March 14, 1939. F. HYMANS 2,150,373

ELEVATOR SAFETY DEVICE

Filed July 2, 1937 3 Sheets-Sheet 1

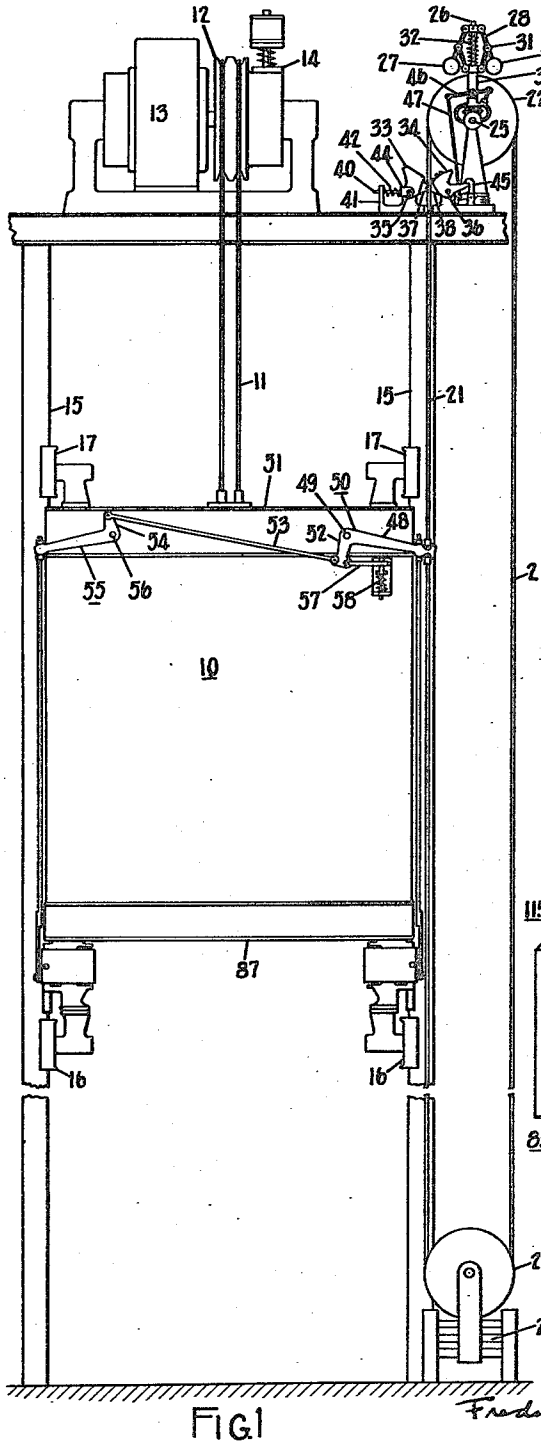

FIG. 1

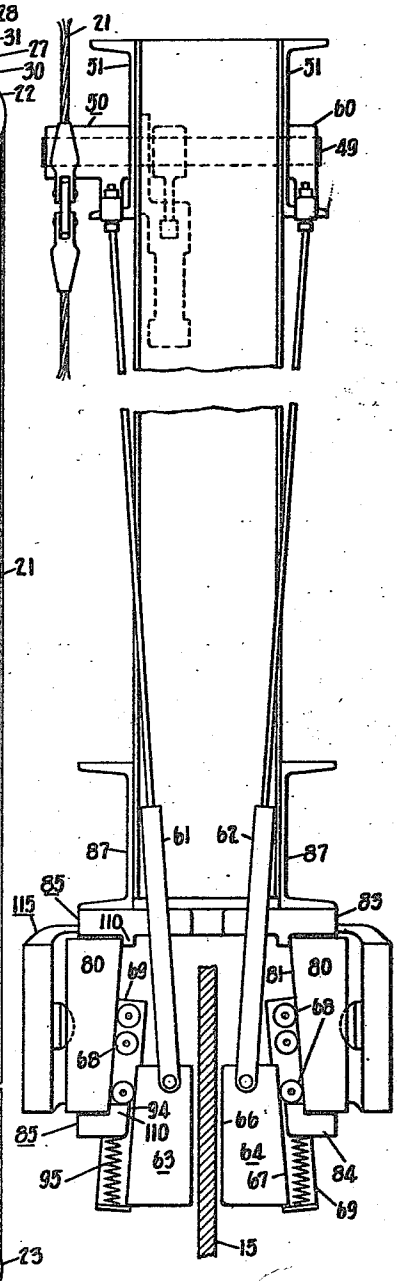

FIG. 2

Frederick Hymans INVENTOR

BY Chatfield & Bradley ATTORNEY

March 14, 1939. F. HYMANS 2,150,373

ELEVATOR SAFETY DEVICE

Filed July 2, 1937 3 Sheets-Sheet 2

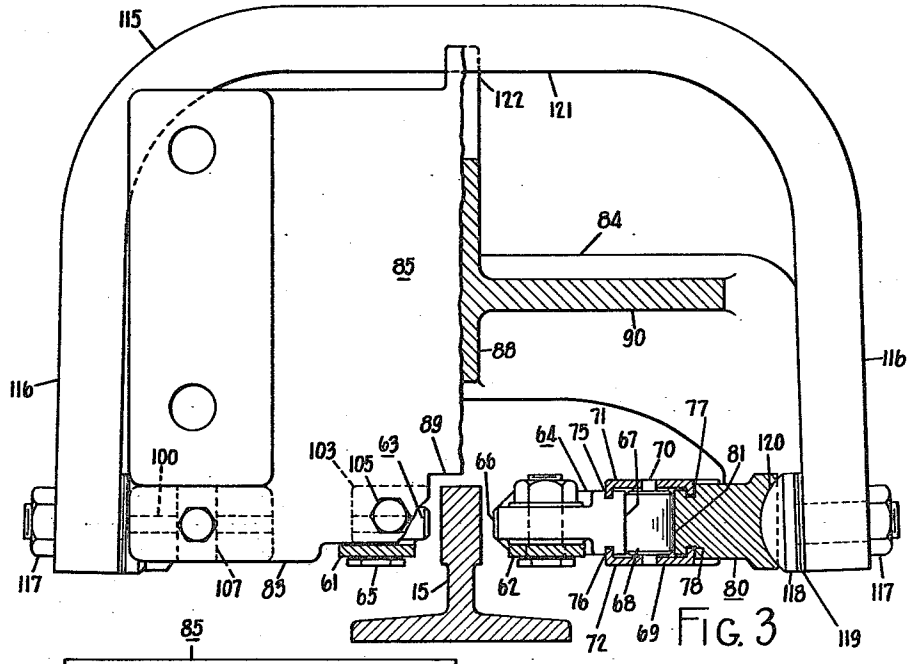

FIG. 3

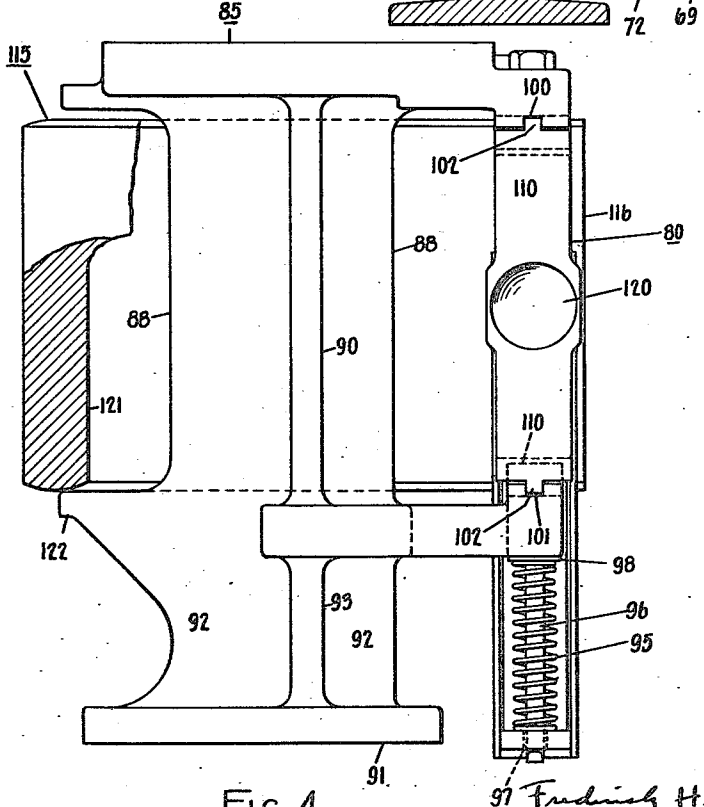

