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(54) **SPEED GOVERNOR FOR ELEVATOR**

GESCHWINDIGKEITSREGLER FÜR EINEN AUFZUG

RÉGULATEUR DE VITESSE POUR ASCENSEUR

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Description

Technical Field

[0001] The present invention relates to an elevator governor.

Background Art

[0002] There are a disk type governor and a fly ball type governor as elevator governors which have hitherto been widely used. Overspeed detection mechanisms of conventional governors have no rotation speed dependence. For this reason, overspeed detection is performed at the same speed in all rotational directions.

[0003] However, for example, in a car-side governor of an elevator in which the ascent speed of a car is higher than the decent speed, an overspeed detection mechanism set so as to be adapted to the descent speed of the car operates also during the ascent of the car. For this reason, it is impossible to perform overspeed detection adapted to each of the ascent speed and the descent speed of the car.

[0004] In contrast to this, there have been proposed governors which are such that one governor is provided with two independent overspeed detection mechanisms having different detection operation speeds. In such governors, the rotation of a sheave is transmitted to an overspeed detection mechanism having a low detection operation speed via a ratchet. On the other hand, the rotation of a sheave is not transmitted to the other overspeed detection mechanism having a high detection operation speed via a ratchet, because the ratchet becomes free. As a result of this, in the car-side governor of an elevator in which the ascent speed of a car is higher than the descent speed, it is possible to carry out overspeed detection adapted to each of the ascent speed and the descent speed (refer to JP 2000-327241 A, for example).

[0005] WO 2010/023745 A1 is related to the preamble of claim 1.

Summary of Invention

Technical Problem

[0006] However, in the governor disclosed in Patent Document 1, vibrations and noises are generated from the ratchet while rotating is performed in the direction in which the ratchet becomes free, and besides the reliability of the governor decreases due to the wear of parts of the ratchet.

[0007] The present invention was made to solve the problems described above, and the object of the invention is to provide an elevator governor capable of achieving, with a simple configuration, an overspeed detection mechanism to which rotation dependence is added while preventing a decrease in reliability due to the generation of vibrations and noises and the wear of parts.

Means for Solving the Problems

[0008] An elevator governor of the present invention includes a sheave on which a rope moving in response to the movement of an ascending and descending body of an elevator is wound, and which changes the rotation speed in one direction in response to the ascent speed of the ascending and descending body and changes the rotation speed in the other direction in response to the descent speed of the ascending and descending body; a fly-weight which is provided on a side surface of the sheave and increases and decreases a moving quantity to a radial outer side of the sheave in response to an increase and decrease in the rotation speed of the sheave; a detector which performs overspeed detection of the sheave when the fly-weight has moved to the radial outer side by a predetermined quantity; a stopper which is provided in the sheave and performs a rotational movement with respect to the sheave so as to be arranged to the radial outer side of the fly-weight in the case where the sheave rotates in a predetermined direction which is either of the two rotational directions, thereby preventing the fly-weight from moving to the radial outer side more than the predetermined quantity; rotational position detection means which detects a rotational position of the sheave; object detection means which is provided in proximity to the sheave and detects the stopper in the case where the stopper has approached the object detection means; and determination means which determines a position of the stopper with respect to the sheave on the basis of the rotational position of the sheave during the detection of the stopper by the object detection means.

Advantageous Effect of Invention

[0009] According to the present invention, it is possible to achieve, with a simple configuration, an overspeed detection mechanism to which rotation dependence is added while preventing a decrease in reliability due to the generation of vibrations and noises and the wear of parts.

Brief Description of the Drawings

[0010]

Figure 1 is a front view of an elevator governor in Embodiment 1 of the present invention.

Figure 2 is a sectional view taken along line A-A of Figure 1.

Figure 3 is a front view showing the essential parts of the elevator governor in Embodiment 1 of the present invention.

Figure 4 is a front view showing the essential parts of the elevator governor in Embodiment 1 of the present invention.

Figure 5 is a front view showing the essential parts of the elevator governor in Embodiment 1 of the present invention.

Figure 6 is a block diagram of a malfunction detection device which is used in the elevator governor in Embodiment 1 of the present invention.

Figure 7 is a block diagram of a malfunction detection device used in an elevator governor in Embodiment 2 of the present invention.

Figure 8 is a diagram to explain an example of signal output of the encoder used in the elevator governor in Embodiment 2 of the present invention.

Figure 9 is a front view showing the essential part of an elevator governor in Embodiment 3 of the present invention.

Figure 10 is a front view of an elevator governor in Embodiment 4 of the present invention.

Figure 11 is a sectional view taken along line B-B of Figure 10.

Figure 12 is a view of an elevator governor in Embodiment 5 of the present invention, which is equivalent to Figure 11.

Description of Embodiments

[0011] Embodiments for carrying out the present invention will be described with reference to the accompanying drawings. In each of the drawings, the same reference symbols refer to the same or corresponding parts and overlaps of descriptions of such parts are correctly simplified or omitted.

Embodiment 1

[0012] In general, the shaft of an elevator is formed from a space extending in the vertical direction through the floors of a building. A machine room is provided in the upper part of the haft. A traction machine is provided in the machine room. A hoisting rope is wound on the traction machine. A car of the elevator is suspended at an end of the hoisting rope. On the other hand, a weight is suspended at the other end of the hoisting rope. And the rotation of the traction machine is controlled by a controller. The car and the weight ascend and descend at a set speed by responding to the rotation of the traction machine.

[0013] Furthermore, a safety gear device is provided in the lower part of the car. An endless governor rope is connected to the safety gear device via an arm. A curved portion at the lower end of the governor rope is wound on a tension pulley. On the other hand, a curved portion at the upper end of the governor rope is wound on a sheave of the governor provided in the machine room and the like. Hereinafter, the governor of this embodiment will be described in more detail with the aid of Figures 1 to 6.

[0014] Figure 1 is a front view of an elevator governor in Embodiment 1 of the present invention. Figure 2 is a sectional view taken along line A-A of Figure 1.

[0015] In Figures 1 and 2, reference numeral 1 denotes a governor. The governor 1 is provided with a sheave 2. The sheave 2 is pivotally supported on a main shaft 3. A governor rope 4 is wound on the sheave 2.

[0016] The governor rope 4 is attached to a car in an endless manner. The governor rope 4 moves in response to the movement of the car. The governor rope 4 rotates the sheave 2 in response to the ascent and descent of the car. That is, the sheave 2 changes the rotation speed in one direction according to the ascent speed of the car and changes the rotation speed in the other direction according to the descent speed of the car.

[0017] A pair of disk type fly-weights 5 is rotatably provided on a side surface of the sheave 2 via a pin 6. Both of the fly-weights 5 increase and decrease the moving quantity to the radial outer side of the sheave 2 along the side surface of the sheave 2 as a result of an increase and decrease in the rotation speed of the sheave 2. Both of the fly-weights 5 are connected by a link 7. As a result of this, the two fly-weights 5 have the same rotational angle.

[0018] A balance spring 9 is provided at an end of one of the fly-weights 5 via a link 8. This balance spring 9 constantly urges either of the fly-weights 5 to the center side of the sheave 2. A spring force adjusting nut 10 is provided in the link 8. The spring force adjusting nut 10 adjusts the urging force of the balance spring 9. A dog 11 is provided at an end of the other fly-weight 5 in such a manner as to be directed to the radial outer side of the sheave 2.

[0019] An actuating cam 12 is provided in proximity to the side of one side portion of the sheave 2. The actuating cam 12 is provided in a governor switch 13. The governor switch 13 comes into action when the actuating cam 12 moves up and down. Below one side portion of the sheave 2, a rope catch 14 is provided in proximity to the governor rope 4 on the side where the car is mounted.

[0020] The rope catch 14 is suspended by being caught by the lower end of a hook 15. This hook 15 is pivotally supported in the center via a pin 16. A fixed shoe 17 is provided on a side opposed to the rope catch 14. As a result of this, the governor rope 4 is surrounded by the rope catch 14 and the fixed shoe 17 below one side portion of the sheave 2.

[0021] In this embodiment, a stopper 18 is provided. The main body of this stopper 18 is rotatably provided in the main shaft 3. A pair of locking notched portions 19 is provided in the main body of the stopper 18. The end portions of the locking notched portions 19 on the center side of the sheave 2 are connected by a connecting notched portion 20. The connecting notched portion 20 is formed in the shape of a circular arc, with the main shaft 3 serving as the center. One end 22 of a lever 21 is inserted in such a manner as to be freely movable along the connecting notched portion 20. The other end 23 of the lever 21 is pivotally supported by the sheave 2.

