



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

(43) Date of publication:
07.12.2005 Bulletin 2005/49

(51) Int Cl.7: **B66B 11/02, B66B 7/08**

(21) Application number: **02778082.4**

(86) International application number:
PCT/JP2002/011686

(22) Date of filing: **08.11.2002**

(87) International publication number:
WO 2004/041702 (21.05.2004 Gazette 2004/21)

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
IE IT LI LU MC NL PT SE SK TR**

(72) Inventor: **HAMAGUCHI, Shuki,**
c/o Mitsubishi Denki K.K
Chiyoda-ku, Tokyo 100-8310 (JP)

(71) Applicant: **mitsubishi denki kabushiki
KAISHA**
Tokyo 100-8310 (JP)

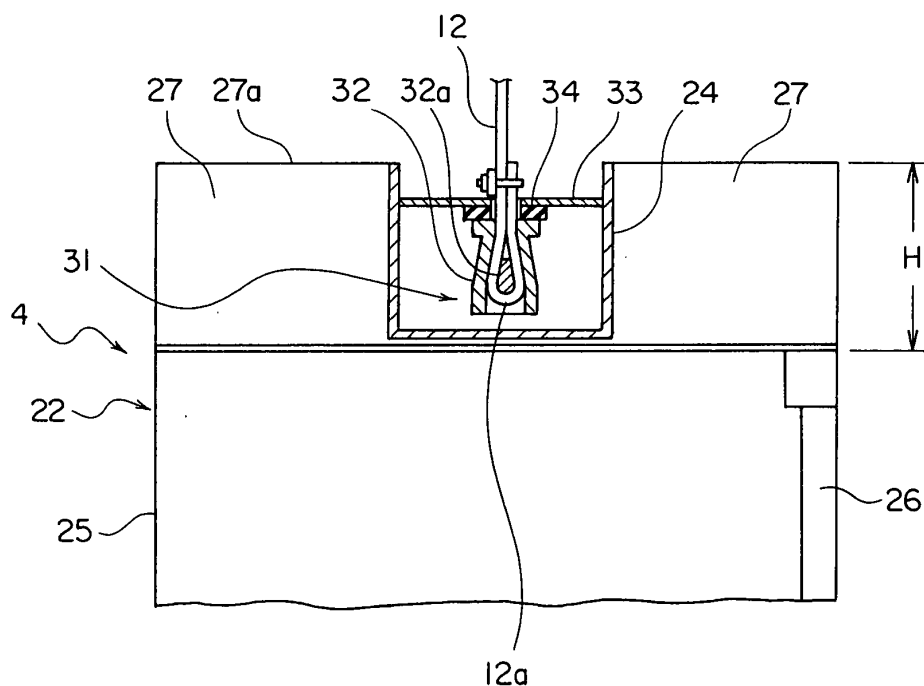
(74) Representative: **HOFFMANN EITLE**
Patent- und Rechtsanwälte
Arabellastrasse 4
81925 München (DE)

(54) **ELEVATOR EQUIPMENT**

(57) In an elevator apparatus, a car is suspended inside a hoistway by a main rope wound around a drive sheave of a driving machine. The car has an upper beam and a ceiling portion. A car connecting end portion

of the main rope is connected to the upper beam by means of a rope end connecting apparatus. The upper beam is disposed such that a lower extremity portion thereof is positioned lower than an upper surface of the ceiling portion.

FIG. 2



Description

TECHNICAL FIELD

[0001] The present invention relates to an elevator apparatus in which a main rope for suspending a car inside a hoistway is connected to an upper portion of the car.

BACKGROUND ART

[0002] In conventional elevator apparatuses (machine-roomless elevators), such as that disclosed in International Publication No. WO 02/16247 A1, for example, a driving machine for raising and lowering a car and a counterweight is disposed in an upper portion inside a hoistway 1. A main rope is wound around a drive sheave of the driving machine, the car being connected to a first end portion of the main rope and the counterweight being connected to a second end portion of the main rope.

[0003] The first end portion of the main rope is connected to an upper beam of the car by means of a rope shackle and a buffering member. The upper beam is disposed above a cabin.

[0004] However, in conventional elevator apparatuses such as that described above, since the upper beam, the rope shackle, and the buffering member, etc., are disposed above the cabin, vertical dimensions of the car are increased. For this reason, it is necessary to increase overhead dimensions (top portion space dimensions) of the hoistway, increasing overall vertical dimensions of the hoistway.

