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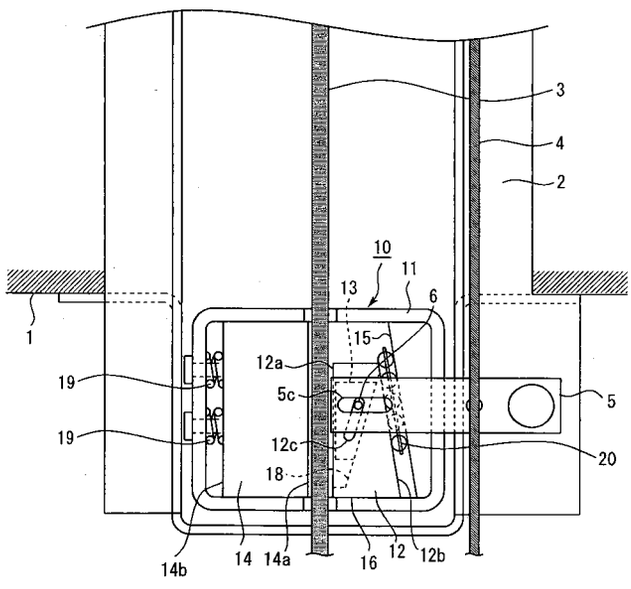
(54) BRAKE SYSTEM FOR ELEVATOR

(57) A braking device for an elevator comprises a shoe-housing mechanism (10) which has a shoe-pressing surface (15) of which the upper part narrows towards the guiderail (3), and is fixed to the car frame (2). The shoe-housing mechanism (10) has a braking surface (12a) facing the guiderail (3) and a rear surface (12b) facing the shoe-pressing surface (15), and on the braking surface (12a), a first shoe (12) on which a housing groove (17) which has a bottom surface (18) of which the lower part narrows towards the guiderail (3), is housed. In the housing groove (17), a second shoe (13) having a braking surface (13a) facing the guiderail (3) and a rear surface (13b) facing the bottom surface (18), is housed. Also, the first shoe (12) and the second shoe (13) are activated respectively to brake in cases where the car (1) accelerates abnormally upward/downward by a lever (5) which operates simultaneously with a governor rope (4) via a pin (6).

Fig. 1



EP 1 568 643 A1

Description

Technical Field

[0001] The present invention relates to a braking device for an elevator which is activated at abnormal acceleration of the elevator car in both upward and downward directions.

Background Art

[0002] Elevator systems of which the elevator car travels through the hoistway guided by guiderails are equipped with a braking device which stops the elevator in cases where the elevator exceeds the rated speed and continues to accelerate overspeed due to malfunction of equipment, breaking of the main rope, or the like. With this braking device, when an abnormality occurs to the elevator and the speed of the elevator car exceeds a predetermined speed, the governor grips the governor rope, the shoes of the braking device which operate simultaneously with the governor rope via the lever are driven, the shoes are pressed to the guiderails, and the car is stopped. Most of this kind of conventional braking devices could be activated only when the car accelerated overspeed downward. On the other hand, in Japanese examined patent publication No. 2698705, a braking device which is activated also when the car accelerates abnormally overspeed upward is disclosed. This braking device has two pairs of shoes which are provided so as to sandwich the guiderails on both sides as in conventional braking devices, however, it adopts a construction in which the shoes of one side are activated when the car accelerates overspeed downward, and the shoes of the other side are activated when the car accelerates overspeed upward. Therefore, in this construction, it is necessary to move the shoes that face the guiderails of both sides both upward and downward, thus the number of parts such as operating bars etc. becomes large, and the structure becomes complex.

[0003] The present invention has as its intention the provision of a braking device in which a pair of shoes to be activated is needed on only one side, and which is activated also at abnormal upward acceleration without increasing the number of parts.

Disolosure of the Invention

[0004] The braking device for an elevator in the present invention comprises: a shoe-housing mechanism which is fixed on the elevator car facing an elevator car guiderail and which has a shoe-pressing surface of which the upper part narrows toward the guiderail; a first shoe which is housed in the shoe-housing mechanism, and which has a braking surface facing the guiderail, and which has a rear surface facing the shoe-pressing surface, and which has a housing groove forming on the braking surface and having a bottom surface of which the lower part narrows toward the guiderail; and a second shoe which is housed in the housing groove of the first shoe, and which has a braking surface facing the guiderail and a rear surface facing the bottom surface of the housing groove. The braking device activates both the first and second shoes by driving the first shoe upward when the elevator car accelerates abnormally downward, and the second shoe downward when the elevator car accelerates abnormally upward, with a lever which operates simultaneously with the governor rope.

[0005] The braking device also has a pin which is passed through a long hole formed along the inclining direction of the bottom surface of the housing groove on one of the side surfaces of the housing groove of the first shoe and a long hole formed on one of the ends of the lever, and which is fixed on one of the side surfaces of the second shoe, and the first shoe and the second shoe are driven by means of this pin.

[0006] Furthermore, the lever is formed in a long shape, the long hole on one of the ends thereof is formed along the lengthwise direction of the lever, and is rotationally movable with the other end as the pivot, and the governor rope is attached closer to the long hole than to this pivot.

[0007] Moreover, the shoe housing mechanism has a locking surface which controls downward movement of the first shoe, and the first shoe is placed on this locking surface during normal travel of the elevator car.

