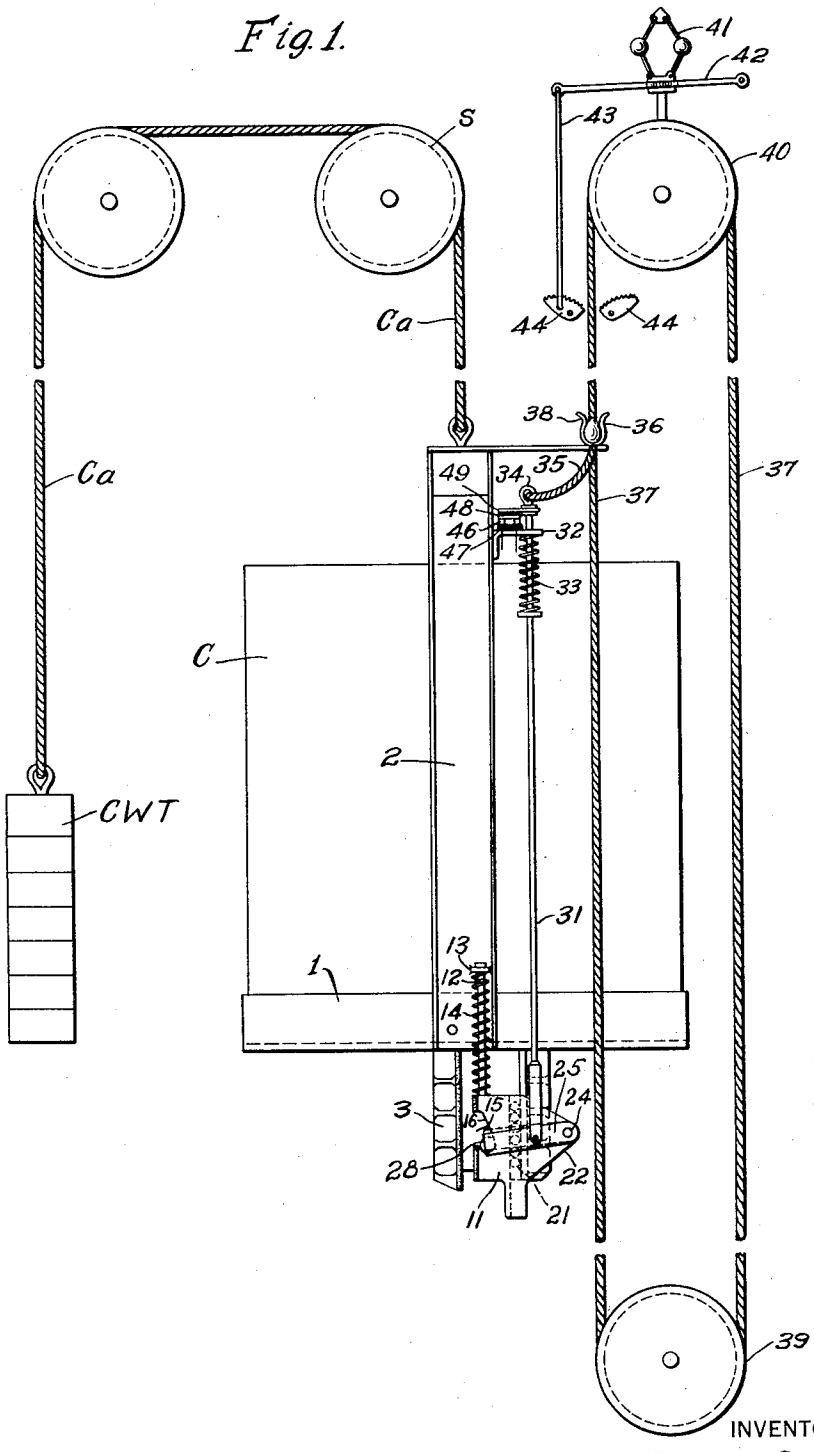
Nov. 28, 1933. J. DUNLOP 1,937,035

ELEVATOR SAFETY DEVICE

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Fig. 1.




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Fig. 2.

