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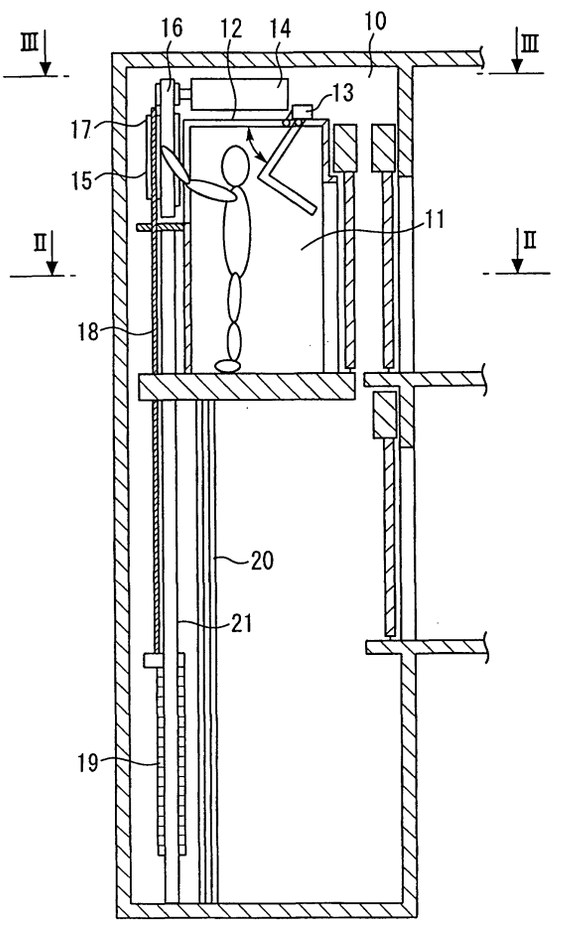
(54) MACHINE HOUSE-LESS ELEVATOR

(57) A *machine-room-less* elevator has a car (11) having an opening section (12) formed in its wall, and a hoisting machine (17) having a sheave (15) around which a cable (18) is to be wound and a motor (14) for actuating the sheave (15), in which the car (11) is fixed to one end of the cable (18) and a counterweight (19) is fixed to the other end of the same. When the car (11) is positioned at the top of a hoistway (10), the sheave (15) is located between the car (11) and a wall of the hoistway; and the sheave (15) can be inspected from the inside of the car (11), by way of the opening section (12).

FIG. 1



EP 1 433 734 A1

Description

Field of the Invention

[0001] The invention relates to a *machine-room-less* elevator.

Background Art

[0002] A common example of a *machine-room-less* elevator is an elevator in which a hoisting machine is set at the top of a hoistway. In such an elevator, a service technician performs maintenance and inspection of an elevator car while positioned on top of the car. A handrail is provided on top of the car for preventing the service technician from a falling from the car into the hoistway when performing inspection and maintenance.

[0003] As mentioned above, in relation to a related-art *machine-room-less* elevator, a hand rail is provided on top of an elevator car. Further, a hoisting machine disposed at the top of the hoistway determines the dimension of the space provided at the top of the elevator. This presents a problem of posing limitation on reduction in the space for installing an elevator or on effective utilization of building space.

Disclosure of the Invention

[0004] The invention has been conceived to solve such a problem and aims at providing a *machine-room-less* elevator in which the space provided at the top of the elevator is of small dimension.

[0005] To achieve the object, a *machine-room-less* elevator according to the invention may comprise a car having an opening formed in its wall, a sheave around which is passed a cable having at one end the car and at the other end a counterweight, and a hoisting machine having a motor for actuating the sheave. When the car remains at the top of a hoistway, the sheave may located between the car and the wall of the hoistway. By way of the opening, the sheave may be inspected from the inside of the car.

[0006] According to one aspect of the present invention, a *machine-room-less* elevator may comprise a car having an opening section formed in its wall, a cable whose both ends are fastened within the hoistway and which is to be routed around pulleys provided on the car and the counterweight, and a hoisting machine having a sheave around which the cable is to be routed, the sheave being located between the pulleys, and a motor for actuating the sheave. When the car is positioned at the top of the hoistway, the sheave may be located between the car and a wall of the hoistway, and inspection of the sheave may be performed from the inside of the car, by way of the opening section.

[0007] Another aspect of the present invention, in the *machine-roow-less* elevator, when the car is positioned at the top of the hoistway, the motor may be placed between the car and the wall of the hoistway, and inspection of the motor may be performed from the inside of the car, by way of the opening section.

[0008] Another aspect of the present invention, in the *machine-room-less* elevator, the opening section may be formed in a ceiling of the car.

[0009] Another aspect of the present invention, the *machine-room-less* elevator further may comprise a fixing device for fixing the car within the hoistway. The fixing device may be to be operated from the inside of the car.

[0010] Another aspect of the present invention, in the *machine-room-less* elevator, rotational motion of the motor may be decelerated and torque thereof may be transmitted to the sheave by way of a belt.

[0011] Another aspect of the present invention, a *machine-room-less* elevator, may comprise a car having an opening section formed in its wall; and a hoisting machine having a sheave aroundwhich a cable is to be wound and amotor for actuating the sheave, in which the car is fixed to one end of the cable and a counterweight is fixed to the other end of the same. When the car is positioned at the top of a hoistway, the hoisting machine may be located between the car and a wall of the hoistway, a floor of the car may extend outward toward the hoisting machine, and the hoisting machine may be inspected by a service technician positioned from the floor extending outward, by way of the opening section.