[0008] According to the above-mentioned invention, it is possible to obtain a braking device which can be activated not only at abnormal downward acceleration as in the past, but also at abnormal upward acceleration, with a structure that moves a pair of shoes of only one side, without increasing the number of parts nor making the structure complex.

Brief Description of the Drawings

[0009]

Figure 1 is a side view of a braking device part of an elevator car for explaining the main parts of the braking device for an elevator in accordance with the first embodiment of the present invention during normal travel of the elevator car.

Figure 2 is a drawing showing the configuration of a shoe of the movable side of the braking device for an elevator in accordance with the first embodiment of the present invention.

Figure 3 is a side view of the braking device part for explaining the motion of the braking device for an elevator in accordance with the first embodiment of the present invention at abnormal downward acceleration of the elevator car.

Figure 4 is a side view of the braking device part for explaining the motion of the braking device for an elevator in accordance with the first embodiment of

the present invention at abnormal upward acceleration of the elevator car.

Figure 5 is a drawing showing the configuration of the movable side shoes of the braking device for an elevator in accordance with the second embodiment of the present invention.

Best Mode for Carrying out the Invention

[0010] To describe the present invention in more detail, the invention will be described by referring to the accompanying drawings. In each of the drawings, the same numerals are given to the same parts or the corresponding parts, and repeated explanation will be appropriately simplified or omitted.

First Embodiment

[0011] Figure 1 is a side view of a braking device part of an elevator car for explaining the main parts of the braking device for an elevator in accordance with the first embodiment of the present invention during normal travel of the elevator of the elevator car. Figure 2 is a drawing showing the configuration of the shoes of the movable side of the braking device for an elevator in accordance with the first embodiment of the present invention. Figure 2(A) is a drawing showing the positional relation between the shoes during normal travel of the car and at a state in which the braking device is activated at abnormal downward acceleration. The left drawing is an elevation of the shoes seen from the braking side, and the right drawing is a side view of the shoes. Figure 2(B) is a side view showing the positional relation between the shoes at abnormal downward acceleration.

[0012] The braking device for an elevator in accordance with the first embodiment of the present invention is composed as a emergency stop device that is activated with the aim of stopping the elevator in the case where it continues to accelerate over the rated speed due to causes such as malfunction of equipment, breaking of the main rope, etc.

[0013] In Figure 1, it is shown that the elevator car travels through the hoistway guided by a pair of elevator car guiderails 3 (in Figure 1 and the remaining figures, only one of the guiderails is shown because they are side views showing only one side of the car 1, however, in fact, there is another guiderail 3 corresponding to the opposite side of the car 1 which is not shown in the figures). Also, a car frame 2, which is a strengthening member, is attached to the elevator car 1 to support the cab.

[0014] Next: the shoe-housing mechanisms 10 are fixed to the car frame 2 in the lower part of the elevator car 1, facing the pair of elevator car guiderails 3. Here, in Figure 1 (and in the following figures), the shoe-housing mechanism 10 of only one side is shown, however in fact, there is a pair provided on each of the car frames 2 on both sides of the car 1, corresponding to the pair of guiderails 3. The shoe-housing mechanism 10 has a gripping metal 11 which functions as a case to house components such as a plurality of shoes, springs, etc. In the gripping metal 11, there are housed shoes of the movable side and the receiving side which face each other holding the guiderail 3 between them.

[0015] The shoe of the movable side of one side comprises a first shoe 12 and a second shoe 13. Here, the configurations of the first shoe 12 and the second shoe 13 will be explained in detail referring to Figure 2. The first shoe 12, which has a wedge-shaped external form, has a braking surface 12a which faces the guiderail 3, and the rear surface 12b, which is opposite to the braking surface 12a, is inclined so as to narrow at the upper part towards the guiderail 3. On this braking surface 12a, a housing groove 17 is formed for housing the second shoe 13, and the bottom surface 18 of the housing groove 17 is inclined so as to narrow at the lower part towards the guiderail 3, contrary to the rear surface 12b. Furthermore, on one of the side surfaces of the housing groove 17 of the first shoe 12, a long hole 12c is formed along the same inclining direction as the bottom surface 18 of the housing groove 17. On the other hand, the second shoe 13, which, like the first shoe 12, has a wedge-shaped external form, is housed in the housing groove 17 of the first shoe 12, and has a braking surface 13a which faces the guiderail 3, and the rear surface 13b of the braking surface 13a faces the bottom surface 18 of the housing groove 17 of the first shoe 12, and is of the same inclination angle. In other words, the construction is that: the aforementioned first shoe 12 has inclined surfaces i.e. the rear surface 12b of the braking surface 12a and the bottom surface 18 of the housing groove 17, which are in the opposite direction to each other; the first shoe 12 is activated at abnormal downward acceleration being guided by the rear surface 12b; and the second shoe 13, which is the other shoe, is activated at abnormal upward acceleration being guided by the bottom surface 18. Furthermore, a pin 6 is passed through the long hole 12c of the first shoe 12 and fixed to one of the side surfaces of the second shoe 13 in the state where the second shoe 13 is housed in the housing groove 17 and the bottom surface 18 and the rear surface 13b overlap each other. To describe in further detail, the pin 6 is fixed to the second shoe 13 in the position in which it comes to the top end of the long hole 12c when the second shoe 13 is in a position during normal ascent and descent of the elevator car 1 as shown in Figure 2 (A), and in this case, the second shoe 13 is arranged so that the braking surface 13a becomes more inside the housing groove 17 than the braking surface 12a of the first shoe 12. The second shoe 13 moves in the area where the pin 6 moves along the long hole 12c of the first shoe 12. As shown in Figure 2(B), the relation between the shoes and the pin is set so that the braking surface 13a of the second shoe 13 is possible of moving outside the braking surface 12a of the first shoe 12 in the position where the pin 6 comes to the lower end of

the long hole 12c.

