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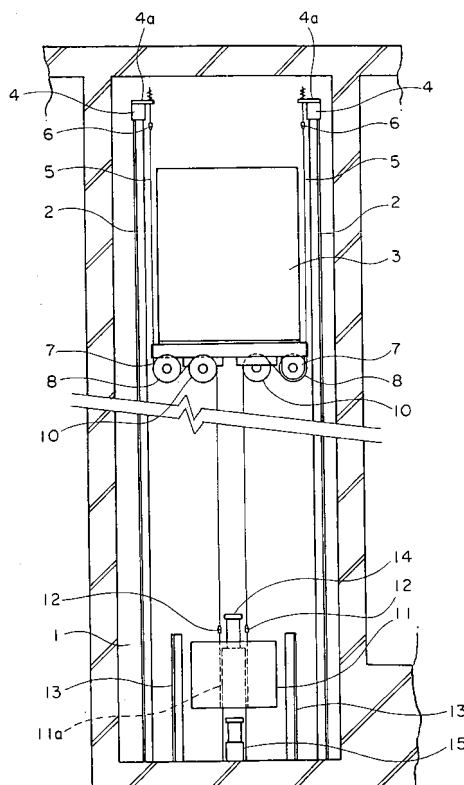
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(54) **ELEVATOR SYSTEM**

(57) A car is raised and lowered so as to be guided by guide rails installed inside a hoistway. A pair of rope bodies are suspended inside the hoistway. A pair of driving machines are mounted to a lower portion of the car. Each of the driving machines has a drive sheave. The rope bodies are wound around the drive sheaves. A pair of deflection sheaves are also mounted to a lower portion of the car. The rope bodies 5 are respectively wound around each of the deflection sheaves. A weight for imparting tension to the rope bodies is suspended on lower end portions of the rope bodies. The weight is disposed inside a region projected vertically from the car.

FIG. 1



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Description

TECHNICAL FIELD

5 **[0001]** The present invention relates to an elevator apparatus in which a car is raised and lowered by a driving force from a driving machine mounted to the car.

BACKGROUND ART

10 **[0002]** In conventional machine-roomless elevators, overall space saving in elevator apparatuses has been sought by disposing driving machines, control boards, etc., inside a hoistway.

[0003] However, since the car and the counterweight are suspended inside the hoistway, and it is necessary for the counterweight to pass the car, the counterweight is disposed side by side with the car. For this reason, horizontal installation space is required for the counterweight, and this has been an obstacle to reducing horizontal dimensions of the hoistway further.

DISCLOSURE OF THE INVENTION

20 **[0004]** The present invention aims to solve the above problems and an object of the present invention is to provide an elevator apparatus enabling horizontal dimensions of a hoistway to be further reduced.

[0005] In order to achieve the above object, according to one aspect of the present invention, there is provided an elevator apparatus including: a car guide rail installed inside a hoistway; a rope body suspended inside the hoistway; a car suspended inside the hoistway by the rope body, and raised and lowered inside the hoistway along the car guide rail; a driving machine for raising and lowering said car, having a drive sheave onto which the rope body is wound, and being mounted to the car; a deflection sheave mounted to the car, and onto which the rope body is wound; and a weight for imparting tension to the rope body, connected to the rope body below the car, and disposed inside a region projected vertically from the car.

[0006] According to another aspect of the present invention, there is provided an elevator apparatus including: a pair of car guide rails installed inside a hoistway; a pair of rope bodies suspended inside the hoistway; a car suspended inside the hoistway by the rope bodies, and raised and lowered inside the hoistway along the car guide rails; a pair of driving machines for raising and lowering said car, each having a drive sheave onto which the rope bodies are respectively wound, and being mounted to the car; a pair of deflection sheaves mounted to the car, and onto which the rope bodies are respectively wound; and a weight for imparting tension to the rope bodies, connected to the rope bodies below the car, and disposed inside a region projected vertically from the car.

35 **[0007]** According to yet another aspect of the present invention, there is provided an elevator apparatus including: a rope body suspended inside a hoistway; a car suspended inside the hoistway by the rope body, and raised and lowered inside the hoistway; a driving machine for raising and lowering said car, having a drive sheave onto which the rope body is wound, and being mounted to the car; a first deflection sheave mounted to the car, and onto which the rope body is wound on a first side of the drive sheave; a second deflection sheave mounted to the car, and onto which the rope body is wound on a second side of the drive sheave; and a weight for imparting tension to the rope body, connected to the rope body below the car, wherein: the driving machine is disposed such that an axis of rotation of the drive sheave extends vertically; and the first and second deflection sheaves are disposed such that an axis of rotation thereof extends horizontally.

45 **[0008]** According to still yet another aspect of the present invention, there is provided an elevator apparatus including: a pair of rope bodies suspended inside a hoistway; a car suspended inside the hoistway by the rope bodies, and raised and lowered inside the hoistway; a pair of driving machines for raising and lowering said car, each having a drive sheave onto which the rope bodies are respectively wound, and being mounted to the car; a pair of first deflection sheaves mounted to the car, and onto which the rope bodies are respectively wound on a first side of the drive sheaves; a pair of second deflection sheaves mounted to the car, and onto which the rope bodies are respectively wound on a second side of the drive sheaves; and a weight for imparting tension to the rope bodies, connected to the rope bodies below the car, wherein: the driving machines are disposed such that an axis of rotation of the drive sheaves extends vertically; and the first and second deflection sheaves are disposed such that an axis of rotation thereof extends horizontally.

BRIEF DESCRIPTION OF THE DRAWINGS

55 **[0009]**

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

Figure 2 is a plan showing the elevator apparatus in Figure 1;
 Figure 3 is a side elevation showing an elevator apparatus according to Embodiment 2 of the present invention;
 Figure 4 is a plan showing the elevator apparatus in Figure 3;
 Figure 5 is a side elevation showing an elevator apparatus according to Embodiment 3 of the present invention;
 Figure 6 is a plan showing the elevator apparatus in Figure 5;
 Figure 7 is a side elevation showing an elevator apparatus according to Embodiment 4 of the present invention;
 Figure 8 is a front elevation showing an elevator apparatus according to Embodiment 5 of the present invention;
 Figure 9 is a plan showing the elevator apparatus in Figure 8; and
 Figure 10 is a front elevation showing an elevator apparatus according to Embodiment 6 of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0010] Preferred embodiments of the present invention will now be explained with reference to the drawings.

Embodiment 1

[0011] Figure 1 is a front elevation showing an elevator apparatus (a self-propelled elevator) according to Embodiment 1 of the present invention, and Figure 2 is a plan showing the elevator apparatus in Figure 1. In the figures, a pair of car guide rails 2 are installed inside a hoistway 1. A car 3 is guided by the car guide rails 2 so as to be raised and lowered inside the hoistway 1. Guiding apparatuses (such as sliding guide shoes or guide rollers) that slide or roll along the car guide rails 2 are mounted to the car 3. The car guide rails 2 are disposed such that an imaginary straight line joining them to each other passes through a center of gravity of the car 3 within a vertical plane of projection.

[0012] A pair of supporting beams 4 are fixed to an upper portion inside the hoistway 1. A rope fastening member 4a is fixed to each of the supporting beams 4. A pair of rope bodies 5 are suspended inside the hoistway 1 from the rope fastening members 4a. Each of the rope bodies 5 is connected to a rope fastening member 4a by means of a rope upper end connecting portion 6. Each of the rope bodies 5 includes one rope or a plurality of ropes (two in the figures). Resin-coated ropes in which an outer periphery is coated with a high-friction resin material can be used for the ropes.

[0013] A pair of driving machines 7 are mounted to a lower portion of the car 3. Each of the driving machines 7 has: a drive sheave 8; and a motor portion 9 for rotating the drive sheave 8. The rope bodies 5 are wound around the drive sheaves 8. The driving machines 7 are cylindrical hoisting machines having an axial length dimension that is greater than a radial dimension of the drive sheaves 8. The driving machines 7 are disposed such that axes of rotation of the drive sheaves 8 are horizontal (or generally horizontal), and extend parallel (or generally parallel) to a depth direction of the car 3.

