ELEVATOR GOVERNOR TESTING DEVICE

John T. Staub Jr.

BY

ATTORNEY
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John T. Staub, Jr., Baltimore, Md., assignor of one-half to Harold S. Bennett, Baltimore, Md.

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The present invention relates to an apparatus or device for testing the governor mechanism for elevator cars which prevents an elevator car from descending in excess of a predetermined speed. The device is particularly adaptable to instances of falling elevators where some type of mechanical failure has occurred, such as, a broken car cable, broken shafts, or gearing in connection with the supporting elements for the elevator car, or by failure in equipment.

Most States and cities have regulations which state at what speed a descending elevator may not exceed. In general, it is believed, that most of the regulations set a bracket of percentages in speed over which the elevator car can not exceed its normal speed. If the elevator does exceed the percentage of the normal speed of the elevator car the governor will operate to release a set of emergency brakes carried by the elevator car to stop the car immediately regardless of its position within the shaft. The governor is operated by the movement of the car up and down, or along the elevator shaft and when the elevator exceeds a predetermined speed it causes certain mechanical functions to come into play that will apply these emergency, or safety brakes.

The primary object of the invention is to provide an elevator governor testing device which may be temporarily carried on the car or on a counter-weight which will operate the governor at a speed in excess of the downward speed of the elevator car or counter-weight as they actually move downward along the elevator shaft.

Another object of the invention is to provide a device which will be economical to manufacture and practical in its application.

A further object of the invention is to provide such a device that may be operated with a substantial saving in both time and labor.

Still another object of the invention is to provide a device for the purpose stated in which the test may be carried out without any undue shock to the elevator car.

While several objects of the invention have been pointed out, other objects may become apparent including its uses and advantages as the nature of the invention is more fully disclosed, consisting, in its novel construction, combination and arrangement of its several parts as illustrated in the accompanying drawings and described in the detail description thereof.

In the drawings:

Figure 1 is an elevational end view of the operating elements of the device, such as the drum units and drum units supporting frame for operating the governor operating means.

Figure 2 is an enlarged fragmentary plan view of a portion of the drum units and supporting frame shown in Figure 1 adjacent their centers.

Figure 3 is an elevational end view of a slightly different form for the drum unit elements mentioned in Figure 1, the elements being in a different operating ratio as to each other than that shown in Figure 1.

Figure 4 is a plan view of the drum units and supporting frame shown in Figure 1.

Figures 5, 6 and 7 show diagrammatically the various steps in the use and of the testing device to an elevator car in which a predetermined percentage of speed is added to the governor operating means over and above the actual speed of the elevator car.

Figures 8, 9 and 10 shows diagrammatically the various steps in the use and application of the testing device to the elevator car in which a higher percentage of speed is added to the governor operating means over and above the actual speed of the elevator car than that shown in Figures 5, 6 and 7.

Figure 11 is a fragmentary elevational end detail view of one of the operating elements for operating the governor operating means used as illustrated in Figures 5, 6 and 7.

Figure 12 is an elevational view of the details of a supporting stand carried by the elevator car for receiving the drum unit supporting frames.

Figure 13 is a plan view of the stand shown in Figure 12.

In referring to the drawings like reference characters are used to indicate like and similar parts throughout the several views.

In describing the invention, the term elevator when used alone is used to designate the elevator car and the elevator shaft.

The governor operating means refers to a pair of inter-connectable operable drums, or similar cylinder elements of different diameters, however, the broad terminology is also intended to include any means whatsoever for operating the governor at a speed greater than the actual speed of the elevator car as it is moved down the elevator shaft. The governor operating element per se is illustrated by a movable cable which is normally fixed to an emergency brake applying element or bar carried on the elevator car. The cable travels up and down the elevator shaft at the same speed as the speed of the elevator car which in turn operates the governor during any movement of the elevator car. The governor is provided with means for locking the governor operating cable should the governor be increased in speed above a predetermined percentage beyond the normal speed of the elevator car.

Any restraint or locking the further movement of the cable will cause a pull on the brake applying bar and cause the operation of the emergency brake carried by the elevator car and prevent its further downward movement along the elevator shaft, all of which will be referred to in more detail hereinafter.