[0022] On the side near the main shaft 3 rather than near the lever 21, a pin 24 is provided in the sheave 2 in such a manner as to protrude to the stopper 18 side. Also in the lever 21, a pin 25 is provided in such a manner as to protrude to the sheave 2 side. Between the pins 24 and 25, there is provided a helical tension spring 26. The helical tension spring 26 constantly urges the lever 21 to the center side of the sheave 2.

[0023] Next, the operation of the governor 1 will be described with the aid of Figures 3 to 5.

[0024] Figures 3 to 5 are front views showing the essential parts of the elevator governor in Embodiment 1 of the present invention.

[0025] A description will be given of the operation of the governor 1 expected when the stopper 18 is not provided.

[0026] When the sheave 2 rotates in synchronization with the ascent and descent of a car, the fly-weight 5 receives a centrifugal force responding to the rotation speed of the sheave 2. While the car is ascending and descending within a rated speed, the force by the balance spring 9 is larger than the centrifugal force applied to the fly-weight 5. For this reason, the relative positions of the fly-weight 5 and the sheave 2 do not change from the initial set condition.

[0027] When the ascending and descent speed of the car exceeds the rated speed, the centrifugal force applied to the fly-weight 5 overcomes the force of the balance spring 9. For this reason, the fly-weight 5 begins to move to the radial outer side of the sheave 2.

[0028] When the ascending and descent speed of the car has reached a first overspeed detection speed, the dog 11 at the forward end of the fly-weight 5 abuts against the actuating cam 12. This abutment causes the governor switch 13 to operate. That is, the actuating cam 12 and the governor switch 13 function as a detector which performs the overspeed detection of the sheave 2 when the fly-weight 5 has moved to the outer side by a predetermined quantity regardless of the ascent and descent of the car. The power to the traction machine and brake of the elevator is interrupted by the operation of the governor switch 13. Usually, the car stops due to this interruption.

[0029] When the car does not stop and the descent speed of the car has exceeded a first overspeed detection speed and has reached a second overspeed detection speed, the fly-weight 5 moves further to the radial outer side of the sheave 2. This movement causes the dog 11 to abut against the upper end of the hook 15 from the actuating cam 12 side. This abutment causes the hook 15 to rotate around the pin 16. This rotation of the hook 15 causes the lower end of the hook 15 to be disengaged from the rope catch 14.

[0030] And the rope catch 14 falls under gravity and sandwiches the governor rope 4 between itself and the fixed shoe 17. As a result of this, the governor rope 4 is braked. In synchronization with the braking of this governor rope 4, the safety gear device provided in the car operates. The operation of this safety gear device causes the car to stop.

[0031] Next, a description will be given of the operation of the governor 1 expected when the stopper 18 exists. In this embodiment, the mass of the lever 21 and the spring constant of the helical tension spring 26 are determined so that the lever 21 moves to the radial outer side of the sheave 2 when the rotation speed of the sheave 2 has exceeded a predetermined threshold value. When the car is accelerated in the ascent direction, the stopper 18 is pressed against one end 22 of the lever 21 in the rotational direction of the sheave 2. As a result of this, the stopper 18 rotates together with the sheave 2.

[0032] And as shown in Figure 3, when the ascent speed of the car exceeds the threshold value, one end 22 of the lever 21 moves to the radial outer side of the sheave 2 due to a centrifugal force and is housed in either of the locking notched portions 19. As a result of this, the stopper 18 is held in a condition in which the stopper 18 cannot rotate relatively with respect to the sheave 2. That is, the stopper 18 rotates together with the sheave 2.

[0033] At this time, the ascent direction exceeds the rated speed and the fly-wheel 2 is almost about to move to the radial outer side of the sheave 5. However, a protruding end of the stopper 18 is arranged on the radial outer side of the sheave 2 with respect to the fly-weight 5. For this reason, the fly-weight 5 interferes with the protruding end of the stopper 18 when the fly-weight 5 moves outside more than the predetermined quantity.

[0034] Therefore, the fly-weight 5 can scarcely move to the radial outer side of the sheave 2. That is, even when the ascent speed of the car has reached a first overspeed detection speed, the dog 11 at the forward end of the fly-weight 5 does not abut against the actuating cam 12. For this reason, the governor switch 13 does not operate, either.

[0035] On the other hand, when the ascent speed of the car decelerates and has lowered to the order of the threshold value, one end 22 of the lever 21 moves to the radial inner side of the sheave 2, i.e., the connecting notched portion 20. For this reason, the stopper 18 becomes able to rotate relatively with respect to the sheave 2 by an amount corresponding to the length of the connecting notched portion 20.

[0036] At this time, the stopper 18 is almost about to rotate at an almost constant speed by the law of inertia even when the sheave 2 has decelerated. For this reason, as shown in Figure 4, the stopper 18 rotates relatively with respect to the sheave 2. Subsequently, when the car has accelerated in the descent direction, the stopper 18 is pressed by one end 22 of the lever 21. As a result of this, the stopper 18 rotates together with the sheave 2.

[0037] And when the decent speed of the car has exceeded the threshold value, as shown in Figure 5, one end 22 of the lever 21 moves due to the centrifugal force to the radial outer side of the sheave 2 and is housed in the other locking notched portion 19. As a result of this, the protruding end of the stopper 18 is held at a position away from the outer side of the fly-weight 5. That is, there is no object which limits the movement of the fly-weight 5. For this reason, when the descent speed of the car has reached a first overspeed detection speed and a second overspeed detection speed, overspeed detection operations responding to each of the speeds are performed.

[0038] Next, a method of detecting malfunctions will be described with the aid of Figure 6.

[0039] Figure 6 is a block diagram of a malfunction detection device which is used in the elevator governor in Embodiment 1 of the present invention.

[0040] As shown in Figure 6, an encoder 27 is provided in the vicinity of the main shaft 3 of the governor 1. The encoder 27 functions as rotational position detection means which outputs a pulse signal responding to the rotational direction of the sheave 2 when the sheave 2 has moved to a prescribed rotational position. The pulse signal is inputted to a malfunction detection device 28.

[0041] The malfunction detection device 28 is provided with a proximity sensor 29 and a stopper position detection part 30. The proximity sensor 29 is arranged just above the sheave 2. The proximity sensor 29 is formed from a distance sensor of the eddy current type, the optical type, and the electrostatic capacity type and the like. For the proximity sensor 29, an area in a prescribed range below the proximity sensor 29 is the detection region. The proximity sensor 29 functions as object detection means which outputs a detection signal in the case where an object is present in the detection region.

[0042] Angular position information of the stopper 18 during the rotation of the governor 1 in the ascent direction is stored beforehand in the stopper position detection part 30. Angular position information of the stopper 18 during the rotation of the governor 1 in the descent direction is stored beforehand in the stopper position detection part 30. The stopper position detection part 30 functions as determination means which makes a determination as to whether or not the stopper 18 is in a prescribed position on the basis of the rotational position of the sheave 2 during the detection of the stopper 18 by the proximity sensor 29.

[0043] According to Embodiment 1 described above, the stopper 18 prevents the fly-weight 5 from moving to the radial outer side of the sheave 2 more than the predetermined quantity while the sheave 2 is rotating in a predetermined direction which is either of the two rotational directions. For this reason, it is possible to provide an elevator governor capable of achievineg, with a simple configuration, an overspeed detection mechanism to which rotation dependence is added while preventing a decrease in reliability due to the generation of vibrations and noises and the wear of parts.

[0044] Furthermore, while the sheave 2 is rotating in a predetermined direction, the main body of the stopper 18 is held by the lever 21 on the radial outer side of the sheave 2 with respect to the fly-weight 5. On the other hand, while the sheave 2 is rotating in a direction reverse to the predetermined direction, the main body of the stopper 18 is held by the lever 21 on the radial outer side of the sheave 2 with respect to the fly-weight 5. For this reason, it is possible to achieve, in a more stable manner, an overspeed detection mechanism to which rotation dependence is added.

[0045] Incidentally, it is preferred that the threshold value of the rotation speed of the sheave 2 for which one end 22 of the lever 21 moves to the radial outer side of the sheave 2, be set beforehand to the order of a half of the rated speed of the ascent and descent speeds of the car, whichever is lower. In this case, it is possible to effectively prevent unintended overspeed detection. Performing overspeed detection only when the car is running in the ascent direction of the car, can be accomplished by configuring the stopper 18 so that the movement of the fly-weight 5 is not prevented while the sheave 2 is rotating in the ascent direction of the car.

[0046] In addition, in this embodiment the malfunction detection device 28 makes a determination on the position of the stopper 18. For this reason, it is possible to detect malfunctions of the stopper 18.

