

AN ELEVATOR SYSTEM

The present invention relates to an elevator system and more particularly to an improvement in a governor means to stop an elevator system in case of emergency.

Hitherto, governor means for elevator systems which in case of overspeed of the elevator cage act to detect the overspeed and grasp a governor wire rope have been installed at the upper part of the hoist way, but it is often the case in the building in which an elevator system is to be installed that a machine room for installing a governor can not be provided directly above the hoist way, or, even if such a machine room can be provided, an entrance, opening, or the like to allow entrance into the room can not be provided.

In order to remedy such difficulties, various countermeasures have been already proposed. For example, Japanese Utility Model Publication No. 37781/1972 (published on November 15, 1972) proposes, as shown in Fig. 3, to install a governor 4 at the lower portion of a hoist way, and Japanese Patent Publication No. 42763/1972 (published on October 28, 1972) proposes, as shown in Figs. 3, 5 and 12,

installing a governor 4 at the lower portion of the hoist way.

However, in those inventions, means for tensioning the governor wire rope are complicated, large in size, etc., and not fully satisfactory. That is, in the first invention mentioned above, as a tensioning device 5 a number of elements are required such as a tension wheel 6, a weight 7, an L-shaped arm 18 rotatably supported by a bracket 17, a lower guide wheel 14, etc., and also in 10 the second invention mentioned above, a chain 7, a sprocket wheel with lock means 8, a weight 6, or a weight with lock means 18, etc. are required.

It is an object of the present invention to provide a governor means for an elevator system in which 15 the tensioning means are improved so as to have a simple construction.

It is another object of the present invention to provide an elevator system wherein a governor is provided in the lower part of the hoist way and a governor wire 20 rope can be maintained in tension by the use of a device of simple construction.

It is a further object of the present invention to provide an elevator system in which a governor means is not actuated by larger than normal but not dangerous 25 oscillation of the cage.

The present invention provides an elevator system possessing a safety device which operates when the rate of descent of an elevator cage travelling up and down a hoist way exceeds a predetermined rated speed to bring
5 said cage to an emergency stop, comprising:

a governor installed at the lower portion of said hoist way, the governor being adapted to detect the rising or descending speed of said cage and when an abnormal speed is detected acts to grasp a governor rope;

10 a guide wheel rotatably mounted at the upper portion of said hoist way;

a safety device installed on said cage, for bringing said cage to an emergency stop when in descending said cage exceeds said rated speed, and associated with an
15 actuation mechanism so as to be operated to bring said cage to an emergency stop;

a governor rope reeved over said guide wheel and said governor so as to be lodged within said hoist way and connected at one end to said actuation mechanism so
20 as to always move together with said cage to operate said governor, said governor rope being adapted to be caught by said governor to be stopped when said governor detects a speed in excess of said rated speed, said governor rope thereby operating said actuation
25 mechanism; and

a tensioning means disposed between the other end of said governor rope and said actuation mechanism to connect them together and adapted to give tension to said governor rope.

5 Thus, at the time of the actuation of the governor the safety device can be operated through the tensioning means and the actuating mechanism. Further, even though the governor is installed at the lower portion of the hoist way, an emergency halt operation can be effected
10 whenever necessary with a device of simple and lost cost constitution, allowing the governor and the governor rope to be installed within a narrow space.

In one aspect of the present invention a vibration absorption mechanism is provided at the connecting point
15 between the governor rope and the actuating mechanism, preventing the undesired actuation of the safety device due to vibrations of the cage.

The invention will be described further, by way of example, with reference to the accompanying drawings, in
20 which:

Fig. 1 is a diagrammatical vertical sectional view of a first embodiment of the present invention;

Fig. 2 is an enlarged view of the principal part of Fig. 2;

Fig. 3 is a diagrammatical vertical view of a second embodiment of the present invention;

Fig. 4 is a partial sectional view of a third embodiment of the present invention on a larger scale, corresponding to the principal portion of Fig. 2; and

Fig. 5 is a partial sectional view of a fourth embodiment of the present invention on a larger scale.

Now an embodiment of the present invention will be explained with reference to Fig. 1 of the attached drawings.

