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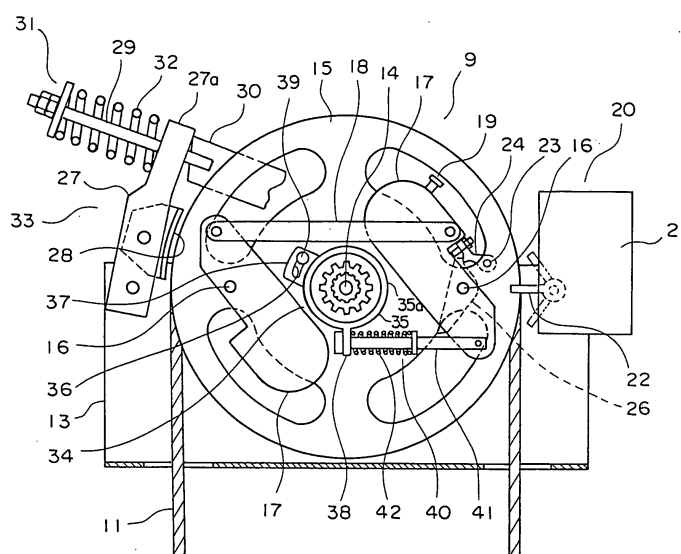
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(54) **ELEVATOR APPARATUS**

(57) A speed governor sheave, which can rotate integrally with a sheave shaft, is supported on a pedestal. A flyweight, which is displaced from a normal position to a trip position due to a centrifugal force resulting from rotation of the speed governor sheave, is provided on the speed governor sheave. An adjusting lever, which can turn in a circumferential direction of the speed governor sheave, is provided on the sheave shaft. A coupling body having a balancing spring for urging the flyweight

in such a direction as to act against the centrifugal force is provided so as to connect the flyweight and the adjusting lever to each other. An operation member, which can be displaced in an axial direction of the sheave shaft, is provided on the sheave shaft. The adjusting lever can be turned through displacement of the operation member in the axial direction of the sheave shaft. Accordingly, the distance from the normal position to the trip position can be adjusted by turning the adjusting lever.

FIG. 3



Description

Technical Field

[0001] The present invention relates to a speed governor for an elevator having a speed governor sheave that is rotated in accordance with a movement of a car.

Background Art

[0002] In a conventional speed governor for an elevator, a flyweight provided on a speed governor sheave is often designed to be turned due to a centrifugal force resulting from rotation of the speed governor sheave, with a view to detecting that the speed of a car has reached a predetermined overspeed. The car is mounted with an emergency stop device for preventing the car from falling. A speed governor rope coupled to the emergency stop device is wrapped around the speed governor sheave. Accordingly, the speed governor sheave is rotated at a speed corresponding to the speed of the car.

[0003] In this conventional speed governor for the elevator, when the rotational speed of the speed governor sheave reaches a first overspeed, a car stop switch is actuated through the turning of the flyweight. A power source for a drive unit of the elevator is shut off through actuation of the car stop switch, and the car is stopped by a braking device of the drive unit. When the rotational speed of the speed governor sheave reaches a second overspeed, the flyweight is further turned, so a braking mechanism for braking the speed governor rope is operated. The speed governor rope is braked through operation of the braking mechanism, and the emergency stop device is operated through the braking of the speed governor rope (see Patent Document 1).

[0004] Patent Document 1: JP 2001-106454 A

Disclosure of the Invention

Problems to be solved by the Invention

[0005] In such the conventional speed governor for the elevator, however, settings of the first overspeed and the second overspeed cannot be adjusted during operation of the elevator. Accordingly, an overspeed set for the speed governor is constant regardless of a position of the car. Thus, the speed governor cannot be operated until the speed of the car reaches an extremely high speed, even when the car is being moved in an upper portion or a lower portion of a hoistway where the car is usually moved at a low speed. As a result, a buffer for softening an impact made on the car cannot be reduced in size, so the depth of a pit portion of the hoistway, in which the buffer is installed, cannot be reduced. Further, an overhead dimension for allowing the car to overshoot or leap is also increased and cannot be reduced either.

[0006] The present invention has been made to solve the problems as described above, and it is therefore an

object of the present invention to obtain a speed governor for an elevator, which allows a set overspeed for stopping a car as an emergency measure to be adjusted easily.

Means for solving the Problems

[0007] A speed governor for an elevator according to the present invention includes: a sheave shaft rotatably supported on a pedestal; a speed governor sheave having a speed governor rope moving together with a car wrapped around the speed governor sheave and which is rotatable integrally with the sheave shaft; a flyweight which is provided on the speed governor sheave, is displaceable with respect to the speed governor sheave between a normal position and a trip position located radially outward of the normal position with respect to the speed governor sheave, and is displaced from the normal position to the trip position due to a centrifugal force resulting from rotation of the speed governor sheave; a braking mechanism for applying a braking force to the speed governor rope by being actuated through displacement of the flyweight to the trip position; an adjusting lever which is turnable in a circumferential direction of the speed governor sheave with respect to the sheave shaft; a coupling body which has a balancing spring for urging the flyweight in a direction for urging the flyweight against the centrifugal force resulting from rotation of the speed governor sheave and is connected between the flyweight and the adjusting lever; an operation member which is provided on the sheave shaft and is displaceable in an axial direction of the sheave shaft; and an interlocking mechanism for interlocking the operation member with the adjusting lever. In the speed governor, the adjusting lever can be turned through displacement of the operation member in the axial direction of the sheave shaft, and the adjusting lever is turned to adjust a distance from the normal position to the trip position.

Brief description of the Drawings

[0008]

Fig. 1 is a construction view showing an elevator apparatus according to Embodiment 1 of the present invention.

Fig. 2 is a front view showing the speed governor of Fig. 1.

Fig. 3 is a back view showing the speed governor of Fig. 2.

Fig. 4 is a partial sectional view showing an essential part of the speed governor of Fig. 3.

Fig. 5 is an exploded perspective view showing the essential part of the speed governor of Fig. 3.

Fig. 6 is a graph showing how a speed of the car, a first overspeed, and a second overspeed are related to a distance from a lowermost floor to the car during normal operation of the elevator of Fig. 1.

Fig. 7 is a sectional view showing an essential part

of a speed governor for an elevator according to Embodiment 2 of the present invention.

Fig. 8 is a construction view showing the essential part of the speed governor as viewed along a radial direction of the speed governor sheave of Fig. 7.

Best Modes for carrying out the Invention

[0009] Preferred embodiments of the present invention will be described hereinafter with reference to the drawings.

Embodiment 1

[0010] Fig. 1 is a construction view showing an elevator apparatus according to Embodiment 1 of the present invention. Referring to the figure, a drive unit 2 is installed in an upper portion within a hoistway 1. A main rope 3 is wrapped around a sheave 2a of the drive unit 2. A car 4 and a counterweight 5 are suspended within the hoistway 1 by means of the main rope 3. A pair of car guide rails 6 for guiding the car 4 during raising and lowering of the car 4 and a pair of counterweight guide rails (not shown) for guiding the counterweight 5 during raising and lowering of the counterweight 5 are also installed within the hoistway 1.