[0014] A pair of deflection sheaves 10 are mounted to a lower portion of the car 3. A rope body 5 is wound around each of the deflection sheaves 10. Each of the deflection sheaves 10 is disposed such that an axis of rotation thereof is horizontal (or generally horizontal), and extends parallel (or generally parallel) to a depth direction of the car 3. The deflection sheaves 10 function to deflect downward the rope bodies 5 extending obliquely upward from the drive sheave 8, and also function to ensure a contact angle (amount of wrap) of the rope bodies 5 on the drive sheaves 8.

[0015] The car 3 is suspended by the rope bodies 5 in line with its center of gravity. Two sets of rope bodies 5, driving machines 7, and deflection sheaves 10 are disposed centrosymmetrically to each other relative to the center of gravity of the car 3 in a vertical plane of projection.

[0016] A rectangular parallelepiped (block-shaped) weight 11 for imparting tension to the rope bodies 5 is suspended on lower end portions of the rope bodies 5. The weight 11 is connected to the rope bodies 5 below the car 3 with rope lower end connecting portions 12 interposed. In other words, the two sets of rope bodies 5 are connected to a shared weight 11. The weight 11 is also disposed inside a region projected vertically from the car 3. The weight of the weight 11 is set such that sufficient traction acts between the rope bodies 5 and the drive sheave 8.

[0017] A pair of weight rails 13 for bracing the weight 11 are installed in a lower portion inside the hoistway 1. The weight rails 13 permit vertical displacement of the weight 11 while regulating horizontal displacement. Engaging members (not shown) for engaging the weight rails 13 are mounted to the weight 11.

[0018] A car buffer 14 for receiving the car 3, and a pair of weight buffers 15 for receiving the weight 11 are also installed in a lower portion inside the hoistway 1. A buffer aperture 11a through which the car buffer 14 passes is disposed through the weight 11.

[0019] Next, action will be explained. When the drive sheaves 8 are rotated by the motor portions 9 of the driving machines 7, the rope bodies 5 are conveyed relative to the car 3, and the car 3 is raised and lowered so as to be guided by the car guide rails 2. The weight 11 ensures traction, making the car 3 steady even if raised and lowered.

[0020] In an elevator apparatus of this kind, since the weight 11 does not pass the car 3, the weight 11 can be disposed directly below the car 3, that is inside a region projected vertically from the car 3, enabling horizontal dimensions of the hoistway 1 to be further reduced. Because the driving machines 7 are also mounted to a lower portion of the car 3,

horizontal dimensions of the hoistway 1 can thereby also be further reduced.

[0021] Because car guide rails 2 are installed inside the hoistway 1 separately from the driving rope bodies 5, the car 3 can be raised and lowered stably.

[0022] In addition, because two sets of rope bodies 5, driving machines 7, and deflection sheaves 10 are used, the load on a single driving machine 7 is reduced, enabling the driving machines 7 to be reduced in size. The car 3 can also be suspended more stably.

[0023] Because the car 3 is suspended by rope bodies 5 in line with its center of gravity, the car 3 can be raised and lowered more stably.

[0024] Because the rope bodies 5, the driving machines 7, and the deflection sheaves 10 are disposed centrosymmetrically relative to the center of gravity of the car 3 in a vertical plane of projection, the car 3 can be raised and lowered even more stably.

[0025] In addition, because a buffer aperture 11a through which the car buffer 14 passes is disposed on the weight 11, the weight 11 and the car buffer 14 can be disposed in a lower portion inside the hoistway 1 while avoiding mutual interference, enabling space inside the hoistway 1 to be used effectively.

[0026] Because weight rails 13 are used to regulate the horizontal displacement of the weight 11, the weight 11 can be prevented from swinging, enabling the car 3 to be raised and lower stably. Furthermore, because the weight rails 13 permit vertical displacement of the weight 11, tension can still be imparted to the rope bodies 5 stably even if stretching occurs in the rope bodies 5.

[0027] Because weight buffers 15 are installed below the weight 11, mechanical shock therefrom can be suppressed even in the unlikely event that the weight 11 were to drop.

[0028] Now, if we let W_1 be the weight of the car 3, C be the capacity of the car 3, and W_2 be the weight of the weight 11, then tension acting on a rope body 5 on a side of a drive sheave 8 nearer to the weight 11 is given by $W_2/2$, and tension acting on the rope body 5 on a side of the drive sheave 8 nearer to the car 3 is given by $(W_1 + C + W_2)/2$. For this reason, the traction ratio in the drive sheave 8 is given by: $\{(W_1 + C + W_2)/W_2\}$.

[0029] Consequently, in order to ensure traction, it is advantageous to increase the weight of the weight 11. However, if the weight of the weight 11 is increased, the axle load acting on the driving machines 7 increases, requiring the driving machines 7 to be increased in size.

[0030] In answer to this, the weight of the weight 11 can be reduced by constituting the rope bodies 5 using a resin-coated rope to increase traction, enabling the driving machines 7 to be reduced in size.

[0031] If we let D be the diameter of the drive sheaves 8, then the load torque acting on the driving machines 7 is $D/2\{(W_1 + C + W_2) - W_2/2\}$, which is greater than in conventional traction elevators. However, by using a resin-coated rope in which the traction is large and also having high flexibility, the diameter of the drive sheaves 8 can be reduced, thereby enabling the load torque acting on the driving machines 7 to be suppressed.

Embodiment 2

[0032] Next, Figure 3 is a side elevation showing an elevator apparatus according to Embodiment 2 of the present invention, and Figure 4 is a plan showing the elevator apparatus in Figure 3, Figure 3 being a side elevation viewed from the right in Figure 4. In the figures, a pair of driving machines 7 are disposed such that axes of rotation of drive sheaves 8 extend parallel (or generally parallel) to a width direction of a car 3. A pair of deflection sheaves 10 are disposed such that axes of rotation thereof also extend parallel (or generally parallel) to the width direction of the car 3.

[0033] The drive sheaves 8 and deflection sheaves 10 are disposed on two sides of the car 3 in the width direction in a vertical plane of projection. Two sets of rope bodies 5, driving machines 7, and deflection sheaves 10 are disposed centrosymmetrically to each other relative to the center of gravity of the car 3 in the vertical plane of projection.

[0034] Engaging members (not shown) for engaging car guide rails 2 are mounted to a weight 11. In other words, the car guide rails 2 also perform the function of the weight rails 13 in Embodiment 1. The rest of the configuration is similar to that of Embodiment 1.

[0035] Using an elevator apparatus of this kind, horizontal dimensions of the hoistway 1 can also be further reduced. If the width dimensions of the car 3 are small and the depth dimensions are large, the drive sheave 8 and the deflection sheaves 10 can be disposed particularly easily.

[0036] Since portions connecting the rope bodies 5 to the weight 11 are disposed between side walls of the car 3 and wall surfaces of the hoistway 1 and do not overlap with the car 3 in a vertical plane of projection, lower end connecting portions 12 will not interfere with the car 3 even in the unlikely event that the car 3 were to collide with the car buffer 14. For this reason, pit depth in the hoistway 1 can be reduced.

Embodiment 3

[0037] Next, Figure 5 is a side elevation showing an elevator apparatus according to Embodiment 3 of the present

invention, and Figure 6 is a plan showing the elevator apparatus in Figure 5, Figure 5 being a side elevation viewed from the right in Figure 6. In Embodiment 3, mounting positions of driving machines 7 and deflection sheaves 10 onto a car 3 are reversed compared to those of Embodiment 2. A weight 11 having a reduced base area and increased height dimensions compared to the weight 11 in Embodiment 2 is used. The rest of the configuration is similar to that of Embodiment 2.

[0038] Similar effects to those in Embodiment 2 can also be achieved using a layout of this kind.