[0016] Next, returning to Figure 1; the gripping metal 11 comprises a shoe-pressing surface 15 which faces the rear surface 12b of the first shoe 12. Also, between the rear surface 12b of the first shoe 12 and the shoe-pressing surface 15, a roller 20 is provided to smoothen the movement of the first shoe 12 at activation of the braking device. The gripping metal 11 has a locking surface 16 below the first shoe 12 which controls downwards movement of the first shoe 12.

[0017] Next, a receiving side shoe 14 is provided in the position which faces the movable side shoe which comprises of the aforementioned first shoe 12 and second shoe 13, with the guiderail 3 between it and the movable side shoe. The receiving side shoe 14 has a braking surface 14a which faces the guiderail 3, and between the rear surface 14b of the braking surface 14a and the gripping metal 11, there are provided springs 19 that expand and contract in the direction perpendicular to the braking surface 14a: in this first embodiment, two springs in parallel.

[0018] Next: a lever 5 is formed in a long shape; at one end a long hole 5c is formed along the lengthwise direction of the lever, and the other end is fixed to the car frame 2 rotationally movable with the other end as the pivot. Further, as for the lever 5, a governor rope 4 is attached closer to the long hole 5c than to the pivot fixed to the car frame 2 (in this embodiment, between the pivot of the lever 5 and the long hole 5c). Also, the pin 6 fixed to the second shoe 13 is passed through both the long hole 12c of the first shoe 12 and the long hole 5c of the lever 5, and it is constructed so that driving of the first shoe 12 and the second shoe 13 by the lever 5 is possible due to this.

[0019] Next, the motion of the braking device for an elevator constructed in the above-mentioned manner will be explained.

[0020] Figure 3 is a side view of the braking device part of the elevator car for explaining the motion of the braking device for an elevator at abnormal downward acceleration in accordance with the first embodiment of the present invention, and Figure 4 is a side view of the braking device part of the elevator car for explaining the motion of the braking device for an elevator at abnormal upward acceleration in accordance with the first embodiment of the present invention.

[0021] In the braking device for an elevator in accordance with the first embodiment of the present invention, the components of the shoe-housing mechanism 10 are arranged in the positional relations as shown in Figure 1. That is, the first shoe 12 is placed on the locking surface 16 of the gripping metal 11, and the whole second shoe 13 is housed in the housing groove 17 so that the braking surface 13a of the second shoe comes inside the housing groove 17 more than the braking surface 12a of the first shoe. Also, the pin 6 is arranged in a position at the upper end of the long hole 12c of the first shoe 12; as for the lever 5, the lengthwise direction thereof becomes horizontal, and the long hole 5c formed on the lever 5 is also arranged horizontally. Furthermore, in this state, the governor rope 4, which is connected to the lever 5, moves up and down the hoistway along with the car 1. Here, as shown in Figure 3, in the case where the elevator car 1 accelerates abnormally downward, the governor (not shown), which detects overspeed of the car 1, is activated and grips the governor rope 4. In accordance to this, the lever 5, which had until then been descending together with the car 1, is rotated by the governor rope 4, and the long hole 5c on the left side of the lever 5 is pulled up. According to this rotation of the lever 5, the rear surface 12b of the first shoe 12, which is engaged to the lever 5 via the pin 6, is moved upward along the shoe-pressing surface 15 of the gripping metal 11 by means of the roller 20, and is pushed between the gripping metal 11 and the guiderail 3. As a result of this, the braking surface 12a of the first shoe is pressed to the guiderail 3, and also the gripping metal 11 is moved in the direction to which it is pushed back by the guiderail 3 as a reaction. That is, referring to Figure 3, the car frame 2, to which is fixed the gripping metal 11, and also the whole car 1 are moved to the right. According to this, the braking surface 14a of the receiving side shoe 14 at the opposite side of the first shoe 12 is pressed against the guiderail 3, and the pressing forces of the shoes of both sides stops the car 1. On this occasion, the deceleration speed of the elevator car 1 is adjusted by adjustment of the pressing force of the receiving side shoe 14 to the guiderail 3 by adjustment of the setting of the spring force of the spring 19 provided on the rear surface 14b of the receiving side shoe 14. The above-mentioned is the motion of the braking device in the case where the elevator car 1 accelerates abnormally in the downward direction, and in this case the second shoe is not activated, so as for the motion, it is similar to that of a conventional braking device wherein only one side of the shoes are moved, however, in this first embodiment, it is different from conventional braking devices in respect that it is possible to activate the braking device at abnormal upward acceleration.

