Feb. 19, 1929. 1,702,384

F. HYMANS

ELEVATOR SAFETY APPLIANCE

Filed Nov. 4, 1927 2 Sheets-Sheet 1

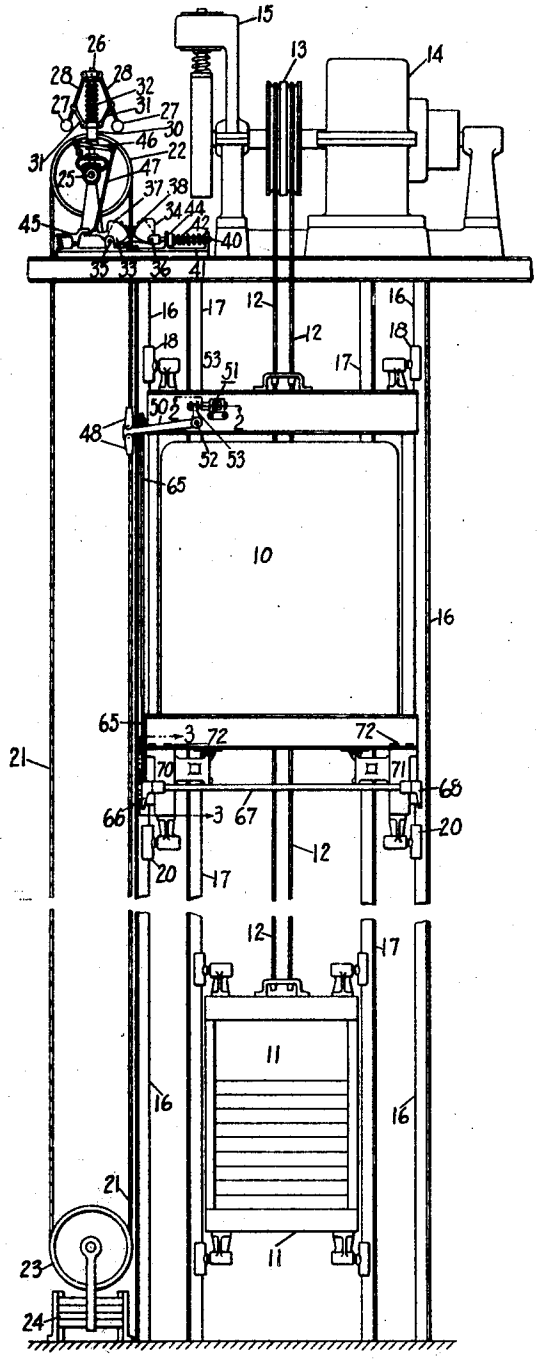

FIG. 1

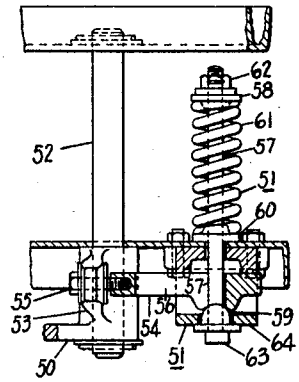

FIG. 2

Frederick Hymans INVENTOR

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ELEVATOR SAFETY APPLIANCE

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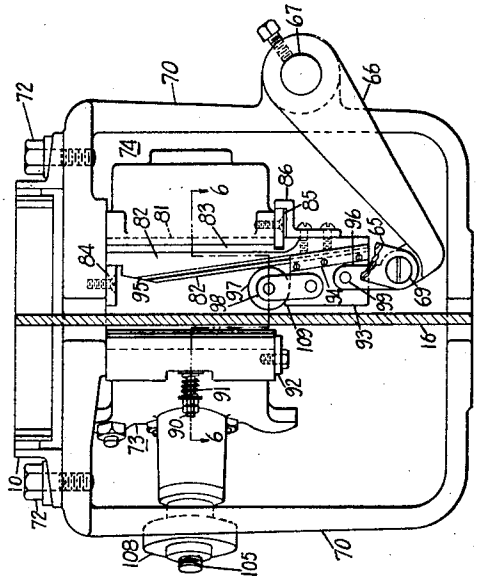

