No. 646,001. Patented Mar. 27, 1900.

C. A. HARKNESS.

ELEVATOR.

(Application filed Feb. 23, 1897.)

(No Model.) 3 Sheets—Sheet 1.

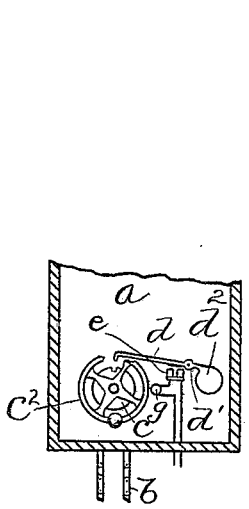

Fig. 3.

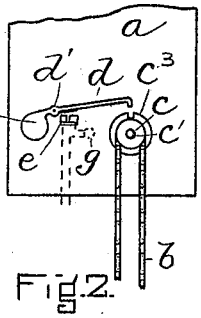

Fig. 2.

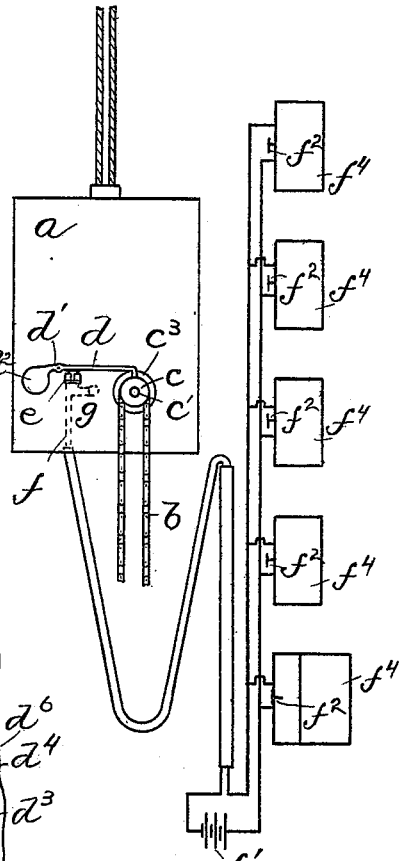

Fig. 1.

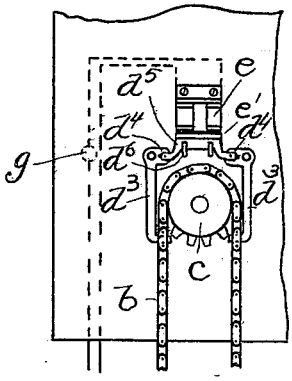

Fig. 4.

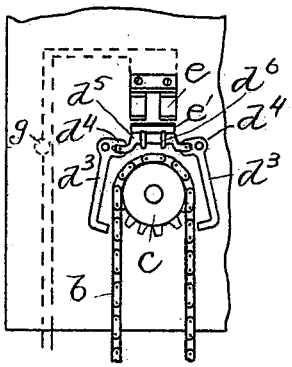

Fig. 5.

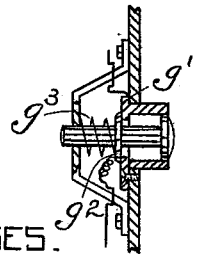

Fig. 2a.

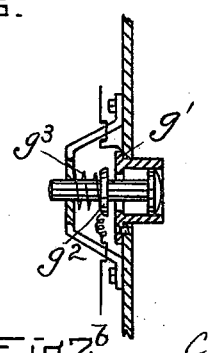

Fig. 2b.

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No. 646,001. Patented Mar. 27, 1900.

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ELEVATOR.

(Application filed Feb. 23, 1897.)

(No Model.) 3 Sheets—Sheet 2.

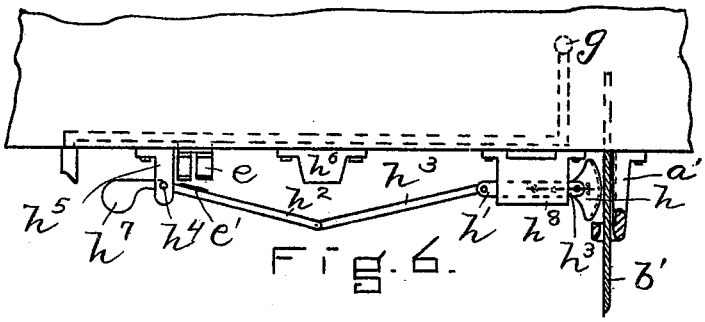

Fig. 6.