FIG. 4

Frederick Hymans INVENTOR

BY Walter E. J. Bradley ATTORNEY

March 14, 1939. F. HYMANS 2,150,373

ELEVATOR SAFETY DEVICE

Filed July 2, 1937 3 Sheets-Sheet 3

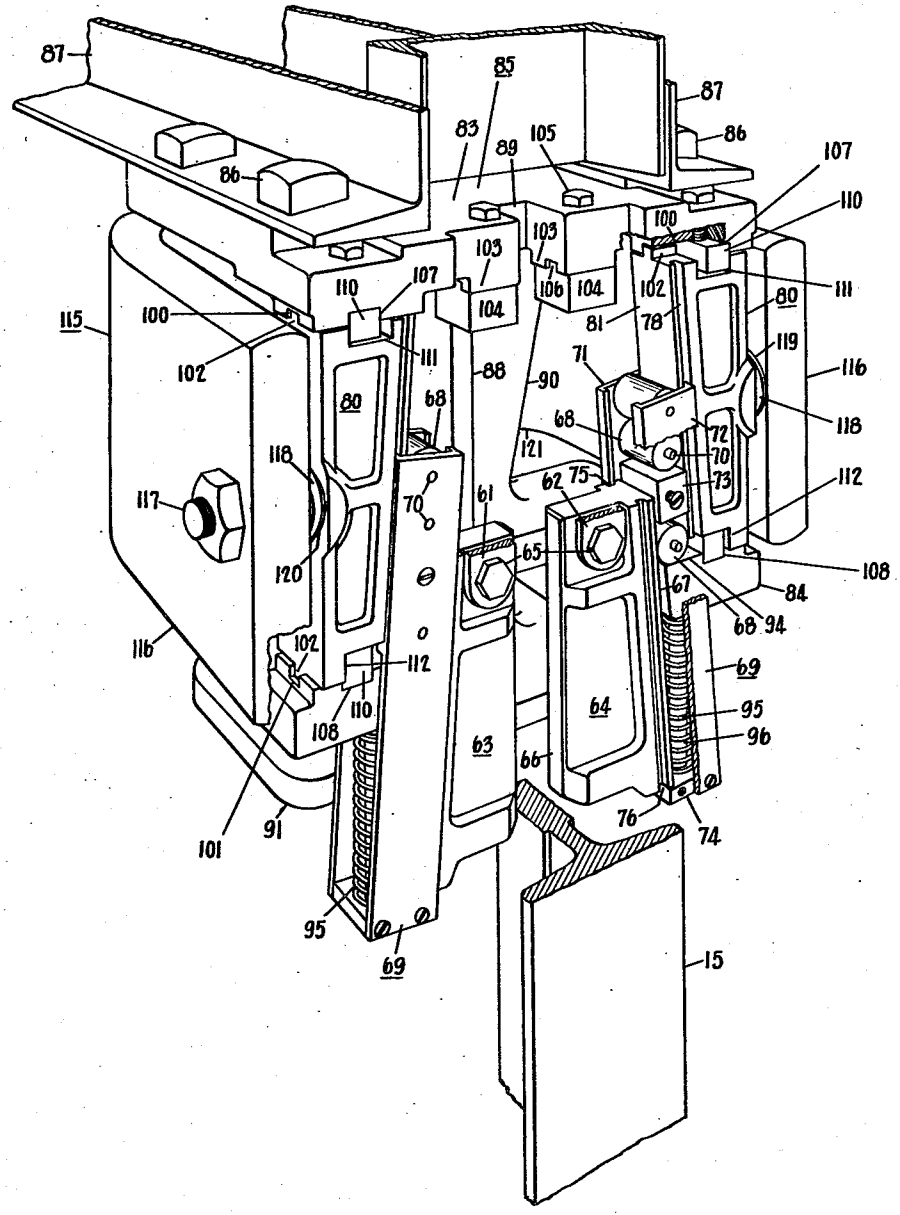

FIG. 5

Frederick Hymans INVENTOR

BY Hall & Bradley ATTORNEY

Patented Mar. 14, 1939 2,150,373

UNITED STATES PATENT OFFICE

2,150,373

ELEVATOR SAFETY DEVICE

Frederick Hymans, Larchmont, N. Y., assignor to Otis Elevator Company, New York, N. Y., a corporation of New Jersey

Application July 2, 1937, Serial No. 151,589

7 Claims. (Cl. 187—90)

The invention relates to safety apparatus for elevators and especially to that type of safety device or brake which acts under emergency conditions to bring the elevator car or counterweight to a stop during its downward movement, by applying means to the guide rail to exert a braking action.

