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(54) **ELEVATOR SYSTEM**

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Description

Technical Field

[0001] The present invention relates to an elevator system and, more particularly, to an elevator system suitably used for a one-shaft multi-car elevator.

Background Art

[0002] At present, as an elevator system often used particularly in a high-rise building etc., an elevator system called a one-shaft multi-car elevator system is available. This elevator system has a plurality of cars arranged vertically in an elevator shaft, and moves them up and down by driving means independently driving each of the cars. With this elevator system, when the elevator is used frequently, such as the time when workers come to and leave an office or a lunch hour for example, a plurality of cars can be operated while being controlled to prevent collision, and when the elevator is used less frequently, only one car can be operated. Thereby, efficient operation of elevator can be achieved, and space, cost, and the like for installing a plurality of elevator systems can be saved.

[0003] A structure of such a one-shaft multi-car elevator system has been disclosed, for example, in Japanese Patent Laid-Open No. 60-19679, which discloses a preamble of claim 1.

[0004] Specifically, in the elevator system of this type, for example two cars are arranged vertically, and a lower car rope wound on a suspension sheave of a lower car on the lower side is wound on a lower car traction machine. The lower car rope is then wound from the traction machine on a suspension sheave of a lower car balancing weight on the upper side of two balancing weights arranged vertically. Also, both ends of the lower car rope are fixed to an upper part of an elevator shaft.

[0005] On the other hand, an upper car rope fixed on the ceiling of an upper car arranged on the upper side is wound on an upper car traction machine. Successively, the upper car rope is caused to pass from the traction machine through a rope through hole formed in the lower car balancing weight, and is fixed to an upper car balancing weight arranged on the lower side.

[0006] That is to say, the lower car is arranged on the lower side, and on the other hand, the lower car balancing weight, which is connected to the lower car via the lower car rope and is moved up and down in balance with the lower car at the time of vertical movement, is arranged on the upper side of the elevator shaft. Inversely, the upper car is arranged on the upper side of the elevator shaft, and the upper car balancing weight is arranged on the lower side of the elevator shaft.

[0007] Also, a total of two shock absorbers are provided under the lower car and under the upper car balancing weight at the bottom of the elevator shaft. The shock absorber under the lower car absorbs a shock when the

lower car collides with the bottom of the elevator shaft due to a failure etc. Also, the shock absorber under the upper car balancing weight absorbs a shock of the upper car balancing weight that collides with the bottom of the elevator shaft when the upper car moves up and collides with the upper part of the elevator shaft, and thereby indirectly absorbs a shock of collision of the upper car.

[0008] However, when the lower car overshoots to the upper part of the elevator shaft, when the upper car overshoots to the lower part of the elevator shaft, when the upper car and the lower car come close to each other, or the like, the above-described elevator system has no precautionary means for preventing these phenomena. Therefore, when the car or balancing weight cannot be stopped due to a failure of a control system etc., the cars or the balancing weights collide directly with each other, by which the cars or the balancing weights are sometimes damaged.

Disclosure of the Invention

[0009] Accordingly, the present invention proposes an improved elevator system for avoiding a collision between cars or balancing weights caused by upward or downward overshoot of car or by any other causes as described above or for alleviating the collision shock.

[0010] Therefore, the present invention provides an elevator system including an elevator shaft; a plurality of elevating bodies which move up and down in the elevator shaft; driving means for independently moving the elevating bodies up and down; and between-elevating bodies braking means which moves up and down by being arranged between one elevating body of the elevating bodies and another elevating body arranged just under the elevating body, and stops independently as necessary between the one elevating body and the other elevating body.

[0011] According to the present invention, the elevating bodies arranged vertically can be prevented from colliding directly with each other. Therefore, the safety of elevator system can further be ensured, and damage etc. caused by a collision between the elevating bodies can be prevented.

Brief Descriptions of Drawings

[0012]

Figure 1 is a front view for illustrating an elevator system in accordance with the first embodiment of the present invention.

Figure 2 is a side view for illustrating an elevator system in accordance with the first embodiment of the present invention.

Figure 3 is a front view for illustrating the between-cars brake system of the elevator system in accordance with the first embodiment of the present invention.

Figure 4 is a side view for illustrating the between-cars brake system of the elevator system in accordance with the first embodiment of the present invention.

Figure 5 is a schematic view for illustrating the hydraulic system of the between-cars brake system in accordance with the first embodiment of the present invention.

Figure 6 is a front view for illustrating the state in which the between-cars brake system is operating in accordance with the first embodiment of the present invention.

Figure 7 is a side view for illustrating the state in which the between-cars brake system is operating in accordance with the first embodiment of the present invention.

Figure 8 is a front view for illustrating the state in which the between-cars brake system is operating in accordance with the first embodiment of the present invention.

Figure 9 is a side view for illustrating the state in which the between-cars brake system is operating in accordance with the first embodiment of the present invention.

Figure 10 is a front view for illustrating an elevator system in accordance with the second embodiment of the present invention.

Best Mode for Carrying Out the Invention

[0013] Embodiments of the present invention will now be described with reference to the accompanying drawings. In the drawings, the same reference numerals are applied to the same or equivalent elements, and the explanation thereof will be simplified or omitted.

[0014] First, a first embodiment of the present invention will be described with reference to Figures 1 to 9.

[0015] Figures 1 and 2 are schematic views for illustrating an elevator system 100 in accordance with the first embodiment of the present invention. Figure 1 is a front view, and Figure 2 is a side view.

[0016] In this description, the side on which a car doorway is provided is referred to as a front side (left-hand side in Figure 2), and the opposite side (right-hand side in Figure 2) is referred to as a back side.

[0017] Referring to Figures 1 and 2, the elevator system 100 includes an elevator shaft 2, a pair of car guide rails 4 erected in the elevator shaft 2, a pair of balancing weight guide rails 6, a lower car elevator 100a and an upper car elevator 100b, which move up and down independently in the elevator shaft 2.

[0018] The lower car elevator 100a includes a lower car 12a and a lower car balancing weight 14a, which move up and down in the elevator shaft 2. Also, below the lower car 12a is provided a suspension sheave 16, and above the lower car balancing weight 14a is provided a suspension sheave 18. On the upper side of the elevator shaft 2, a lower car traction machine 20a is provided.

Both ends of a lower car rope 22a are fixed to rope retainers 24 provided above the elevator shaft 2. The lower car rope 22a extending from one end fixed to the rope retainer 24, is wound on the suspension sheave 16 below the lower car 12a, passing through the bottom of the lower car 12a, and is wound on the lower car traction machine 20a above the elevator shaft 2. Further, the lower car rope 22a extends from the lower car traction machine 20a, being wound on the suspension sheave 18 above the lower car balancing weight 14a, and the other end is fixed to the rope retainer 24.

[0019] Thus, the lower car elevator 100a is an elevator in which a rope is wound as in a 2:1 roping system. In the central portion of the lower car balancing weight 14a, a rope through hole 26 formed in the elevating direction is provided.

[0020] Also, at the bottom of the elevator shaft 2 under the lower car 12a, a lower car shock absorber 28a is provided.

[0021] On the other hand, the upper car elevator 100b includes an upper car 12b and an upper car balancing weight 14b, which move up and down in the elevator shaft 2. Also, on the upper side of the elevator shaft 2 is provided an upper car traction machine 20b. One end of an upper car rope 22b is fixed to a position near the center of the ceiling surface of the upper car 12b, and the other end thereof is fixed to a position near the center of the ceiling surface of the upper car balancing weight 14b. Also, a portion of the upper car rope 22b between the upper car 12b and the upper car balancing weight 14b is wound on the upper car traction machine 20b. In other words, one end of the upper car rope 22b is fixed to the ceiling of the upper car 12b, and after the upper car rope 22b extends upwards and is wound on the upper car traction machine 20b from the upper car 12b, the upper car rope 22b passes through the rope through hole 26 in the lower car balancing weight 14a, and the other end thereof is fixed to the ceiling of the upper car balancing weight 14b.

[0022] Thus, the upper car elevator 100b is an elevator in which a rope is wound as in a 1:1 roping system.

[0023] Also, at the bottom of the elevator shaft 2 under the upper car balancing weight 14b, an upper car shock absorber 28b is provided.

[0024] The following is an explanation of the positional relationship between the lower car elevator 100a and the upper car elevator 100b, which are configured as described above, in the elevator shaft 2.

[0025] The upper car 12b and the lower car 12a are arranged at the upper and lower positions, respectively, in the elevating direction in the elevator shaft 2. Specifically, the lower car 12a is arranged just under the upper car 12b, and always moves up and down in the range under the upper car 12b.