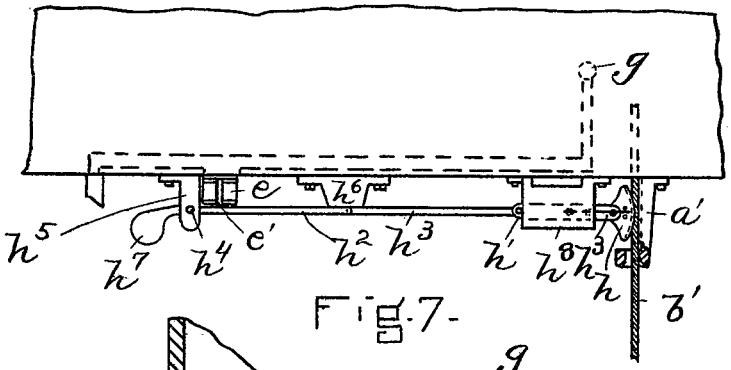

Fig. 7.

Fig. 8.

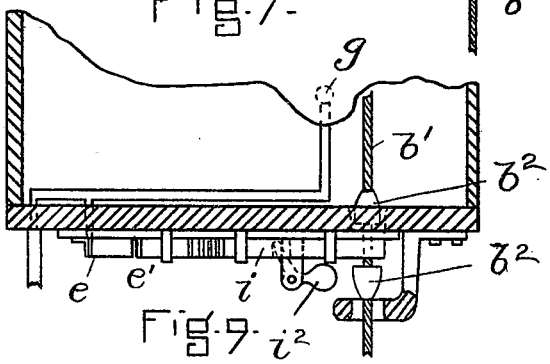

Fig. 9.

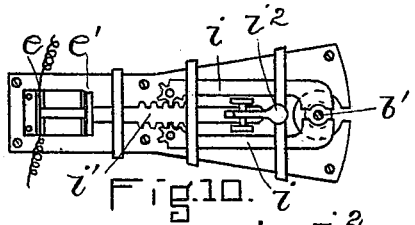

Fig. 10.

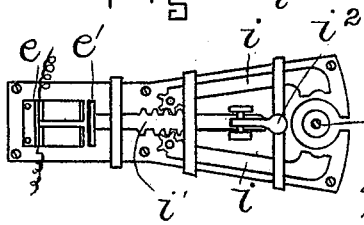

Fig. 11.

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(No Model.) 3 Sheets—Sheet 3.

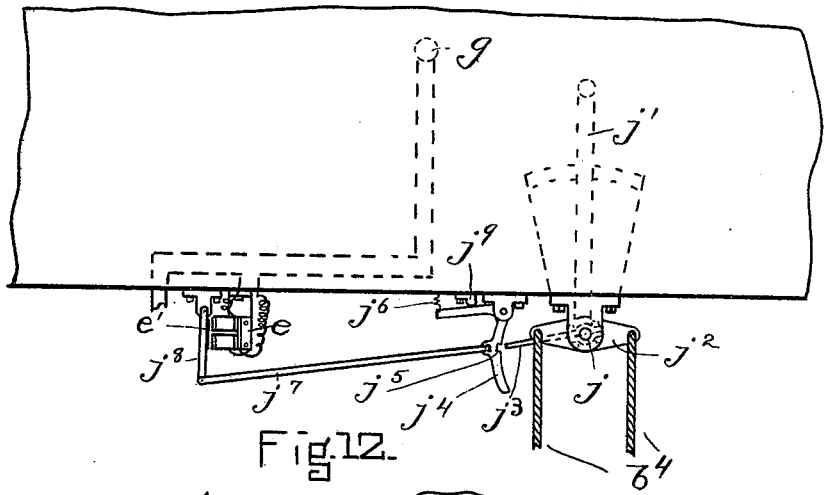

Fig. 12.