Embodiment 2

[0047] Figure 7 is a block diagram of a malfunction detection device used in an elevator governor in Embodiment 2 of the present invention. Incidentally, parts which are the same as in Embodiment 1 or similar to those of Embodiment 1 bear the same reference characters and descriptions of such parts are omitted.

[0048] A disk of the sheave 2 of Embodiment 2 is provided with reference plates 31a, 31b. The reference plates 31a, 31b are arranged in positions shifted 180 degrees from the center of the sheave 2 as the standard. In the case where the sheave 2 is rotating in the ascent direction, a stopper 18a which operated correctly is arranged in a position shifted 30 degrees from the reference plate 31a (in a position shifted 150 degrees form the reference plate 31b), with the center of the sheave 2 serving as the standard. And a stopper 18b which operated correctly is arranged in a position shifted 30 degrees from the reference plate 31b (in a position shifted 150 degrees form the reference plate 31a), with the center of the sheave 2 serving as the standard. In contrast to this, in the case where the sheave 2 is rotating in the descent direction, the stopper 18a which operated correctly is arranged in a position shifted 60 degrees from the reference plate 31a (in a position shifted 120 degrees form the reference plate 31b), with the center of the sheave 2 serving as the standard. And the stopper 18b which operated correctly is arranged in a position shifted 60 degrees from the reference plate 31b (in a position shifted 120 degrees form the reference plate 31a), with the center of the sheave 2 serving as the standard.

[0049] A malfunction detection device 32 of Embodiment 2 is provided with a proximity sensor part 33, a stopper position detection part 34, and a stopper position determination part 35. In the case where the stoppers 18a, 18b and the reference plates 31a, 31b have approached the proximity sensor part 33, the proximity sensor part 33 detects the stoppers 18a, 18b and the reference plates 31a, 31b. On the basis of a difference in detection timing between the stoppers 18a, 18b and the reference plates 31a, 31b, the stopper position detection part 34 detects the positions of the stoppers 18a, 18b with respect to the sheave 2. On the basis of a pulse output of the encoder 27, the stopper position determination part 35 makes a determination on the rotational direction of the sheave 2. The stopper position determination part 35 makes a determination as to whether or not the stoppers 18a, 18b are in correct positions with respect to the rotational direction of the sheave 2.

[0050] Next, with the aid of Figure 8 a description will be given of a method of position detection by the stopper 18 in the stopper position detection part 34.

[0051] Figure 8 is a diagram to explain an example of signal output of the encoder 27 used in the elevator governor in Embodiment 2 of the present invention. The abscissa of Figure 8 indicates time. The ordinate of Figure 8 indicates the output of the proximity sensor part 33.

[0052] Figure 8 shows the case where the sheave 2 is rotating in the decent direction. When the sheave 2 has rotated 60 degrees from the detection position of the stopper 18a, the reference plate 31a is detected. The time interval at this time is denoted by t0. Furthermore, when the sheave 2 has rotated 120 degrees, the stopper 18b is detected. The time interval at this time is denoted by t1. Furthermore, when the sheave 2 has rotated 60 degrees by taking time t0, the reference plate 31b is detected. Furthermore, when the sheave 2 has rotated 120 degrees by taking time t1, the stopper 18a is detected again. The ratio of these time intervals is expressed by the ratio of rotational angles of the sheave 2. That is, t0: t1 = 60: 120 = 1:2. In this case, it is determined that the stoppers 18a, 18b are in correct positions with respect to the sheave 2 which is rotating in the descent direction.

[0053] In contrast to this, in the case where the sheave 2 is rotating in the ascent direction, when the sheave 2 has rotated 30 degrees from the detection position of the reference plate 31a, the stopper 18a is detected. The time interval at this time is denoted by T0. Furthermore, when the sheave 2 has rotated 150 degrees, the reference plate 31b is detected. The time interval at this time is denoted by T1. Furthermore, when the sheave 2 has rotated 30 degrees by taking time T0, the stopper 18b is detected. Furthermore, when the sheave 2 has rotated 150 degrees by taking time T1, the reference plate 31a is detected again. The ratio of these time intervals is expressed by the ratio of rotational angles of the sheave 2. That is, T0: T1 = 30: 150 = 1:5. In this case, it is determined that the stoppers 18a, 18b are in correct positions with respect to the sheave 2 which is rotating in the ascent direction.

[0054] According to Embodiment 2 described above, a determination is made as to whether or not the stoppers 18a, 18b are in correct positions on the basis of the rotational position and rotational direction of the sheave 2 during the detection of the stoppers 18a, 18b. For this reason, it is possible to positively detect malfunctions of the stoppers 18a, 18b.

[0055] Specifically, a determination is made on the positions of the stoppers 18a, 18b with respect to the sheave 2 on the basis of a difference in detection timing between the reference plates 31a, 31b and the stoppers 18a, 18b. For this reason, it is possible to positively detect malfunctions of the stoppers 18a, 18b with a simple configuration.

[0056] It is unnecessary to limit the positional relationship between the stoppers 18a, 18b and the reference plates 31a, 31b to the relationship of Embodiment 2. That is, it is necessary only that the positional relationship between the stoppers 18a, 18b and the reference plates 31a, 31b change depending on the rotational direction of the sheave 2. Also in this case, it is possible to positively detect malfunctions of the stoppers 18a, 18b.

[0057] Incidentally, the number of times of object detection by the proximity sensor part 33 during one rotation of the sheave 2 is uniquely determined by the installed number of the stoppers 18a, 18b and the reference plates 31a, 31b. Using this fact, it is possible to provide signal output means which outputs a malfunction signal in the case where the number of times of object detection by the proximity sensor part 33 during one rotation of the sheave 2 is different from a total number of the stoppers 18a, 18b and the reference plates 31a, 31b. It is possible to make a determination, from a malfunction signal, that a malfunction of the proximity sensor part 33 and an abnormal operation of the governor 1 occurred.

[0058] Furthermore, it is possible to provide prohibition means which prohibits a determination on the positions of the stoppers 18a, 18b in the case where the rotation speed of the sheave 2 is lower than the speed at which the fly-weight 5 is moved to the radial outer side by a prescribed quantity. In this case, it is possible to suppress an unnecessary detection action.

[0059] In addition, it is possible to provide signal output means which outputs a malfunction signal in the case where the rotation speed of the sheave 2 is higher than the speed at which the fly-weight 5 is moved to the radial outer side by a prescribed quantity and the stoppers 18a, 18b are not in correct positions. It is possible to make a determination, from a malfunction signal, that a malfunction of the stoppers 18a, 18b and a wrong detection of the malfunction detection device 32 occurred.

[0060] A malfunction signal may include information for bringing a brake installed in the traction machine driving the elevator into action. If a control device of the elevator brings the brake into action on the basis of a malfunction signal, it is possible to stop the elevator. As a result of this, it is possible to improve the safety of the elevator.

Embodiment 3

[0061] Figure 9 is a front view showing the essential part of an elevator governor in Embodiment 3 of the present invention. Incidentally, parts which are the same as in Embodiment 1 or corresponding pats bear like numerals and descriptions of these parts are omitted.

[0062] In Embodiment 1, all of the locking notched portion 19 of the stopper 18, the connecting notched 20, the lever 21, the pins 24, 25, and the helical tension spring 26 are provided in a quantity of one. On the other hand, in Embodiment 3, all of the locking notched portion 19 of the stopper 18, the connecting notched 20, the lever 21, the pins 24, 25, and the helical tension spring 26 are provided symmetrically with respect to the main shaft 3 in a plurality of numbers.

[0063] According to Embodiment 3 described above, the load applied to the lever 21 decreases. For this reason, it is possible to improve the reliability of the governor 1.

Embodiment 4

[0064] Figure 10 is a front view of an elevator governor in Embodiment 4 of the present invention. Figure 11 is a sectional view taken along line B-B of Figure 10. Incidentally, parts which are the same as in Embodiment 1 or similar to those of Embodiment 1 bear the same reference characters and descriptions of such parts are omitted.

[0065] The governor 1 of Embodiment 4 differs from the governor of Embodiment 1 in the configuration of the fly-weight, the shape of the stopper 18 and the like. The governor 1 of Embodiment 4 will be described below.

[0066] In Figures 10 and 11, reference numeral 36 denotes a pair of linear motion bearings. The linear motion bearings 36 are each attached to a side surface of the sheave 2 via a fixed portion 37. A fly-weight 38 is inserted into the linear motion bearing 36. The linear motion bearing 36 may be a sliding bearing using sliding friction or a ball and roller bearing using the frictions of balls and rollers.

[0067] A spring force adjusting nut 39 is provided in the fly-weight 38. A balance spring 40 is provided between the spring force adjusting nut 39 and the fixed portion 37. The balance spring 40 constantly urges the fly-weight 38 to the center side of the sheave 2.

