown in FIG. 23(a). Hand-crank generator 52 is vertically oriented and fitted in the depressed portion while the electric power cable goes forward via a hole 64a below to electric actuators 31, 34 ... of the bed.

[0221] Here, in the present invention, the on/off switching means and selector switching means are configured to mechanically drive the contact points by the mechanical wires as mentioned above in the first embodiment to the fourth

embodiment B. Other than this, these switching means may use various kinds of mechanical or electrical configurations.

[0222] For example, the switching means such as the on/off switching means and selector switching means may use a relay circuit (circuit of a contact-point type, semiconductor type or the like). When a relay circuit is used, signal output devices such as press buttons and touch switches are provided in the control portion for operation so that the electric signals from those devices are transmitted via signal lines and the transmitted electric signals are used in the relay circuit to turn on and off the electric power paths or change the power supply destination.

[0223] Use of a relay circuit in this way enables use of press buttons and touch switches as the control portion, hence provides such excellent effect that the control portion can be operated with a light operating sensation compared to the case where mechanical wires are used.

[0224] Though in each of the above first embodiment to the fourth embodiment B, the electricity use devices to which electric power are supplied by the hand-crank generator have been explained by exemplifying electric back drive actuator 31 and electric leg drive actuator 34, the electric power use devices of the present invention should not be limited to these. The hand-crank generator may be used as an electric power source for other electric actuators. Further, when,

instead of an electric actuator, a hydraulically operated actuator is used as the driver, the electric power from the hand-crank generator may be supplied as the driving power supply for that actuator. Moreover, the hand-crank generator
5 may be used to supply electric power to, other than drivers, electricity use devices that are installed around the bed apparatus, for example, various kinds of measuring devices for patients.

[0225] Though each of the above first embodiment to the fourth
10 embodiment B has been described by giving an example where hand-crank generator 52 is arranged on the foot board, or the side rails in the present invention, the generator may be arranged in an appropriate place (preferably easily accessible by the operator) on an outer side surface of the
15 head side, lateral sides or foot side of the bed apparatus.

[0226] Though in the first embodiment, third embodiment A and fourth embodiment A, a separate hand-crank generator is connected to the relay box, the hand-crank generator may be integrated with the relay box. Further, when the hand-crank
20 generator is integrated, the handle may be either integrated or removable. When the handle is separable, it is possible to assure safety so that only the operator can use it.

[0227] Though in the first embodiment, third embodiment A and fourth embodiment A, the relay box is mounted to the foot
25 board in an embedded manner or in a projected manner, in the

present invention, the way of mounting of the relay box should not be of course limited to these. The relay box may be mounted to bed frames, other bed boards, fences, side rails, the adjuncts around the bed such as IV pole (pole for intravenous administration), etc.

[0228] Further, in the present invention, the electric power use devices to which the hand-crank generator can be electrically connected may include peripheral devices of the bed apparatus. This arrangement makes it possible for the hand-crank generator to supply electric power to operate the peripherals when there is no electric power source in the facility.

[0229] The size and material of the relay box can be suitably selected depending on the use condition. The number of ports to be used for connection may be also selected appropriately.

[0230] Though in the second embodiment, third embodiment B and fourth embodiment B the hand-crank generator is embedded in the foot board, the placement embedded in the foot board, the position of the board in which the generator is embedded (e.g., head board, side rails, etc.) do not matter in the present invention. Further, in the present invention the board may use various kinds of material. Embedding the hand-crank generator in the board enables mounting at an easily operable height as well as can achieve high design performance without the need of supporting the board.

Industrial Applicability

[0231] The bed apparatus of the present invention can be applied to diverse kinds of bed apparatuses for hospital and for nursing care, that have back drive and leg drive mechanisms.