FIG. 3

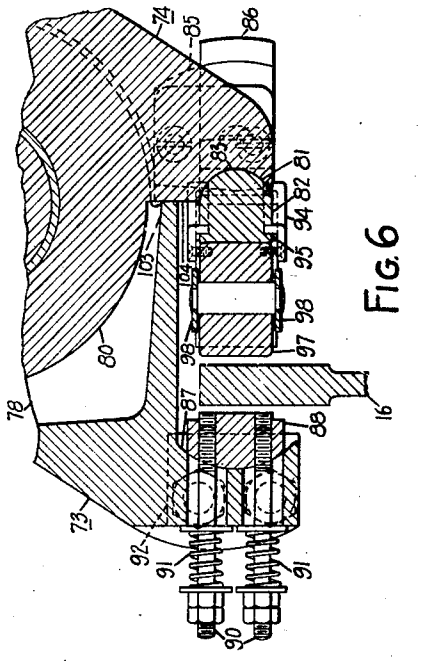

FIG. 6

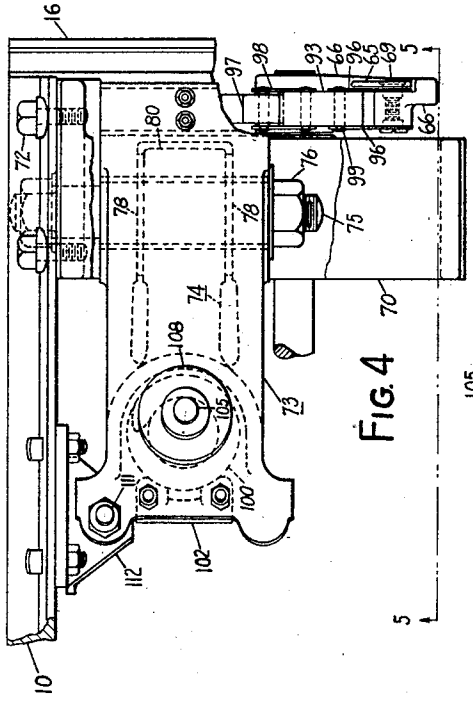

FIG. 4

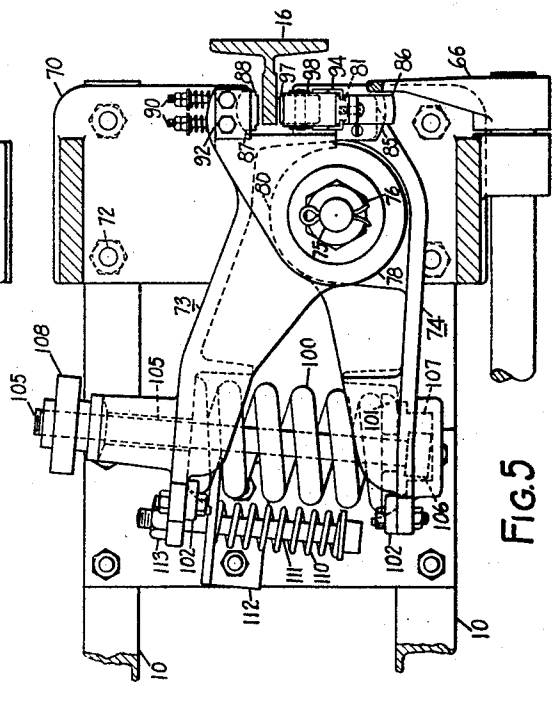

FIG. 5

Frederick Hymans INVENTOR

BY Walter E. Bradley ATTORNEY

Patented Feb. 19, 1929. 1,702,384

UNITED STATES PATENT OFFICE.

FREDERICK HYMANS, OF YONKERS, NEW YORK, ASSIGNOR TO OTIS ELEVATOR COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

ELEVATOR SAFETY APPLIANCE.