In the drawing, the reference numeral 1 is the hoist way of an elevator system, 1a is its upper part, 1b is its lower part, 2 is a traction machine mounted within lower part 1b, 2a is a hoisting wire rope, 3 are suspension wheels for wire rope 2a which are rotatably attached to upper part 1a, 4 is an elevator cage suspended from wire rope 2a through suspension wheels 3, 5 is a publicly known safety device provided on cage 4, 5a is an operating mechanism therefor, 6 is a governor mounted at the lower part 1b of hoist way 1, 7 is a guide wheel rotatably secured to the upper part 1a of hoist way 1, and 10 is an actuation mechanism for safety device 5. 101 is

a transmission device constituting a part of actuation mechanism 10; 101a is a first lever constituting, as shown in Fig. 2, a part of transmission device 101, which is pivotably attached at one end to the frame of cage 4 and has a through-hole 101b at its other end oriented transversely to the axial direction of the first lever 101a; 101c is a protrusion which projects upwards from the mid portion of first lever 101a; 101d, as shown in Fig. 1, is a second lever which is pivoted at one end to the bottom of the frame of cage 4 and holds at the other end the brake member (not shown) of safety device 5; 101e is a rod pivotably connected at its ends to the mid portions of first lever 101a and second lever 101d, respectively; 101f is a bolt loosely passing through the upper part of protrusion 101c and rigidly secured to the cage 4 with the head abutting against protrusion 101c and the opposite end being secured by a nut; and 101g is a holding spring formed of a compression spring loosely disposed around bolt 101f between cage 4 and protrusion 101c. 102 is a vibration absorbing mechanism mounted to the free end portion of first lever 101a; 102a, as shown in Fig. 2, is a connecting rod (constituting a part of vibration absorbing mechanism 102) which is connected at its upper end with one end of governor wire rope 8 and loosely passes through through-hole 101b of first lever 101a, the lower end of connecting rod 102a being formed with a connecting hole 102b; and 102c are vibration absorbing springs each comprising a compression spring which is loosely disposed around connecting rod

102a so as to be positioned above and below first lever 101a, respectively, and kept compressed by screwing nuts 102d to the upper and lower portions of connecting rod 102a, respectively.. 103 is a friction damping mechanism mounted to first lever 101a of transmission device 101, 103a is a first shifting member loosely fit within a bore 103b longitudinally formed in first lever 101a so as to be in communication with through hole 101b and opened at the free end of lever 101a, 103c is a second shifting member disposed between the wall of through hole 101b and the outer periphery of connecting rod 102a so as to confront first shifting member 103a, 103d is a pusher plug screwed into bore 103b from the free open end of first lever 101a, and 103e is a pusher spring comprising a compression spring received within bore 103b and disposed between first shifting member 103a and pusher plug 103d. 11 is a tension device comprising a tension coil spring. Governor wire rope 8, as shown in Fig. 1, connected at one end to the upper end of connecting rod 102a, extends upwards, is reeved around guide wheel 7, and then extends downwards to be reeved around governor 6. The governor 6 is thereby actuated, and so the portion of governor wire rope 8 described so far will be hereafter referred to as the wire rope actuating part. The remaining portion of governor wire rope 8 then extends upwards from governor 6 and is connected to tension device 11, this latter portion of governor wire rope 8 between the governor 6 and the tension device 11 being hereafter referred to as the wire rope non-actuating part.

The embodiment of the present invention described herein and shown in Figs. 1 and 2 operates as follows.

5 Governor wire rope 8, which is kept under tension by tension device 11, is held by cage 4 through vibration absorbing mechanism 102 and transmission device 101, i.e. actuation mechanism 10, so that governor 6 is operated as cage 4 moves up and down. Transmission device 101 is maintained in a non-operating condition by holding spring 101g so that transmission device 101 is not brought
10 into operation during normal acceleration of cage 4. If, however, cage 4 descends at a speed exceeding a predetermined velocity, governor wire rope 8 is constrained by governor 6 upon its detection of such an overspeed. This constraint force is applied to actuation mechanism 10 independently of
15 tension device 11 so that safety device 5 is operated through the operation of actuation mechanism 10 alone.