Again this governor operating means may take various forms within the meaning of the invention, that is, it may be as illustrative in the form of a pair of rotatable drums, or it may be a rotatable shaft adapted to be rotated by the actual movement of the elevator car and at any predetermined speed ratio with the actual speed of elevator car along the elevator shaft. While the description is primarily described for the use of the device with an elevator car, the device is equally useful in testing the governors of counter-weights which are generally in use in unusually high buildings.

Generally, the elevator car is guided along a vertical elevator shaft. This is best illustrated in Figures 5 to 10, in which, an elevator car 20 is guided along a vertical elevator shaft by the side members 22. The cars are moved vertically along the shafts preferably by conventional electrically operated machinery carried in the housings 24 shown at the top of each shaft, the elevator
car being supported by cables 26 in which one end is attached to the car and the other end adapted to be wound upon a winding drum (not shown) of the operating machinery, which in turn is operated by an electric motor of either alternating or direct current. It should also be understood the same or similar principle of operation applies when the elevator car lifting cables are passed over the upper half of a lifting drum and depend on tautness engagement therewith and have the opposite ends of the cable supporting the usual counter-weight structure. The device may likewise be used to test the governors of hydraulic lifts, or any other standard type of mechanism used in operating elevator cars.

All passenger elevator cars of any consequence are required to have a means for preventing the car from descending at too fast a rate of speed. For example, the supporting cable may break and allow the car to fall freely, or the operating machine may fail and allow the winding drum to run freely which may allow the elevator car to move beyond its normal rate of speed. Therefore, under any condition when the car descends at a speed greater than the predetermined normal speed of the elevator car, the emergency brake engages the shaft and stops the car wherever it may be along the shaft.

This emergency braking mechanism is carried on the car and when placed into braking operation is extended to engage the guide members 22, which, within a reasonable distance will halt the descent of the car. These brakes (not shown) are operated by what is generally referred to as a governor as shown at 28 in Figures 5 to 10. These governors are generally operated by a small emergency cable 29 supported at the bottom of the elevator shafts by pulleys 30. The upper ends of the cables are supported upon pulleys 31, which in turn operate the governors 28. The cables are operated by the elevator cars by attaching the cable to the link and swinging bar assemblies 32 indicated diagrammatically extending outwardly from the car in line with one side of the cable, as shown by the dotted lines in Figures 5 to 10. This link and bar 32 is connected with the braking mechanism of the elevator car and will trip the brake to bring it in engagement with the guide members 22 when sufficient resistance or locking is encountered in the movement of the cable. As long as the car moves at normal speed up and down the shaft the cable rolls freely about the pulleys 30 and 31 operating the governor, which is shown to be of the centrifugal type, however the invention is not limited to this type alone. The governor assembly is provided with clutch elements 33 and 34, see Figures 5 to 10. In Figures 5 and 8 the clutch elements 33 and 34 are shown in position to allow the governor operating cable to pass freely therethrough to operate the centrifugal governor 28. However, if the car moves beyond a predetermined speed the governor will be further expanded by the outward swinging of the governor and cause the clutch to move to a position shown in Figures 6, 7, 9 and 10 to grip the cable 22 and resist further free movement of the cable, whereby a pull is exerted on the bar 32 sufficient to apply the emergency brakes on the elevator car.

It may be well to state here that the normal braking of the car is done through the operating mechanism carried within the housing 24 previously mentioned and only the emergency brakes are carried on the car.

As stated in the beginning, one of the objects of the invention is to increase the speed of the governor operating to a predetermined speed of the elevator car when the car is in motion by a true speed ratio between the speed of the car and the speed of the governor operating means. The governor operating means in this case being the cable 64, the actual device and the manner in which it is accomplished will be set forth in detail as the description proceeds.

The principal elements of the device comprise a pair of interconnected rotatable drums 36 and 38. Drum 36 is referred to as the primary element of the drum unit and is the larger of the two, and drum 38 is referred to as the secondary element of the drum unit and is the smaller of the two. These drums are preferably provided with parallel cylindrical surfaces. The diameters of these drums are of definite ratios in relation to each other, that is, the circumference of the smaller drum is, for example, smaller by a predetermined percentage than the circumference of the larger drum.