DISCLOSURE OF THE INVENTION

[0005] The present invention aims to solve the above problems and an object of the present invention is to provide an elevator apparatus enabling vertical dimensions of a hoistway to be reduced.

[0006] In order to achieve the above object, according to one aspect of the present invention, there is provided an elevator apparatus including a driving machine having a drive sheave; a car raised and lowered inside a hoistway by a driving force from the driving machine, having a car frame including an upper beam, and a cabin supported by the car frame and including a ceiling portion; a main rope for suspending the car inside the hoistway, having a car connecting end portion and being wound around the drive sheave; and a rope end connecting apparatus for connecting the car connecting end portion to the upper beam, wherein the upper beam is disposed such that a lower extremity portion thereof is positioned lower than an upper surface of the ceiling portion.

[0007] According to another aspect of the present invention, there is provided an elevator apparatus including a driving machine having a drive sheave; a car raised

and lowered inside a hoistway by a driving force from the driving machine, having a ceiling portion; a main rope for suspending the car inside the hoistway, having a car connecting end portion and being wound around the drive sheave; and a rope end connecting apparatus for connecting the car connecting end portion to an upper portion of the car, wherein the rope end connecting apparatus is disposed such that a lower extremity portion thereof is positioned lower than an upper surface of the ceiling portion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

Figure 1 is a general front elevation showing an elevator apparatus according to Embodiment 1 of the present invention;

Figure 2 is a cross section taken along line II - II in Figure 1;

Figure 3 is a cross section of a rope end connecting apparatus of an elevator apparatus according to Embodiment 2 of the present invention; and

Figure 4 is a cross section of a rope end connecting apparatus of an elevator apparatus according to Embodiment 3 of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0009] Preferred embodiments of the present invention will now be explained with reference to the drawings.

Embodiment 1

[0010] Figure 1 is a general front elevation showing an elevator apparatus according to Embodiment 1 of the present invention.

[0011] In the figure, a pair of car guide rails 2 and a pair of counterweight guide rails 3 are installed inside a hoistway 1. A car 4 is guided by the car guide rails 2 while being raised and lowered inside the hoistway 1. A counterweight 5 is guided by the counterweight guide rails 3 while being raised and lowered inside the hoistway 1.

[0012] A plurality of car guide shoes 6 for engaging the car guide rails 2 are disposed on the car 4. A plurality of counterweight guide shoes 7 for engaging the counterweight guide rails 3 are disposed on the counterweight 5.

[0013] A supporting platform 8 is mounted to an upper end portion of the guide rails 2 and 3. A driving machine (a hoisting machine) 9 is mounted to the supporting platform 8. The driving machine 9 has: a motor 10; and a drive sheave 11 rotated by the motor 10. The driving machine 9 has a thin external shape in which an axial length is smaller than a diameter thereof. In addition, the driving machine 9 is disposed such that an axis of the drive

sheave 11 extends along a vertical direction. Furthermore, the driving machine 9 is disposed above a corner portion of the car 4.

[0014] A plurality of main ropes 12 (only one is shown in the figure) are wound around the drive sheave 11. Each of the main ropes 12 has: a car connecting end portion 12a connected to the car 4; and a counterweight connecting end portion 12b connected to the counterweight 5. In other words, the car 4 and the counterweight 5 are suspended inside the hoistway 1 using a 1:1 roping method.

[0015] A first direction-changing deflection sheave 13 for directing the main ropes 12 from the driving machine 9 to the car 4, and a second direction-changing deflection sheave 14 for directing the main ropes 12 from the driving machine 9 to the counterweight 5 are supported by the supporting platform 8. The first and second direction-changing deflection sheaves 13 and 14 are disposed such that rotating shafts thereof extend horizontally. The first direction-changing deflection sheave 13 and the second direction-changing deflection sheave 14 are disposed directly above the car 4 and directly above the counterweight 5, respectively.

[0016] The car 4 has: a car frame 21; and a cabin 22 supported by the car frame 21. The car frame 21 has: a pair of vertical stanchions 21a extending vertically parallel to each other; a lower beam 23 secured between lower end portions of the vertical stanchions 21a; and an upper beam 24 secured between upper end portions of the vertical stanchions 21a. The cabin 22 has: a car floor (not shown); cabin walls 25; a car door 26; and a ceiling portion 27.

