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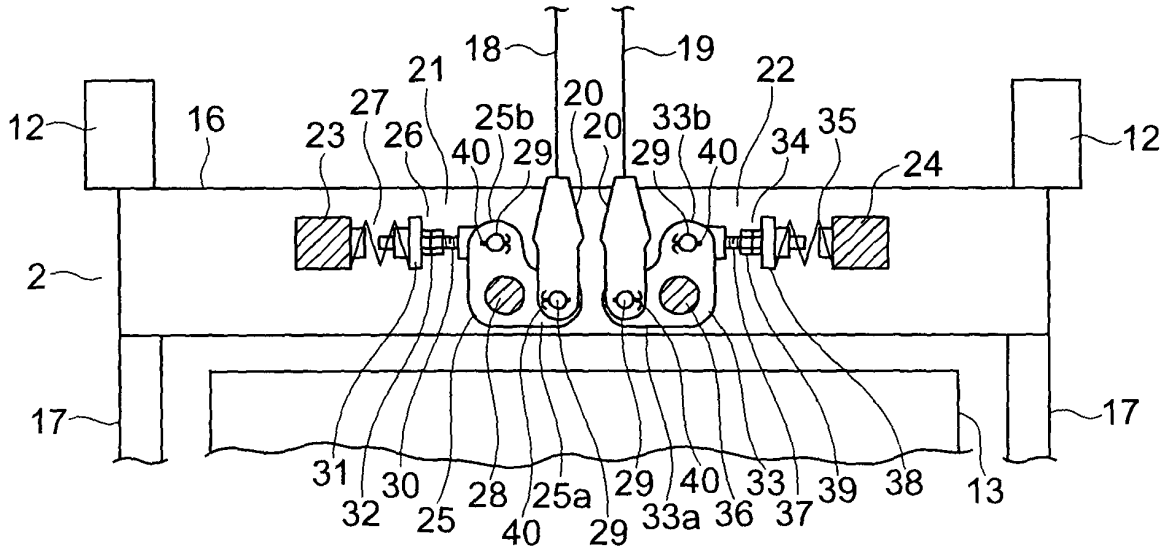
(54) **SUSPENSION DEVICE FOR ELEVATOR**

(57) A suspension device for an elevator has a main rope for suspending a raised/lowered body, and a cleat device for joining the main rope to the raised/lowered body. The cleat device is provided on the raised/lowered body. The cleat device includes a turning lever having an end of the main rope connected thereto to be turned with respect to the raised/lowered body through vertical displacement of the raised/lowered body with respect to the end of the main rope, a displacement body that is displaced horizontally with respect to the raised/lowered body through the turning of the turning lever, and an urging body for urging the displacement body in such a direction as to act against downward displacement of the raised/lowered body with respect to the end of the main rope.

FIG. 3



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Description

Technical Field

[0001] The present invention relates to a suspension device for an elevator, which serves to suspend a raised/lowered body such as a car.

Background Art

[0002] Conventionally, with a view to reducing the height dimension of a car, there is proposed a coupling device for an elevator main rope which is structured such that a guide roller for deflecting the main rope horizontally is provided on an upper portion of the car and that a thimble rod provided at an end of the main rope is installed horizontally on the car (see Patent Document 1).

[0003] Patent Document 1: JP 2005-212941 A

Disclosure of the Invention

Problem to be solved by the Invention

[0004] However, the main rope is constantly bent by the guide roller, so the life of the main rope is shortened.

[0005] The present invention has been made to solve the above-mentioned problem, and it is therefore an object of the present invention to provide a suspension device for an elevator, which makes it possible to reduce the dimension of a raised/lowered body in a height direction thereof and prolong the life of a main rope for suspending the raised/lowered body.

Means for solving the Problem

[0006] A suspension device for an elevator according to the present invention includes: a main rope for suspending a raised/lowered body; and a cleat device provided on the raised/lowered body and having a turning lever having connected thereto an end of the main rope to be turned with respect to the raised/lowered body through vertical displacement of the raised/lowered body with respect to the end of the main rope, a displacement body that is horizontally displaced with respect to the raised/lowered body through turning of the turning lever, and an urging body for urging the displacement body in such a direction as to act against downward displacement of the raised/lowered body with respect to the end of the main rope.

Brief Description of the Drawings

[0007]

Fig. 1 is a schematic diagram showing an elevator according to Embodiment 1 of the present invention.
Fig. 2 is a front view showing the car of Fig. 1.
Fig. 3 is a front view showing the upper portion of the car of Fig. 2.
Fig. 4 is a front view showing the cleat devices at the time when the tensile forces of the main ropes of Fig. 3 are adjusted.
Fig. 5 is a front view showing a suspension device for an elevator according to Embodiment 2 of the present invention.
Fig. 6 is a front view showing a suspension device for an elevator according to Embodiment 3 of the present invention.
Fig. 7 is a perspective view showing an elevator according to Embodiment 4 of the present invention.
Fig. 8 is a front view showing the upper portion of the car of Fig. 7.
Fig. 9 is a perspective view showing an elevator according to Embodiment 5 of the present invention.
Fig. 10 is a front view showing the upper portion of the car of Fig. 9.

Best Modes for carrying out the Invention

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

Embodiment 1

[0009] Fig. 1 is a schematic diagram showing an elevator according to Embodiment 1 of the present invention. Referring to Fig. 1, a car (raised/lowered body) 2 and a counterweight (raised/lowered body) 3 are provided in a manner enabling the raising/lowering thereof within a hoistway 1. A support pedestal 5 is provided within a machine room 4 provided in an upper portion of the hoistway 1. A hoisting machine 6 serving as a drive device and a deflector pulley 7 are supported on the support pedestal 5.

[0010] The hoisting machine 6 has a hoisting machine body 8 including a motor, and a drive sheave 9 that is rotated by the hoisting machine body 8. A main rope group 10 for suspending the car 2 and the counterweight 3 is looped around the drive sheave 9 and the deflector pulley 7. The car 2 and the counterweight 3 are raised/lowered within the hoistway 1 through rotation of the drive sheave 9.

[0011] Fig. 2 is a front view showing the car 2 of Fig. 1. Referring to Fig. 2, a pair of guide rails 11 are installed within the hoistway 1. The car 2 is disposed between the guide rails 11. Guide devices 12, each of which is guided by the guide rail 11, are provided on an upper portion of the car 2 and a lower portion of the car 2, respectively. When the guide devices 12 are guided by the guide rails 11, the car 2 is thereby raised/lowered along the guide rails 11.

