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W. J. ALBERSHEIM ET AL

SAFETY APPARATUS FOR ELEVATORS

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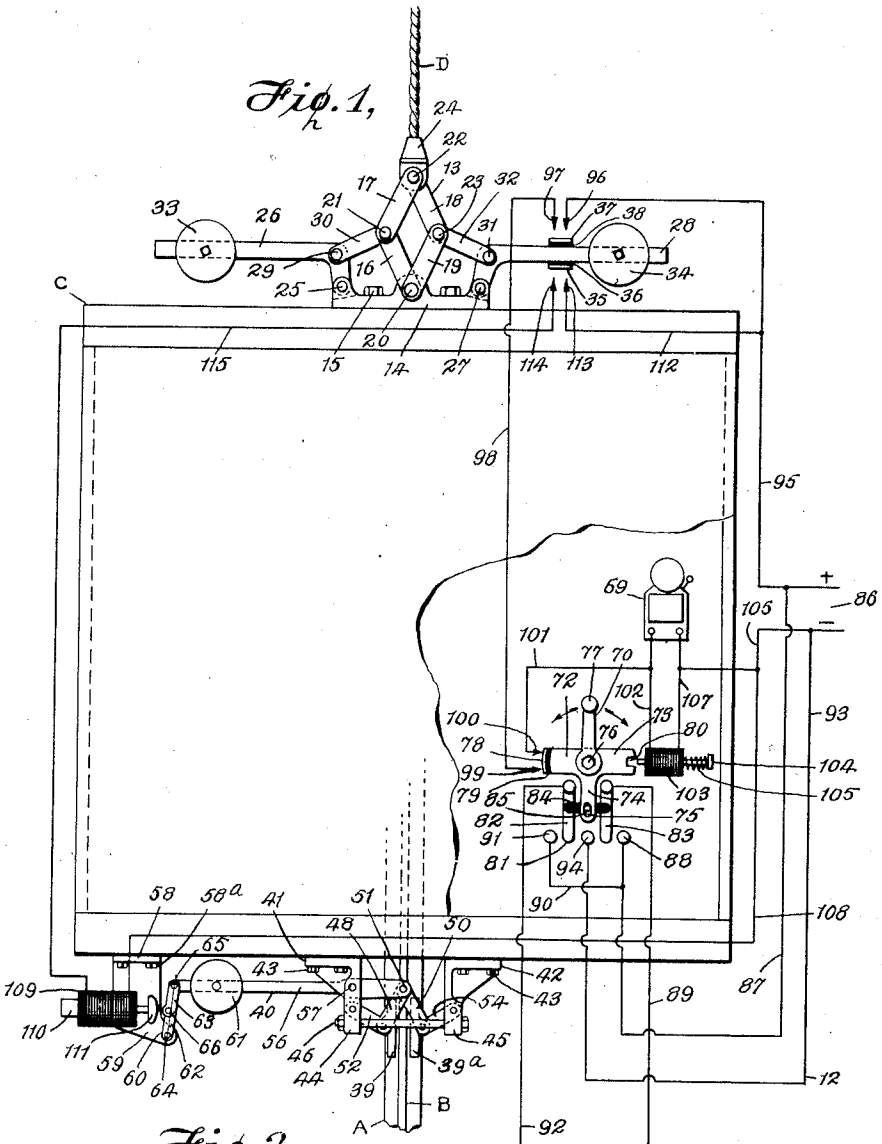
Fig. 1.



INVENTORS
Walter J. Albersheim
and Harvey S. Konheim
BY
W. T. Criswell.
ATTORNEY

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WALTER J. ALBERSHEIM AND HARVEY S. KONHEIM, OF NEW YORK, N. Y.

SAFETY APPARATUS FOR ELEVATORS.

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This invention relates more particularly to a class of accident preventive apparatuses.