[0017] The ceiling portion 27 has a predetermined vertical dimension (a thickness dimension) H, equipment such as lighting equipment (not shown), etc., being housed inside the ceiling portion 27. The upper beam 24 is disposed such that a lower extremity portion thereof is positioned lower than an upper surface 27a of the ceiling portion 27. In this embodiment, the upper beam 24 is housed entirely within a range of the vertical dimension H of the ceiling portion 27.

[0018] The car connecting end portion 12a of each of the main ropes 12 is connected to the upper beam 24 by a rope end connecting apparatus 31. The counterweight connecting end portion 12b of each of the main ropes 12 is connected to an upper beam 5a of the counterweight 5 by means of a rope shackle 15 and a buffering member 16.

[0019] Figure 2 is a cross section taken along line II-II in Figure 1, delineation of the equipment accommodated inside the ceiling portion 27 being omitted. The rope end connecting apparatus 31 has: a rope shackle 32 functioning as a securing member secured to the car connecting end portion 12a; a supporting member 33 secured to the upper beam 24 so as to be positioned above the rope shackle 32; and a buffering member 34 interposed between the rope shackle 32 and the supporting member 33.

[0020] The rope shackle 32, the supporting member 33, and the buffering member 34 are disposed inside the upper beam 24 (inside a groove formed by the upper beam 24), and are housed within a range of the vertical dimension H of the ceiling portion 27. The rope shackle 32 has a wedge rope fastener portion 32a. A rubber plate, for example, is used for the buffering member 34. The upper beam 24 is disposed horizontally along a width direction of the car 4 so as to divide the ceiling portion 27 generally uniformly in two in a depth direction of the car 4.

[0021] In an elevator apparatus of this kind, because the upper beam 24 is disposed such that a lower extremity portion thereof is positioned lower than an upper surface 27a of the ceiling portion 27, vertical dimensions of the car 4 can be reduced, thereby enabling vertical dimensions of the hoistway 1 to be reduced. Furthermore, overhead dimensions in a top portion of the hoistway 1 can also be reduced, enabling the hoistway to be prevented from projecting through an upper portion of a building, thereby enabling reductions in construction costs and also enabling the appearance of the building to be improved.

[0022] Because the upper beam 24 is housed entirely within a range of the vertical dimension H of the ceiling portion 27, vertical dimensions of the car 4 can be further reduced, thereby enabling vertical dimensions of the hoistway 1 to be further reduced.

[0023] In addition, because the upper beam 24 is disposed horizontally along a width direction of the car 4 so as to divide the ceiling portion 27 in two in a depth direction of the car 4, the upper beam 24 can be housed within a range of the vertical dimension H of the ceiling portion 27 by a simple construction.

[0024] Furthermore, because the rope end connecting apparatus 31 has a rope shackle 32, a supporting member 33, and a buffering member 34, the rope end connecting apparatus 31 can be made compact.

[0025] Because the rope shackle 32, the supporting member 33, and the buffering member 34 are housed within a range of the vertical dimension H of the ceiling portion 27, vertical dimensions of the car 4 can be further reduced, thereby enabling vertical dimensions of the hoistway 1 to be further reduced.

[0026] In addition, because the rope shackle 32 has a wedge rope fastener portion 32a, the main ropes 12 can be connected firmly to the upper beam 24 by a simple construction.

Embodiment 2

[0027] Next, Figure 3 is a cross section of a rope end connecting apparatus of an elevator apparatus according to Embodiment 2 of the present invention. A rope shackle 41 functioning as a securing member having a wedge rope fastener portion 41a and a spring bearing flange 41b is secured to a car connecting end portion 12a. A spring 42 functioning as a buffering member is

interposed between the spring bearing flange 41b and a supporting member 33.

[0028] A rope end connecting apparatus 43 includes the rope shackle 41, the supporting member 33, and the spring 42. The rope shackle 41, the supporting member 33, and the spring 42 are disposed inside the upper beam 24, being housed within a range of a vertical dimension H of a ceiling portion 27. The rest of the construction is similar to that of Embodiment 1.

[0029] When a rope end connecting apparatus 43 of this kind is used, vertical dimensions of the car 4 can also be reduced, thereby enabling vertical dimensions of the hoistway 1 to be reduced.

Embodiment 3

[0030] Next, Figure 4 is a cross section of a rope end connecting apparatus of an elevator apparatus according to Embodiment 3 of the present invention. A rope shackle 44 functioning as a securing member having a wedge rope fastener portion 44a is secured to a car connecting end portion 12a. A screw threaded portion 44b is disposed on an outer peripheral portion of the rope shackle 44.

