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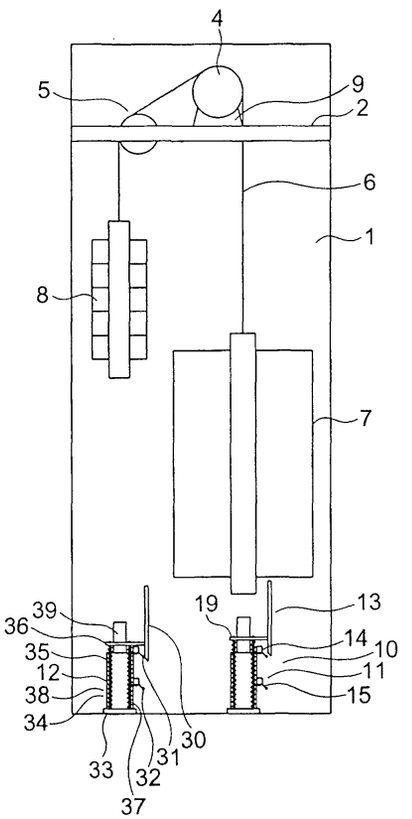
(54) ELEVATOR APPARATUS

(57) An elevator apparatus according to the present invention includes a hoistway; a hoisted body ascending and descending inside the hoistway; a buffer disposed in a pit in a lower portion of the hoistway, for stopping the hoisted body and for absorbing mechanical shock therefrom; an arm disposed under the hoisted body, for tracking vertical movement of the hoisted body; and a switch activated in response to downward movement of the arm, for stopping the hoisted body. As the switch and the arm are disposed inside a vertical plane of projection of the hoisted body, a cross-sectional area of a hoistway is reduced.

FIG. 1



EP 1 518 811 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to an elevator apparatus including a buffer disposed in a pit in a lower portion of a hoistway, for stopping a car that has descended below a landing position of a lowermost floor, for example, and for absorbing mechanical shock therefrom.

BACKGROUND ART

[0002] Conventional elevator apparatuses are known in which a lowermost floor overtravel control switch and an uppermost floor overtravel control switch are each disposed in a pit of a floor portion of a hoistway, the switches being activated to make the car perform an emergency stop by a car cam and a counterweight cam respectively disposed on a car and a counterweight coming into contact with these switches. (See Japanese Patent Laid-Open No. HEI 7-157219 (Gazette, Figure 1), for example.)

[0003] However, in such cases, because the car cam is secured to a side surface of the car and the counterweight cam is also secured to a side surface of the counterweight, and the lowermost floor overtravel control switch is disposed even further outward than the car cam inside the hoistway, and the uppermost floor overtravel control switch is also disposed even further outward than the counterweight cam inside the hoistway, there have been problems such as the cross sectional area of the hoistway being increased.

DISCLOSURE OF INVENTION

[0004] The present invention aims to solve the above problems and an object of the present invention is to provide an elevator apparatus enabling a cross-sectional area of a hoistway to be reduced, etc.

[0005] In order to achieve the above object, according to one aspect of the present invention, there is provided an elevator apparatus including: a hoistway; a hoisted body ascending and descending inside the hoistway; a buffer disposed in a pit in a lower portion of the hoistway, for stopping the hoisted body and for absorbing mechanical shock therefrom; an arm disposed under the hoisted body, for tracking vertical movement of the hoisted body; and a switch activated in response to downward movement of the arm, for stopping the hoisted body, the switch and the arm being disposed inside a vertical plane of projection of the hoisted body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006]

Figure 1 is a structural diagram of an elevator apparatus according to Embodiment 1 of the present invention;

Figure 2 is a structural diagram of the elevator apparatus in Figure 1 during operation;

Figure 3 is a cross section taken along line III - III in Figure 2;

Figure 4 is a structural diagram of an elevator apparatus according to Embodiment 2 of the present invention;

Figure 5 is a structural diagram of an elevator apparatus according to Embodiment 3 of the present invention; and

Figure 6 is a structural diagram of an elevator apparatus according to Embodiment 4 of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0007] Preferred embodiments of the present invention will now be explained with reference to the drawings, and members and portions identical or equivalent in each of the embodiments will be given identical numbering.

Embodiment 1

[0008] Figure 1 is a structural diagram of an elevator apparatus according to Embodiment 1 of the present invention.

