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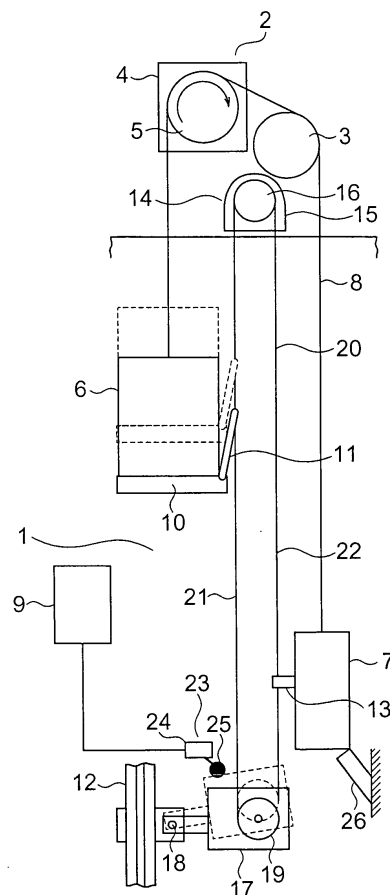
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(54) **ELEVATOR APPARATUS**

(57) In an elevator apparatus, a coupling rope is connected between a car and a counterweight, which are suspended by a main rope and raised/lowered by a drive unit. The coupling rope is looped around a tension pulley. The tension pulley is suspended by the coupling rope. The tension pulley can be displaced by being pulled by the coupling rope when the raising and lowering distances of the car and the counterweight are different from each other. A detection portion is provided above the tension pulley. When the displacement amount of the tension pulley reaches a predetermined amount, a detection signal is outputted from the detection portion. The drive unit is controlled by a control device based on an input of the detection signal to the control device.

FIG. 1



Description

Technical Field

[0001] The present invention relates to a traction type elevator apparatus having a car and a counterweight that are raised/lowered by a drive unit.

Background Art

[0002] Conventionally, it has been proposed to mount each of a car and a counterweight with an emergency stop device in order to more reliably stop the car and the counterweight as an emergency measure. The emergency stop devices each are connected to a common governor rope. The governor rope is looped around a speed governor sheave of a speed governor (governor). The speed governor binds the governor rope when the speed of the car and the counterweight has become abnormally high. The emergency stop devices each are actuated due to the binding of the governor rope by the speed governor, so the car and the counterweight are stopped (see Patent Document 1).

[0003] [Patent Document 1] US 6318506 B

Disclosure of the Invention

Problem to be solved by the Invention

[0004] However, an abnormality in speed cannot be detected when, for example, an obstacle protrudes into a hoistway for some reason and the counterweight hits the obstacle and cannot be lowered normally. Therefore, an abnormality in an elevator cannot be detected.

[0005] The present invention has been made to solve the problem as described above. It is an object of the present invention to obtain an elevator apparatus which allows detection of an abnormality caused at the time when one of the car and the counterweight is prevented from being lowered by an obstacle.

Means for solving the Problem

[0006] An elevator apparatus according to the present invention includes: a drive unit having a rotatable drive sheave; a main rope looped around the drive sheave; a car and a counterweight which are suspended by the main rope, and raised/lowered in opposite directions through rotation of the drive sheave; a coupling rope which is connected between the car and the counterweight, and moved through raising and lowering of the car and the counterweight; a tension pulley which has the coupling rope looped around the tension pulley, and is displaceable by being pulled by the coupling rope when raising and lowering distances of the car and the counterweight are different from each other; a detection portion for outputting a detection signal when a displacement amount of the tension pulley has reached a predeter-

mined amount; and a control device for controlling driving of the drive unit based on an input of the detection signal.

Brief Description of the Drawings

[0007]

Fig. 1 is a structural diagram showing an elevator apparatus according to Embodiment 1 of the present invention;

Fig. 2 is a structural diagram showing an elevator apparatus according to Embodiment 2 of the present invention;

Fig. 3 is a structural diagram showing an elevator apparatus according to Embodiment 3 of the present invention;

Fig. 4 is a structural diagram showing an elevator apparatus according to Embodiment 4 of the present invention;

Fig. 5 is a structural diagram showing an elevator apparatus according to Embodiment 5 of the present invention.

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 structural diagram showing an elevator apparatus according to Embodiment 1 of the present invention. Referring to the figure, a hoisting machine 2 as a drive unit and a deflector pulley 3 disposed apart from the hoisting machine 2 are provided in an upper portion of a hoistway 1. The hoisting machine 2 has a drive unit main body 4 including a motor, and a drive sheave 5 as a pulley rotated by the drive unit main body 4. A main rope 8 for suspending a car 6 and a counterweight 7 is looped around the drive sheave 5 and the deflector pulley 3. The car 6 and the counterweight 7 are raised/lowered in opposite directions within the hoistway 1 by being driven by the hoisting machine 2. A control device 9 for controlling the operation of an elevator is provided within the hoistway 1.