[0022] Next, referring to Figure 4, the motion of the braking device for an elevator at abnormal upward acceleration in accordance with the first embodiment of the present invention will be explained. Also in this case, the governor detects abnormal acceleration of the elevator car 1, and the governor rope 4 is gripped. In accordance with this, the lever 5, which had until then been ascending together with the elevator car 1, is rotated by the governor rope 4, and the long hole 5c on the left side of the lever 5 is pulled down. According to this rotation of the lever 5, firstly, the rear surface 13b of the second shoe 13, which is engaged to the lever 5 via the pin 6, is moved downward along the bottom surface 18 of the housing groove 17 of the shoe 12, as the pin 6 moves downward along the long hole 12c formed on the first shoe 12. In this case, as the first shoe 12 is placed on

the locking surface 16 of the gripping metal 11, the first shoe 12 does not move downward and only the second shoe 13 moves, and the second shoe 13 is pushed between the gripping metal 11 and the guiderail 3. For this reason, the bottom surface 18 of the housing groove 17 of the first shoe 12 functions as a pressing surface, and presses the braking surface 13a of the second shoe against the guiderail 3, and also the gripping metal 11 is moved in the direction to which it is pushed back by the guiderail 3 as a reaction. That is, referring to Figure 4, the car frame 2, to which is fixed the gripping metal 11, and also the whole car 1 are moved to the right. According to this, the braking surface 14a of the receiving side shoe 14 is pressed against the guiderail 3, and the pressing forces of the shoes of both sides stops the car 1. Also, similarly to abnormal downward acceleration, the deceleration speed of the elevator car 1 is adjusted by adjustment of the pressing force of the receiving side shoe 14 to the guiderail 3 by adjustment of setting of the spring force of the spring 19 provided on the rear surface 14b of the receiving side shoe 14. In addition to this, in this first embodiment, as the movable side shoes that are used for braking in the upward and downward directions are different, it is possible to set the deceleration speed of the car 1 of the upward and downward directions separately by making a difference in the material, surface area, etc. of the braking surfaces of each of the shoes. Furthermore, by passing the pin 6 through the long hole 12c of the first shoe 12 and the long hole 5c of the lever 5, and also by fixing it to the second shoe 13, it is possible to drive two shoes (shoe 12 and shoe 13) with just one lever.

[0023] According to the above, in the braking device for an elevator in accordance with the first embodiment of the present invention, the structure wherein the shoes of only one side are activated as in conventional braking devices is fundamentally taken over, and by dividing the shoe of the movable side into two shoes which correspond respectively to the upward and downward directions, it is possible to obtain a braking device which is activated not only at abnormal downward acceleration as before, but also at abnormal upward acceleration, without increasing much parts of equipment nor making the structure cocriplex. It is also possible to improve productivity.

Second Embodiment

[0024] Figure 5 is a drawing showing the configuration of movable side shoes of a braking device for an elevator in accordance with the second embodiment of the present invention. Figure 5(A) is a drawing showing the positional relation between the shoes during normal travel of the car, and at a state in which the braking device is activated at abnormal downward acceleration. The left drawing is an elevation of the shoes seen from the braking surface side, and the right drawing is a side view of the shoes. Figure 5(B) is a side view showing the positional relation between the shoes at abnormal upward acceleration.

[0025] As shown in Figure 5, in the braking device for an elevator in accordance with the second embodiment of the present invention, a roller 21 is provided between the bottom surface 18 of the housing groove 17 formed on the first shoe 12 and the rear surface 13b of the second shoe 13. As the structures and the motions of the other parts are the same as in the first embodiment, explanation for the other parts will be omitted by giving the same numerals to the same or the according parts. Due to this, in the case where the elevator car 1 abnormally accelerates upward and the lever 5 drives the second shoe 13, for example, by taking a large area as the braking surface 13a in order to increase the braking force of the shoe 13, as a result, also the surface area of the rear surface 13b increases, and it is possible to drive the shoe 13 smoothly by providing the roller 21 as the occasion demands, such as in a case where the sliding resistance on the rear surface 13b at driving of the shoe 13 becomes large. Also, successful outcome as in the first embodiment can be achieved.

Industrial Applicability

[0026] As described above, the braking device in the present invention can be activated not only at abnormal downward acceleration of the elevator car, but also at abnormal upward acceleration. According to this, for example, in a case where the elevator car accelerates abnormally upward due to malfunction of elevator equipment or the like in the state where the counterweight is heavier than the elevator car because the number of persons riding is small, it is possible to stop the elevator car without failure, so it is useful as an elevator with improved safety.

[0027] Furthermore, compared with a conventional braking device, as the braking device for an elevator in accordance with the present invention can be activated at both upward and downward abnormal acceleration without increasing the number of parts of equipment nor making the structure complex, it is useful as an elevator with improved productivity.

Claims

1. A braking device for an elevator comprising:

a shoe-housing mechanism, fixed to an elevator car facing an elevator car guiderail, having a shoe-pressing surface of which the upper part narrows towards said guiderail;

a first shoe, housed in the shoe-housing mechanism, having a braking surface which faces said guiderail, having a rear surface which faces said shoe-pressing surface, and having a housing groove which is formed on said braking

surface and which has a bottom surface of which the lower part narrows towards said guiderail;

a second shoe, housed in said housing groove of said first shoe, having a braking surface which faces said guiderail and a rear surface which faces said bottom surface of said housing groove;

wherein both of said first shoe and said second shoe are activated respectively to brake by driving said first shoe upward in the case where said elevator car accelerates abnormally downward, and by driving said second shoe downward in the case where said elevator car accelerates abnormally upward, by means of a lever which operates simultaneously with a governor rope.

2. The braking device for an elevator according to claim 1, comprising a pin which is passed through a long hole formed on one of the side surfaces of said housing groove of said first shoe along the direction of inclination of the bottom surface of said housing groove and a long hole formed on one of the ends of said lever, also fixed to one of the side surfaces of said second shoe, wherein said first shoe and said second shoe are driven via said pin.