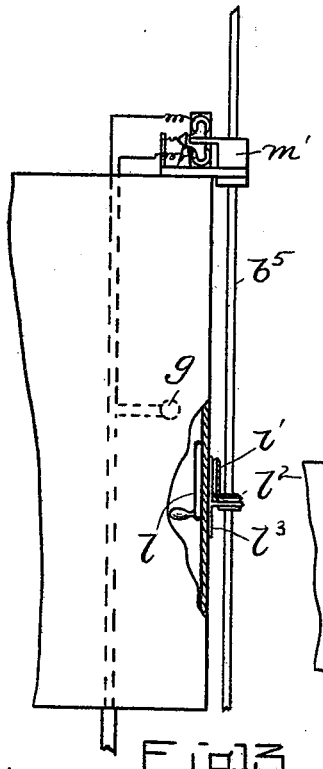

Fig. 13.

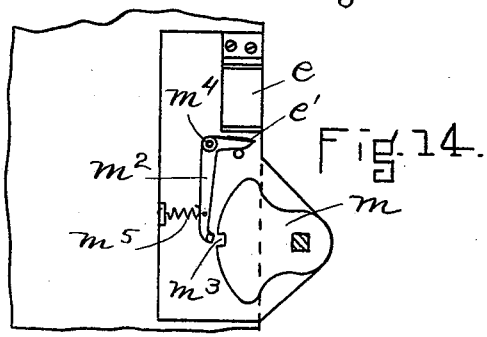

Fig. 14.

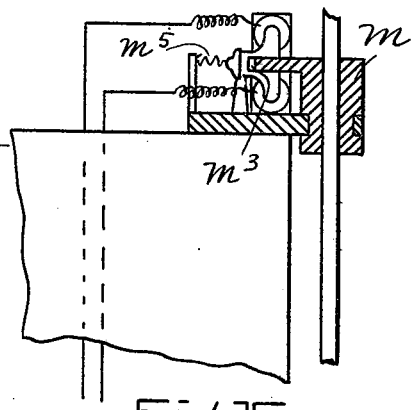

Fig. 15.

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UNITED STATES PATENT OFFICE.

CHARLES A. HARKNESS, OF PROVIDENCE, RHODE ISLAND.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 646,001, dated March 27, 1900.

Application filed February 23, 1897. Serial No. 624,668. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. HARKNESS, of Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Elevators, of which the following is a specification.

This invention relates to elevators, and has for its object to present such improvements in the same as will fully appear from the following description.

The invention may be said to consist, broadly, of controlling means, (including either a flexible line relatively to which the car travels, a flexible line traveling with the car, a stationary shaft relatively to which the car travels and which is connected with hand-operative means on the car in sliding engagement therewith, an electric switch or any other device for controlling the motor employed for the purpose of raising and lowering the car;) a lock for such controlling means, which lock is mounted upon the car; an electromagnet, likewise mounted on the car, for throwing the lock into operative position, and an electric circuit including said electromagnet and also having included therein "make-and-break" devices operated by the doors leading into the elevator-well, whereby when one of the doors is open the electromagnet will be operated to cause the lock to lock the controlling means.

The invention also consists of the devices and mechanisms above enumerated, in combination with means under the control of the attendant in the car for breaking the electric circuit to throw the lock into its inoperative position even while the door is open.

The invention also consists of means for causing the stoppage of the motor in case one of the doors be opened to immediately bring the car to a state of rest irrespective of the position of the said car in the hatchway.

The invention also consists of certain combinations and arrangements of parts, all as illustrated in the drawings, to be hereinafter described in detail, and to be fully and particularly pointed out in the claims hereto appended.

Reference is to be had to the accompanying drawings and to the letters marked thereon, forming a part of this specification, the same letters designating the same parts or features, as the case may be, wherever they occur.