[0009] This elevator apparatus includes: a hoistway 1; a machine room 2 formed in an upper portion of the hoistway 1; a hoisting machine 9 disposed inside the machine room 2; a car 7 constituting a hoisted body and a counterweight 8 constituting a hoisted body, suspended like well buckets by means of a rope 6 on a sheave 4 of the hoisting machine 9 and a deflection sheave 5; a car buffer 11 secured in a pit 10 in a lower portion of the hoistway 1 directly under the car 7; and a counterweight buffer 12 secured in the pit 10 in the lower portion of the hoistway 1 directly under the counterweight 8.

[0010] The elevator apparatus includes: a car arm 13 secured to the car buffer 11; an upper portion terminal safety switch 14 secured to the car buffer 11, constituting a limit switch during maintenance inspections; and a lower portion terminal safety switch 15 constituting a limit switch operating before the car buffer 11 finishes operating.

[0011] The car buffer 11 is a hydraulic buffer with an orifice bar, and includes: a base 16; a buffer main body 17 secured to the base 16; two pairs of bar-shaped guides 18 disposed so as to be secured to the base 16 in front of and behind the buffer main body 17 respectively; an angular U-shaped guide plate 19 that can slide vertically relative to the guides 18; and springs 22 disposed so as to surround the guides 18 and force the guide plate 19 toward the car 7. The buffer main body 17 includes: a cylindrical fixed portion 20 containing oil; and a cylindrical movable portion 21 vertically slidable

relative to the fixed portion 20.

[0012] Moreover, a counterweight 8 side of this elevator apparatus also has a construction similar to a car 7 side.

[0013] Specifically, it includes: a counterweight arm 30 secured to the counterweight buffer 12; an upper portion terminal safety switch 31 secured to the counterweight buffer 12, constituting a limit switch during maintenance inspections; and a lower portion terminal safety switch 32 constituting a limit switch operating before the counterweight buffer 12 finishes operating. The counterweight buffer 12 also includes: a base 33; a buffer main body 34 constituted by a fixed portion 38 and a movable portion 39; bar-shaped guides 35; a guide plate 36; and springs 37, all similar to those of the car buffer 11.

[0014] Next, operation of an elevator apparatus having the above construction will be explained.

[0015] During operation of the above elevator apparatus, if, for some reason, the car 7 overtravels and descends below a lowermost floor landing position, a bottom surface of the car 7 collides midway with the car arm 13, which is inside a vertical plane of projection of the car 7, and thereafter the car arm 13 tracks the descent of the car 7, the car arm 13 is placed in contact with the upper portion terminal safety switch 14, the upper portion terminal safety switch 14 is activated, and a braking force acts on the hoisting machine 9.

[0016] If the car 7 is still not stopped by that braking force, the car 7 continues to descend, the car arm 13 tracks the descent of the car 7 and is placed in contact with the lower portion terminal safety switch 15, and the lower portion terminal safety switch 15 is activated, interrupting the power source of the elevator apparatus to make the car 7 perform an emergency stop. Here, the lower portion terminal safety switch 15 is installed so as to be activated before the movable portion 21 of the car buffer 11 reaches its maximum stroke position, in other words, before the car 7 reaches a car range lowermost end position in Figure 2.

[0017] During operation of the above elevator apparatus, if, for some reason, the car 7 overtravels and ascends above an uppermost floor landing position, a bottom surface of the counterweight 8 collides midway with the counterweight arm 30, which is inside a vertical plane of projection of the counterweight 8, and thereafter the counterweight arm 30 tracks the descent of the counterweight 8, the counterweight arm 30 is placed in contact with the upper portion terminal safety switch 31, the upper portion terminal safety switch 31 is activated, and a braking force acts on the hoisting machine 9.

[0018] If the car 7 is still not stopped by that braking force, the car 7 continues to ascend and the counterweight 8 to descend, the counterweight arm 30 tracks the descent of the counterweight 8 and is placed in contact with the lower portion terminal safety switch 32, and the lower portion terminal safety switch 32 is activated, interrupting the power source of the elevator apparatus to make the car 7 perform an emergency stop. Here, the lower portion terminal safety switch 32 is installed so as to be activated before the movable portion 39 of the counterweight buffer 12 reaches its maximum stroke position, in other words, before the car 7 reaches a range uppermost end position (not shown).