[0010] A lower portion of the car 6 is mounted with an emergency stop device 10 for preventing the car 6 from falling. The emergency stop device 10 is provided with a pull-up mechanism 11 for actuating the emergency stop device 10. The emergency stop device 9 grips a car guide rail 12, thereby braking the car 6. A connecting device 13 protruding from the counterweight 7 is fixed to an intermediate portion of the counterweight 7.

[0011] A speed governor (governor) 14 is also provided in the upper portion of the hoistway 1. The speed governor 14 has a speed governor main body 15, and a speed governor sheave 16 as a pulley rotatable with re-

spect to the speed governor main body 15.

[0012] A displacement member 17 is provided in a lower portion of the hoistway 1 so as to be displaceable with respect to the car guide rail 12. In this example, the displacement member 17 is turnably connected to the car guide rail 12 by means of a pin 18. A tension pulley 19 as a pulley is rotatably provided on the displacement member 17. The tension pulley 19 is vertically displaceable due to the turning of the displacement member 17 around the pin 18.

[0013] An upper speed governor rope 20 as a coupling rope is looped around the speed governor sheave 16. A lower speed governor rope 21 as a coupling rope is looped around the tension pulley 19. The tension pulley 19 is suspended by the lower speed governor rope 21.

[0014] One end of the upper speed governor rope 20 is connected to the pull-up mechanism 11, and the other end of the upper speed governor rope 20 is connected to the connecting device 13. One end of the lower speed governor rope 21 is connected to the pull-up mechanism 11, and the other end of the lower speed governor rope 21 is connected to the connecting device 13. That is, the upper speed governor rope 20 and the lower speed governor rope 21 are connected between the car 6 and the counterweight 7.

[0015] A speed governor rope 22 has the upper speed governor rope 20 and the lower speed governor rope 21. That is, the speed governor rope 22 is interlocked with the emergency stop device 10.

[0016] The speed governor rope 22 is moved together with the car 6 and the counterweight 7. The speed governor sheave 16 is thereby rotated at a speed corresponding to a raising and lowering speed of the car 6 and the counterweight 7. The speed governor main body 15 binds the upper speed governor rope 20 when the rotational speed of the speed governor sheave 16 has reached a set overspeed. The emergency stop device 10 is actuated when the upper speed governor rope 20 is bound while the car 6 is being lowered. The car 6 is braked through actuation of the emergency stop device 9.

[0017] A detection switch 23 as a detection portion is provided above the displacement member 17. The detection switch 23 is electrically connected to the control device. The detection switch 23 has a switch main body 24, and an operating lever 25 provided turnably on the switch main body 24. The operating lever 25 is operated by being pressed by the displacement member 17, due to the upward turning of the displacement member 17 around the pin 18. In response to the operation of the operating lever 25, the detection switch 23 outputs a detection signal from the switch main body 24 to the control device 9. In other words, the detection switch 23 outputs a detection signal when the displacement amount of the tension pulley 19 has reached a predetermined amount. The control device 9 controls the driving of the hoisting machine 2 based on an input of the detection signal. In this example, the control device 9 performs control for stopping the driving of the hoisting machine 2 based on

the input of the detection signal.

[0018] The tension pulley 19 is pulled upward by the lower speed governor rope 21 when one of the car 6 and the counterweight 7 is prevented from being lowered while the other of the car 6 and the counterweight 7 is being raised. In other words, the tension pulley 19 is displaced by being pulled by the lower speed governor rope 21 when the raising and lowering distances of the car 6 and the counterweight 7 are different from each other. In this example, the counterweight 7 hits an obstacle 26 protruding into the hoistway 1 for some reason, so the obstacle 26 prevents the counterweight 7 from being lowered. The tension pulley 19 is pulled upward by the lower speed governor rope 21 when the car 6 is being raised through the driving of the hoisting machine 2 while the counterweight 7 is prevented from being lowered.

[0019] Next, an operation will be described. When the lowering speed of the car 6 has become abnormally high, the upper speed governor rope 20 is bound by the speed governor 14. The pull-up mechanism 11 is thereby mechanically actuated, so the emergency stop device 10 is actuated. The car 6 is braked through actuation of the emergency stop device 10.

[0020] When the counterweight 7 is prevented from being lowered after hitting the obstacle 26 protruding into the hoistway 1, the counterweight 7 is stopped. However, the car 6 is raised through the driving of the hoisting machine 2. At this moment, the upper speed governor rope 20 slacks, and the lower speed governor rope 21 is pulled upward together with the car 6. As a result, the tension pulley 19 is also displaced upward and the displacement member 17 is turned upward around the pin 18.

[0021] After that, when the displacement amount of the tension pulley 19 reaches a predetermined amount, the displacement member 17 is brought into abutment on an operating lever 25, which is then operated. A detection signal is thereby outputted from the detection switch 23 to the control device 9. When the detection signal is inputted to the control device 9, the driving of the hoisting machine 2 is stopped through control of the control device 9.