[0012] The car 2 has a car chamber 13, and a car frame 14 for supporting the car chamber 13. The car frame 14 has a lower frame 15 on which the car chamber 13 is laid, an upper frame 16 disposed above the car chamber

13, and a pair of longitudinal frames 17 for coupling ends of the lower frame 15 to ends of the upper frame 16, respectively.

[0013] The main rope group 10 includes a plurality (a pair in this example) of main ropes 18 and 19. The main ropes 18 and 19 are subjected to a terminal treatment at ends thereof by main rope stopper clasps (terminal clasps) 20. A cleat device 21 for fastening the end of the main rope 18 of the main ropes 18 and 19 to the car 2 and a cleat device 22 for fastening the end of the other main rope 19 to the car 2 are provided on the upper frame 16, that is, on the upper portion of the car 2.

[0014] Fig. 3 is a front view showing the upper portion of the car 2 of Fig. 2. Referring to Fig. 3, the cleat devices 21 and 22 are horizontally disposed adjacent to each other. The ends of the main ropes 18 and 19 are disposed between the cleat devices 21 and 22. The ends of the main ropes 18 and 19 and the cleat devices 21 and 22 are disposed between a pair of receiving members 23 and 24 provided on the upper frame 16.

[0015] One of the cleat devices 21 has a turning lever 25 turnable with respect to the car 2, a displacement body 26 connected to the turning lever 25 to be displaced horizontally with respect to the car 2 through the turning of the turning lever 25, and an urging spring (urging body) 27 contracted between the displacement body 26 and the receiving member 23 to generate an elastic restoring force.

[0016] The turning lever 25 is turnable around a support shaft 28 provided on the upper frame 16. The turning lever 25 has a main rope mounting portion 25a located on the cleat device 22 side with respect to the support shaft 28 (i.e., on the other side of receiving member 23 side with respect to support shaft 28), and a displacement body mounting portion 25b located above the support shaft 28. That one of the terminal clasps 20 which is provided at the end of the main rope 18 is connected to the main rope mounting portion 25a by a pin 29. The displacement body 26 is connected at one end thereof to the displacement body mounting portion 25b by another pin 29.

[0017] The turning lever 25 is turned in such a direction that the main rope mounting portion 25a is displaced upward (counterclockwise in Fig. 3) through downward displacement of the car 2 with respect to the end of the main rope 18, and in such a direction that the main rope mounting portion 25a is displaced downward (clockwise in Fig. 3) through upward displacement of the car 2 with respect to the end of the main rope 18.

[0018] The displacement body 26 is displaced toward the receiving member 23 through the turning of the turning lever 25 in such a direction that the main rope mounting portion 25a is displaced upward, and away from the receiving member 23 through the turning of the turning lever 25 in such a direction that the main rope mounting portion 25a is displaced downward.

[0019] The displacement body 26 has a rod (displacement body main unit) 30 connected to the displacement body mounting portion 25b, an adjustment member (spring bracket) 31 provided on the rod 30 and designed to be adjustable in position horizontally (in the direction of displacement of displacement body 26) with respect to the rod 30, and a double nut (positioning device) 32 screwed on the rod 30 to fix the adjustment member 31 in position (i.e., to position adjustment member 31) with respect to the rod 30.

[0020] The urging spring 27 is contracted between the adjustment member 31 and the receiving member 23. That is, the urging spring 27 urges the displacement body 26 in such a direction as to act against displacement of the displacement body 26 toward the receiving member 23 (i.e., in such a direction as to act against downward displacement of car 2 with respect to the end of main rope 18). Thus, the rod 30 receives an urging force of the urging spring 27 as a compressive force. The receiving member 23 receives from the urging spring 27 a reactive force of the urging force applied to the displacement body 26.

[0021] The urging force of the urging spring 27 is adjusted by adjusting the position of the adjustment member 31 with respect to the rod 30. The tensile force of the main rope 18 is adjusted by adjusting the urging force of the urging spring 27.

[0022] The other cleat device 22 has a turning lever 33 turnable with respect to the car 2, a displacement body 34 connected to the turning lever 33 to be displaced horizontally with respect to the car 2 through the turning of the turning lever 33, and an urging spring (urging body) 35 contracted between the displacement body 34 and the receiving member 24 to generate an elastic restoring force.

[0023] The turning lever 33 is turnable around a support shaft 36 provided on the upper frame 16. The turning lever 33 has a main rope mounting portion 33a located on the cleat device 21 side with respect to the support shaft 36 (i.e., on the other side of receiving member 24 side with respect to support shaft 36), and a displacement body mounting portion 33b located above the support shaft 36. That one of the terminal clasps 20 which is provided at the end of the main rope 19 is connected to the main rope mounting portion 33a by a pin 29. The displacement body 34 is connected at one end thereof to the displacement body mounting portion 33b by another pin 29.

[0024] The turning lever 33 is turned in such a direction that the main rope mounting portion 33a is displaced upward (clockwise in Fig. 3) through downward displacement of the car 2 with respect to the end of the main rope 19, and in such a direction that the main rope mounting portion 33a is displaced downward (counterclockwise in Fig. 3) through upward displacement of the car 2 with respect to the end of the main rope 19.

[0025] The displacement body 34 is displaced toward the receiving member 24 through the turning of the turning lever 33 in such a direction that the main rope mounting portion 33a is displaced upward, and away from the

receiving member 24 through the turning of the turning lever 33 in such a direction that the main rope mounting portion 33a is displaced downward.

[0026] The displacement body 34 has a rod (displacement body main unit) 37 connected to the displacement body mounting portion 33b and disposed horizontally, an adjustment member (spring bracket) 38 provided on the rod 37 and designed to be adjustable in position horizontally (in direction of displacement of displacement body 34) with respect to the rod 37, and a double nut (positioning device) 39 screwed on the rod 37 to fix the adjustment member 38 in position (i.e., to position adjustment member 38) with respect to the rod 37.

[0027] The urging spring 35 is contracted between the adjustment member 38 and the receiving member 24. That is, the urging spring 35 urges the displacement body 34 in such a direction as to act against displacement of the displacement body 34 toward the receiving member 24 (i.e., in such a direction as to act against downward displacement of car 2 with respect to the end of main rope 19). Thus, the rod 37 receives an urging force of the urging spring 35 as a compressive force. The receiving member 24 receives from the urging spring 35 a reactive force of the urging force applied to the displacement body 34.