3. The braking device for an elevator according to claim 2, wherein said lever is formed in a long shape; said long hole on one of the ends of said lever is formed along the lengthwise direction of said lever; said lever is rotatably movable with the other end of said lever as the pivot; and said governor rope is attached closer to said long hole than to said pivot.

4. The braking device for an elevator according to claim 2 or 3, wherein said shoe-housing mechanism comprises a locking surface to control downward movement of the first shoe, and said first shoe is placed on said locking surface during normal travel of said elevator car.

5. The braking device for an elevator according to any one of claims 1 through 4, wherein a roller is provided between said bottom surface of housing groove of said first shoe and said rear surface of said second shoe.

Fig. 1

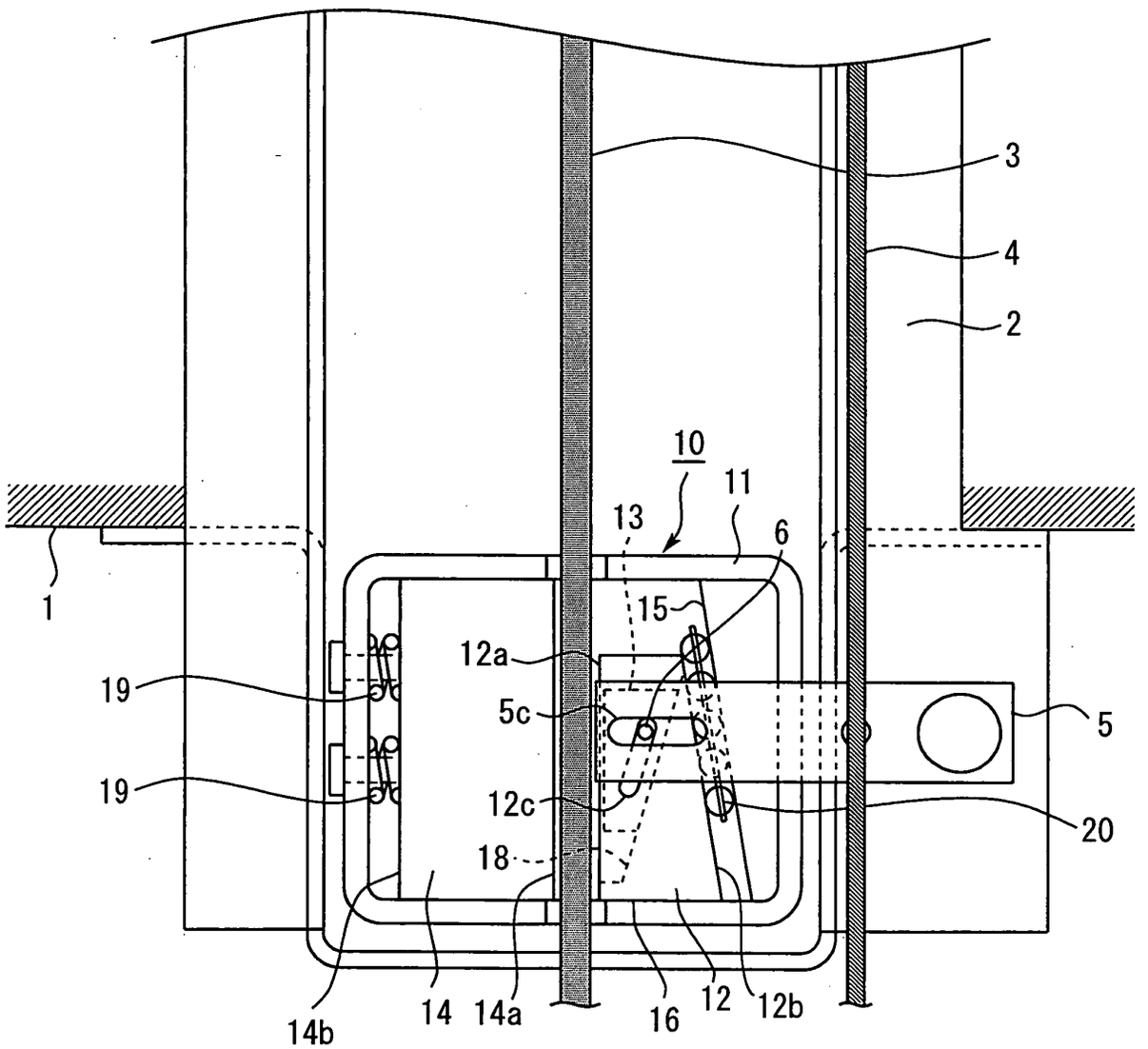
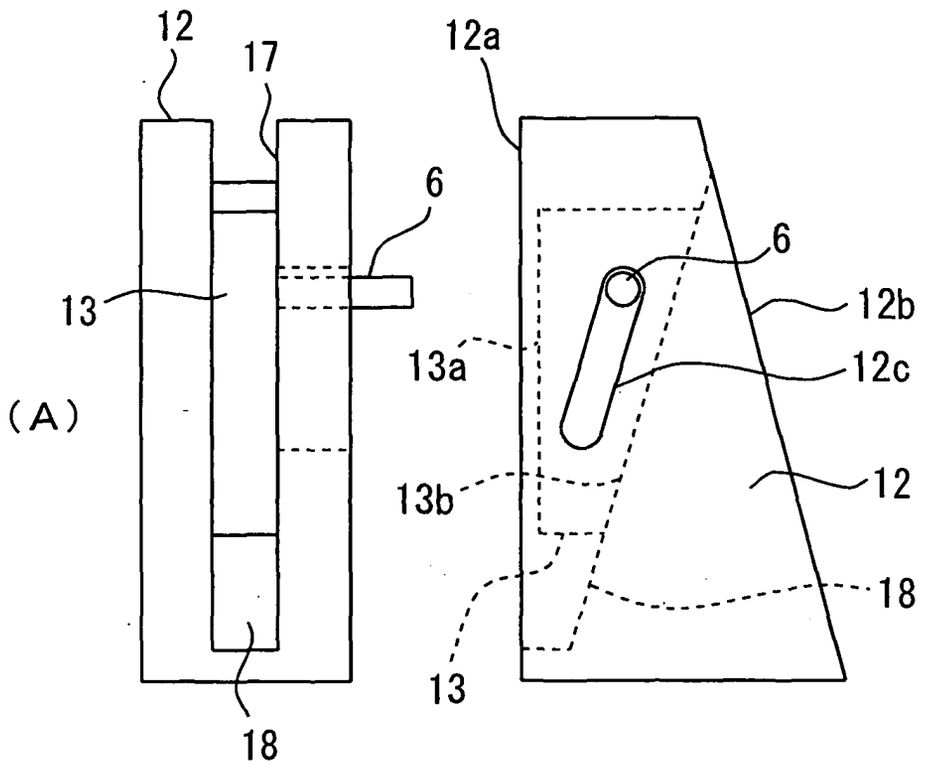