[0022] In the elevator apparatus constructed as described above, a detection signal is outputted from the detection switch 23 when the displacement amount of the tension pulley 19 reaches a predetermined amount, and the control device controls the driving of the hoisting machine 2 based on the detection signal. Therefore, an abnormality caused at the time when the counterweight 7 is prevented from being lowered by, for example, the obstacle 26 protruding into the hoistway 1 can be detected from upward displacement of the tension pulley 19 resulting from a rise of the car 6, and the hoisting machine 2 can be stopped from being driven. An abnormality caused at the time when the car 6 is prevented from being lowered can also be detected in a similar manner because the tension pulley 19 is displaced upward due to a rise of the counterweight 7.

[0023] Although only the car 6 is mounted with the

emergency stop device 10 in the foregoing example, the counterweight 7 may also be mounted with an emergency stop device. In this case, the emergency stop device mounted to the counterweight 7 is provided with a pull-up mechanism for actuating the emergency stop device. Further, the speed governor rope 22 is connected to the pull-up mechanism.

Embodiment 2

[0024] Fig. 2 is a structural diagram showing an elevator apparatus according to Embodiment 2 of the present invention. Referring to the figure, the upper speed governor rope 20 and the lower speed governor rope 21 are connected to the counterweight 7 via a connecting device 31. The connecting device 31 has a holding member 32 which is fixed to the intermediate portion of the counterweight 7 and a movable member 33 which is provided so as to be displaceable with respect to the holding member 32, and connected to the upper speed governor rope 20 and the lower speed governor rope 21. In this example, the movable member 33 is slidably provided in the holding member 32.

[0025] The holding member 32 has a protruding portion 34 protruding from the intermediate portion of the counterweight 7 and a tubular portion 35 which is fixed to a tip of the protruding portion 34, and is open at its upper end and its lower end. The movable member 33 is vertically slidably passed through the tubular portion 35.

[0026] The movable member 33 has a through-rod 36 which is passed through the tubular portion 35, and an upper regulatory portion 37 and a lower regulatory portion 38 which are a pair of regulatory portions for regulating the displacement amount of the movable member 33 with respect to the tubular member 35, are provided at the upper end and the lower end of the through-rod 36, respectively. In other words, the movable member 33 is reciprocally displaceable with respect to the tubular member 35 between a lower-limit position at which the upper regulatory portion 37 abuts on the upper end of the tubular portion 35 and an upper-limit position at which the lower regulatory portion 38 abuts on the lower end of the tubular portion 35.

[0027] The length of the through-rod 36 is longer than the vertical length of the tubular portion 35. Further, the outer diameter of each of the regulatory portions 37 and 38 is larger than the inner diameter of the tubular portion 35. The other end of the upper speed governor rope 20 is connected to the upper regulatory portion 37. The other end of the lower speed governor rope 21 is connected to the lower regulatory portion 38.

[0028] That is, the connecting device 31 is provided on the counterweight 7 so as to allow the speed governor rope 22 to be displaced by a predetermined amount with respect to the counterweight 7. Embodiment 2 is identical to Embodiment 1 in other constructional details.

[0029] Next, an operation will be described. When the

car 6 is raised while the counterweight 7 is prevented from being lowered by the obstacle 26 (Fig. 1), the movable member 33 is displaced downward with respect to the holding member 32. After that, the upper regulatory portion 37 is brought into abutment on the upper end of the tubular portion 35. When the car 6 continues to be raised thereafter as well, the tension pulley 19 is pulled upward by the lower speed governor rope 21. Embodiment 2 is identical to Embodiment 1 in the operation performed thereafter.

[0030] When the car 6 is prevented from being lowered by the obstacle, the counterweight 7 is raised. The holding member 32 is thereby displaced upward with respect to the movable member 33. When the counterweight 7 continues to be raised thereafter as well, the upper end of the tubular portion 35 is brought into abutment on the upper regulatory portion 37, so the lower speed governor rope 21 is raised. The tension pulley 19 is thereby pulled upward. Embodiment 2 is identical to Embodiment 1 in the operation performed thereafter.

[0031] In the elevator apparatus constructed as described above, the displacement amount of the movable member 33 with respect to the holding member 32 is regulated by the regulatory portions 27 and 28 provided on the movable member 33. Therefore, an abnormality caused at the time when one of the car 6 and the counterweight 7 is prevented from being lowered can be detected while the speed governor rope 22 is allowed to be displaced with respect to the counterweight 7.

[0032] Now, when a passenger gets on the car 6, the main rope 8 stretches due to an increase in the weight of the car 6. The main rope 8 stretches with the lapse of time as well. On the other hand, a stretch of the speed governor rope 22 is shorter than a stretch of the main rope 8. Thus, a difference is created between the stretch of the main rope 8 and the stretch of the speed governor rope 22. When the difference is created between the stretch of the main rope 8 and the speed governor rope 22, the emergency stop device 10 may operate erroneously because the car 6 is displaced with respect to the speed governor rope 22. The connecting device 31 can allow the speed governor rope 22 to be displaced with respect to the counterweight 7, and thus can absorb the difference between the stretch of the main rope 8 and the stretch of the speed governor rope 22. As a result, the emergency stop device 10 can be prevented from operating erroneously.