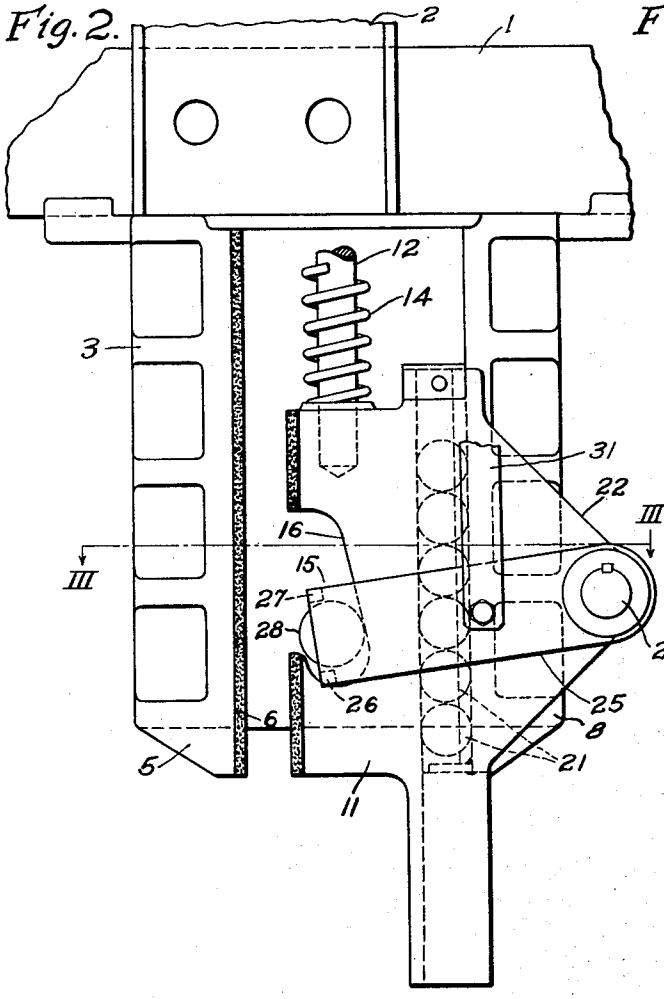



Fig. 4.

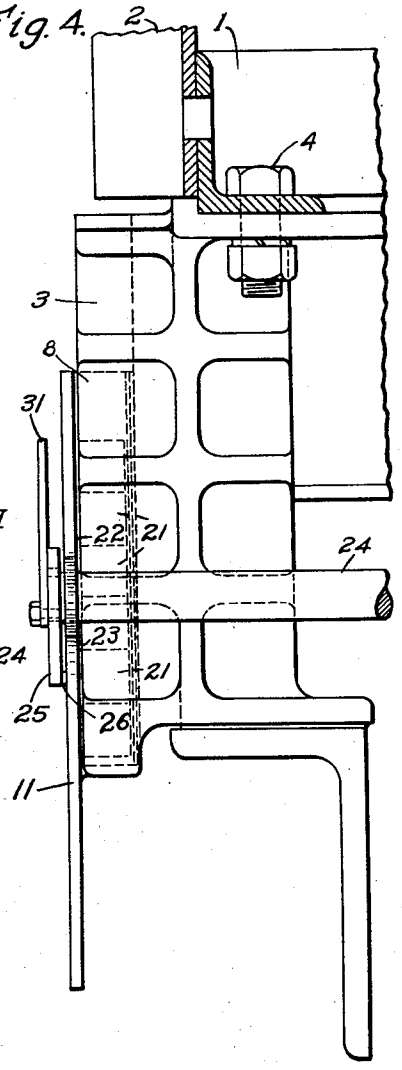
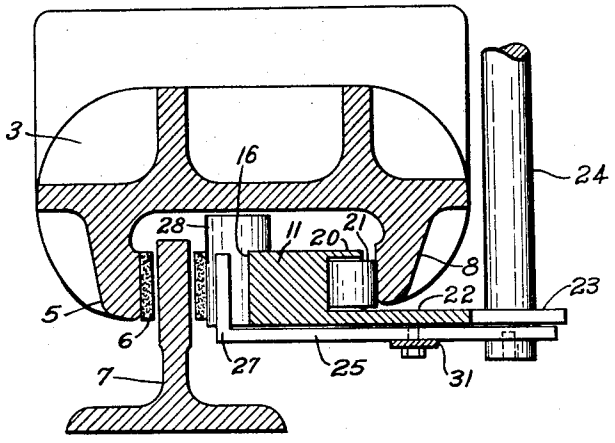



Fig. 3.