Fig. 2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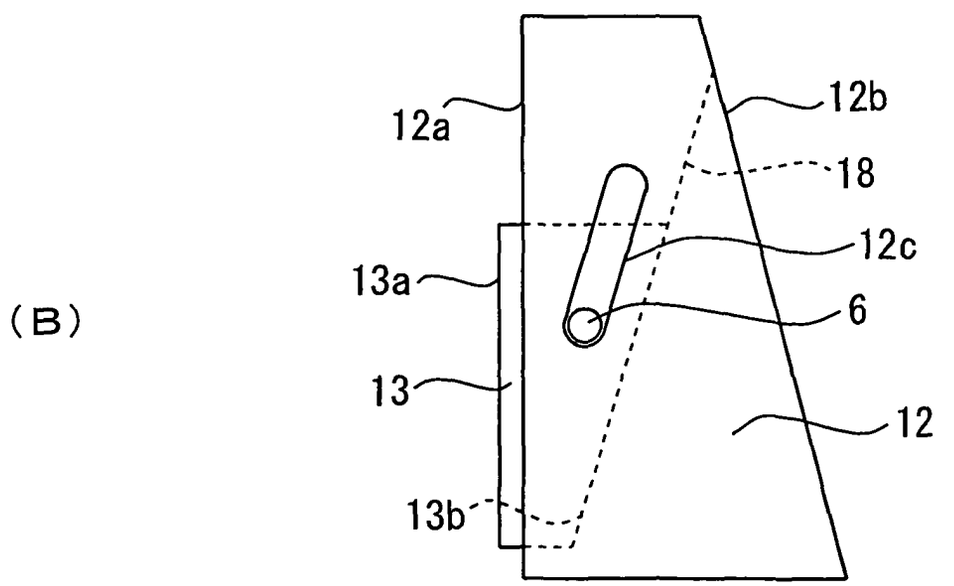
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(B)