Of the drawings, Figure 1 is a diagrammatic view showing a car the movements of which are controlled by a line traveling therewith, a lock on the car for locking the line through the medium of the wheel around which the line may be moved, an electromagnet for operating the lock, a series of doors, and an electric circuit including said electromagnet and including make-and-break devices operated by the doors for causing the energizing of the magnet to operate the lock. The circuit also includes a push-button by means of which the current may be broken when desired. Fig. 2 illustrates the lock in Fig. 1 in its inoperative position. Figs. 2^a and 2^b illustrate the push-button. Fig. 3 illustrates another embodiment of the invention which is slightly different from that shown in Figs. 1 and 2, in which the lock is mounted on the inside of the car and engages a disk behind the hand-operative wheel by means of which the traveling line is shifted. Figs. 4 and 5 illustrate a slightly-different form of mechanism for locking the controlling means, the lock in this case consisting of two dogs which engage the controlling-line itself and which are simultaneously operated by an electromagnet, the rest of the construction being similar to that illustrated in Fig. 1. Figs. 6, 7, and 8 illustrate a different embodiment of the invention in which the locking means may be actuated to lock the line to the car in such way as to immediately bring the car to a state of rest upon one of the doors leading into the elevator-shaft being opened. Figs. 9, 10, and 11 illustrate the lock formed in such way as to be thrown into operative position immediately upon one of the doors being opened, but which will not operate to stop the car until the latter arrives at one of the landings. Fig. 12 illustrates a device for locking a hand-operative lever on the car, which lever is connected with a line traveling with the car. Figs. 13, 14, and 15 illustrate the lock as being employed for the purpose of locking an upright shaft against rotation when one of the doors is open, said shaft being connected with the motor.

First referring to Figs. 1 and 2, the eleva-

tor-car is indicated by a, and b indicates the controlling means, which in this case consists of a chain connected with the motor and passing around the wheel c on the outside of the car a. The wheel c is supported upon a shaft c', projecting through the wall of the car and equipped on its other end with a hand-wheel c^2—such as shown, for instance, in Fig. 3. Upon the shaft is likewise mounted outside the wall of the car a disk c^3, having a notch adapted to receive the hooked end of a lock consisting of a weighted lever d, pivoted at d' on the outside of the car. e is an electromagnet arranged below the lock b and having its armature e' secured thereto, so that upon the magnet being energized the lever which is raised by reason of the weight d^2 will be drawn downward, so as to thrust its hooked end into the notch in the disk c^3. The magnet is included in a circuit, (indicated by f,) which circuit also includes a suitable source of power, here shown as a generator f', and a series of make-and-break devices (shown conventionally at f^2) to be operated by a series of horizontally-movable corridor-doors f^4, opening into the elevator shaft or well. When the doors are all closed, the circuit is broken; but when one of the doors is open the circuit is closed through the magnet and the lock is thrown into its operative position. Under this arrangement when the attendant upon the car shifts the shaft c' by means of the hand-wheel c^2 to bring the car to a state of rest opposite the landing and thereupon proceeds to open the door the first movement of the door toward open position causes the closing of the circuit and the actuation of the lock to hold the shaft c' against movement so long as the door is open.

It will be readily understood that my invention is capable of being embodied in many forms and various constructions and arrangements of parts. For instance, in Fig. 3 the lock d and the disk c are mounted on the shaft inside of the wall of the car. In Figs. 4 and and 5 I have shown a lock for the controlling means, consisting of two pivoted dogs d^3 d^3, which may enter the open links of the chain b on either side of the wheel c, the dogs being provided with slots d^4 to receive fingers d^5, secured to the armature e' of the electromagnet e. When the circuit through the magnet is broken, the dogs will remain in the inoperative position shown in Fig. 5, with the armature resting upon the guides d^6; but when the magnet is energized they will be thrown into engagement with the links of the chain, as shown, so as to lock the controlling means against movement.

It sometimes happens that where the elevator-door has not been properly latched after having been closed an inexperienced or thoughtless person exposes himself to danger by opening the door and looking into the elevator shaft or well to ascertain the position of the car, which at the time may be in close proximity and therefore liable to cause injury or death, so that it is desirable to provide means for accomplishing the immediate stoppage of the car in case one of the doors be opened.