[0033] Although the speed governor rope 22 is connected to the counterweight 7 via the connecting device 31 in the foregoing example, the speed governor rope 22 may be connected to the car 6 via the connecting device 31 when the counterweight 7 is mounted with an emergency stop device. In this manner as well, the connecting device 31 can absorb the difference between the stretch of the main rope 8 and the stretch of the speed governor rope 22. As a result, the emergency stop device can be prevented from operating erroneously.

Embodiment 3

[0034] Fig. 3 is a structural diagram showing an elevator apparatus according to Embodiment 3 of the present invention. Referring to the figure, a connecting device 41 has the holding member 32, the movable member 33 which are identical in construction to those of Embodiment 2, and springs 42, 43 which are elastic bodies provided between the upper regulatory portion 37 and the tubular portion 35, and between the lower regulatory portion 38 and the tubular portion 35, respectively.

[0035] The through-rod 36 of the movable member 33 is passed through the springs 42 and 43. The spring 42 is contracted through displacement of the upper regulatory portion 37 toward the tubular portion 35 side. The spring 43 is contracted through displacement of the lower regulatory portion 38 toward the tubular portion 35 side. Embodiment 3 is identical to Embodiment 2 in other constructional details.

[0036] In the elevator apparatus constructed as described above, the spring 42 is provided between the upper regulatory portion 37 and the tubular portion 35, and the spring 43 is provided between the lower regulatory portion 38 and the tubular portion 35. Therefore, as is the case with Embodiment 2, the speed governor rope 22 can be allowed to be displaced with respect to the counterweight 7. Further, the time it takes until the operating lever 25 is operated after one of the car 6 and the counterweight 7 has been prevented from being lowered can be reduced.

[0037] That is, an elastic restoring force can be generated in the spring 42 through displacement of the upper regulatory portion 37 toward the tubular portion 35 side. Thus, the displacement amount of the movable member 33 with respect to the tubular portion 35, which is required until the tension pulley 19 is pulled upward after one of the car 6 and the counterweight 7 has been prevented from being lowered, can be reduced. Accordingly, the delay time created through displacement of the movable member 33 with respect to the tubular portion 35 can be reduced. Consequently, the time it takes until the operating lever 25 is operated after one of the car 6 and the counterweight 7 has been prevented from being lowered can be reduced.

Embodiment 4

[0038] Fig. 4 is a structural diagram showing an elevator apparatus according to Embodiment 4 of the present invention. Referring to the figure, a holding member 51 is fixed to the intermediate portion of the counterweight 7. The holding member 51 has an upper regulatory portion 52 and a lower regulatory portion 53, which are a pair of regulatory portions disposed vertically apart from each other. The upper speed governor rope 20 is passed through the upper regulatory portion 52, and the lower speed governor rope 21 is passed through the lower regulatory portion 53.

[0039] A movable member 54 displaceable with respect to the holding member 51 is disposed between the upper regulatory portion 52 and the lower regulatory portion 53. The upper speed governor rope 20 and the lower speed governor rope 21 are connected to the movable member 54. The movable member 54 is provided on the counterweight 7 so as to be turnable around a pin 55. By turning around the pin 55, the movable member 54 is displaced with respect to the holding member 54. In addition, the displacement amount of the movable member 54 resulting from its turning around the pin 55 is regulated by the upper regulatory portion 52 and the lower regulatory portion 53.

[0040] A spring 56 as an elastic body is provided between the upper regulatory portion 52 and the movable member 54. A spring 57 as an elastic body is provided between the lower regulatory portion 53 and the movable member 54. The spring 56 is contracted through displacement of the movable member 54 toward the upper regulatory portion 52 side. The spring 57 is contracted through displacement of the movable member 54 toward the lower regulatory portion 53 side.

[0041] A connecting device 60 for connecting the upper speed governor rope 20 and the lower speed governor rope 21 to the counterweight 7 has the holding member 51, the movable member 54, and the springs 56, 57.

[0042] Tension pulley guide rails 58 as a pair of guide rails parallel to each other are installed in the lower portion of the hoistway 1. Disposed between the respective tension pulley guide rails 58 is a displacement member 59 slidable with respect to the tension pulley guide rails 58. The displacement member 59 is vertically guided by the respective tension pulley guide rails 58.

[0043] The tension pulley 19 is rotatably provided on the displacement member 59. The detection switch 23 is provided above the displacement member 59. The operating lever 25 is operated by being pressed by the displacement member 59 through upward displacement of the displacement member 59. Embodiment 4 is identical to Embodiment 2 in other constructional details.

[0044] In the elevator apparatus constructed as described above, the displacement amount of the movable member 54 with respect to the holding member 51 is regulated by the regulatory portions 52, 53 with which the holding member 51 is provided. Therefore, an abnormality caused at the time when one of the car 6 and the counterweight 7 is prevented from being lowered can be detected while the speed governor rope 22 is allowed to be displaced with respect to the counterweight 7. Consequently, an effect identical to that of the foregoing Embodiment 2 is produced.

[0045] The spring 56 is provided between the upper regulatory portion 52 and the movable member 54, and the spring 57 is provided between the lower regulatory portion 53 and the movable member 54. Therefore, the speed governor rope 22 is allowed to be displaced with respect to the counterweight 7. Further, the time it takes until the operating lever 25 is operated after one of the

car 6 and the counterweight 7 has been prevented from being lowered can be reduced.