Application filed November 4, 1927. Serial No. 231,027.

The invention relates to safety devices for elevators and more particularly to that type of safety device or brake in which jaws carried by the car are adapted to grip stationary rails in the hatchway.

In the normal operation of the elevator the jaws are kept out of engagement with the rails. Means are provided for causing the jaws to be applied to the rails for bringing the car to a stop in the event of overspeed, and for this purpose a centrifugal governor may be employed. It is important that the safety brake be applied in the least possible time upon the occurrence of overspeed, and it is also important that the action of the safety brake be uniform over a considerable number of operations.

One feature of the invention is the provision of a safety device in which the jaws are spread apart against the force of resilient means during the application of the safety brake by means of a member provided for that purpose, which member at the same time causes a shoe to move into cooperative position with a jaw for frictional engagement with the rail.

A second feature of the invention is the provision of a safety device in which the gripping of a rail is brought about by a roller which moves a shoe into a position for cooperation with a jaw to frictionally engage the rail.

A third feature of the invention is the provision of a safety device in which a roller positioned between a jaw and a rail is brought into operative engagement with the jaw and the rail and thereafter by downward movement of the car causes a shoe to be moved into a position for cooperation with a jaw to frictionally engage the rail.

A fourth feature of the invention resides in releasing the roller, provided for moving the shoe into engagement with the rail, from operative engagement with the rail after it has moved the shoe into a position for cooperation with a jaw member to frictionally engage the rail.

A fifth feature of the invention is the provision of a safety device, which is of simple construction, reliable in operation, and which may be safely operated a considerable number of times without replacement.

Other features and advantages will become apparent from the following description and appended claims.

In the drawings:—

Figure 1 is a schematic representation of an elevator system illustrating the adaptation of the safety device to an elevator car;

Figure 2 is a view, partially in section, illustrating the releasing carrier;

Figure 3 is a sectional view of the safety brake taken on the line 3—3 of Figure 1;

Figure 4 is a front elevation of the safety brake with portions broken away to illustrate certain structural details;

Figure 5 is a sectional view of the safety brake taken on the line 5—5 of Figure 4; and

Figure 6 is an enlarged sectional view taken on the line 6—6 of Figure 3.

Referring to Figure 1, the elevator car is designated by the numeral 10, and the counterweight is designated by the numeral 11. Hoisting ropes 12, for the car and counterweight, pass over hoisting drum 13, the drum being rotated by hoisting motor 14. A brake 15 is employed to bring the motor and consequently the car and counterweight to a stop. Guide rails 16 are provided for the car, and guide rails 17 are provided for the counterweight. The car is provided with upper guide shoes 18 and lower guide shoes 20 for engaging guide rail 16. A governor rope 21 extends around governor sheave 22 at the top and tensioning sheave 23 at the bottom, the tensioning sheave 23 being provided with weights 24. Governor sheave 22 is mounted upon a governor shaft 25, the shaft 25 being geared to governor spindle 26. The governor is 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 upon shafts 35 and 36 and caused to move together by spur gear segments 37 and 38. Shaft 36 is mounted upon a movable rod 40, the rod being mounted in a frame 41. A spring 42, abutting against a portion of the frame and a collar 44 on the rod, forces clutches 33 and 34 together and consequently acts upon rope 21 as it passes through the clutches, when the clutches are thrown to engage the rope. 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 33 to prevent application of the clutches until the governor acting through links 46 and 47 effects a release of the latch.

A double rope clevis 48 connects the ends of governor rope 21 and at the same time effects a connection between the rope and one arm 50 of the releasing carrier lever. The releasing carrier, designated in Figure 1 by the numeral 51, is clearly shown in Figure 2. Referring to Figure 2, 52 designates a shaft upon which the releasing lever is mounted, shaft 52 being supported by the car frame. A second arm 53 of the releasing lever is connected to a lock bar 54 by means of a screw 55. Lock bar 54 is provided with an elongated slot 56 to accommodate a lock bolt 57. Lock bolt 57 is provided with a semi-spherical portion 59 normally seated in a semi-spherical recessed portion formed in the lock bar. A spring 61 is placed around bolt 57 and is held in position by two spring seats 58 and 60; the compression of the spring may be varied by means of nut 62 threaded upon the bolt. Spring 61 serves to maintain bolt 57 in firm contact with the lock bar, the head 63 on the bolt preventing the bolt from sliding through releasing frame 64.