Our invention has for its object primarily to provide a safety apparatus for use on elevators to serve for avoiding accidents with attendant danger of injury to persons in the car by giving a timely warning as well as preventing the car from operating in event of being overloaded and by also stopping the travel of the car should the hoisting cables break. These advantages are accomplished mainly by providing between the hoisting cable and the car a yielding connection, and a circuit closer operated by the yielding connection. On the car are brake shoes for clamping the guide rail of the elevator, and in the circuit is mechanism for operating the brake shoes to stop the travel of the car in event of severance of the hoisting cable, in order to prevent the car from falling more than a short distance. In the circuit may be an indicator or alarm for giving a signal of warning, and in the alarm circuit is electrical locking means. When excess of load is imposed on the car the closer and yielding connection are designed to operate for closing the circuit independent of the operation of the brake shoes to cause the locking means to engage the controller for controlling the circuit to prevent starting the car and simultaneously closing the alarm circuit for indicating that the load on the car is in excess of its maximum carrying capacity.

A further object of the invention is to provide a safety apparatus for elevators of a simple and efficient construction which may be employed on both passenger and freight elevators.

With these and other objects in view, the invention will be hereinafter more fully explained with reference to the accompanying drawing forming a part of this specification in which similar characters of reference indicate corresponding parts in all the views, and will then be pointed out in the claims at the end of the description.

In the drawing, Figure 1 is an elevation, partly diagrammatic and partly broken away, of the car of an electrically operated elevator with one form of our improved safety apparatus applied thereto as well as showing a diagrammatic view of the electric circuit of the apparatus, and

Fig. 2 is an enlarged fragmentary view showing an elevation of part of the car with the brake shoes and operating mechanism used in the apparatus.

The apparatus may be employed in conjunction with any appropriate form of elevator, as A, having the usual T-shaped guide rail B and the car, as C, adapted to be operated by one or more hoisting cables D which in turn are operated by a reversible motor, as 10, interposed in an electric circuit, as 12.

Between the cable D and the car C is a yielding or toggle connection 13 preferably of a form having a base plate, as 14, which is fastened, at 15, to the top of the car. The toggle proper is in the form of four links 16, 17, 18, 19 having their ends pivoted at 20, 21, 22, 23 so that the links of the toggle may relatively move expansibly and contractibly. The pivot 20 protrudes from the central part of the base plate 14, and on the pivot 22 is a suitable coupling, as 24, for connecting the cable D to the toggle 13. To one end of the base plate is pivoted, at 25, one end of an angular bar or lever 26, and to the other end of the base plate is pivoted, at 27, one end of another angular bar or lever 28. The elbow of the angular lever 26 is pivoted, at 29, to one end of a link 30 having its other end pivoted to the pivot 21 of the toggle 13, and the elbow of the angular lever 28 is pivoted, at 31, to one end of a link 32 having its other end pivoted to the pivot 23 of the toggle. The links 30, 32 are of such lengths that when the toggle is in its normal position, as shown in Fig. 1, the levers 26, 28 will be held movably in spaced relation to the top of the car C, and these levers extend in opposite directions toward opposite sides of the car. At the free end of the lever 26 is a ball or weight 33, and at the free end of the lever 28 is a ball or weight 34. The balls 33, 34 are of sufficient total weight to counterbalance the strain upon the toggle corresponding to the determined maximum load which the car should carry, and when the car is at or below its maximum load the toggle and counterbalancing weights will permit the car to be operated in normal manner. On the underside of the part of the lever 28 between its weight 34 and the pivot 31 of its elbow is a conductive plate, as 35, which is insulated, at 36, from the lever for serving as a circuit closer, and on the top of the lever opposite to the circuit closer 35 is another conductive plate 37 which is also insulated,

at 38, from the lever for serving as a second circuit closer, as will be later explained.