[0028] The urging force of the urging spring 35 is adjusted by adjusting the position of the adjustment member 38 with respect to the rod 37. The tensile force of the main rope 19 is adjusted by adjusting the urging force of the urging spring 35. The pins 29 are each provided with a retainer 40 for preventing disconnection.

[0029] Fig. 4 is a front view showing the cleat devices 21 and 22 at the time when the tensile forces of the main ropes 18 and 19 of Fig. 3 are adjusted. As shown in Fig. 4, the position of the adjustment member 31 with respect to the rod 30 and the position of the adjustment member 38 with respect to the rod 37 are adjusted to equalize the tensile forces of the main ropes 18 and 19 with each other. In this example, the main rope 18 is longer than the main rope 19, and the tensile forces of the main ropes 18 and 19 are equal to each other when the position of the end of the main rope 18 with respect to the car 2 is lower than the position of the end of the main rope 19 with respect to the car 2.

[0030] In the suspension device for the elevator constructed as described above, the turning lever 25 is turned through vertical displacement of the car 2 with respect to the end of the main rope 18, the displacement body 26 is displaced horizontally through the turning of the turning lever 25, and the urging spring 27 urges the displacement body 26 in such a direction as to act against downward displacement of the car 2 with respect to the end of the main rope 18. Therefore, the displacement body 26 and the urging spring 27 can be disposed horizontally, so the dimension of the cleat device 21 in the height direction thereof can be reduced. The dimension of the terminal clasp 20 provided at the end of the main rope 18 can also be reduced. Thus, the amounts of protrusion of the cleat device 21 and the terminal clasp 20 from the upper frame 16 can be reduced, so the dimension of the car 2 in the height direction thereof can be reduced. Further, the main rope 18 is not bent due to horizontal disposition of the displacement body 26 and the urging spring 27, so the life of the main rope 18 can be prolonged as well.

[0031] The displacement body 26 has the rod 30 connected to the turning lever 25, and the adjustment member 31 provided on the rod 30 and designed to be adjustable in position horizontally with respect to the rod 30, and the urging force of the urging spring 27 is adjusted by adjusting the position of the adjustment member 31 with respect to the rod 30. Therefore, even when the position of the adjustment member 31 with respect to the rod 30 is changed to adjust the tensile force of the main rope 18, only the position of the adjustment member 31 changes horizontally, and the dimension of the cleat device 21 in the height direction thereof does not change. Accordingly, the dimension of the car 2 in the height direction thereof can be reduced.

[0032] The displacement body 26 receives an urging force of the urging spring 27 as a compressive force. Therefore, the urging body 27 and the displacement body 26 can be disposed side by side horizontally, so the dimension of the cleat device 21 in the height direction thereof can be prevented from increasing. The cleat device 22 also achieves the same effect as the cleat device 21.

Embodiment 2

[0033] Fig. 5 is a front view showing a suspension device for an elevator according to Embodiment 2 of the present invention. Referring to Fig. 5, the turning lever 25 has a main rope mounting portion 25a to which the end of the main rope 18 is connected, and a displacement body mounting portion 25b to which one end of the displacement body 26 is connected. The main rope mounting portion 25a is located on the cleat device 22 side with respect to the support shaft 28 (on the other side of receiving member 23 side with respect to support shaft 28). The displacement body mounting portion 25b is located below the support shaft 28.

[0034] The receiving member 23 is disposed between the adjustment member 31 and the turning lever 25. The rod 30 penetrates the receiving member 23. The rod 30 is displaceable horizontally with respect to the receiving member 23. The urging spring 27 is contracted between the adjustment member 31 and the receiving member 23.

[0035] The turning lever 25 is turned in such a direction that the main rope mounting portion 25a is displaced upward through downward displacement of the car 2 with respect to the end of the main rope 18, and in such a direction that the main rope mounting portion 25a is displaced downward through upward displacement of the car 2 with respect to the end of the main rope 18.

[0036] The displacement body 26 is displaced toward

the receiving member 23 through the turning of the turning lever 25 in such a direction that the main rope mounting portion 25a is displaced upward, and away from the receiving member 23 through the turning of the turning lever 25 in such a direction that the main rope mounting portion 25a is displaced downward.

[0037] The urging spring 27 urges the displacement body 26 in such a direction as to act against displacement of the displacement body 26 toward the receiving member 23 (i.e., in such a direction as to act against downward displacement of car 2 with respect to the end of main rope 18). Thus, the rod 30 receives an urging force of the urging spring 27 as a tensile force. The receiving member 23 receives from the urging spring 27 a reactive force of the urging force applied to the displacement body 26.

[0038] The turning lever 33 has the main rope mounting portion 33a to which the end of the main rope 19 is connected, and the displacement body mounting portion 33b to which one end of the displacement body 34 is connected. The main rope mounting portion 33a is located on the cleat device 21 side with respect to the support shaft 36 (i.e., on the other side of receiving member 24 side with respect to support shaft 36). The displacement bodymounting portion 33b is located below the support shaft 36.

[0039] The receiving member 24 is disposed between the adjustment member 38 and the turning lever 33. The rod 37 penetrates the receiving member 24. The rod 37 is displaceable horizontally with respect to the receiving member 24. The urging spring 35 is contracted between the adjustment member 38 and the receiving member 24.

[0040] The turning lever 33 is turned in such a direction that the main rope mounting portion 33a is displaced upward through downward displacement of the car 2 with respect to the end of the main rope 19, and in such a direction that the main rope mounting portion 33a is displaced downward through upward displacement of the car 2 with respect to the end of the main rope 19.

[0041] The displacement body 34 is displaced toward the receiving member 24 through the turning of the turning lever 33 in such a direction that the main rope mounting portion 33a is displaced upward, and away from the receiving member 24 through the turning of the turning lever 33 in such a direction that the main rope mounting portion 33a is displaced downward.

[0042] The urging spring 35 urges the displacement body 34 in such a direction as to act against displacement of the displacement body 34 toward the receiving member 24 (i.e., in such a direction as to act against downward displacement of car 2 with respect to the end of main rope 19). Thus, the rod 37 receives an urging force of the urging spring 35 as a tensile force. The receiving member 24 receives from the urging spring 35 a reactive force of the urging force applied to the displacement body 34. Embodiment 2 of the present invention is identical to Embodiment 1 of the present invention in other constructional details.