[0011] An emergency stop device 7 for preventing the car 4 from falling is provided on a lower portion of the car 4. A speed governor supporting member 8 is fixed to an upper portion of one of the car guide rails 6. A speed governor 9 for detecting an overspeed of the car 4 to operate the emergency stop device 7 is supported on the speed governor supporting member 8.

[0012] A rotatable tension pulley 10 is provided in the vicinity of a bottom portion of the hoistway 1. A speed governor rope 11 is wrapped around the speed governor 9 and the tension pulley 10. The speed governor rope 11 is connected at one end and the other end thereof to the emergency stop device 7 via a lever 12. The speed governor rope 11 is moved in a circulating manner as the car 4 is raised and lowered.

[0013] Fig. 2 is a front view showing the speed governor 9 of Fig. 1. Referring to the figure, a pedestal 13 is fixed on the speed governor supporting member 8. A sheave shaft 14, which extends horizontally, is rotatably supported on the pedestal 13. A speed governor sheave 15 around which the speed governor rope 11 is wrapped is fixed to the sheave shaft 14. The speed governor sheave 15 is rotated integrally with the sheave shaft 14.

[0014] A pair of flyweights 17, which can turn around pins 16, respectively, are provided on a lateral surface of the speed governor sheave 15. Each of the flyweights 17 can be displaced between a normal position and a trip position located radially outward of the normal position with respect to the speed governor sheave 15, by turning around a corresponding one of the pins 16. Each of the flyweights 17 is turned from the normal position to the trip position due to a centrifugal force resulting from

rotation of the speed governor sheave 15. The respective flyweights 17 are coupled to each other by a link 18.

[0015] An actuating pawl 19 is fixed to one end of one of the flyweights 17. The actuating pawl 19 is displaced radially outward with respect to the speed governor sheave 15 through the turning of the flyweight 17 from the normal position to the trip position.

[0016] A car stop switch 20 for stopping supply of electric power to the drive unit 2 and operating a braking device (not shown) of the drive unit 2 is mounted to the pedestal 13. The car stop switch 20 has a switch body 21 and a switch lever 22. The switch lever 22, which is provided in the switch body 21, is operated by the actuating pawl 19. The switch lever 22 is operated by the actuating pawl 19 when the flyweight 17 is turned to a stop operation position located between the normal position and the trip position. The flyweights 17 are each turned to the stop operation position when the speed of the car 4 reaches a first overspeed (in general, about one and three-tenths of a rated speed). The flyweights 17 are each turned to the trip position when the speed of the car 4 reaches a second overspeed (in general, about one and four-tenths of the rated speed).

[0017] A trip lever 24, which can turn around a shaft 23 parallel to the pins 16, is provided on the speed governor sheave 15. The trip lever 24 partially abuts on one of the flyweights 17. The trip lever 24 is turned around the shaft 23 through the turning of the flyweight 17. The shaft 23 is provided with a torsion spring (not shown) for urging the trip lever 24 in such a direction as to bring the trip lever 24 into abutment on the flyweight 17.

[0018] A ratchet 25, which can rotate around the sheave shaft 14, is provided on the pedestal 13. The ratchet 25 is rotated with respect to the sheave shaft 14. A plurality of teeth are provided on an outer peripheral portion of the ratchet 25.

[0019] An engaging pawl 26 for being selectively engaged with one of the trip lever 24 and the ratchet 25 is turnably provided on one of the pins 16. The engaging pawl 26 is urged by a tension spring (not shown) in such a direction as to be engaged with the ratchet 25. The engaging pawl 26 is in engagement with the trip lever 24 and has been separated from the ratchet 25 when the flyweight 17 is at the normal position. When the flyweight 17 is turned to the trip position, the engaging pawl 26 is disengaged from the trip lever 24 and turned due to a force of the tension spring to be engaged with the ratchet 25.

[0020] An arm 27 is turnably mounted on the pedestal 13. A shoe 28, which is pressed against the speed governor sheave 15 via the speed governor rope 11, is turnably mounted to the arm 27. A spring shaft 29 is passed through a tip 27a of the arm 27 in a displaceable manner. A connection link 30, which is turnably connected to the ratchet 25, is fixed to one end of the spring shaft 29. A spring receiving member 31 is provided at the other end of the spring shaft 29. A pressing spring 32 for pressing the shoe 28 against the speed governor rope 11 is pro-

vided between the tip 27a of the arm 27 and the spring receiving member 31.

[0021] The ratchet 25 is rotated in the same direction as the speed governor sheave 15 through engagement with the engaging pawl 26 during rotation of the speed governor sheave 15. The arm 27 is thereby turned in such a direction that the shoe 28 is pressed against the speed governor sheave 15. A movement of the speed governor rope 11 is braked through the pressing of the shoe 28 against the speed governor sheave 15 via the speed governor rope 11.

[0022] A braking mechanism 33 for applying a braking force to the speed governor rope 11 has the trip lever 24, the ratchet 25, the engaging pawl 26, the arm 27, the shoe 28, the spring shaft 29, the connection link 30, the spring receiving member 31, and the pressing spring 32.

[0023] Fig. 3 is a back view showing the speed governor 9 of Fig. 2. Referring to the figure, the sheave shaft 14 is provided with an adjusting lever 34, which can turn in a circumferential direction of the speed governor sheave 15 with respect to the sheave shaft 14. The adjusting lever 34 has a lever body 35, a turning regulating portion 37, and a lever strip 38. The lever body 35 includes a cylinder portion 35a through which the sheave shaft 14 has been passed. The turning regulating portion 37, which is provided on an outer peripheral portion of the lever body 35, is provided with a long hole 36 extending in the circumferential direction of the speed governor sheave 15. The lever strip 38 is provided on the outer peripheral portion of the lever body 35 and extends radially outward of the lever body 35.

[0024] A pin 39 passed through the long hole 36 is fixed on the lateral surface of the speed governor sheave 15. The pin 39 can slide within the long hole 36 in a longitudinal direction of the long hole 36. The turning regulating portion 37 is slid with respect to the pin 39 through the turning of the adjusting lever 34 with respect to the sheave shaft 14. A turning amount of the adjusting lever 34 is thereby regulated.

[0025] The lever strip 38 is displaced in the circumferential direction of the speed governor sheave 15 through the turning of the lever body 35. A coupling body 40 for coupling one of the flyweights 17 to the adjusting lever 34 is connected between the other end of the flyweight 17 and the lever strip 38. The coupling body 40 has an extendable rod 41 and a balancing spring 42. The extendable rod 41 is connected between the flyweight 17 and the lever strip 38. The balancing spring 42, which is provided on the extendable rod 41, urges the flyweight 17 in such a direction as to act against a centrifugal force resulting from rotation of the speed governor sheave 15.