Below the bottom of the car are brake shoes 39, 39ª which may be in the form of two clamping plates one on each side of the guide rail B and adapted to engage the guide rail to stop the travel of the car in event of severance of the cable D. The brake shoes are operated by electrically operative mechanism 40. The mechanism 40 may be of any suitable construction, though the mechanism illustrated includes two substantially L-shaped brackets, as 41, 42, fastened, at 43, to the underside of the bottom of the car so that their arms, as 44, 45, depend from the car in closely spaced relation to the sides of the guide rail and to the brake shoes. The free ends of the arms 44, 45 are connected by a bolt rod 46. To the central part of the brake shoe 39 is pivoted, at 47, one end of a link 48, and to the central part of the brake shoes 39ª is pivoted, at 49, one end of a link 50. The links 48, 50 are disposed upwardly in a triangular fashion, and the upper ends of the links are pivoted together, at 51, so that the other ends of the links may be moved laterally back and forth to move the brake shoes into and out of clamping engagement with the guide rail B. To the pivot 47 of the link 48 is pivotally held one end of a link 52 having its other end pivoted, at 53, to the lower part of the depending arm 44 of the bracket 41, and to the pivot 49 of the link 50 is pivotally held one end of a link 54 having its other end pivoted, at 55, to the lower part of the depending arm 45 of the bracket 42. To the pivot 51 of the links 48, 50 is pivotally held one end of a bar or lever 56 which is fulcrumed, at 57, to part of the depending arm 44 of the bracket 41 above the link 52, and the lever 56 is of a length so that its other end terminates in proximity to a bracket 58 which is fastened, at 58ª to the underside of the bottom of the car in spaced relation to the bracket 41. The bracket 58 has an arm 59 which depends from the car. The free end of the lever 56 is hinged, at 60, to the lower end of the arm 59 of the bracket 58, and on the lever adjacent the arm 59 of this bracket is a ball or weight 61. The hinge 60 is of a well known form composed of two strips 62, 63 having two of their ends pivoted respectively, at 64, 65, to the arm 59 of the bracket 58 and to the free end of the lever 56. The other ends of the strips of the hinge 60 are pivoted together, as at 66, in a manner to provide companion shoulders 67, 68 on their ends at the pivot 66. The hinge 60 is so arranged that when collapsed the pivoted shouldered ends will be disposed downwardly from the lever 56, as shown in Fig. 2, and the strips or leaves 62, 63 of the hinge are of such lengths that when unfolded, as shown in Fig. 1, the lever 56 and weight 61 will be moved upwardly toward the bottom of the car. The hinge 60 is also arranged so that when unfolded the shoulders 67, 68 will engage each other for locking the lever 56 and weight 61 in their elevated positions, and the weight 61 is provided so that when the hinge is collapsed the lever will be swung downwardly. Moreover, the hinge is so positioned that the pivoted ends 66 of its strips when struck from a direction opposite to the shoulders 67, 68 will cause the hinge to collapse in a manner for allowing the weight 61 to carry the lever downwardly, and the lever 56, links 48, 50 with the links 52, 54 are so proportioned that when the lever is swung upwardly and downwardly on its fulcrum 57 the links will be operated for moving the brake shoes 39, 39ª into and out of clamping engagement with the guide rail B.

In a suitable part of the car C may be an indicator or alarm, as 69, for giving a signal of warning when the car is overloaded, and this alarm is preferably of a well known form of electrically operative bell adapted to ring with the timely closing of the circuit, as will be hereinafter more fully explained.

Also within the car is a controller 70 comprising two oppositely extending integral arms 72, 73 and a downwardly projecting arm 74 having in its lower end a slot 75. The controller is pivoted, at 76, to a convenient part of the car, and on the pivot 76 is held the lower end of a handle 77 which protrudes upwardly from the arms 72, 73 of the controller to enable the controller to be adjustably swung in the directions indicated by the arrows so that the arms 72, 73 may be moved upwardly and downwardly and so that the slotted arm 74 will move back and forth horizontally. On the free end of the arm 72 of the controller is a contact plate 78 which is insulated, at 79, and in the free end of the arm 72 of the controller is a notch 80. The controller 70 carries a reversing switch 81 which may be of a commonly used type having two spaced parallel conductive bars 82, 83, and to the central parts of these bars are pivoted the ends of an insulating cross bar 84 having in its central part a projecting pin 85 which extends through the slot 75. When the handle 77 is swung to the right the arm 72 will move upwardly and the bars 82, 83 of the switch 81 will be swung toward the left. When the handle 77 is swung to the left the arm 73 will then move upwardly and the bars 82, 83 of the switch 81 will be swung toward the right.