Again referring to Figure 1, 65 designates a member which is connected at its upper end to arm 50, and at its lower end, by means of a screw 69, to crank 66, the crank 66 being rigidly connected with shaft 67. A crank 68 similar to crank 66 is also rigidly connected to shaft 67, so that motion is also transmitted from arm 50 to crank 68. The above system of connections serves to transmit motion from governor rope 21 for causing operation of the safety brakes.

The rail clamp housings, designated by the numerals 70 and 71, are bolted to the car frame by bolts 72. As the rail clamps are identical in structure only one will be described. The construction of one of the rail clamps may be clearly seen in Figures 3 to 6. The rail clamp comprises two jaw members 73 and 74. Jaw member 73 is pivotally mounted upon a vertical shaft 75 by means of apertured lugs 78, while jaw member 74 is pivotally mounted upon vertical shaft 75 by means of apertured lug 80. Shaft 75 is provided with threaded ends to accommodate nuts 76, the nuts securely holding the shaft to the frame and the jaw members on the shaft. Cotter pins serve to lock nuts 76 upon the threaded portions.

Jaw member 74 is formed with a vertical semi-cylindrical recess 81. A wedge 82 having a semi-cylindrical bearing surface 83 corresponding to recess 81 is mounted upon the jaw within recess 81, the semi-cylindrical formations allowing the wedge to swivel within the jaw. A stop plate 84 holds the upper end of wedge 82 in place; a key 85 serves to hold wedge 82 in a vertical position and also by cooperation with angle 86, which angle is secured to the wedge, serves to hold the lower end of the wedge in place. The cooperating edges of key 85 and angle 86 are curved to allow for the swivelling action of the wedge. The wedge is formed with oppositely inclined surfaces, the apex formed by the junction of these surfaces being adjacent rail 16. The surfaces, in effect, constitute two wedges integrally formed; two separate wedges may be used to accomplish the same results.

Jaw member 73 is also formed with a cylindrical recess, designated by the numeral 87. Within this recess is fitted a rail bearing member 88 formed with a cylindrical bearing surface to fit within recess 87. Bearing member 88 is held in against the jaw by means of screws 90 and springs 91, the bearing member being held in its vertical position by means of plate 92.

A wedge-shaped shoe 93 carrying tongues 94 is mounted to ride along wedge 82, the wedge being provided with guide ways 95 to accommodate the tongues. The material from which the guides and tongues are made depends upon the coefficient of friction desired. In applying the safety brake, shoe 93 is initially moved by crank 66 through connecting links 96, the links 96 being pivotally connected by means of pin 99 to the shoe, and by means of screw 69 to the crank. A roller 97 is pivotally connected to shoe 93 by means of links 98. The roller is prevented from swinging laterally to the left, as viewed in Figure 3, by a projection 109 upon the shoe. Thus when the shoe is in its lowest position both the shoe and the roller will be held out of contact with rail 16.

A spring 100, placed under any desired predetermined compression, is inserted between those portions of jaw members 73 and 74 that are remote from rail 16. The compression of spring 100 may be varied by the varying number of washers 101. The spring 100 is held in place by means of semi-annular seats 102. A lip 103, formed upon jaw member 73, engages a corresponding lip 104, formed upon jaw member 74, to prevent the spring from forcing the jaw members into engagement with rail 16 when roller 97 and shoe 93 are in their inoperative position as viewed in Figure 3. A bolt 105 is provided with a square head 106, fitting in a longitudinal recess 107 in jaw member 74 to prevent the bolt from turning. The bolt extends through spring 100 and an aperture in jaw member 73, and is provided with a nut 108, the nut serving, upon being screwed in upon the bolt, to compress spring 100.