[0043] In the suspension device for the elevator constructed as described above, the displacement body 34 receives an urging force of the urging spring 27 as a tensile force. Therefore, the dimension of the cleat device 21 in the height direction thereof can be prevented from increasing, and horizontal displacement of the displacement body 26 can be stabilized. The cleat device 22 also achieves the same effect as the cleat device 21.

Embodiment 3

[0044] Fig. 6 is a front view showing a suspension device for an elevator according to Embodiment 3 of the present invention. Referring to Fig. 6, the turning levers 25 and 33 are turnable around a common support shaft 45 provided on the upper frame 16. The support shaft 45 is disposed between the ends of the main ropes 18 and 19.

[0045] The turning lever 25 has the main rope mounting portion 25a to which the end of the main rope 18 is connected, and the displacement body mounting portion 25b to which one end of the displacement body 26 is connected. The main rope mounting portion 25a is located on the cleat device 22 side with respect to the support shaft 45 (on the other side of receiving member 23 side with respect to support shaft 45). The displacement body mounting portion 25b is located below the support shaft 45.

[0046] The turning lever 33 has the main rope mounting portion 33a to which the end of the main rope 19 is connected, and the displacement body mounting portion 33b to which one end of the displacement body 34 is connected. The main rope mounting portion 33a is located on the cleat device 21 side with respect to the support shaft 45 (on the other side of receiving member 24 side with respect to support shaft 45). The displacement body mounting portion 33b is located below the support shaft 45. Embodiment 3 of the present invention is identical to Embodiment 2 of the present invention in other constructional details.

[0047] In the suspension device for the elevator constructed as described above, the turning levers 25 and 33 are turnable around the common support shaft 45. Therefore, the number of parts can be reduced, so a structural complication and a rise in cost can be prevented.

[0048] In the foregoing example, the turning levers 25 and 33 in Embodiment 2 of the present invention are turnable around the common support shaft 45. However, the turning levers 25 and 33 in Embodiment 1 of the present invention may be turnable around a common support shaft.

Embodiment 4

[0049] Fig. 7 is a perspective view showing an elevator according to Embodiment 4 of the present invention. Referring to Fig. 7, the hoisting machine 6 has the hoisting

machine body 8, a first drive sheave 51, and a second drive sheave 52. The first drive sheave 51 and the second drive sheave 52 are rotated by the hoisting machine body 8. The hoisting machine body 8 is disposed between the first drive sheave 51 and the second drive sheave 52. The first drive sheave 51 and the second drive sheave 52 are rotated around a common rotaryshaft. A first deflector pulley 53 is provided in the vicinity of the first drive sheave 51, and a second deflector pulley 54 is provided in the vicinity of the second drive sheave 52.

[0050] Of the main ropes 18 and 19, the main rope 18 is looped around the first drive sheave 51 and the first deflector pulley 53. The other main rope 19 is looped around the second drive sheave 52 and the second deflector pulley 54. The car 2 and the counterweight 3 are suspended by the main ropes 18 and 19.

[0051] Fig. 8 is a front view showing the upper portion of the car 2 of Fig. 7. Referring to Fig. 8, the ends of the main ropes 18 and 19 are disposed horizontally apart from each other. The cleat devices 21 and 22 are disposed between the ends of the main ropes 18 and 19.

[0052] The cleat devices 21 and 22 are disposed such that the position of the main rope mounting portion 25a with respect to the support shaft 28 and the position of the main rope mounting portion 33a with respect to the support shaft 36 are located horizontally on the other side of each other. The cleat devices 21 and 22 are disposed such that the position of the displacement body mounting portion 25b with respect to the support shaft 28 and the position of the displacement body mounting portion 33b with respect to the support shaft 36 are located vertically on the same side. Thus, the displacement bodies 26 and 34 are displaced in opposite directions through vertical displacement of the car 2 with respect to the ends of the main ropes 18 and 19, respectively.

[0053] In this example, the main rope mounting portions 25a and 33a protrude away from each other from the support shafts 28 and 36, respectively, and the displacement body mounting portions 25b and 33b protrude above the support shafts 28 and 36, respectively. The displacement bodies 26 and 34 are displaced toward each other through downward displacement of the car 2 with respect to the ends of the main ropes 18 and 19, respectively, and away from each other through upward displacement of the car 2 with respect to the ends of the main ropes 18 and 19, respectively.

[0054] A common receiving member 55 coupled to the displacement bodies 26 and 34 via the respective urging springs 27 and 35 is provided between the cleat devices 21 and 22. That is, the receiving member 55 receives from the urging springs 27 and 35 a reactive force of an urging force applied to the displacement body 26 and a reactive force of an urging force applied to the displacement body 34, respectively. The receiving member 55 is displaceable horizontally with respect to the car 2.

[0055] A tubular guide member 56 for guiding horizontal displacement of the receiving member 55 is provided on the upper frame 16. The receiving member 55 is slid within the guide member 56 to be guided horizontally. Embodiment 4 of the present invention is identical to Embodiment 1 of the present invention in other constructional details.

[0056] In the suspension device for the elevator constructed as described above, the car 2 is provided with the common receiving member 55 coupled to the displacement bodies 26 and 34 via the respective urging springs 27 and 35, and the receiving member 55 is displaceable horizontally with respect to the car 2. Therefore, the urging forces of the urging springs 27 and 35 are equal to each other, so the tensile forces of the main ropes 18 and 19 can be prevented from being biased against each other. Accordingly, even in the case where passengers gather at a corner of the car chamber 13 and a biased load is applied to the car 2, the tensile forces of the main ropes 18 and 19 can be prevented from being biased against each other.

Embodiment 5

[0057] Fig. 9 is a perspective view showing an elevator according to Embodiment 5 of the present invention. Referring to Fig. 9, the car 2 and the counterweight 3 are raised/lowered within the hoistway 1 due to driving forces of a first hoisting machine 61 and a second hoisting machine 62. The first hoisting machine 61 has a hoisting machine body 63, and a first drive sheave 64 that is rotated by the hoisting machine body 63. The second hoisting machine 62 has a hoisting machine body 65, and a second drive sheave 66 that is rotated by the hoisting machine body 65. The first drive sheave 64 and the second drive sheave 66 are controlled to be rotated in synchronization with each other.