[0012] Another aspect of the present invention, a *machine-room-less* elevator, may comprise a car having an opening section formed in its wall; a cable whose both ends are fastened within the hoistway and which is to be routed around pulleys provided on the car and the counterweight; and a hoisting machine having a sheave around which the cable is to be routed, the sheave being located between the pulleys, and a motor for actuating the sheave. When the car is positioned at the top of the hoistway, the hoisting machine may be located between the car and a wall of the hoistway, a floor of the car may extend outward toward the hoisting machine, and the hoisting machine may be inspected by a service technician who has moved to the floor extending outward by way of the opening section.

Brief Description of the Drawings

[0013]

Fig. 1 is a cross-sectional view showing a *machine-room-less* elevator according to a first embodiment of the invention;

Fig. 2 is a cross-sectional view of the *machine-room-less* elevator taken along line II-II shown in Fig. 1;

Fig. 3 is a cross-sectional view of the *machine-room-less* elevator taken along line III-III shown in Fig. 1;

Fig. 4 is a cross-sectional view of a *machine-room-less* elevator according to a second embodiment of the invention;

Fig. 5 is a cross-sectional view of the *machine-room-less* elevator taken along line V-V shown in Fig. 4;

Fig. 6 is a cross-sectional view of a *machine-room-less* elevator according to a third embodiment of the invention; and

Fig. 7 is a cross-sectional view of the *machine-room-less* elevator taken along line VII-VII shown in Fig. 6.

Best Modes for Implementing the Invention

[0014] Embodiments of the invention will now be described as follows.

First Embodiment

[0015] An embodiment of a *machine-room-less* elevator according to the invention will be described by reference to Fig. 1. Fig. 1 is a cross-sectional view showing a vertical cross section of a *machine-room-less* elevator according to a first embodiment of the invention.

[0016] As shown in Fig. 1, reference numeral 10 designates an elevator hoistway. Reference numeral 11 designates an elevator car located within the hoistway 10. Reference numeral 12 designates an opening section to be formed in a wall or ceiling of the car 11. The opening section 12 is embodied by integrally drawing, into the car, a portion of wall of the car and a portion of the ceiling of the car or by separately drawing the same into the car. Reference numeral 13 designates a switch which controls operation of the elevator when the opening section 12 is opened. Reference numeral 14 designates a motor disposed on top of the hoistway 10. Reference numeral 15 designates a sheave located on a wall surface of the top of the hoistway 10. When the car 11 remains at the top of the hoistway, the sheave 15 is interposed between the wall surface of the hoistway and the car 11. Reference numeral 16 designates a belt which decelerates and transmits torque of the motor 14 to the sheave 15. Reference numeral 17 designates a hoisting machine constituted of the motor 14, the sheave 15, and the belt 16. Reference numeral 18 designates a cable passed around the sheave 15. One end of the cable 18 is secured on the car 11, and the other end of the same is fastened to a counterweight 19. Reference numeral 20 designates a car guide rail. Reference numeral 21 designates a counterweight guide rail. The sheave 15 is disposed in a position above the counterweight guide rail 21.

[0017] Fig. 2 shows a cross-sectional view of the *machine-room-less* elevator taken along line II-II shown in Fig. 1. In Fig. 2, those elements which are identical with or correspond to those shown in Fig. 1 are assigned the same reference numerals, and their repeated explanations are omitted.

[0018] Fig. 3 shows a cross-sectional view of the *machine-room-less* elevator taken along line III-III shown in Fig. 1.

[0019] As shown in Fig. 3, reference numeral 30 designates a car locking device. The car locking device 30 of the embodiment is for locking the car 11 by means of manipulating, from the inside of the car, a plate attached to the car guide rail 20 through use of a lock bar. The car locking device 30 is not limited to this example. Such a car locking device 30 is used for locking the car 11 at the time of, e.g. , maintenance work.

[0020] In Fig. 3, those elements which are identical with or correspond to those shown in Fig. 1 are assigned the same reference numerals, and their repeated explanations are omitted. Explanations are given of only the features of the *machine-room-less* elevator shown in Fig. 3 and that are not shown in Fig. 1.

[0021] As mentioned above, the opening section 12 is formed in the wall or the like of the car 11, and the sheave 15 of the hoisting machine 17 or a like element which is heavily reliant on maintenance work is interposed between the car 11 and the wall of the hoistway. Hence, a service technician can readily perform maintenance of the sheave 15 or like elements from the inside of the car. During maintenance and inspection of the sheave 15 or like elements to be performed from the inside of the car, the car can be positioned at the highest floor level or at a position slightly above or below the highest floor level. Thus, positions in close proximity to the highest floor level are taken as the top. Here, movement of the car to the neighborhood of the highest floor level is performed by means of predetermined actuation of switches or like elements.

[0022] Since maintenance of the sheave 15 provided on the wall of the car 11 can be readily performed from the inside of the car, the service technician can safely perform maintenance while standing directly on the floor of the car without use of a footstool in the car.

[0023] Since the service technician can perform maintenance from the inside of the car, a necessity for climbing up on top of the car for maintenance and inspection is obviated. Hence, a handrail provided on the car can be removed.

[0024] Since the handrail provided on the car can be removed, the dimension of a space provided at the top of the elevator can be reduced.

[0025] The sheave 15 of the hoisting machine 17 and reduction gears can be placed between the car 11 and the wall of the hoistway . Parts to be placed at a position above the car and within the top of the hoistway can be minimized, thereby reducing the dimension of the space provided at the top of the elevator.

