(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 882 667 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
**30.01.2008 Bulletin 2008/05**

(21) Application number: **05738967.8**

(22) Date of filing: **16.05.2005**

(51) Int Cl.:
***B66B 5/28*** *(2006.01)*

(86) International application number:
**PCT/JP2005/008889**

(87) International publication number:
**WO 2006/123393 (23.11.2006 Gazette 2006/47)**

(84) Designated Contracting States:
**DE**

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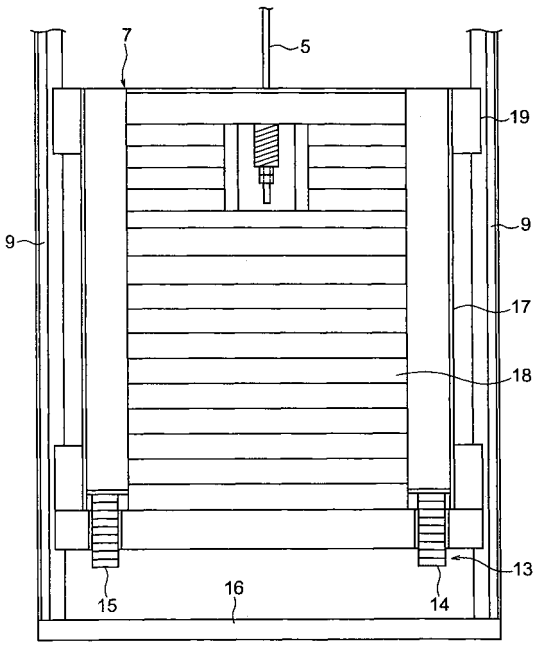
(54) **ELEVATOR DEVICE**

(57) In an elevator apparatus, a shock absorber for absorbing a shock of a collision of an ascending/descending body with a lower portion of a hoistway, is mounted on a lower portion of the ascending/descending body to be raised and lowered within the hoistway. The shock absorber has a part, which is equal to or longer than a stroke length thereof, protruding downward from a lower end of the ascending/descending body, and the remaining part of the shock absorber is disposed within a range of a vertical dimension of the ascending/descending body.

FIG. 2

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## Description

Technical Field

**[0001]** The present invention relates to an elevator apparatus having a shock absorber for absorbing a shock caused upon a collision of an ascending/descending body such as a car, a counterweight, or the like with a lower end of a hoistway.

Background Art

**[0002]** In a conventional elevator apparatus, a car shock absorber is installed on a lower portion of a hoistway, and a counterweight shock absorber is mounted on a lower portion of a counterweight (e.g., see Patent Document 1).

**[0003]** Patent Document 1: Japanese Utility Model Application Laid-open No. Sho 59-192085

Disclosure of the Invention

Problem to be solved by the Invention

**[0004]** In the conventional elevator apparatus constructed as described above, irrespective of whether the counterweight shock absorber is mounted on the counterweight or installed on the lower portion of the hoistway, the raised and lowered range of the counterweight is within a range obtained by subtracting a total length of the counterweight shock absorber from a total length of the hoistway. Therefore, height dimension of the counterweight is restricted by the length dimension of the counterweight shock absorber. Inparticular, inthecaseofamachine-room-lesselevator which has a component such as a drive unit or the like disposed in an upper portion within a hoistway, the height dimension of the counterweight is also restricted by the component disposed in the upper portion within the hoistway. Accordingly, the width dimension or thickness dimension of the counterweight was required to be increased in a case where the weight of the counterweight needed to be increased, for example, in a case where designed parts of a car are heavy, thereby making it difficult to cope with.

**[0005]** The present invention has been made to solve the problem discussed above, and it is therefore an object of the invention to obtain an elevator apparatus allowing a restriction on the height dimension of an ascending/descending body to be eased.

Means for solving the Problem

**[0006]** An elevator apparatus according to the present invention includes: an ascending/descending body for being raised and lowered within a hoistway; and a shock absorber mounted on a lower portion of the ascending/descending body, in which the shock absorber has a part, which is equal to or longer than a stroke length thereof, protruding downward from a lower end of the ascending/descending body; and the remaining part of the shock absorber is disposed within a range of a vertical dimension of the ascending/descending body.

