

TITLE OF THE INVENTION

ELEVATOR SYSTEM

FIELD OF THE INVENTION

5 The present invention relates to an elevator system, more particularly, to an elevator system including a governor.

BACKGROUND OF THE INVENTION

 An elevator system includes a governor and, when the
10 ascending or descending speed of the car of the elevator reaches a preset value larger than the rated speed, a car stopping switch of the governor is actuated to stop the car. The car stopping switch has a switch lever, for example. When the ascending or descending speed of the car reaches the preset value, the switch
15 lever is actuated to rotate from the static position (a position in the direction of rotating when the elevator system is in operation), thereby shutting off the power supplied to a drive device for driving the car and eventually stopping the car.

 Such an elevator stopping device including a switch which,
20 when actuated, stops an elevator drive device, an operation device (an operation lever) attached to a pendulum lever, and a support device (a retraction spring) attached to the pendulum lever is disclosed in Japanese Unexamined Patent Publication No. 62-51584. In the elevator stopping device, the operation lever rotates
25 and makes switching to stop the elevator drive device and the

support device causes the operation lever, which has tilted as a result of rotating, to automatically return to the static position.

Once the car stopping switch is actuated, it is necessary
5 to return the car stopping switch to the static position (a position in the direction of rotating when the elevator system is in operation) by using a lever restoration device after necessary inspection and recovery is made by a specialized technician or technicians and then to permit the elevator system
10 to be put in operation again. Namely, the car stopping switch must not automatically return to the static position.

According to conventional techniques, to allow a car stopping switch and a switch lever to rotate without hitting any part positioned in areas peripheral to them, it is necessary
15 to secure large space around them. Without such provision, when the car stopping switch is rotated out of the static position, the car stopping switch and the switch lever may hit a part, such as the lever restoration device, positioned in a peripheral area, consequently causing the car stopping switch to move back
20 to the static position as a reaction of the hitting. Hence, governors used in conventional elevator systems, which require large space around the car stopping switch and switch lever, are large and require a large space for installation.

An object of the present invention is to provide an elevator
25 system equipped with a compact governor including a car stopping

switch which does not automatically return to the static position (a position in the direction of rotating when the elevator system is in operation).

5 SUMMARY OF THE INVENTION

The elevator system according to the present invention has been developed to achieve the above object and has the following features.

The elevator system according to the present invention
10 includes: a car which ascends and descends in a hoistway provided in a building; a governor rope connected to the car; a sheave provided in the building, with the governor rope wound therearound; a governor weight provided on a side of the sheave, the governor weight including an end portion which is able to
15 project outward in a radial direction of the sheave by a centrifugal force generated when the sheave rotates; a car stopping switch rotatably installed in a base frame, the car stopping switch including a switch lever which projects toward the sheave in a state where power is supplied to a drive device
20 for driving the car, and the car stopping switch shutting off the power supplied to the drive device when the car stopping switch rotates to exit the state where the power is supplied to the drive device; a first switch cam stopper which is a projection installed in the base frame, the first switch cam
25 stopper provided at a position lateral to the car stopping switch

where the first switch cam stopper can be in contact with the car stopping switch when the car stopping switch rotates; and a lever holder fixed to the base frame. The car stopping switch is positioned such that, when an ascending or descending speed of the car reaches a predetermined value, the switch lever moves by being pushed by the end portion of the governor weight projecting outward in a radial direction of the sheave. The lever holder is positioned such that at least a part of the lever holder covers a space between the car stopping switch in the state where the power is supplied and the first switch cam stopper. When the switch lever moves by being pushed by the end portion of the governor weight, the car stopping switch rotates to come into contact with the first switch cam stopper. The lever holder holds the car stopping switch between the lever holder and the base frame, the car stopping switch having contacted the first switch cam stopper and stopped rotating.

The elevator system according to the present invention can be equipped with a compact governor including a car stopping switch which does not automatically return to the static position.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of an elevator system according to an embodiment of the present invention;

FIG. 2 is a front view of a governor;

25 FIG. 3 is a sectional view of the governor taken along

line A-A in FIG. 2 and shows a car stopping switch, switch cam stoppers, and lever holder as seen from below;

FIG. 4 is a front view of the governor with the lever holder fixedly holding the car stopping switch between the lever holder
5 and a vertical portion of a base frame; and

FIG. 5 is a sectional view of the governor taken along line A-A in FIG. 4 and shows the car stopping switch, switch cam stoppers, and lever holder as seen from below.