[0068] Next, the operation of the governor 1 in the case where the stopper 18 does not exist will be described.

[0069] When the sheave 2 rotates in synchronization with the ascent and descent of the car, the fly-weight 38 receives a centrifugal force responding to the rotation speed of the sheave 2. While the car is ascending and descending within a rated speed, the force by the balance spring 40 is larger than the centrifugal force applied to the fly-weight 38. For this reason, the relative position of the fly-weight 38 and the sheave 2 does not change from the initial set state.

[0070] When the ascent and descent speed of the car exceeds the rated speed, the centrifugal force applied to the fly-weight 38 overcomes the centrifugal force by the balance spring 40. For this reason, the fly-weight 38 starts to move to the radial outer side of the sheave 2.

[0071] When the ascending and descent speed of the car has reached a first overspeed detection speed, the forward end of the fly-weight 38 abuts against the actuating cam 12. This abutment causes the governor switch 13 to operate. That is, the actuating cam 12 and the governor switch 13 function as a detector which performs the overspeed detection of the sheave 2 when the fly-weight 38 has moved to the outer side by a predetermined quantity regardless of the ascent and descent of the car. The power to the traction machine and brake of the elevator is interrupted by the operation of the governor switch 13. Usually, the car stops due to this interruption.

[0072] When the car does not stop and the descent speed of the car has exceeded a first overspeed detection speed and has reached a second overspeed detection speed, the fly-weight 38 moves further to the radial outer side of the sheave 2. This movement causes the forward end of the fly-weight 38 to abut against the upper end of the hook 15 from the actuating cam 12 side. This abutment causes the hook 15 to rotate around the pin 16. The lower end of the hook 15 becomes disengaged from the rope catch 14. As a result of this rotation, the rope catch 14 falls under gravity.

[0073] And the rope catch 14 falls under gravity and sandwiches the governor rope 4 between itself and the fixed shoe 17. As a result of this, the governor rope 4 is braked. In synchronization with the braking of this governor rope 4, the safety gear device provided in the car operates. As a result of this, the car stops.

[0074] Incidentally, because the operation in the case where the stopper 18 exists is the same as in Embodiment 1, a description of this operation is omitted.

[0075] According to Embodiment 4 described above, it is possible to achieve an overspeed detection mechanism having the same effect as in Embodiment 1 to which rotation dependence is added even when the disk type fly-weights 5 are not used.

Embodiment 5

[0076] Figure 12 is a view of an elevator governor in Embodiment 5 of the present invention, which is equivalent to Figure 11. Incidentally, parts which are the same as in Embodiment 4 or corresponding pats bear like numerals and descriptions of these parts are omitted.

[0077] In Embodiment 4 one overspeed detection mechanism is provided, whereas in Embodiment 5 two overspeed detection mechanisms are provided. The overspeed detection mechanisms operate independently from each other. The governor 1 of Embodiment 5 will be described with the aid of Figure 9.

[0078] In Figure 12, reference numeral 41 denotes a rotary body. The rotary body 41 is fixed to one side surface of the sheave 2. That is, the rotary body has the function of rotating together with the sheave 2. One overspeed detection mechanism is provided on the other side surface. One overspeed detection mechanism is provided with a stopper 18 similar to that of Embodiment 3. The other overspeed detection mechanism is provided on one side surface of the rotary body 41. The other overspeed detection mechanism is not provided with a stopper 18.

[0079] One overspeed detection mechanism is set to match a rated speed in the descent direction of the car. One overspeed detection mechanism is such that the operation thereof is limited by the stopper 18 during the ascent of the car before the speed becomes higher than the rated speed in the descent direction of the car. In contrast to this, the other overspeed detection mechanism is set to match a rated speed in the ascent direction of the car. This governor 1 is provided in an elevator in which the ascent direction of the car is higher than the descent speed.

[0080] According to Embodiment 5 described above, in an elevator in which the ascent direction of the car is higher than the descent speed, it is possible to perform overspeed detection adapted to each of the ascent speed and the descent speed.

[0081] In an elevator in which the ascent speed of the car is lower than the descent speed, the detection speed of the overspeed detection mechanism whose operation is limited by the stopper 18 is set to match a rated speed in the ascent direction of the car, and the governor 1 whose operation is not limited by the stopper 18 is set to be adaptable to a rated speed in the descent direction of the car.

[0082] In Embodiments 1 to 5 above, the description was given of the configurations in which the stopper 18 is provided in the car-side governor 1. However, the same effect as in Embodiments 1 to 5 is obtained even when the stopper 18 is provided in the weight-side governor 1.

Industrial Applicability

[0083] As described above, the elevator governor of the present invention can be used in an elevator in which, with a simple configuration, is achieved an overspeed detection mechanism to which rotation dependence is added while preventing a decrease in reliability due to the generation of vibrations and noises and the wear of parts.

Description of symbols

[0084] 1 governor, 2 sheave, 3 main shaft, 4 governor rope, 5 fly-weight, 6 pin, 7 link, 8 link, 9 balance spring, 10 spring force adjusting nut, 11 dog, 12 actuating cam, 13 governor switch, 14 rope catch, 15 hook, 16 pin, 17 fixed shoe, 18 stopper, 18, 18a, 18b stopper, 19 locking notched portion, 20 connecting notched portion, 21 lever, 22 one end, 23 other end, 24 pin, 25 pin, 26 helical tension spring, 27 encoder, 28 malfunction detection device, 29 proximity sensor, 30 stopper position detection part, 31, 31a, 31b reference plate, 32 malfunction detection device, 33 proximity sensor part, 34 stopper position detection part, 35 stopper position determination part, 36 linear motion bearing, 37 fixed portion, 38 fly-weight, 39 spring force adjusting nut, 40 balance spring, 41 rotary body

Claims

1. An elevator governor comprising:

   a sheave (2) on which a rope (4) moving in response to the movement of an ascending and descending body of an elevator is wound, and which changes the rotation speed in one direction in response to the ascent speed of the ascending and descending body and changes the rotation speed in the other direction in response to the descent speed of the ascending and descending body;
   a fly-weight (5) which is provided on a side surface of the sheave (2) and increases and decreases a moving quantity to a radial outer side of the sheave in response to an increase and decrease in the rotation speed of the sheave; and
   a detector (12,13) which performs overspeed detection of the sheave when the fly-weight has moved to the radial outer side by a predetermined quantity;
   characterized by:

      a stopper (18) which is provided in the sheave and performs a rotational movement with respect to the sheave so as to be arranged to the radial outer side of the fly-weight in the case where the sheave rotates in a predetermined direction which is either of the two rotational directions, thereby preventing the fly-weight from moving to the radial outer side more than the predetermined quantity;
      rotational position detection means (27) which detects a rotational position of the sheave;
      object detection means (29) which is provided in proximity to the sheave and detects the stopper in the case where the stopper has approached the object detection means; and
      determination means (30) which determines a position of the stopper with respect to the sheave on the basis of the rotational position of the sheave during the detection of the stopper by the object detection means,

2. The elevator governor according to claim 1, wherein the rotational position detection means (27) outputs a pulse responding to the rotational direction of the sheave, and

wherein the determination means (30) determines the rotational direction of the sheave on the basis of the pulse, and makes a determination as to whether or not the stopper is in a correct position on the basis of the rotational position and rotational direction of the sheave during the detection of the stopper by the object detection means.

3. The elevator governor according to claim 2, further comprising:

a reference plate (31) provided in the sheave; wherein the object detection means detects the reference plate when the reference plate has approached the object detection means, and wherein the determination means makes a determination on a position of the stopper with respect to the sheave on the basis of a difference in detection timing between the reference plate and the stopper and makes a determination as to whether or not the stopper is present in a correct position.

4. The elevator governor according to claim 3, further comprising:
signal output means which outputs a malfunction signal in the case where a determination is made on one rotation of the sheave on the basis of a change in the rotational position of the sheave, and the number of times of object detection by the object detection means (29) during one rotation of the sheave is different from a total number of the stopper (18) and the reference plate. (31)

5. The elevator governor according to any of claims 1 to 4, further comprising:
prohibition means which prohibits a determination on the position of the stopper by the determination means (30) in the case where a determination is made on the rotation speed of the sheave on the basis of the rotational position of the sheave, and the rotation speed of the sheave is lower than the speed at which the fly-weight is moved to the radial outer side by the prescribed quantity.

6. The elevator governor according to claim 5, further comprising:
signal output means which outputs a malfunction signal when the stopper (18) is not in a correct position.

7. The elevator governor according to claim 4 or 6, wherein the signal output means outputs, as the malfunction signal, a signal including information to cause a brake provided on a traction machine which drives the elevator to operate.