[0026] The lower car balancing weight 14a and the upper car balancing weight 14b are arranged at the upper and lower positions, respectively, in the elevating direction in the elevator shaft 2. Specifically, the lower car

balancing weight 14a is arranged just over the upper car balancing weight 14b, and always moves up and down in the range over the upper car balancing weight 14b.

[0027] Between the lower car 12a and the upper car 12b, a between-cars brake system 30 is provided.

[0028] Figures 3 and 4 are schematic views for illustrating the between-cars brake system 30. Figure 3 is a front view, and Figure 4 is a side view.

[0029] Referring to Figures 3 and 4, in the between-cars brake system 30, one lower-side shock absorber 32a is provided on a rail gripper 34 so as to project downward. Also, on both sides of the lower-side shock absorber 32a, two upper-side shock absorbers 32b are arranged so as to project upward, and are provided on the rail gripper 34.

[0030] Both ends of the rail gripper 34 each are connected to a guide 36, and are provided movably on the car guide rail 4 by the guide 36. Also, on the rail gripper 34, supports 38 are provided on both sides of the upper-side shock absorbers 32b. Each of the supports 38 is provided with a lower-side collision detector 40a and an upper-side collision detector 40b, which project downward and upward, respectively. The support 38 is filled with oil so that at the normal time, the collision detectors 40a and 40b project downward and upward by means of a hydraulic pressure of oil filled in the support 38.

[0031] On the ceiling surface of the lower car 12a is provided a power unit 42.

[0032] The rail gripper 34 includes a lower-side support plate 48a and an upper-side support plate 48b, which are arranged perpendicularly to the car guide rails 4.

[0033] In a portion contacting with the car guide rail 4 at each end of the lower-side support plate 48a, a lower holding member 50a is provided. As shown in Figure 4, each of the lower holding members 50a is provided with a lower wedge-shaped groove 52a, the width of which decreases upward. The lower-side support plate 48a is arranged perpendicularly to the car guide rails 4 in a state in which the lower wedge-shaped groove 52a provided at each end of the lower-side support plate 48a engages with the car guide rail 4.

[0034] Referring again to Figures 3 and 4, at each end of the front side of the lower-side support plate 48a, an L-shaped lower lever 54a is provided. Each of the lower levers 54a is made up of a longitudinal portion and a transverse portion, which is connected to one end of the longitudinal portion and is provided perpendicularly thereto. The longitudinal portion of the lower lever 54a is rotatably installed to each end of the lower-side support plate 48a by a lower rotation pin 56a. The transverse portion is arranged in the direction directed from the front side to the back side. At one end of the transverse portion of the lower lever 54a on the back side, a lower roller 58a is provided. The lower roller 58a is fitted in the lower wedge-shaped groove 52a together with the car guide rail 4.

[0035] At the end of the longitudinal portion of the lower lever 54a on the side opposite to a portion connecting to

the transverse portion, one end of a lower spring 60a is fixed. The other end of the lower spring 60a is fixed to the guide 36. The lower spring 60a provides an elastic force so as to press the lower lever 54a downward.

[0036] On the surface of the lower lever 54a which is opposed to the surface on which the lower spring 60a is provided, a hydraulic lower pressing device 62a is provided. The lower pressing device 62a is filled with oil to apply pressure so as to provide a force for pushing back the elastic force of the lower spring 60a to the opposite side, i.e., upward by means of the hydraulic pressure.

[0037] As described above, the lower-side support plate 48a is provided with the lower holding member 50a, the lower wedge-shaped groove 52a, the lower lever 54a, the lower rotation pin 56a, the lower roller 58a, the lower spring 60a, and the lower pressing device 62a. Also, at each end of the upper-side support plate 48b are provided an upper holding member 50b, an upper wedge-shaped groove 52b, an upper lever 54b, an upper rotation pin 56b, an upper roller 58b, an upper spring 60b, and an upper pressing device 62b in a form symmetrical with the lower-side support plate 48a with respect to a horizontal line. Contrary to the lower wedge-shaped groove 52a, the upper wedge-shaped groove 52b has a shape such that the width decreases downward. Also, contrary to the lower spring 60a, the upper spring 60b provides a force pushing the upper lever 54b upward. Therefore, contrary to the lower pressing device 62a, the upper pressing device 62b provides a force such as to push back the upper lever 54b downward against a braking force of the upper spring 60b.

[0038] The lower-side support plate 48a and the upper-side support plate 48b, each of which is provided with the above-described elements, are arranged in parallel in the direction perpendicular to the car guide rails 4, by which the rail gripper 34 is formed.

[0039] Figure 5 is a schematic view for illustrating the state in which the power unit 42 is connected to the support 38 and the pressing devices 62a and 62b.

[0040] Referring to Figures 3 to 5, the power unit 42 provided on the ceiling of the lower car 12a is connected to each of the supports 38 by a hydraulic pipe 64 for support. Also, the power unit 42 is connected to each of the lower pressing devices 62a by a hydraulic pipe 66a for a lower pressing device, and is connected to each of the upper pressing devices 62b by a hydraulic pipe 66b for an upper pressing device.

[0041] As shown in Figure 5, in the power unit 42, the hydraulic pipe 66a for the lower pressing device and the hydraulic pipe 64 for support are connected to each other via a lower valve 68a, and the hydraulic pipe 66b for the upper pressing device and the hydraulic pipe 64 for support are connected to each other by an upper valve 68b. While in Figure 5, only connections of the support 38 and the pressing devices 62a, 62b on one side are shown, the support 38 and the pressing devices 62a, 62b on the other side are practically connected in the same manner.

[0042] Figures 6 and 7 are schematic views for illus-

trating the state in which in the elevator system 100, the lower car 12a moves up and collides with the upper car 12b. Figure 6 is a front view, and Figure 7 is a side view. Also, Figures 8 and 9 are schematic views for illustrating the state in which in the elevator system 100, the upper car 12b moves down and collides with the lower car 12a. Figure 8 is a front view, and Figure 9 is a side view.

[0043] Next, the operation of the elevator system 100 in accordance with the first embodiment will be described with reference to Figures 1 to 9.

[0044] First, referring to Figures 1 and 2, in the lower car elevator 100a of the elevator system 100, the lower car rope 22a is moved by a rotation of the lower car traction machine 20a. Along with the movement of the lower car rope 22a, the lower car 12a and the lower car balancing weight 14a move up or down in a balanced state while the tension of the lower car rope 22a is kept.

[0045] Also, in the upper car elevator 100b, the upper car rope 22b is moved by a rotation of the upper car traction machine 20b. Along with the movement of the upper car rope 22b, the upper car 12b and the upper car balancing weight 14b move up or down in a balanced state while the tension of the upper car rope 22b is kept.

[0046] At this time, the lower car traction machine 20a and the upper car traction machine 20b can be driven independently to move the lower car 12a and the upper car 12b. Therefore, for example, only the upper car elevator 100b can be operated while the lower car elevator 100a is in a state in which the lower car 12a is stopped at a position lower than the lowest floor in the elevator shaft 2, so that the elevator system 100 can be operated according to the utilization frequency. In the elevator system 100, when both of the elevators 100a and 100b are operated normally, control is carried out to prevent the cars 12a and 12b from colliding with each other.

[0047] When the lower car 12a does not stop due to any cause such as a failure of the traction machine etc. even if it moves downward further from the lowest floor in the elevator shaft 2, the lower car 12a collides with the lower car shock absorber 28a. By the lower car shock absorber 28a, a shock caused when the lower car 12a collides with the bottom floor of the elevator shaft 2 is alleviated.

[0048] Also, when the upper car 12b does not stop even if it moves upward further from the highest floor in the elevator shaft 2, the upper car balancing weight 14b inversely moves downward further from the lowest floor in the elevator shaft 2. In this case, the upper car balancing weight 14b collides with the upper car shock absorber 28b provided at the bottom of the elevator shaft 2. By the upper car shock absorber 28b, a shock caused when the upper car balancing weight 14b collides with the bottom floor of the elevator shaft 2 is alleviated. Thereby, a shock caused when the upper car 12b collides with the ceiling of the elevator shaft 2 is also alleviated indirectly.

[0049] Further, for example, when the lower car 12a does not stop and comes close to the stopping or decelerating upper car 12b due to a failure of the control system

or any other cause, as shown in Figure 6, the distance between the ceiling surface of the lower car 12a and the bottom surface of the upper car 12b becomes short. Thereby, the collision detectors 40a and 40b are held between the ceiling surface of the lower car 12a and the bottom surface of the upper car 12b and are pressed.

[0050] Referring to Figure 5, when the collision detectors 40a and 40b are pressed, the pressure in the supports 38 rises. Thereby, the oil filled in the supports 38 is discharged to the hydraulic pipe 64 for support. When the pressure in the hydraulic pipe 64 for support is increased to a predetermined value by the discharged oil, the valves 68a and 68b are opened. Thereby, the oil in the supports 38 is discharged into the power unit 42 through the hydraulic pipe 64 for support, so that the collision detectors 40a and 40b become in a state of being housed in the supports 38.