[0031] An adjusting member 45 for adjusting tension in the main ropes 12 by adjusting its position relative to the rope shackle 44 is screwed onto the screw threaded portion 44b. A locknut 46 for locking the position of the adjusting member 45 relative to the rope shackle 44 is also screwed onto the screw threaded portion 44b.

[0032] A rope end connecting apparatus 47 includes the rope shackle 44, the supporting member 33, the spring 42, the adjusting member 45, and the lock nut 46. The rope shackle 44, the supporting member 33, the spring 42, the adjusting member 45, and the lock nut 46 are disposed inside the upper beam 24, being housed within a range of a vertical dimension H of a ceiling portion 27. The rest of the construction is similar to that of Embodiment 1.

[0033] When a rope end connecting apparatus 47 of this kind is used, vertical dimensions of the car 4 can also be reduced, thereby enabling vertical dimensions of the hoistway 1 to be reduced.

[0034] Because tension in each of the main ropes 12 can be adjusted by an adjusting member 45, tension in the main ropes 12 can be made more uniform.

[0035] Moreover, machine-roomless elevators were explained in the above examples, but the present invention can also be applied to elevator apparatuses having a machine room.

Claims

1. An elevator apparatus comprising:

a driving machine having a drive sheave;
a car raised and lowered inside a hoistway by

a driving force from said driving machine, having a car frame including an upper beam, and a cabin supported by said car frame and including a ceiling portion;

a main rope for suspending said car inside said hoistway, having a car connecting end portion and being wound around said drive sheave; and

a rope end connecting apparatus for connecting said car connecting end portion to said upper beam,

wherein said upper beam is disposed such that a lower extremity portion thereof is positioned lower than an upper surface of said ceiling portion.

2. The elevator apparatus according to Claim 1, wherein said upper beam is housed entirely within a range of a vertical dimension of said ceiling portion.

3. The elevator apparatus according to Claim 1, wherein said upper beam is disposed horizontally along a width direction of said car so as to divide said ceiling portion substantially uniformly in two in a depth direction of said car.

4. The elevator apparatus according to Claim 1, wherein said rope end connecting apparatus has:

a securing member secured to said car connecting end portion;

a supporting member secured to said upper beam so as to be positioned above said securing member; and

a buffering member interposed between said securing member and said supporting member.

5. The elevator apparatus according to Claim 4, wherein said securing member, said supporting member, and said buffering member are housed within a range of a vertical dimension of said ceiling portion.

6. The elevator apparatus according to Claim 4, wherein said securing member has a wedge rope fastener portion.

7. The elevator apparatus according to Claim 4, wherein said buffering member is a spring, and an adjusting member for adjusting tension in said main rope by adjusting a position thereof relative to said securing member is disposed between said securing member and said spring.

8. An elevator apparatus comprising:

a driving machine having a drive sheave;

a car raised and lowered inside a hoistway by
a driving force from said driving machine, hav-
ing a ceiling portion;

a main rope for suspending said car inside said
hoistway, having a car connecting end portion 5
and being wound around said drive sheave;
and

a rope end connecting apparatus for connect-
ing said car connecting end portion to an upper
portion of said car, 10

wherein said rope end connecting apparatus
is disposed such that a lower extremity portion
thereof is positioned lower than an upper surface of
said ceiling portion. 15