The drum shown in Figures 5 to 7 has a circumference which is forty percent of the circumference of the larger drum and the drum shown in Figure 3 and Figures 8 to 10 has a circumference fifteen percent of the larger drum. The ratio between the different sized inter-connected drums may be varied depending upon the type of elevator car, emergency braking system and governor being tested and the circumstances under which the tests are being made. The two drums are interconnected as stated hereinafore and rotate as a unit upon a common axis. Through the axis of the two drums are suitable bearings adapted to be receivable over an axle 40. The axle 40 extends outwardly beyond the opposite ends of the drums a sufficient distance to support the drum unit upon a frame having normally a vertical portion 41 and a horizontal portion 42.

While it has been stated that the drum unit and frame may be held by one carrying out the test, the installation and use of the drum will only be described with the use of a stand as shown in Figures 12 and 14 to support the drum unit and frame, as its operation in either case is substantially the same regardless of the manner in which it is carried on the elevator car.

The stand 43 may be of any desirable type or shape, one illustrated comprising a plurality of legs 44, 45, 46 and 47. These legs have one end connected with a base member 48. The base is normally secured to one or more cross-members 49 of the elevator by any suitable convenient and suitable means such as bolts 50. The upper ends of the legs are provided with suitable supporting members 51, 52, 53 and 54, which are adapted to engage the underside of the frame portion 42, which has been previously described for rotatably supporting the drum unit.

The members 51 and 52 positioned on top of legs 44 and 45 are of U-shape and are adapted to receive the portions 42' and 42'' of the element 42 in such a manner as to prevent any side transverse movement, that is, the U-shaped members comprise an integral part of the construction and in each of the sections 42' and 42'' to engage the frame 42 where it is bent at right angles on itself, shown best in Figure 4 and the members 53 and 54 are adapted to receive the end portions 42''' of the frame member 42.

In the lower end of the vertical member 41 there is an eye bolt 56 and in the base of the stand there is a similar eye bolt 58 through which a breakable cord or rope 60 may be threaded and tautly tied to hold the drums and frame in position on the stand against any normal pull. After the drum and frame unit has been placed upon the stand and the cord 60 secured between the eye bolts 56 and 58, a cable 62 which has been fully wound upon the drum 36 and one end thereof attached thereto by the cable clamp 63 rotates the drum unit by an unwinding operation when the elevator car is moved downwardly, the operation of which will be later described.

Secured to the smaller drum 38 is one end of a cable 64. This cable is not wound upon the drum before hand, as is done with cable 62, for the reason that the cable 64 is wound upon the drum 38 as the cable 62 is being unwound from the drum 36.

When it is desirable to change the ratio between the surfaces of the two drums, the larger drum is generally not changed, the smaller or secondary drum or drum element is removed from the shaft of the large drum, and a smaller drum of different ratio is secured to the larger
drum in place of the one removed. The smaller drums each in turn are held and fixedly secured to the larger drum by means similar to the bolt 68. The bolt 68 is readily removable in order that the drums may be disconnected and freely rotated independently of each other for adjusting the lengths of the cables of the two drums at the beginning of the testing operation. A drum having a surface of 40 percent of the size of the larger drum is shown in Figures 1 and 4, and a drum having a surface of 13 percent of the size of the larger drum is shown fragmentarily in Figures 2 and 3.

To start the governor test, the stand is secured to the top of the elevator car by the bolts 50 or by some other attaching means. The frame 41—42 on which the drum units 36 and 38 have been rotatably supported is placed upon the upper surfaces of the members 51 to 54 carried on the upper ends of the legs 44 to 47, and the tie 60 is threaded through the eyes 56 and 58 and tightly drawn and tied. It will be noted that the stand is free to move downwardly from the drum and frame unit because of the shape of the rests 51 to 54, when the tie 60 is broken by the action of the lacking of the governor operating cable.