[0051] On the other hand, since the valves 68a and 68b are opened, the oil filled in the pressing devices 62a and 62b is discharged via the hydraulic pipes 66a and 66b for pressing device, respectively. Thereby, the hydraulic force of the pressing devices 62a and 62b is released.

[0052] Referring again to Figures 6 and 7, when the hydraulic force of the pressing device 62a, 62b is released, the spring 60a, 60b having been pushed back by the pressing device 62a, 62b extends to turn the lever 54a, 54b around the rotation pin 56a, 56b. Thereby, the roller 58a, 58b is pushed toward the side on which the width of the wedge-shaped groove 52a, 52b decreases, and is pushed in between the car guide rail 4 and the wedge-shaped groove 52a, 52b. Thereby, the between-cars brake system 30 is supported by the car guide rails 4, and stops at a midway position of the elevator shaft 2.

[0053] For example, when the downward movement of the upper car 12b does not stop due to a failure of the upper car traction machine 20b or any other cause, the upper car 12b collides with the upper-side shock absorbers 32b of the stopped between-cars brake system 30, and stops while the collision shock is absorbed.

[0054] Also, a shock caused when the lower car 12a comes close to the upper car 12b is absorbed by the collision with the lower-side shock absorber 32a. Further, when the lower car 12a drops downward due to a failure of the lower car traction machine 20a etc., the lower car 12a collides with the lower car shock absorber 28a, and stops while the collision shock is alleviated.

[0055] On the other hand, when the downward movement of the upper car 12b of the elevator system 100 cannot be controlled and the upper car 12b moves down and collides with the lower car 12a, the between-cars brake system 30 operates in the same way as described above. In this case as well, as shown in Figures 8 and 9, the distance between the ceiling surface of the lower car 12a and the bottom surface of the upper car 12b becomes short, and thereby the collision detectors 40a and 40b are pressed. Therefore, the oil in the supports 38 is discharged to the hydraulic pipe 64 for support, and

the valves 68a and 68b are opened. Thereby, the hydraulic pressure in the pressing devices 62a and 62b is released, and hence the springs 60a and 60b extend, so that the rollers 58a and 58b are fitted in the wedge-shaped grooves 52a and 52b, and thus the between-cars brake system 30 is stopped by the wedge effect.

[0056] In this case, a shock caused when the upper car 12b comes close to and collides with the lower car 12a is absorbed by the upper-side shock absorbers 32b. Also, when the lower car 12a drops due to a failure of the lower car traction machine 20a etc., the lower car 12a collides with the lower car shock absorber 28a, and the collision shock is absorbed.

[0057] When the between-cars brake system 30 is moving upward, a frictional force between the roller 58a, 58b and the car guide rail 4 acts downward. Therefore, a frictional force against the car guide rail 4, which is opposite to the upward elastic force from the lower spring 60a, is applied to the lower roller 58a, so that a force by which the lower roller 58a is fitted into the lower wedge-shaped groove 52a is somewhat weak. Contrarily, a downward frictional force against the car guide rail 4 is applied to the upper roller 58b in addition to the downward elastic force from the upper spring 60b, so that the upper roller 58b is fitted into the upper wedge-shaped groove 52b more strongly.

[0058] Inversely, when the between-cars brake system 30 is moving downward, a frictional force between the roller 58a, 58b and the car guide rail 4 acts upward. Therefore, a force by which the lower roller 58a is fitted into the lower wedge-shaped groove 52a is stronger.

[0059] That is to say, when the between-cars brake system 30 is moving up, the upward movement thereof is stopped mainly by the wedge effect of the upper roller 58b and the upper wedge-shaped groove 52b, and when the between-cars brake system 30 is moving down, the downward movement thereof is stopped mainly by the wedge effect of the lower roller 58a and the lower wedge-shaped groove 52a.

[0060] As described above, according to the first embodiment, the collision shock can be absorbed by the between-cars brake system 30 provided between the lower car 12a and the upper car 12b. Also, since the between-cars brake system 30 can be stopped independently at a midway position in the elevator shaft 2, the downward movement of the upper car 12b can be stopped at that position. Therefore, damage etc. caused by a collision between the upper and lower cars can be prevented.

[0061] In the first embodiment, explanation has been given of the case where a collision is detected by hydraulic pressure to stop the between-cars brake system 30. In this case, without especially providing electrical control, a collision is detected, whereby the car can be stopped, or the collision shock can be alleviated. Therefore, the between-cars brake system 30 can be operated in a case of power outage, a failure of control system, or the like. However, the present invention is not limited to

hydraulic operation. For example, the operation may be such that a collision is detected by a sensor or the like, and an electrical signal is sent to the pressing devices to release the elastic force of the springs 60a, 60b, by which the between-cars brake system is stopped.

[0062] In the first embodiment, explanation has been given of the case where the between-cars brake system 30 is provided over the lower car 12a. However, the present invention is not limited to this configuration. The between-cars brake system 30 may be provided on the bottom of the upper car 12b in any form.

[0063] In the first embodiment, explanation has been given of the case where for the lower car elevator 100a, the rope is wound in the 2:1 roping system, and for the upper car elevator 100b, the rope is wound in the 1:1 roping system. However, the present invention is not limited to this configuration, and other roping systems may be used.

[0064] The between-cars brake system 30 explained in the first embodiment has one lower-side shock absorber 32a and two upper-side shock absorbers 32b. However, the present invention is not limited to this configuration. The number and arrangement of the shock absorbers are not subject to any special restriction. For example, one shock absorber may be provided on the upper side and the lower side.

[0065] Also, the between-cars brake system 30 in the first embodiment is stopped at a midway position of the car guide rail 4 by the wedge effect of the roller 58a, 58b and the wedge-shaped groove 52a, 52b of the rail gripper 34. However, the present invention is not limited to this configuration. The between-cars brake system 30 may be stopped by any other method.

[0066] The shapes of the between-cars brake system 30 and other elements of the present invention are not limited to those explained in this embodiment. Any other shape and structure that can achieve the same effect may be used.

[0067] Next, a second embodiment of the present invention will be described with reference to Figure 10.

[0068] Figure 10 is a front view for illustrating an elevator system 200 in accordance with the second embodiment of the present invention.

[0069] The elevator system 200 is similar to the elevator system 100 explained in the first embodiment. In the elevator system 200, unlike the elevator system 100, the between-cars brake system 30 is not provided. In place of the between-cars brake system 30, a between-balancing weights brake system 70 is provided over the upper car balancing weight 14b.

[0070] A structure of the between-balancing weights brake system 70 is the same as the structure of the between-cars brake system 30 in the first embodiment. The between-balancing weights brake system 70 operates in the same way as the between-cars brake system 30. It operates when the upper and lower balancing weights 14a and 14b come close to each other, and is fixed to the balancing weight guide rails 6 by fitting rollers into

wedge-shaped grooves engaging with the balancing weight guide rails 6. Also, the between-balancing weights brake system 70 is provided with the lower and upper shock absorbers 32a and 32b. When the balancing weight 14a, 14b collides with the stopped between-balancing weights brake system 70, it collides with the shock absorber 32a, 32b. Thereby, the collision shock between the upper and lower balancing weights 14a and 14b can be alleviated. By the alleviating of collision shock between the balancing weights 14a and 14b, the collision between the cars 12a and 12b connected by the rope 22a, 22b can be restrained, or the collision shock can be alleviated.

[0071] Other portions are the same as those explained in the first embodiment, so that the explanation thereof will be omitted.

[0072] In the second embodiment, explanation has been given of the case where the between-balancing weights brake system 70 is provided on the ceiling of the upper car balancing weight 14b. However, the present invention is not limited to this configuration. The between-balancing weights brake system 70 may be provided on the bottom of the lower car balancing weight 14a.

[0073] Also, in the second embodiment, the between-balancing weights brake system 70 is provided only between the balancing weights 14a and 14b. However, the present invention is not limited to this configuration. The between-cars brake system 30 as explained in the first embodiment may additionally be provided between the cars 12a and 12b. By doing this, the collision shock of the car or the balancing weight caused, for example, when the rope is cut can be alleviated properly.

[0074] In the present invention, an elevating body corresponds, for example, to the lower car 12a and the upper car 12b or the lower car balancing weight 14a and the upper car balancing weight 14b in the first and second embodiments, and driving means corresponds, for example, to the lower car traction machine 20a and the upper car traction machine 20b. Also, between-elevating bodies braking means corresponds, for example, to the between-cars brake system 30 in the first embodiment or the between-balancing weights brake system 70 in the second embodiment.