Fig. 3

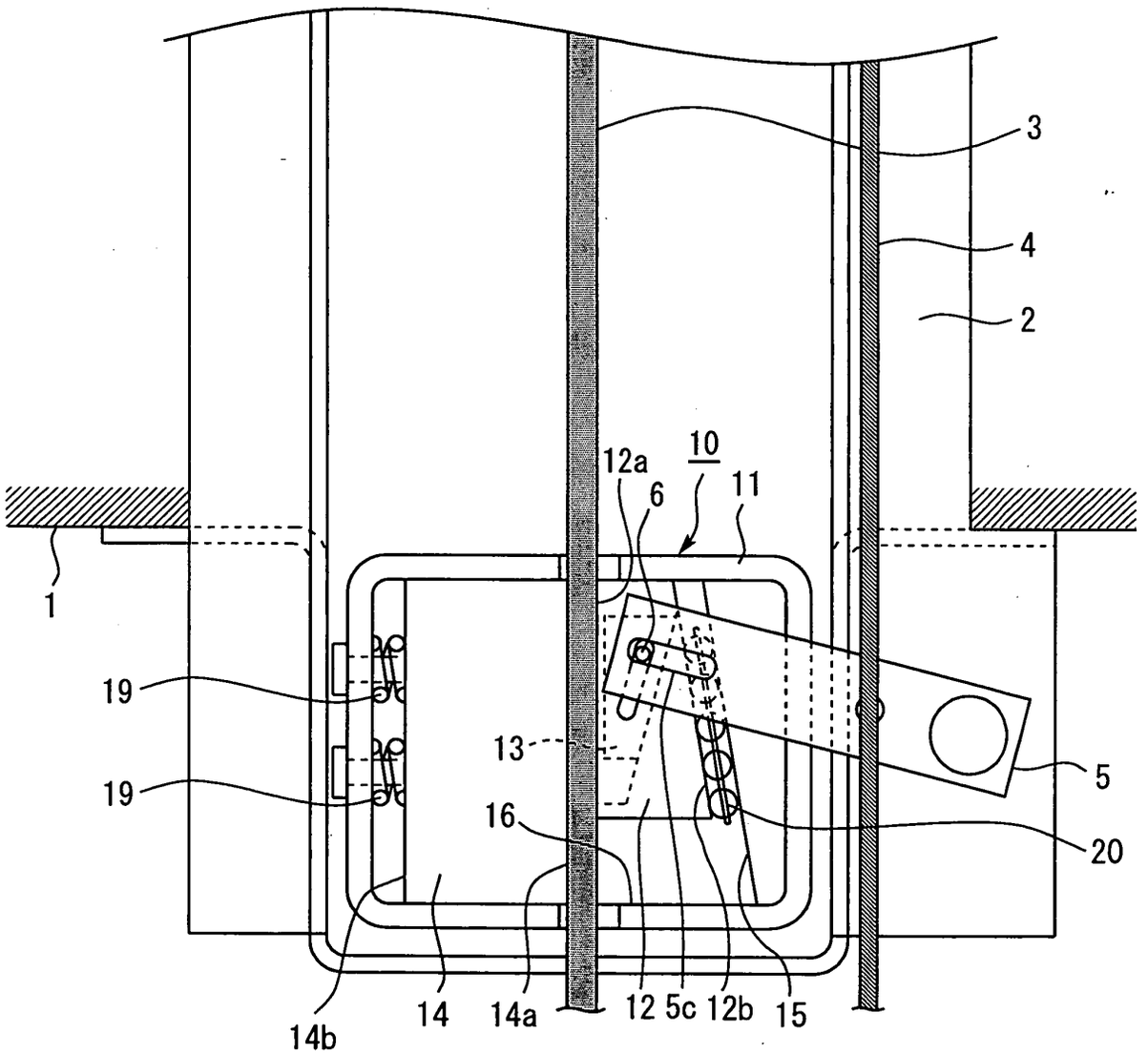


Fig. 4

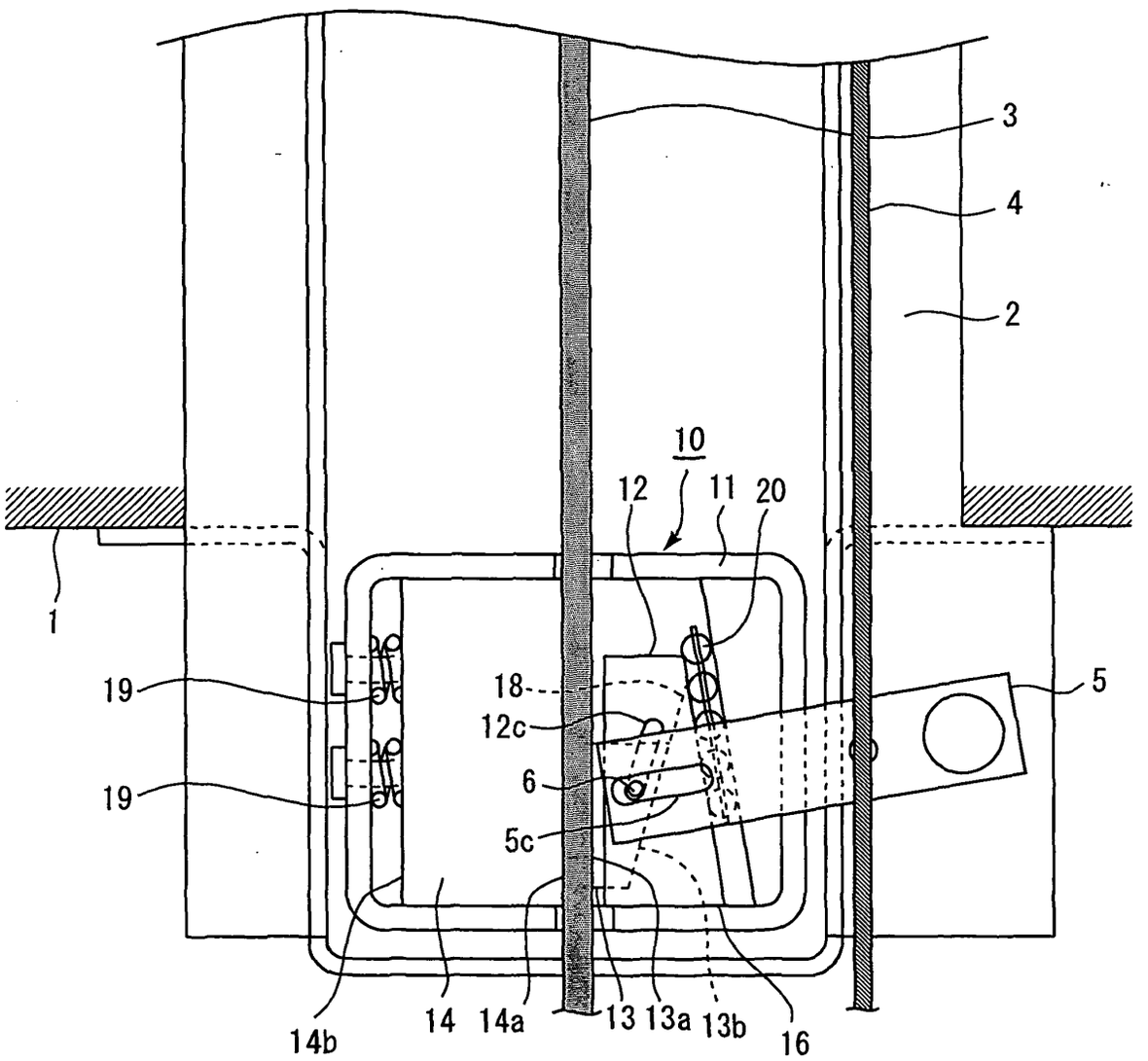
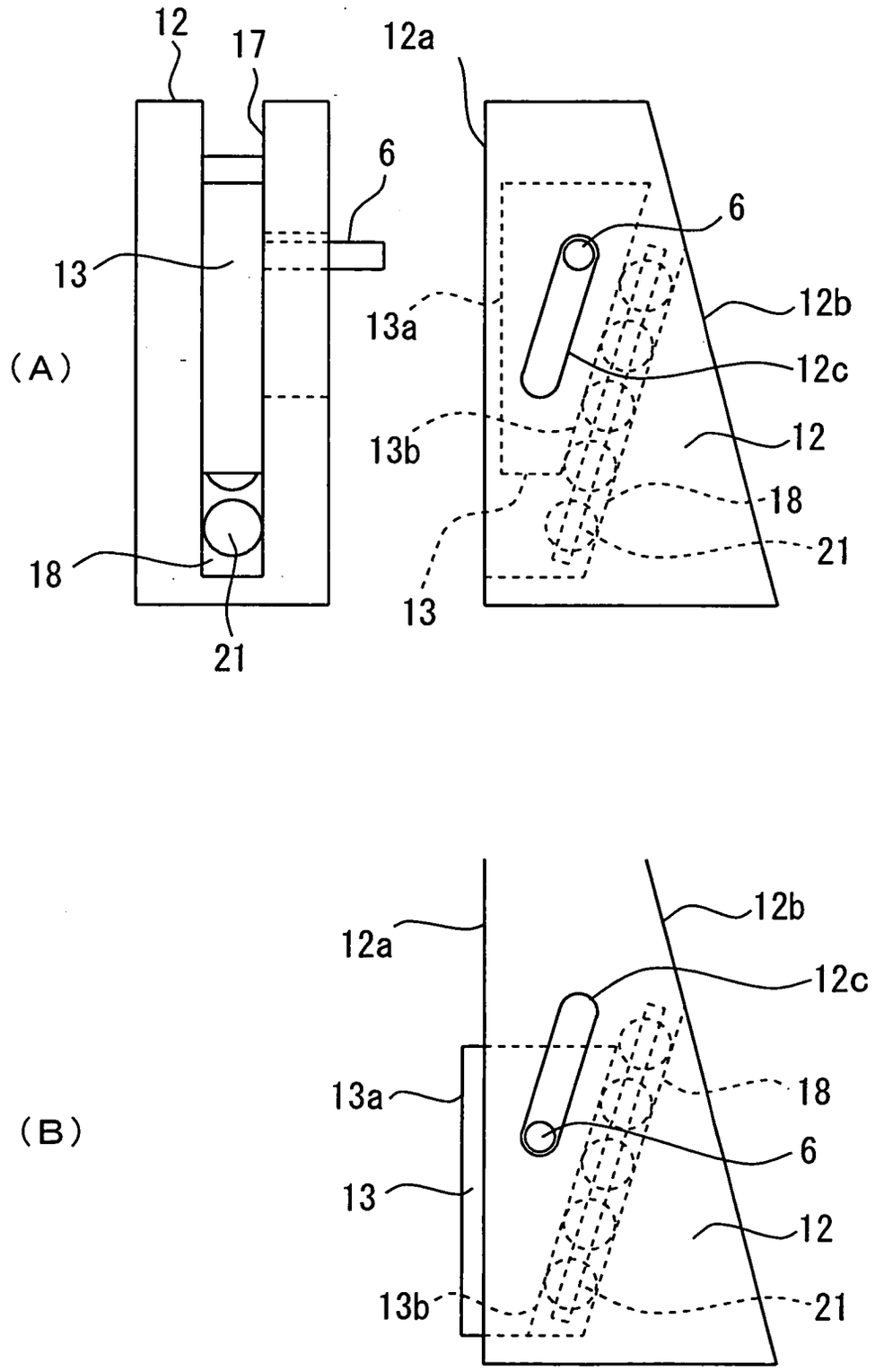


Fig. 5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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP02/12707

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B66B5/22, 5/04

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] B66B5/00-5/28

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2003
Kokai Jitsuyo Shinan Koho	1971-2003	Toroku Jitsuyo Shinan Koho	1994-2003

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2002-154761 A (Otis Elevator Co.), 28 May, 2002 (28.05.02), (Family: none)	1-5
A	EP 1167269 A1 (KABUSHIKI KAISHA TOSHIBA), 02 January, 2002 (02.01.02), & JP 2001-192184 A & WO 01/51399 A1	1-5
A	EP 432634 A2 (KONE Elevator GmbH), 19 June, 1991 (19.06.91), & JP 2698705 B2 & US 5096020 A1	1-5
A	JP 59-43342 Y2 (Mitsubishi Electric Corp.), 21 December, 1984 (21.12.84), (Family: none)	1-5

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

* Special categories of cited documents:
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Date of the actual completion of the international search	Date of mailing of the international search report
10 March, 2003 (10.03.03)	08 April, 2003 (08.04.03)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

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