The circuit 12 may lead from any suitable source of electricity supply, as 86, and leading from the source of current is a wire 87 which terminates with a contact 88 adapted to be engaged by the arm 83 of the switch

81. To the upper end of the arm 83 of the switch is connected a wire 89 which leads to one terminal of the motor 10, and leading from the wire 89 is a wire 90 which terminates with a contact 91 adapted to be engaged by the arm 82 of the switch 81. To the upper end of the arm 82 of the switch is connected a wire 92 which leads to the second terminal of the motor. Also leading from the source of current 12 is a wire 93 which terminates with a contact 94 disposed between the contacts 88 and 91 for being engaged at different intervals by the arms 82 and 83 of the switch 81. Leading from the wire 87 is a wire 95 which terminates with a contact 96 adapted to be engaged by the closer 37 of the bar 28 of the counterbalancing weight 34, and spaced from the contact 96 is another contact 97 also engageable by the closer 37 of the bar 28 of the counterbalancing weight 34. Leading from the contact 97 is a wire 98 which terminates with a contact 99 engageable by the contact plate 78 of the arm 72. In closely spaced relation to the contact 99 is a second contact 100 for also being engaged by the contact plate 78 and leading from the contact 100 to one pole of the alarm 69 is a wire 101. Leading from the wire 101 is a wire 102 which is connected to one end of the winding of a solenoid 103 of a well known type having a slidable core pin 104 arranged so that one of its ends will move into the notch 80 of the arm 73 when the solenoid is energized for locking the controller, from which position, it may be manually released, if desired. On the second end of the core pin 104 is a compression spring 105 adapted to normally hold the pin from engaging the notch 80. Connected to the wire 93 is a wire 106 which leads to the second pole of the alarm 69, and connected to the second end of the winding of the solenoid 103 is a wire 107 which leads to the wire 106. Connected to the wire 106 is a wire 108 which leads to one end of the winding of an electromagnet 109 of a commonly known form having a movable hammer core 110. This electromagnet is arranged so that the head, as 111, of its core 110 is adapted when the electromagnet is energized to strike the pivoted ends 66 of the strips 62, 63 of the hinge 60 for causing the hinge to fold together. To the wire 95 is connected one end of a wire 112 which terminates with a contact 113 adapted to be engaged by the closer 35. In closely spaced relation to the contact 113 is a second contact 114 also adapted to be engaged by the closer 35, and leading from the contact 114 is a wire 115 which is connected to the second end of the winding of the hammer electromagnet 109.

When the car C is under a load at or below its maximum carrying capacity, the counterbalanced yielding connections or toggle 13 will not operate by reason of being capable of sustaining the pressure of the car and its load, and the bar 28 with its weight 34 will be positioned between and in spaced relation to the pairs of contacts 96, 97 and 113, 114 of the circuit 12. The hinge 60 is unfolded to lock the lever 56 for positioning the brake shoes 39, 39a free from engagement with the guide rail B, as shown in Fig. 1. The controller 70 is in its normal position for being manipulated to operate the car with the arms 82, 83 of its switch 81 disposed between the contacts 88, 91, 94 of the circuit 12. The closer or plate 78 of the controller is in engagement with the contacts 99, 100 of the alarm circuit, and the slidable core of the solenoid 103 is free of the notch 80. To operate the car in its usual fashion to cause it to travel upwardly the handle 77 of the controller 70 is moved to the right separating the closer from engagement with one or both of the contacts 99, 100 and the arms 82, 83 of the switch 81 will be moved into engagement with the contacts 91, 94 of the circuit. The circuit will be closed from the source of current 86, over wire 93, through the arm 83 and over wire 89 to the motor 10. The circuit will also be closed from the source of current, over wire 87, over wire 90, through the arm 82 of the switch 81 and over wire 92 to the motor. The motor will then operate for causing the car to travel upwardly. To cause the car to travel downwardly the handle 77 of the controller 70 is swung toward the left, and the arm 72 will move in a downward direction for cutting-out the alarm circuit by separating the closer 78 from one or both of the contacts 99, 100. The switch 81 will also be swung for moving its arms 82, 83 into engagement with the contacts 88, 94. The circuit will thereby be closed from the source of current 86, over wire 87, through the arm 83 of the switch 81 and over wire 89 to the motor 10, and the circuit will be closed from the source of current over wire 93, through the arm 82, and over wire 92 to the second terminal of the motor.