[0058] The first hoisting machine 61 and the second hoisting machine 62 are disposed with the first drive sheave 64 and the second drive sheave 66 facing each other, respectively. A first deflector pulley 67 is provided in the vicinity of the first drive sheave 64, and a second deflector pulley 68 is provided in the vicinity of the second drive sheave 66.

[0059] Of the main ropes 18 and 19, the main rope 18 is looped around the first drive sheave 64 and the first deflector pulley 67. The other main rope 19 is looped around the second drive sheave 66 and the second deflector pulley 68. The car 2 and the counterweight 3 are suspended by the main ropes 18 and 19.

[0060] Fig. 10 is a front view showing the upper portion of the car 2 of Fig. 9. Referring to Fig. 10, a common receiving member 69 coupled to the displacement bodies 26 and 34 via the respective urging springs 27 and 35 is provided on the upper frame 16. The receiving member 69 is displaceable horizontally with respect to the car 2. Guide members 70 for guiding horizontal displacement of the receiving member 69 are provided on the upper frame 16.

[0061] The receiving member 69 has a first receiving portion 69a disposed between the turning lever 25 and

the adjustment member 31, a second receiving portion 69b disposed between the turning lever 33 and the adjustment member 38, and a joint portion 69c for joining the first receiving portion 69a and the second receiving portion 69b to each other while bypassing the turning levers 25 and 33. The rod 30 displaceably penetrates the first receiving portion 69a, and the rod 37 displaceably penetrates the second receiving portion 69b.

[0062] The guide members 70 are a plurality of protrusion members disposed above and below the receiving member 69. The receiving member 69 is slid along the protrusion members to be guided horizontally. Embodiment 5 of the present invention is identical to Embodiment 2 of the present invention in other constructional details.

[0063] In the suspension device for the elevator constructed as described above, the car 2 is provided with the common receiving member 69 coupled to the displacement bodies 26 and 34 via the respective urging springs 27 and 35, and the receiving member 69 is displaceable horizontally with respect to the car 2. Therefore, the urging forces of the urging springs 27 and 35 are equal to each other, so the tensile forces of the main ropes 18 and 19 can be prevented from being biased against each other. Accordingly, even in the case where, for example, the first drive sheave 64 and the second drive sheave 66 rotate out of synchronization with each other, the tensile forces of the main ropes 18 and 19 can be prevented from being biased against each other, so a load can be prevented from being biased toward one of the first hoisting machine 61 and the second hoisting machine 62.

[0064] In each of the aforementioned embodiments of the present invention, the cleat devices 21 and 22 are provided on the car 2. However, the cleat devices 21 and 22 may be provided on the counterweight 3.

Claims

1. A suspension device for an elevator, comprising:

a main rope for suspending a raised/lowered body; and
a cleat device provided on the raised/lowered body and having

a turning lever having connected thereto an end of the main rope to be turned with respect to the raised/lowered body through vertical displacement of the raised/lowered body with respect to the end of the main rope,
a displacement body that is horizontally displaced with respect to the raised/lowered body through turning of the turning lever, and
an urging body for urging the displacement body in such a direction as to act against downward displacement of the raised/lowered body with respect to the end of the main rope.

2. A suspension device for an elevator according to Claim 1, wherein:

the displacement body comprises

a displacement body main unit connected to the turning lever, and
an adjustment member provided on the displacement body main unit and being adjustable in position horizontally with respect to the displacement body main unit; and

the urging body exerts an urging force that is adjusted by adjusting a position of the adjustment member with respect to the displacement body main unit.

3. A suspension device for an elevator according to Claim 1, wherein the displacement body receives an urging force of the urging body as a compressive force.

4. A suspension device for an elevator according to Claim 1, wherein the displacement body receives an urging force of the urging body as a tensile force.

5. A suspension device for an elevator according to any one of Claims 1 to 4, wherein:

the raised/lowered body is suspended by a plurality of main ropes identical to the main rope;
the raised/lowered body is provided with a plurality of cleat devices identical to the cleat device to which the main ropes are connected; and
the turning lever of each of the plurality of cleat devices is turnable around a common support shaft.

6. A suspension device for an elevator according to any one of Claims 1 to 4, wherein:

the raised/lowered body is suspended by a pair of main ropes identical to the main rope;
the cleat device, to which one of the main ropes is connected, and the cleat device, to which the other of the main ropes is connected, are disposed so that the displacement body of the former cleat device and the displacement body of the latter cleat device are displaced in opposite directions through vertical displacement of the raised/lowered body with respect to ends of the pair of the main ropes;
the raised/lowered body is provided with a common receiving member coupled to the displace-

ment bodies via the urging body of the former cleat device and the urging body of the latter cleat device, respectively; and
the receiving member is displaceable horizontally with respect to the raised/lowered body.