A small compression spring 110 is arranged on a bolt 111 between an angle bar 112 and a washer abutting against the head of the bolt. Angle bar 112 is supported by the car frame. Bolt 111 extends through an aperture in the angle bar and through a similar aperture in a lug formed upon jaw member 73. A nut 113 is screwed on bolt 111 by means of which the compression of spring 110 may be varied. This construction serves to hold

the clamp structure, as a unit, securely against stop plate 84. Thus stop plate 84 serves as a stop for the clamp structure and also as a means for holding wedge 82 against jaw member 74.

In operation elevator car 10 is caused to move up and down in the hatchway by motor 14, the car transmitting motion to the governor by means of rope 21. Under the predetermined speed for which the governor is set to cause operation of clutches 33 and 34, no relative motion takes place between car 10 and rope 21 since the compression of spring 61 is sufficient to hold arm 50 in place against the inertia of the governor in starting and stopping. In the event that the speed of car 10 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 with a force depending upon the strength of spring 42. This gripping action causes rope 21 to move in an upward direction relative to the car and thus by means of rods 65 pulls cranks 66 and 68 in an upward direction. Cranks 66 and 68 by so moving effect an operation of the rail clamps. As the operation of each of the rail clamps is the same that of only one, namely, clamp 70 will be described.

As crank 66 swings upwardly it forces roller 97 into contact with rail 16. As soon as this contact is effected the roller rolls up the lower incline of wedge 82 since the car is moving the wedge downwardly relative to the rail and pulls shoe 93 with it. The diameter of roller 97 is so chosen that shoe 93 is held out of engagement with rail 16 during this portion of the upward movement. As roller 97 rolls up the inclined surface it swings the jaw members, as a unit, around shaft 75, thus moving bearing surface 88 of jaw member 73 into contact with rail 16. As roller 97 continues to roll up the lower incline, spring 100 is compressed and a retarding force developed between jaw member 73 and rail 16. Thus roller 97 acts against the force of spring 100 in compressing it, but does not itself exert any force tending to retard the car in its downward motion since the roller makes but rolling contact with rail 16. As soon as roller 97 rolls over the apex formed by the two inclined surfaces, spring 100 forces the jaw of jaw member 74 towards the rail. As the jaw so moves under the influence of spring 100, wedge 82 tends to force roller 97 still farther upwardly, which results in shoe 93 being moved still farther upwardly with respect to the jaw until shoe 93 engages the rail. The shoe then exerts a retarding force in a direction to cause still farther upward movement of the shoe with respect to the jaw and this, in turn, results in the roller being moved upwardly out of operative engagement with rail 16. The safety brake is now fully applied and the car is brought to a stop.

The above action from the time the roller starts to roll up the wedge surface until the final transfer of pressure to the shoe occurs very rapidly, effecting a quick braking of the car.

In order to reset the safety device, spring 100 is further compressed by manually turning nut 108, the square head 106 preventing the bolt from turning. The jaws are thus caused to move apart and wedge 82 is carried away from rail 16 allowing roller 97 to be drawn down to its initial position. Releasing catch 51 and the governor mechanism are manually reset.

It is to be noted that the safety brake may be repeatedly used at very high speeds with substantially no wear on the parts of the safety or on the rails. The rollers move the shoes into engagement with the rails and as they effect this by a rolling action shearing of the rollers and gouging of the rails are prevented, the complete braking action being effected by the relatively large bearing surfaces of shoes 93 and of rail bearing members 88.

Attention is called to the fact that a safety brake has been provided which is certain and effective in its operation. The use of a roller for drawing the shoe into full operative position insures complete braking action, since the full upward movement of the shoe and consequently the full compression of the spring is accomplished.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanyng 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 hatchway and a rail for said movable body, a safety brake for said movable body, said safety brake comprising; jaws for gripping said rail; means cooperating with said jaws for causing said jaws to grip said rail; means for releasing said first mentioned means from cooperation with said jaws; and means for maintaining said jaws in gripping relation with said rail upon the release of said first mentioned means.

