Aug. 29, 1933. J. DUNLOP 1,924,310

ELEVATOR SAFETY BRAKE

Filed Jan. 22, 1931

Fig. 1.

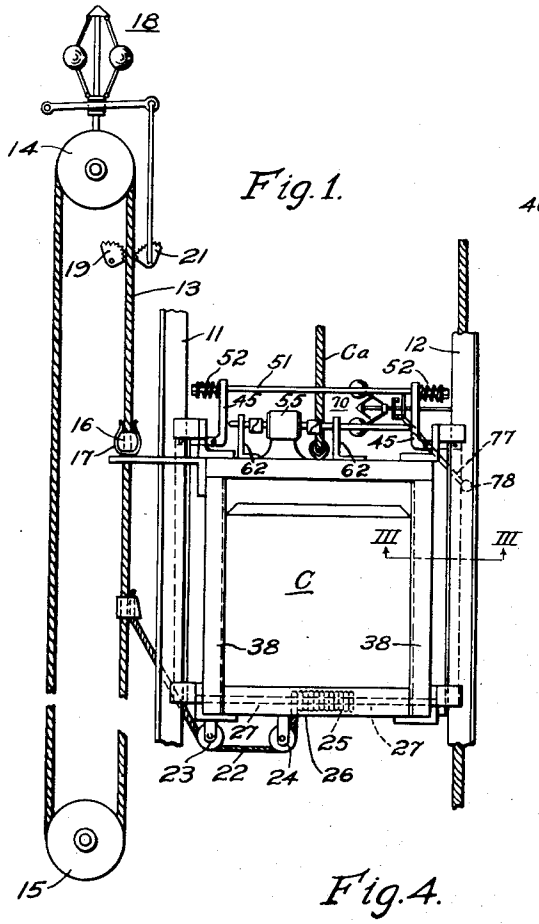


Fig. 2.

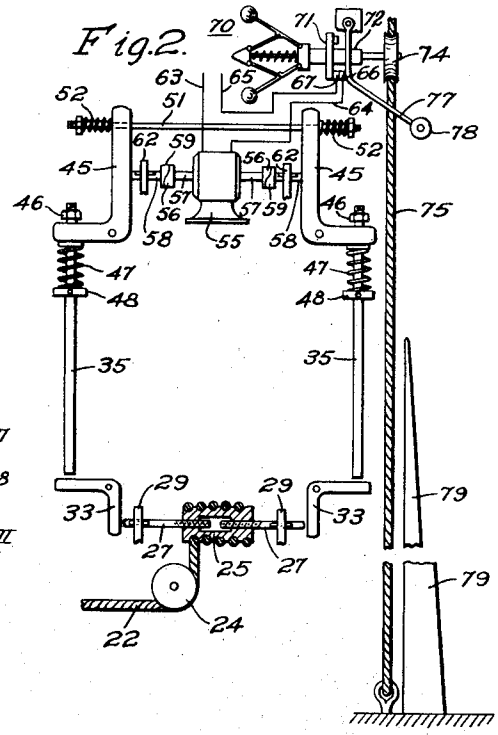


Fig. 5.

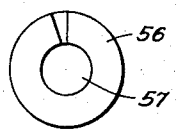


Fig. 6.

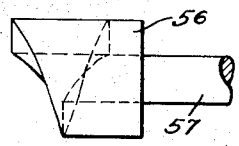


Fig. 4.

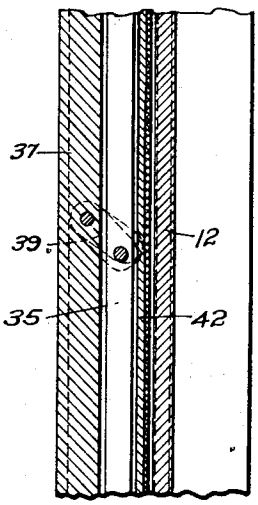


Fig. 3.