[0075] In the present invention, a shock absorber corresponds, for example, to the lower-side shock absorber 32a and the upper-side shock absorbers 32b in the first and second embodiments, and detecting means corresponds, for example, to the collision detectors 40a and 40b.

[0076] Also, in the present invention, a braking member corresponds, for example, to the rollers 58a and 58b in the first and second embodiments, a projecting member corresponds, for example, to the collision detectors 40a and 40b, and a pushing member corresponds, for example, to the springs 60a and 60b. Further, a pressing member corresponds, for example, to the pressing devices 62a and 62b, a pipe for detecting means corresponds, for example, to the hydraulic pipe 64 for support,

and a pressing member pipe corresponds, for example, to the hydraulic pipes 66a and 66b for pressing device.

Industrial Applicability

[0077] As described above, in the present invention, between-elevating bodies braking means, which stops independently, is provided between elevating bodies arranged vertically. Therefore, the elevating bodies arranged vertically can be prevented from colliding directly with each other, so that the safety of operation of elevator system can be ensured, and also damage etc. caused by the collision between the elevating bodies can be prevented. Thereupon, the present invention is useful as the elevator system.

Claims

1. An elevator system (100), comprising:

an elevator shaft (2);
a plurality of elevating bodies (12a, 12b, 14a, 14b) which move up and down in said elevator shaft (2); and
driving means (20a, 20b) for independently moving said elevating bodies (12a, 12b, 14a, 14b) up and down; **characterized by**
between-elevating bodies braking means (30) which moves up and down by being arranged between one elevating body (12b, 14a) of said elevating bodies (12a, 12b, 14a, 14b) and another elevating body (12a, 14b) arranged just under said elevating body (12b, 14a), and stops independently as necessary between said one elevating body (12b, 14a) and said another elevating body (12a, 14b).

2. The elevator system (100) according to claim 1, **characterized in that** said between-elevating bodies braking means (30) has a shock absorber (32a, 32b) which is provided at a position corresponding to said one elevating body (12b, 14a) or said other elevating body (12a, 14b) to alleviate the collision shock of said one elevating body (12b, 14a) or said another elevating body (12a, 14b).

3. The elevator system (100) according to claim 1 or 2, **characterized in that** said between-elevating bodies braking means (30) has detecting means (40a, 40b) for detecting approach when said one elevating body (12b, 14a) and said another elevating body (12a, 14b) approach each other so as to have a predetermined distance therebetween, and the upward or downward movement is stopped according to the detection of approach by said detecting means (40a, 40b).

4. The elevator system (100) according to claim 1 or 2, **characterized in that** said elevator shaft (2) has a guide rail (4,6) for guiding the movement of said elevating bodies (12a,12b,14a,14b) ;
 said between-elevating bodies braking means (30) has a braking member (58a,58b) provided at a position opposed to said guide rail (4,6) ; and
 said between-elevating bodies braking means (30) is stopped as necessary by pressing said braking member (58a, 58b) against said guide rail (4,6).
5. The elevator system (100) according to claim 4, **characterized in that** said between-elevating bodies braking means (30) comprises:

detecting means (40a, 40b) which includes a projecting member (40a,40b) which is filled with a fluid therein and is projected by applying a pressure, and detects approach by pressing said projecting member (40a, 40b) when said one elevating body (12b,14a) and said another elevating body (12a,14b) approach to each other to have a predetermined distance therebetween;

a pushing member (60a,60b) which applies a force in the direction such that said braking member (58a,58b) is pushed against said guide rail (4,6) ;

a pressing member (62a, 62b) which is filled with a fluid therein to apply a pressure, and applies a force to said braking member (58a,58b) in the direction opposite to said pushing member (60a, 60b) by means of said pressure;

a hydraulic pipe (64) for detecting means (40a, 40b) which is connected to said detecting means (40a, 40b) and can discharge the fluid in said detecting means (40a, 40b) when said projecting portion is pressed;

a valve (68a,68b) which is connected to said hydraulic pipe (64) for detecting means (40a, 40b), and is opened when the fluid is discharged to said pipe for detecting means (40a, 40b); and
 a pressing member hydraulic pipe (66a, 66b) which connects said pressing member to said valve, and discharges the fluid in said pressing member (62a, 62b) when said valve (68a, 68b) is opened.

6. The elevator system (100) according to claim 5, **characterized in that** said between-elevating bodies braking means (30) is provided with a wedge-shaped groove (52a, 52b) that engages with said guide rail (4, 6) ;
 said braking member (58a, 58b) is a roller (58a, 58b) fitted in said wedge-shaped groove (52a, 52b); and
 said pushing member (60a, 60b) stops said between-elevating bodies braking means (30) by pushing said roller (58a, 58b) into said wedge-shaped

groove (52a, 52b) and by pressing said roller (58a, 58b) against said guide rail (4, 6).

7. The elevator system (100) according to any one of claims 1 to 6, **characterized in that** said elevating bodies (12a, 12b, 14a, 14b) include at least two sets of elevating bodies including a car (12a, 12b) and a balancing weight (14a, 14b), which are connected to each other by a rope (22a, 22b); and
 said between-elevating bodies braking means (30) is arranged between a car (12a) of one set of elevating bodies and a car (12b) of another set of elevating bodies, of said elevating bodies (12a, 12b, 14a, 14b).

8. The elevator system (100) according to any one of claims 1 to 6, **characterized in that** said elevating bodies (12a, 12b, 14a, 14b) include at least two sets of elevating bodies including a car (12a, 12b) and a balancing weight (14a, 14b), which are connected to each other by a rope (22a, 22b); and
 said between-elevating bodies braking means (30) is arranged between a balancing weight (14a) of one set of elevating bodies and a balancing weight (14b) of another set of elevating bodies, of said elevating bodies (12a, 12b, 14a, 14b).

Patentansprüche

1. Aufzugssystem (100) mit:

einem Aufzugsschacht (2),
 mehreren Anhebekörpern (12a, 12b, 14a, 14b), die sich in dem Aufzugsschacht (2) nach oben und nach unten bewegen und
 einem Antriebsmittel (20a, 20b) zum unabhängigen nach oben und nach unten Bewegen der Anhebekörper (12a, 12b, 14a, 14b), **gekennzeichnet durch**
 ein Bremsmittel (30) zwischen den Anhebekörpern, welches sich nach oben und nach unten bewegt, indem es zwischen einem Anhebekörper (12b, 14a) der Anhebekörper (12a, 12b, 14a, 14b) und einem anderen Anhebekörper (12a, 14b) angeordnet ist, der genau unter dem Anhebekörper (12b, 14a) angeordnet ist, und das unabhängig, falls nötig, zwischen dem einen Anhebekörper (12b, 14a) und dem anderen Anhebekörper (12a, 14b) anhält.

2. Aufzugssystem (100) nach Anspruch 1, **dadurch gekennzeichnet, dass** das Bremsmittel (30) zwischen den Anhebekörpern einen Schockabsorbierer (33a, 32b) aufweist, der an einer Position entsprechend dem einen Anhebekörper (12b, 14a) oder dem anderen Anhebekörper (12a, 14b) vorgesehen ist, um den Kollisionsschock des einen Anhebekör-

pers (12b, 14a) oder des anderen Anhebekörpers (12a, 14b) zu lindern.

3. Aufzugssystem (100) nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** das Bremsmittel (30) zwischen den Anhebekörpern ein Erfassungsmittel (40a, 40b) aufweist, um ein Annähern zu erfassen, wenn sich der eine Anhebekörper (12b, 14a) und der andere Anhebekörper (12a, 14b) einander so annähern, dass sie einen voreingestellten Abstand dazwischen aufweisen, und die Bewegung nach oben oder nach unten gemäß der Annäherungserfassung durch das Erfassungsmittel (40a, 40b) angehalten wird.
4. Aufzugssystem (100) nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** der Aufzugsschacht (2) eine Führungsschiene (4, 6) zum Führen der Bewegung der Anhebekörper (12a, 12b, 14a, 14b) aufweist, das Bremsmittel (30) zwischen den Anhebekörpern ein Bremsselement (58a, 58b) aufweist, das an einer Position gegenüber der Führungsschiene (4, 6) vorgesehen ist und das Bremsmittel (30) zwischen den Anhebekörpern, falls benötigt, angehalten wird, indem das Bremsselement (58a, 58b) gegen die Führungsschiene (4, 6) gedrückt wird.
5. Aufzugssystem (100) nach Anspruch 4, **dadurch gekennzeichnet, dass** das Bremsmittel (30) zwischen den Anhebekörpern aufweist:

ein Erfassungsmittel (40a, 40b) welches ein Vorstehelement (40a, 40b) aufweist, das mit einem Fluid gefüllt ist und das durch Aufbringen eines Druck hervorsteht, und welches eine Annäherung erfasst, indem das Vorstehelement (40a, 40b) gedrückt wird, wenn der eine Anhebekörper (12b, 14a) und der andere Anhebekörper (12a, 14b) sich so einander annähern, dass sie einen voreingestellten Abstand dazwischen aufweisen, ein Drückelement (60a, 60b), welches eine Kraft in einer solchen Richtung aufbringt, dass das Bremsselement (58a, 58b) gegen die Führungsschiene (4, 6) gedrückt wird, ein Presselement (62a, 62b), das mit einem Fluid angefüllt ist, um einen Druck aufzubringen und welches eine Kraft auf das Bremsselement (58a, 58b) in der Richtung entgegengesetzt zu dem Drückelement (60a, 60b) durch den Druck aufbringt, eine Hydraulikröhre (64) für das Erfassungsmittel (40a, 40b), die mit dem Erfassungsmittel (40a, 40b) verbunden ist und das Fluid in dem Erfassungsmittel (40a, 40b) ausgeben kann, wenn der Vorstehabschnitt gepresst wird,

ein Ventil (68a, 68b), welches mit der Hydraulikröhre (64) für das Erfassungsmittel (40a, 40b) verbunden ist und welches offen ist, wenn das Fluid zu der Röhre für das Erfassungsmittel (40a, 40b) hin ausgegeben wird, und eine Presselement-Hydraulikröhre (66a, 66b), welche das Presselement mit dem Ventil verbindet und welches das Fluid in dem Presselement (68a, 68b) ausgibt, wenn das Ventil (68a, 68b) geöffnet wird.

6. Aufzugssystem (100) nach Anspruch 5, **dadurch gekennzeichnet, dass** das Bremsmittel (30) zwischen den Anhebekörpern mit einer keilförmigen Nut (52a, 52b) versehen ist, die mit der Führungsschiene (4, 6) in Eingriff treten kann, das Bremsselement (58a, 58b) eine Rolle (58a, 58b) ist, die in die keilförmige Nut (52a, 52b) eingepasst ist und das Drückelement (60a, 60b) das Bremsmittel (30) zwischen den Anhebekörpern durch Drücken der Rolle (58a, 58b) in die keilförmige Nut (52a, 52b) und durch Pressen der Rolle (58a, 58b) gegen die Führungsschiene (4, 6) anhält.
7. Aufzugssystem (100) nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** die Anhebekörper (12a, 12b, 14a, 14b) wenigstens zwei Gruppen an Anhebekörpern einschließlich einer Kabine (12a, 12b) und einem Gegengewicht (14a, 14b) aufweisen, die miteinander durch ein Seil (22a, 22b) verbunden sind und das Bremsmittel (30) zwischen den Anhebekörpern zwischen einer Kabine (12a) einer Gruppe an Anhebekörpern und einer Kabine (12b) einer anderen Gruppe an Anhebekörpern unter den Anhebekörpern (12a, 12b, 14a, 14b) angeordnet ist.
8. Aufzugssystem (100) nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** die Anhebekörper (12a, 12b, 14a, 14b) wenigstens zwei Gruppen an Anhebekörpern einschließlich einer Kabine (12a, 12b) und einem Gegengewicht (14a, 14b) enthalten, die miteinander durch ein Seil (22a, 22b) verbunden sind und das Bremsmittel (30) zwischen den Anhebekörpern zwischen einem Gegengewicht (14a) einer Gruppe an Anhebekörpern und einem Gegengewicht (14b) einer anderen Gruppe an Anhebekörpern unter den Anhebekörpern (12a, 12b, 14a, 14b) angeordnet ist.

Revendications

1. Système d'ascenseur (100), comprenant :
une cage d'ascenseur (2) ;
une pluralité de corps élévateurs (12a, 12b, 14a,

- 14b) qui montent et descendent dans ladite cage d'ascenseur (2) ; et
un moyen d'entraînement (20a, 20b) pour monter et descendre lesdits corps élévateurs (12a, 12b, 14a, 14b) de manière indépendante ; **caractérisé par**
un moyen (30) de freinage entre les corps élévateurs qui monte et descend en étant disposé entre un corps élévateur (12b, 14a) desdits corps élévateurs (12a, 12b, 14a, 14b) et un autre corps élévateur (12a, 14b) disposé juste en-dessous dudit corps élévateur (12b, 14a), et si besoin s'arrête de manière indépendante entre ledit un corps élévateur (12b, 14a) et ledit autre corps élévateur (12a, 14b).
2. Système d'ascenseur (100) selon la revendication 1, **caractérisé en ce que** ledit moyen (30) de freinage entre les corps élévateurs possède un amortisseur (32a, 32b) qui est pourvu à une position correspondant audit un corps élévateur (12b, 14a) ou audit autre corps élévateur (12a, 14b) pour atténuer le choc de la collision dudit un corps élévateur (12b, 14a) ou dudit autre corps élévateur (12a, 14b).
3. Système d'ascenseur (100) selon la revendication 1 ou 2, **caractérisé en ce que** ledit moyen (30) de freinage entre les corps élévateurs possède un moyen de détection (40a, 40b) pour détecter une approche lorsque ledit un corps élévateur (12b, 14a) et ledit autre corps élévateur (12a, 14b) se rapprochent l'un de l'autre de sorte à avoir une distance prédéterminée entre eux, et le déplacement vers le haut ou vers le bas est stoppé selon la détection d'approche par ledit moyen de détection (40a, 40b).
4. Système d'ascenseur (100) selon la revendication 1 ou 2, **caractérisé en ce que** ladite cage d'ascenseur (2) possède un rail de guidage (4, 6) pour guider le mouvement desdits corps élévateurs (12a, 12b, 14a, 14b) ; ledit moyen (30) de freinage entre les corps élévateurs possède un élément de freinage (58a, 58b) pourvu à une position opposée audit rail de guidage (4, 6) ; et ledit moyen (30) de freinage entre les corps élévateurs est stoppé si besoin en pressant ledit élément de freinage (58a, 58b) contre ledit rail de guidage (4, 6).
5. Système d'ascenseur (100) selon la revendication 4, **caractérisé en ce que** ledit moyen (30) de freinage entre les corps élévateurs comprend :
un moyen de détection (40a, 40b) qui comporte un élément en saillie (40a, 40b) qui est rempli d'un fluide et est projeté en appliquant une pression, et qui détecte une approche en pressant ledit élément en saillie (40a, 40b) lorsque ledit un corps élévateur (12b, 14a) et ledit autre corps élévateur (12a, 14b) se rapprochent l'un de l'autre pour avoir une distance prédéterminée entre eux ;
un élément de poussée (60a, 60b) qui applique une force dans la direction de telle sorte que ledit élément de freinage (58a, 58b) soit poussé contre ledit rail de guidage (4, 6) ;
un élément de pression (62a, 62b) qui est rempli d'un fluide pour appliquer une pression, et applique une force audit élément de freinage (58a, 58b) dans la direction opposée audit élément de poussée (60a, 60b) au moyen de ladite pression ;
un tuyau hydraulique (64) pour le moyen de détection (40a, 40b) qui est relié audit moyen de détection (40a, 40b) et peut décharger le fluide dans ledit moyen de détection (40a, 40b) lorsque ladite partie en saillie est pressée ;
une soupape (68a, 68b) qui est reliée audit tuyau hydraulique (64) pour le moyen de détection (40a, 40b), et est ouverte lorsque le fluide est déchargé vers ledit tuyau pour le moyen de détection (40a, 40b) ; et
un tuyau hydraulique (66a, 66b) d'élément de pression qui relie ledit élément de pression à ladite soupape, et décharge le fluide dans ledit élément de pression (62a, 62b) lorsque ladite soupape (68a, 68b) est ouverte.
6. Système d'ascenseur (100) selon la revendication 5, **caractérisé en ce que** ledit moyen (30) de freinage entre les corps élévateurs est pourvu d'une rainure (52a, 52b) en forme de coin qui vient en prise avec ledit rail de guidage (4, 6) ; ledit élément de freinage (68a, 68b) est un rouleau (58a, 58b) ajusté dans ladite rainure (52a, 52b) en forme de coin ; et ledit élément de poussée (60a, 60b) stoppe ledit moyen (30) de freinage entre les corps élévateurs en poussant ledit rouleau (58a, 58b) dans ladite rainure (52a, 52b) en forme de coin et en pressant ledit rouleau (58a, 58b) contre ledit rail de guidage (4, 6).
7. Système d'ascenseur (100) selon l'une quelconque des revendications 1 à 6, **caractérisé en ce que** lesdits corps élévateurs (12a, 12b, 14a, 14b) comportent au moins deux ensembles de corps élévateurs comportant une cabine (12a, 12b) et une masse d'équilibrage (14a, 14b), qui sont reliées l'une à l'autre par un câble (22a, 22b) ; et ledit moyen (30) de freinage entre les corps élévateurs est disposé entre une cabine (12a) d'un ensemble de corps élévateurs et une cabine (12b) d'un autre ensemble de corps élévateurs desdits corps élévateurs (12a, 12b, 14a, 14b).