Since tension device 11 is positioned below the elevator cage, in the non-actuating part of the wire rope 8, it is not tensioned when the governor 6 activates and
20 tensions the actuating part of the wire rope 8. This location of the tension device has 2 advantages. One is that it is not subject to damage due to the great tension which would be applied to it were it located above the elevator in the actuating part of the wire rope 8. Another
25 is that, if it were located in the actuating part, it would be stretched to its full length by the tension applied to governor rope 8 before it would actuate the safety device 5. The time required to stretch the tension device 11 would create a time delay between the tensioning of the wire

rope 8 by the governor 6 and the actuation of safety device 5. With the tensioning device 11 in the non-actuating part of the wire rope, however, tension applied to the wire rope 8 by the governor 6 can immediately activate the safety device 5 with no time delay. Further, in order that transmission device 101 and safety device 5 are not erroneously actuated by a larger than usual but not dangerous oscillation of cage 4 due to, for example, jumping of the passengers within the cage 4, such larger than usual oscillations can be absorbed by vibration absorbing mechanism 102. Friction damping mechanism 103 operates to damp the oscillations so that the erroneous actuation of safety device 5 is prevented.

Now the manner in which such an erroneous actuation is prevented will be explained more precisely with reference to Fig. 2. When cage 4 is accelerated upwards, inertial force exerts a clockwise torque on first lever 101a, as viewed in Fig. 2, but since protrusion 101c abuts against the head of bolt 101f, the clockwise rotation of first lever 101a is prevented. Therefore, as cage 4 rises first lever 101a does not rotate, and rod 101e does not move, either. Accordingly, actuation mechanism 10 does not operate, and safety device 5 is not actuated.

Alternatively, when cage 4 accelerates downwards or oscillates downwards, first lever 101a tends to rotate in the counterclockwise direction as viewed in Fig. 2, but the rotation of first lever 101a in the counterclockwise direction is constrained due to the force applied to protrusion 101c in the clockwise direction by spring 101g

as well as the force applied to first lever 101a to hold it at an intermediate position by springs 102c, 102c, and the frictional force generated between grasping governor wire rope 8 and first and second shifting members 103a, 103c by spring 103e, etc. Therefore, rod 101e and actuation mechanism 10 do not move much during normal acceleration and oscillation of cage 4 in the downwards direction so that safety device 5 is not erroneously actuated.

Therefore, in spite of the fact that, in the present invention, governor 6 is mounted at the lower part lb of hoist way 1 with vibration absorbing mechanism 102 and friction damping mechanism 103 being associated therewith, the present invention allows cage 4 to effect an emergency stopping operation whenever necessary using an apparatus of simple construction

It will be apparent that when this embodiment is applied to a fluid pressure actuated elevator, a similar operation will be revealed.

Fig. 3 shows another embodiment of the present invention wherein the same reference numerals as those in Figs. 1 and 2 indicate equivalent parts; 10 is an actuation mechanism comprising a lever which is pivotally connected at one end to cage 4 and holds at the other end a brake member (not shown) of safety device 5 similar to in the previous embodiment. As is apparent from Fig. 3, in this embodiment a governor wire rope 8, one end of which is connected to actuation mechanism 10, extends upwards to be wound around guide wheel 7 and thence extends downwards to be wound around governor 8, the other end extending upwards

and being connected to actuation mechanism 10 through tension device 11.

Although a detailed explanation is omitted, it will be apparent that this embodiment operates similarly to the embodiment shown in Figs. 1 and 2.

Fig. 4 shows a further embodiment of the present invention wherein the same reference numerals as those in Fig. 2 indicate equivalent parts. The reference numeral 11a is a cylinder constituting a tension device 11; 11b are tapered portions formed at the upper and lower end positions of cylinder 11a; 11c is a piston rod projecting from cylinder 11a; 11d is an energizing element comprising a compression coil spring disposed around piston 11c and arranged between the lower end of piston rod 11c and the upper inner end of cylinder 11a; and 11e is an operating fluid contained within cylinder 11a. 12 is a pin to connect the upper end of piston rod 11c with actuation mechanism 10, and 8 is governor wire rope which is connected at its extreme ends to the upper end of piston rod 11c and the lower end of cylinder 11a, respectively.

The operation of this embodiment is as follows.

Governor wire rope 8, which is adapted to be tensioned by energizing element 11d, is connected at one end to the top end of tension device 11 through actuation mechanism 10 and then extends upwards. After reeving around guide wheel 7, rope 8 descends to be reeved around governor 6, and the other end of rope 8 rises upwards and is connected to the lower end of tension device 11. Thus, although a detailed explanation is omitted, it will be apparent

that an operation similar to that in the first and second embodiments is also produced in this embodiment. In this embodiment the following additional operation can be obtained. Since energizing element 11d comprises a compression coil spring, if the governor rope should happen to catch on and be momentarily constrained from moving by some structure protruding from the sides of hoist way 1, such as a structural beam, governor wire rope 8 is not broken because of full compression of energizing element 11d. Further, since tension device 11 comprises an oil damper means the oscillation of actuation mechanism 10, etc. caused when cage 4 is accelerated or decelerated can be suppressed. Moreover, tapered portions 11b of cylinder 11a serve to prevent cylinder 11a from catching on any structures mounted in hoist way 1.