Patentansprüche

1. Aufzugsregler aufweisend:

eine Seilrolle (2), an der ein Seil (4) gewickelt ist, das sich in Reaktion auf die Bewegung eines aufsteigenden und absteigenden Körpers eines Aufzugs bewegt, und die die Drehgeschwindigkeit in einer Richtung in Reaktion auf die Aufstiegsgeschwindigkeit des aufsteigenden und absteigenden Körpers ändert und die Drehgeschwindigkeit in der anderen Richtung in Reaktion auf die Abstiegsgeschwindigkeit des aufsteigenden und absteigenden Körpers ändert;
ein Fliehgewicht (5), das an einer Seitenfläche der Seilrolle (2) vorgesehen ist und in Reaktion auf eine Erhöhung und Verringerung in der Drehgeschwindigkeit der Seilrolle einen Bewegungsbetrag zu einer radialen Außenseite der Seilrolle erhöht und verringert; und
einen Detektor (12, 13), der eine Übergeschwindigkeitserfassung der Seilrolle durchführt, wenn sich das Fliehgewicht um einen vorbestimmten Betrag zu der radialen Außenseite bewegt hat;
gekennzeichnet durch:

einen Stopper (18), der in der Seilrolle vorgesehen ist und eine Drehbewegung in Bezug auf die Seilrolle ausführt, so dass er in dem Fall, in dem sich die Seilrolle in einer vorbestimmten Richtung dreht, die eine der beiden Drehrichtungen ist, an der radialen Außenseite des Fliehgewichts angeordnet ist, wodurch verhindert wird, dass sich das Fliehgewicht um mehr als den vorbestimmten Betrag zu der radialen Außenseite bewegt;
ein Drehpositionserfassungsmittel (27), das eine Drehposition der Seilrolle erfasst;
ein Objekterfassungsmittel (29), das in der Nähe der Seilrolle vorgesehen ist und den Stopper in dem Fall erfasst, in dem sich der Stopper dem Objekterfassungsmittel genähert hat; und
ein Bestimmungsmittel (30), das eine Position des Stoppers in Bezug auf die Seilrolle auf der Grundlage der Drehposition der Seilrolle während der Erfassung des Stoppers durch das Objekterfassungsmittel bestimmt.

2. Aufzugsregler nach Anspruch 1, bei dem das Drehpositionserfassungsmittel (27) einen Impuls ausgibt, der auf die Drehrichtung der Seilrolle reagiert, und wobei das Bestimmungsmittel (30) die Drehrichtung der Seilrolle auf der Grundlage des Impulses bestimmt und auf der Grundlage der Drehposition und Drehrichtung der Seilrolle während der Erfassung des Stoppers durch das Objekterfassungsmittel eine Bestimmung vornimmt, ob der Stopper in einer korrekten Position ist oder nicht.

3. Aufzugsregler nach Anspruch 2, ferner aufweisend:

eine Referenzplatte (31), die in der Seilrolle vorgesehen ist;
wobei das Objekterfassungsmittel die Referenzplatte erfasst, wenn die Referenzplatte sich dem Objekterfassungsmittel genähert hat, und wobei das Bestimmungsmittel eine Bestimmung über einer Position des Stoppers in Bezug auf die Seilrolle auf der Grundlage einer Differenz in der Erfassungszeit zwischen der Referenzplatte und dem Stopper vornimmt und eine Bestimmung vornimmt, ob der Stopper in einer korrekten Position vorhanden ist oder nicht.

4. Aufzugsregler nach Anspruch 3, ferner aufweisend: ein Signalausgabemittel, das ein Fehlersignal ausgibt, in dem Fall, in dem eine Bestimmung über eine Umdrehung der Seilrolle auf der Grundlage einer Änderung in der Drehposition der Seilrolle vorgenommen wird, und die Anzahl der Male der Objekterfassung durch das Objekterfassungsmittel (29) während einer Umdrehung der Seilrolle von einer Gesamtzahl des Stoppers (18) und der Referenzplatte (31) verschieden ist.

5. Aufzugsregler nach einem der Ansprüche 1 bis 4, ferner aufweisend:
ein Verbietungsmittel, das eine Bestimmung über die Position des Stoppers durch das Bestimmungsmittel (30) verbietet, in dem Fall, in dem eine Bestimmung über die Drehgeschwindigkeit der Seilrolle auf der Grundlage der Drehposition der Seilrolle vorgenommen wird, und die Drehgeschwindigkeit der Seilrolle geringer ist als die Geschwindigkeit, mit der das Fliehgewicht um den vorgeschriebenen Betrag zu der radialen Außenseite bewegt wird.

6. Aufzugsregler nach Anspruch 5, ferner aufweisend: ein Signalausgabemittel, das ein Fehlersignal ausgibt, wenn der Stopper (18) nicht in einer korrekten Position ist.

7. Aufzugsregler nach Anspruch 4 oder 6, bei dem das Signalausgabemittel als das Fehlersignal ein Signal ausgibt, das Informationen aufweist, um den Betrieb einer Bremse zu veranlassen, die an einer Zugmaschine vorgesehen ist, die den Aufzug antreibt.

Revendications

1. Régulateur pour ascenseur comprenant :

un réa (2) sur lequel une corde (4) se déplaçant en réponse au mouvement d'un corps ascendant et descendant d'un ascenseur est enroulée, et qui change la vitesse de rotation dans une direction en réponse à la vitesse d'ascension du corps ascendant et descendant et change la vitesse de rotation dans l'autre direction en réponse à la vitesse de descente du corps ascendant et descendant ;
une masselotte (5) qui est fournie sur une surface latérale du réa (2) et augmente et diminue une quantité de mouvement vers un côté externe radial du réa en réponse à une augmentation et une diminution de la vitesse de rotation du réa ; et
un détecteur (12, 13) qui effectue une détection d'allure excessive du réa lorsque la masselotte s'est déplacée vers le côté externe radial d'une quantité prédéterminée ;
caractérisé par :

un butoir (18) qui est fourni dans le réa et effectue un mouvement de rotation par rapport au réa de manière à être agencé vers le côté externe radial de la masselotte dans le cas où le réa tourne dans une direction prédéterminée qui est l'une ou l'autre des deux directions de rotation, empêchant ainsi la masselotte de se déplacer vers le côté externe radial plus que de la quantité prédéterminée ;
un moyen de détection de position de rotation (27) qui détecte une position de rotation du réa ;
un moyen de détection d'objet (29) qui est fourni à proximité du réa et détecte le butoir dans le cas où le butoir s'est approché du moyen de détection d'objet ; et
un moyen de détermination (30) qui détermine une position du butoir par rapport au réa sur la base de la position de rotation du réa pendant la détection du butoir par le moyen de détection d'objet.

2. Régulateur pour ascenseur selon la revendication 1, dans lequel le moyen de détection de position de rotation (27) émet une impulsion en réponse à la direction de rotation du réa, et dans lequel le moyen de détermination (30) détermine la direction de rotation du réa sur la base de l'impulsion, et détermine si le butoir se trouve ou non dans une position correcte sur la base de la position de rotation et de la direction de rotation du réa pendant la détection du butoir par le moyen de détection d'objet.

3. Régulateur pour ascenseur selon la revendication 2, comprenant en outre :

une plaque de référence (31) fournie dans le réa ;
dans lequel le moyen de détection d'objet détecte la plaque de référence quand la plaque de référence s'est approchée du moyen de détection d'objet, et
dans lequel le moyen de détermination détermine une position du butoir par rapport au réa sur la base d'une différence d'instant de détection entre la plaque de référence et le butoir et détermine si le butoir est présent ou non dans une position correcte.

4. Régulateur pour ascenseur selon la revendication 3, comprenant en outre :
un moyen d'émission de signal qui émet un signal de dysfonctionnement dans le cas où une détermination est effectuée concernant une rotation du réa sur la base d'un changement de la position de rotation du réa, et du nombre de fois que la détection d'objet par le moyen de détection d'objet (29) pendant une rotation du réa est différent d'un nombre total du butoir (18) et de la plaque de référence (31).

5. Régulateur pour ascenseur selon l'une quelconque des revendications 1 à 4, comprenant en outre :
un moyen d'interdiction qui interdit une détermination de la position du butoir par le moyen de détermination (30) dans le cas où une détermination est effectuée concernant la vitesse de rotation du réa sur la base de la position de rotation du réa, et la vitesse de rotation du réa est inférieure à la vitesse à laquelle la masselotte est déplacée vers le côté externe radial de la quantité prescrite.

6. Régulateur pour ascenseur selon la revendication 5, comprenant en outre :
un moyen d'émission de signal qui émet un signal de dysfonctionnement quand le butoir (18) n'est pas dans une position correcte.