Embodiment 4

[0039] Next, Figure 7 is a side elevation showing an elevator apparatus according to Embodiment 4 of the present invention. In Embodiment 4, driving machines 7 and deflection sheaves 10 are mounted to an upper portion of a car 3. The rest of the configuration is similar to that of Embodiment 2.

[0040] Similar effects to those in Embodiment 2 can also be achieved if driving machines 7 and deflection sheaves 10 are mounted to an upper portion of a car 3 in this manner.

[0041] Moreover, in Embodiments 1 to 4, cylindrical hoisting machines were used for the driving machines 7, but thin hoisting machines having an axial length dimension that is less than a radial dimension of a drive sheave may also be used.

[0042] In Embodiments 1 to 4, two sets of rope bodies 5, driving machines 7, and deflection sheaves 10 were used, but three or more sets may also be used if installation space can be secured.

[0043] In addition, the positions of disposal of the driving machines 7 and the deflection sheaves 10 in Embodiment 4 may also be reversed.

Embodiment 5

[0044] Figure 8 is a front elevation showing an elevator apparatus according to Embodiment 5 of the present invention, and Figure 9 is a plan showing the elevator apparatus in Figure 8. In the figures, a pair of driving machines 21 are mounted to a lower portion of a car 3. Each of the driving machines 21 has: a drive sheave 22; and a motor portion 23 for rotating the drive sheave 22. Rope bodies 5 are wound around the drive sheaves 22. The driving machines 21 are thin hoisting machines having an axial length dimension that is less than a radial dimension of the drive sheaves 22. The driving machines 21 are disposed such that axes of rotation of the drive sheaves 22 extend vertically (or generally vertically).

[0045] A pair of first deflection sheaves 24 and a pair of second deflection sheaves 25 are mounted to a lower portion of the car 3. The rope bodies 5 are wound around each of the first deflection sheaves 24 on a first side (a car 3 side) of the drive sheaves 22. The rope bodies 5 are wound around each of the second deflection sheaves 25 on a second side (a weight 11 side) of the drive sheaves 22.

[0046] Each of the deflection sheaves 24 and 25 is disposed such that an axis of rotation thereof is horizontal (or generally horizontal), and extends parallel (or generally parallel) to a depth direction of the car 3. The first and second deflection sheaves 24 and 25 are also disposed so as to be offset from each other in a vertical direction. Specifically, the first deflection sheaves 24 are disposed at a position that is higher than that of the second deflection sheaves 25.

[0047] Two sets of rope bodies 5, driving machines 21, first deflection sheaves 24, and second deflection sheaves 25 are disposed centrosymmetrically to each other relative to the center of gravity of the car 3 in a vertical plane of projection. The rest of the configuration is similar to that of Embodiment 1.

[0048] Using an elevator apparatus of this kind, the weight 11 can also be disposed directly below the car 3, enabling horizontal dimensions of the hoistway 1 to be further reduced. Because the driving machines 21 are mounted to a lower portion of the car 3, horizontal dimensions of the hoistway 1 can thereby also be further reduced.

[0049] Because the first deflection sheaves 24 are disposed at a position that is higher than that of the second deflection sheaves 25, approach angles (fleet angles) of the rope bodies 5 entering the drive sheaves 22 from the first and second deflection sheaves 24 and 25 can be reduced.

Embodiment 6

[0050] Figure 10 is a front elevation showing an elevator apparatus according to Embodiment 6 of the present invention. In Embodiment 6, driving machines 21, first deflection sheaves 24, and second deflection sheaves 25 are mounted to an upper portion of a car 3. The rest of the configuration is similar to that of Embodiment 5.

[0051] Similar effects to those in Embodiment 5 can also be achieved if the driving machines 21, the first deflection sheaves 24, and the second deflection sheaves 25 are mounted to an upper portion of the car 3 in this manner.

[0052] Moreover, in Embodiments 5 and 6, two sets of rope bodies 5, driving machines 21, first deflection sheaves 24, and second deflection sheaves 25 were used, but three or more sets may also be used if installation space can be secured.

Claims

1. An elevator apparatus comprising:

5 a car guide rail installed inside a hoistway;
a rope body suspended inside the hoistway;
a car suspended inside the hoistway by the rope body, and raised and lowered inside the hoistway along the
car guide rail;
a driving machine for raising and lowering the car, having a drive sheave onto which the rope body is wound,
10 and being mounted to the car;
a deflection sheave mounted to the car, and onto which the rope body is wound; and
a weight for imparting tension to the rope body, connected to the rope body below the car, and disposed inside
a region projected vertically from the car.

15 2. An elevator apparatus comprising:

a pair of car guide rails installed inside a hoistway;
a pair of rope bodies suspended inside the hoistway;
a car suspended inside the hoistway by the rope bodies, and raised and lowered inside the hoistway along the
20 car guide rails;
a pair of driving machines for raising and lowering the car, each having a drive sheave onto which the rope
bodies are respectively wound, and being mounted to the car;
a pair of deflection sheaves mounted to the car, and onto which the rope bodies are respectively wound; and
a weight for imparting tension to the rope bodies, connected to the rope bodies below the car, and disposed
25 inside a region projected vertically from the car.

3. An elevator apparatus comprising:

a rope body suspended inside a hoistway;
30 a car suspended inside the hoistway by the rope body, and raised and lowered inside the hoistway;
a driving machine for raising and lowering the car, having a drive sheave onto which the rope body is wound,
and being mounted to the car;
a first deflection sheave mounted to the car, and onto which the rope body is wound on a first side of the drive
sheave;
35 a second deflection sheave mounted to the car, and onto which the rope body is wound on a second side of
the drive sheave; and
a weight for imparting tension to the rope body, connected to the rope body below the car,
wherein:
the driving machine is disposed such that an axis of rotation of the drive sheave extends vertically; and
40 the first and second deflection sheaves are disposed such that an axis of rotation thereof extends horizontally.

4. An elevator apparatus comprising:

a pair of rope bodies suspended inside a hoistway;
45 a car suspended inside the hoistway by the rope bodies, and raised and lowered inside the hoistway;
a pair of driving machines for raising and lowering the car, each having a drive sheave onto which the rope
bodies are respectively wound, and being mounted to the car;
a pair of first deflection sheaves mounted to the car, and onto which the rope bodies are respectively wound
on a first side of the drive sheaves;
50 a pair of second deflection sheaves mounted to the car, and onto which the rope bodies are respectively wound
on a second side of the drive sheaves; and
a weight for imparting tension to the rope bodies, connected to the rope bodies below the car,
wherein:
the driving machines are disposed such that an axis of rotation of the drive sheaves extends vertically; and
55 the first and second deflection sheaves are disposed such that an axis of rotation thereof extends horizontally.

5. The elevator apparatus according to either of Claims 2 or 4, wherein:

the car is suspended by the rope bodies in line with a center of gravity thereof.

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

5 the rope bodies, the driving machines, and the deflection sheave are disposed centrosymmetrically relative to the center of gravity of the car in a vertical plane of projection.

7. The elevator apparatus according to any of Claims 1 to 4, wherein:

10 a car buffer for receiving the car is installed in a lower portion of the hoistway; and a buffer aperture through which the car buffer passes is disposed on the weight.

8. The elevator apparatus according to either of Claims 3 or 4, wherein:

15 the first and second deflection sheaves are disposed so as to be offset from each other in a vertical direction.

9. The elevator apparatus according to either of Claims 3 or 4, wherein:

20 the driving machine is a thin hoisting machine having an axial length dimension that is less than a radial dimension of the drive sheave.

10. The elevator apparatus according to any of Claims 1 to 4, wherein:

25 the rope body includes a resin-coated rope in which an outer periphery is coated with a high-friction resin material.