[0026] The flyweight 17 and the adjusting lever 34 are interlocked with each other by the coupling body 40. Accordingly, the normal position of the flyweight 17 can be adjusted in such a direction as to move toward or away from the trip position, through the turning of the adjusting lever 34. In other words, a turning angle (a turning distance) of the flyweight 17 during displacement from the

normal position to the trip position can be adjusted by the adjusting lever 34. The magnitudes of the first overspeed and the second overspeed for stopping the car 4 as an emergency measure can be adjusted through the turning of the adjusting lever 34.

[0027] Fig. 4 is a partial sectional view showing an essential part of the speed governor 9 of Fig. 3. Fig. 5 is an exploded perspective view showing the essential part of the speed governor 9 of Fig. 3. An operation member 43, which can be displaced in an axial direction of the sheave shaft 14, is provided on the sheave shaft 14. The operation member 43 has a tube portion 44 surrounding the sheave shaft 14, and a plate-shaped disc portion 45 provided on an outer peripheral portion of the tube portion 44. The disc portion 45 is disposed on the sheave shaft 14 perpendicularly to an axis of the sheave shaft 14.

[0028] An interlocking mechanism 46 for interlocking the operation member 43 with the adjusting lever 34 is provided between the sheave shaft 14 and the lever body 35. The interlocking mechanism 46 converts a displacement of the operation member 43 with respect to the sheave shaft 14 into a turning motion of the adjusting lever 34 with respect to the sheave shaft 14.

[0029] The interlocking mechanism 46 has a displacement body 47, a sheave shaft-side spline portion 48, and a lever-side spline portion 49. The displacement body 47 is integrated with the operation member 43. The sheave shaft-side spline portion 48, which is provided on an outer peripheral surface of the sheave shaft 14, is a first guide portion for turning the displacement body 47 with respect to the sheave shaft 14 when the displacement body 47 is displaced with respect to the sheave shaft 14. The lever-side spline portion 49, which is provided on an inner peripheral surface of the cylinder portion 35a, turns the cylinder portion 35a with respect to the displacement body 47 reversely to a direction in which the displacement body 47 is turned by the sheave shaft-side spline portion 48, when the displacement body 47 is displaced with respect to the sheave shaft 14.

[0030] An internal gear spline portion 50 fitted to the sheave shaft-side spline portion 48 is provided on an inner peripheral surface of the displacement body 47. An external gear spline portion 51 fitted to the lever-side spline portion 49 is provided on an outer peripheral surface of the displacement body 47. In other words, the displacement body 47 is spline-connected with the lever body 35 and the sheave shaft 14. The displacement body 47 can thereby be displaced while being turned in the axial direction of the sheave shaft 14 with respect to the sheave shaft 14 and the cylinder portion 35a.

[0031] Tooth traces of the sheave shaft-side spline portion 48 and the lever-side spline portion 49 are inclined with respect to the axial direction of the sheave shaft 14. In other words, the sheave shaft-side spline portion 48 and the lever-side spline portion 49 are designed as helical spline portions. An inclination direction (a torsion direction) of the tooth traces of the sheave shaft-side spline portion 48 is reverse to that of the tooth traces of

the lever-side spline portion 49. In addition, an inclination angle (a torsion angle) of the tooth traces of the sheave shaft-side spline portion 48 is different from that of the tooth traces of the lever-side spline portion 49.

[0032] When the displacement body 47 is displaced with respect to the sheave shaft 14 in the axial direction of the sheave shaft 14, the turning of the displacement body 47 with respect to the sheave shaft 14 occurs simultaneously with the turning of the cylinder portion 35a with respect to the displacement body 47. A turning direction of the displacement body 47 with respect to the sheave shaft 14 is reverse to a turning direction of the cylinder portion 35a with respect to the displacement body 47. Accordingly, when the displacement body 47 is displaced in the axial direction of the sheave shaft 14, the adjusting lever 34 is turned with respect to the sheave shaft 14 by an angular difference between a turning angle of the displacement body 47 with respect to the sheave shaft 14 and a turning angle of the cylinder portion 35a with respect to the displacement body.

[0033] An actuating device (not shown) for displacing the operation member 43 in the axial direction of the sheave shaft 14 is provided on the pedestal 13. The actuating device has an arm portion for coming into contact with the disc portion 45 to displace the operation member 43. An encoder (not shown) serving as a detecting portion for detecting a position and a speed of the car 4 is provided on the sheave shaft 14. The encoder generates a signal corresponding to rotation of the speed governor sheave 15 and sends the generated signal to an elevator control unit (not shown). The elevator control unit controls the actuating device based on information acquired from the encoder.

[0034] Fig. 6 is a graph showing how a speed of the car 4, a first overspeed, and a second overspeed are related to a distance from a lowermost floor to the car 4 during normal operation of the elevator of Fig. 1. Referring to the figure, the hoistway 1 is provided with acceleration/deceleration zones in which the car 4 is accelerated/decelerated in the vicinity of the lowermost floor and an uppermost floor (i.e., one terminal floor and the other terminal floor), and a constant-speed zone in which the car 4 moves at a constant speed between the acceleration/deceleration zones.

[0035] In the elevator control unit, a normal speed pattern 55 representing a speed of the car 4 during normal operation, a first overspeed pattern 56 representing a speed higher than the speed of the normal speed pattern 55, and a second overspeed pattern 57 representing a speed higher than the speed of the first overspeed pattern 56 are set so as to correspond to positions of the car 4, respectively.

[0036] The normal speed pattern 55, the first overspeed pattern 56, and the second overspeed pattern 57 are set so as to remain constant in the constant-speed zone and continuously decrease as the car 4 approaches each of the terminal floors in a corresponding one of the acceleration/deceleration zones.

[0037] The elevator control unit controls the actuating device such that the magnitudes of the first overspeed and the second overspeed are adjusted along the first overspeed pattern 56 and the second overspeed pattern 57, respectively. In other words, the elevator control unit controls the actuating device such that the magnitudes of the first overspeed and the second overspeed each decrease continuously as the position of the car 4 approaches the lowermost floor or the uppermost floor in each of the acceleration/deceleration zones.

[0038] In this example, the elevator control unit controls the actuating device such that the operation member 43 is displaced in such a direction as to reduce a turning distance of the flyweight 17 between the normal position and the trip position when the car 4 is moved toward the lowermost floor or the uppermost floor in each of the acceleration/deceleration zones. Meanwhile, the elevator control unit controls the actuating device such that the operation member 43 is displaced in such a direction as to increase a turning distance of the flyweight 17 between the normal position and the trip position when the car 4 is moved away from the lowermost floor or the uppermost floor in each of the acceleration/deceleration zones.

[0039] Next, an operation will be described. In the elevator control unit, a speed of the car 4 is constantly calculated based on information acquired from the encoder. When the car 4 is moved within the constant-speed zone, the operation member 43 is fixed at a predetermined position without being displaced by the actuating device. Accordingly, the respective magnitudes of the first overspeed and the second overspeed are constant regardless of the position of the car 4.