Finally, Fig. 5 shows a still further embodiment of the present invention in which the first lever has a twin legged construction. In the drawing the element similar to those shown in Fig. 2 bear similar reference numerals. 101a is the first lever which is pivotably connected at one end to cage 4 and formed at the other end with a solid end 101h. Protruding upwards at the mid portion is a bent protrusion 101c, 101b being a through hole formed at the end portion in the horizontal portion of protrusion 101c. 102 is a vibration absorbing mechanism mounted to the horizontal portion of protrusion 101c, 102c is a vibration absorbing spring comprising a coil spring which is connected at one end to a connecting hole 102b of a connecting rod 102a and engaged at the other

end by a portion of solid end 101h of first lever 101a, and 102e is a stopper comprising a nut screwed onto the lower end portion of connecting rod 102a. 11 is a tensioning means disposed beneath first lever 101a and
5 comprising a coil spring which is engaged at one end by a portion of solid end 101h of first lever 101a, the other end of which connects to governor wire rope 8. Tensioning means 11 simultaneously serves as a vibration absorbing spring of vibration absorbing mechanism 102.

10 Thus, in this embodiment governor wire rope 8 which is tensioned by tensioning means 11 is connected to cage 4 through vibration absorbing mechanism 102 and friction damping mechanism 103. Therefore, although a detailed explanation is omitted, it is apparent that also in this
15 embodiment an operation similar to that in the embodiment shown in Figs. 2 and 3 is obtainable. Further, in the embodiment of Fig. 5, since tensioning means 11 and vibration absorbing mechanism 102 share a vibration absorption spring, the desired operation will
20 be realized by the use of fewer parts.

Although a few preferred embodiments of the present invention have been described and illustrated, it will be understood by those skilled in the art that modifications may be made in the structure, form and
25 relative arrangement of parts without necessarily departing from the scope of the present invention.

**Claims:**

1. An elevator system possessing a safety device which operates when the rate of descent of an elevator cage travelling up and down a hoist way exceeds a
5 predetermined rated speed to bring said cage to an emergency stop, comprising:
 - a governor installed at the lower portion of said hoist way, the governor being adapted to detect the rising or descending speed of said cage and when an
10 abnormal speed is detected acts to grasp a governor rope;
 - a guide wheel rotatably mounted at the upper portion of said hoist way;
 - a safety device installed on said cage, for bringing said cage to an emergency stop when in descending said
15 cage exceeds said rated speed, and associated with an actuation mechanism so as to be operated to bring said cage to an emergency stop;
 - a governor rope reeved over said guide wheel and said governor so as to be lodged within said hoist way
20 and connected at one end to said actuation mechanism so as to always move together with said cage to operate said governor, said governor rope being adapted to be caught by said governor to be stopped when said governor detects a speed in excess of said rated speed, said
25 governor rope thereby operating said actuation



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mechanism; and

a tensioning means disposed between the other end of said governor rope and said actuation mechanism to connect them together and adapted to give tension to
5 said governor rope.

2. An elevator system as claimed in claim 1, wherein said tensioning means is a coil spring which simultaneously functions as a connecting means to connect said governor rope and said actuation mechanism.

10 3. An elevator system as claimed in claim 2, wherein said tensioning means is arranged in the non-actuating part of said governor rope.

4. An elevator system as claimed in any preceding claim, wherein said one end of said governor rope and
15 said actuation mechanism are connected together through friction damping means.

5. An elevator system as claimed in claim 4, wherein said friction damping means comprise a first and a second shifter element adapted so that said governor
20 rope passes therebetween, and also comprise elastic means to cause said shifter elements to frictionally engage said governor rope.

6. An elevator system as claimed in claim 4 or 5, wherein said friction damping means is arranged within a
25 void part formed within a number of said actuation mechanism so as to be directly connected to said governor rope.



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7. An elevator system as claimed in any preceding claim, wherein disposed within the connecting part of said one end of said governor rope and said actuation mechanism is a vibration absorbing mechanism.