The emergency brake cable is disconnected from the emergency brake operating link and swinging bar assembly 32 and the link in turn is then disconnected from the elevator car by disconnecting the same from the swinging bar assembly attached to the elevator for purposes of fully freeing the governor acting mechanism before the start of the test. The free end of the cable 62 as referred to above, as identified with the fully wrapped larger drum 36, has this free end secured to a convenient stationary place on, or adjacent a point in the elevator shaft, as shown at 67 in Figures 5 to 10. One end of the cable 62 has been fastened to the smaller drum, as shown at 69 by the clamp 70 is attached to the cable 29 as indicated diagrammatically at 71 in Figures 5 to 10. This cable at the beginning of the test is adapted to be wound upon the smaller drum as the cable 62 is unwound from the larger drum.

Referring first to Figures 8 to 10, as this is the drum unit having a 40 percent ratio between the winding surfaces of the two drums. At the start of the test the car is in the position as shown in Figure 8. As the car is moved down in the direction of the arrow, the cable 62 wrapped about the longer drum 36 will rotate the drum units 36 and 38, and the car will wind about the smaller drum moving the governor operating cable 40 percent faster than it normally would travel if connected with the brake release bar 32. If the governor is set to operate the cable clutch elements 33 and 34 to engage the governor operating cable 29 at 40 percent over the normal speed of the elevator, the governor should function, if not, the governor is reset to function at the proper speed. For illustration, it is assumed the governors reached a point to operate the clutch members 33 and 34 at the position of the elevator car, as shown in Figure 9. As the governor operating cable 29 is not connected with the emergency brake operating bar 32, the resistance in travel of the cable does not effect the brake, but as the cable slows down and/or stops, it will not effect the movement of the car. The car will continue on until stopped by the operator. However, as both cables are now held at a stationary point somewhere along the elevator shaft, the tie 60 is broken, and the drum and frame unit will be held stationary while the car and stand continue to descend until stopped by the operator.

By the apparatus and method just described for testing the governors for operating the emergency brake on elevator cars, the governors and the clutches adapted to engage the governor operating cables may be tested by the actual operation of the elevator cars along the elevator shaft to obtain a true by ratio test.

In Figures 5 to 7, the exact same steps are taken to test an elevator governor set to apply the emergency brake to the elevator car should the rate of the descending car exceed its normal speed by 15 percent.

While the maximum speed of the car is usually used in testing the governor, it may be done by increasing the circumference of the smaller drum to operate the governor cable at a greater speed than the ratio set up between the maximum speed of the elevator car and the governor, that is, within limits, the speed of the governor operating element may be such as to operate the governor at the desired speed to cause the governor to apply the emergency brake to the elevator car while the elevator car may only be moving at a speed well below its maximum speed. In fact, the smaller drum may easily become the larger drum, if it was designed to operate the governor operating cable at a relatively high speed with a very slow speed to the movement of the elevator car.

A method of attaching the cable to the small drum is shown in Figure 11, which comprises studs 55, which grip the cable 64 as they extend through suitable openings in the drum, as shown in Figures 2 and 11.

Most all elevator cars of any consequence are provided with counter-weights. In one form the weights may be fastened to cables which are fastened to the top of the elevator car, and extend upwardly and over a pulley and down to the counter-weight. Part of the function of these counter-weights is to balance the normal weight of the elevator car. These counterbalances in elevator cars in particular high buildings are in many cases provided with their own individual governor and emergency braking equipment. The governors on the counter-weights must also be tested. These are tested with the identical apparatus by placing the drum units on the counter-weights and connecting the cable to the smaller drum to the governor control cable for the counter-weight and the cable wound around the larger drum to a stationary point adjacent the elevator shaft in a manner as that described in testing the governor for the elevator car.

It will be seen that the same device may be used for testing the mechanism of both the elevator car, or the counter-weight or, in fact, the present mechanism may be used to test any type of governor or any element that moves up and down the elevator shaft.

As stated hereinbefore, most regulations require that elevator cars have an emergency braking mechanism which will operate to stop the car, if the car is moving from 15 percent to 40 percent over the normal speed. By the use of the present device it is readily seen how the ratio of the speed of the governor operating cable is increased to any desired speed in relation to the speed of the elevator car to check on the governor to ascertain if it is operating at the set designated speed for that particular elevator car.