20

25

30

35

40

45

50

55

FIG. 1

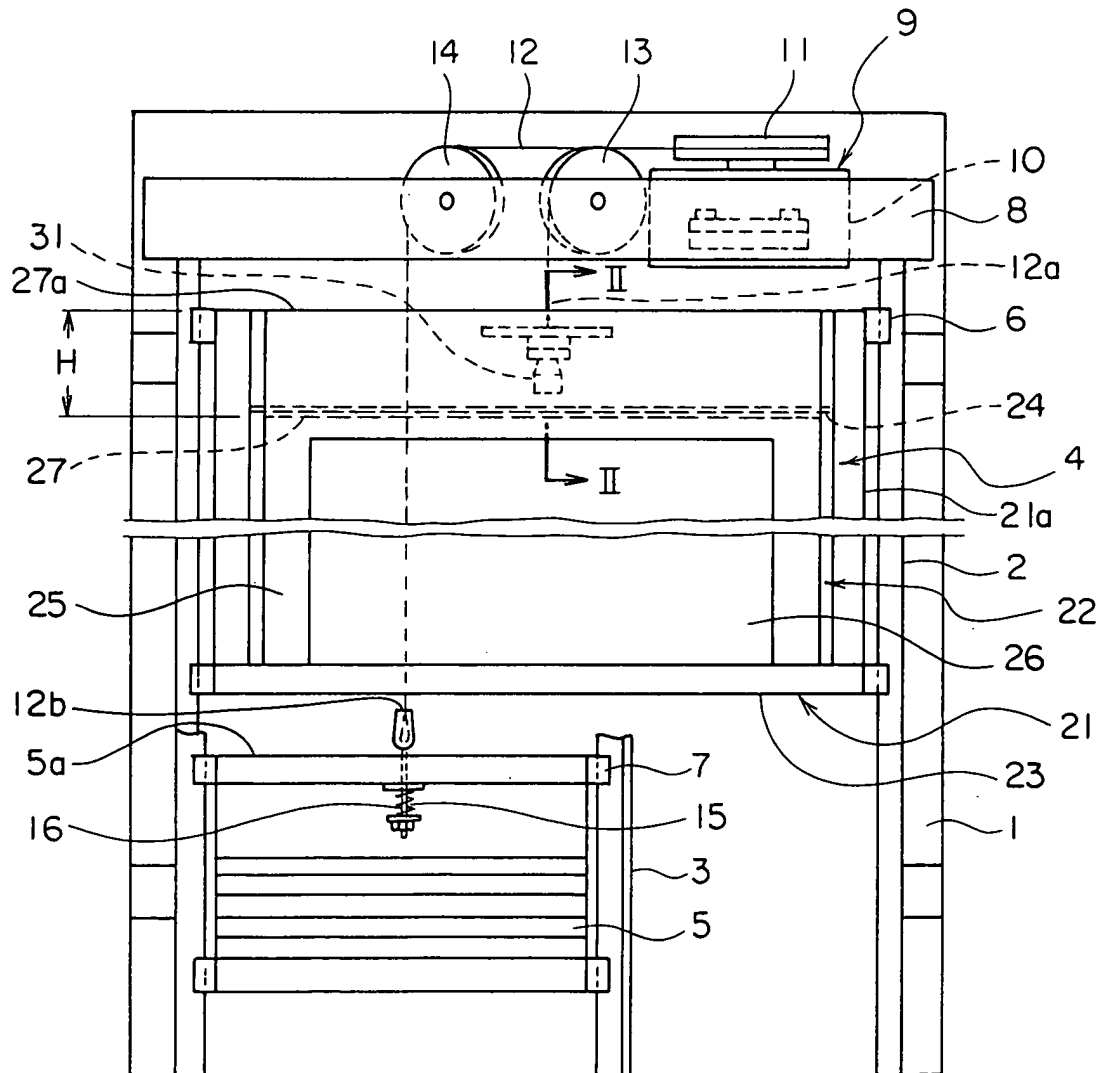


FIG. 2

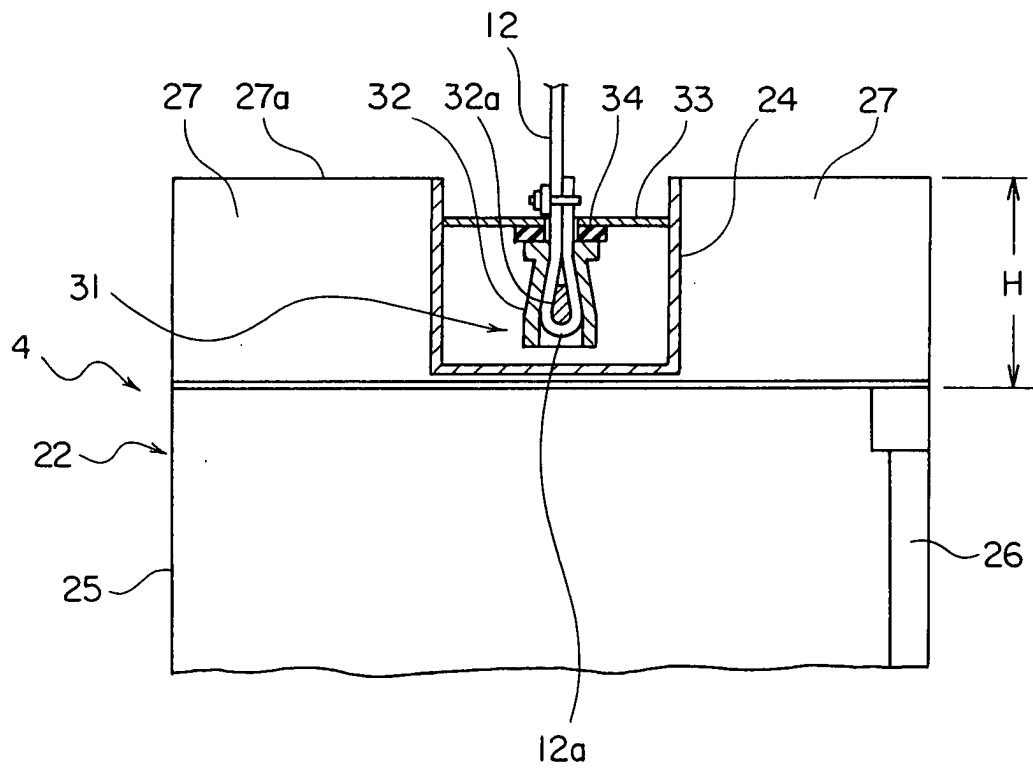


FIG. 3

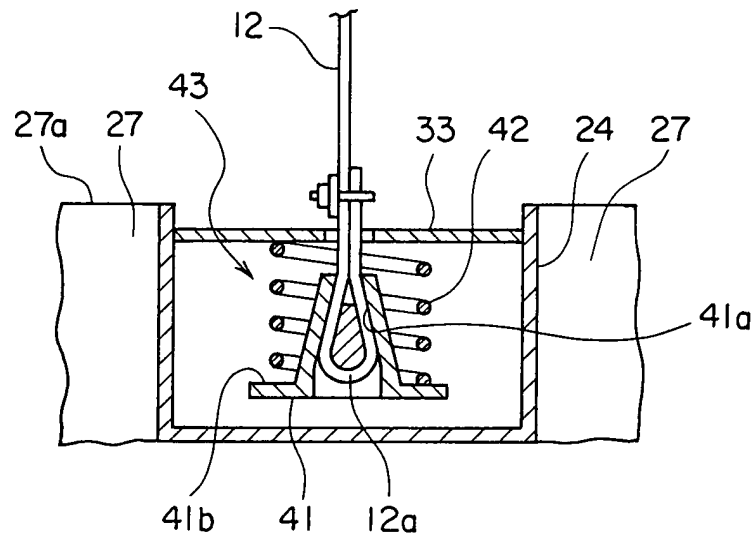
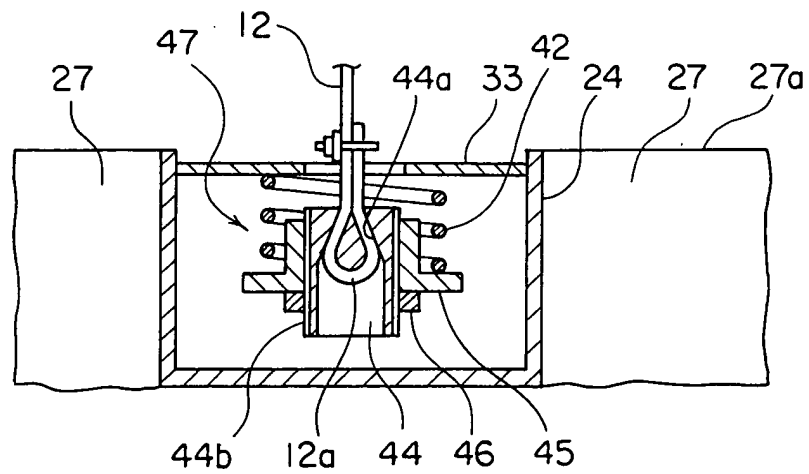


FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP02/11686

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl ⁷ B66B11/02, B66B7/08		
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 B66B7/00-B66B11/08		
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 1996-2003 Kokai Jitsuyo Shinan Koho 1971-2003 Toroku Jitsuyo Shinan Koho 1994-2003		
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 Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 53562/1983 (Laid-open No. 159680/1984) (Mitsubishi Electric Corp.), 26 October, 1984 (26.10.84), (Family: none)	1-4, 8 5-7
X Y	JP 60-102385 A (Toshiba Corp.), 06 June, 1985 (06.06.85), (Family: none)	1-2, 4, 8 3, 5-7
Y	JP 56-117980 A (Tokyo Shibaura Electric Co., Ltd.), 16 September, 1981 (16.09.81), (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 "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "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 31 July, 2003 (31.07.03)		Date of mailing of the international search report 19 August, 2003 (19.08.03)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

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