In the normal operation of elevators, the rail engaging means of such safety devices do not engage the guide rails. Upon the occurrence of emergency conditions where it becomes imperative that the system be brought to an immediate stop, such as parting of the hoisting ropes or overspeed due to other conditions, mechanism comes into immediate operation to effect the application of the rail engaging means to the guide rails. It is important that the force with which the rail engaging means engage the rails be sufficient to effect a stop which is as quick as is consistent with the comfort and safety of passengers within the car and which will not cause damage to apparatus. Also, it is desirable that the release of the rail engaging means from the guide rail may be readily effected.

It is an object of the invention to provide safety apparatus of the above character which is of simple construction, reliable in operation and which may be safely operated a considerable number of times without any replacements.

The invention involves the provision of a U spring spanning the rail engaging means for exerting the force applying the rail engaging means to the guide rail. As the rail engaging means is applied to the rail, the legs of the U spring are gradually spread, thereby gradually increasing the force with which the rail engaging means grips the rail. Preferably, the mechanism is arranged so that the force with which the rail engaging means is applied to the rail becomes constant upon reaching a certain predetermined amount.

Features and advantages of the invention will become apparent from the following description and appended claims.

In the drawings:

Figure 1 is a schematic representation of an elevator system embodying elevator safety apparatus in accordance with the invention, the safety apparatus being illustrated as applied to the elevator car;

Figure 2 is an enlarged end view in somewhat diagrammatic form of the safety apparatus shown in Figure 1;

Figure 3 is a plan view with parts in section on a further enlarged scale of the rail clamp shown in Figure 2;

Figure 4 is a side view of the rail clamp shown in Figure 3 with parts broken away; and

Figure 5 is a view in perspective of the rail clamp of the preceding figures.

Reference will first be had to Figure 2, in which the mechanism is somewhat diagrammatically shown for illustrating principles of operation of the invention. The rail clamp for only one of the guide rails is shown in this figure. The operating parts of the rail clamp are supported by a mounting block **85** secured to the safety channels **87** of the car framework. The shoes for engaging the guide rail are in the form of wedges **63** and **64**, one on each side of the guide rail. These wedges are normally disengaged from the rail. To apply them to the rail, they are pulled upwardly by rods **61** and **62**. As they move upwardly, these wedges slide against and roll on rollers **68** mounted in frames **69**. The rollers, in turn, are arranged to roll on the inclined surfaces of guide blocks **80**. The rollers are biased into position against stops **94** on mounting block **85** by springs **95** arranged between the mounting block and the bottoms of frames **69**. The mounting block is arranged to guide the guide blocks **80** for movement normal to the side faces of the guide rail and provides stops **110** to limit their inward movement. A U spring **115** spans the guide blocks, this spring being under an initial pressure. Swivel joints are provided between blocks **80** and the legs of the U spring, the spring being supported at its yoke on a portion of mounting block **85**.

Assume that the elevator car is moving downwardly. Upon a pull being exerted on rods **61** and **62**, the wedges **63** and **64** are lifted. During the initial part of their movement, they slide upon rollers **68**. This continues until the wedges, due to their being pushed inwardly by the rollers, engage the sides of the guide rail. From this point on, the wedges roll on the rollers until they are brought to a stop by the mounting block **85**. As soon as the wedges start to roll on the rollers, the rollers in turn roll on the inclined surfaces of the guide blocks **80**, lifting their frames **69** upwardly against the force of springs **95**. As this movement takes place, the guide blocks are forced outwardly by the wedges against the force of the U spring **115** so that the force with which the wedges are applied to the guide rail is gradually increased until the wedges are brought to a stop by the mounting block. Due to the wedges gripping the rail, the elevator car is gradually

retarded by an increasing force which becomes constant as the wedges are brought to a stop by the mounting block. In this way the elevator car is gradually retarded and is finally brought to a stop. With this construction, the upward thrust resulting from the retarding action is transmitted directly through the wedges 63 and 64 to the mounting block 85 and from the mounting block in turn to the car framework, while the side thrust is transmitted through the rollers and guide blocks to the legs of the U spring.