[0046] The displacement member 59 mounted with the tension pulley 19 is vertically guided by the tension pulley guide rails 58. Therefore, the tension pulley 19 can be prevented from deviating horizontally, and the operating lever 25 can be more reliably operated through the displacement member 59.

[0047] Although the spring 56 is provided between the upper regulatory portion 52 and the movable member 54 and the spring 57 is provided between the lower regulatory portion 53 and the movable member 54 in the foregoing example, the springs 56 and 57 may not be provided. In this manner as well, an abnormality caused at the time when one of the car 6 and the counterweight 7 is prevented from being lowered can be detected while the speed governor rope 22 is allowed to be displaced with respect to the counterweight 7.

Embodiment 5

[0048] Fig. 5 is a structural diagram showing an elevator apparatus according to Embodiment 5 of the present invention. Referring to the figure, a coupling rope 61 is connected between the car 6 and the counterweight 7. One end of the coupling rope 61 is connected to the lower portion of the car 6, and the other end of the coupling rope 61 is connected to a lower portion of the counterweight 7. The coupling rope 61 is looped around the tension pulley 19. The tension pulley 19 is suspended by the coupling rope 61. The coupling rope 61 is moved through the raising and lowering of the car 6 and the counterweight 7. Embodiment 5 is identical to Embodiment 1 in other constructional details.

[0049] In the elevator apparatus constructed as described above as well, the tension pulley 19 can be pulled upward when one of the car 6 and the counterweight 7 is prevented from being lowered by an obstacle. Therefore, an abnormality caused at the time when one of the car 6 and the counterweight 7 is prevented from being lowered can be detected with a simple construction.

[0050] Although the one end and the other end of the coupling rope 61 are directly connected to the car 6 and the counterweight 7, respectively in the foregoing example, at least one of the one end and the other end of the coupling rope 61 may be connected to the car 6 and the counterweight 7 via the connecting device 31 of Embodiment 2, the connecting device 41 of Embodiment 3, or the connecting device 60 of Embodiment 4.

[0051] The displacement member 17, which is turnable with respect to the car guide rail 12, is provided with the tension pulley 19 in the foregoing Embodiments 1 to 3 and 5. However, the displacement member 17 should not be limited to a member turnable with respect to the car guide rail 12 as long as it is displaced together with the tension pulley 19 and can operate the operating member 25. Accordingly, for example, the displacement member may be vertically slidable with respect to the car guide

rail 12. Alternatively, the displacement member may be slidable with respect to the guide rails that are different from the car guide rail 12 as described in Embodiment 4.

Claims

1. An elevator apparatus comprising:

a drive unit having a rotatable drive sheave;
a main rope looped around the drive sheave;
a car and a counterweight which are suspended by the main rope, and raised/lowered in opposite directions through rotation of the drive sheave;
a coupling rope which is connected between the car and the counterweight, and moved through raising and lowering of the car and the counterweight;
a tension pulley which has the coupling rope looped around the tension pulley, and is displaceable by being pulled by the coupling rope when raising and lowering distances of the car and the counterweight are different from each other;
a detection portion for outputting a detection signal when a displacement amount of the tension pulley has reached a predetermined amount; and
a control device for controlling driving of the drive unit based on an input of the detection signal.

2. An elevator apparatus according to Claim 1, **characterized in that:**

the coupling rope is connected to at least one of the car and the counterweight via a connecting device;
the connecting device has a holding member provided on at least one of the car and the counterweight, and a movable member provided so that the movable member is displaceable with respect to the holding member and connected to the coupling rope; and
one of the holding member and the movable member has a regulatory portion for regulating a displacement amount of the movable member with respect to the holding member.

3. An elevator apparatus according to Claim 2, **characterized by** providing between another of the holding member and the movable member, and the regulatory portion, an elastic body.

4. An elevator apparatus according to any one of Claims 1 to 3, **characterized in that:**

at least one of the car and the counterweight is mounted with an emergency stop device for pre-

venting the car and the counterweight from falling; and
the coupling rope is a speed governor rope for interlocking with the emergency stop device.