FIG. 1

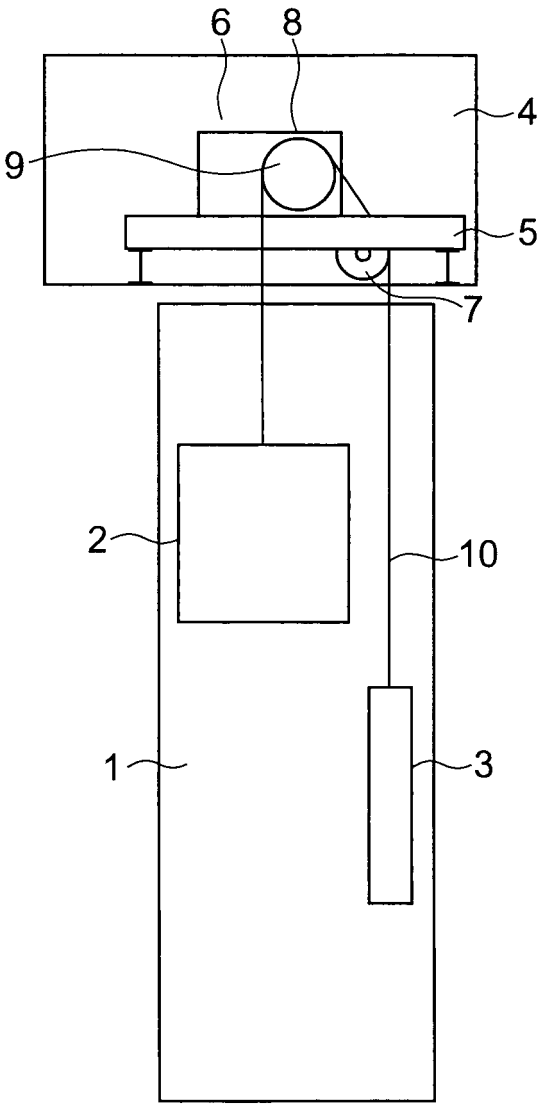

FIG. 2

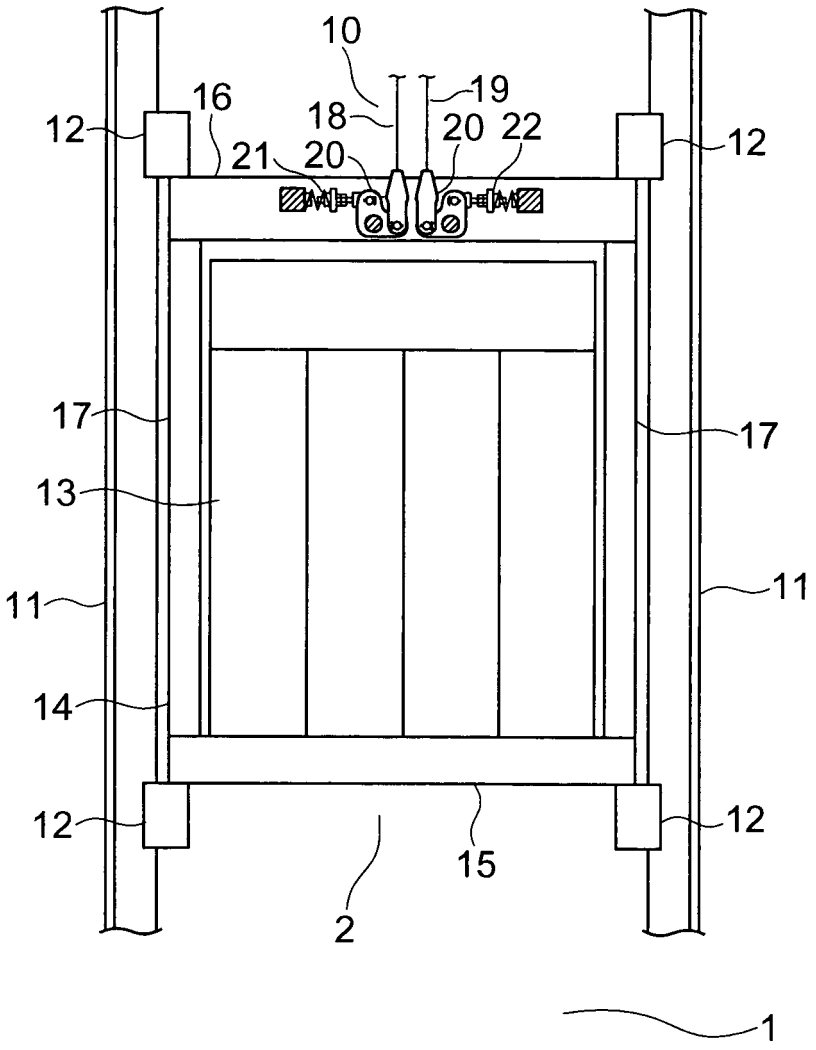

FIG. 3

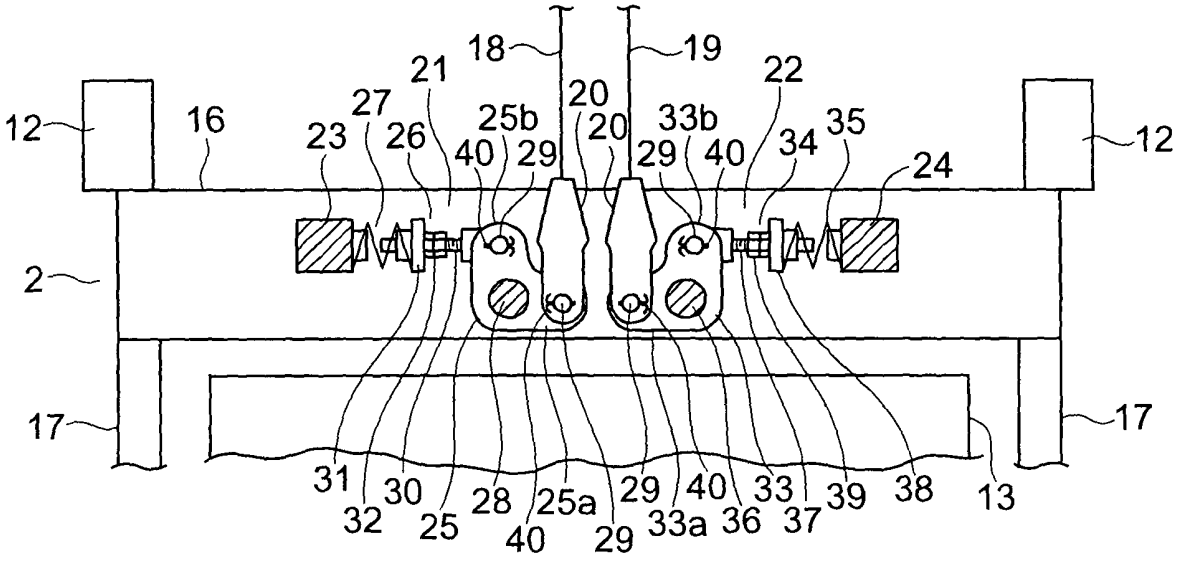
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FIG. 4