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1,937,035

## ELEVATOR SAFETY DEVICE

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Application October 20, 1930. Serial No. 489,877

6 Claims. (Cl. 187—89)

My invention relates to elevator safety devices and more specifically to elevator safety devices which, when applied, will grip the guide rails immediately and retard the elevator car gradually.

To ensure the safe operation of elevators, two emergency conditions must be provided for. These are breakage of the hoist cables and a runaway condition of the hoisting machine.

If the hoist cables break, it is apparent that the movement of the elevator car will always be downward. This is the most dangerous condition, and to provide for it a safety device is always carried upon the car. The safety device is controlled by a speed governor which actuates it to lock the car to the rails and bring it to an immediate stop when the speed becomes excessive.

If the hoisting machine runs away, it may do so when the car is moving either up or down. If the car is moving downwardly, the safety device will be actuated to lock the car to the rails and stop it, as set forth in the preceding paragraph. If the car is moving upwardly, the worst that can happen is that the car will go to the top of the hatchway. When it reaches that position, the counterweights strike the buffers at the bottom of the pit, thus causing the cables to slip on the hoisting sheave and permitting the car to stop. Since it considerably complicates a safety device to design it for operation in both directions of travel, it is customary practice to rely upon the slippage of the cables when the car reaches the top of the shaft to bring the car to rest in case of excessive speed in an upward direction.

Safety devices used heretofore have been of two general types or classes, namely, those in which the stoppage of the car is immediate, and those in which an attempt is made to bring the car to a gradual stop. Safety devices of the first class are objectionable because of the discomfort, and in some cases injury, suffered by the passengers when the device is caused to set, thereby decelerating the car from something in excess of normal running speed to zero speed in a slow-down distance approaching zero.

Safety devices of the second class, in general, may be divided into two subclasses, first, those in which the maximum setting of the safety is immediate but in which it is expected that the car will move some distance, and second, those in which the setting of the safety is gradual. The first are unsatisfactory because there is danger that the slippage of the jaws on the rails may deform the rails, as by gouging. The second are objectionable because the rate of acceleration of a freely falling car is so high as to cause the car to reach a speed much in excess of its running speed before the safety device has had time to engage the rails and apply a retarding force thereto.

It is, accordingly, an object of my invention to provide a safety device in which the setting of the device is immediate, but in which the deceleration of the car is gradual.

It is also an object of my invention to provide a safety device which will operate simultaneously and equally on both guide rails

It is a further object of my invention to provide a switch associated with the safety device for operation simultaneously therewith to deenergize the elevator motor, or for any other purpose desired.

It is another object of my invention to design a safety device which will be of simple construction and positive in its action, and which may be promptly and conveniently reset to restore the elevator car to service.

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 drawings, in which:

Figure 1 is a diagrammatic view representing an elevator system in which the elevator car is provided with a safety device in accordance with my invention;

Fig. 2 is an enlarged side elevational view of a portion of the safety device attached to the car below the platform thereof;

Fig. 3 is a sectional view, taken on line III—III of Fig. 2; and

Fig. 4 is a view, in end elevation, of the portion of the safety device shown in Fig. 2.

Referring to the drawings, the apparatus shown in Fig. 1 comprises an elevator car C suspended by a hoist cable C*a* passing over a hoist sheave S to a counterweight CWT in the usual manner. The hoist sheave S may be driven and controlled by any conventional elevator system (not shown).

The body and platform of the elevator car C rests upon horizontal angle members 1 which are secured to the vertical stiles or channel members 2 in any suitable manner, as by bolting or riveting. The specific relation of a horizontal angle member 1 and an associated vertical stile or channel member 2 is most clearly shown in Figs. 2 and 4. The upper ends of the vertical stile members 1 carry the usual cross-head to which

the hoist cable is attached in the customary manner.

Mounted on each side of the car below the platform is a rigid casting 3 which may be attached to the horizontal angle member 1 by bolts 4, as shown in Fig. 4. The casting 3, as shown, may be of honeycomb formation to reduce the weight without sacrificing rigidity.