[0019] In an elevator apparatus of this kind, because the upper portion terminal safety switch 14, the lower portion terminal safety switch 15, and the car arm 13 are disposed inside a vertical plane of projection of the car 7 constituting a hoisted body, and the upper portion terminal safety switch 31, the lower portion terminal safety switch 32, and the counterweight arm 30 are disposed inside a vertical plane of projection of the counterweight 8 constituting a hoisted body, the cross-sectional area of the hoistway 1 can be reduced compared to conventional constructions.

[0020] Because the upper portion terminal safety switch 14 and the lower portion terminal safety switch 15 are secured to the car buffer 11, and the upper portion terminal safety switch 31 and the lower portion terminal safety switch 32 are secured to the counterweight buffer 12, the switches and the buffers each being integrated, installation work for the switches and the buffers is simple, reducing installation costs.

[0021] Because the respective arms 13 and 30 move vertically by means of the guide plates 19 and 36 guided by the guides 18 and 35, respectively, the vertical movement of the arms 13 and 30 is reliable and stabilized.

[0022] Moreover, in the above embodiment, guides, a guide plate, and springs were explained as being portions of a buffer, but switches and guides on which a guide plate to which an arm is secured slides vertically and is guided may also be secured to a lower surface of a hoisted body. In that case, as the hoisted body descends, a tip end surface of the arm is placed in contact with an arm receiver disposed on a bottom surface of the pit and the switches are activated by a base end surface of the arm approaching and contacting the switches.

Embodiment 2

[0023] Figure 4 is a structural diagram of an elevator apparatus according to Embodiment 2 of the present invention.

[0024] In this elevator apparatus, a car arm 13 is secured directly to a car 7, and the car arm 13 tracks the vertical movement of the car 7 directly.

[0025] Although not shown, a counterweight arm 30 is secured directly to a counterweight 8, and the counterweight arm 30 tracks the vertical movement of the counterweight 8 directly. Here, since the car 7 and the counterweight 8 ascend and descend while being supported horizontally on guide rails installed in a vertical direction of the hoistway (not shown), the vertical movement of the arms 13 and 30 secured to the car 7 and the counterweight 8 is reliable and stable.

[0026] In an elevator apparatus according to this embodiment, springs 22 and 37 for resetting the arms 13 and 30, guides 18 and 35 for guiding those springs 22 and 37, and guide plates 19 and 36 integrated with the arms 13 and 30 are all no longer necessary, making the construction simple compared to that of Embodiment 1.

[0027] When springs 22 and 37 are disposed as in Embodiment 1, a height sufficient to dispose the compressed springs 22 and 37 is required at the car range lowermost end position (or the counterweight range lowermost end position). Since the stroke and the height of the buffers 11 and 12 are reduced if the rated speed of an elevator apparatus is low, the height in which the compressed springs can be disposed is shorter. On the other hand, since spacing between the upper portion terminal safety switches 14 and 31 and the lower portion terminal safety switches 15 and 32 is constant irrespective of the rated speed of the elevator apparatus, the stroke required for the springs does not change very much even if the rated speed of an elevator apparatus is reduced. Consequently, the lower the rated speed of the elevator apparatus, the more difficult it becomes to dispose the springs.

[0028] In contrast to this, because the springs 22 and 37 are unnecessary in this embodiment, it can be applied satisfactorily without such problems even to low-speed elevators.

[0029] Moreover, in the above embodiment, an arm is secured to a hoisted body, and a buffer is secured to a pit, but the buffer may also be secured directly to the hoisted body, and the arm secured to the pit.

Embodiment 3

[0030] Figure 5 is a structural diagram of an elevator apparatus according to Embodiment 3 of the present invention.

[0031] In this elevator apparatus, magnets 50 constituting a guide plate holding means are secured to an end portion of a guide 18 on a car 7 side. A guide plate 19 adheres to the magnets 50 due to the magnetic force from these magnets 50.

[0032] A magnet 51 constituting an arm holding means is secured to an end portion of a car arm 13 on the car 7 side. A car arm 13 adheres to the car 7 due to the magnetic force from this magnet 51.

[0033] Moreover, although not shown, a construction for a counterweight 8 side is also similar.

[0034] In this embodiment, the car arm 13 is held by a car buffer 11 by means of the guide plate 19 held by the magnets 50 when the car 7 ascends and descends inside a hoisting range between the uppermost floor landing position and the lowermost floor landing position.