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FIG. 1

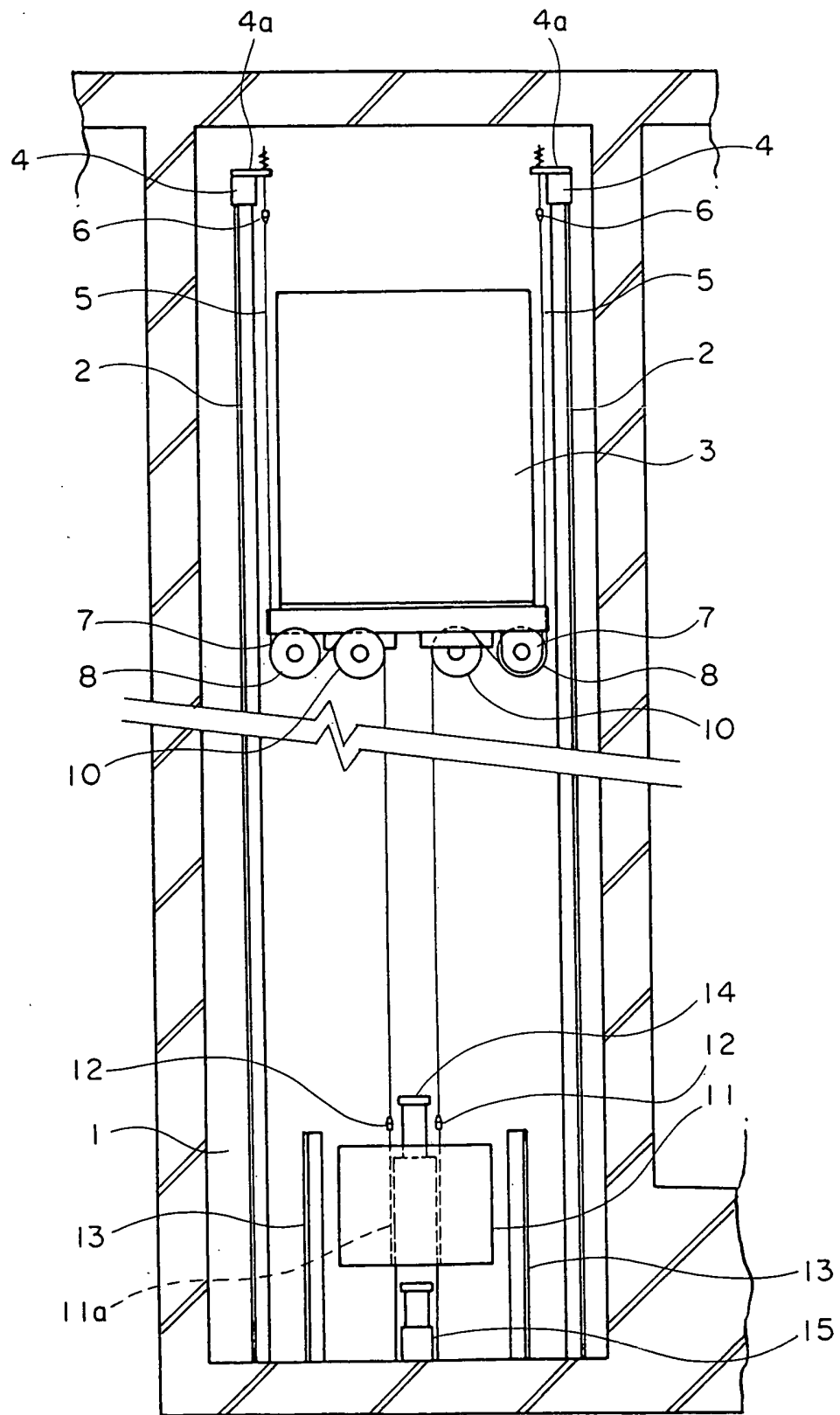


FIG. 2

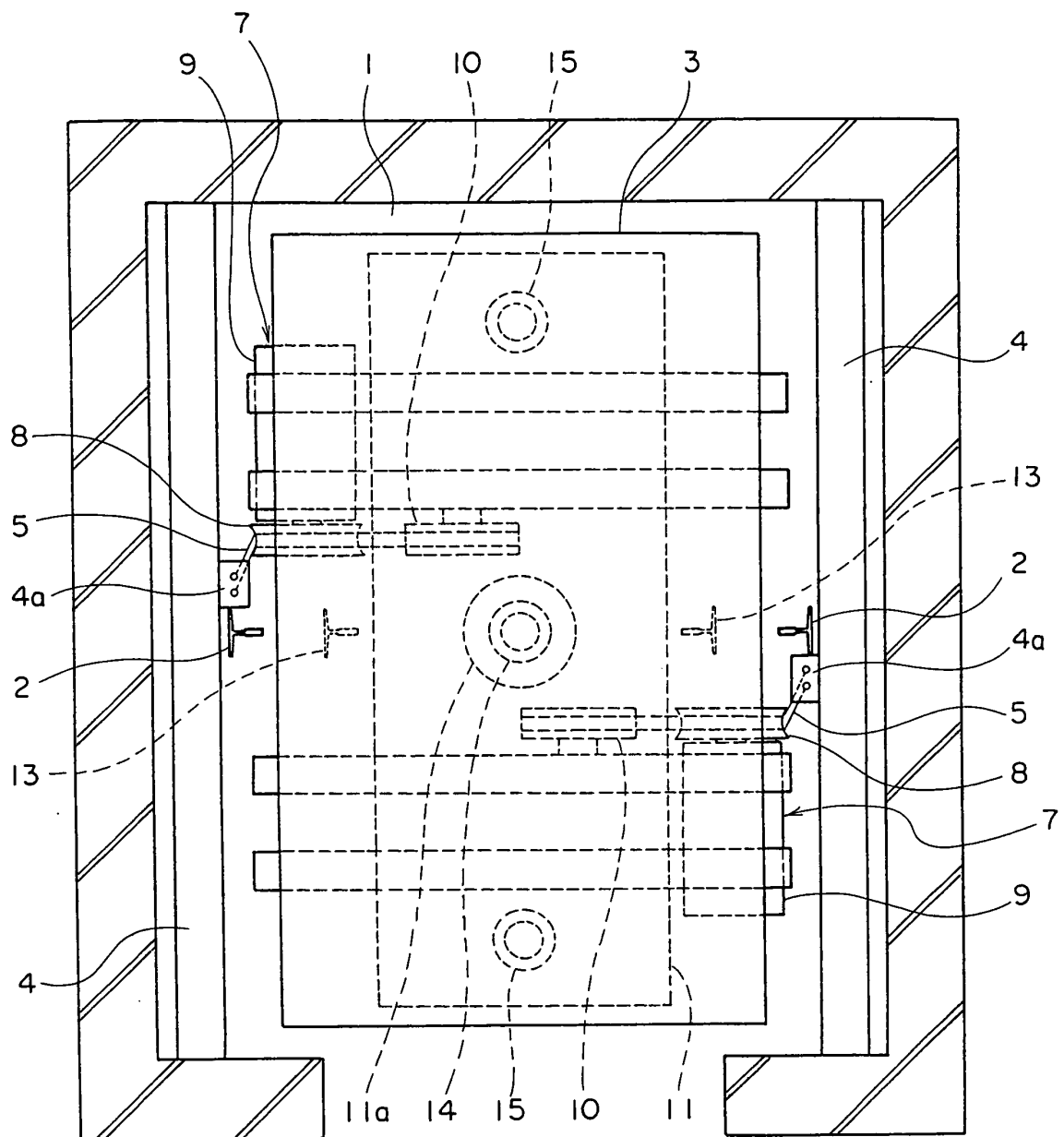


FIG. 3

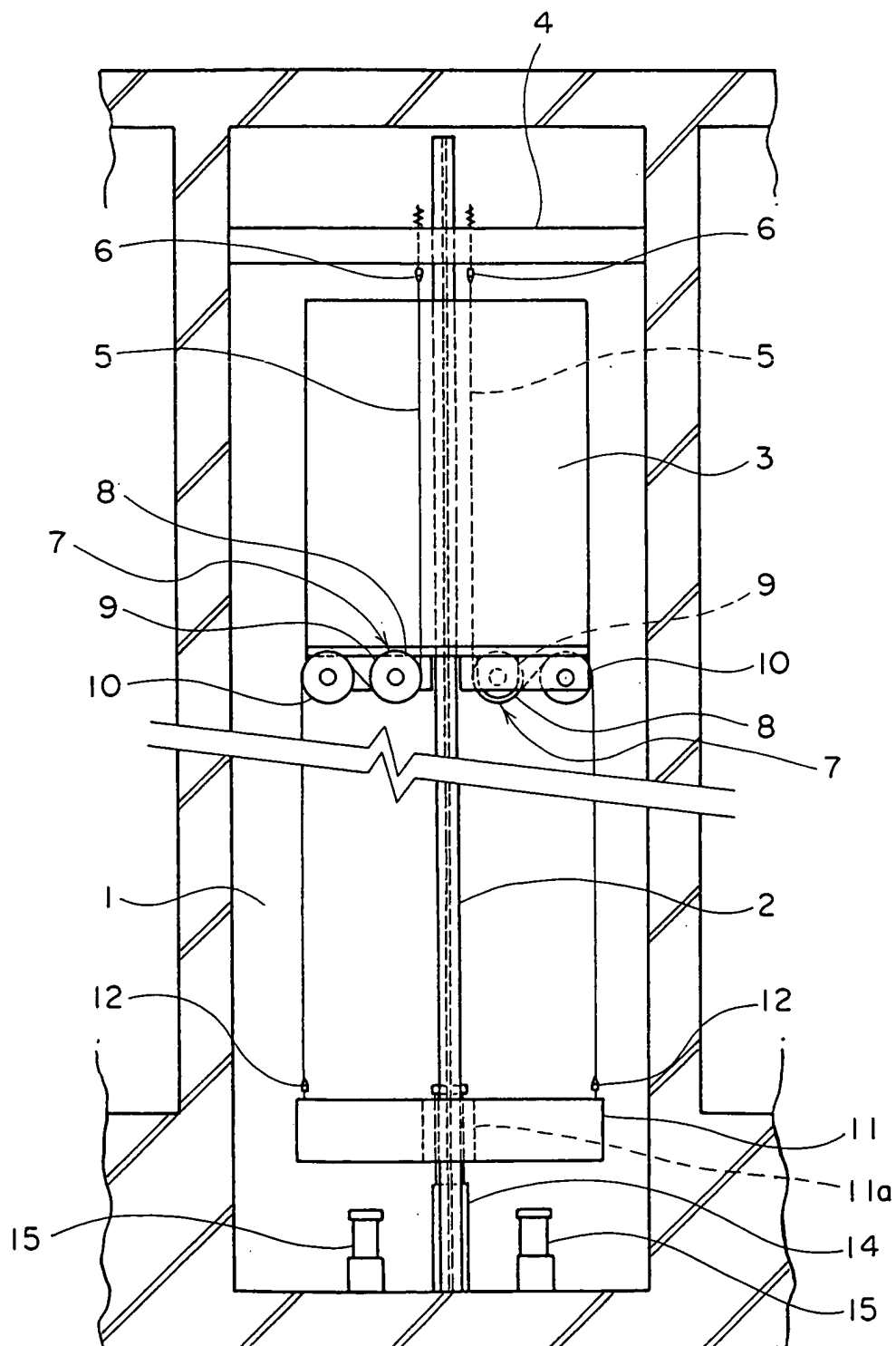


FIG. 4

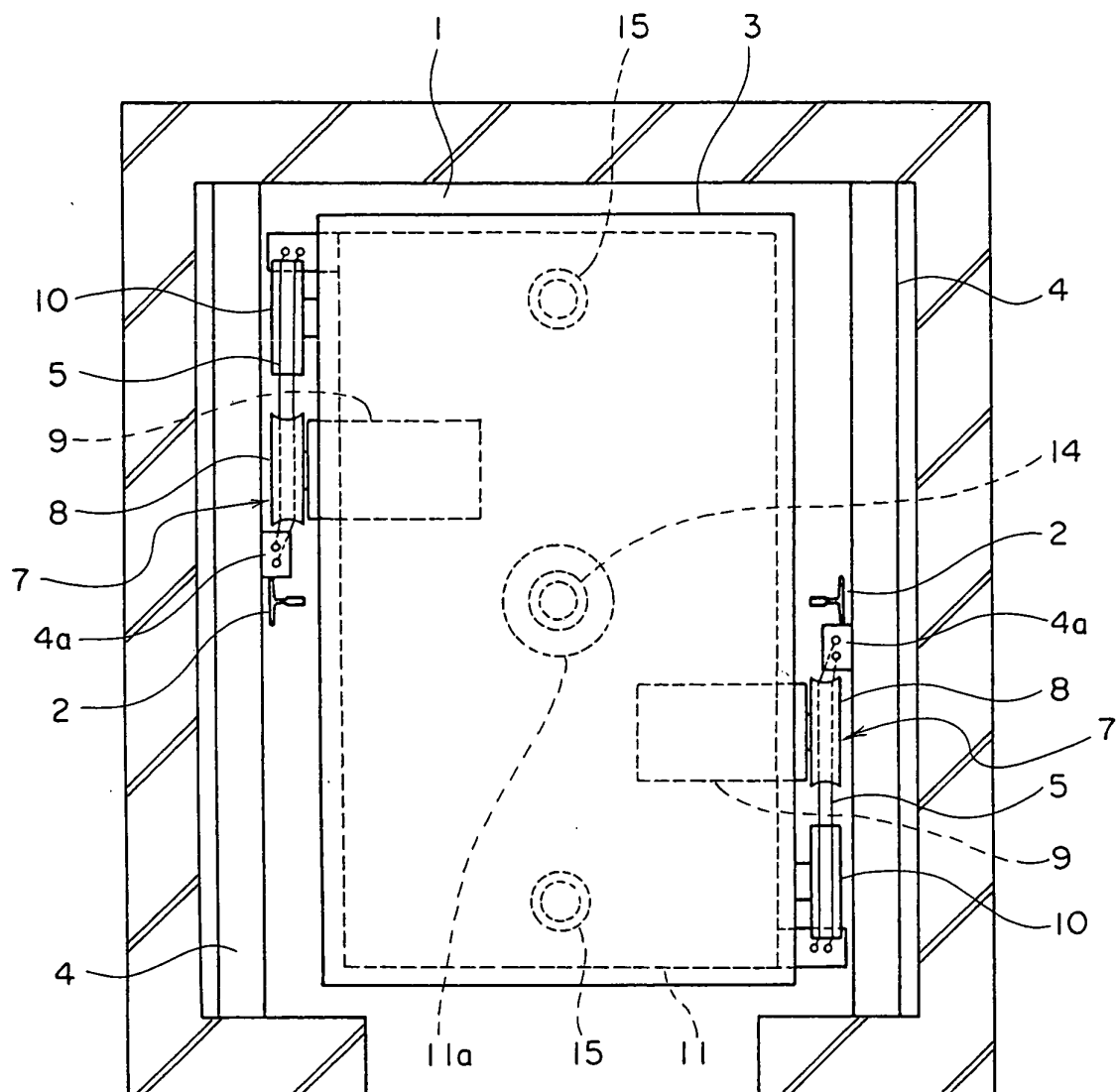


FIG. 5

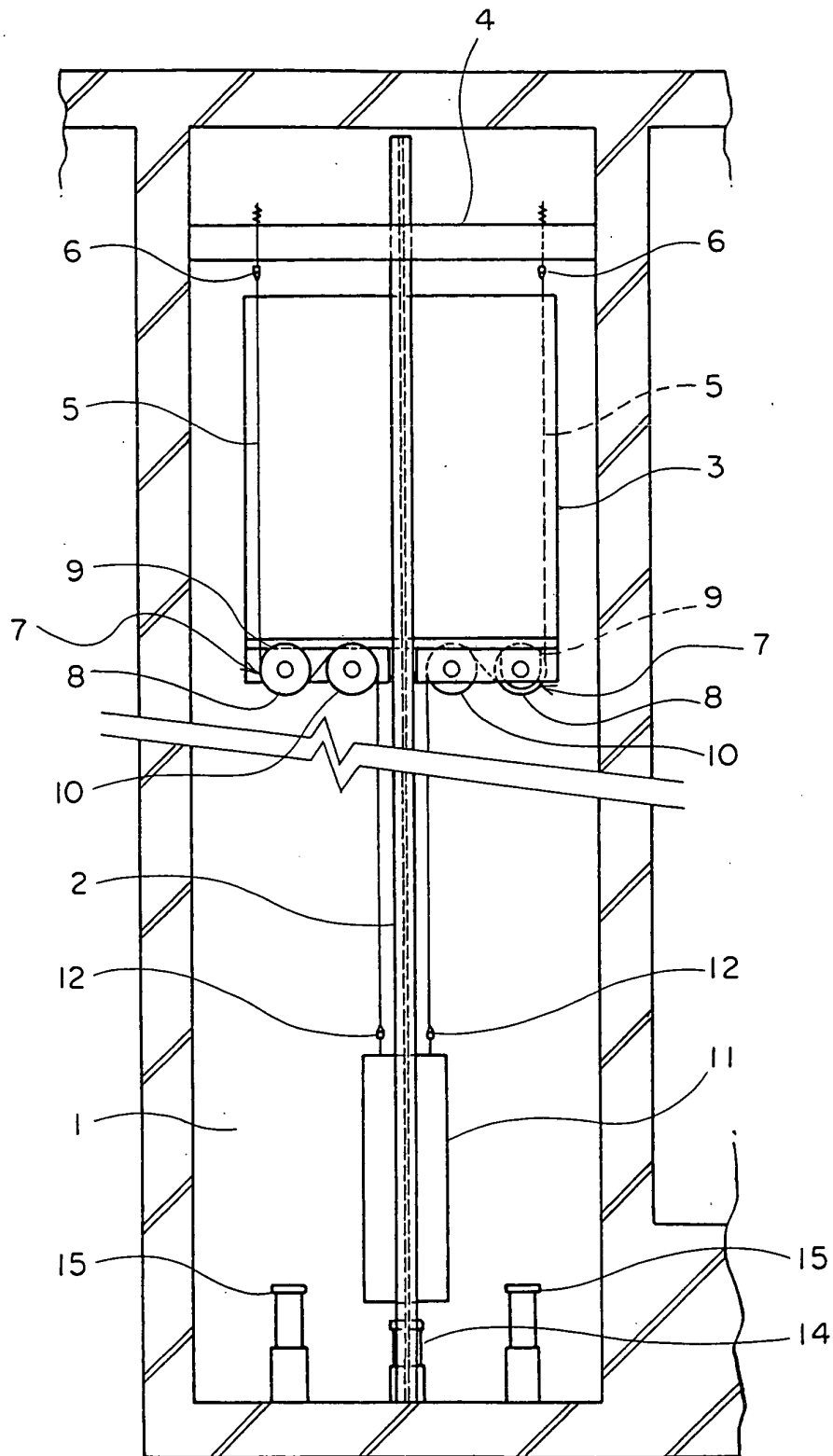


FIG. 6

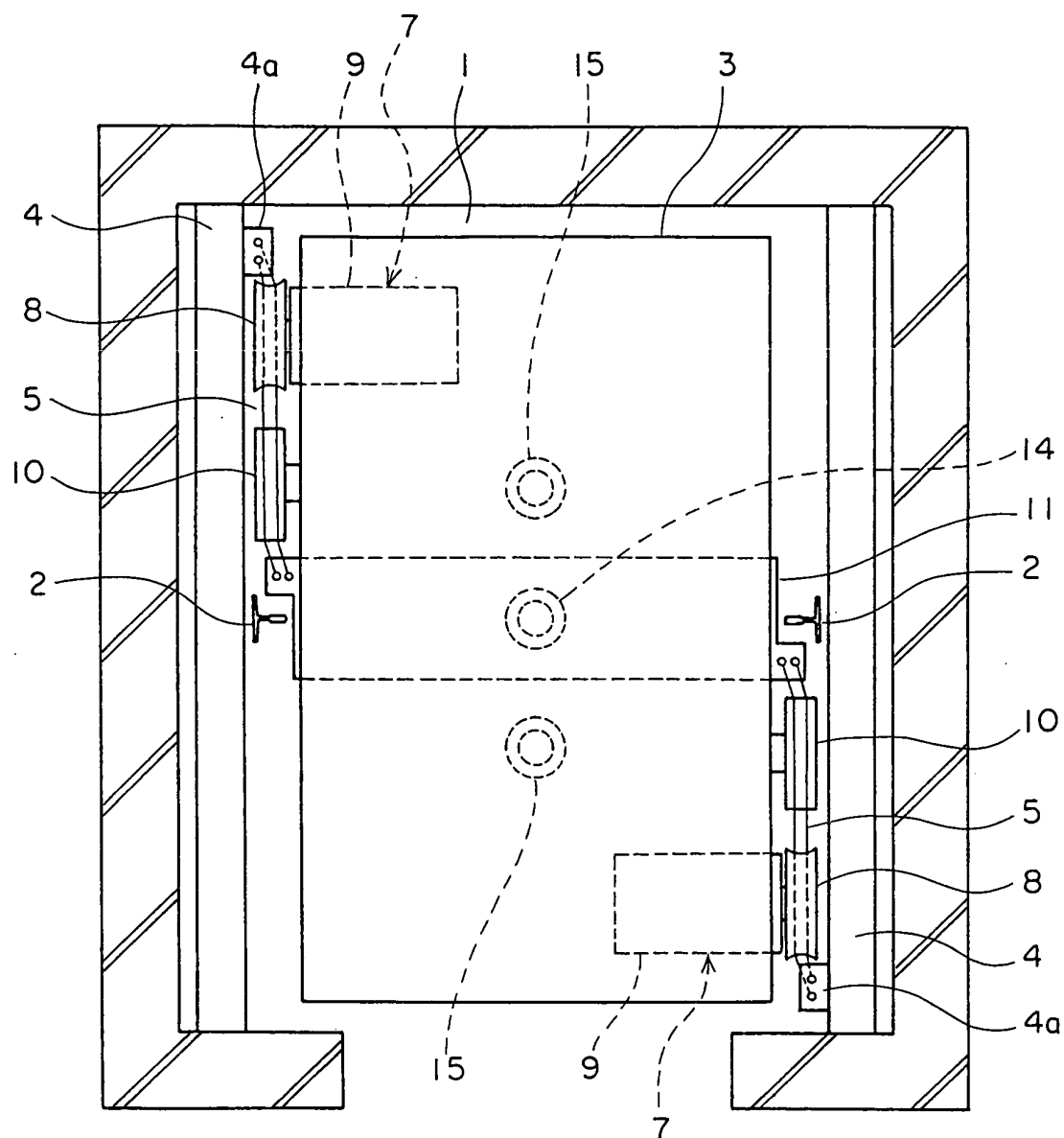


FIG. 7

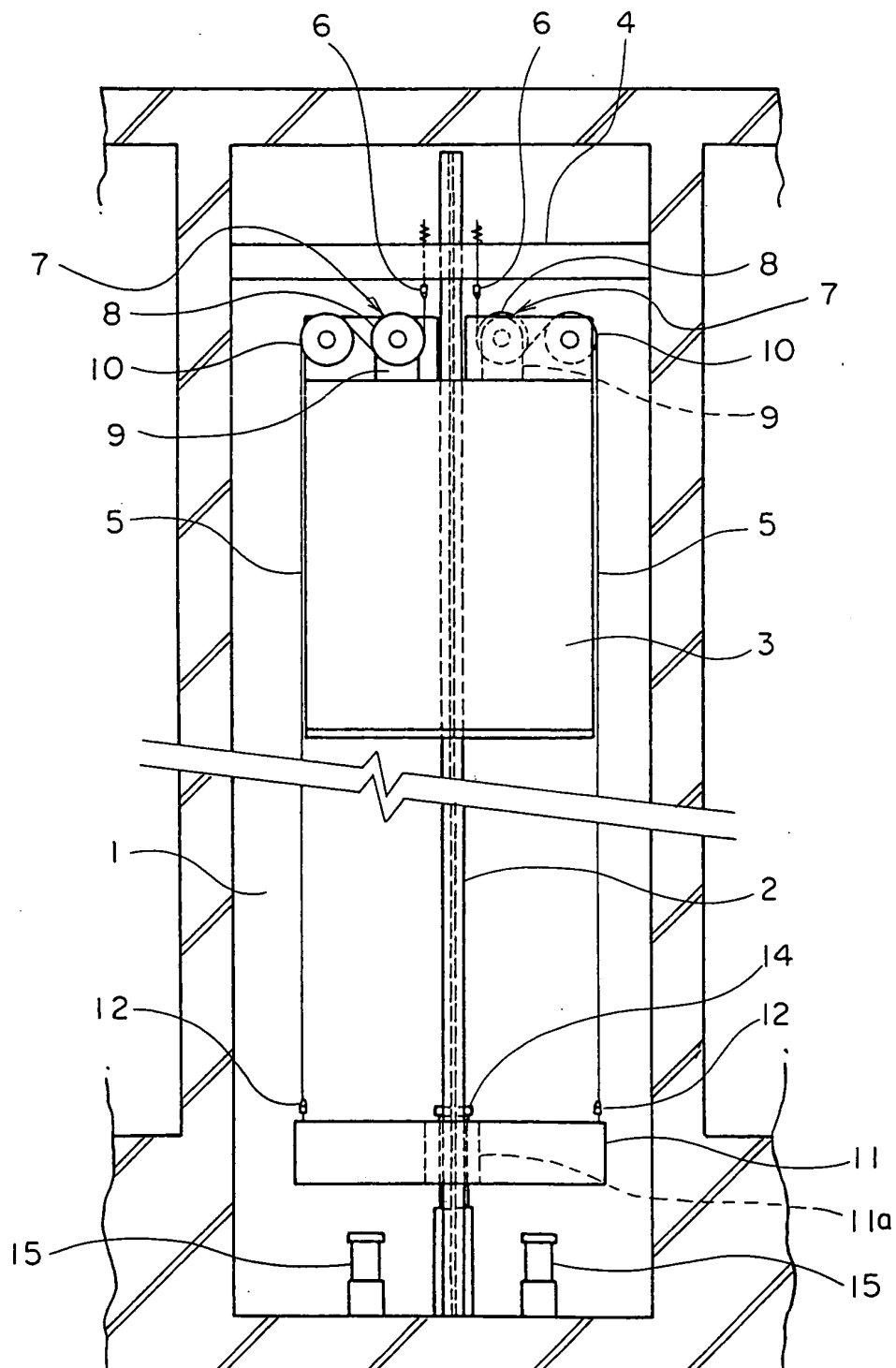