10 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

An elevator system according to an embodiment of the present invention will be described below with reference to FIGs. 1 to 5.

FIG. 1 is a schematic diagram of an elevator system according
15 to the present embodiment. The elevator system includes a hoistway 2, a car 3, a main rope 5, a traction sheave 6, a guide rail 7, an emergency stopper device 8, an actuation lever 9, a governor rope 10, and a governor 12.

The hoistway 2 is provided in a building 1. The car 3
20 ascends and descends in the hoistway 2. The main rope 5 hangs the car 3 connected to one end thereof and a balancing weight 4 connected to the other end thereof. The traction sheave 6 is provided in a top portion of the hoistway 2 with the main rope 5 wound therearound. The traction sheave 6 is driven by
25 a drive device (not shown in FIG. 1) having a brake device. The

car 3 ascends and descends in the hoistway 2 by being driven by the traction sheave 6 via the main rope 5. The guide rail 7 is provided in the hoistway 2 to guide the car 3 moving up and down. The car 3 has the emergency stopper device 8 that stops the car 3 by grasping the guide rail 7 at a time of emergency. The emergency stopper device 8 can be set to stop the car 3, for example, when the car 3 reaches a predetermined ascending/descending speed, for example, 1.4 times the rated speed. The actuation lever 9 is included in the car 3 and is used to drive the emergency stopper device 8. The governor rope 10 is an endless rope connected to the actuation lever 9 and is spanned along the entire up-and-down distance of the car 3 in the hoistway 2. The governor 12 is provided in a top portion of the hoistway 2 and includes a sheave 11 which is wound with the governor rope 10. The sheave 11 is caused to rotate by the governor rope 10 as the car 3 ascends and descends.

FIG. 2 is a front view of the governor 12. The governor 12 has a base frame 13 which is fixed to a top portion of the guide rail 7. The base frame 13 has a horizontal "U" shape as seen from a side and includes three planes, a vertical portion 13V, an upper horizontal portion, and a lower horizontal portion. The vertical portion 13V is upright and parallel to the direction of movement of the car 3. The upper horizontal portion is perpendicularly connected to a top portion of the vertical portion 13V. The lower horizontal portion is perpendicularly connected

to a bottom portion of the vertical portion 13V. A support shaft 14 is fixed to the vertical portion 13V of the base frame 13, the support shaft 14 rotatably supporting the sheave 11.

The sheave 11 has a pair of governor weights 15A and 15B
5 attached to a side of the sheave 11 to be rotatable about support pins 16A and 16B, respectively. Each of the support pins 16A and 16B supports the corresponding one of the governor weights 15A and 15B at a position near an outer edge of the corresponding governor weight, not at a center of the corresponding governor
10 weight. The governor weights 15A and 15B are connected to each other by a connection bar 17. The governor weight 15A is connected with the connection bar 17 at one end portion closer to the support pin 16A of two opposite end portions thereof, and has a claw-like part 18A formed in the other end portion
15 farther from the support pin 16A of the two opposite end portions thereof. The governor weight 15B is connected with one end of a spring 19 at one end portion closer to the support pin 16B of two opposite end portions thereof, and has a claw-like part 18B formed in the other end portion farther from the support
20 pin 16B of the two opposite end portions thereof. The other end of the spring 19 is fixed to the boss of the sheave 11. The governor weights 15A and 15B are held in position by the elastic force of the spring 19.

When the car 3 ascends or descends and the sheave 11 rotates,
25 the governor weights 15A and 15B rotate about the support pins

16A and 16B, respectively, causing the claw-like parts 18A and 18B to be displaced outward in a radial direction of the sheave 11 by the centrifugal forces. At this time, with the governor weights 15A and 15B connected to each other by the connection
5 bar 17 not to be freely movable, the claw-like parts 18a and 18B are displaced by the same distance outward in a radial direction of the sheave 11. This causes each of the claw-like parts 18A and 18B to project outward in a radial direction of the sheave 11.