[0035] If the car 7 descends below the above hoisting range, the car arm 13 adheres to the car 7 due to the magnet 51, and the car guide 19 is simultaneously separated from the magnets 50. Next, the car arm 13 moves downward tracking the descent of the car 7, and thereafter performs an operation similar to that of Embodiment 1.

[0036] If the car 7 ascends above the above hoisting range, a counterweight arm 30 adheres to the counterweight 8 due to a magnet, and a counterweight guide 35 is simultaneously separated from magnets. Next, the counterweight arm 30 moves downward tracking the ascent of the car 7, and thereafter performs an operation similar to that of Embodiment 1.

[0037] In an elevator apparatus according to this embodiment, compared to that of Embodiment 1, springs 22 and 37 for resetting the arms 13 and 30 are no longer necessary, also enabling it to be applied to cases in which the descent speed of the car 7 is low, and the strokes of the movable portions 21 and 39 of the buffers 11 and 12 are short, in a similar manner to Embodiment 2.

[0038] Moreover, in the above embodiment, magnets 50 are used for the guide plate holding means, but of course the guide plate holding means is not limited to this. For example, the construction may also be such that when a guide plate reaches an end portion of a guide, the guide plate engages physically with the end portion of the guide, and the guide plate moves downward when an external force in a downward direction acts on the guide plate.

[0039] Furthermore, a magnet 51 is used for the arm holding means, but of course the arm holding means is not limited to this. For example, the construction may also be such that when a hoisted body and an arm collide, they engage physically with each other at an end portion of the arm, and are separated when a separating force acts between the hoisted body and the arm.

Embodiment 4

[0040] Figure 6 is a structural diagram of an elevator apparatus according to Embodiment 4 of the present invention.

[0041] In this elevator apparatus, a car arm 13 is secured to a car 7, and an upper portion terminal safety switch 14 and a lower portion terminal safety switch 15 are secured to the car arm 13. A receiving portion 52 for contacting the upper portion terminal safety switch 14 and the lower portion terminal safety switch 15 is secured to a side surface of the car buffer 11.

[0042] Moreover, although not shown, a construction for a counterweight 8 side is also similar.

[0043] In an elevator apparatus according to this embodiment, springs 22 and 37 for resetting the arms 13 and 30, guides 18 and 35 for guiding those springs 22 and 37, and guide plates 19 and 36 integrated with the arms 13 and 30 are all no longer necessary, making the construction simple compared to that of Embodiment 1.

[0044] Springs 22 and 37 for resetting the arms 13 and 30 are no longer necessary, also enabling it to be applied to cases in which the descent speed of the car

7 may be low, and the strokes of the movable portions 21 and 39 of the buffers 11 and 12 short, in a similar manner to Embodiment 2.

[0045] Moreover, in each of the above embodiments, cases in which hydraulic buffers are used have been explained, but spring buffers may also be used.

INDUSTRIAL APPLICABILITY

[0046] As explained above, the present invention can be used to reduce cross-sectional area in a hoistway of an elevator apparatus including a buffer disposed in a pit in a lower portion of the hoistway, for stopping a descending hoisted body and for absorbing mechanical shock therefrom.

Claims

1. An elevator apparatus comprising:

a hoistway;
a hoisted body ascending and descending inside said hoistway;
a buffer disposed in a pit in a lower portion of said hoistway, for stopping said hoisted body and for absorbing mechanical shock therefrom;
an arm disposed under said hoisted body, for tracking vertical movement of said hoisted body; and
a switch activated in response to downward movement of said arm, for stopping said hoisted body,
said switch and said arm being disposed inside a vertical plane of projection of said hoisted body.

2. The elevator apparatus according to Claim 1, wherein:

said switch is secured to said buffer.

3. The elevator apparatus according to Claim 1 or Claim 2, wherein:

said arm is disposed on said buffer so as to be vertically movable.

4. The elevator apparatus according to Claim 1 or Claim 2, wherein:

said arm is secured to said hoisted body.

5. The elevator apparatus according to Claim 1, wherein:

said arm is secured to said hoisted body; and
said switch is secured to said arm.

6. The elevator apparatus according to any of Claims 1 to 3, wherein:

said buffer comprises:

a buffer main body;
a guide disposed in a vicinity of said buffer main body so as to extend in a vertical direction; and
a guide plate disposed so as to be slidable in a vertical direction relative to said guide and to which said arm is secured.