When the car is at a standstill the controller 70 is in its normal inactive position and the closer plate 78 is in engagement with the contacts 99, 100 of the circuit, as above explained. Should excess of load be imposed on the car the pressure will cause the toggle 13 to operate for moving the bars 26, 28 and the counterbalancing weights 33, 34 upwardly. With the upward movement of the bar 28 the closer plate 37 will engage the contacts 96, 97 of the electric circuit. The circuit will then be closed from the source of current 86, over wire 95, through the closer 37, over wire 98, to contact 99, through the closer plate 78, to contact 100, over wires 101 and 102 to the alarm 69 and to solenoid 103. Also from the source of current the

circuit will be closed over wire 93, over wire 106 and over wire 107 to the alarm 69 and to the solenoid. The solenoid 103 will thereby be energized, and its core pin 104 will move against the tension of its spring 105 into engagement with the notch 80 of the controller 70. The alarm will then sound to give a signal of warning, and the controller will be releasably locked against being operated until the car is relieved of the excess of load to allow the toggle 13 and the bar 28 with its weight to return to their normal positions. The circuit will then be open by severance of the engagement of the closer plate 37 with the contacts 96, 97 and the tension of the spring 105 will cause the pin 104 of the solenoid 103 to be withdrawn from the notch 80. The controller may then be operated to operate the car, as above explained.

In event of severance or slackening of the cable D whereby the car would drop, the weights 33, 34 and the bars 26, 28 would fall toward the top of the car with collapsing of the toggle 13. The lowering of the bar 28 will cause its closer plate 35 to engage the contacts 113, 114 of the circuit, and the circuit will be closed from the source of current 86 over wires 95 and 112 to contact 113, through the closer 35 to contact 114 and over wire 115 to the hammer solenoid 109. From the source of current the circuit will be closed over wire 106 and over wire 108 to the solenoid 109. With the energizing of the solenoid 109 its hammer core 110 will strike the pivoted ends 66 of the hinge 60 a blow, and cause the members of the hinge to coliapse, as illustrated in Fig. 2, and the weight 61 with the lever 50 of the mechanism 40 will swing downwardly on the fulcrum 57 of the lever. The pivoted end 51 of the lever will swing upwardly, and cause the links 48, 50 to also move upwardly for forcing the brake shoes into engagement with the guide rail B.

The friction of the guide rail upon the brake shoes will tend to move them toward the floor of the car, thus forcing them into close contact with the guide rail. If desired, the shoes may be of such length that they will engage the bottom of the car when in engagement with the guide rail.

In the foregoing description, we have embodied the preferred form of our invention, but we do not wish to be understood as limiting ourselves thereto, as we are aware that modifications may be made therein without departing from the principle or sacrificing any of the advantages of this invention, therefore, we reserve to ourselves the right to make such changes as fairly fall within the scope thereof.

Having thus described our invention, we claim as new and desire to secure by Letters Patent:—

1. In a safety apparatus for elevators, the combination with a car, a hoisting cable therefor, an electric circuit, and a motor in the circuit, of yielding connections between the cable and the car and inoperative when the load of the car is below its maximum carrying capacity, brake shoes for engaging the guide rail of the car, an alarm in the circuit, a controller for opening and closing of the circuit, electrical locking means in the alarm circuit, contacts in the circuit engageable by the movement of the yielding connections for cutting-out the circuit to the motor and for operating said locking means to lock the controller as well as closing the circuit to sound the alarm when excess of load is imposed on the car, and contacts in the circuit engageable by the yielding connections when moved for operating the brake shoes for stopping the travel of the car with severance of the hoisting cable.