10 The vertical portion 13V of the base frame 13 is provided with a car stopping switch 20 positioned above the sheave 11. The car stopping switch 20 is an L-shaped plate member having two surfaces, a surface parallel to the vertical portion 13V and a surface perpendicular to the vertical portion 13V. The
15 car stopping switch 20 is supported by a rotary shaft 24 at a central part of the surface thereof parallel to the vertical portion 13V and is rotatable along the vertical portion 13V. The rotary shaft 24 is fixed to the vertical portion 13V. The car stopping switch 20 includes a switch lever 20L attached to
20 a lower part of the surface thereof parallel to the vertical portion 13V. When the elevator system is in operation, the switch lever 20L is downwardly projecting toward the sheave 11 as shown in FIG. 2. The state of the car stopping switch 20 with the switch lever 20L downwardly projecting toward the sheave 11 is
25 referred to as a "static state." The position in the rotating

direction of the car stopping switch 20 (the orientation of the car stopping switch 20) in a static state is referred to as a "static position." In a static state, the driving device (not shown in FIG. 2) for driving the car 3 is supplied with power.

5 The car stopping switch 20 is in a static state in FIG. 2.

The vertical portion 13V of the base frame 13 is provided, upwardly of the car stopping switch 20, with a switch contact 20S for switching the power on or off for the drive device (not shown in FIG. 2) that drives the car 3. When the car stopping
10 switch 20 is in a static position, i.e. when the elevator system is in operation (when the car 3 is ascending or descending), the switch contact 20S is in contact with the car stopping switch 20, allowing the drive device for driving the car 3 to be powered. When the switch contact 20S is not in contact with the car stopping
15 switch 20, the power supply to the drive device for driving the car 3 is shut off.

The vertical portion 13V of the base frame 13 is further provided with two switch cam stoppers 21 and a lever holder 22 at the position lateral to the car stopping switch 20.

20 FIG. 3 is a sectional view of the governor 12 taken along line A-A in FIG. 2 and shows the car stopping switch 20, switch cam stoppers 21, and lever holder 22 as seen from below. In FIG. 3, reference numerals identical to those used in FIG. 2 represent the corresponding parts shown in FIG. 2, and
25 descriptions of such parts are omitted in the following. In

FIG. 3, the car stopping switch 20 is in a static state as in FIG. 2.

As mentioned in the foregoing, the car stopping switch 20 is an L-shaped plate member having two surfaces, a surface parallel to the vertical portion 13V and a surface perpendicular to the vertical portion 13V, and is supported by the rotary shaft 24 at the central part of the surface thereof parallel to the vertical portion 13V.

As shown in FIG. 3, each of the two switch cam stoppers 21 is a projection provided on the vertical portion 13V. As shown in FIG. 2, one of the two switch cam stoppers 21 is positioned above the rotary shaft 24 and the other is positioned below the rotary shaft 24. Preferably, the two switch cam stoppers 21 are spaced at an equal distance from the rotary shaft 24 in the vertical direction.

The lever holder 22 includes a plate spring and is fixed to the vertical portion 13V by two pins 25 such that at least a part thereof covers a space on the vertical portion 13V between the car stopping switch 20 in a static state and the two switch cam stoppers 21.

The two switch cam stoppers 21 are provided for stopping the rotation of the car stopping switch 20, so that they are positioned to be able to contact with the rotating car stopping switch 20. When the car stopping switch 20 rotates about the rotary shaft 24 and along the vertical portion 13V, it is stopped

by contacting with one of the switch cam stoppers 21. One and the other of the two switch cam stoppers 21 are positioned to be above and below the rotary shaft 24, respectively, so that the car stopping switch 20, rotating either clockwise or
5 counterclockwise, can be stopped while the rotation angle is still small.

The position of each of the switch cam stoppers 21 (defined by a distance in the horizontal direction from the car stopping switch 20 and a distance in the vertical direction from the rotary
10 shaft 24) can be determined based on the allowable rotation angle of the car stopping switch 20. The allowable rotation angle of the car stopping switch 20 can be determined based on the distances between the car stopping switch 20 as well as switch lever 20L and the parts (excluding the switch cam stoppers 21
15 and the lever holder 22) disposed around them. Namely, the switch cam stoppers 21 are to be positioned such that, when the car stopping switch 20 rotates, it can contact with one of the switch cam stoppers 21 before neither the car stopping switch 20 nor the switch lever 20L contact with any other part disposed around
20 them.

When rotating of the car stopping switch 20 is stopped by one of the switch cam stoppers 21, the lever holder 22 including a plate spring fixedly holds the car stopping switch 20 between itself and the vertical portion 13V. Namely, when the car
25 stopping switch 20 is, after starting rotating, contacted with

one of the switch cam stoppers 21, the lever holder 22 holds the car stopping switch 20 where the car stopping switch 20 has been stopped in contact with the one of the switch cam stoppers 21. In this way, the car stopping switch 20 does not automatically
5 return to the static position (a position in the rotating direction with the elevator system in operation).