[0026] A method of reducing the dimension of the space provided at the top of an elevator can be embodied inexpensively.

[0027] If the sheave 15 and the motor 14, both belonging to the hoisting machine 17, can be made slim, the

space for installing an elevator can be reduced further, thereby enabling more effective utilization of a building space.

Second Embodiment

[0028] Another embodiment of the *machine-room-less* elevator according to the invention will be described by reference to Fig. 4. Fig. 4 is a cross-sectional view showing the vertical cross section of the *machine-room-less* elevator of the second embodiment.

[0029] As shown in Fig. 4, reference numeral 40 designates a car cable anchoring section provided in a hoistway 10. One end of a cable 18 is anchored to the car cable anchoring section 40. Reference numeral 41 designates car turnaround pulleys disposed on the lower surface of a car 11. Reference numeral 42 designates a counterweight turnaround pulley to be provided in a position above a counterweight 19. Reference numeral 43 designates a counterweight cable anchoring section provided on a counterweight guide rail 21 or provided in the hoistway 10. The remaining end of the cable 18 is anchored to the counterweight cable anchoring section 43.

[0030] As mentioned, in relation to the *machine-room-less* elevator of the embodiment, one end of the cable 18 is anchored to the car cable anchoring section 40 and routed around the car turnaround pulleys 41, the sheave 15, and the counterweight turnaround pulley 42. The other end of the cable 18 is anchored to the counterweight cable anchoring section 43. Such a cable arrangement is called a 2-to-1 cable arrangement.

[0031] In Fig. 4, those elements which are identical with or correspond to those shown in Fig. 1 are assigned the same reference numerals, and their repeated explanations are omitted. Explanations are given of only features of the *machine-room-less* elevator shown in Fig. 4 and those not shown in Fig. 1.

[0032] Fig. 5 shows a cross-sectional view of the *machine-room-less* elevator taken along line V-V shown in Fig. 4. As shown in Fig. 5, those elements which are identical with or correspond to those shown in Fig. 4 are assigned the same reference numerals, and their repeated explanations are omitted.

[0033] As mentioned above, use of the 2-to-1 cable arrangement enables reduction of the load exerted on the hoisting machine 17 to one-half, so that a motor or like elements can be made compact. Therefore, the dimension of the space provided at the top of the elevator can be reduced by means of the layout of the hoisting machine 17 of the embodiment.

[0034] Since the opening section 12 is formed in the wall of the car 11, maintenance of a sheave 15 or like elements interposed between the wall of the hoistway and the car 11 can be carried out readily and safely.

[0035] Since a necessity for the service technician to climb up onto the car 11 and to perform maintenance is obviated, the handrail provided on the car can be removed, thereby curtailing the dimension of the space provided at the top of the elevator.

Third Embodiment

[0036] Yet another embodiment of a machine-room-less elevator according to the invention will be described by reference to Fig. 6. Fig. 6 is a cross-sectional view showing the vertical cross section of a *machine-room-less* elevator according to a third embodiment of the invention.

[0037] As shown in Fig. 6, reference numeral 50 designates a floor of a car. Reference numeral 51 designates a handrail. The handrail 51 is provided on the floor 50 extending to the outside of a car 11. The handrail 51 is for enabling the service technician to safely perform work while positioned on the floor 50. Reference numeral 52 designates a door (opening section) provided in the wall of the car 11. By opening the door 52, the service technician can move to the portion of the floor 50 extending outside the car 11. Reference numeral 53 designates a switch. When the door 52 is opened, the operation of the elevator is controlled by means of the switch. Reference numeral 54 designates a controller provided on the wall of the hoistway.

[0038] As mentioned above, in relation to the machine-room-less elevator of the embodiment, a sheave and a motor, both belonging to a hoisting machine, and like elements are disposed on the wall surface of the top of the hoistway 10 and in positions in close proximity to the portion of the floor 50 extending outside the car 11. Hence, nothing is disposed between the ceiling of the hoistway 10 and that of the car 11. Therefore, the service technician opens the door 52 of the wall of the car and performs maintenance and inspection of the sheave 15 and the motor 14, both belonging to the hoisting machine 17 and disposed in positions above the portion of the floor extending outside the car.

[0039] In Fig. 6, those elements which are identical with or correspond to those shown in Fig. 1 are assigned the same reference numerals, and their repeated explanations are omitted. Explanations are given of only features of the *machine-room-less* elevator shown in Fig. 6 and those not shown in Fig. 1.

[0040] Fig. 7 shows a cross-sectional view of the *machine-room-less* elevator taken along line VII-VII shown in Fig. 6. In Fig. 7, those elements which are identical with or correspond to those shown in Fig. 6 are assigned the same reference numerals, and their repeated explanations are omitted.

[0041] As mentioned above, the service technician can perform a maintenance operation outside the car. Hence, the range of action of the service technician is broadened, thereby enabling maintenance of a controller provided on the wall of the hoistway.

[0042] The sheave and the motor, both belonging to the hoisting machine, and like elements are disposed in positions above the portion of the floor extending out-

side the car, and maintenance is performed on that floor. Hence, a necessity for performing maintenance on the top of the car 11 is obviated, thereby enabling removal of the handrail provided on the upper surface of the car 11 and reducing the dimension of the space provided at the top of the elevator.

[0043] Fig. 6 shows an example of *machine-room-less* elevator having a 1-to-1 cable arrangement. However, even when there is employed a *machine-room-less* elevator having a 2-to-1 cable arrangement, there is also yielded the same advantage.