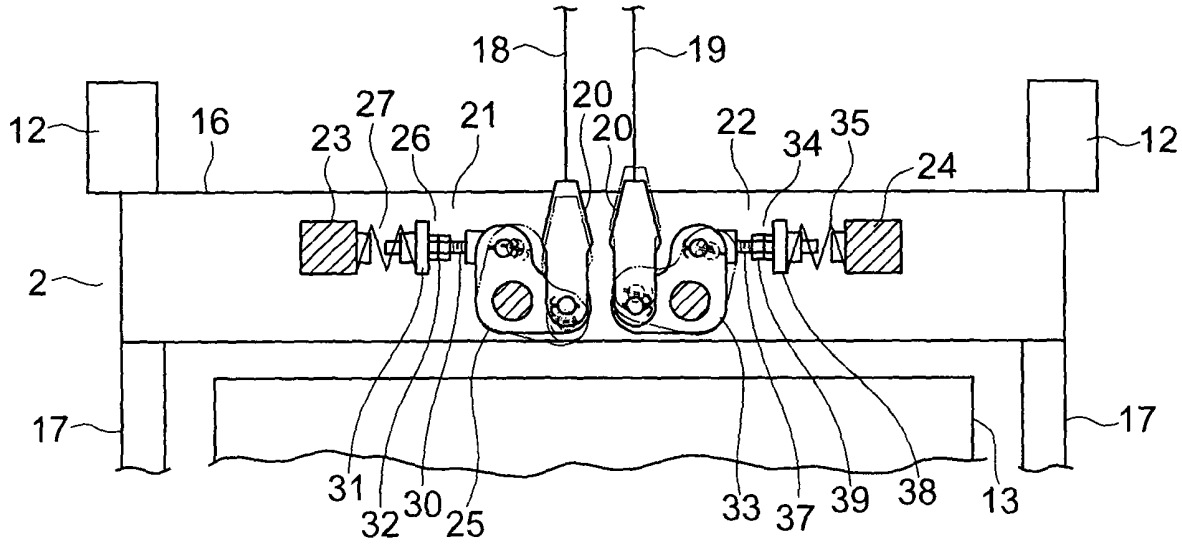
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FIG. 5

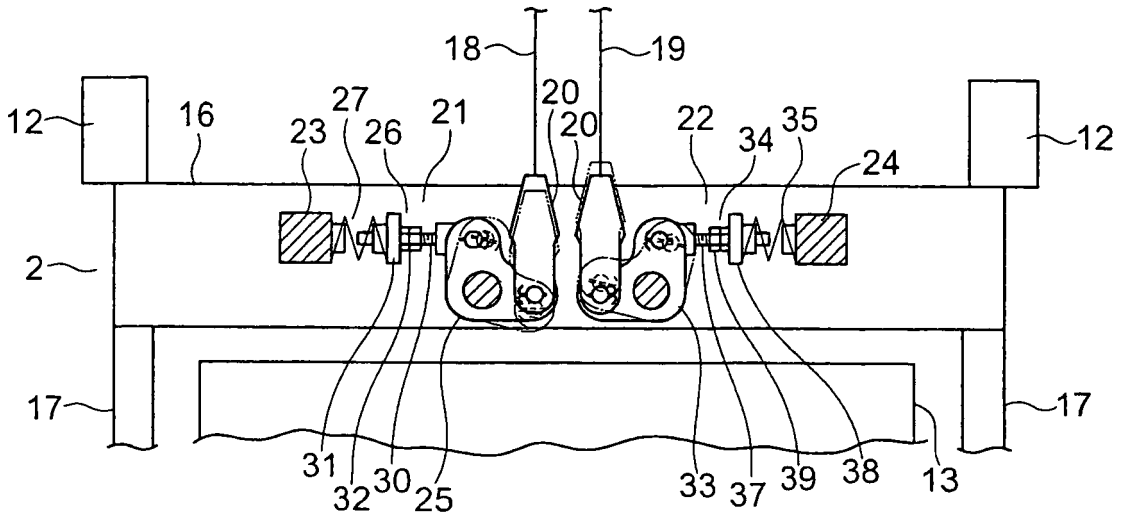
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FIG. 6

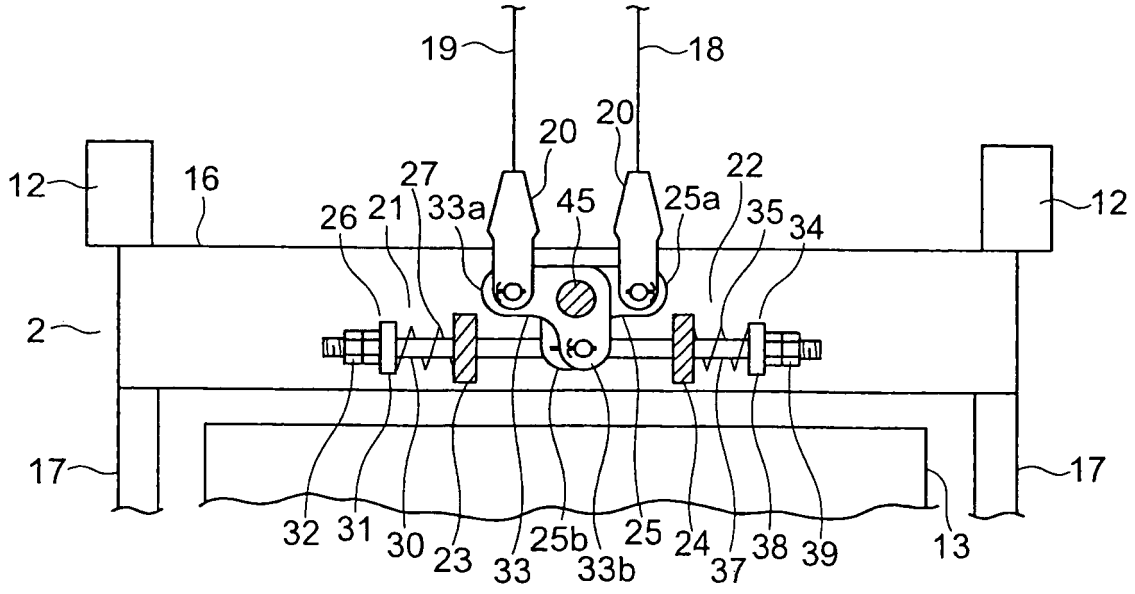
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FIG. 7

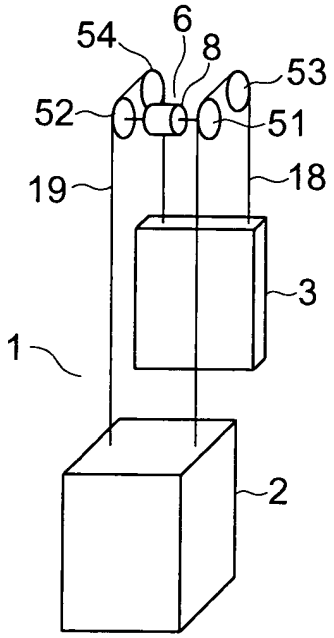
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FIG. 8