7. Régulateur pour ascenseur selon la revendication 4 ou 6, dans lequel le moyen d'émission de signal émet, en tant que le signal de dysfonctionnement, un signal incluant des informations pour provoquer le fonctionnement d'un frein fourni sur une machine de traction qui entraîne l'ascenseur.

FIG. 1

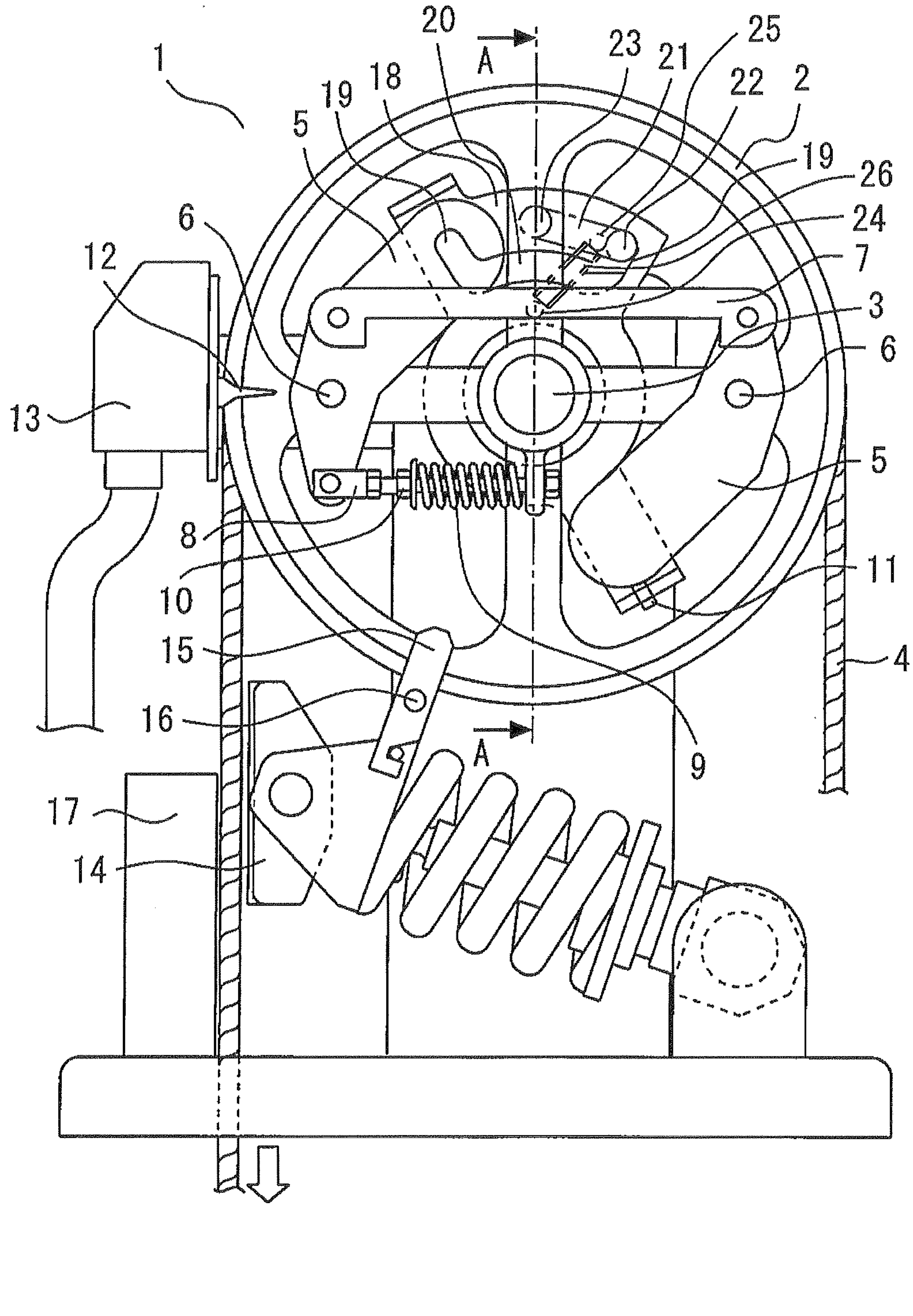

FIG. 2

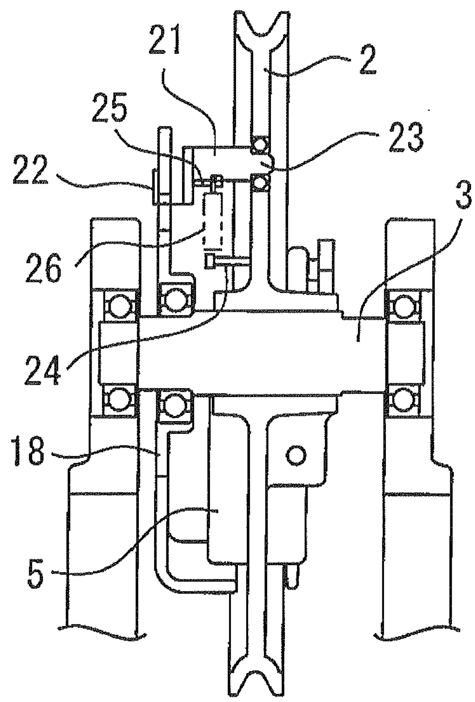

FIG. 3

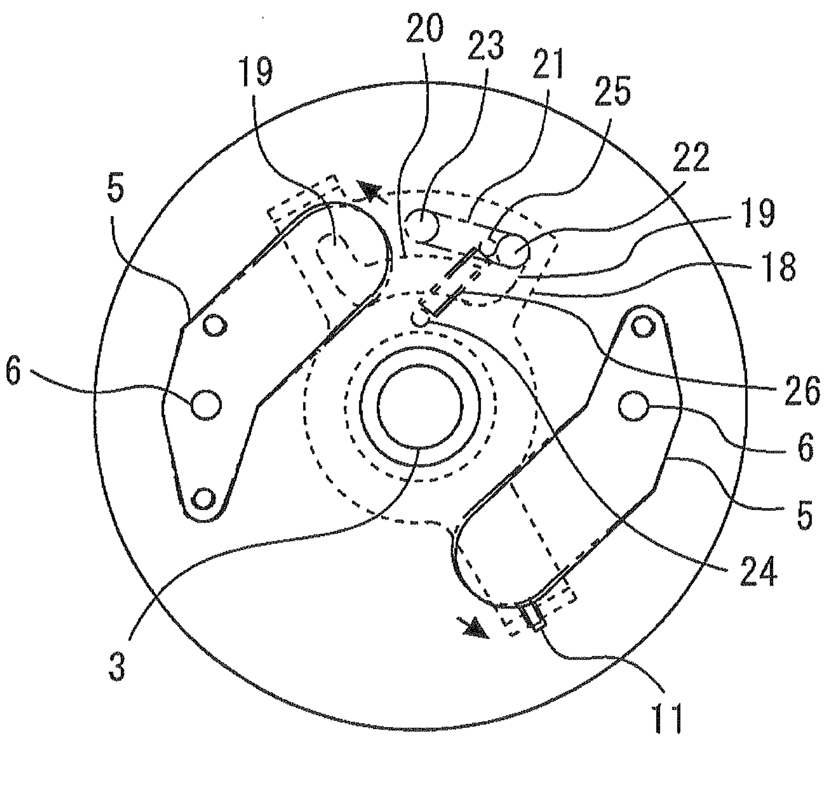

FIG. 4

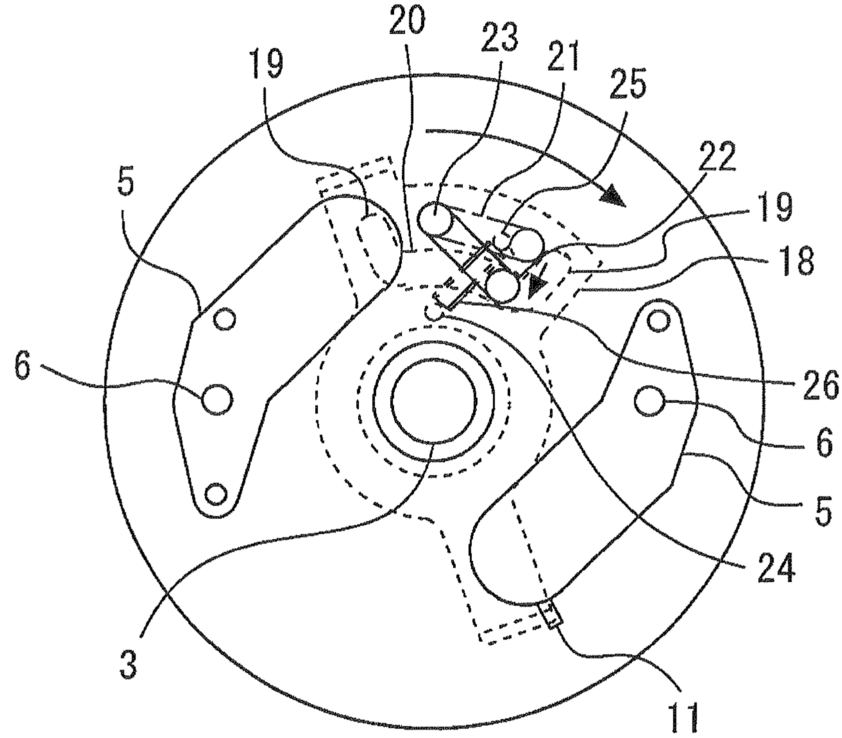
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FIG. 5