The rail clamp is released by upward movement of the elevator car. As this upward movement takes place, the mounting block 85 is lifted and the rollers gradually roll down the inclined surface of guide blocks 80. This permits inward movement of the guide blocks, gradually decreasing the force with which the wedges are applied to the guide rail and finally releasing the wedges, whereupon the parts assume their positions illustrated in Figure 2.

Before describing details of a specific embodiment of the invention, reference will be had to Figure 1 for a general understanding of the elevator system to which the safety apparatus may be applied. Hoisting ropes 11 for the car and counterweight pass over the hoisting drum 12 at the top of the elevator shaft. This drum is driven by means of a hoisting motor 13 to effect the raising and lowering of the car and counterweight. An electromagnetic brake 14 is employed to aid in bringing the motor to a stop and to hold the car while at rest. Guide rails 15 are provided for the elevator car. The bottom guide shoes for the car are designated 16 while the top guide shoes are designated 17. These guide shoes cooperate with the guide rails to guide the car in its movement up and down the elevator shaft.

A governor rope 21 extends around a governor sheave 22 at the top and a tensioning sheave 23 at the bottom of the hatchway, the tensioning sheave being provided with weights 24. Governor sheave 22 is mounted on a governor shaft 25, which is geared to spindle 26. The governor is illustrated as of the fly ball type, being provided with centrifugal weights 27, weight arms 28, sleeve 30, connecting links 31, and resisting spring 32. Two eccentric clutches 33 and 34 are rotatably mounted on shafts 35 and 36 and are caused to move together by spur gear segments 37 and 38. Shaft 35 is mounted on movable rod 40, the rod being mounted in a frame 41. A spring 42, abutting against a portion of the frame and the collar 44 on the rod, biases clutch 33 toward clutch 34, this spring determining the pressure with which rope 21 is gripped by the clutches as it passes between them when the clutches are released. Thus governor rope 21 is allowed to slide through clutches 33 and 34 but at the same time exerts a pull sufficient to apply the safety. A spring pressed latch 45 engages a projecting portion of clutch 34 to prevent application of the clutches until the governor, acting through links 46 and 47, effects a release of the latch.

The ends of the governor rope are secured in rope sockets which are pivotally connected to one arm 48 of a bell crank lever 50. This lever is mounted on a pivot pin 49 extending through the upper cross channels 51 of the car framework. The other arm 52 of the bell crank lever is connected by a link 53 to an arm 54 of an additional bell crank lever 55. This lever is likewise mounted on a pivot pin 56 extending through channels 51. These levers are for actuation by the governor rope when the rope is gripped by the governor clutches to apply the rail clamps to the guide rails. In the positions illustrated in Figure 1, these levers are in non-brake-applying positions. They are latched in these positions by means of a link 57 pivoted to arm 52 of lever 50 and yieldably held between a fixed pin and a movable pin by a spring 58, these pins extending into depressions formed in the link.

Each of pins 49 and 56, on the other side of channels 51, has secured thereto another lever similar to levers 50 and 55 respectively. The additional lever 60 on pin 49 is shown in Figure 2. Each of these four levers has an operating rod secured thereto, these rods being actuated by the levers to apply the rail clamps to the guide rails. The arrangement is the same for both guide rails. Therefore, the arrangement for only one guide rail will be described in detail.

Referring now to Figures 2, 3, 4 and 5, the operating rods 61 and 62 extend from levers 50 and 60 to wedges 63 and 64 of the rail clamp, to which they are connected by bolts 65. These wedges are arranged one on each side of the guide rail and are normally disengaged therefrom but are adapted to be moved into engagement with the side faces of the guide rail upon the actuation of their operating rods by levers 50 and 60. The arrangement of the guide clamp on the two sides of the guide rail is symmetrical so that the construction of only one side, the side including wedge 64, will be described in detail.