8. Système d'ascenseur (100) selon l'une quelconque des revendications 1 à 6, **caractérisé en ce que** lesdits corps élévateurs (12a, 12b, 14a, 14b) comportent au moins deux ensembles de corps élévateurs comportant une cabine (12a, 12b) et une masse d'équilibrage (14a, 14b), qui sont reliées l'une à l'autre par un câble (22a, 22b) ; et ledit moyen (30) de freinage entre les corps élévateurs est disposé entre une masse d'équilibrage (14a) d'un ensemble de corps élévateurs et une masse d'équilibrage (14b) d'un autre ensemble de corps élévateurs, desdits corps élévateurs (12a, 12b, 14a, 14b).

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Fig. 1

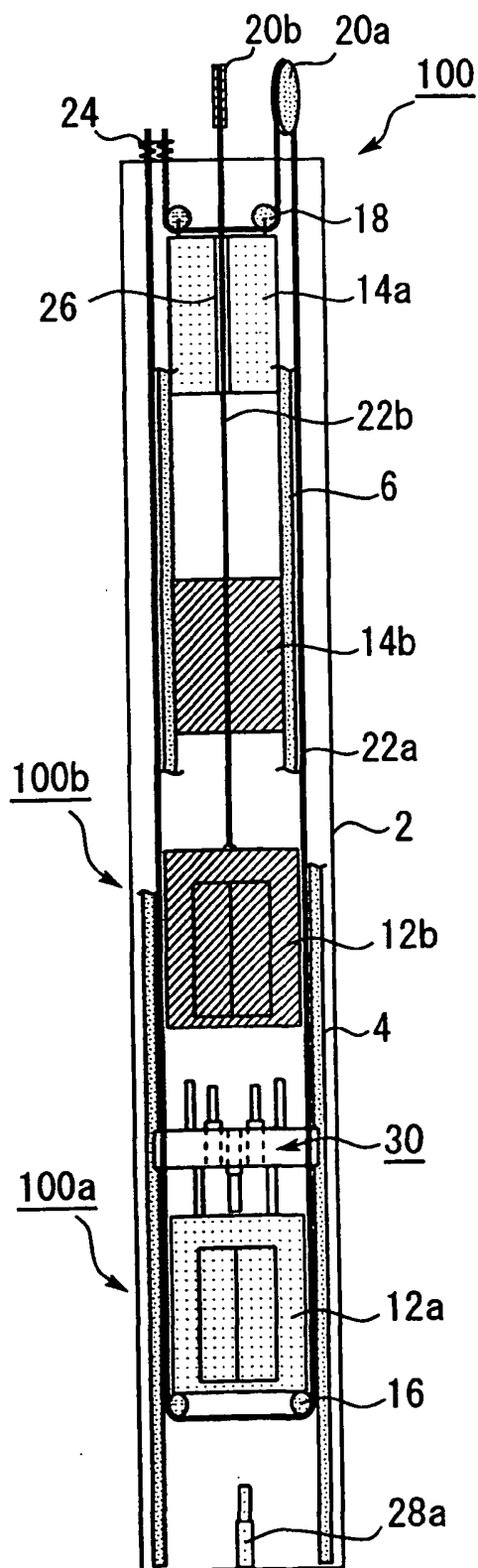


Fig. 2

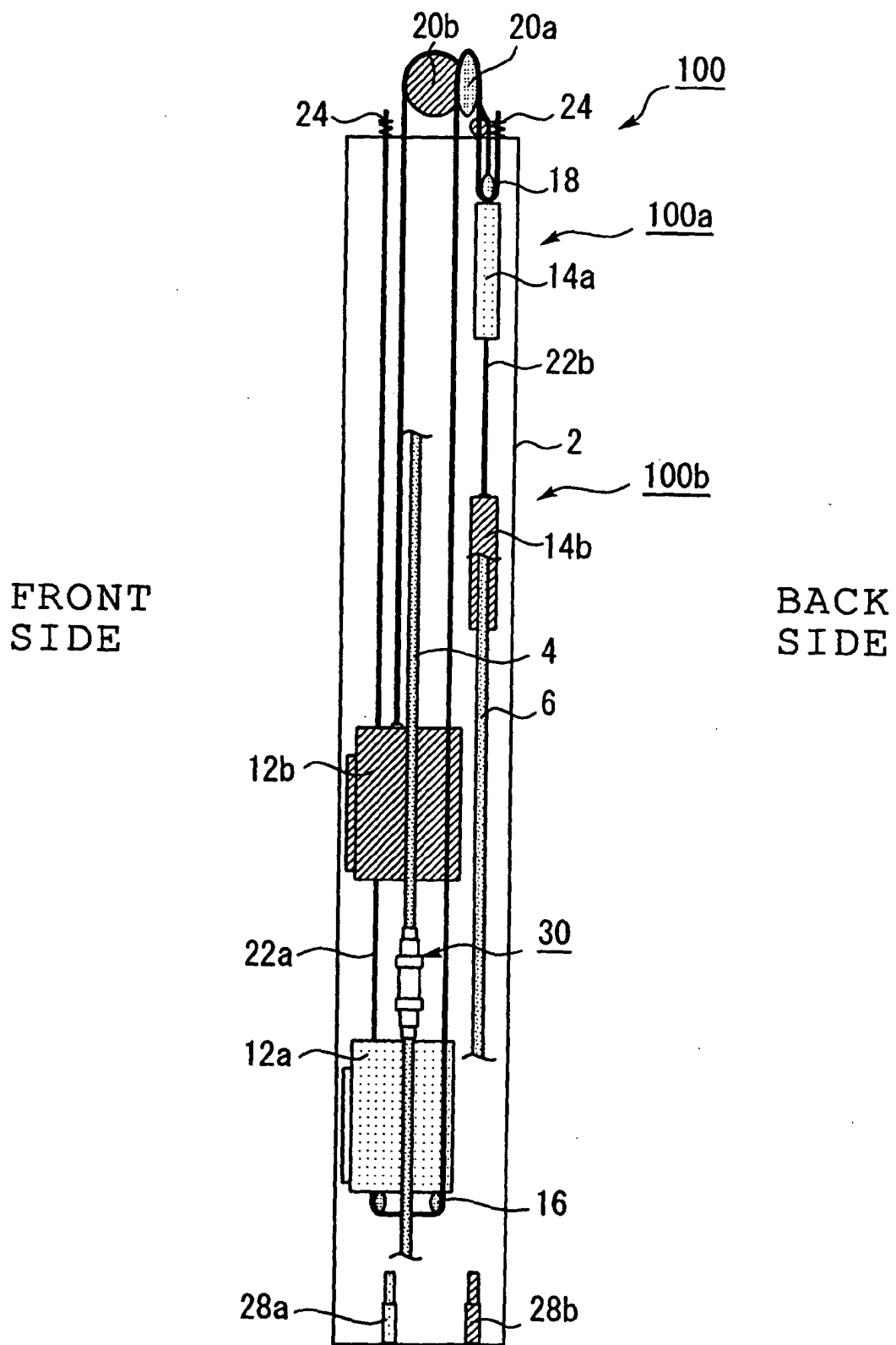


Fig. 3

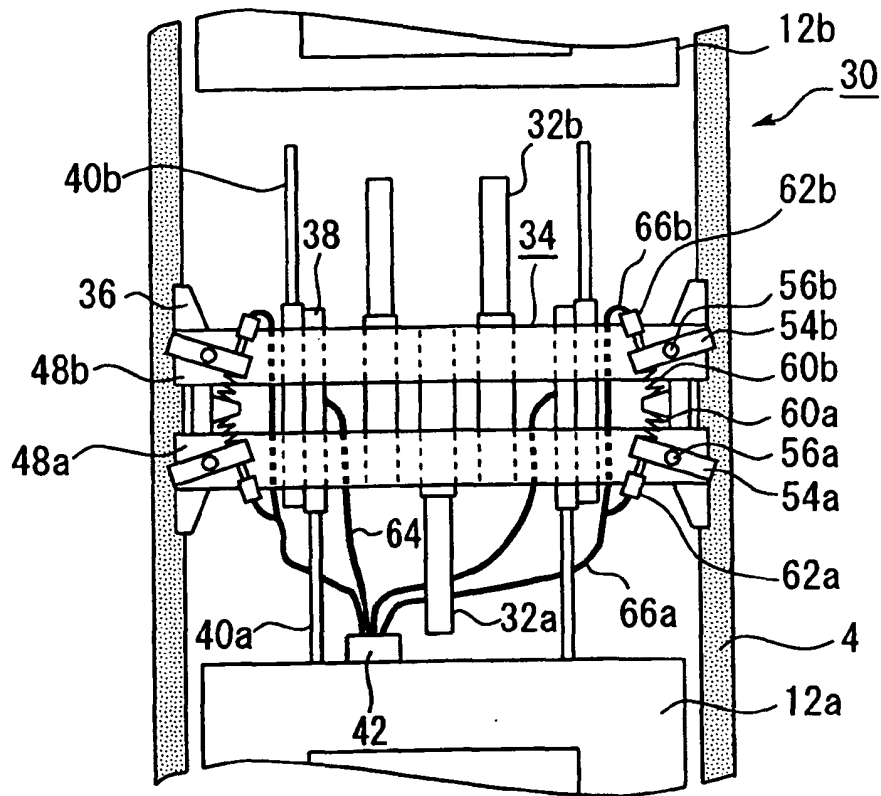


Fig. 4

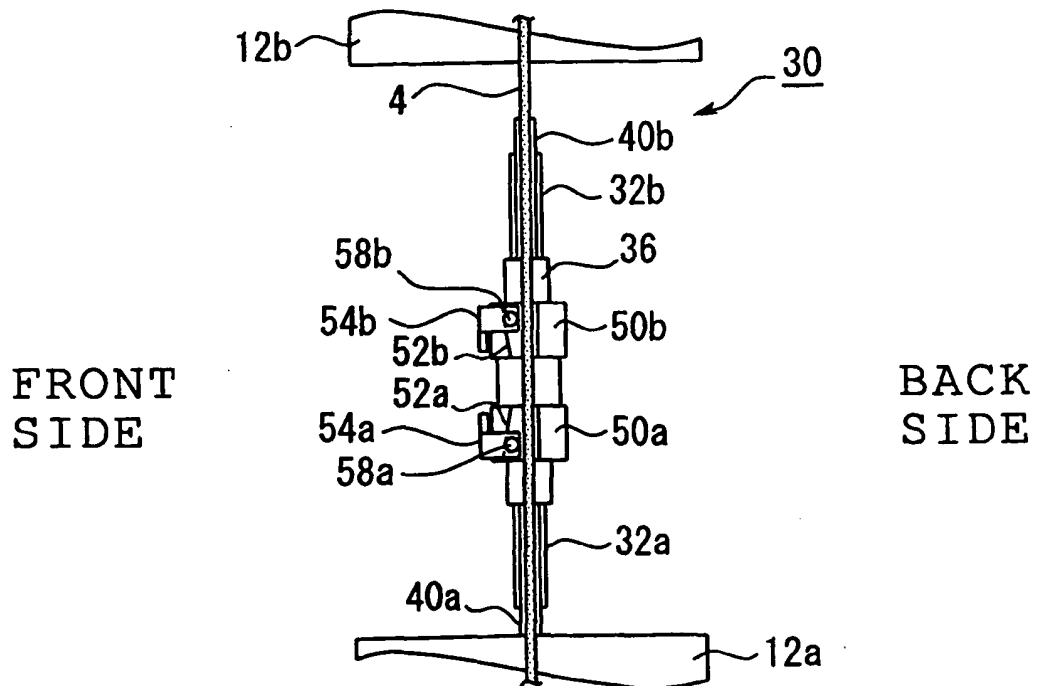