[0044] As has been described, a *machine-room-less* elevator of the invention includes a car having an opening section formed in its wall; and a hoisting machine having a sheave around which a cable is to be wound and a motor for actuating the sheave, in which the car is fixed to one end of the cable and a counterweight is fixed to the other end of the same, wherein, when the car is positioned at the top of a hoistway, the sheave is located between the car and a wall of the hoistway; and the sheave can be inspected from the inside of the car, by way of the opening section. Since a service technician can perform maintenance from the inside of the car, a necessity for climbing up on top of the car for maintenance and inspection is obviated. Hence, a handrail provided on the car can be removed. Since the handrail provided on the car can be removed, the dimension of a space provided at the top of the elevator can be reduced. Space for installing an elevator can be reduced, and more effective utilization of a building space can be realized.

[0045] A *machine-room-less* elevator of the invention includes a car having an opening section formed in its wall; a cable whose both ends are fastened within the hoistway and which is to be routed around pulleys provided on the car and the counterweight; and a hoisting machine having a sheave around which the cable is to be routed, the sheave being located between the pulleys, and a motor for actuating the sheave, wherein, when the car is positioned at the top of the hoistway, the sheave is located between the car and a wall of the hoistway, and inspection of the sheave can be performed from the inside of the car, by way of the opening section. Since a service technician can perform maintenance from the inside of the car, a necessity for climbing up on top of the car for maintenance and inspection is obviated. Hence, a handrail provided on the car can be removed. Since the handrail provided on the car can be removed, the dimension of a space provided at the top of the elevator top can be reduced. A space for installing an elevator can be reduced, and more effective utilization of a building space can be realized.

[0046] A *machine-room-less* elevator of the invention includes a car having an opening section formed in its wall; and a hoisting machine having a sheave around which a cable is to be wound and a motor for actuating the sheave, in which the car is fixed to one end of the cable and a counterweight is fixed to the other end of the same, wherein, when the car is positioned at the top of a hoistway, the hoisting machine is located between the car and a wall of the hoistway; a floor of the car extends outward toward the hoisting machine; and the hoisting machine can be inspected on the floor extending outward by way of the opening section. Since a service technician can perform maintenance from the inside of the car, a necessity for climbing up on top of the car for maintenance and inspection is obviated. Hence, a handrail provided on the car can be removed. Since the handrail provided on the car can be removed, the dimension of a space provided at the top of the elevator can be reduced. A space for installing an elevator can be reduced, and more effective utilization of a building space can be realized.

Industrial Applicability

[0047] As has been described, a *machine-room-less* elevator of the invention includes a car having an opening section formed in its wall; and a hoisting machine having a sheave around which a cable is to be wound and a motor for actuating the sheave, in which the car is fixed to one end of the cable and a counterweight is fixed to the other end of the same, wherein, when the car is positioned at the top of a hoistway, the sheave is located between the car and a wall of the hoistway; and the sheave can be inspected from the inside of the car, by way of the opening section. Since a service technician can perform maintenance from the inside of the car, a necessity for climbing up on top of the car for maintenance and inspection is obviated. Hence, a handrail provided on the car can be removed. Since the handrail provided on the car can be removed, the dimension of a space provided at the top of the elevator can be reduced. Space for installing an elevator can be reduced, and more effective utilization of a building space can be realized.

Claims

1. A *machine-room-less* elevator comprising:

a car having an opening section formed in its wall; and

a hoisting machine having a sheave around which a cable is to be wound and a motor for actuating the sheave, in which the car is fixed to one end of the cable and a counterweight is fixed to the other end of the same, wherein,

when the car is positioned at the top of a hoistway, the sheave is located between the car and a wall of the hoistway; and

the sheave can be inspected from the inside of the car, by way of the opening section.

2. A *machine-room-less* elevator comprising:

a car having an opening section formed in its wall;
a cable whose both ends are fastened within the hoistway and which is to be routed around pulleys provided on the car and the counterweight; and
a hoisting machine having a sheave around which the cable is to be routed, the sheave being located between the pulleys, and a motor for actuating the sheave, wherein,
when the car is positioned at the top of the hoistway, the sheave is located between the car and a wall of the hoistway, and inspection of the sheave can be performed from the inside of the car, by way of the opening section.

3. The *machine-room-less* elevator according to claim 1 or 2, wherein, when the car is positioned at the top of the hoistway, the motor is placed between the car and the wall of the hoistway, and inspection of the motor can be performed from the inside of the car, by way of the opening section.

4. The *machine-room-less* elevator according to claim 1 or 2, wherein the opening section is formed in a ceiling of the car.

5. The *machine-room-less* elevator according to claim 1 or 2, further comprising a fixing device for fixing the car within the hoistway, wherein the fixing device is to be operated from the inside of the car.

6. The *machine-room-less* elevator according to claim 1 or 2, wherein rotational motion of the motor is decelerated and torque thereof is transmitted to the sheave by way of a belt.

7. A *machine-room-less* elevator comprising:

a car having an opening section formed in its wall; and
a hoisting machine having a sheave around which a cable is to be wound and a motor for actuating the sheave, in which the car is fixed to one end of the cable and a counterweight is fixed to the other end of the same, wherein,
when the car is positioned at the top of a hoistway, the hoisting machine is located between the car and a wall of the hoistway;
a floor of the car extends outward toward the hoisting machine; and
the hoisting machine can be inspected by a service technician positioned from the floor extending outward, by way of the opening section.