Brief Description of the Drawings

**[0007]**

[Fig. 1] Fig. 1 is a side view showing an elevator apparatus according to Embodiment 1 of the present invention.
[Fig. 2] Fig. 2 is a front view showing a counterweight of Fig. 1.
[Fig. 3] Fig. 3 is a front view showing a counterweight of an elevator apparatus according to Embodiment 2 of the present invention.
[Fig. 4] Fig. 4 is a side view showing a car of an elevator apparatus according to Embodiment 3 of the present invention.
[Fig. 5] Fig. 5 is a plan view showing the car of Fig. 4.

Best Modes for carrying out the Invention

**[0008]** Preferred embodiments of the present invention will be described hereinafter with reference to the drawings.

Embodiment 1

**[0009]** Fig. 1 is a side view showing an elevator apparatus (machine-room-less elevator) according to Embodiment 1 of the present invention. Referring to Fig. 1, a drive unit (hoisting machine) 2 is installed in an upper portion within a hoistway 1. The drive unit 2 has a drive unit body 3 including a motor and a brake, and a drive sheave 4 rotated by the drive unit body 3. The drive unit 2 is disposed such that a rotation axis of the drive sheave 4 is held vertical or substantially vertical. In addition, a thin-type hoisting machine having an axial dimension smaller than a dimension in a direction perpendicular to an axial direction is employed as the drive unit 2.

**[0010]** A plurality of ropes 5 (only one of them is shown in the figures) are wrapped around the drive sheave 4. A car 6 as an ascending/descending body is connected to a first end portion of each of the ropes 5. A counterweight 7 as an ascending/descending body is connected to a second end portion of each of the ropes 5. The car 6 and the counterweight 7, which are suspended within the hoistway 1 according to a 1:1 roping method by means of the ropes 5, are raised and lowered within the hoistway 1 due to a driving force of the drive unit 2.

**[0011]** A pair of car guide rails 8 for guiding the raising/lowering of the car 6 and a pair of counterweight guide rails 9 for guiding the raising/lowering of the counterweight 7 are installed within the hoistway 1. The counterweight 7 is disposed behind the car 6 so as to face a back surface thereof when being located at the same

height as the car 6.

**[0012]** A car-side guide pulley 10 for leading the ropes 5 from the drive sheave 4 to the car 6 and a counterweight-side guide pulley 11 for leading the ropes 5 from the drive sheave 4 to the counterweight 7 are disposed in the upper portion within the hoistway 1. The guide pulleys 10 and 11 are disposed such that rotation axes thereof are held horizontal. Components in the upper portion of the hoistway, namely, the drive unit 2, the guide pulleys 10 and 11, and the like are supported by a common upper support beam (not shown). The upper support beam is supported by upper portions of at least either the car guide rails 8 or the counterweight guide rails 9, or a fixed portion of an architectural structure.

**[0013]** A car shock absorber 12 for absorbing a shock caused upon a collision of the car 6 with a lower portion of the hoistway 1 is installed on the lower portion (pit) of the hoistway 1. A counterweight shock absorber 13 for absorbing a shock caused upon a collision of the counterweight 7 with the lower portion of the hoistway 1 is mounted on a lower portion of the counterweight 7.

**[0014]** Fig. 2 is a front view showing the counterweight 7 of Fig. 1. The counterweight shock absorber 13 includes therein a first counterweight buffer 14 and a second counterweight buffer 15, which are disposed in parallel to one another, to perform a shock absorbing operation simultaneously. The first counterweight buffer 14 and the second counterweight buffer 15 are identical in capacity and stroke length to each other. The first counterweight buffer 14 and the second counterweight buffer 15 are disposed symmetrically with respect to a centerline in a width direction of the counterweight 7.

**[0015]** A guide rail pedestal 16 is fixed to the lower portion of the hoistway 1. The counterweight guide rails 9 are fixed at lower ends thereof on the guide rail pedestal 16. The guide rail pedestal 16 also serves as a shock absorber receiver for receiving the counterweight buffers 14 and 15.

**[0016]** The counterweight 7 includes therein a weight frame 17, a plurality of weight plates 18 laminated within the weight frame 17, and a plurality of weight guide shoes 19 that are fitted to the weight frame 17 and engage to the counterweight guide rails 9. The counterweight buffers 14 and 15 are fitted to the weight frame 17.

**[0017]** A part of each of the counterweight buffers 14 and 15, which is equal to or longer than a stroke length thereof, protrudes downward from a lower end of the counterweight 7. The remaining part of each of the counterweight buffers 14 and 15 is disposed within a range of a vertical dimension of the counterweight 7. In other words, upper ends of the counterweight buffers 14 and 15 are located above the lower end of the counterweight 7. In this example, the protrusion length of each of the counterweight buffers 14 and 15 from the lower end of the counterweight 7 is substantially equal to the stroke length.