5 Description of Reference Numerals

[0232]

- 1 bed apparatus
- 3 bed frame
- 4 base truck
- 10 7 side rail
- 8 head board
- 9 foot board
- 22 back bottom
- 24 hip bottom
- 15 26 leg bottom
- 31 electric back drive actuator
- 32 electric elevating actuator
- 34 electric leg drive actuator
- 40 control box
- 20 50 relay box
- 50a socket in relay box
- 52 hand-crank generator
- 52a main body of hand-crank generator
- 52b handle of hand-crank generator
- 25 52c shaft of hand-crank generator

- 52d first electric power path
- 54 extracting port
- 58 second electric power path
- 60 outer cover
- 5 60a indented portion
- 60b hole of hand-crank generator handle
- 61 hand-driven/electricity-driven switching means
- 62 selector switching means
- 64 depressed portion in the foot board with its outer cover
- 10 removed
- 66 mechanical wire
- 68 relay box
- 70 relay box

Claims

1. A bed apparatus comprising:

an electric power use device that is operated by an
5 electric power,

wherein

the electric power can be supplied by a hand-crank
generator, and

at least one end of an electric power path for delivering
10 power to the electric power use device is arranged at a position
on an outer side surface of a head side, lateral sides, or
a foot side of the bed apparatus.

2. The bed apparatus according to Claim 1, wherein

15 the hand-crank generator is provided outside the bed
apparatus,

as the electric power path, the first electric power
path connected to the hand-crank generator and a single or
a plurality of second electric power paths for supplying the
20 electric power to a single or a plurality of electric power
use devices are provided,

input side ends of the single or the plurality of second
electric power paths are provided in a relay box while an
output-side end of the first electric power path can be
25 connected to the input side ends of the second electric power

paths provided in the relay box, whereby when the hand-crank generator is operated to generate electricity in a state that the first electric power path is connected to the second electric power path, the electric power use device can operate, and,

the relay box is arranged at a place on a horizontal outer side surface of the head side, the lateral sides, or the foot side of the bed apparatus within reach of user's hands.

3. The bed apparatus according to Claim 2, wherein

a plurality of electric power use devices are provided, the relay box is provided with a plurality of input-side ends of the plurality of second electric power paths each connected to the plurality of electric power use devices, and,

the output side of the first electric power path can be selectively connected to any one of the input-side ends of the plurality of second electric power paths, and when the external hand-crank generator is operated to generate electricity in a state that the first electric power path is connected to a selected second electric power path, electric power can be supplied to the electric power use device connected to the selected second electric power path.

4. The bed apparatus according to Claim 2, wherein the relay box is provided with a switching means that turns on and off connection of the second electric power path with the first electric power path from the hand-crank generator or switches connection between the first electric power path and the plurality of second electric power paths.

5. The bed apparatus according to Claim 1, wherein the hand-crank generator is provided on the bed apparatus itself, and,

the hand-crank generator is arranged at a position on an outer side surface of the head side, the lateral sides, or the foot side of the bed apparatus so as to be able to supply electric power from the first electric power path connected to the hand-crank generator to the ends of the second electric power paths for supplying the electric power to a single or a plurality of electric power use devices.

6. The bed apparatus according to Claim 5, wherein a handle for operating the hand-crank generator to generate electricity can be accommodated in the bed apparatus, and can be turned round from an outside of the hand-crank generator when the handle is used.

7. The bed apparatus according to Claim 5 or 6, wherein

a plurality of electric power use devices are provided,
an output side of the first electric power paths from
a single or a plurality of hand-crank generators can be
selectively connected to any one of ends of the plurality
of second electric power paths, and

when the hand-crank generators are operated to generate
electricity in a state that the first electric power path
is connected to a selected second electric power path, electric
power can be supplied to the electric power use device connected
to the selected second electric power path.

8. The bed apparatus according to Claim 5 or 6, further
comprising a switching means adjacent to the hand-crank
generator that turns on and off the connection of the second
electric power path with the first electric power path from
the hand-crank generator or that switches connection between
the first electric power path and the plurality of second
electric power paths.

9. The bed apparatus according to Claim 4 or 8, wherein
the switching means contains a switching mechanism that
mechanically performs an on/off operation of the second
electric power path or a switching operation of a power supply
destination, by an operating force that is transmitted from
a control portion for operation via a mechanical wire.

10. The bed apparatus according to Claim 4 or 8, wherein the switching means uses a relay circuit that performs an on/off operation of the electric power path or a switching operation of an electric power supply destination, based on electric signals transmitted from a control portion for operation.

11. The bed apparatus according to any one of Claims 1 to 10, further comprising a driver that drives a predetermined part of the bed apparatus by means of an electric actuator or a peripheral device of the bed apparatus, as the electric power use device.