Fig. 5

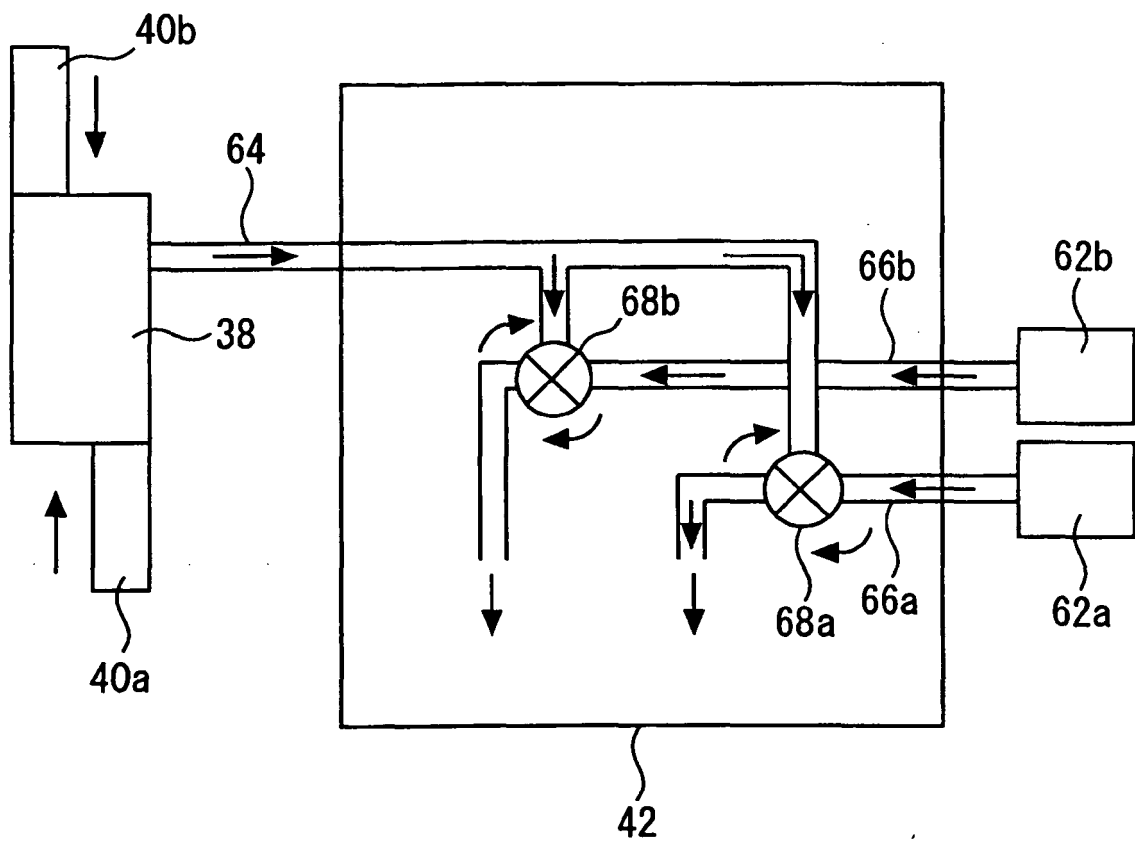


Fig. 6

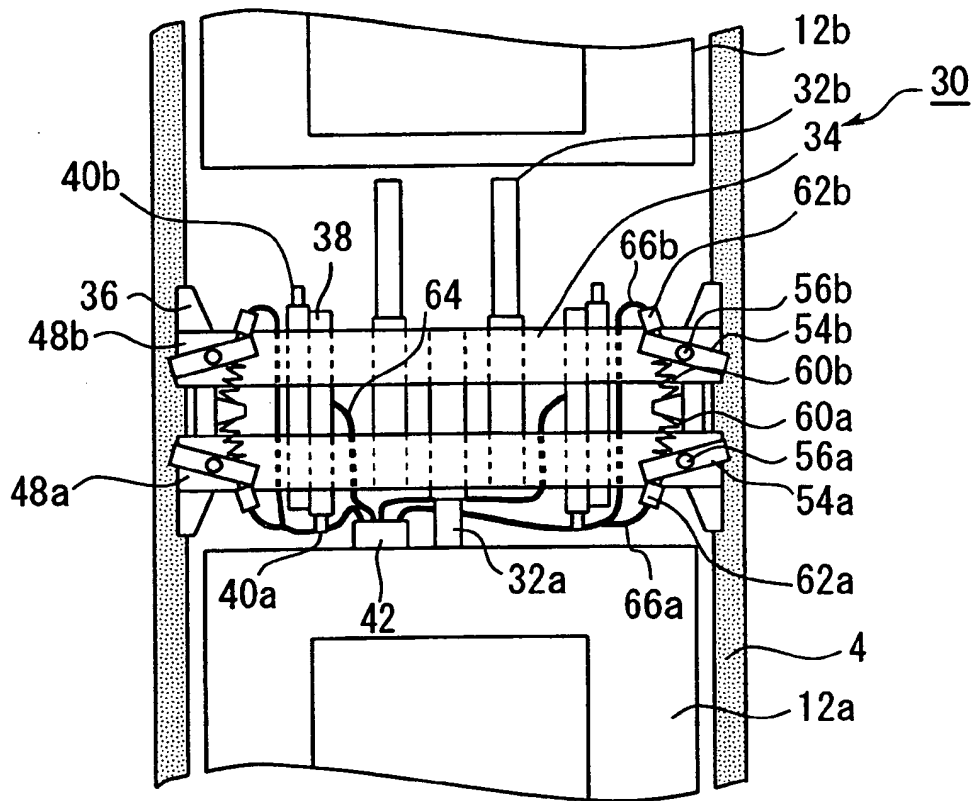


Fig. 7

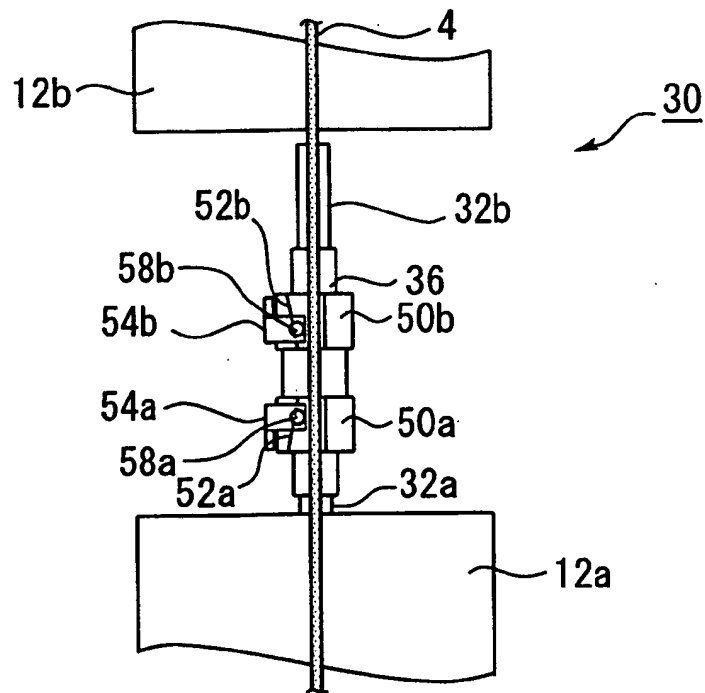


Fig. 8

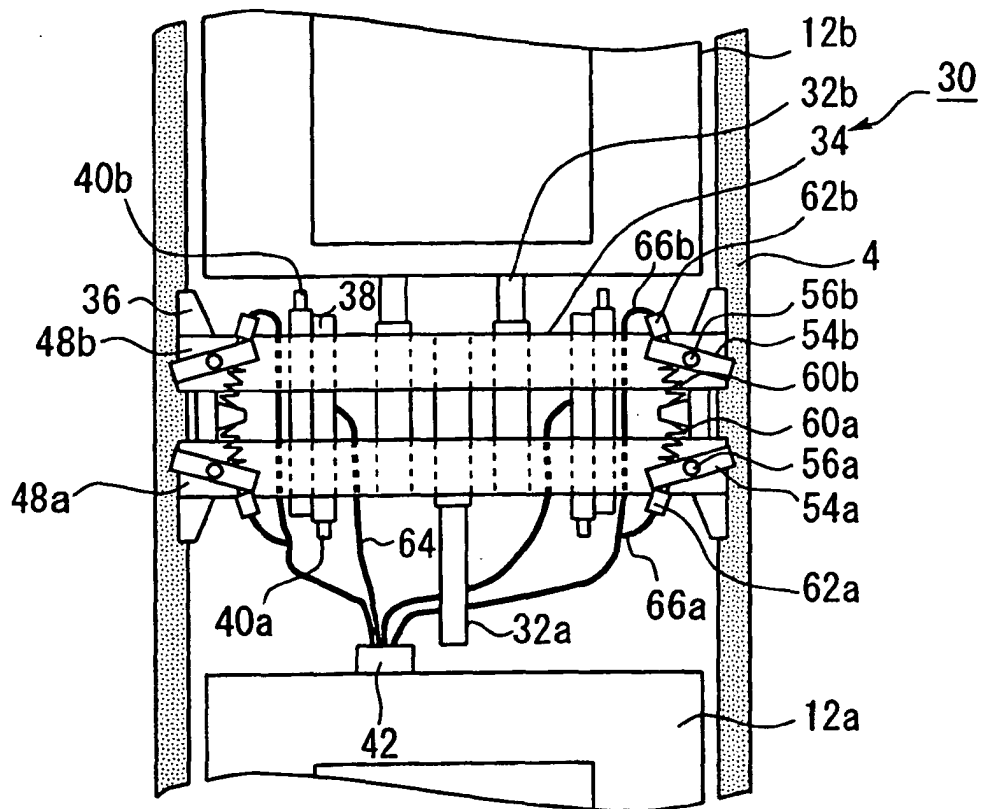


Fig. 9

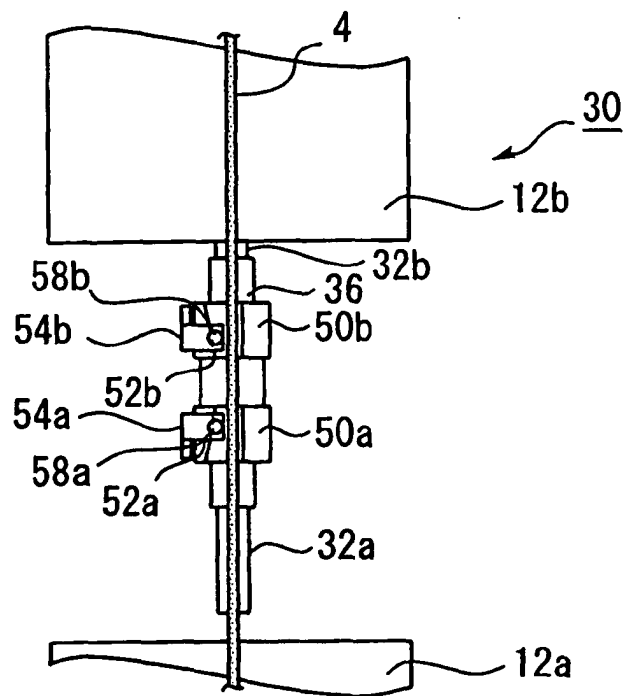
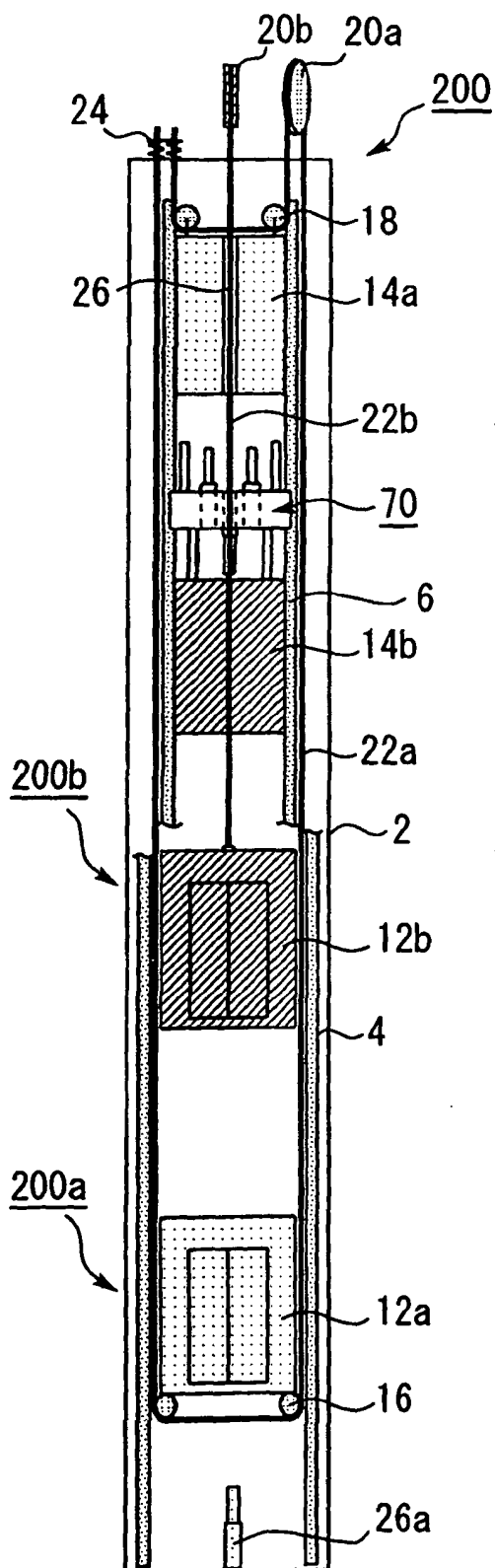


Fig. 10



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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