FIG. 8

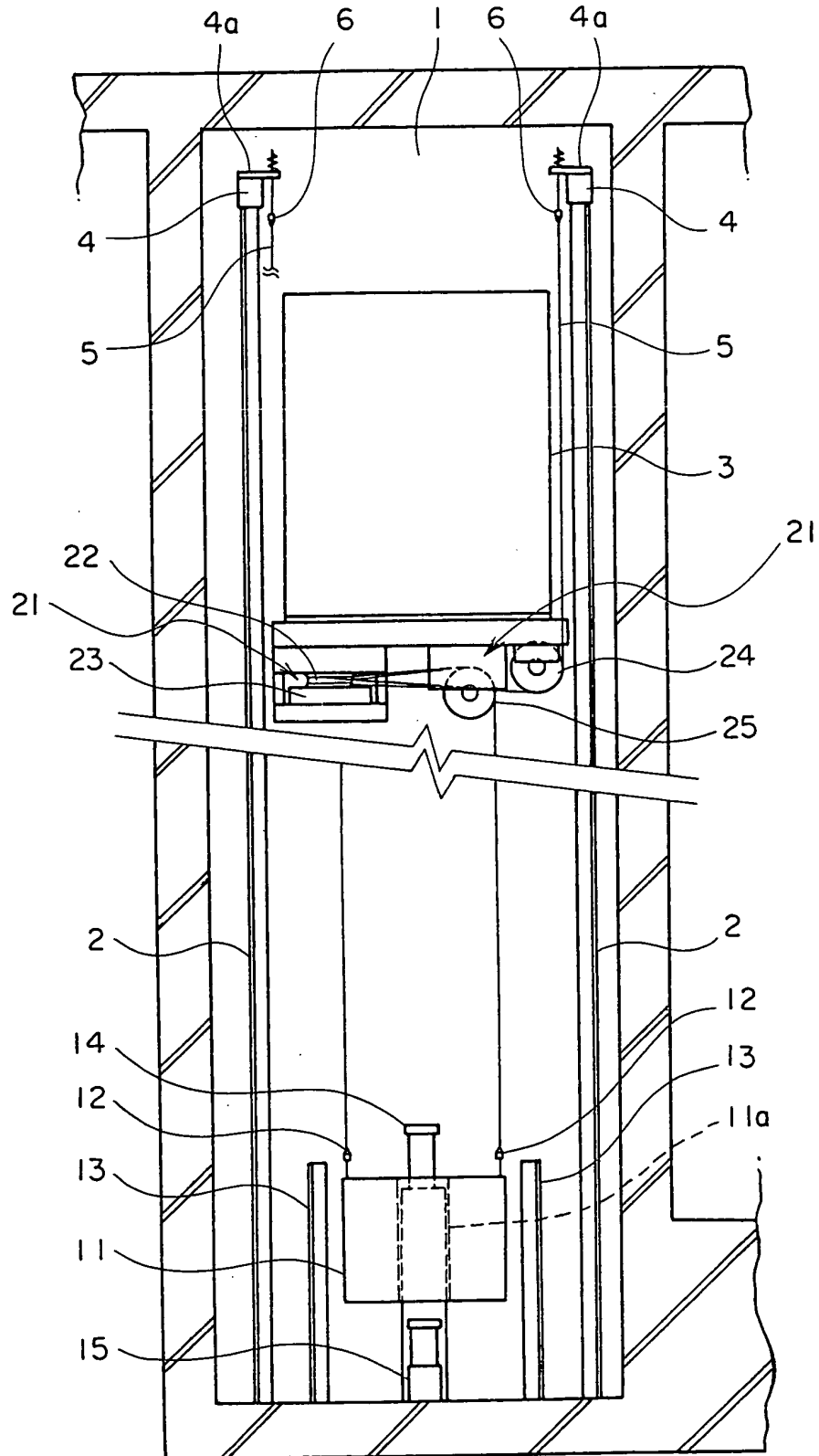


FIG. 9

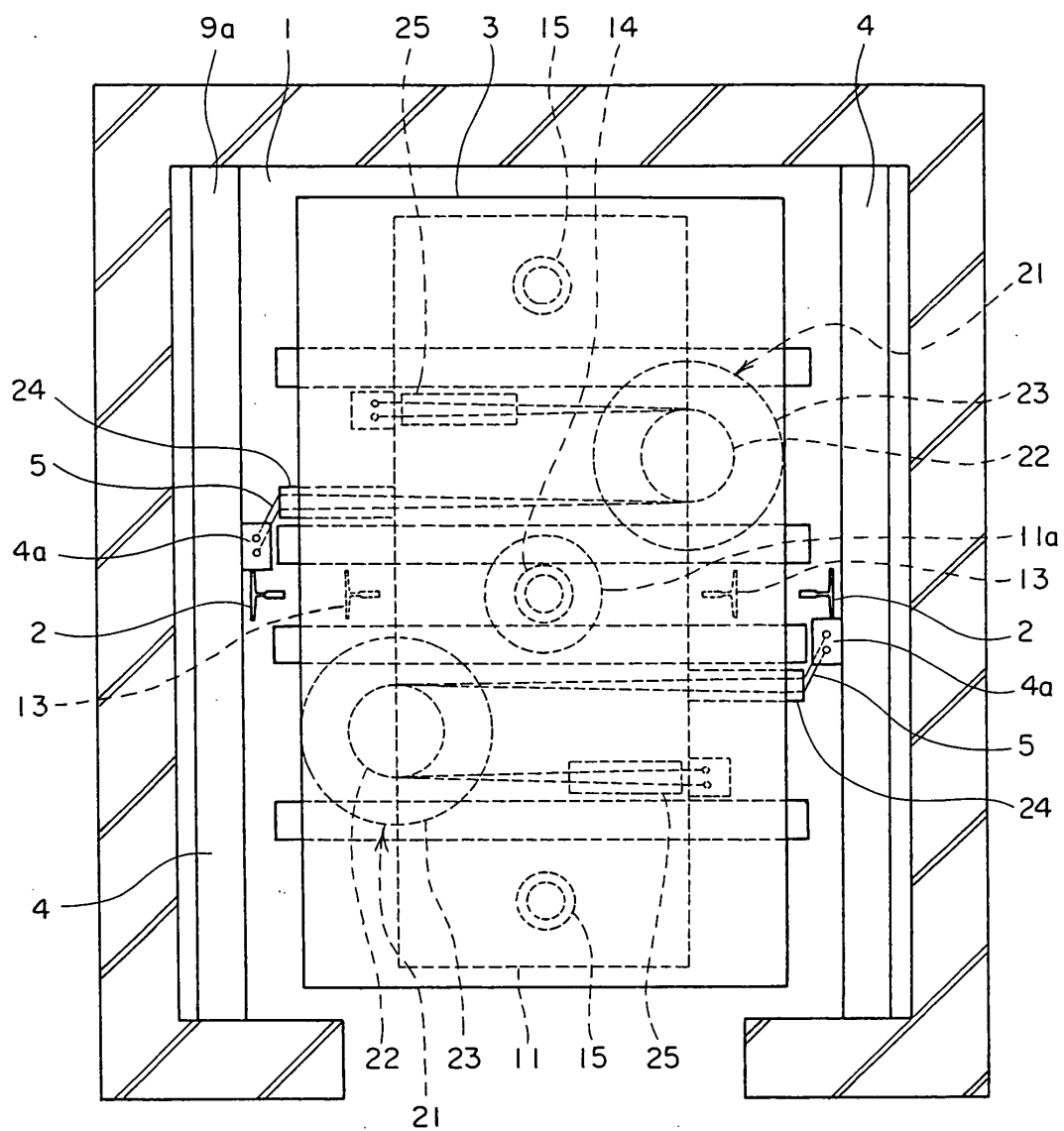
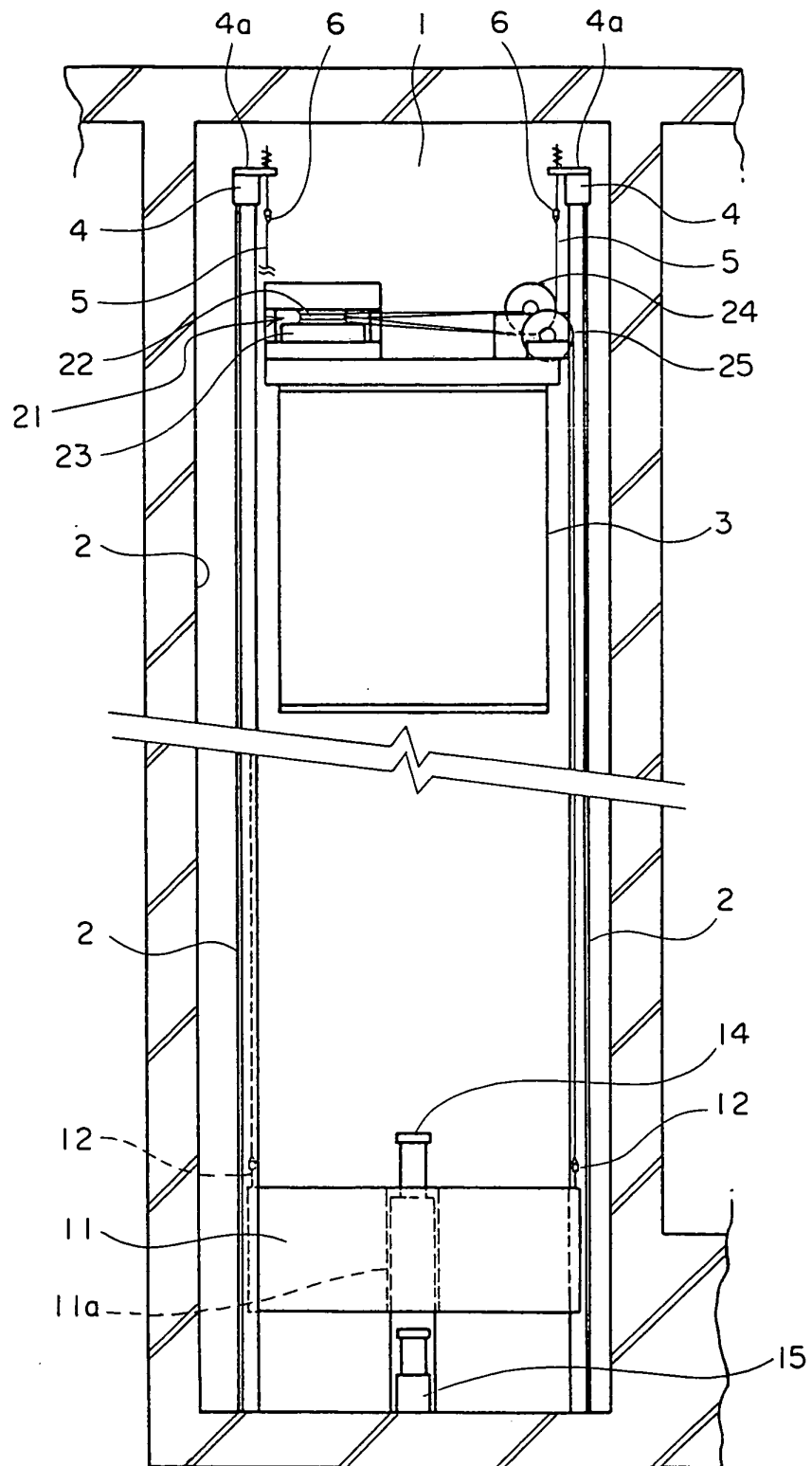


FIG.10



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP03/14583

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl ⁷ B66B11/04, B66B9/02														
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 1996-2004 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.												