[0040] When the car 4 is moved within the acceleration/deceleration zones, the actuating device is operated through control of the elevator control unit, so the operation member 43 is displaced in accordance with the position of the car 4. The normal position of each of the flyweights 17 is thereby adjusted to be displaced radially further outward of the speed governor sheave 15 as the position of the car 4 moves toward the lowermost floor or the uppermost floor, and to be displaced radially further inward of the speed governor sheave 15 as the position of the car 4 moves away from the lowermost floor or the uppermost floor. In other words, the respective magnitudes of the first overspeed and the second overspeed are continuously reduced as the car 4 moves toward the lowermost floor or the uppermost floor, and are continuously increased as the car 4 moves away from the lowermost floor or the uppermost floor.

[0041] During normal operation, the car 4 is moved within the hoistway 1 according to the normal speed pattern 55. At this moment, each of the flyweights 17 has been turned radially outward of the speed governor sheave 15 due to a centrifugal force resulting from rotation of the speed governor sheave 15 corresponding to a speed of the car 4.

[0042] When the speed of the car 4 further rises to reach a value of the first overspeed pattern 56 for some

reason, the flyweight 17 is turned to the stop operation position, so the switch lever 22 is operated by the actuating pawl 19. The supply of electric power to the drive unit 2 is thereby stopped through control of the elevator control unit, so the braking device is operated to stop the car 4.

[0043] The car 4 is moved without being stopped even when the drive unit 2 is stopped, for example, when the main rope 3 is broken. When the speed of the car 4 reaches a value of the second overspeed pattern 57, the flyweight 17 is further turned to reach the trip position due to the centrifugal force resulting from rotation of the speed governor sheave 15. The engaging pawl 26 is thereby disengaged from the trip lever 24 and turned to be engaged with the ratchet 25. The ratchet 25 is thereby slightly rotated in a rotational direction of the speed governor sheave 15.

[0044] A rotational force of the ratchet 25 is transmitted to the arm 27 via the connection link 30, the spring shaft 29, the spring receiving member 31, and the pressing spring 32. The arm 27 is thereby turned, so the shoe 28 comes into contact with the speed governor rope 11 and then is pressed thereagainst by the pressing spring 32. The speed governor rope 11 is thereby braked.

[0045] When the speed governor rope 11 is stopped from moving, the car 4 continues to be moved. Thus, the lever 12 is operated to actuate the emergency stop device 7.

[0046] In such the speed governor 9 for the elevator, the adjusting lever 34, which can turn in the circumferential direction of the speed governor sheave 15, is interlocked with the operation member 43, which can be displaced in the axial direction of the sheave shaft 14, via the interlocking mechanism 46, and the flyweights 17 are turned by turning the adjusting lever 34. Therefore, even when the speed governor sheave 15 is in rotation, the turning angle of each of the flyweights 17 from the normal position to the trip position can be adjusted by displacing the operation member 43 in the axial direction of the sheave shaft 14. As a result, the magnitudes of the first overspeed and the second overspeed can be changed easily in accordance with the position of the car 4.

[0047] Thus, while the magnitudes of the first overspeed and the second overspeed can be reduced as the car 4 moves toward each of the terminal floors in a corresponding one of the acceleration/deceleration zones provided in the vicinity of the terminal floors, they can be held constant in the constant-speed zone provided between the respective acceleration/deceleration zones. Therefore, in the vicinity of each of the terminal floors, the first overspeed and the second overspeed can be lowered in comparison with those in the constant-speed zone, so the braking distance in stopping the car 4 as an emergency measure can be shortened. A buffer provided in a pit portion of the hoistway 1 can thereby be made compact, so a depth of the pit portion can be reduced. An overhead dimension for allowing the car 4 to over-

shoot or leap can also be reduced. In other words, a dimension in a height direction of the hoistway 1 can be reduced.

[0048] The interlocking mechanism 46 has the displacement body 47, the sheave shaft-side spline portion 48, and the lever-side spline portion 49. The displacement body 47 is integrated with the operation member 43. The sheave shaft-side spline portion 48, which is provided on the outer peripheral surface of the sheave shaft 14, turns the displacement body 47 with respect to the sheave shaft 14 when the displacement body 47 is displaced with respect to the sheave shaft 14. The lever-side spline portion 49, which is provided on the inner peripheral surface of the cylinder portion 35a, turns the cylinder portion 35a with respect to the displacement body 47 reversely to the direction in which the displacement body 47 is turned by the sheave shaft-side spline portion 48, when the displacement body 47 is displaced with respect to the sheave shaft 14. Therefore, a predetermined resistance force can be generated by the sheave shaft-side spline portion 48 and the lever-side spline portion 49 for a displacement of the displacement body 47 in the axial direction of the sheave shaft 14. Consequently, the displacement body 47 can be prevented from being displaced with respect to the sheave shaft 14 due to vibrations or a centrifugal force resulting from rotation of the speed governor sheave 15.

[0049] The displacement body 47 is spline-connected with the sheave shaft 14 by means of the sheave-side spline portion 48 having the tooth traces inclined with respect to the axial direction of the sheave shaft 14, and with the cylinder portion 35a by means of the lever-side spline portion 49 having the tooth traces inclined with respect to the axial direction of the sheave shaft 14. Therefore, the displacement body 47 can be more reliably turned with respect to the sheave shaft 14 by being displaced in the axial direction of the sheave shaft 14, and the cylinder portion 35a can be more reliably turned with respect to the displacement body 47.

[0050] In the foregoing embodiment, the displacement body 47 is spline-connected with both the cylinder portion 35a and the sheave shaft 14. However, the displacement body 47 may not be spline-connected but connected through other methods with them as long as the displacement body 47 can be -turned by being displaced in the axial direction of the sheave shaft 14.

Embodiment 2

[0051] Fig. 7 is a sectional view showing an essential part of a speed governor for an elevator according to Embodiment 2 of the present invention. Fig. 8 is a construction view showing the essential part of the speed governor 9 as viewed along a radial direction of the speed governor sheave 15 of Fig. 7. Referring to the figures, a slide pin 61 extending in the radial direction of the speed governor sheave 15 is fixed to the displacement body 47 while passing through the displacement body 47. The

slide pin 61 has a first protruding portion 61a protruding from the inner peripheral surface of the displacement body 47, and a second protruding portion 61b protruding from the outer peripheral surface of the displacement body 47.

[0052] A sheave shaft-side groove portion 62, in which the first protruding portion 61a is slidably inserted, is provided in the outer peripheral surface of the sheave shaft 14. The sheave shaft-side groove portion 62 is inclined with respect to the axial direction of the sheave shaft 14. The first protruding portion 61a is guided along the sheave shaft-side groove portion 62 through displacement of the displacement body 47 in the axial direction of the sheave shaft 14. The displacement body 47 is thereby displaced in the axial direction of the sheave shaft 14 while being turned with respect to the sheave shaft 14.