The inner edge 66 of wedge 64 facing the guide rail is parallel to the side face thereof. The outer edge 67 of the wedge is arranged at an angle to the guide rail. A plurality of rollers 68 are provided for the outer edge of the wedge to slide and roll upon when it is pulled upwardly by its operating rod in the operation of the clamp. The rollers 68 are rotatably mounted on pins 70 extending between two shallow channels 71 and 72. The channels are secured to spacing blocks 73 and 74 to form a frame 69, these blocks being of a width to permit rotation of the rollers. Slots 75 and 76 are provided in the sides of the wedge to receive the inner flanges of these channels. These slots are parallel to the outer edge of the wedge and form a guide for the wedge in its movement relative to the rollers. The outer flanges of the channels extend into slots 77 and 78 formed on opposite sides of a guide block 80. This guide block is also wedge shaped, its inner edge 81 being parallel to the outer edge of the wedge. The slots 77 and 78 in the guide block are parallel to face 81 and thus act to guide frame 69.

The guide block 80 and the corresponding guide block on the other side of the guide rail are positioned between two plates 83 and 84 of a mounting block 85. The upper plate 83 is secured as by bolts 86 to the flanges of the safety channels 87 of the car framework. A slot 89 is provided in the plate through which the guide rail extends, ample clearance being provided so that the rail does not strike the plate during movement of the car. Plate 84 is joined to upper plate 83 by means of cross ribs 88 and 90. Another plate 91 is arranged beneath plate 84 and is joined thereto by means of cross ribs 92 and 93 aligned with cross ribs 88 and 90. This lower plate 91 is for mounting the lower guide shoes as indicated in Figure 1.

When the rail clamp is not applied, the lowermost one of the rollers 68 on each side of the guide rail rests on the upper surface of a portion

of intermediate plate 84, these portions of the plate forming stops 94 to limit the downward movement of frames 69. The frames are biased into these positions by compression springs 95. Each of these springs is arranged on a rod 96 and extends between the bottom of plate 84 and the bottom spacing block 74 of the frame. The rod extends downwardly through an aperture 97 formed in block 74. Near its top the rod has a washer 98 secured thereto so as to cause the rod to be supported by the spring. Above this washer the end of the rod extends into a locating aperture (not shown) in the bottom of plate 84. When the rail clamp is not applied, wedges 63 and 64 rest on the blocks 74 of frames 69.

The upper plate 83 is provided with a pair of slots 100, one on each side of the guide rail in the bottom thereof, while the plate 84 is provided with a pair of slots 101, one on each side of the guide rail in the top thereof. These slots are normal to the side faces of the guide rail and are for receiving keys 102 provided on the top and bottom of the guide blocks to guide the blocks for movement in the direction perpendicular to the sides of the guide rail. The slots 100 in upper plate 83 extend through lugs 103 formed on the bottom of plate 83 at the guide rail slot 89. Blocks 104 are secured to the bottom of these lugs by bolts 105, keys 106 being formed on the blocks for extending into slots 100 for properly locating these blocks. The blocks 104 are in the path of movement of wedges 63 and 64 and serve as stops to limit the upward movement of the wedges with respect to the mounting block 85 when the rail clamp is applied to the guide rail.

The upper plate 83 is provided with an additional pair of slots 107 in the bottom thereof, one on each side of the guide rail, these additional slots being crosswise with respect to slots 100. Similarly, intermediate plate 84 is also provided with a pair of additional slots 108, one on each side of the guide rail, extending crosswise with respect to slots 101. In each of these slots is secured, as by bolt, an enlogated block 110. The top ones of these blocks extend into slots 111 formed in the top of guide blocks 80. The upper blocks 110 cooperate with the outer sides of slots 111 and the lower blocks 110 cooperate with shoulders 112 formed on the bottoms of the guide blocks 80 to limit the inward movement of these guide blocks.

The guide blocks 80 are spanned by a U spring 115. The legs 116 of this spring are supported by the guide blocks 80 through the intermediary of bolts 117 secured to the legs and having rounded heads 118 extending into sockets 120 of the corresponding contour formed in the outer edges of the guide blocks, thereby providing swivel connections. Spacing washers 119 may be provided between the heads 118 and the legs of the U spring to adjust for the desired initial force exerted by the spring on the guide blocks, the amount of initial force being dependent upon the dimensions of the parts and the material of the spring. The yoke 121 of the spring is supported by a lug 122 formed as a rearward extension of cross ribs 88 and 92.