2. In an elevator system having a body movable in the elevator hatchway and a rail for said movable body, a safety device for said body, said safety device comprising; a pair of jaws spanning said rail; means for urging said jaws toward said rail; means adapted to be inserted between one of said jaws and said rail to cause said urging means to exert pressure through the second named means to force said jaws into gripping relation with said

rail; and means adapted to be inserted between said one jaw and said rail to transfer the pressure of said urging means from said second named means to the third named means while maintaining said jaws in gripping relation with said rail.

3. In an elevator system having a movable body and a rail for said movable body, a safety device for said movable body comprising; a pair of jaws mounted on the movable body and spanning the rail; resilient means for urging the jaws toward the rail; a shoe; means for spreading the jaws against the force of the resilient means and for moving the shoe into operative position between one of the jaws and the rail, while maintaining the shoe out of engagement with the rail, and for thereafter bringing the shoe into engagement with the rail.

4. In an elevator system having a body movable in the hatchway and a rail for said movable body, a safety brake for said movable body, said safety brake comprising; jaws movable into gripping relation with said rail; anti-friction means cooperating with said jaws for causing said jaws to move into said gripping relation; means for releasing said anti-friction means from cooperation with said jaws; and friction means for maintaining said gripping relation upon the release of said antit-friction means.

5. In an elevator system having a body movable in the hatchway and a rail for said movable body, a safety brake for said movable body, said safety brake comprising; jaws for gripping said rail; a roller for engaging one of said jaws for causing the jaws to grip said rail; means for causing said roller to disengage said one jaw; and a shoe for engaging said one jaw for maintaining said jaws in gripping relation with said rail upon said roller disengaging said one jaw.

6. In an elevator system having a body movable in the hatchway and a rail for said movable body, a safety brake for said movable body, said safety brake comprising; jaws for gripping said rail; a wedge; a roller movable into engagement with said wedge and said rail for causing said jaws to grip said rail; means for releasing said roller from said engagement; and a shoe movable into engagement with said wedge and said rail for maintaining said jaws in gripping relation with said rail upon the release of said roller.

7. In an elevator system having a body movable in the hatchway and a rail for said movable body, a safety brake for said movable body, said safety brake comprising; jaws for gripping said rail; a roller positioned between one of said jaws and said rail; a shoe for cooperating with said one jaw to frictionally engage said rail, said shoe being pivotally connected to said roller; and means for moving said roller into operative engagement with said rail for causing said roller by downward movement of the car to move said shoe into a position for cooperating with said one jaw.

8. In an elevator system having a body movable in the hatchway and a rail for said movable body, a safety brake for said movable body, said safety brake comprising; jaws for gripping said rail; a roller positioned between one of said jaws and said rail; a shoe for cooperating with said one jaw to frictionally engage said rail, said shoe being pivotally connected to said roller; means for moving said roller into operative engagement with said rail for causing said roller by downward movement of the car to move said shoe into a position for cooperating with said one jaw; and means for moving said roller out of operative engagement with said rail after it has moved said shoe into a position for cooperating with said one jaw.

9. In an elevator system having a body movable in the elevator hatchway and a rail for said movable body, a safety device for said movable body, said safety device comprising; a pair of jaws spanning said rail; resilient means for biasing said jaws toward the rail; a shoe; and means for moving said shoe into operative position between one of the jaws and the rail and for spreading the jaws against the force of the resilient means during such movement to prevent operative engagement of said shoe with the rail before such operative position is reached.

10. In an elevator system having a body movable in the elevator hatchway and a guide rail for said movable body, a safety device for said movable body, said safety device comprising; a pair of jaws mounted on said body and spanning said rail; resilient means for biasing said jaws toward the rail; a shoe; and means for moving said shoe into operative position between one of the jaws and the rail and for spreading the jaws against the force of the resilient means during such movement to prevent operative engagement of said shoe with the rail before such operative position is reached, said resilient means acting through said jaws to force said shoe into operative engagement with said rail after said operative position is reached.