In Figs. 6, 7, and 8 I have shown my invention as embodied in a mechanism for causing the immediate stoppage of the elevator-car irrespective of its position in the shaft or well upon the opening of one of the doors. In this case the controlling means consists of a line b' of the type known as "standing" lines—that is to say, a line relatively to which the car travels and which is positively or directly connected with the mechanism which controls the movements of the motor. The car is provided with an attachment or member a', through which the line passes and which forms an abutment for a movable member h, having a roughened groove, the abutment also having a groove, so that the rope may be tightly clamped between them, the said movable member being in the form of a double eccentric pivoted upon the end of a bar h', sliding in a guide h^8 on the bottom of the car. The eccentric member is held in its normal position by a spring h^3, so that when the line is wedged between the member h and the abutment the former will be rocked more or less upon its axis to obtain a better bite upon the line. The bar h' is operated by toggle-levers h^2 h^3, the former being pivoted at h^4 to a bracket h^5 and having secured to it the armature e' of the electromagnet e. The movement of the toggle-levers h^2 h^3 is limited by the stop h^6, placed in their path. The weight h^7 does not quite counterbalance the weight of the levers $h^2 h^3$, so that when the magnet is not energized they will assume the position shown in Fig. 6. The parts as described constitute a lock which will lock the standing line to the car in such way as to cause the immediate shifting of the motor-controlling mechanism upon the opening of one of the doors and effect the stoppage of the car irrespective of its position in the hatchway.

In Figs. 9, 10, and 11 the invention is shown as embodied in a mechanism in which, though the lock be thrown into its operative position immediately upon the opening of one of the doors, yet the car will not be stopped until it comes to a landing, so that in case one of the doors be opened while the car is in transit it will not be stopped in such position as to prevent egress therefrom. In this construction the line b' is equipped with stops b^2, there being a pair of these stops upon the line at each landing. The lock in this case consists of two pivoted dogs or arms i i, formed with teeth at their pivoted ends, which engage a rack-bar i', connected with the armature e' of the electromagnet e. The rack-bar is normally held forward by a pivoted weight i^2, so that when the magnet is energized it draws the rack-bar to it and rocks the dogs i about their pivots into the position shown in Fig. 10, and hence when the car has reached the landing the dogs will be separated by the first one of the conical

stops b^2 and engage the other stop b^2, so as to shift the line and stop the car automatically. The conical stops have their points oppositely arranged, so that one of the two stops passes between the two arms, while the flat face of the other engages the said arms to stop the car. Thus it will be seen that by opening one of the doors the magnet will be energized and the lock will immediately be thrown into its operative position; but the car will not be brought to a state of rest until it reaches the next landing either in ascending or descending.

In Fig. 12 the lock is employed for locking the rock-shaft j, to which the hand-operative lever j' (shown in dotted lines) is attached, the said shaft being provided with a cross-bar j^2, to which the ends of the line b^4, which travels with the car, are attached. Projecting out from the shaft is a bar j^3, with which a swinging catch j^4, having a recess j^5 to receive the end of the bar j^3, may engage. The catch is normally held out of its locking position by a spring j^6, but is connected by a rod j^7 with a pivoted rod j^8, to which the armature e' of the electromagnet e is connected. When the car has been brought to a standstill and one of the doors is open, the current passing through the electromagnet e causes it to draw the armature to it and to throw the catch j^4 toward the bar j^3, so that the latter enters the recess j^5 in the former. The movement of the catch in the direction of the tension of the spring is limited by a stop j^9, projecting down from the bottom of the car.

In all of the embodiments of my invention which I have thus far described the controlling means by which the motor is controlled is in the form of a flexible line, either connected to the car to travel therewith or arranged in the hatchway in such way that the car travels relatively thereto; but in Figs. 13, 14, and 15 I have illustrated controlling means as consisting of an angular shaft b^5, which is connected to the mechanism for controlling the motor in such way that by rotating the shaft in one direction or the other the car may be raised and lowered or stopped, as the case may be. The shaft may be angular in cross-section, as shown, or else it may be grooved or formed with longitudinal webs or flanges and is operated by means of a hand-operative device l, mounted on a shaft projecting through the wall of the car and having on its outer end a bevel-wheel l', intermeshing with a bevel-wheel l^2, supported in a bracket l^3, mounted upon the wall of the car, the bevel-wheel l^2 having an angular aperture to receive the shaft b^5, so as to slide relatively to the latter, though locked to it in such way as to cause its rotation when the hand-wheel is rotated. The lock for the shaft consists of a plate m, having a hub m', with an angular aperture to receive the shaft b^5 and which is mounted on a bracket extending out from the car, so as to travel with the latter relatively to the shaft, while adapted to allow its rotation or to prevent it from being rotated when the plate m is locked against movement. m^2 is a bell-crank lever having a hooked end which is adapted to enter a recess m^3 in the plate m, so as to lock the said plate against movement. The armature e' of the electromagnet e is connected to the bell-crank lever, and when the electromagnet is energized it rocks the said lever upon its pivot m^4 and forces the hooked end thereof into the recess m^3 of the plate m. The bell-crank lever is held in its inoperative position under normal conditions by the spring m^5, which is connected to it, as shown in Fig. 14. In this case, as in the previous one, the opening of one of the doors closes the circuit through the magnet and causes the locking of the controlling means.