In operation, the elevator car is caused to move up and down the hatchway by motor 13, the car transmitting motion to the governor through governor rope 21. So long as the elevator runs at a speed less than the predetermined speed for which the governor is set to cause operation of clutches 33 and 34, no relative motion takes place between the car and the governor rope. In the event that the car in its downward motion exceeds this predetermined speed, the governor operates to release latch 45, allowing clutches 33 and 34 to fall by gravity and grip rope 21. This gripping action retards movement of the rope, thereby lifting arm 48 of bell crank lever 50 and pushing link 57 out of the position in which it is held by spring 58. Lever 50 acts through rod 53 to swing bell crank lever 55 clockwise. These levers cause corresponding movement of the levers on the other side of channels 51 in the car framework. This movement of these levers lifts the rods 61 and 62 to pull the wedges 63 and 64 of the rail clamps upwardly between the guide blocks 80. The wedges of each rail clamp in their initial movement slide on the rollers 68 on each side of the guide rail until they are forced into engagement with the side faces of the guide rail. From this point on, the wedges roll on the rollers and the rollers in turn roll on the inclined surfaces of guide blocks 80. As this movement takes place, the guide blocks are forced outwardly against the force of the U spring 115. This increases the force exerted by the U spring on the guide blocks which increases the force with which the wedges grip the rail. This increase in force continues until the wedges strike their stops 104. When this point is reached, the force with which the wedges grip the rail becomes constant. The above described action takes place very rapidly so that when an emergency condition arises requiring operation of the safety apparatus to stop the car, the rail clamps are quickly applied. The gripping of the rail as above set forth gradually dissipates the kinetic energy of the elevator car, causing it to come smoothly to rest in a suitable distance without excessive deceleration. The elasticity of the U spring enables the rail clamp to adjust itself to any unevenness of the guide rail, obviating any undue stresses or abrupt stops. The force with which the wedges grip the rail may be varied to suit the requirements of different installations by varying the thickness of stops 104.

When it is desired to release the rail clamps from the guide rail, the hoisting motor is energized so as to move the car in the up direction. As this movement takes place, the wedges 63 and 64 of each rail clamp remain stationary on the rail owing to the frictional force between the wedges and the rail. The rollers 68 roll on the inclined surfaces of the wedge as the mounting block 85 is moved upwardly by the car, permitting the guide blocks 80 to be moved inwardly by the U spring, thereby diminishing the force exerted by this spring on the wedges. This continues until the guide blocks are brought to a stop against their stops 110, whereupon the wedges 63 and 64 are released. The springs 95 return the roller frames 69 to their lowermost position and the wedges are brought to rest against the spacing blocks 74 of the frames.

The rail clamps are now in their disengaged conditions. The manual resetting of the governor jaws 33 and 34 and the setting of link 57 in position to be held by spring 58 places the mechanism in condition for another operation.

Although the safety apparatus has been described as applied to an elevator car, it is to be understood that it may equally as well be applied to the counterweight. It is to be further understood that the rail clamps may be arranged to be operated under emergency conditions other than overspeed or in addition to overspeed. Also,

the arrangement of the operating mechanism for the rail clamps may be varied, this including not only the mechanism for lifting the wedges but also the governor operated apparatus. In addition, details of construction of the rail clamps themselves may be varied. Other changes may be made in the apparatus described and many apparently widely different embodiments of the invention may be made without departing from the scope thereof. It is therefore intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In an elevator system having a body movable in the elevator hatchway and a rail extending longitudinally of the hatchway, a safety device for said movable body, said safety device comprising; mounting means carried by said body; a member slidably supported by said mounting means for movement toward and away from said rail; means for gripping said rail; a U spring spanning said rail gripping means, one leg of said U spring being supported by said member; and means operable to apply said gripping means to said rail during downward movement of said body, said gripping means, upon being applied, acting to spread the legs of said U spring.

2. In an elevator system having a body movable in the elevator hatchway and a guide rail for said body, a safety device for said body, said safety device comprising; a pair of rail gripping members, one on each side of the rail; means secured to said movable body for supporting said members; a U spring spanning said gripping members, the yoke of said U spring being supported by said supporting means; means operable during downward movement of said body to apply said members to said guide rail; and means interposed between said members and said spring, supporting the legs of said spring and operable by said members upon their engaging said rail to spread the legs of said U spring.