2. In a safety apparatus for elevators, the combination with a car, a hoisting cable therefor, an electric circuit, and a motor in the circuit, of yielding connections between the cable and the car and inoperative when the load of the car is below its maximum carrying capacity, brake shoes for engaging the guide rail of the car, mechanism in the circuit for operating the brake shoes, an alarm in the circuit, a controller for opening and closing of the circuit, electrical locking means in the alarm circuit, contacts in the circuit engageable by the movement of the yielding connections for cutting-out the circuit to the motor and for operating said locking means to lock the controller as well as closing the circuit to sound the alarm when excess of load is imposed on the car, and contacts in the circuit engageable by the yielding connections when moved for operating said mechanism to operate the brake shoes for stopping the travel of the car with severance of the hoisting cable.

3. In a safety apparatus for elevators, the combination with a car, a hoisting cable therefor, an electric circuit, and a motor in the circuit, of yielding connections between the cable and the car and inoperative when the load of the car is below its maximum carrying capacity, brake shoes for engaging the guide rail of the car, an alarm in the circuit, a controller for opening and closing of the circuit, contacts in the circuit leading to the alarm, a circuit closer carried by the controller normally engaging the contacts in the alarm circuit, electrical locking means in the alarm circuit, contacts in the circuit engageable by the movement of the yielding connections for cutting-out the circuit to the motor and for operating said locking means to lock the controller as well as closing the circuit to sound the alarm when excess of load is imposed on the car, and contacts in the circuit engageable by the movement of the yielding connections for

operating the brake shoes for stopping the travel of the car with severance of the hoisting cable.

4. In a safety apparatus for elevators, the combination with a car, a hoisting cable therefor, an electric circuit, and a motor in the circuit, of yielding connections between the cable and the car and inoperative when the load of the car is below its maximum carrying capacity, brake shoes for engaging the guide rail of the car, mechanism in the circuit for operating the brake shoes, an alarm in the circuit, a controller for opening and closing of the circuit, contacts in the circuit leading to the alarm, a circuit closer carried by the controller normally engaging the contacts in the alarm circuit, electrical locking means in the alarm circuit, contacts in the circuit engageable by the movement of the yielding connections for cutting-out the circuit to the motor and for operating said locking means to lock the controller as well as closing the circuit to sound the alarm when excess of load is imposed on the car, and contacts in the circuit engageable by the movement of the yielding connections for operating said mechanism to operate the brake shoes for stopping the travel of the car with severance of the hoisting cable.

5. In a safety apparatus for elevators, the combination with a car, a hoisting cable therefor, an electric circuit, and a motor in the circuit, of yielding connections between the cable and the car and inoperative when the load of the car is below its maximum carrying capacity, said yielding connections having a circuit closer, brake shoes for clamping the guide rail of the car, an alarm in the circuit, a controller for opening and closing of the circuit, contacts in the circuit leading to the alarm, a circuit closer carried by the controller normally engaging the contacts in the alarm circuit, electrical locking means in the alarm circuit, means in the circuit engageable by the movement of the yielding connections and the closer for cutting-out the circuit to the motor and for operating said locking means to lock the controller as well as closing the circuit to sound the alarm when excess of load is imposed on the car, and means in the circuit engageable by the movement of the yielding connections and said closer for operating the brake shoes to clamp the guide rail for stopping the travel of the car with severance of the hoisting cable.

6. In a safety apparatus for elevators, the combination with a car, a hoisting cable therefor, an electric circuit, and a motor in the circuit, of yielding connections between the cable and the car and inoperative when the load of the car is below its maximum carrying capacity, said yielding connections having a circuit closer, brake shoes for clamping the guide rail of the car, mechanism in the circuit for operating the brake shoes, an alarm in the circuit, a controller for opening and closing of the circuit, contacts in the circuit leading to the alarm, a circuit closer carried by the controller normally engaging the contacts in the alarm circuit, electrical locking means in the alarm circuit, means in the circuit engageable by the movement of the yielding connections and the closer for cutting-out the circuit to the motor and for operating said locking means to lock the controller as well as closing the circuit to sound the alarm when excess of load is imposed on the car, and means in the circuit engageable by the movement of the yielding connections and said closer for operating said mechanism to operate the brake shoes to clamp the guide rail for stopping the travel of the car with severance of the hoisting cable.