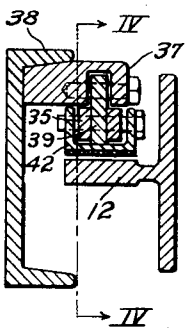
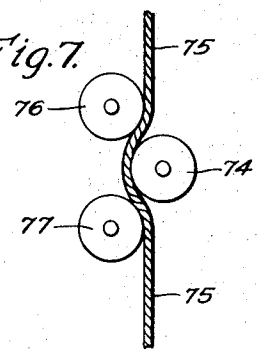


Fig. 7.



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1,924,310

ELEVATOR SAFETY BRAKE

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6 Claims. (Cl. 187—90)

My invention pertains to an improved elevator safety brake adapted to be carried by the elevator car, and a system of control for automatically actuating the brake to stop the car upon the occurrence of various emergency conditions.

Prior elevator safety devices have consisted of small area rail gripping jaws, or scissors grip, and actuating means for applying the jaws to grip the rails with such a high unit area pressure that they would bite into the rails and bring the car to a violent stop. Not only do such devices stop the car so suddenly that the passengers may be injured, but the apparatus itself may be damaged. In many cases the rails are scored, and the rail gripping jaws are found to be actually welded to the rails after an application of the safety device.

It is, accordingly, an object of my invention to provide a safety brake device which will bring the car to a smooth stop without damaging the rails and other equipment.

It is also an object of my invention to provide a smooth acting safety braking device which will apply the brake shoes to the rails with an equalized low unit area pressure.

It is a further object of my invention to provide a safety braking device which may apply either a mild braking force or a strong braking force commensurate with the requirements of the emergency.

Another object of my invention is to provide a safety braking device having two independent actuating mechanisms.

A further object of my invention is the provision of a safety braking device on a car and a speed responsive actuating device for applying the brake when the car speed exceeds a predetermined rate having associated means for varying the predetermined speed rate in accordance with the position of the car in the hatchway.

According to my invention, I provide a safety braking device having long, lined, brake shoes instead of the usual scissors grip or small area wedge safety devices. A standard safety plank of the drum type is provided under the car, but it operates the brake shoes through bell cranks instead of wedges as in the standard friction safety. Independent actuating means is provided on top of the car comprising biasing springs tending to lift the shoes to rail engaging position and electromagnetic motive means normally energized to oppose the biasing springs. A speed responsive device on the car deenergizes the electromagnetic means and permits the brake to be applied when the car speed exceeds a predetermined rate, and means are provided for diminishing the predetermined rate of speed as the car approaches its limit of travel.

The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment, when read in conjunction with the accompanying drawing, in which:

Figure 1 is a view in side elevation of an elevator system arranged in accordance with my invention;

Fig. 2 is a view showing the various elements of my invention in cooperative relation, the elevator car and its guide rails being omitted for the sake of clearness;

Fig. 3 is an enlarged sectional view taken on line III—III of Fig. 1;

Fig. 4 is a vertical section view taken on line IV—IV as shown in Fig. 3; and

Figs. 5, 6 and 7 are detail views.

Referring more specifically to the drawing, the apparatus shown in Fig. 1 comprises an elevator car C supported by a hoist cable C*a* and operable between guide rails 11 and 12 in the usual manner.

A governor rope 13 passes over a governor sheave 14 at the top of the hatchway and under an idler sheave 15 at the bottom of the hatchway. The rope carries a "minnie ball" 16 releasably received by a spring clip 17 on the car whereby the governor rope 13 is constrained to follow the car in its movements up and down the hatchway.

The governor sheave 14 drives an over-speed governor 18 at speeds corresponding to the speed of the car, and the governor, in turn, controls a pair of conventional rope gripping jaws 19 and 21 which it trips to rope-gripping position in the well known manner when the speed of the car becomes excessive. Attached to the governor rope is a safety cable 22 which is passed around deflecting pulleys 23 and 24 and reeled upon a cable drum 25 which is mounted under the car in a safety plank 26. The construction of the safety plank may be identical with the standard drum type except that the usual rail gripping jaws or scissors grip, and the wedge-actuating members are omitted.