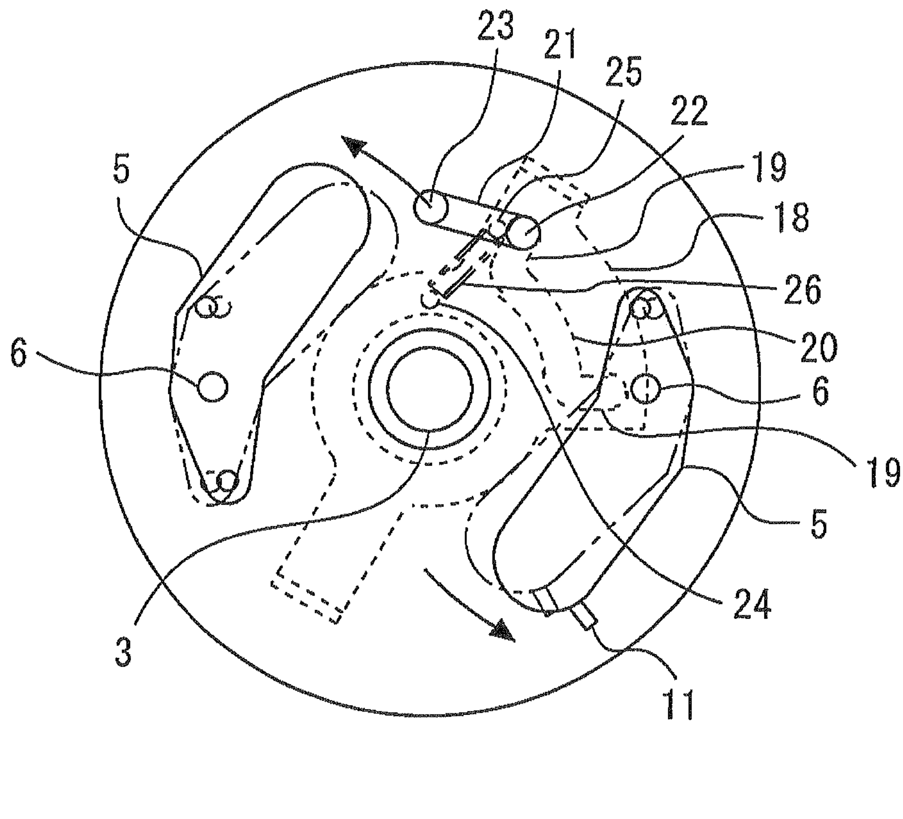
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FIG. 6