3. In an elevator system having a body movable in the elevator hatchway and a guide rail for said body, a safety device for said body, said safety device comprising; a pair of wedges, one on each side of the rail; guide means for each wedge; means secured to said movable body for mounting said guide means; a U spring spanning said guide means; and means operable during downward movement of said body to lift said wedges with respect to said mounting means, said wedges upon being lifted being guided by said guide means into position wedged between their guide means and said guide rail, said U spring acting to apply said wedges to said rail with sufficient force to bring the movable body to a stop.

4. In an elevator system having a body movable in the elevator hatchway and a guide rail for said body, a safety device for said body, said safety device comprising; a pair of wedges, one on each side of the rail and normally disengaged therefrom; guide means for each wedge; means secured to said movable body for mounting said guide means, said mounting means being arranged to guide said guide means toward and away from said rail; a U spring spanning said guide means; and means operable during downward movement of said body to lift said wedges with respect to said mounting means, said wedges upon being lifted being guided by said guide means into engagement with said guide rail and thereafter acting through said guide means against the force of said U spring to grip the rail, said mounting means including stops for limiting the amount of upward movement of said wedges to thereby limit the retarding force.

5. In an elevator system having a body movable in the elevator hatchway and a guide rail for said body, a safety device for said body, said safety device comprising; a pair of wedges, one on each side of the rail and normally disengaged therefrom; a guide block for each wedge; a plurality of rollers between each wedge and its guide block; a mounting block for said guide blocks secured to said movable body, said mounting block being arranged to guide said guide blocks toward and away from said rail; a U spring spanning said guide blocks; and means operable during downward movement of said body to lift said wedges with respect to said mounting block, said wedges upon being lifted being guided by said guide blocks through said rollers into engagement with said guide rail and thereafter acting through said rollers and guide blocks against said U spring, said mounting block being provided with stops for limiting the amount of upward movement of said wedges, the force exerted by said wedges in bringing said body to a stop being transmitted directly through said stops to said mounting block, said U spring taking only the side thrust of applying said wedges to said rail.

6. In an elevator system having a body movable in the elevator hatchway and a guide rail for said body, a safety device for said body, said safety device comprising; a pair of wedges, one on each side of the rail and normally disengaged therefrom; a guide block for each wedge; a plurality of rollers between each wedge and its guide block; a mounting block for said guide blocks secured to said movable body, said mounting block having guides for guiding said guide blocks for movement in a direction normal to the faces of said guide rail, stops for limiting the inward movement of said guide blocks, and stops for limiting the upward movement of said wedges; a U spring spanning said guide blocks and exerting an initial pressure against them; and means operable during downward movement of said body to lift said wedges with respect to said mounting block, said wedges upon being lifted being guided by said guide blocks through said rollers into engagement with said guide rail and thereafter acting, until brought to a stop by engaging their stops, through said rollers and guide blocks to spread said U spring, thereby increasing the force with which they grip the rail to an amount sufficient to cause said body to be retarded and finally brought to a stop at a desired rate.

7. In an elevator system having a body movable in the elevator hatchway and a guide rail for said body, a safety device for said body, said safety device comprising; a pair of wedges, one on each side of the rail and normally disengaged therefrom, the inside edge of each wedge being parallel to the side of the guide rail which it faces and the outside edge being at an angle thereto taken on a line intersecting said rail at a point above; a guide block for each wedge, each guide block having its inner edge parallel to the outer edge of the wedge for which it is provided; a plurality of rollers between each wedge and its guide block; a mounting block for said guide blocks secured to said movable body, said mounting block having guides for guiding said guide

blocks for movement in a direction normal to the faces of said guide rail, stops for limiting the inward movement of said guide blocks, and stops for limiting the upward movement of said wedges; a U spring spanning said guide blocks; a swivel connection between each guide block and the leg of said spring adjacent thereto, said spring being supported by said swivel connections and said mounting block and exerting an initial pressure on said guide blocks; and means operable during downward movement of said body to lift said wedges with respect to said mounting block, said wedges upon being lifted being guided by said guide blocks through said rollers into engagement with said guide rail and thereafter acting, until brought to a stop by engaging their stops, through said rollers and guide blocks to spread said U spring, thereby increasing the force with which they grip the rail to an amount sufficient to cause said body to be retarded and finally brought to a stop at a desired rate.

FREDERICK HYMANS.