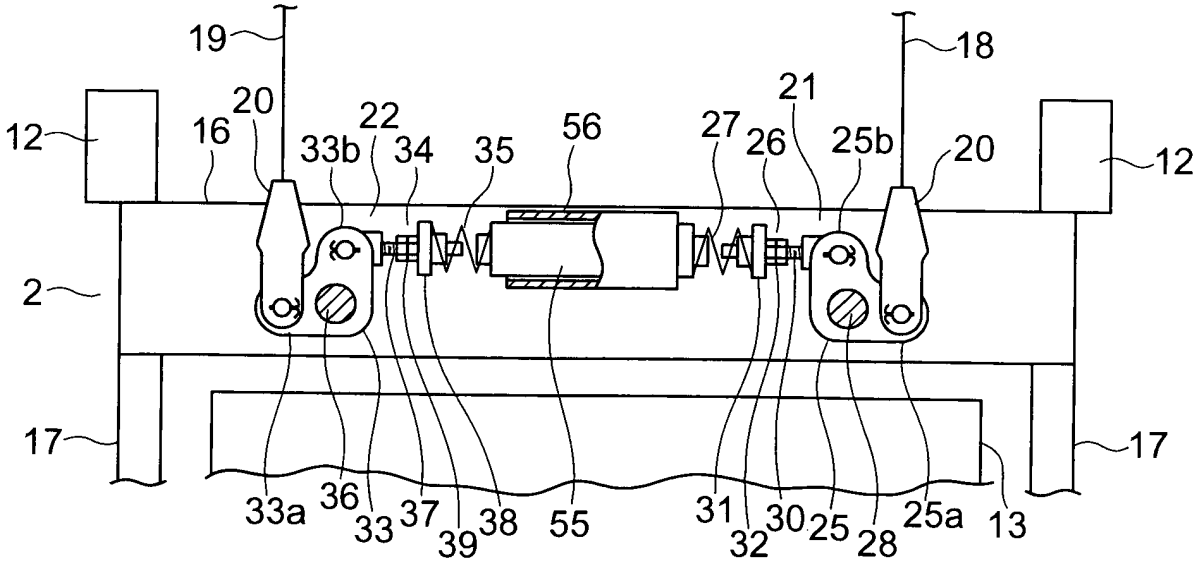
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FIG. 9

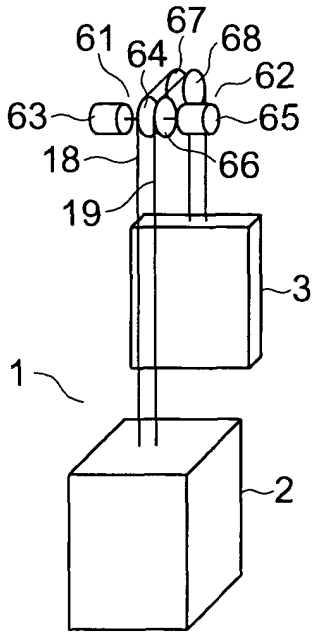
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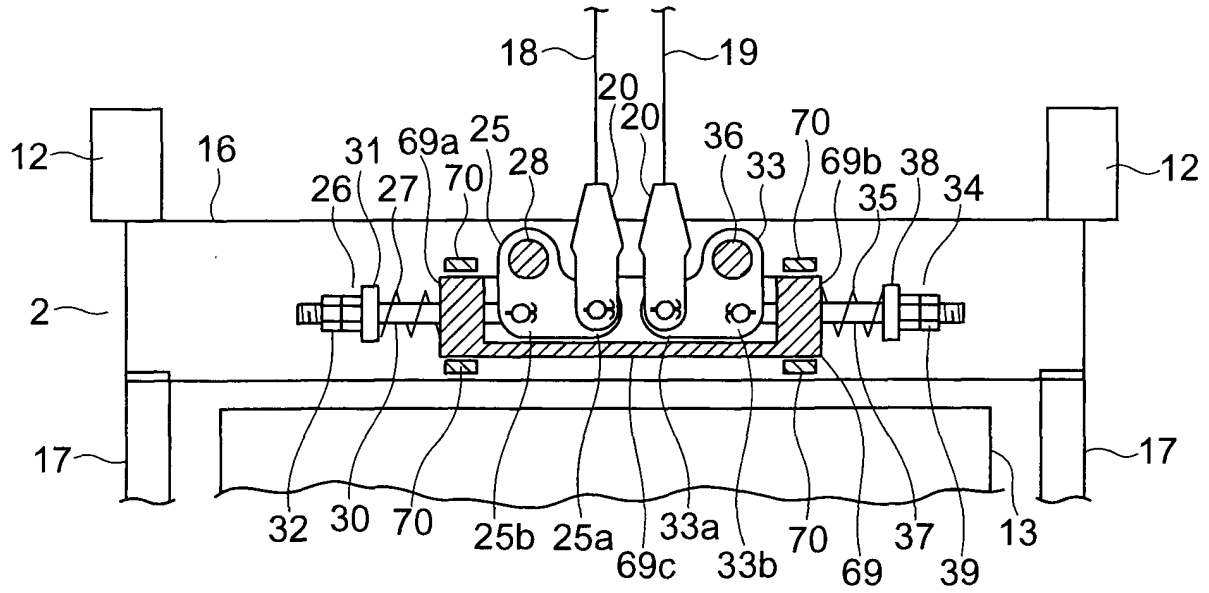
FIG. 10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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2006/304333

A. CLASSIFICATION OF SUBJECT MATTER
B66B7/08(2006.01)i

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)
B66B1/00-B66B20/00

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2006
Kokai Jitsuyo Shinan Koho	1971-2006	Toroku Jitsuyo Shinan Koho	1994-2006

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 2005-212941 A (Hitachi, Ltd.), 11 August, 2005 (11.08.05), (Family: none)	1-4,6 5
Y A	JP 49-024142 Y1 (Mitsubishi Heavy Industries, Ltd.), 28 June, 1974 (28.06.74), (Family: none)	1-4,6 5
Y	JP 01-011656 Y2 (Fujitec Co., Ltd.), 05 April, 1989 (05.04.89), & JP 59-133571 U	2-4

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Date of the actual completion of the international search 28 November, 2006 (28.11.06)	Date of mailing of the international search report 12 December, 2006 (12.12.06)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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Patent documents cited in the description

- JP 2005212941 A **[0003]**