As shown in Fig. 3, the cross section of the casting 3 may be of substantially U-shape, one leg 5 of which constitutes a braking member having a flat face or braking surface extending vertically adjacent to the side of the guide rail 7. The flat braking surface may be faced with suitable brake lining 6. The other leg 8 of the U-shaped section constitutes a bearing surface spaced from the opposite side of the guide rail 7 upon which is mounted a second braking member or braking device.

Slidably mounted within the space between the leg 8 and the side of the guide rail 7 is a casting 11, comprising one part of the braking device, the movements of which are guided and limited by a rod 12 passing through a lug 13 projecting from the side of the vertical stile member 2. To further limit the movement of the casting 11 and resist its movement upwardly relative to the car, a cushioning means such as a compression spring 14 is concentrically disposed on the rod 12. In the side of the casting 11, adjacent to the guide rail 7, is an opening 15 the inner wall 16 of which inclines angularly upward toward the rail 7.

The right-hand side of the slidable casting 11, or, in other words, the side which is adjacent to the leg 8 of the stationary casting 3, provides a smooth bearing surface in cooperative relation to the bearing surface presented by the leg 8. The bearing surfaces may abut for direct sliding engagement or they may be spaced, as shown in the drawings, and rollers 21 provided therebetween to reduce the friction. A retaining flange 20 may extend from casting 11 to support the rollers 21.

Extending from the outer edge of the slidable casting 11 is a bearing bracket 22 which passes beyond the outer limits of the rigid casting 3 to provide a bearing 23 for a shaft 24. Secured to the outer end of the shaft 24 is a lifter arm 25, the free end of which is adjacent to the opening 15. Pins or fingers 26 and 27 extend from the free end of the lifter 25 into the opening 15 to receive a wedging member or roll 28 which is supported therebetween. The roll 28, constituting another part of the braking device, may be of hardened steel provided with a knurled surface which will bite into the surface of the rail 7 when raised into engagement therewith by the lifter 25. An actuator bar or rod 31 is pivotally secured to the side of the lifter arm to raise the latter and lift the roll 28 into engagement with the rail 7 upon the occurrence of emergency conditions.

It is to be understood that the shaft 24 extends across the car to the opposite side thereof where it is provided with a similar lifter arm. When the lifter arm is raised by the actuator 31, the shaft 24 will be rotated and will cause the simultaneous actuation of the safety device at the opposite side of the car. In order that the safety devices may be applied equally, the lifter arm at the side of the car remote from the actuator bar should be slightly advanced with reference to the one which is directly connected to the actuator bar. The remotely disposed steel roll will thus be moved into engagement with its guide rail first, and the application of the devices will be equalized by the torsional elasticity of the shaft.

After the device is installed, the relative positions of the lifter arms may be conveniently adjusted by applying pipe wrenches to the shaft and straining it the necessary amount. The operating characteristics of the device may be regulated by selecting springs of suitable strength. The stronger the springs, the more abruptly the car will be retarded, and vice versa. The normal position of the device, when the car is operating, is shown in the various figures of the drawings.

For initiating the operation of the safety device upon the occurrence of overspeed conditions, the actuator rod 31 is extended to the top of the car, as shown in Fig. 1, where it passes through a bracket guide 32. A spring 33 may be concentrically disposed on the actuator rod to normally bias it to its lowermost position. An eyelet 34 at the upper end of the rod receives one end of the safety cable 35 which is secured thereto. The other end of the safety cable 35 enters a "minnie ball" 36 by which it is attached to the usual governor cable 37.

The governor cable 37 passes over a governor sheave 40 at the top of the hatchway and under an idler sheave 39 at the bottom, and a spring clip 38 on the car releasably receives the "minnie ball" whereby the governor cable 37 is constrained to move with the car in the usual manner during normal operation of the elevator. Associated with the governor sheave 38, and driven thereby, is the usual governor 41 which, through the pivoted lever 42 and link mechanism 43, operates a pair of pivoted rope-gripping jaws 44 to grip and lock the governor rope 37, in the customary manner, when the elevator car overspeeds.