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FIG. 1

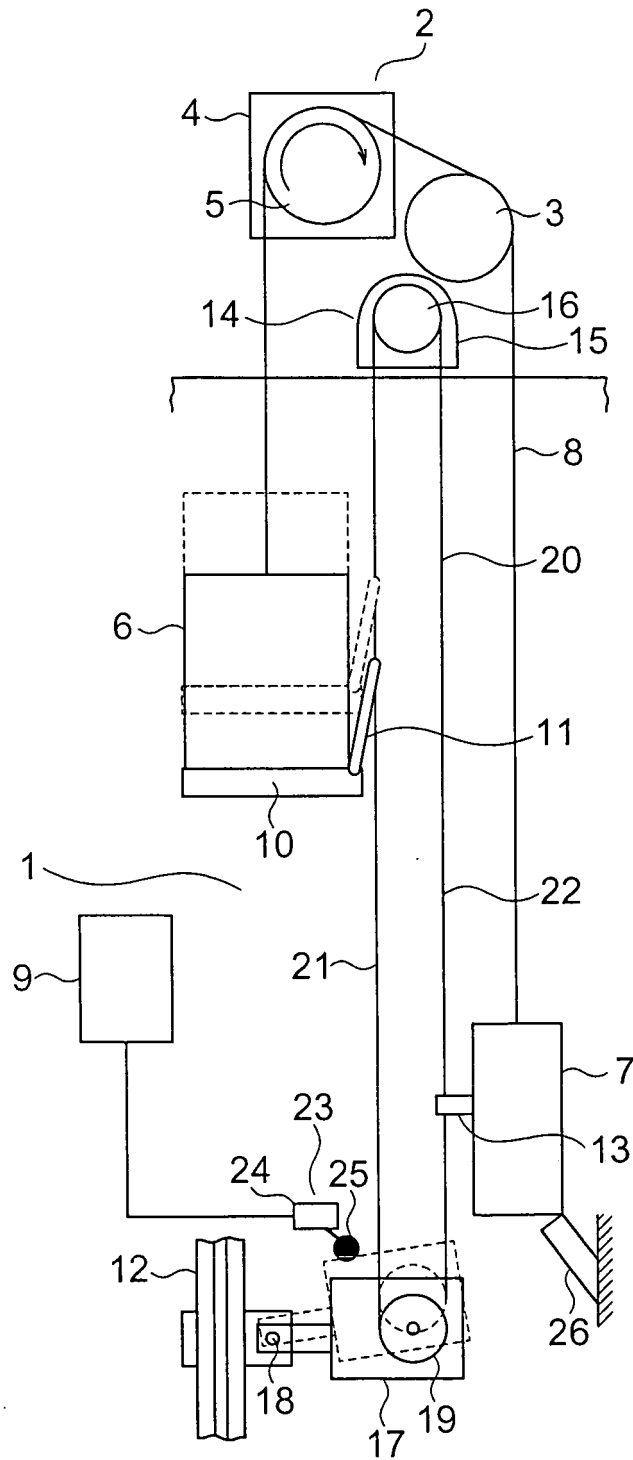


FIG. 2

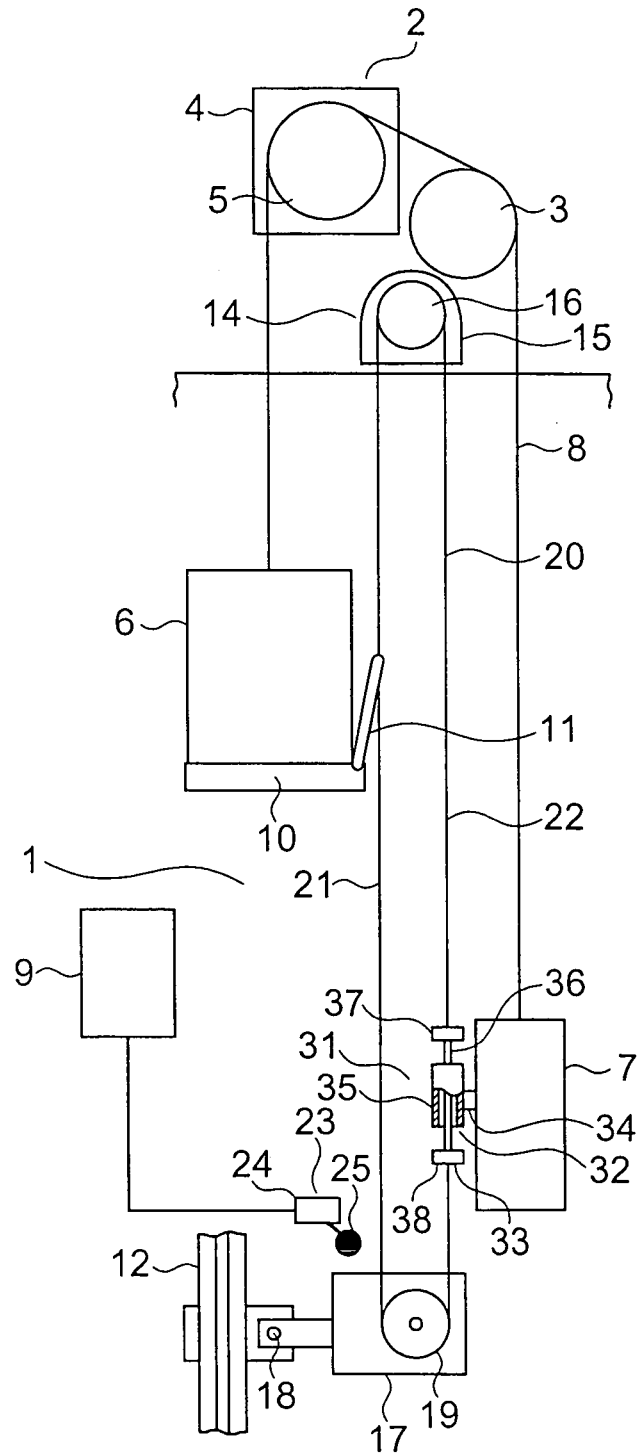


FIG. 3

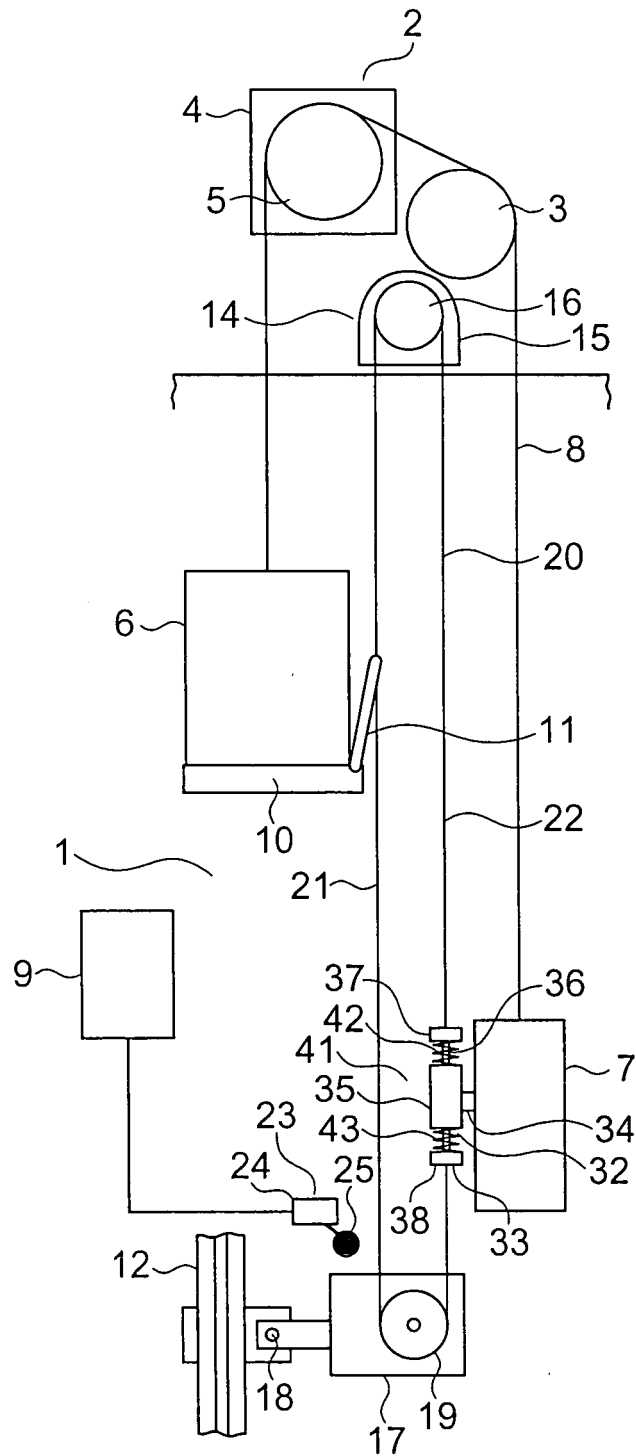


FIG. 4

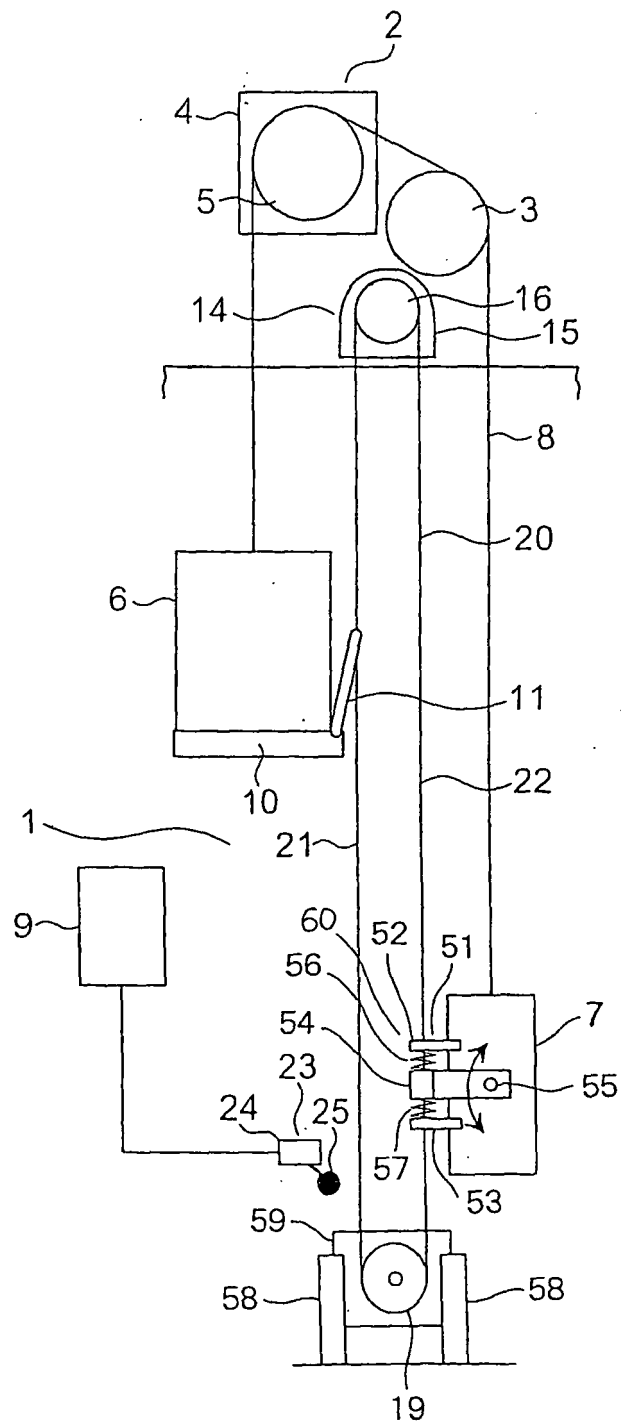
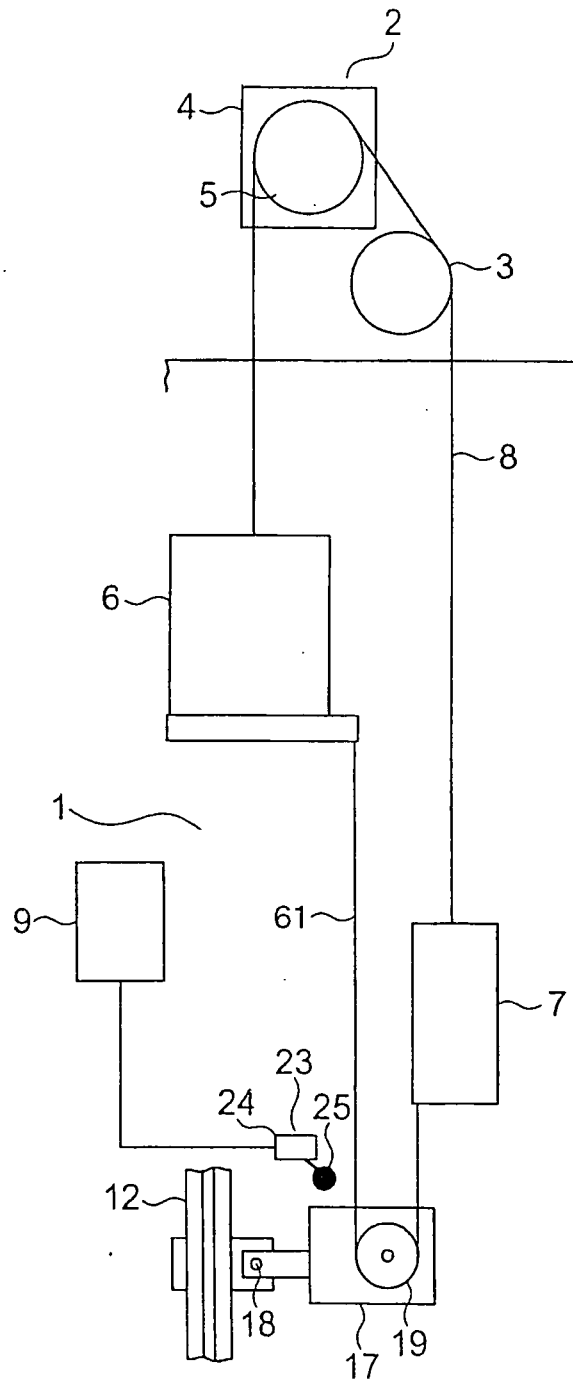


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/012367

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl⁷ B66B5/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int.Cl⁷ B66B5/00-B66B7/12

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 1996-2005

Kokai Jitsuyo Shinan Koho 1971-2005 Toroku Jitsuyo Shinan Koho 1994-2005