[0053] A lever-side groove portion 63, in which the second protruding portion 61b is slidably inserted, is provided in the inner peripheral surface of the cylinder portion 35a. The lever-side groove portion 63 is inclined with respect to the axial direction of the sheave shaft 14 reversely to an inclination direction of the sheave shaft-side groove portion 62. The second protruding portion 61b is guided along the lever-side groove portion 63 through displacement of the displacement body 47 in the axial direction of the sheave shaft 14. The cylinder portion 35a is turned with respect to the displacement body 47 reversely to a direction in which the displacement body 47 is turned due to the sheave shaft-side groove portion 62, through displacement of the displacement body 47 in the axial direction of the sheave shaft 14.

[0054] An inclination angle of the sheave shaft-side groove portion 62 with respect to the axial direction of the sheave shaft 14 is different from an inclination angle of the lever-side groove portion 63 with respect to the axial direction of the sheave shaft 14. When the displacement body 47 is displaced with respect to the sheave shaft 14 in the axial direction of the sheave shaft 14, the turning of the displacement body 47 with respect to the sheave shaft 14 occurs simultaneously with the turning of the cylinder portion 35a with respect to the displacement body 47. A turning direction of the displacement body 47 with respect to the sheave shaft 14 is reverse to a turning direction of the cylinder portion 35a with respect to the displacement body 47. Accordingly, when the displacement body 47 is displaced in the axial direction of the sheave shaft 14, the adjusting lever 34 is turned with respect to the sheave shaft 14 and the speed governor sheave 15 by an angular difference between a turning angle of the displacement body 47 with respect to the sheave shaft 14 and a turning angle of the cylinder portion 35a with respect to the displacement body.

[0055] An interlocking mechanism 64 for interlocking the operation member 43 with the adjusting lever 34 has the displacement body 47, the slide pin 61, the sheave shaft-side groove portion 62, and the lever-side groove portion 63. Embodiment 2 of the present invention is identical to Embodiment 1 of the present invention in other

constructional details.

[0056] In such the elevator apparatus, the sheave shaft-side groove portion 62 for guiding the first protruding portion 61a protruding from the inner peripheral surface of the displacement body 47 to turn the displacement body 47 with respect to the sheave shaft 14 is provided in the sheave shaft 14, and the lever-side groove portion 63 for guiding the second protruding portion 61b protruding from the outer peripheral surface of the displacement body 47 to turn the cylinder portion 35a with respect to the displacement body 47 is provided in the inner peripheral surface of the cylinder portion 35a. Thus, the interlocking mechanism 64 can be simplified in construction, so the cost of production can be reduced.

[0057] In the foregoing embodiment, the sheave shaft-side groove portion 62 is provided in the sheave shaft 14. However, the sheave shaft-side groove portion 62 may be replaced with a long hole. In the foregoing embodiment, the lever-side groove portion 63 is provided in the cylinder portion 35a. However, the lever-side groove portion 63 may be replaced with a long hole.

Claims

1. A speed governor for an elevator, comprising:

- a sheave shaft rotatably supported on a pedestal;
- a speed governor sheave having a speed governor rope moving together with a car wrapped around the speed governor sheave and which is rotatable integrally with the sheave shaft;
- a flyweight which is provided on the speed governor sheave, is displaceable with respect to the speed governor sheave between a normal position and a trip position located radially outward of the normal position with respect to the speed governor sheave, and is displaced from the normal position to the trip position due to a centrifugal force resulting from rotation of the speed governor sheave;
- a braking mechanism for applying a braking force to the speed governor rope by being actuated through displacement of the flyweight to the trip position;
- an adjusting lever which is turnable in a circumferential direction of the speed governor sheave with respect to the sheave shaft;
- a coupling body which has a balancing spring for urging the flyweight in a direction for urging the flyweight against the centrifugal force and is connected between the flyweight and the adjusting lever;
- an operation member which is provided on the sheave shaft and is displaceable in an axial direction of the sheave shaft; and
- an interlocking mechanism for interlocking the

operation member with the adjusting lever,
characterized in that:

the adjusting lever can be turned through
 displacement of the operation member in 5
 the axial direction of the sheave shaft; and
 the adjusting lever is turned to adjust a distance from the normal position to the trip position.

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2. A speed governor for an elevator according to Claim 1, **characterized in that:**

the adjusting lever has a lever body including a
 cylinder portion into which the sheave shaft has 15
 been passed, and a lever strip provided on the lever body and having the coupling body connected to the lever strip; and
 the interlocking mechanism has an annular displacement body integrated with the operation 20
 member, a first guide portion provided on an outer peripheral surface of the sheave shaft to turn the displacement body with respect to the sheave shaft when the displacement body is displaced with respect to the sheave shaft, and a 25
 second guide portion provided on an inner peripheral surface of the cylinder portion to turn the cylinder portion with respect to the displacement body reversely to a direction in which the displacement body is turned by the first guide 30
 portion when the displacement body is displaced with respect to the sheave shaft.

3. A speed governor for an elevator according to Claim 2, 35
characterized in that:

at least one of the first guide portion and the
 second guide portion is a spline portion having
 tooth traces inclined with respect to the axial direction of the sheave shaft; and 40
 the displacement body is spline-connected with at least one of the cylinder portion and the sheave shaft through the spline portion.

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4. A speed governor for an elevator according to Claim 2,
characterized in that:

at least one of the first guide portion and the 50
 second guide portion is a groove portion inclined with respect to the axial direction of the sheave shaft; and
 the displacement body is provided with a protruding portion inserted in the groove portion. 55