**[0018]** Further, employed as the counterweight buffers 14 and 15 are, for example, spring-loaded buffers. Still further, each of the counterweight buffers 14 and 15 is fitted to the weight frame 17 such that a spring portion thereof is located at a lower end of the weight frame 17.

**[0019]** In the elevator apparatus constructed as described above, the counterweight buffers 14 and 15 are mounted on the counterweight 7, and the aforementioned remaining part of each of the counterweight buffers 14 and 15 is disposed within a range of the vertical dimension of the counterweight 7. Therefore, a restriction on the height dimension of the counterweight 7 can be eased, so the height dimension of the counterweight 7 can be increased. Thus, a necessary measure can be taken with ease when the counterweight 7 needs to be made heavier, for example, in a case where designed parts of the car 6 are heavy.

**[0020]** The weight of the counterweight shock absorber 13 is added to the weight of the counterweight 7, so the number of the weight plates 18 can be reduced. Moreover, the two counterweight buffers 14 and 15 are employed, therefore, the respective counterweight buffers 14 and 15 can be made compact, and the required space of the counterweight 7 for installing the counterweight buffers 14 and 15 therein can be reduced.

**[0021]** It should be noted that the counterweight buffers 14 and 15 may also be fitted to the counterweight 7 with springs thereof located above.

Embodiment 2

**[0022]** Next, Fig. 3 is a front view showing the counterweight 7 of an elevator apparatus according to Embodiment 2 of the present invention. Referring to Fig. 3, the counterweight shock absorber 13 includes therein a first counterweight buffer 21 and a second counterweight buffer 22, which are disposed in parallel to one another to perform a shock absorbing operation simultaneously. The first counterweight buffer 21 and the second counterweight buffer 22 are identical in capacity and stroke length to each other. The first counterweight buffer 21 and the second counterweight buffer 22 are disposed symmetrically with respect to the centerline in the width direction of the counterweight 7.

**[0023]** A part of each of the counterweight buffers 21 and 22, which is equal to or longer than a stroke length S thereof, protrudes downward from the lower end of the counterweight 7. The remaining part of each of the counterweight buffers 21 and 22 is disposed within the range of the vertical dimension of the counterweight 7. In this example, the protrusion length of each of the counterweight buffers 21 and 22 from the lower end of the counterweight 7 is substantially equal to the stroke length S.

**[0024]** Further, employed as the counterweight buffers 21 and 22 are, for example, hydraulic buffers. Still further, the counterweight buffers 21 and 22 are fitted to the weight frame 17 such that plungers and cylinders thereof are located in the upper portion and the lower portion, respectively. Other constructional details are identical to that of Embodiment 1.

**[0025]** As described above, the aforementioned remaining part of each of the counterweight buffers 21 and 22 is disposed within the range of the vertical dimension of the counterweight 7 even in a case where the hydraulic buffers are employed as the counterweight buffers 21 and 22. Therefore, a restriction on the height dimension of the counterweight 7 can be eased, so the height dimension of the counterweight 7 can be increased.

**[0026]** It should be noted that although the counterweight buffers 21 and 22 are mounted on the counterweight 7 such that the plungers and the cylinders are located in the upper portion and the lower portion, respectively, in Embodiment 2, the counterweight buffers 21 and 22 may also be fitted to the counterweight 7 upside down.

Embodiment 3

**[0027]** Next, Fig. 4 is a side view showing the car 6 of an elevator apparatus according to Embodiment 3 of the present invention, and Fig. 5 is a plan view showing the car 6 of Fig. 4. Referring to Figs. 4 and 5, the car 6 includes therein a car frame 23 and a cage 24 supported by the car frame 23. The car frame 23 has a pair of longitudinal columns disposed on the left side and the right side of the cage 24.

**[0028]** A first buffer fitting pedestal 25 and a second buffer fitting pedestal 26 are fixed to the longitudinal columns of the car frame 23. A first car buffer 27 and a second car buffer 28 are fitted to the first buffer fitting pedestal 25 and the second buffer fitting pedestal 26, respectively. A car shock absorber 29 is composed of the first car buffer 27 and the second car buffer 28.

**[0029]** The first car buffer 27 and the second car buffer 28 are disposed in parallel to one another to perform a shock absorbing operation simultaneously. The first car buffer 27 and the second car buffer 28 are identical in capacity and stroke length to each other. Furthermore, the first car buffer 27 and the second car buffer 28 are disposed symmetrically, with gravity of the car 6 as the center, on a vertical projection plane.