7. In a safety apparatus for elevators, the combination with a car, a hoisting cable therefor, an electric circuit, and a motor in the circuit of yielding connections between the cable and the car and inoperative when the load of the car is below its maximum carrying capacity, said yielding connections having a circuit closer, brake shoes for clamping the guide rail of the car, an alarm in the circuit, a controller for opening and closing of the circuit, a circuit closer carried by the controller normally closing the alarm circuit, electrical locking means in the alarm circuit, means in the circuit engageable by the movement of the yielding connections and the closer for cutting-out the circuit to the motor and for operating said locking means to lock the controller as well as closing the circuit to sound the alarm when excess of load is imposed on the car, and means in the circuit engageable by the movement of the yielding connections and the closer for operating the brake shoes to clamp the guide rail for stopping the travel of the car with severance of the hoisting cable.

8. In a safety apparatus for elevators, the combination with a car, a hoisting cable therefor, an electric circuit, and a motor in the circuit, of yielding connections between the cable and the car and inoperative when the load of the car is below its maximum carrying capacity, said yielding connections having a circuit closer, brake shoes for clamping the guide rail of the car, mechanism in the circuit for operating the brake shoes, an alarm in the circuit, a controller for opening and closing of the circuit, a circuit closer carried by the controller normally closing the alarm circuit, electrical locking means in the alarm circuit, means in the circuit engageable by the movement of the yielding connections and the closer for cutting-out the circuit to the motor and for operating said locking means to lock the controller as well

as closing the circuit to sound the alarm when excess of load is imposed on the car, and means in the circuit engageable by the movement of the yielding connections and the closer for operating said mechanism to operate the brake shoes to clamp the guide rail for stopping the travel of the car with severance of the hoisting cable.

9. The combination with an electric elevator having a cable, and a car suspended thereby; of a vertical rail extending adjacent the path of said car, a brake shoe on said car adapted to frictionally engage said rail for gradually arresting the movement of the car, means for normally retaining said brake shoe in inoperative position, a yielding connection between said cable and said car, an electric circuit adapted to be closed by said connection, and means in said circuit for causing the brake shoe to engage the rail.

10. The combination with an elevator having a cable, and a car suspended thereby; of a guide rail for said car, a brake shoe on said car adapted to engage said rail, locking means for normally retaining said brake shoe out of engagement with the rail, a toggle connection between said cable and said car, an electric circuit adapted to be closed by said connection, and a hammer solenoid in said circuit adapted to render said locking means inoperative to thereby allow the brake shoe to engage the rail.

11. In an electric elevator, a cable, a car suspended thereby, a yielding connection between the car and the cable, a controller lever, an electric circuit, means operable by said yielding connection for closing said circuit, and means in said circuit for locking said controller lever in its neutral position.

12. In an elevator, a cable, a car, a yielding connection between the car and the cable, a controller lever, an electric circuit, means operable by said yielding connection for closing said circuit, an indicator in said circuit, and means in said circuit for locking said controller lever in its neutral position.

13. In an elevator, a cable, a car suspended thereby, a yielding connection between the car and the cable, a controller lever in said car, an electric circuit, a closer for said circuit attached to said lever, means operable by said yielding connection for closing said circuit, an indicator in said circuit, and means in said circuit for locking said controller lever, said means being operative only when the controller lever is in its neutral position.

14. In an elevator, a cable, a car suspended thereby, a yielding connection between the car and the cable, a controller lever in said car, an electric circuit, a closer for said circuit, said closer being operative only when the controller lever is in its neutral position, a second closer associated with said yielding connection, and means operable upon the closing of said circuit to releasably lock said controller in its neutral position.

This specification signed and witnessed this 9th day of December A. D. 1925.

WALTER J. ALBERSHEIM.
HARVEY S. KONHEIM.