FIG. 1

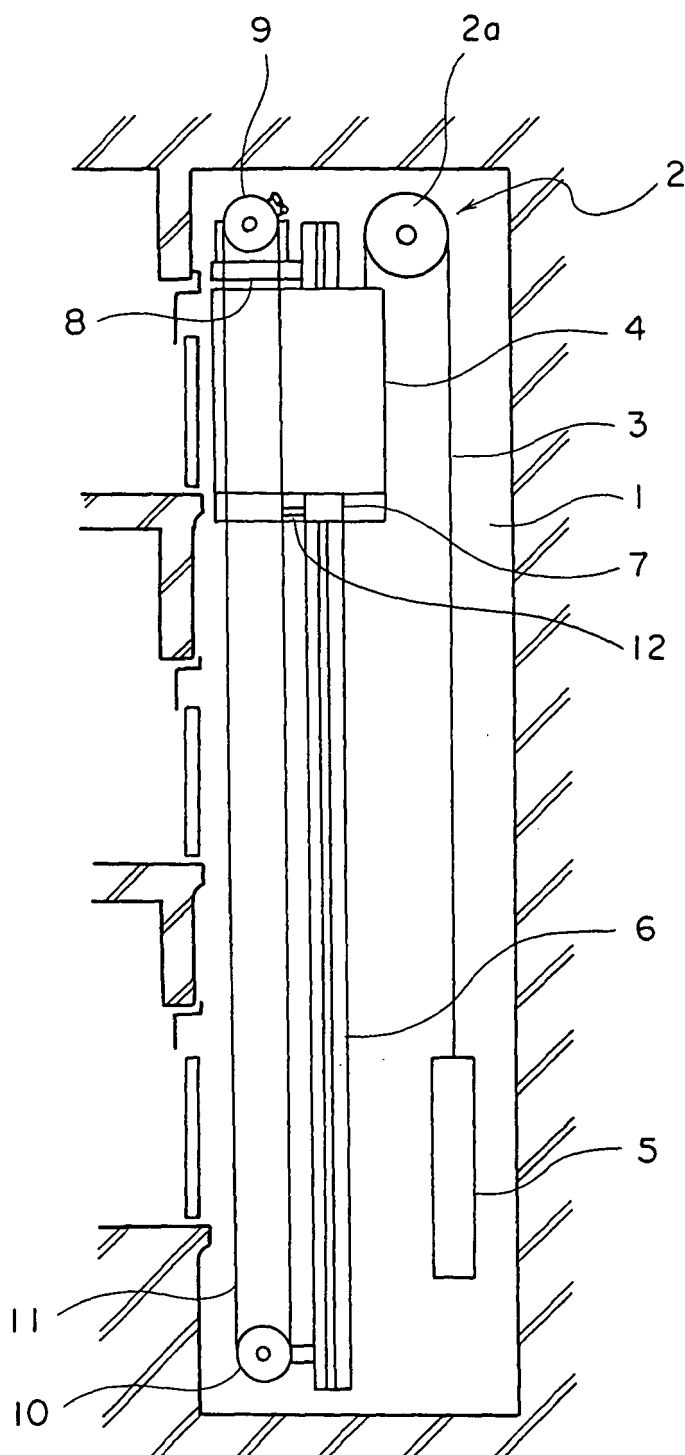


FIG. 2

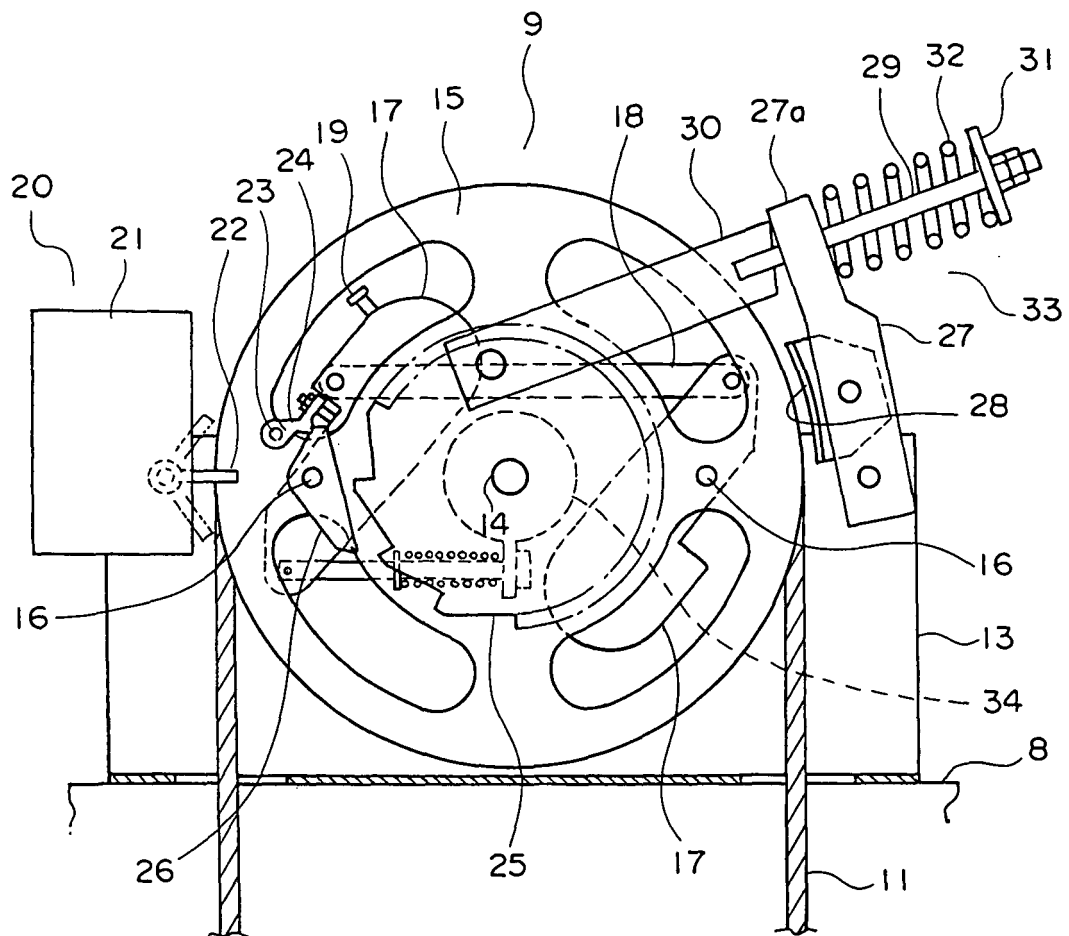


FIG. 3

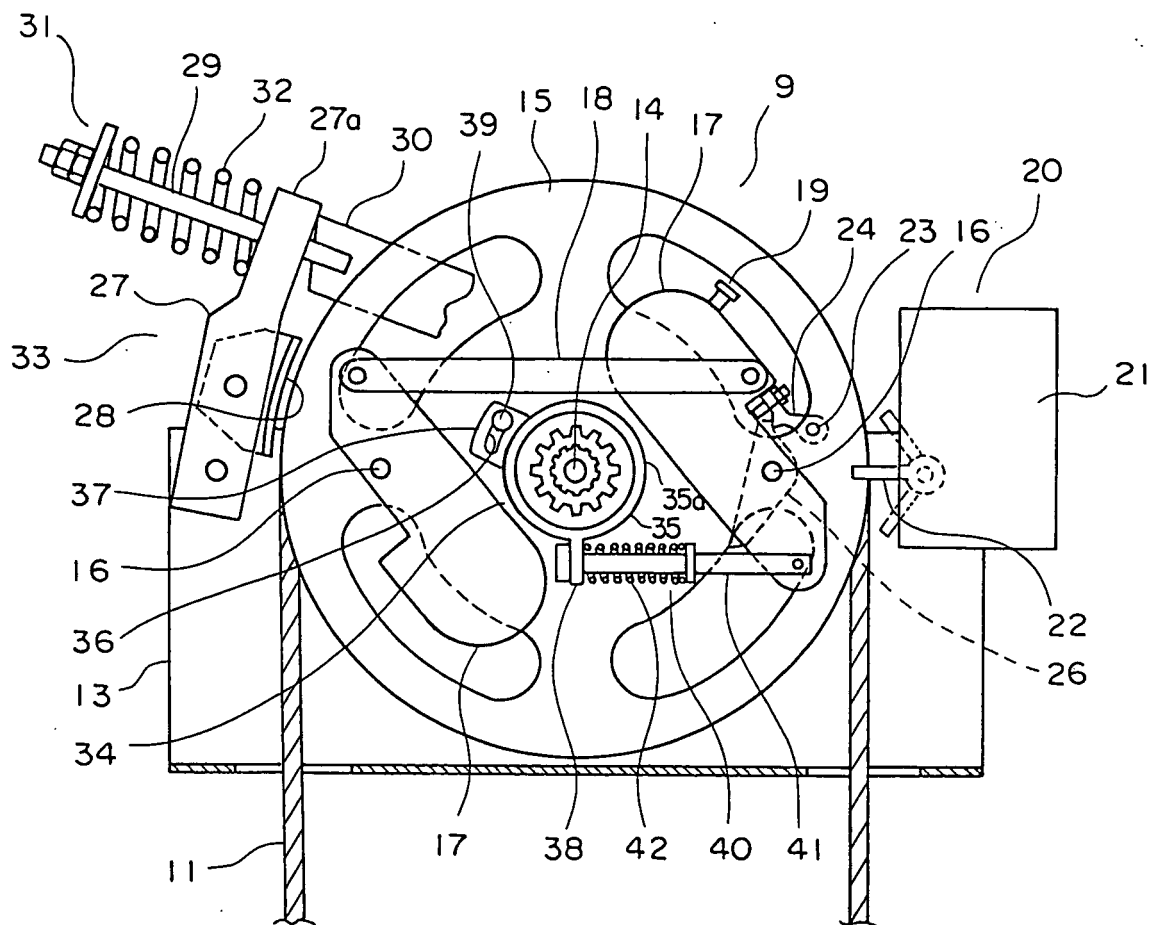


FIG. 4

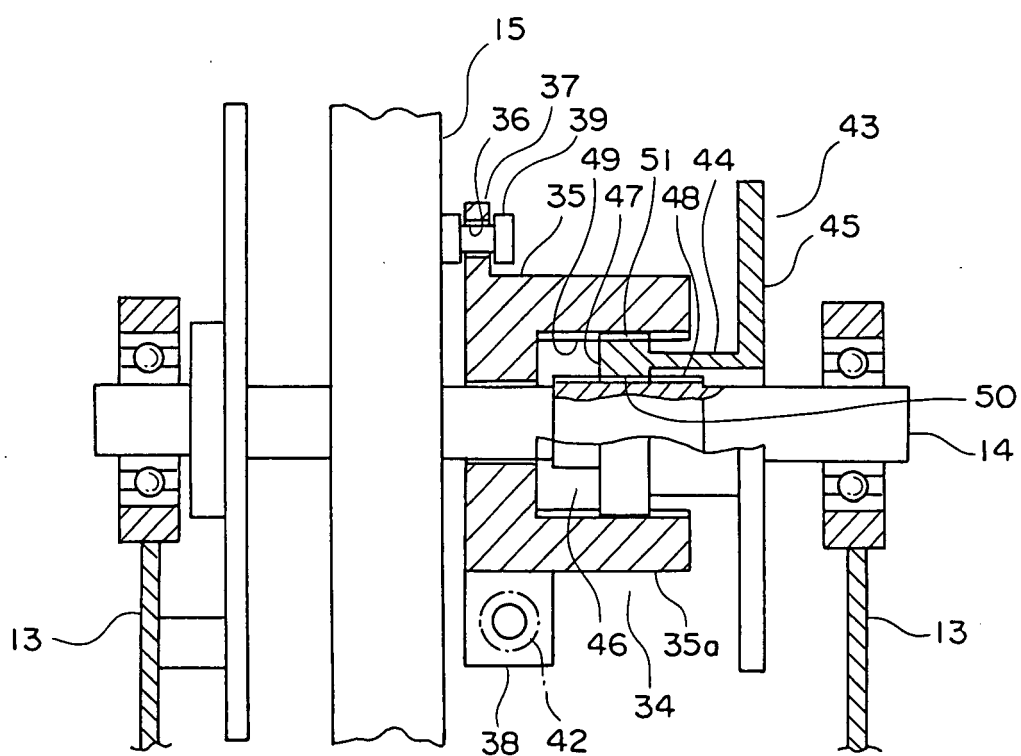


FIG. 5

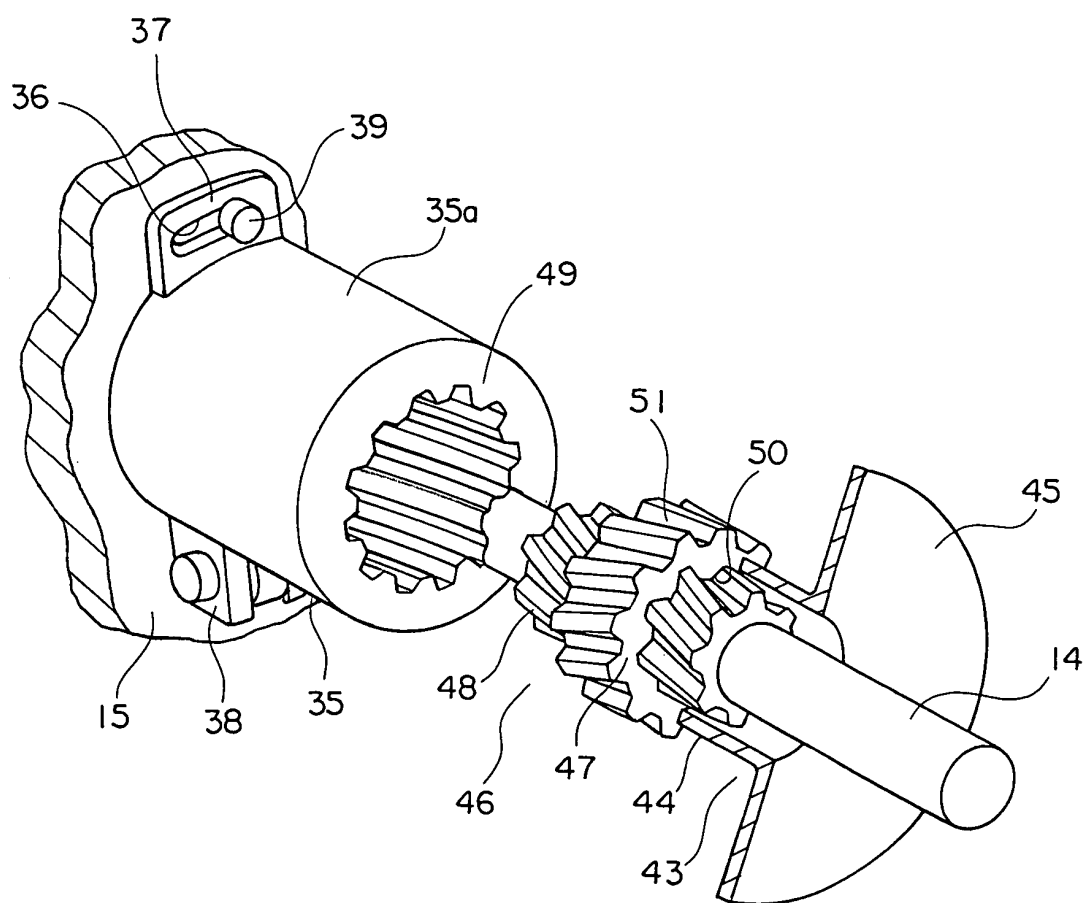


FIG. 6

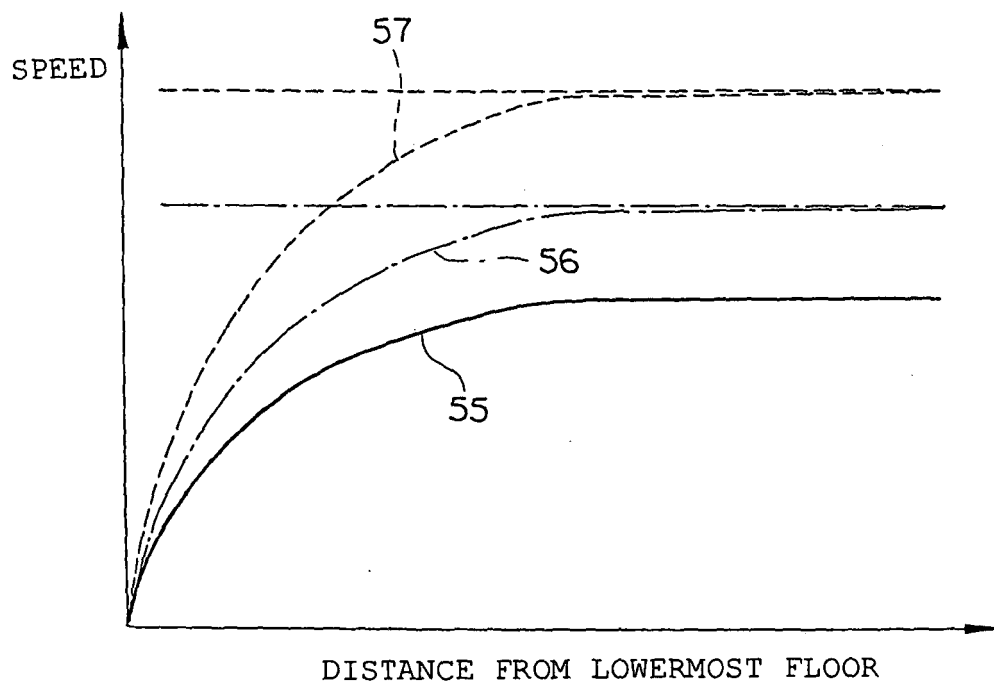


FIG. 7

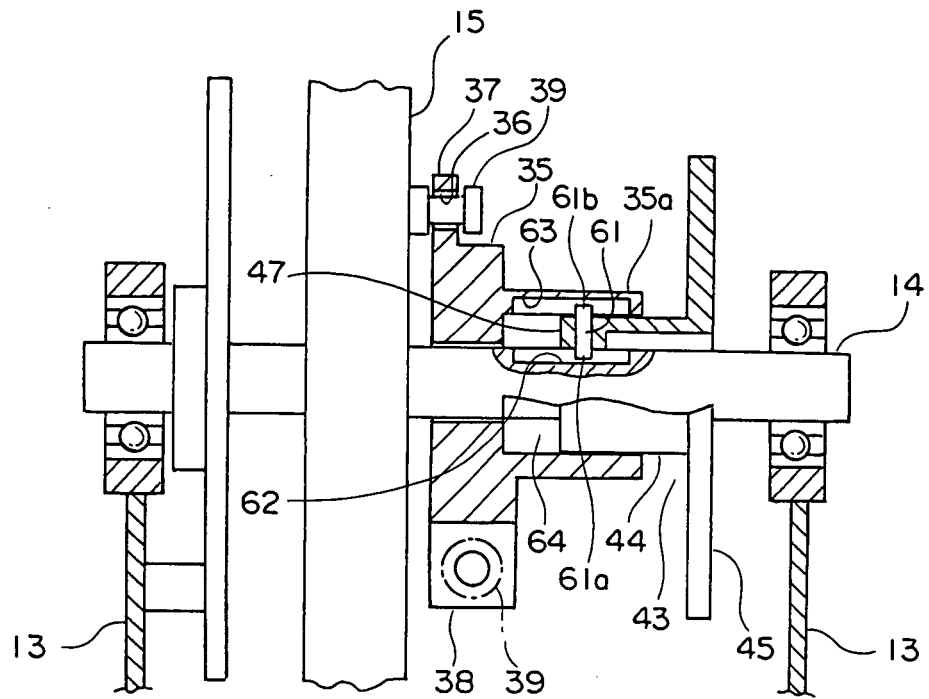
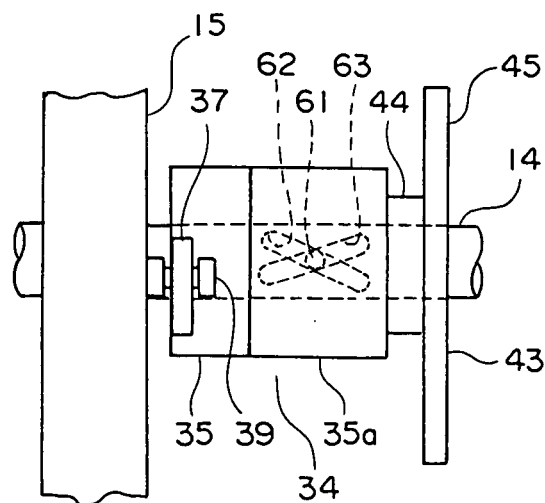


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/014834

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl. ⁷ B66B5/04		
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-B66B5/28		
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 1996-2005 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.
A	WO 03/091142 A1 (MITSUBISHI DENKI KABUSHIKI KAISHA), 06 November, 2003 (06.11.03), & EP 1497214 A1	1-4
A	JP 1-13388 A (MITSUBISHI DENKI KABUSHIKI KAISHA), 18 January, 1989 (18.01.89), (Family: none)	1-4
A	WO 03/029123 A1 (MITSUBISHI DENKI KABUSHIKI KAISHA), 10 April, 2003 (10.04.03), & EP 1431229 A1 & US 2004/0200671 A1	1
☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
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Date of the actual completion of the international search 07 July, 2005 (07.07.05)		Date of mailing of the international search report 26 July, 2005 (26.07.05)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2004/014834

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2001-106454 A (MITSUBISHI DENKI KABUSHIKI KAISHA), 17 April, 2001 (17.04.01), (Family: none)	1

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2001106454 A [0004]