The cable drum 25 is internally threaded with right and left handed threads to receive slidably mounted shafts 27, as more clearly shown in Fig. 2. The shafts 27 pass through bearing members 29 which prevent rotation of the shafts, but permit them to slide freely. For this purpose, each

shaft may carry a key passing loosely through corresponding keyways in the bearings, or the shafts and bearings may be of square cross-section. Adjacent the outer extremities of the shafts 27 are pivotally mounted bell cranks 33 having their vertical arms disposed in cooperative engagement therewith. Brake shoe actuator members 35 extend vertically above the horizontal arms of the bell cranks 33, and are adapted to be lifted thereby when the safety cable is unreeled from the safety drum.

Brake shoes 42, of a length comparable with the height of the car, are associated with the actuator members 35, as shown in Figs. 3 and 4. Bars 37 are welded to the vertical stile members 38 extending the height of the car, and link members 39 are pivotally secured thereto at spaced intervals. The link members 39 may be spaced about twelve inches apart, for example, and the free or movable ends thereof are pivotally secured to the long brake shoe 42.

As shown in Figs. 3 and 4, the brake shoe 42 is supported adjacent the side of the guide rail 12, and when the shoe rests in its lowermost position, the link members 39 swing back and carry it toward the bar 37 and away from the guide rail. To simplify the drawing, only one brake shoe is shown in Figs. 3 and 4, but it is to be understood that a similar brake shoe is likewise mounted adjacent the opposite side of the guide rail 12, and a pair of brake shoes are similarly associated with the guide rail 11 on the other side of .the car.

It will be apparent that when the bell cranks 33 are rotated by unreeling the safety cable 22, they lift the brake shoe actuators 35, causing the rotation of the links 39 from the full-line position to the dotted-line position, as shown in Fig. 4. As a consequence thereof, the brake shoes 42 will be projected into engaging relation with their adjacent guide rails. The long brake shoes 42 may be lined with any suitable brake lining material, whereby a smooth uniform braking pressure will be applied.

To permit the application of the brakes independently of the safety plank 26 and its drum 25, the upper ends of the brake shoe actuators 35 pass through bell cranks 45 disposed on the upper structure of the elevator car. A stop nut 46 is provided on the upper end of each actuator member 35 above the associated bell crank 45 to limit its downward movement. A concentrically disposed compresson spring 47 is provided on each actuator member just below its associated bell crank 45. The spring 47 reacts between the bell crank and a stop washer 48 on the actuator 35 to take up slack motion and normally hold the actuator in its lowermost position.

Passing through the upper ends of the bell cranks 45 is a biasing rod 51 which carries concentrically disposed biasing springs 52 on the outer ends thereof. The biasing springs 52 react between the upper ends of the associated bell cranks and the stop nuts on the outer ends of the biasing rod 51, thereby applying a force tending to rock the bell cranks 45 and lift the brake shoe actuators 35. When the force of the biasing springs is unopposed, the brake shoe actuators 35 and associated brake shoes 42 are thereby lifted and the link members 39 thrust the brake shoes 42 into engaging relation with the adjacent guide rails.

In order to control the application of the brakes by the biasing springs 52, controllable means is provided on top of the car for normally applying an opposing force to the bell cranks 45. A specific mechanism suitable for this purpose comprises a torque motor 55 provided with a portion of a split block cam actuator 56 on each end of its shaft 57. Adjacent each end of the motor shaft is a slidably mounted shaft 58 which carries the cooperating portions 59 of the split block actuators in engaging relation with those portions which are carried by the motor shaft. The slidable shafts are supported by bearings 62 in which rotation is prevented in any suitable manner, as by providing a key in a large keyway or by making both the bearings and the shafts 58 of square cross-section. The outwardly directed extremities of the slidable shafts 58 engage in abutting relation with the vertical arms of the bell cranks 45.