8. A *machine-room-less* elevator comprising:

a car having an opening section formed in its wall;
a cable whose both ends are fastened within the hoistway and which is to be routed around pulleys provided on the car and the counterweight; and
a hoisting machine having a sheave around which the cable is to be routed, the sheave being located between the pulleys, and a motor for actuating the sheave, wherein,
when the car is positioned at the top of the hoistway, the hoisting machine is located between the car and a wall of the hoistway;
a floor of the car extends outward toward the hoisting machine; and
the hoisting machine can be inspected by a service technician who has moved to the floor extending outward by way of the opening section.

FIG. 1

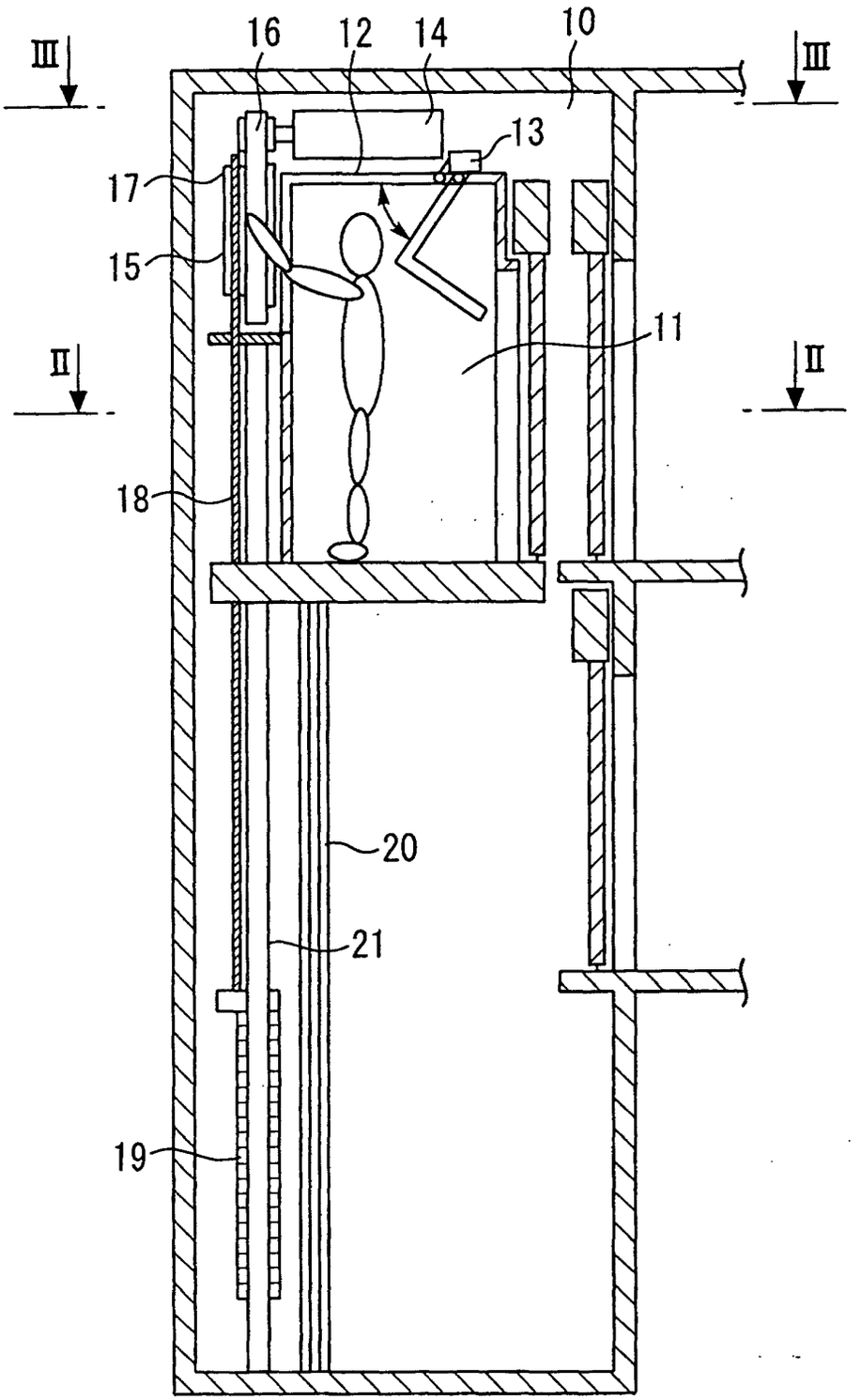


FIG. 2

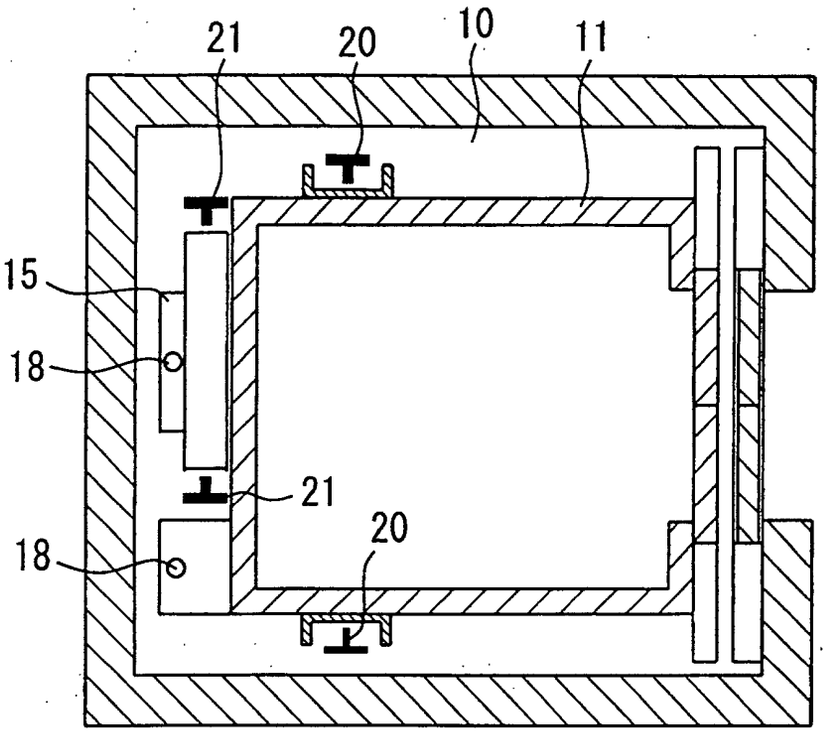


FIG. 3

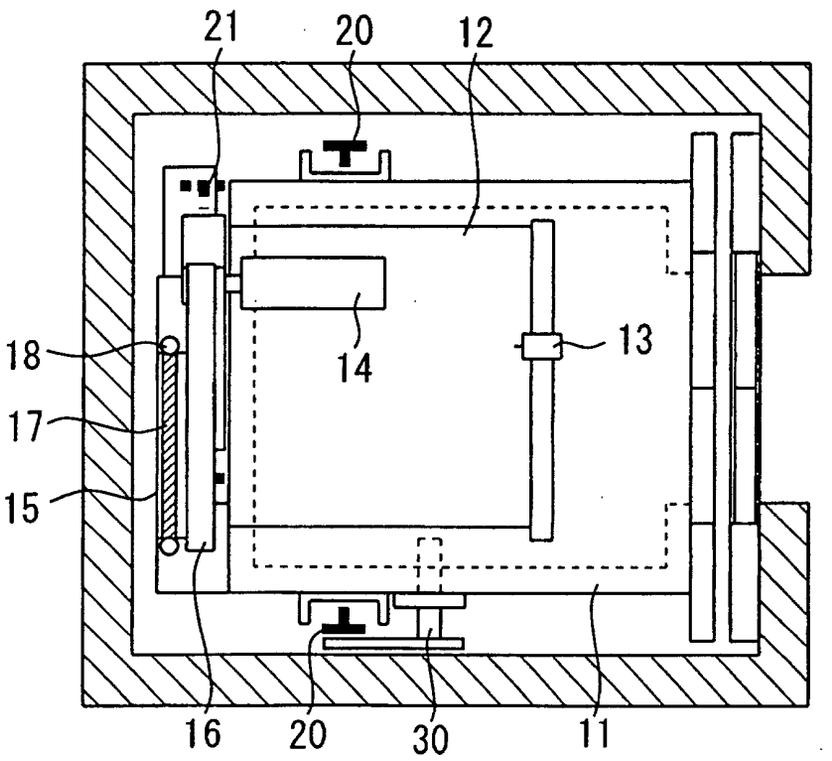


FIG. 4

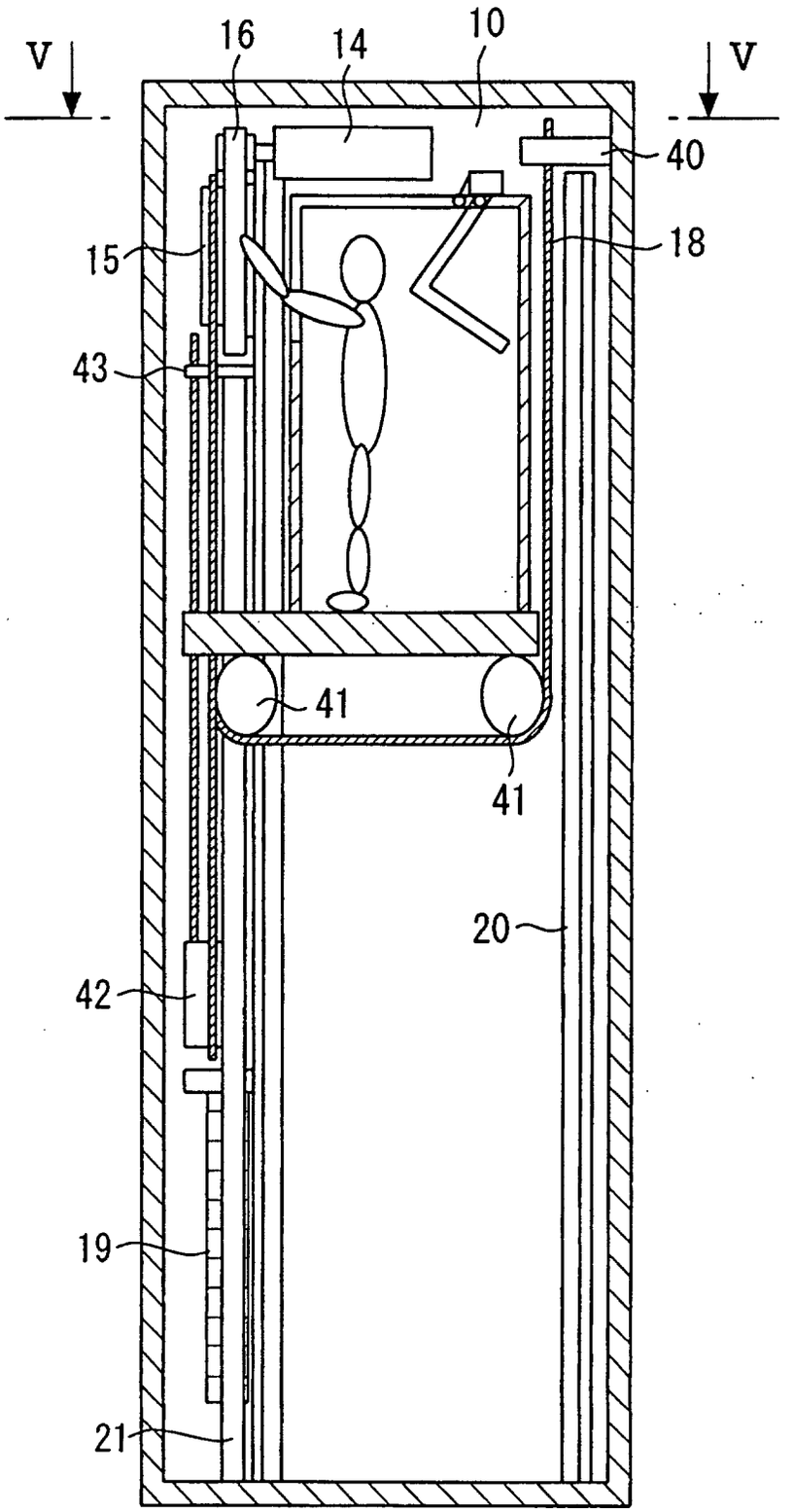


FIG. 5

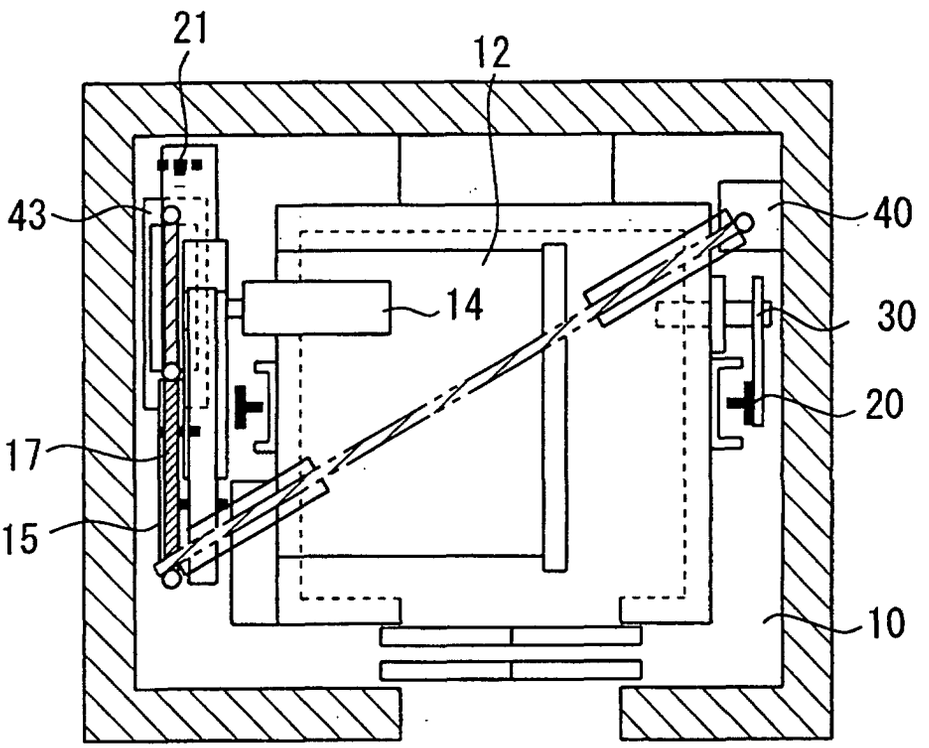


FIG. 6

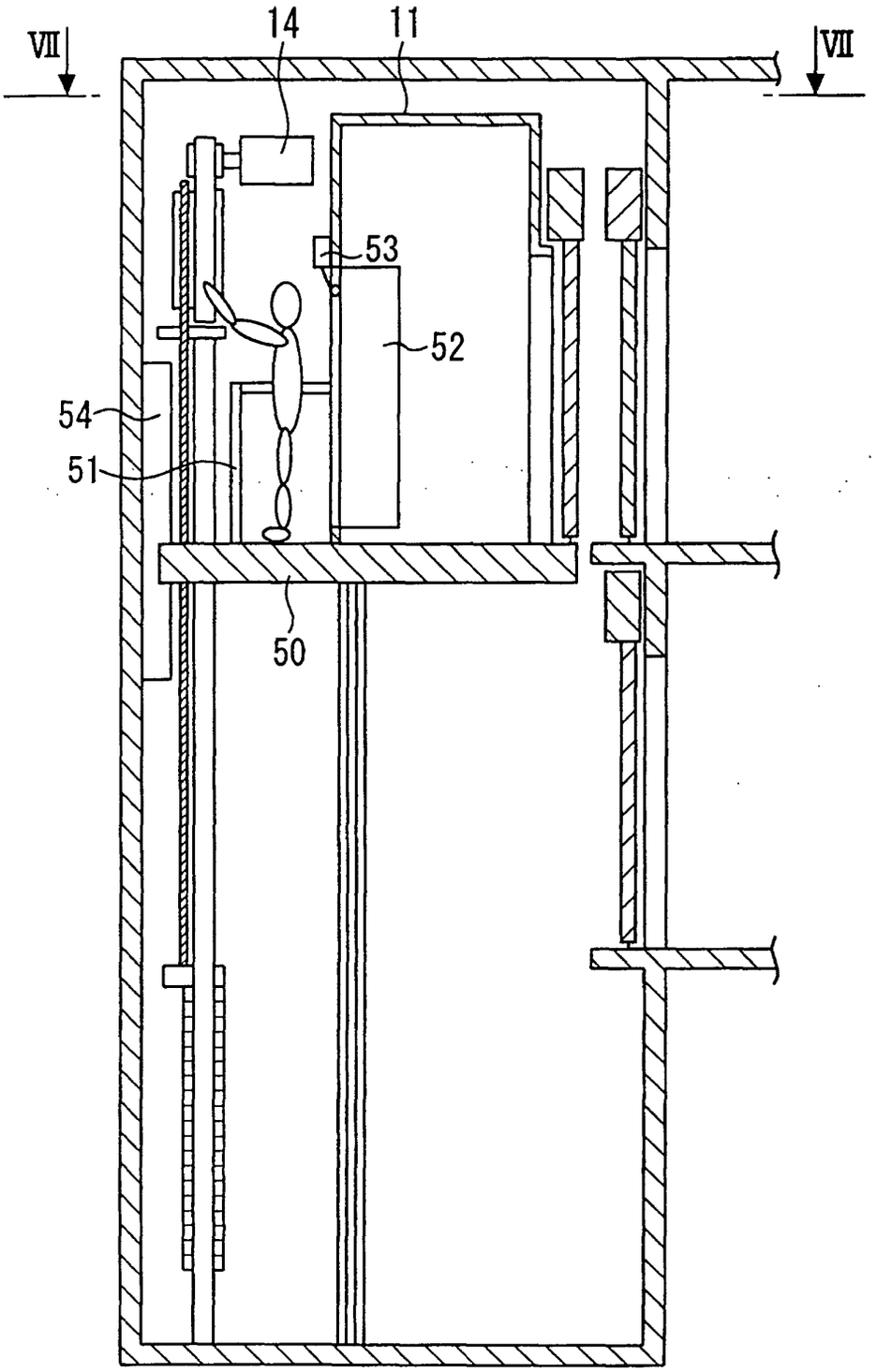
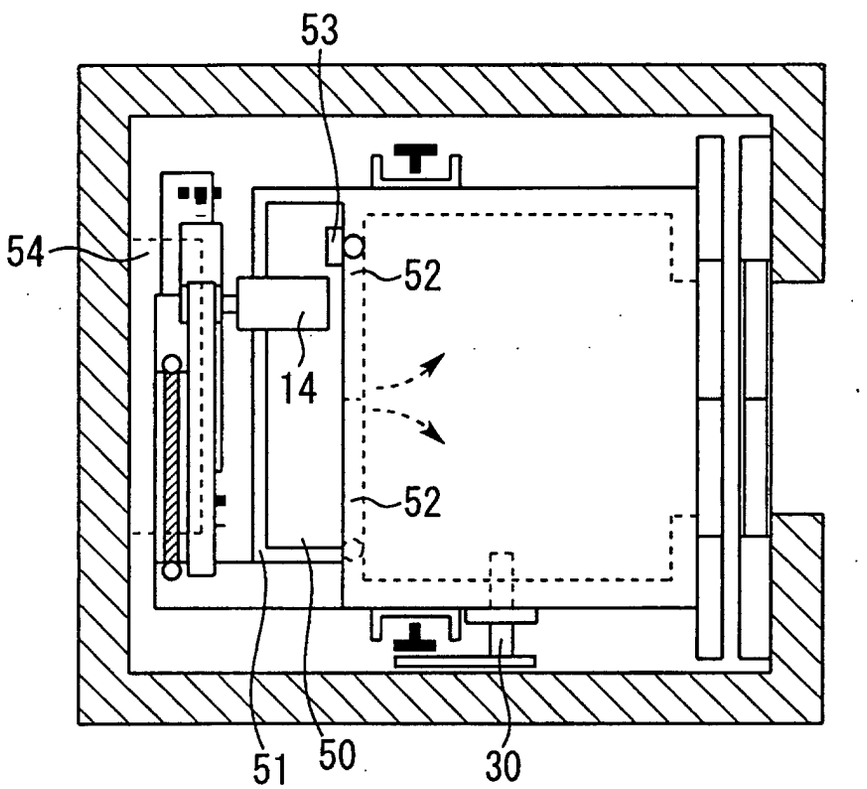


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP01/05134

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B66B5/00, B66B7/00

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] B66B5/00, B66B7/00, B66B11/02, B66B11/08

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-2001
Kokai Jitsuyo Shinan Koho 1971-2001 Jitsuyo Shinan Toroku Koho 1996-2001

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	Par. No. [0025]; Fig. 1	1-6
A		7-8
Y	Par. Nos. [0022] to [0023]	2-6
A		8
	& EP 1026116 A1	
	JP 11-139730 A (Toshiba Corporation), 25 May, 1999 (25.05.99),	
Y	Par. No. [0024]	1,3-6
A		7
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	JP 2000-203774 A (Toshiba Corporation), 25 July, 2000 (25.07.00),	
Y	Par. Nos. [0039] to [0043] (Family: none)	5

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 August, 2001 (16.08.01)	28 August, 2001 (28.08.01)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

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International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 52-28264 Y2 (Takenaka Corporation), 28 June, 1977 (28.06.77), column 2, lines 13 to 25 (Family: none)	5
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