11. In an elevator system having a body movable in the elevator hatchway and a guide rail for said movable body, a safety device for said movable body, said safety device comprising; a pair of jaws mounted on said body and spanning said rail; resilient means for biasing said jaws toward the rail; a shoe; a member movable to bring said shoe into operative position between one of the jaws and the rail; and mechanism for causing such movement of said member, said member acting during such movement to spread the jaws against the force of the resilient means to prevent operative engagement of said shoe with the rail before such operative position is reached, said resilient means acting

through said jaws to force said shoe into operative engagement with said rail after said operative position is reached.

12. In an elevator system having a body movable in the elevator hatchway and a guide rail for said movable body, a safety device for said movable body, said safety device comprising; a pair of jaws mounted on said body and spanning said rail; resilient means for biasing said jaws toward the rail; a shoe; a roller movable between one of said jaws and said rail to bring said shoe into operative position between said one jaw and the rail; and mechanism for causing such movement of said roller, said roller acting against said one jaw during such movement to spread said jaws against the force of the resilient means to prevent operative engagement of said shoe with the rail before operative position is reached, said resilient means acting through said jaws to force said shoe into operative engagement with said rail after said operative position is reached.

13. In an elevator system having a body movable in the elevator hatchway and a guide rail for said movable body, a safety device for said movable body, said safety device comprising; a pair of jaws mounted on said body and spanning said rail, one of said jaws having a portion of its surface facing said rail inclined upwardly toward said rail; resilient means for biasing said jaws toward the rail; a wedge; a roller movable upwardly relative to said jaws between said inclined surface and said rail to bring said wedge into operative position between said inclined surface and the rail; and mechanism for causing such upward movement of said roller to bring it into engagement with said rail, said roller upon continuing such upward movement after engagement with said rail acting against said inclined surface to spread said jaws against the force of the resilient means to prevent operative engagement of said wedge with the rail before such operative position is reached, said resilient means acting through said jaws to force said wedge into operative engagement with said rail after said operative position is reached.

14. In an elevator system having a body movable in the elevator hatchway and a guide rail for said movable body, a safety device for said movable body, said safety device comprising; a pair of jaws spanning said rail, one of said jaws having its surface facing said rail inclined upwardly toward said rail to a certain point; resilient means biasing said jaws toward said rail; a roller; mechanism for moving said roller upwardly with respect to said one jaw between said inclined surface and said rail; and a wedge arranged to be pulled upwardly with respect to said one jaw by said roller during such upward movement thereof, said roller, upon continuing such upward movement along said inclined surface after engaging said rail, causing the spreading of said jaws against the force of said resilient means, thus permitting continued upward movement of said wedge with respect to said one jaw without operative engagement with said rail, said wedge, after said roller reaches said certain point in such upward movement, operatively engaging said rail.

15. In an elevator system having a body movable in the elevator hatchway and a guide rail for said movable body, a safety device for said movable body, said safety device comprising; a pair of jaws mounted on said body and spanning said rail, one of said jaws having its surface facing said rail inclined upwardly toward said rail to a certain point and above said point inclined away from said rail; resilient means for biasing said jaws toward said rail; a roller arranged to be moved upwardly with respect to said one jaw, said inclined surface and said rail; a wedge arranged to be pulled upwardly with respect to said one jaw between said inclined surface and said rail by said roller and to be maintianed in engagement with said one jaw during such movement; and mechanism for effecting said upward movement of said roller to cause its engagement with said rail, said roller upon continuing such upward movement after engaging said rail causing said other jaw to engage said rail and thereafter as it moves upwardly with respect to said one jaw along said inclined surface forcing said one jaw away from said rail against the force of said resilient means, said wedge upon being pulled upwardly with respect to said one jaw by said roller being maintained disengaged from said rail owing to said one jaw being moved away from said rail by said roller but moving into engagement with said rail after said roller has reached said certain point in such upward movement.