**[0030]** A guide rail pedestal 30 is fixed on the lower portion of the hoistway 1. The car guide rails 8 are fixed at lower ends thereof on the guide rail pedestal 30. A pair of buffer receiving pedestals 31 for receiving the car buffers 27 and 28 are fixed on the guide rail pedestal 30.

**[0031]** A part of each of the car buffers 27 and 28, which is equal to or longer than a stroke length thereof, protrudes downward from the lower end of the car 6. The remaining part of each of the car buffers 27 and 28 is disposed within the range of the vertical dimension of the car 6. In this example, the protrusion length of each of the car buffers 27 and 28 from the lower end of the car 6 is substantially equal to the stroke length.

**[0032]** Further, employed as the car buffers 27 and 28 are, for example, spring-loaded buffers. Still further, the car buffers 27 and 28 are fitted to the buffer fitting pedestals 25 and 26, respectively, such that spring portions thereof are located at lower ends of the buffer fitting pedestals 25 and 26, respectively.

**[0033]** In the elevator apparatus constructed as described above, the car buffers 27 and 28 are mounted on the car 6, and the aforementioned remaining part of each of the car buffers 27 and 28 is disposed within the range of the vertical dimension of the car 6. Therefore, a restriction on the height dimension of the car 6 can be eased, so the height dimension of the car 6 can be increased.

**[0034]** It should be noted that although the two counterweight buffers and the two car buffers are employed in the foregoing examples, it is also appropriate to employ one counterweight buffer and one car buffer, or three or more counterweight buffers and three or more car buffers.

The present invention may be applied to one or both of the counterweight and the car.

In addition, although the elevator apparatus according to the 1:1 roping method has been illustrated in the foregoing examples, the roping method should not be limited thereto. For instance, a 2:1 roping method may be adopted instead.

Still further, although the elevator apparatus having the counterweight disposed behind the car has been illustrated in the foregoing examples, the present invention is also applicable to an elevator apparatus having a counterweight disposed beside a car.

Yet further, although the elevator apparatus employing single counterweight has been illustrated in the foregoing examples, the present invention is also applicable to an elevator apparatus employing a plurality of counterweights.

## Claims

**1.** An elevator apparatus, comprising:

an ascending/descending body for being raised and lowered within a hoistway; and
a shock absorber mounted on a lower portion of the ascending/descending body, wherein:
the shock absorber has a part, which is equal to or longer than a stroke length thereof, protruding downward from a lower end of the ascending/descending body; and
the remaining part of the shock absorber is disposed within a range of a vertical dimension of the ascending/descending body.

**2.** The elevator apparatus according to Claim 1, wherein the shock absorber comprises a plurality of buffers that are disposed in parallel to one another to perform a shock absorbing operation simultaneously.