Y A	JP 3127957 A (Donald S. Nelson), 07 April, 1964 (07.04.64), Page 1, column 2, line 21 to page 2, column 3, line 9; Figs. 1 to 2 (Family: none)	1-2, 5-6, 10 3-4, 7-9												
Y	JP 2002-504473 A (Otis Elevator Co.), 12 February, 2002 (12.02.02), Par. Nos. [0012] to [0014]; Figs. 1 to 3	1, 3, 9												
Y	Par. Nos. [0012] to [0014], [0018] to [0019]; Figs. 1 to 6	2, 4-6												
Y	Par. Nos. [0012] to [0014], [0034] to [0035]; Figs. 1 to 3, 15 to 16 & WO 99/43601 A2 & BR 9908304 A	10												
☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.														
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International application No.

PCT/JP03/14583

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 2000-229772 A (Mitsubishi Electric Corp.), 22 August, 2000 (22.08.00), Par. Nos. [0011] to [0015]; Figs. 1 to 3 & EP 1028082 A2 & CN 1263042 A & KR 2000057942 A	3-4, 9 8
A A	JP 10-273274 A (Otis Elevator Co.), 13 October, 1998 (13.10.98), Par. Nos. [0011] to [0013]; Figs. 1 to 3 Par. Nos. [0011] to [0013], [0017] to [0018]; Figs. 1 to 6 & EP 0867395 A2 & US 5931265 A	1, 3, 9 2, 4-6

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