Mounted on the upper face of the bracket 32 and suitably insulated therefrom by insulation 47 are a pair of contact members 46. A bridging contact member 48 is carried by insulation 49 on the actuator rod 31 and extends laterally therefrom. The position of the bridging member 48 is such that it will normally engage both of the contact members 46 mounted upon the upper face of the bracket 32 as shown in Fig. 1. The switch, consisting of contact members 46 and 48, may be utilized as a cut-out for deenergizing the elevator motor when the safety device is actuated, and, for this purpose, may be connected into the common connection from the relays or any other suitable portion of the control circuit.

My invention is best understood however, when considered with reference to an assumed operation thereof. Assuming that the elevator car C of Fig. 1 is moving down the hatchway at a normal rate of speed, the governor rope 37 will be driven at a speed corresponding to the speed of the elevator car and will drive the governor sheave and the governor at corresponding speeds.

If the speed of the elevator car increases to a predetermined abnormal rate, the governor 41 will trip the rope-gripping jaws 44, thereby locking the governor rope against further movement. The continued downward movement of the car will pull the "minnie ball" 36 from the releasable spring clip 38 and thereafter pull the safety cable 35 taut to lift the safety actuator-rod 31. The rod 31, in its upward movement, lifts the bridging member 48 from the contacts 46, thereby interrupting the circuit and deenergizing the elevator hoist motor, as previously set forth. As the rod 31 is pulled up by the safety cable 35, it will also raise the lifter arm 25 and lift the roll 28 into contact with the rail 7. When the roll is lifted, it engages between the inclined surface

16 and the rail 7. As the knurled surface of the roll 28 bites into the rail 7, the downward movement of the car causes it to bind more tightly between the inclined surface 16 and the rail.

As a result of the frictional engagement of the roll 28 with the rail, the slidable member 11 will at first move upwardly, relative to the car, riding on the rollers 21. The movement of the slidable member 11 upwardly, relative to the car, compresses the spring 14, thereby retarding the downward motion of the car and at the same time, the increasing downward thrust of the car causes the roll 28 to bind more tightly against the rail. As this action continues, the engagement of the roll 28 against one side of the guide rail pulls the braking surface 6 of leg 5 against the opposite side of the guide rail, which sets up a braking force that also tends to retard the car. This action continues until the car comes to rest.

As previously set forth, the shaft 24 extends through to the opposite side of the car to an identical safety device which is adjusted for equalized and simultaneous operation, hence, the braking force is applied equally and simultaneously on both sides of the car.

To restore the car to service after the safety device has set, it is only necessary to start the car upwardly to thereby permit the rolls 28 to fall back from the guide rail into disengaging position. The device may also be reset for normal operation by driving the members 11 upwardly to release the rolls 28 from the rails.

It will be seen that I have provided an elevator safety device which sets immediately after the initial engagement with the rail to apply an equalized braking force simultaneously at both sides of the car and decelerate the car gradually, and wherein the operation of the device, having been initiated by a preliminary tensioning of the governor rope, is carried to a complete operation by the motion of the car, irrespective of the continuation of the tensioned condition of the governor rope and the safety cable.

It do not wish to be restricted to the specific structural details and arrangement of parts herein set forth as various modifications thereof may be employed without departing from the spirit and scope of my invention. I desire, therefore, that only such limitations shall be imposed as are necessitated by the prior art and commensurate with the spirit of the appended claims.

I claim as my invention:

1. In a safety braking device for elevator cars operating between guide rails, rail-gripping means on each side of the car comprising a pair of braking members mounted for movement into engaging relation with the rails, whereby the downward movement of the car is effective to set the rail-gripping device, an actuator connected to a first of said members, and a rod having torsional elasticity and connected between said members, said members being mounted on said connecting rod at different angles of approach to the rails so that the movement of the first of said members toward the adjacent guide rail will cause the second member to be moved toward its associated guide rail slightly in advance of said first member, whereby the members will engage the rails equally by reason of the torsional elasticity of the connecting rod.