FIG. 1

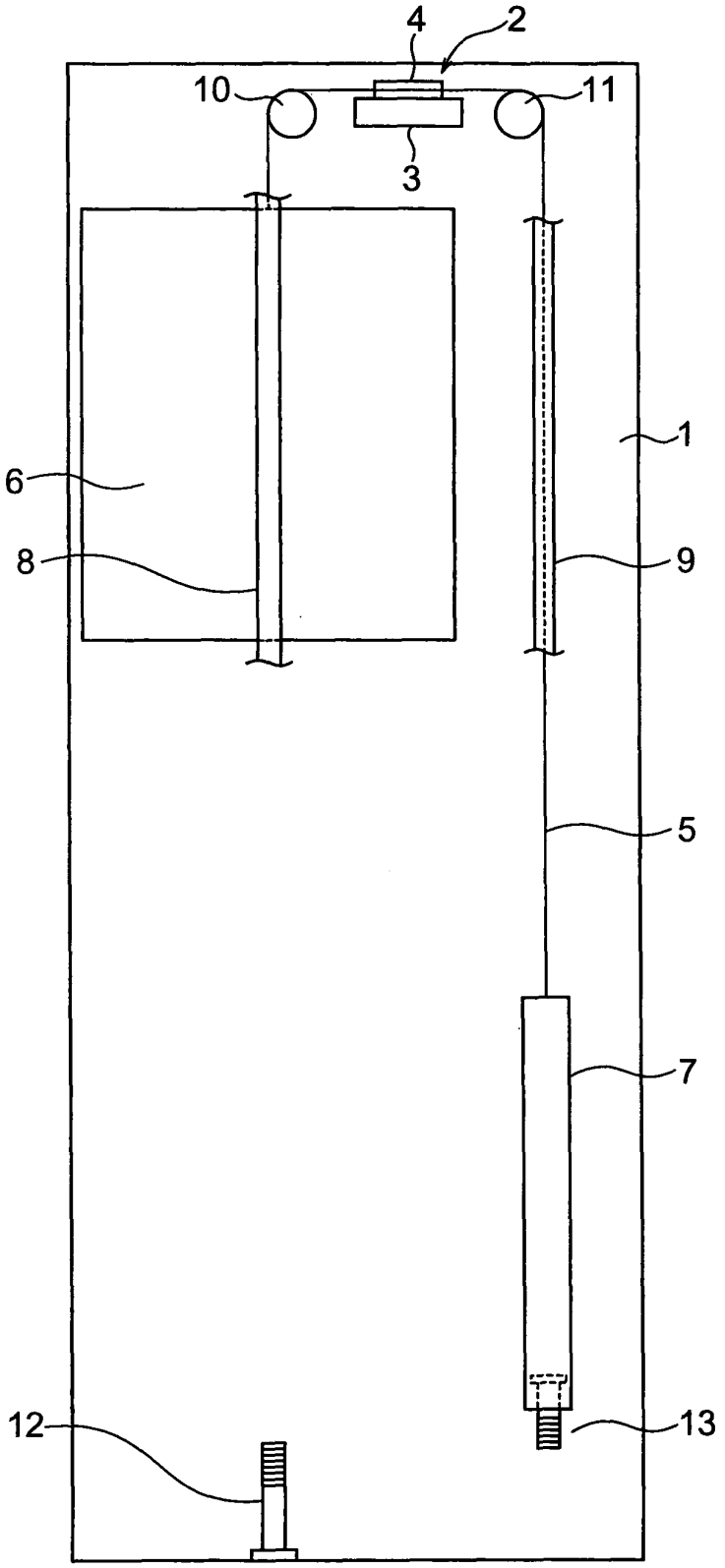


FIG. 2

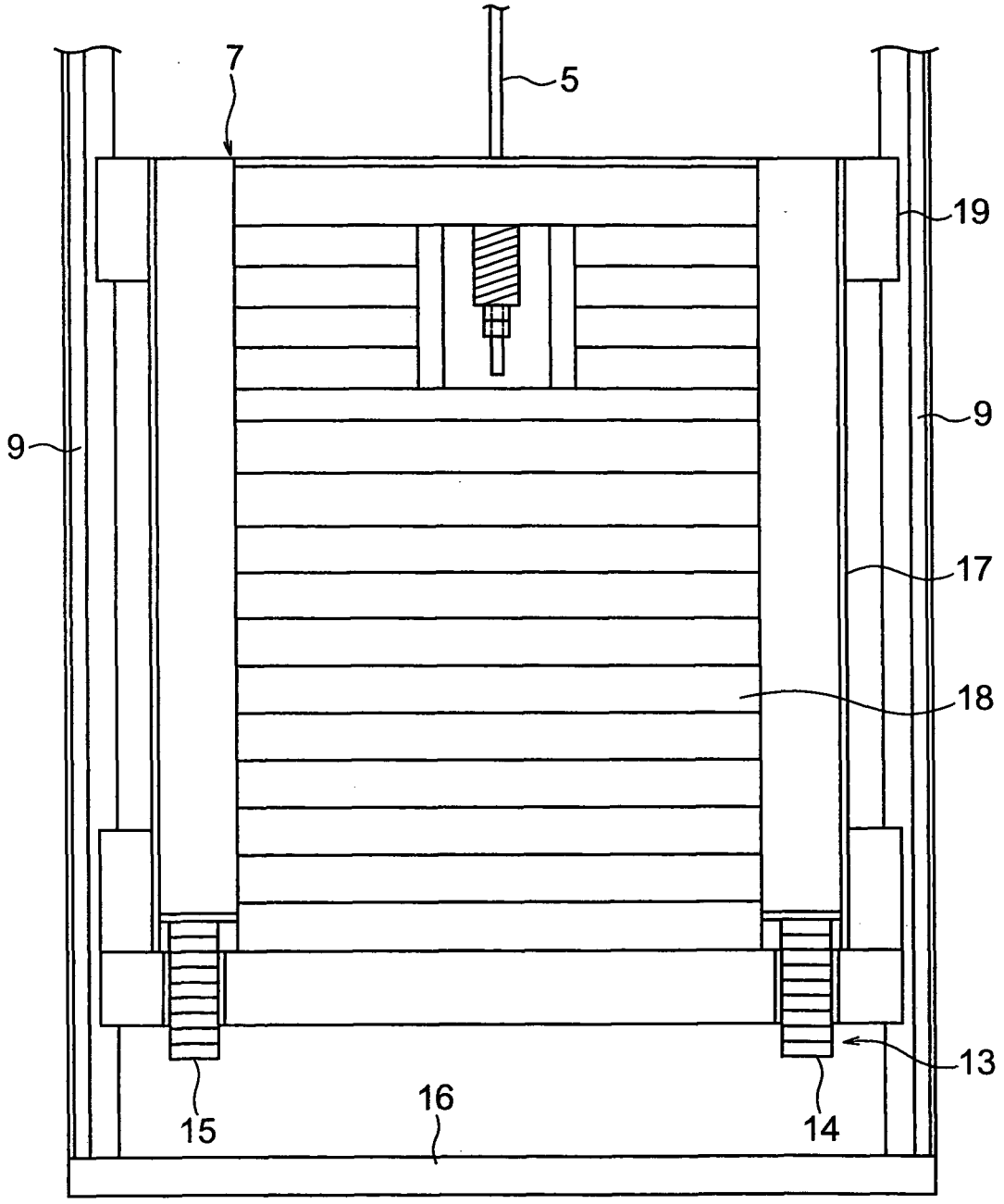


FIG. 3

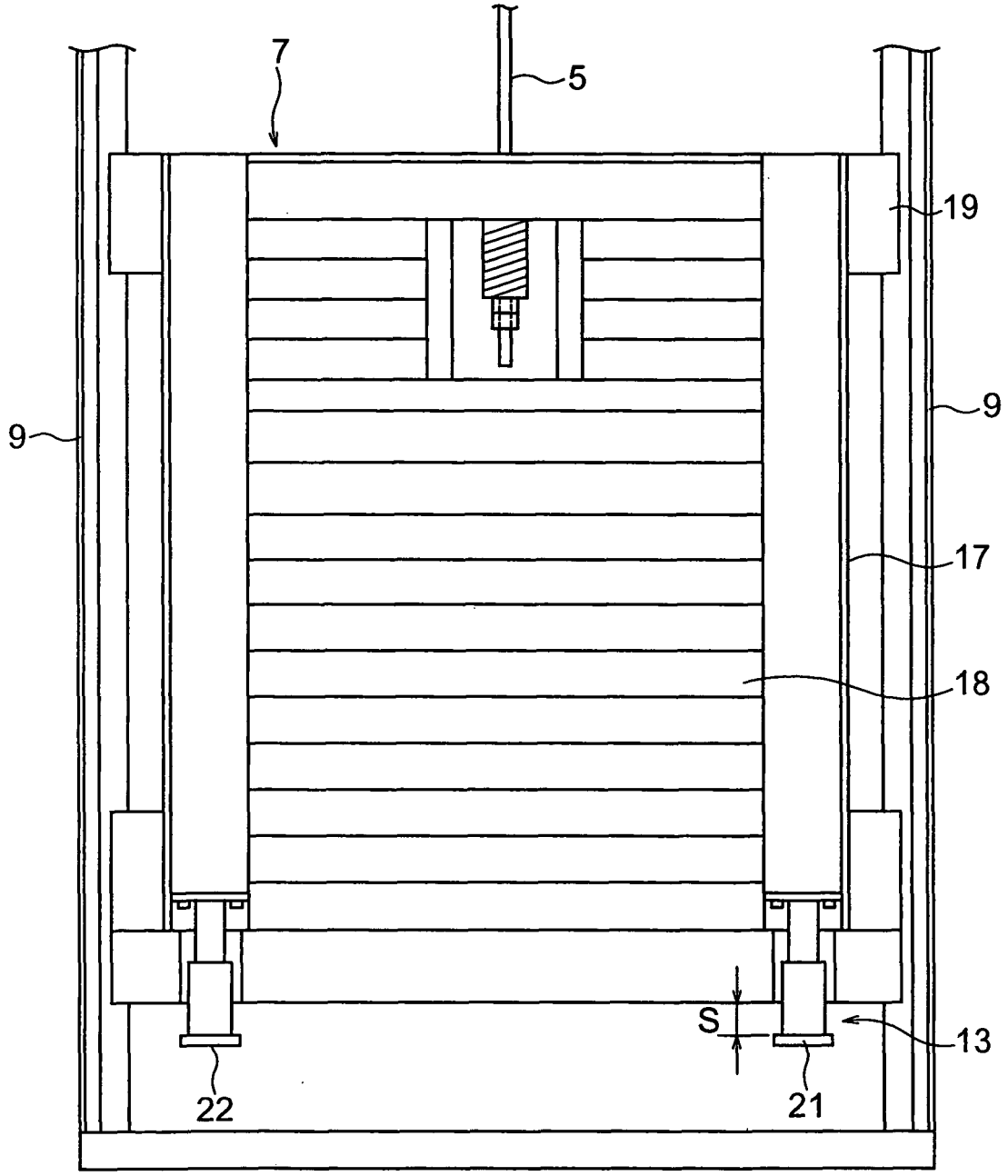


FIG. 4

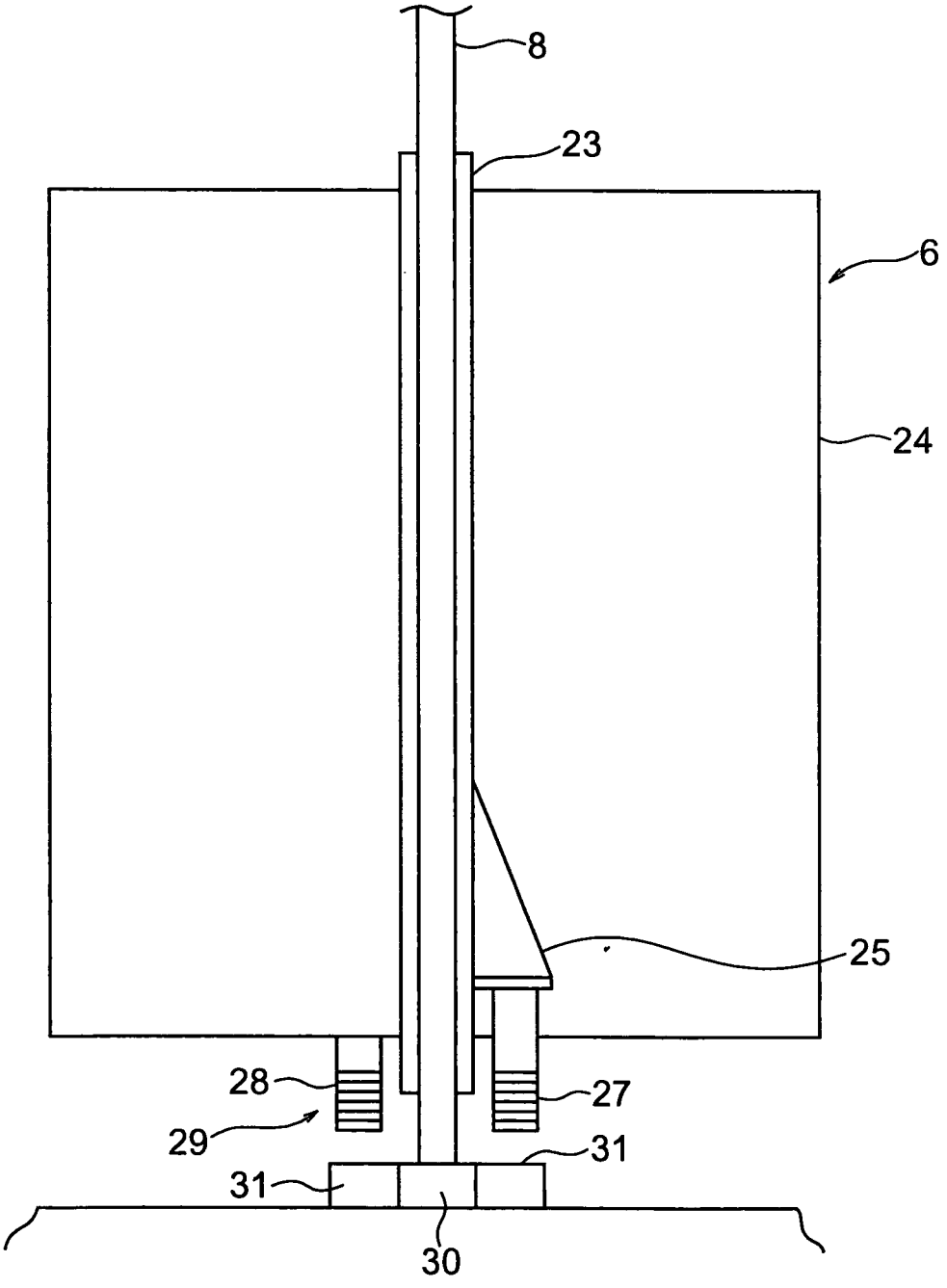
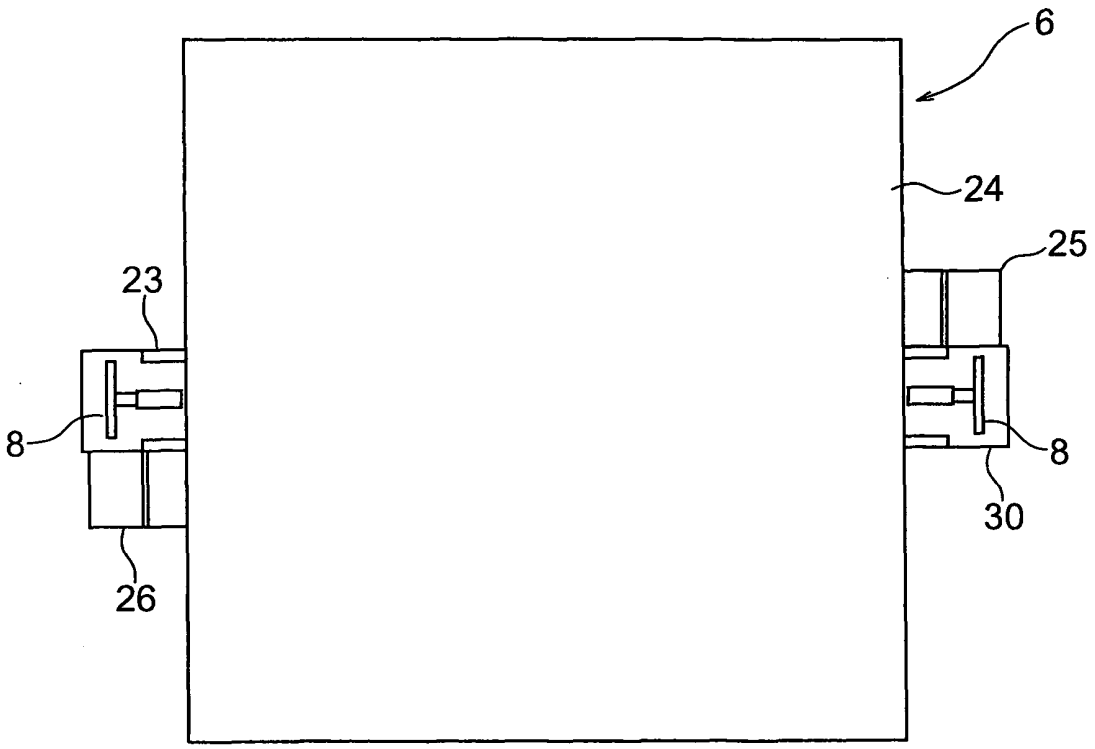


FIG. 5



**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/JP2005/008889

A. CLASSIFICATION OF SUBJECT MATTER
***B66B5/28***(2006.01)

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)
***B66B5/28***(2006.01)

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 1996-2006
Kokai Jitsuyo Shinan Koho 1971-2006 Toroku Jitsuyo Shinan Koho 1994-2006

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 | JP 2001-163543 A (Oil Drive Kogyo Kabushiki Kaisha), 19 June, 2001 (19.06.01), Par. No. [0010]; Fig. 3 (Family: none) | 1-2 |
| A | JP 2003-276966 A (Toshiba Elevator and Building Systems Corp.), 02 October, 2003 (02.10.03), Abstract; Fig. 2 (Family: none) | 1 |
| A | JP 2001-146370 A (Mitsubishi Electric Corp.), 29 May, 2001 (29.05.01), Par. Nos. [0027] to [0028]; Figs. 6 to 7 (Family: none) | 1-2 |

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

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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 14 February, 2006 (14.02.06) | 21 February, 2006 (21.02.06) |
| Name and mailing address of the ISA/ Japanese Patent Office<br>Facsimile No. | Authorized officer<br>Telephone No. |

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## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


- JP 59192085 U **[0003]**