To allow the lever holder 22 to fixedly hold the car stopping switch 20 in contact with one of the switch cam stoppers 21 between the lever holder 22 and the vertical portion 13V, the lever holder
10 22 is positioned such that, as shown in FIGs. 2 and 3, at least a part of the lever holder 22 covers a space on the vertical portion 13V between the car stopping switch 20 in a static state and the two switch cam stoppers 21.

Also, to allow the lever holder 22 to fixedly hold the
15 car stopping switch 20, the minimum distance between the lever holder 22 and the vertical portion 13V in the space between the car stopping switch 20 in a static state and the two switch cam stoppers 21 is required to be smaller than the thickness of the car stopping switch 20 as shown in FIG. 3. (A part of the lever
20 holder 22 may be in contact with the vertical portion 13V in the space between the car stopping switch 20 in a static state and the two switch cam stoppers 21.) Also, as shown in FIG. 3, to allow the car stopping switch 20 to enter between the lever holder 22 and the vertical portion 13V, there must also be a
25 gap between the lever holder 22 and the vertical portion 13V

in the space between the car stopping switch 20 in a static state and the two switch cam stoppers 21. The maximum distance between the lever holder 22 and the vertical portion 13V in the gap is larger than the thickness of the car stopping switch 20.

5 As shown in FIG. 2, on the vertical portion 13V of the base frame 13, a lever restoration device 23 is provided at a position lateral to the car stopping switch 20 and opposite to the lever holder 22. The lever restoration device 23 is a part disposed around the car stopping switch 20 and the switch lever
10 20L. The lever restoration device 23 returns the car stopping switch 20 fixedly held between the lever holder 22 and the vertical portion 13V to the static position.

The lever restoration device 23 may include, for example, a solenoid coil and a projection part which projects toward the
15 car stopping switch 20 when a voltage is applied to the solenoid coil. When the projection part projects and pushes a surface perpendicular to the vertical portion 13V of the car stopping switch 20, the lever restoration device 23 can cause the car stopping switch 20 held between the lever holder 22 and the
20 vertical portion 13V to return to the static position.

The lever holder 22 is not necessarily made of a plate spring. It may be, for example, a plate member provided with an adhesive material on the surface opposing the vertical portion 13V. The lever holder 22 of such a type can fixedly hold the
25 car stopping switch 20 that has stopped rotating by contacting

with one of the switch cam stoppers 21 by the adhesive force of the adhesive material. The lever restoration device 23 can also return the car stopping switch 20 fixedly held by the adhesive material to the static position in a way described above.

5 When, for whatever reason, the ascending/descending speed of the car 3 reaches a preset value (a value smaller than a preset threshold for causing the emergency stopper device 8 to grasp the guide rail 7), for example, 1.3 times the rated speed of the car 3, the governor weights 15A and 15B are caused, by the
10 centrifugal force generated by rotation of the sheave 11, to rotate about the support pins 16A and 16B, respectively. This causes the claw-like parts 18A and 18B, against the elastic force of the spring 19, to be displaced outward in a radial direction of the sheave 11 pivotally about the support pins 16A and 16B
15 and to project from the sheave 11. The claw-like parts 18A and 18B, having projected from the sheave 11, push the switch lever 20L and thereby rotate the car stopping switch 20. When the car stopping switch 20 rotates, it comes off from the switch contact 20S, shutting off the power supply to the drive device
20 (not shown in FIG. 2) for driving the car 3, and actuating the brake device to electrically stop the ascending/descending of the car 3.

 The rotation of the car stopping switch 20 is stopped when the car stopping switch 20 comes into contact with one of the
25 switch cam stoppers 21. When the car stopping switch 20 contacts

with one of the switch cam stoppers 21 and stops the rotation, the lever holder 22 fixedly holds the car stopping switch 20 between the lever holder 22 and vertical portion 13V, thereby preventing the car stopping switch 20 from automatically
5 returning to the static position.