16. In an elevator system having a body movable in the elevator hatchway and a guide rail for said movable body, a safety device for said movable body, said safety device comprsing; a pair of jaws mounted on said body and spanning the sides of said rail, one of said jaws having its surface facing said rail inclined upwardly toward said rail to a certain point and above said point inclined away from said rail; resilient means for urging said jaws toward said rail; a roller positioned between said inclined surface and said rail; a wedge connected to said roller and also arranged between said inclined surface and said rail; mechanism for moving said roller upwardly with respect to said one jaw into engagement with said rail, said roller upon continuing such upward movement, between said rail and said inclined surface after said engagement causing movement of said one jaw away from said rail to effect the engagement of the other jaw with said rail and

thereafter the spreading of said jaws against the force of said resilient means, said wedge being pulled upwardly with respect to said one jaw by said roller during such upward movement thereof; and means for maintaining said wedge in engagement with said inclined surface during such upward movement, said wedge being maintained disengaged from said rail owing to the spreading of said jaws, said resilient means, after said roller has reached said certain point in such upward movement, acting through said one jaw to force said wedge into engagement with said rail

17. In an elevator system having a body movable in the elevator hatchway and a guide rail for said movable body, a safety device for said movable body, said safety device comprising; a pair of jaw members pivoted between their ends on said body and having their jaw ends embracing the sides of said rail, one of said jaw members having the surface of its jaw end facing said rail inclined upwardly toward said rail to a certain point and above said point inclined away from said rail; a spring arranged between the other ends of said jaw members; a roller positioned between said inclined surface and said rail; a wedge connected to said roller and also arranged between said inclined surface and said rail, both the roller and the wedge being normally disengaged from said rail; mechanism for moving said roller upwardly with respect to said one jaw member into engagement with said rail, said roller upon continuing such upward movement between said rail and said inclined surface after said engagement causing the jaw end of the other jaw member to engage said rail and thereafter forcing the jaw end of said one jaw member away from said rail against the force of said spring to spread the jaw ends of said jaw members, said wedge being pulled upwardly with respect to said one jaw member by said roller during such upward movement thereof; and means for maintaining said wedge in engagement with said inclined surface during such upward movement, said wedge being maintained disengaged from said rail owing to the jaw end of said one jaw member being moved away from said rail by said roller, said spring, after said roller has reached said certain point in such upward movement, acting through said one jaw member to force said wedge into engagement with said rail.

18. In an elevator system having a body movable in the elevator hatchway and a guide rail for said movable body, a safety device for bringing said movable body to a stop during its downward movement, said safety device comprising; a pair of jaw members pivoted between their ends and having their jaw ends spanning the sides of said rail, one of said jaw members having the surface of its jaw end facing said rail inclined upwardly toward said rail to a certain point and above said point inclined away from said rail; a spring arranged between the other ends of said jaw members; a roller positioned between said inclined surface and said rail; a wedge connected to said roller and also arranged between said inclined surface and said rail, both the roller and the wedge being normally disengaged from said rail; mechanism for moving said roller upwardly with respect to said one jaw member into engagement with said rail during downward movement of said body, said roller upon continuing such upward movement as the downward movement of said body continues causing the jaw end of the other jaw member to engage said rail and thereafter as it moves upwardly with respect to said one jaw member along said inclined surface forcing the jaw end of said one jaw member away from said rail against the force of said spring, said wedge being pulled upwardly with respect to said one jaw member by said roller during such upward movement thereof; and means for maintaining said wedge in engagement with said inclined surface during such upward movement, said wedge being maintained disengaged from said rail owing to the jaw end of said one jaw member being moved away from said rail by said roller, said spring, after said roller has reached said certain point in such upward movement, acting through said one jaw member to force said wedge into engagement with the side of said rail whereby the pressure of said spring is transferred from said roller to said wedge to bring said body to a stop.

In testimony whereof, I have signed my name to this specification.

FREDERICK HYMANS.