The present apparatus provides for the necessary increased speed of the governor operating means by the operation of the elevator car itself without the necessity of increasing the normal speed of the car, which always required considerable changes in the driving means for the elevator car and may also include adjustments to the electric motor used in the operation of the car. In some instances where alternating electric current is used to operate the elevator car, it is next to being impossible to increase the speed of the motor beyond its normal speed.

While a preferred form of the invention has been illustrated and described in detail, it is not intended as a limitation as it is obvious that various changes and modifications of the device may be made without departing from the principles set forth herein, therefore, the scope of the invention is best defined in the appended claims.

I claim:

1. An apparatus for testing the governors for operating the brakes on over-speeding elevator cars including a detachable operating means normally connected between the car and governor for operating the governor at a predetermined speed relative to the speed of the ele-
vator, said apparatus comprising, a primary operatable means adapted to be operated by the movement of the elevator car and a secondary operatable means connected with the primary operatable means, adapted to operate the governor operating means at a speed in excess of its normal speed relative to the same speed of the elevator.

2. An apparatus for testing the governor operating the brakes on over-speed elevator cars, comprising, in combination, a differential speed device having a pair of inter-connected rotatable drums of different diameters, one of the said drums having means for rotating the same at a surface speed equal to that of the downward speed of the car, means connecting the other drum with a governor operating means for moving the governor operating means at a speed in excess of the downward speed of the car equal to the ratio between the diameters of the two drums.

3. An apparatus for testing the governors operating the brakes on overspeeding counter-weights, comprising, in combination, a differential speed device adapted to be carried by the counter-weight having a pair of inter-connected rotatable drums having cylindrical faces of different diameters, the cylindrical face with the larger diameter having means for rotating the same at a surface speed equal to that of the downward speed of the counter-weight, means connecting the cylinder with the lesser diameter with a governor operating means for moving the governor operating means at a speed in excess of the downward speed of the counter-weight equal to the ratio between the diameters of the two cylinders.

4. An apparatus for testing the governors operating the brakes on over-speeding elevator cars, comprising, in combination, a pair of connected rotatable drums of different diameters carried by the elevator, a flexible cable wrapped about the larger of the drums and means for flexibly securing the outer end of the cable to a stationary element in such a manner as to rotate the drum at a surface speed substantially equal to that of the downward speed of the elevator car as the elevator car is moved downwardly, a second cable connected to the smaller drum and adapted to be wound thereon as both drums are rotated by the first mentioned cable wound about the larger drum, the opposite end of the second mentioned cable connected with the smaller drum being connected with a cable operating the governor, whereby the cable connected with the governor is moved at a speed equal to the speed of the elevator car plus the ratio of the differences between the diameters of the two drums.

5. In an apparatus for testing governors operating the brakes on over-speeding elevator cars as set forth in claim 4 having a stand for supporting the drums thereon, the drums being free to be detached upwardly from the stand by the downward motion of the elevator car, a holding means of predetermined strength adapted to hold the drums downwardly in place upon the stand until such time as the governor operates to stop the governor operating cable.

6. An apparatus for testing the governors operating the brakes on over-speeding elevator cars, comprising, in combination, a differential speed device adapted to be carried by the elevator car having a pair of inter-connected rotatable drums having cylindrical faces of different diameters, the cylindrical face with the larger diameter having means for rotating the same at a surface speed equal to that of the downward speed of the elevator car, means connecting the cylinder with the lesser diameter with a governor operating means for moving the governor operating means at a speed in excess of the downward speed of the elevator car equal to the ratio between the diameters of the two cylinders.

7. An apparatus for testing the governors operating the brakes on over-speeding elevator cars as set forth in claim 6 in which the drum members are rotatably supported upon a stand carried by the elevator car, the drums being detachable from the stand by the downward movement of the elevator car when the pull on the drums exceeds a predetermined amount.

References Cited in the file of this patent

UNITED STATES PATENTS

735,395 Lindstrom Aug. 4, 1903
1,534,291 MacAskill Apr. 21, 1925

FOREIGN PATENTS

17,715 Great Britain Dec. 2, 1899