7. The elevator apparatus according to Claim 6, wherein:

a guide plate holding means for holding said guide plate is disposed on said guide;
an arm holding means for holding said arm when in contact with said hoisted body is disposed on said arm; and
said arm is held on said guide by means of said guide plate by said guide plate holding means when a car constituting said hoisted body ascends or descends within a hoisting range between an uppermost floor landing position and a lowermost floor landing position, and is held on said hoisted body by said arm holding means so as to move vertically together with said hoisted body when said hoisted body ascends or descends outside said hoisting range.

FIG. 1

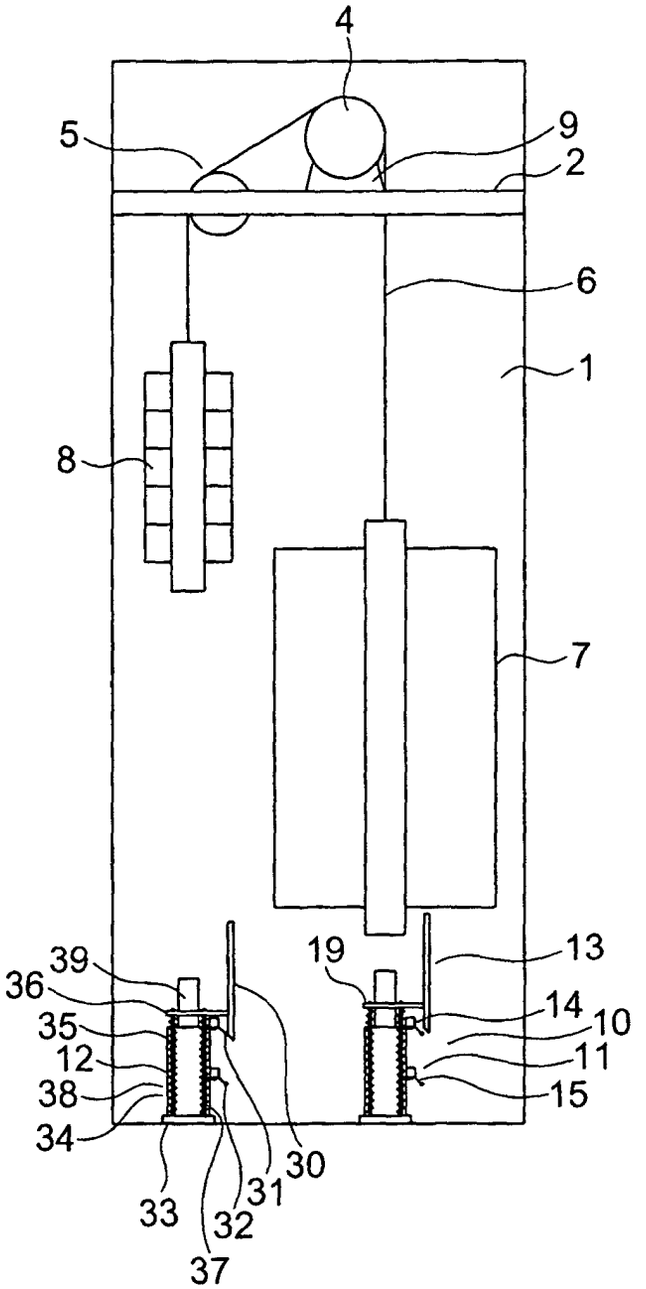


FIG. 2

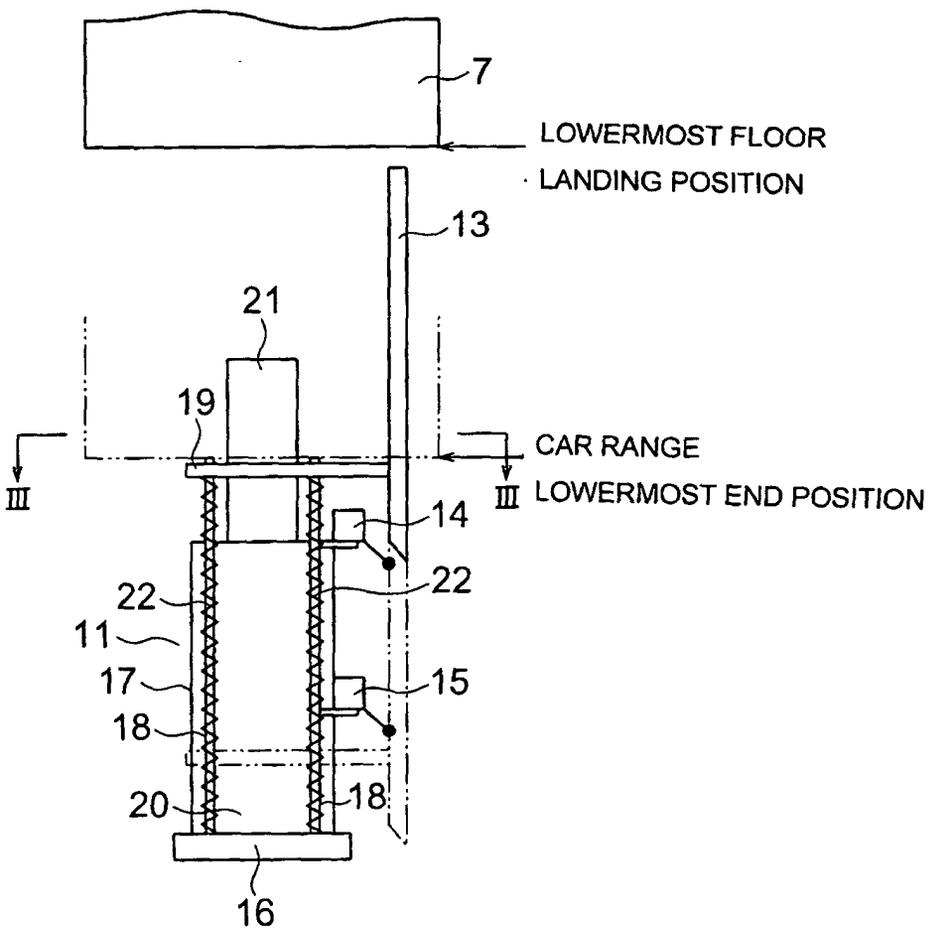

7
LOWERMOST FLOOR
LANDING POSITION
13
21
19
CAR RANGE
III
III
LOWERMOST END POSITION
14
22
22
11
17
15
18
20
18
16

FIG. 3

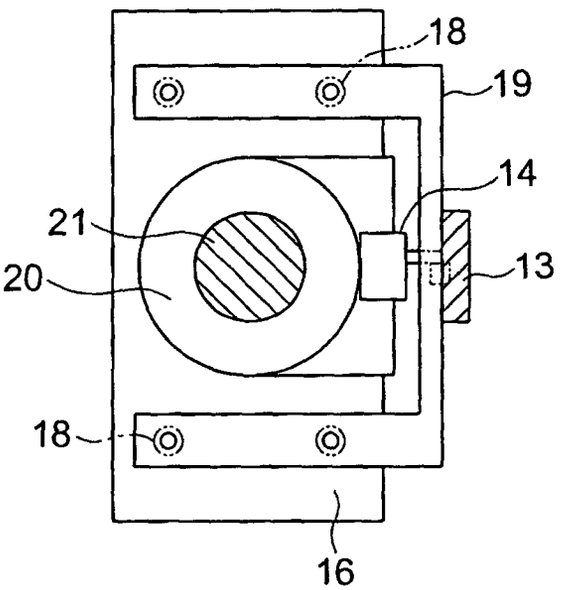
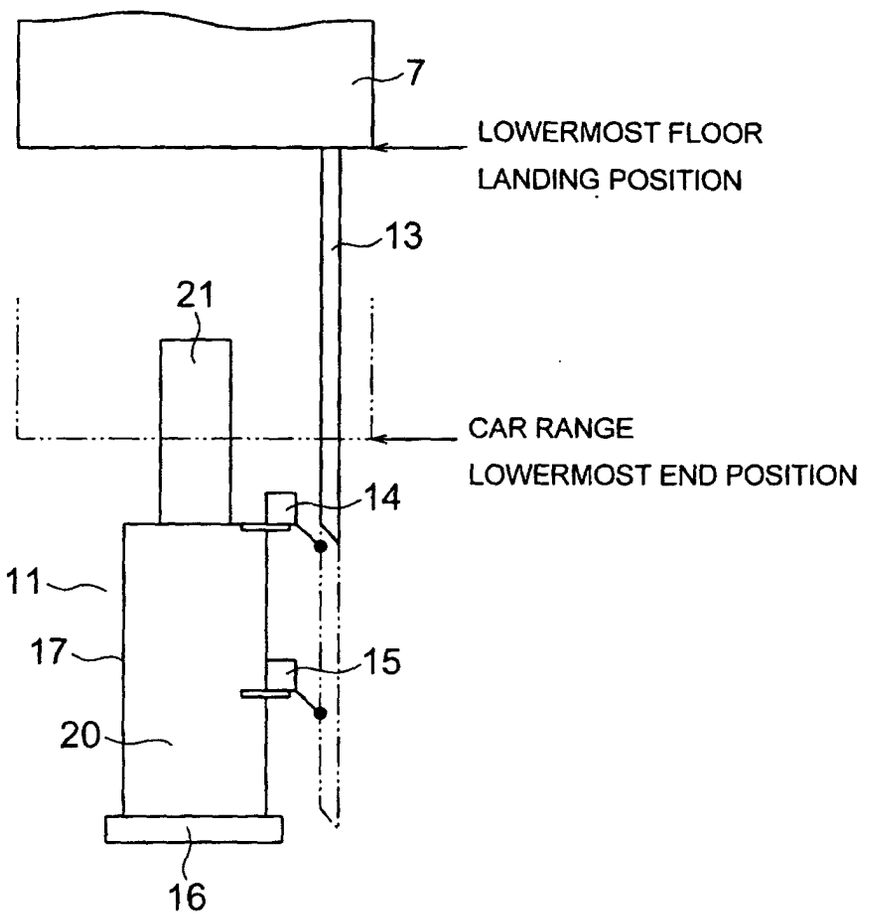