5 8. An elevator system as claimed in claim 7,
wherein said vibration absorbing mechanism is a
mechanism to elastically constrain a member of said
actuation mechanism, said member being directly
connected to said governor rope, said vibration
10 absorbing mechanism comprising springs to elastically
constrain the motion of said member in the direction
parallel to said governor rope so as to absorb forces
tending to move said member in said direction.

9. An elevator system as claimed in claim 8,
15 wherein said member is adapted to be elastically held by
a set of springs disposed above and below said member.

10. An elevator system as claimed in claim 9,
wherein one spring of said set of springs is arranged in
said non-actuating part of said governor rope, acting
20 also as a tensioning means for said governor rope.

11. An elevator system as claimed in any preceding
claim, wherein a member of said actuation mechanism
which is adapted to be directly connected to said
governor rope has a constraining force elastically
25 applied thereto to constrain the operation of said
member.



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12. An elevator system as claimed in claim 11, wherein said member is formed with a protrusion against which a spring elastically abuts so that a constraining force is applied to said member.

5 13. An elevator system as claimed in any preceding claim, wherein said tensioning means comprises an oil damper.

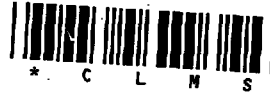
14. An elevator system as claimed in claim 13, wherein both ends of said oil damper are tapered.

10 15. An elevator system as claimed in claim 13 or 14, wherein the protruding end of the piston rod of said oil damper is connected to said actuating mechanism as well as to said one end of said governor rope.

16. An elevator system possessing a safety device
15 which operates when the rate of descent of an elevator cage travelling up and down a hoist way exceeds a predetermined rated speed to bring said cage to an emergency stop, comprising:

a governor installed at the lower portion of said
20 hoist way and adapted to detect the up and down speed of said cage and to grasp a governor wire rope when a downward velocity in excess of said rated speed is detected;

a guide wheel rotatably mounted at the upper portion
25 of said hoist way;



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an emergency stopping device installed on said cage and adapted to stop said cage when it exceeds said rated speed, said device being provided with an actuation mechanism for actuating said device during an emergency
5 stop;

a governor wire rope reeved over said guide wheel and said governor to extend along said hoist way, one end thereof being connected to said actuation mechanism so as to always move together with said cage to operate
10 said governor, whereby when said governor detects a speed in excess of said rated speed said governor wire rope is grasped by said governor and operates said actuating mechanism;

tensioning means connected between the other end of
15 said governor wire rope and said actuation mechanism to interconnect them and adapted to give tension to said governor wire rope;

friction damping means disposed in a member of said actuation mechanism and frictionally engaging the
20 connecting part of said one end of said governor wire rope for frictionally damping abnormal vibrations of said cage; and

vibration absorbing means arranged at the connecting part of said one end of said governor wire rope and said
25 member of said actuation mechanism directly connected to said governor wire rope, said vibration absorbing means being adapted to absorb a vibrating force applied in the



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direction parallel to said governor wire rope so that said actuation mechanism is prevented from being actuated by vibrations of said cage.

17. An elevator system as claimed in claim 16,
5 wherein said member of said actuation mechanism is formed with a through-hole for the passage of said one end of said governor wire rope and with an opening to receive therein said friction damping means, there being arranged in said through hole a first and a second
10 shifter element between which passes said governor wire rope, and said first and second shifter elements are caused to frictionally engage said governor wire rope by a pusher spring and a pusher plug disposed within said opening, and said governor wire rope has nuts fixed on it
15 above and below said member of said actuation mechanism at predetermined distances from said member, a vibration absorbing spring being disposed between each of said nuts and said member so as to elastically press said mechanism from above and below.

20 18. An elevator system as claimed in claim 16, wherein said member of said actuation mechanism has a twin legged constitution, one of said legs through which said one end of said governor wire rope passes being provided with said friction damping means, while the
25 other leg is connected to said vibration absorbing means comprising a pair of vibration absorbing springs.



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19. An elevator system as claimed in claim 18,
wherein one of said vibration absorbing springs of said
vibration absorbing means to be disposed between said
other leg and said governor wire rope acts also as said
5 tensioning means.

20. An elevator system substantially as described
with reference to, and as shown in, Figures 1 and 2,
Figure 3, Figure 4, or Figure 5 of the accompanying
drawings.

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