If it should happen when the car is in transit or at a landing that one of the other doors should be opened, either accidentally or maliciously, it would ordinarily be impossible to unlock the hand-operative devices on the car, so that some means would be necessary to render the lock inoperative. Hence I include in the electric circuit f a device (indicated conventionally at g) for breaking the circuit, which device is under the control of the attendant on the car. I prefer a device which will operate to break the circuit only so long as pressure is put upon it, and therefore employ a push-button, as in Figs. 2^a and 2^b, the contacts g' g^2 of which are held normally together by a spring g^3, so as to render it impossible for the attendant to forget to close the circuit in case he has opened it for any purpose.

In all of the embodiments of my invention which I have illustrated and described the lock is mounted upon the car and is actuated by an electromagnet in circuit with a series of make-and-break devices operated by the doors leading into the elevator shaft or well, and in each embodiment of the invention the energizing of the magnet causes the locking of the controlling means. Again, in all of the embodiments of my invention as above described a push-button is located in the circuit which includes the electromagnet, so that the attendant may by pressing upon the button throw the lock into its inoperative position to permit him to retain his control of the car in case some person has accidentally or with evil intent opened one of the doors leading into the elevator shaft or well.

By means of the various devices which I have described I am enabled, first, to decrease the liability of accident to persons entering or leaving the elevator-car by preventing the starting of the same while the door is open, and, second, I provide for the immediate stoppage of the car upon the opening of one of the doors or provide for the car being stopped at the next adjacent landing.

Of course it will be understood that I do not limit myself to the precise construction and arrangement of parts illustrated in the draw-

ings and above described, as the invention may be embodied in other devices without departing from the spirit or scope of my invention. While I have selected several forms for the purpose of illustrating how the invention may be embodied and operated, yet at the same time it may be equally well embodied in devices presenting a different appearance from those shown in the drawings. The controlling means may include the devices which cause the motor to either raise or lower the car or bring it to a state of rest.

Having thus explained the nature of the invention and to what it relates, as well as several of the forms in which it may be embodied, what I now declare to be my invention is—

1. In an elevator, controlling means, a lock on the car for said means, an electromagnet on the car for actuating said lock, a door, and an electric circuit for energizing the electromagnet to actuate said lock when said door is open.

2. In an elevator, controlling means, a lock on the car for said means, an electromagnet on the car for actuating said lock, a door, an electric circuit for energizing the electromagnet to actuate said lock when said door is open, and a circuit-breaker normally closing the circuit and constructed to be manipulated to break the circuit temporarily, and to return to its normal position automatically.

3. In an elevator, controlling means, a lock on the car for said means, an electromagnet on the car for actuating said lock, a door, an electric circuit for energizing the electromagnet to actuate said lock when said door is open, and means controlled by said door for breaking the circuit when the door is closed whereby the said lock is free from said controlling means when the said door is closed.

4. In an elevator, controlling means for shifting the controlling parts of the motor, a corridor-door, and means including an electric circuit adapted to be closed by the opening of said door for actuating the controlling means to stop the travel of the car.

5. In an elevator, controlling means for controlling the movements of the motor, a series of horizontally-movable corridor-doors, and means between the doors and the said motor-controlling means for operating said motor-controlling means to bring it to a neutral position and stop the car irrespective of its position in the hatchway when any one of said doors is open.

6. In an elevator, controlling means, a lock for said means, a series of horizontally-movable corridor-doors, and means operated by the opening of any one of said doors for causing the lock to actuate the controlling means to bring the car to a state of rest irrespective of its position in the hatchway.