FIG. 4 is a front view of the governor 12 with the lever holder 22 fixedly holding the car stopping switch 20 between the lever holder 22 and the vertical portion 13V. In FIG. 4, reference numerals identical to those used in FIG. 2 represent
10 the corresponding parts shown in FIG. 2. FIG. 4 shows a state in which the car 3 and the sheave 11 are not moving. In this state, no centrifugal force is applied to the governor weights 15A and 15B, so that neither of the claw-like parts 18A and 18B is projecting outward in a radial direction of the sheave 11.

15 The car stopping switch 20, fixedly held between the lever holder 22 and the vertical portion 13V, cannot automatically return to the static position, so that the switch contact 20S can remain in an off state.

The car stopping switch 20 fixedly held between the lever
20 holder 22 and the vertical portion 13V as shown in FIG. 4 can return to the static position when, as described above, the projection part of the lever restoration device 23 projects and pushes the surface perpendicular to the vertical portion 13V of the car stopping switch 20.

25 FIG. 5 is a sectional view of the governor 12 taken along

line A-A in FIG. 4 and shows, like FIG. 3, the car stopping switch 20, switch cam stoppers 21, and lever holder 22 as seen from below. In FIG. 5, reference numerals identical to those used in FIG. 3 represent the corresponding parts shown in FIG. 3.

5 In FIG. 5, the lever holder 22 fixedly holds the car stopping switch 20, which has stopped the rotation by contacting with one of the switch cam stoppers 21, between the lever holder 22 and the vertical portion 13V.

As described above, in the elevator system according to
10 the present embodiment, the car stopping switch 20, which has shut off the power supply for driving the car 3 and electrically stopped the movement of the car 3, does not automatically return to the static position. In addition, in the elevator system according to the present embodiment, it does not occur that the
15 car stopping switch 20 or switch lever 20L hits a part peripheral to them, such as the lever restoration device 23, to cause the car stopping switch 20 to return to the static position. Therefore, it is not necessary to secure large space around the car stopping switch 20 and switch lever 20L. This makes it
20 possible to miniaturize the governor for space saving.

The present invention is not limited to the above embodiment and can be modified in various ways. The above embodiment has been described in detail so as to make the present invention easier to understand, and the present invention is not limited
25 to a structure provided with all the above-described parts.

Also, the drawings referred to above show control lines and information lines required for describing the embodiment and do not necessarily show all the control lines and information lines included in the product described. In reality, almost
5 all constituent elements of the product may be regarded as being interconnected.

WHAT IS CLAIMED IS:

1. An elevator system comprising:

a car which ascends and descends in a hoistway provided in a building;

5 a governor rope connected to the car;

a sheave provided in the building, with the governor rope wound therearound;

a governor weight provided on a side of the sheave, the governor weight including an end portion which is able to project
10 outward in a radial direction of the sheave by a centrifugal force generated when the sheave rotates;

a car stopping switch rotatably installed in a base frame, the car stopping switch including a switch lever which projects toward the sheave in a state where power is supplied to a drive
15 device for driving the car, and the car stopping switch shutting off the power supplied to the drive device when the car stopping switch rotates to exit the state where the power is supplied to the drive device;

a first switch cam stopper which is a projection installed
20 in the base frame, the first switch cam stopper provided at a position lateral to the car stopping switch where the first switch cam stopper can be in contact with the car stopping switch when the car stopping switch rotates; and

a lever holder fixed to the base frame;

25 wherein the car stopping switch is positioned such that,

when an ascending or descending speed of the car reaches a predetermined value, the switch lever moves by being pushed by the end portion of the governor weight projecting outward in a radial direction of the sheave;

5 wherein the lever holder is positioned such that at least a part of the lever holder covers a space between the car stopping switch in the state where the power is supplied and the first switch cam stopper;

 wherein, when the switch lever moves by being pushed by
10 the end portion of the governor weight, the car stopping switch rotates to come into contact with the first switch cam stopper;
and

 wherein the lever holder holds the car stopping switch between the lever holder and the base frame, the car stopping
15 switch having contacted the first switch cam stopper and stopped rotating.

2. The elevator system according to claim 1, wherein the lever holder comprises a plate spring.

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3. The elevator system according to claim 1, further comprising:

 a second switch cam stopper identical to the first switch cam stopper,

25 wherein one of the first and second switch cam stoppers

is positioned above a rotary shaft about which the car stopping switch rotates and another of the first and second switch cam stoppers is positioned below the rotary shaft; and

wherein the lever holder is positioned such that at least
5 a part of the lever holder covers a space between the car stopping switch in the state where the power is supplied and the first and second switch cam stoppers.