FIG. 4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LANDING POSITION
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CAR RANGE
LOWERMOST END POSITION
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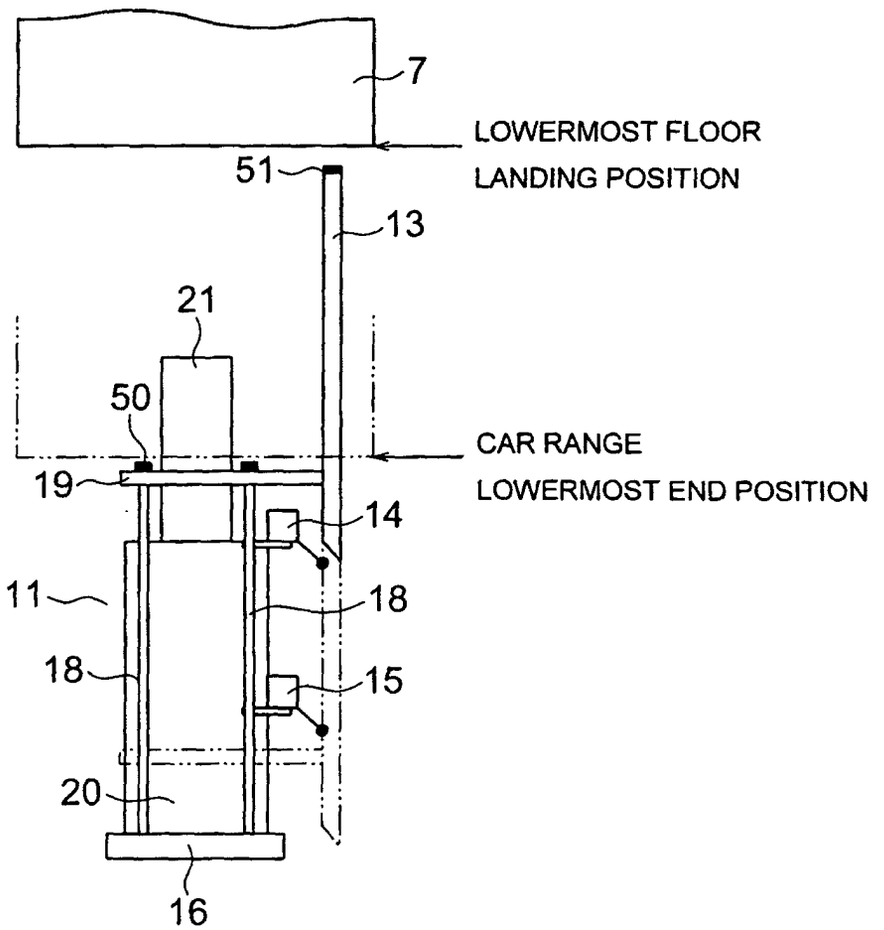
FIG. 5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LOWERMOST FLOOR
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CAR RANGE
LOWERMOST END POSITION
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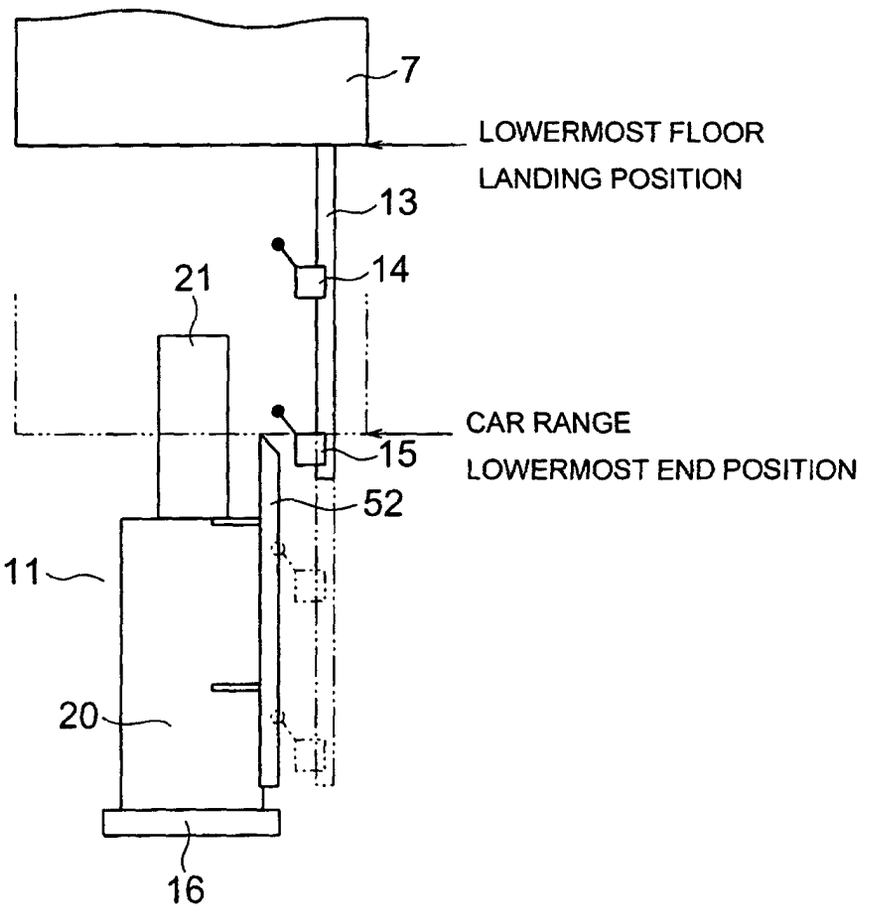
FIG. 6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LOWERMOST FLOOR
LANDING POSITION
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CAR RANGE
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LOWERMOST END POSITION
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16

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP03/07213

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B66B1/48, B66B5/28

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] B66B1/00-B66B5/28

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2004
Kokai Jitsuyo Shinan Koho	1971-2004	Toroku Jitsuyo Shinan Koho	1994-2004

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.
X A	JP 3-96728 A (Mitsubishi Electric Corp.), 22 April, 1991 (22.04.91), (Family: none)	1-3 6-7
X Y A	JP 61-166482 A (Mitsubishi Electric Corp.), 28 July, 1986 (28.07.86), (Family: none)	1,4 5 6-7
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 183394/1987(Laid-open No. 88687/1989) (Mitsubishi Electric Corp.), 12 June, 1989 (12.06.89), (Family: none)	5

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
01 March, 2004 (01.03.04)	16 March, 2004 (16.03.04)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP03/07213

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 7-157219 A (Mitsubishi Electric Corp.), 20 June, 1995 (20.06.95), & US 5637842 A	1-7
A	JP 2002-211856 A (Mitsubishi Electric Corp.), 31 July, 2002 (31.07.02), (Family: none)	1-7

Form PCT/ISA/210 (continuation of second sheet) (July 1998)