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	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 85304/1975 (Laid-open No. 870/1977) (Tokyo Shibaura Electric Co., Ltd.), 06 January, 1977 (06.01.77), Pay attention to Claims; Figs. 1 to 4 (Family: none)	1-3 4

☒ 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
26 May, 2005 (26.05.05)Date of mailing of the international search report
14 June, 2005 (14.06.05)Name and mailing address of the ISA/
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/012367

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 55984/1976 (Laid-open No. 147374/1977) (Mitsubishi Electric Corp.), 08 November, 1977 (08.11.77), Pay attention to description; page 1, line 13 to page 5, line 11; Figs. 1 to 3 (Family: none)	1-3 4
Y	JP 48-37969 Y1 (Hitachi, Ltd.), 10 November, 1973 (10.11.73), Pay attention to page 1, left column, line 18 to right column, line 25; Figs. 1 to 3 (Family: none)	2-3
A	WO 00/55085 A1 (Mitsubishi Electric Corp.), 21 September, 2000 (21.09.00), & EP 1086921 A1	1, 4
A	JP 55-48181 A (Mitsubishi Electric Corp.), 05 April, 1980 (05.04.80), (Family: none)	1

Form PCT/ISA/210 (continuation of second sheet) (January 2004)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 6318506 B [0003]