The configuration of the cam surfaces of one of the split actuator blocks is clearly shown in Figs. 5 and 6 from which it will be apparent that a motion of rotation of less than one revolution imparted to the portions carried by ends of the motor shaft 57 will impart a motion of translation to each of the cooperating blocks and slidable shafts associated therewith. An energizing circuit extends by way of conductors 63, 64 and 65 to any suitable source of excitation whereby the torque motor is normally energized during the operation of the elevator car to continuously oppose the biasing springs 52 which are thereby rendered ineffective to lift the brake actuator bars 35 and apply the brakes.

To deenergize the torque motor 55 and permit the application of the brake when the car overspeeds, a pair of cooperating contact members 66 and 67 are interposed in the energizing circuit. One of contact members 67 is directly controlled by an overspeed governor 70 carried by the car, and may comprise an annular ring of conducting material supported by a disc 71 of insulating material carried by the slidable sleeve 72 of the governor.

In order that the governor 70 which is carried by the car may be driven at speeds corresponding to the speed of the car up and down the hatchway, the governor shaft carries a driving sheave 74 which engages a governor rope 75 secured stationarily in the hatchway. As shown in Fig. 7, diverting sheaves 76 and 77 may be provided to hold the rope 75 in engaging relation with the governor sheave 74 at all times.

The energizing circuit is not controlled solely by the movements of the contact member 67 associated with the governor 70, but depends also upon the position of the cooperating contact member 66 which is controlled by a pivot lever arm 77. The free end of the pivoted lever arm 77 carries a roller 78 projected into the hatchway to cooperatively engage a stationary cam 79, which is mounted in the hatchway adjacent the limit of travel of the car.

As the car approaches the end of the hatchway the roller 78 engages the cam 79 and is thereby constrained to move its contact member 66 to the right. If the operator properly reduces the speed of the car as it approaches its limit of travel, the cooperating contact member 67 associated with the governor 70 will also be moved to the right to maintain engagement with the cooperating contact member and the energizing circuit will not be interrupted. If the speed of the car is not sufficiently diminished, the governor contact member 67 will not move to the right as fast as does its cooperating contact member 66, and the energizing circuit of the torque motor 55 will be interrupted and the brake applied.

It is to be understood that a similar stationary cam member may be likewise provided adjacent the upper limit of travel and will operate in a similar manner to insure a safe reduction of speed as the car approaches its upper limit of travel.

It is to be noted that when released, the biasing springs 52 cooperate to apply an equalized constant braking force to the brake shoes, the intensity of which is predetermined by the adjustment of the stop nuts on the ends of the rod 51. However, when the overspeed governor 18 trips to actuate the brake shoes through the cable drum 25, an ever increasing braking force is applied until the car is stopped. The governor 70 carried by the car is preferably adjusted to set the brakes at a slower speed than is governor 18.

My invention is, however, most readily understood by considering an assumed operation thereof. Assuming that the car is traveling down the hatchway at a normal rate of speed, the brakes are released and the energizing circuit of the torque motor is maintained closed through the contact members 66 and 67.

If for some cause, such as a defective control system, or a broken hoist cable, the speed of the car increases, the governor 70 on the car will move its contact member 67 away from the cooperating contact member 66 thereby interupting the energizing circuit of the torque motor 55. The opposing force of the torque motor having been interrupted, the biasing springs 52 rock the bell cranks 45 inwardly to lift the brake shoe actuator members 35. As the actuators 35 are raised the links 29 thrust the lined brake shoes 42 into engaging relation with the guide rails to apply a smooth predetermined braking force and retard the car.

If, however, the speed of the car continues to increase, the overspeed governor 18 will trip its rope-gripping jaws 19 and 21 to grip the rope 13. The continued downward motion of the car will then be effective to unreel the safety cable 22 from the cable drum 25 causing the rotation of the latter. As the drum 25 rotates, its threaded portions project the shafts 27 outwardly, thereby rocking the bell cranks 33 to force the long brake shoes 42 into more forceful engagement with the guide rails. The braking effort is thereby increased until it is sufficient to stop the car, but it continues at all times smooth and equalized.