2. In a safety braking device for elevator cars operating between guide rails, rail-gripping means mounted on each side of the car adjacent to each guide rail comprising members rigidly secured to the car in position for presenting a rail-engaging surface adjacent to one side of each of the guide rails, members slidably mounted on the car providing an opening adjacent to the other side of each of said rails, the upper surface of said opening inclining upward and toward the rail, a wedging member carried in each of said openings, a lifter for raising each wedging member for engagement between the inclined surface and the side of the associated guide rail whereby the downward movement of the car will cause the rails to be squeezed between the wedging members on one side and the rail-engaging surfaces on the other side, and springs disposed between the car and the slidable members for limiting the movement of said slidably mounted members upwardly relative to the car to retard the car gradually.

3. In a safety braking device for elevator cars operating between guide rails, rail-gripping means mounted on each side of the car adjacent to each guide rail comprising members rigidly secured to the car on each side for presenting a rail-engaging surface adjacent to the sides of the guide rails, members slidably mounted on the car providing an opening adjacent to the other side of each of said guide rails, the upper surface of each of said openings inclining upward and toward the rail, wedging members carried in said openings, lifters for raising said wedging members for engagement between the inclined surfaces and the sides of the guide rails, whereby the downward movement of the car will cause the rails to be squeezed between the wedging members on one side and the rail-engaging surfaces on the other side, an actuator rod connected to the first of said lifters for actuating the device to retard the car, and a connector rod having torsional elasticity and extending from said first lifter to the second lifter for causing the simultaneous movement of both lifting means, said second lifter being secured to the connector rod at a smaller angle of approach to its rail than the first lifter so that the second lifter will carry its wedging member into engagement with its rail slightly in advance of the first, whereby the wedging members will be applied to the rails equally because of the torsional elasticity of the connector rod.

4. In a safety braking device for elevator cars operating between guide rails, rail-gripping means mounted on each side of the car adjacent to each guide rail comprising members rigidly secured to the car on each side for presenting rail-engaging surfaces adjacent to the sides of the guide rails, members slidably mounted on the car providing an opening adjacent to the other side of each of the guide rails, the upper surface of each of said openings inclining upward and toward the rail, wedging members carried in said openings, lifters for raising said wedging members for engagement between the inclined surfaces and the sides of the guide rails, whereby the downward movement of the car will cause the rails to be squeezed between the wedging members on the one side and the rail-engaging surfaces on the other side, an actuator rod connected to the first of said lifters for actuating the device to retard the car, a connector rod having torsional elasticity and extending from said first lifter to the second lifter for causing the simultaneous movement of both lifting means, said second lifter being secured to the connector rod at a smaller angle of approach to its rail than the first lifter so that the second lifter will carry its wedging member into engagement with the

rail slightly in advance of the first, whereby the wedging members will be applied to the rails equally because of the torsional elasticity of the connector rod, and springs for limiting the movement of said slidable members upwardly relative to the car to retard the car gradually.

5. In a safety braking device for elevator cars operating between guide rails, rail-gripping means mounted on each side of the car adjacent to each guide rail comprising members rigidly secured to the car on each side for presenting rail-engaging surfaces adjacent to the sides of the guide rails, members slidably mounted on the car providing an opening adjacent to the other side of each of the guide rails, the upper surface of each of said openings inclining upward and toward the rail, wedging members carried in said openings, lifters for raising said wedging members for engagement between the inclined surfaces and the sides of the guide rails, whereby the downward movement of the car will cause the rails to be squeezed between the wedging members on the one side and the rail-engaging surfaces on the other side, an actuator rod connected to the first one of said lifters for actuating the device to retard the car, a connector rod extending from said first lifter to the second lifter for causing the simultaneous movement of both lifting means, and springs reacting between the slidable members and the car for limiting the movement of said slidable members relative to the car to retard the car gradually.

6. In a safety braking device for elevator cars operating between guide rails, rail-gripping means mounted on each side of the car adjacent to each guide rail comprising a member rigidly secured to the car at each side providing a rail-engaging surface adjacent to one side of each rail and a bearing surface spaced from the opposite side of each rail, a member slidably mounted between each bearing surface and the rail, an opening being provided in each slidable member adjacent to the rail and having an inner surface inclined upwardly and toward the rail, a roller carried in each opening in engageable relation to the rail, means for lifting the rollers into engaging relation between the rails and the inclined surfaces upon the occurrence of emergency conditions, and cushioning means for connecting the car and the slidable members to cause the car to decelerate gradually when the rails are gripped by the rail-engaging surfaces and the rollers.

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