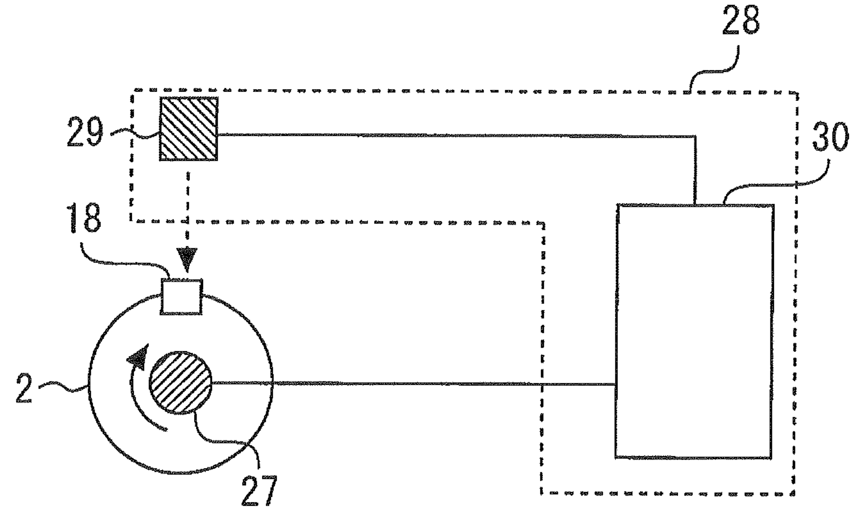

FIG. 7

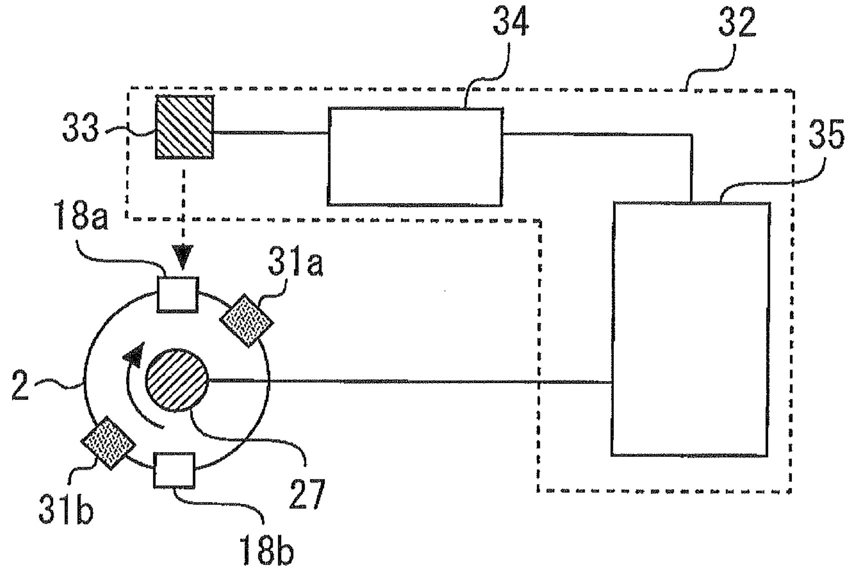

FIG. 8

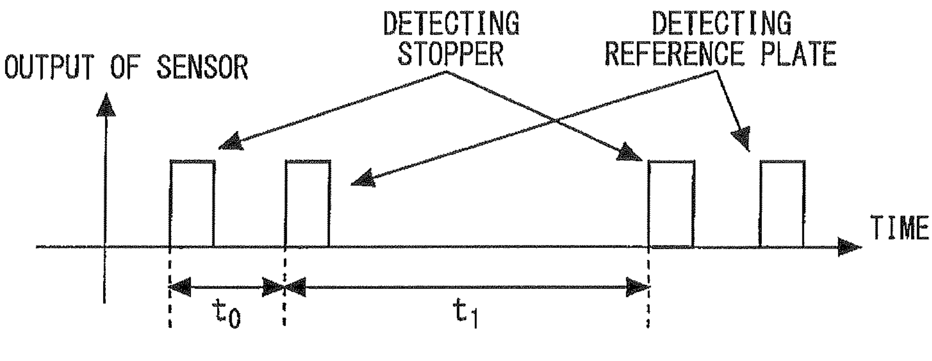
OUTPUT OF SENSOR
DETECTING STOPPER
DETECTING REFERENCE PLATE
TIME
t0
t1

FIG. 9

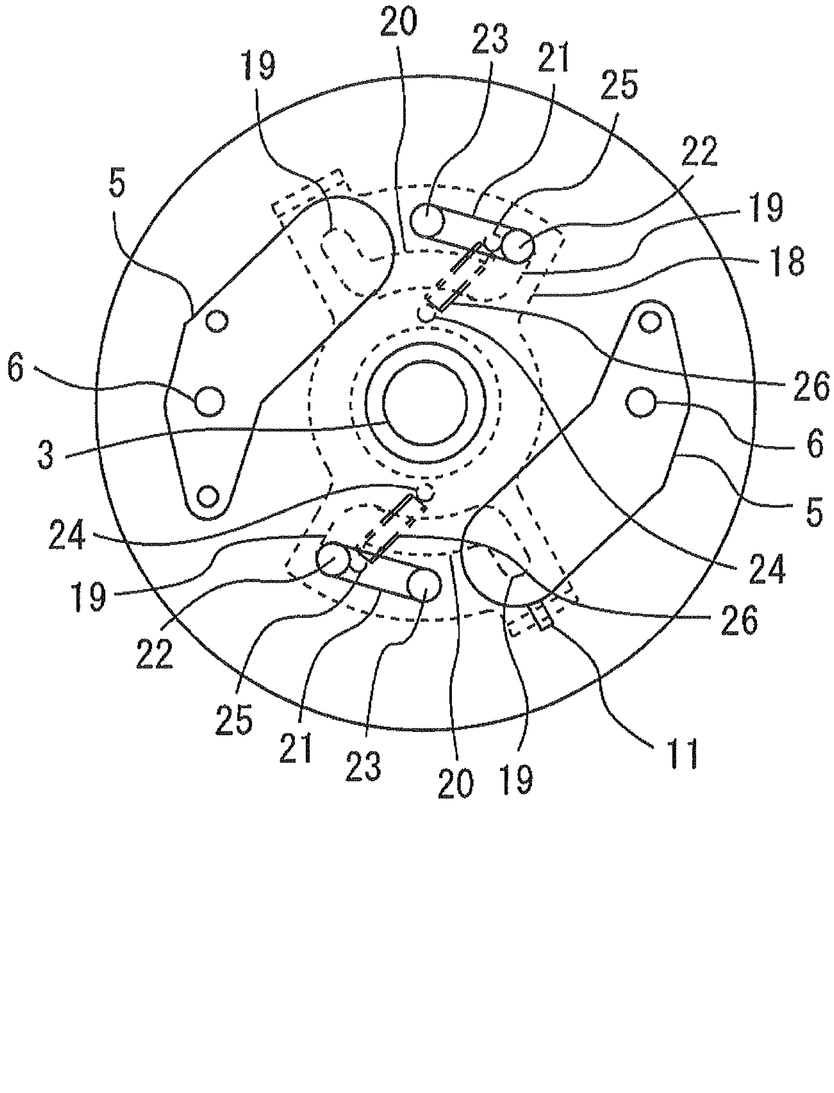

FIG. 10

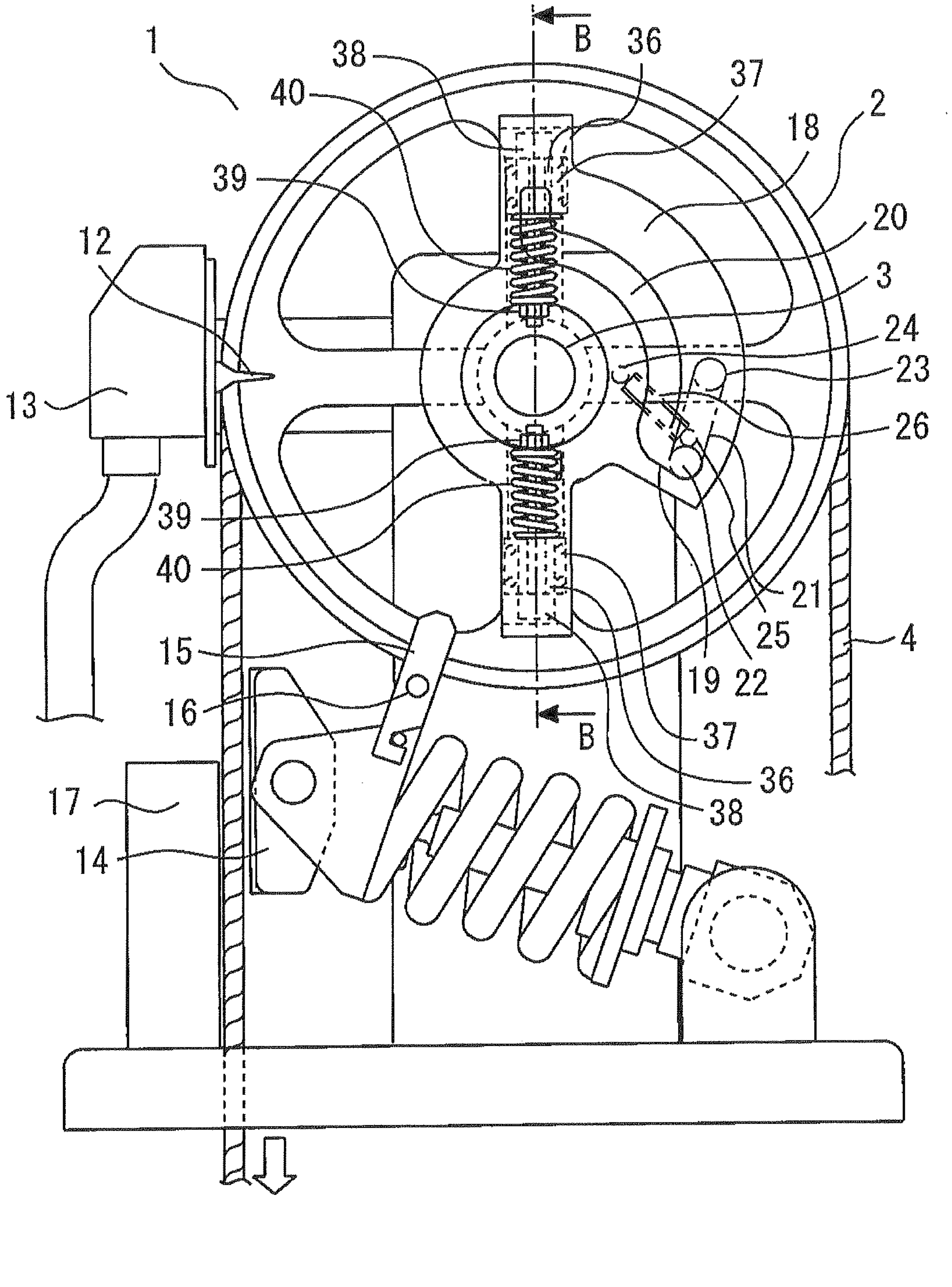
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FIG. 11

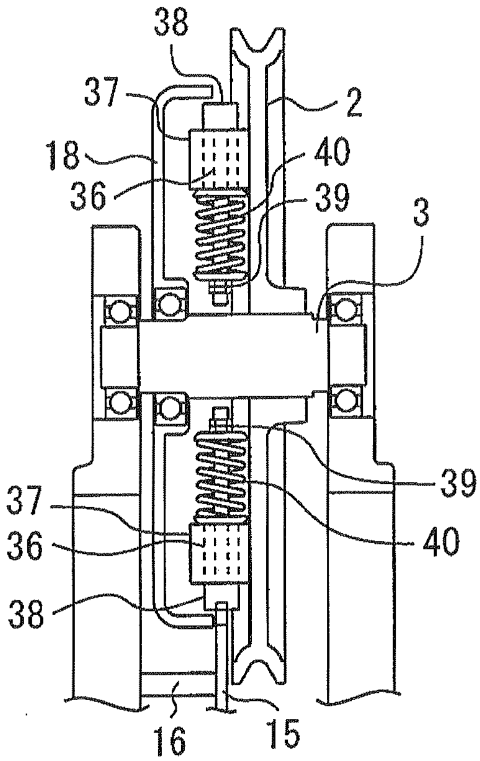
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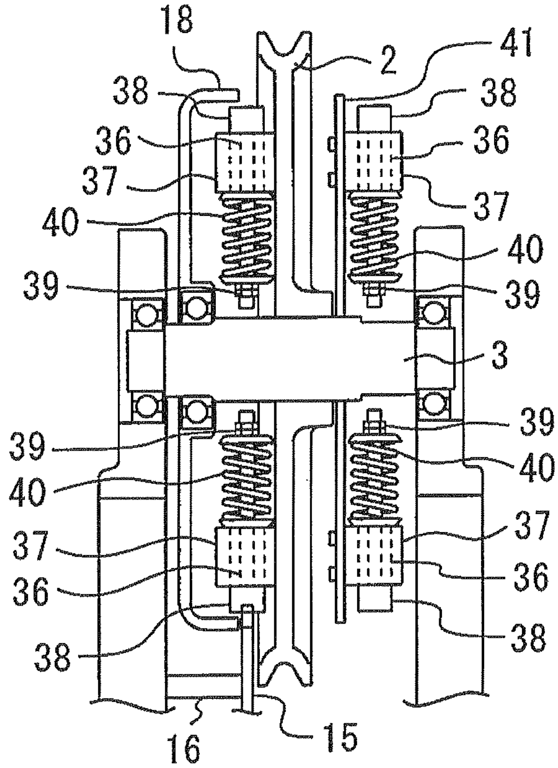
FIG. 12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- WO 2010023745 A1 **[0005]**