Assume, alternatively, that the car travels down the intermediate portions of the hatchway at a normal rate of speed in the usual manner. As the car approaches the end of its hatchway, the operator, or the automatic leveling or slow down apparatus, will normally diminish the car speed properly to bring it to a safe landing. When the car has progressed within a predetermined distance of its limits of travel, the roller 78 engages the stationary cam member 79, and rotates the lever arm 77 counter-clockwise, thereby moving the associated contact member 66 to the right. If the speed of the car is properly diminished, the governor contact member 67 will follow up its cooperating member 66 and the energizing circuit 63, 64 and 65 of the torque motor 55 is maintained.

Assuming, however, that for some reason the car speed is not sufficiently diminished, the governor contact 67 will not follow and maintain engagement with contact 66 and motor 55 will be deenergized. The opposing force being interrupted, the brakes are then actuated by the biasing springs 52 to apply an equalized constant braking force, and the car speed will be automatically diminished.

It will be seen, therefore, that I have provided a long shoe safety brake and means for independently actuating the same responsive to either the usual overspeed governor or a governor which is carried by the car including cooperating means for varying the speed regulation of the latter in accordance with the position of the car in the hatchway.

Although I have shown and described certain specific embodiments of my invention, I am fully aware that many modifications thereof are possible. My invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. In combination, an elevator car operable between guide rails, movable brake shoes carried by the car, biasing means for urging the brake shoes into engaging relation with the rails, electromagnetic means effective when energized for opposing said biasing means to prevent the application of the brake, a circuit for energizing said electromagnetic means when the car is operating, cooperating contact members connected into said energizing circuit, a speed responsive device for moving a first one of said contact members away from the second contact member when the car overspeeds, a stationary cam member mounted adjacent the end of the hatchway, cam engaging means carried by the car and associated with said second contact members to move it away from the first contact and apply the brake if the car speed is not sufficiently reduced as it approaches its limit of travel.

2. In combination, an elevator car operable between guide rails, lined brake shoes of a length comparable with the height of the car, link members pivotally attached to the brake shoes and the vertical stile members of the car whereby the shoes are carried adjacent the sides of the guide rails, biasing means continuously tending to lift the brake shoes whereby the link members will swing them into engaging relation with the rails, electromagnetic means effective when energized for opposing said biasing means to prevent the application of the brake shoes, an energizing circuit for energizing said electromagnetic means when the car is operating, and a speed controlled contact member connected into said circuit for interrupting the circuit to permit the brakes to be applied when the car overspeeds.

3. In combination, an elevator car operable between guide rails, a safety brake carried by the car, speed responsive means for applying said brake to stop the car when the speed of the car exceeds a predetermined rate, and means rendered effective as the car approaches a limit of travel for gradually diminishing the speed rate at which said speed responsive means will apply the brake.

4. In combination, an elevator car operable between guide rails, a safety brake carried by the car, a speed responsive device mounted on the car for applying said brake to stop the car when its speed exceeds a predetermined rate, a stationary cam member mounted adjacent the end of the hatchway, and speed regulating means carried by the car for engaging the cam member in the hatchway to gradually diminish the speed rate at which the device will apply the brake as the car approaches its limit of travel.

5. In combination, an elevator car operable be-

tween guide rails, a safety brake carried by the car, means for controlling the application of the brake comprising a pair of cooperating elements for controlling the application of said brake, means for moving one of said controlling elements in accordance with the speed of the car, means for moving the other controlling element in accordance with the position of the car whereby said controlling elements are normally maintained in a predetermined relative position and means responsive to movement of one element relatively to the other for actuating said safety brake.

6. In combination, an elevator car operable between guide rails, a safety brake carried by the car, a rope stationary in the hatchway, a speed responsive device mounted on the car in engaging relation with said rope whereby the movement of the car up and down the hatchway drives the device at corresponding speeds, means controlled thereby for actuating the brake when the car speed exceeds a predetermined rate, an overspeed governor, a movable governor rope releasably secured to the car for driving the governor, and means controlled thereby for moving the brake to rail engaging position when the car overspeeds at an excessive rate.

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