7. In an elevator, motor-controlling means, a series of corridor-doors, and means including an electric circuit adapted to be closed by the opening of one of said doors, for operating said motor-controlling means to bring it to a neutral position and stop the travel of the car, irrespective of the position of the car in the hatchway.

8. In an elevator, motor-controlling means, a series of corridor-doors, an electric circuit including an electromagnet and make-and-break devices controlled by the doors, and means actuated by said magnet when one of the doors is open, for operating the motor-controlling means to bring it to a neutral position and stop the travel of the car irrespective of the position of the car in the hatchway.

9. In an elevator, motor-controlling means, a series of corridor-doors, a lock on the outside of the car for locking the controlling means thereto against movement and an electric circuit including an electromagnet, and adapted to be closed by opening one of the doors, for causing said electromagnet to actuate the lock to hold the car against movement.

10. In an elevator, motor-controlling means including a line relatively to which the car travels, a lock on the car for locking the line thereto, and an electric circuit closed by opening one of the doors and including an electromagnet which actuates the lock, whereby when one of the doors is opened, the line is locked to the car to bring said car to a state of rest.

11. In an elevator, motor-controlling means including a line relatively to which the car travels, and an electrically-actuated lock adapted to lock the line to the car, and thrown into operative position by the opening of a corridor-door, which lock, upon locking the line to the car, brings the car to a state of rest.

12. In an elevator, motor-controlling means including a line relatively to which the car travels, a lock mounted on the car and consisting of two members adapted to engage the line between them, and an electromagnet, the circuit through which is closed by opening one of the corridor-doors, for causing said members to engage the line to stop the travel of the car, upon one of the doors being open.

13. In an elevator, motor-controlling means including a line relatively to which the car travels, a lock mounted on the car, and consisting of a stationary member and a movable member adapted to clamp the line between them, a sliding bar to which the last said member is pivoted, toggle-levers pivoted to the car and to the said sliding bar, a stop to limit the movement of the toggle-levers, and means for actuating said toggle-levers.

14. In an elevator, motor-controlling means including a line relatively to which the car travels, a lock mounted on the car and consisting of a stationary member and a movable member adapted to clamp the line between them, toggle-levers for actuating said movable member, and an electromagnet controlled by the doors leading into the hatchway, for operating said toggle-levers, where-

by when one of said doors is open said electromagnet is energized and the line is locked to the car to stop the travel of the latter.

15. In an elevator, controlling means, an electrically-actuated lock for said means, an electric circuit arranged to be closed by the opening of a door for operating the lock, and a circuit-breaker normally closing the circuit and arranged to be manipulated to break the circuit temporarily and to return to its normal position automatically.

16. The combination of an elevator-car, a landing-door, a controlling-rope, magnetic gripping mechanism on the car adapted to grip the controlling-rope, a contact device actuated by the door, and wires connecting the contact device with the gripping mechanism so that as soon as the door is opened, the contact will be made and the gripping-jaws closed on the rope.

17. In an elevator, motor-controlling means, a series of corridor-doors, and means including an electric circuit adapted to be closed by the opening of any one of said doors for operating said motor-controlling means to bring them to a neutral position and stop the travel of the car.

18. In a safety device for elevators, the combination with the controlling devices for the motor, of mechanism for operating said controlling devices so as to move said controlling devices to an inactive position to prevent movement of the motor, said mechanism being normally inactive to allow the controlling devices to be freely operated from the car, a series of horizontally-movable doors, and a connection between said mechanism and said doors, whereby the opening of any one of said doors will cause said mechanism to operate and move the controlling devices to an inactive position so as to stop the motor.

19. A safety device for elevators, comprising means normally retracted from the elevator-controlling mechanism but adapted to engage and move the same to an inactive position, an electromagnet for controlling said means, a safety-circuit for said magnet and a circuit breaker or closer controlled by a door adjacent to the elevator-shaft.

20. In an elevator, controlling means, a lock on the car for said means, an electromagnet on the car for actuating said lock, a door, an electric circuit including make-and-break devices for energizing the electromagnet to actuate the lock when the door is open, and a switch for cutting out the make-and-break devices.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 17th day of February, A. D. 1897.

CHARLES A. HARKNESS.

Witnesses:
MARCUS B. MAY,
C. C. STECHER.