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E. L. & G. HAIL.

ELECTRIC ELEVATOR SAFETY APPLIANCE.

APPLICATION FILED APR. 1, 1902.

NO MODEL.

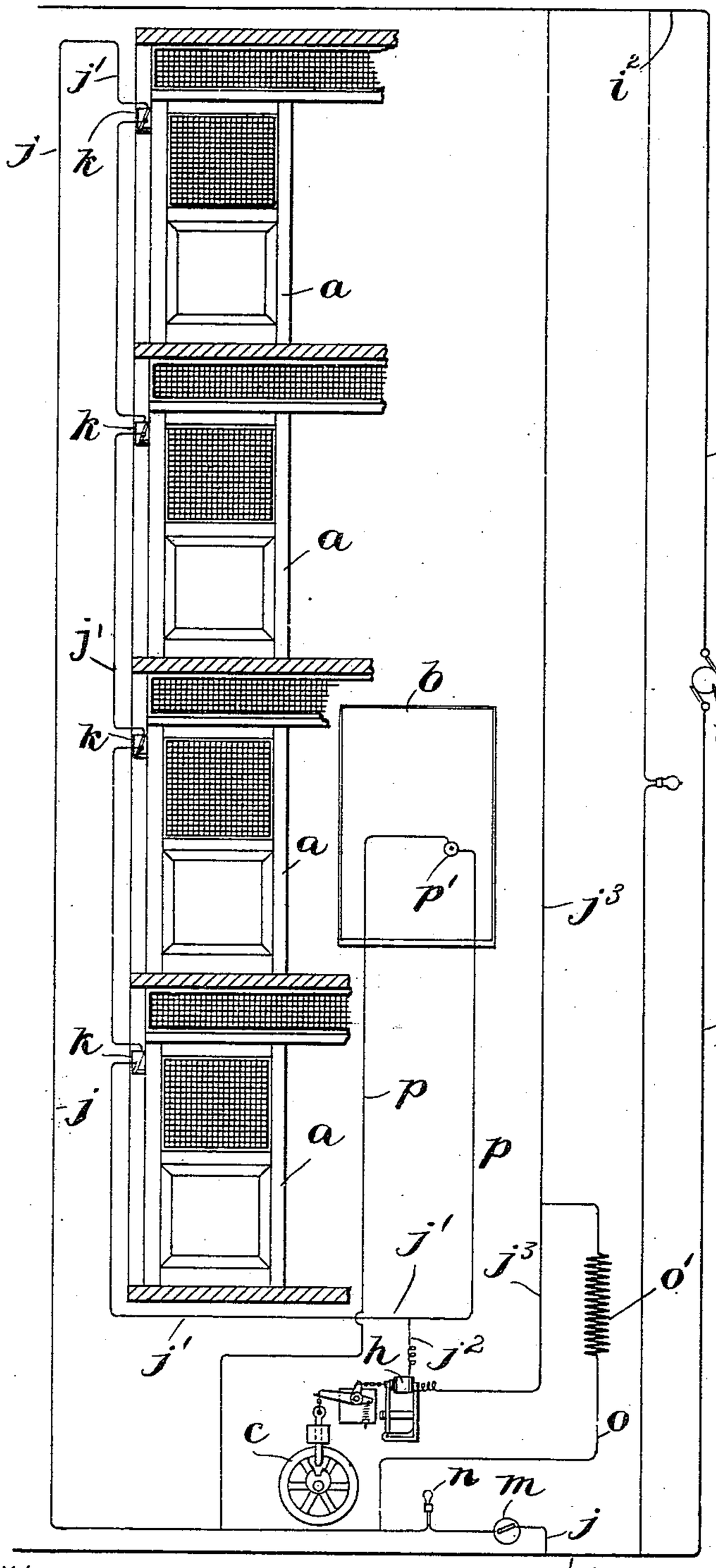

FIG. 1.

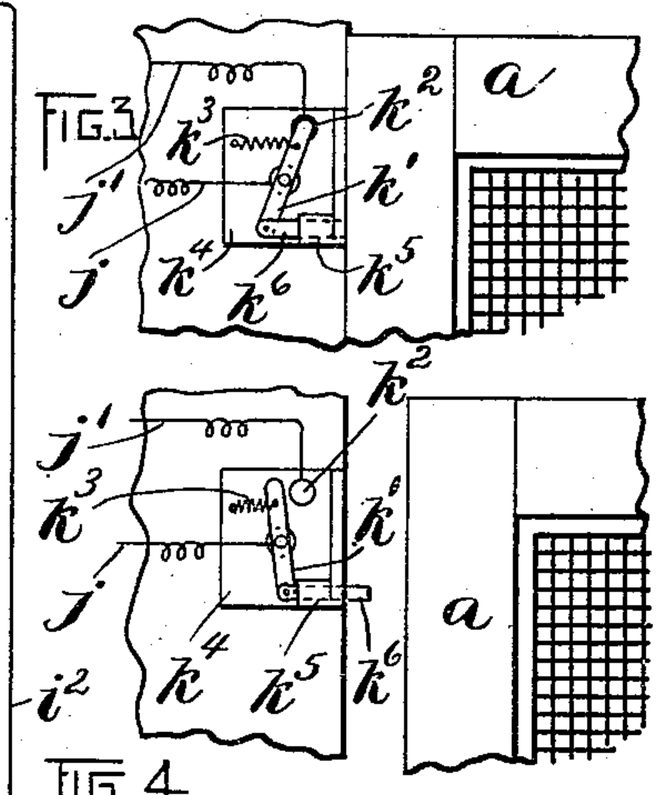

FIG. 3.

FIG. 4.

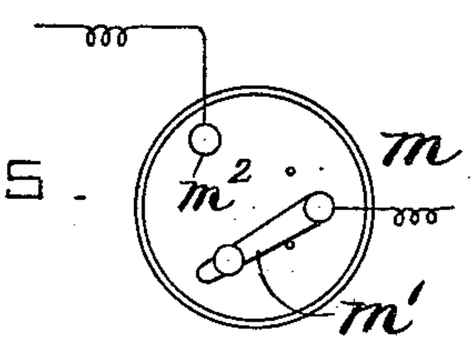

FIG. 5.

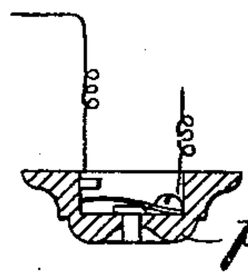

FIG. 6.

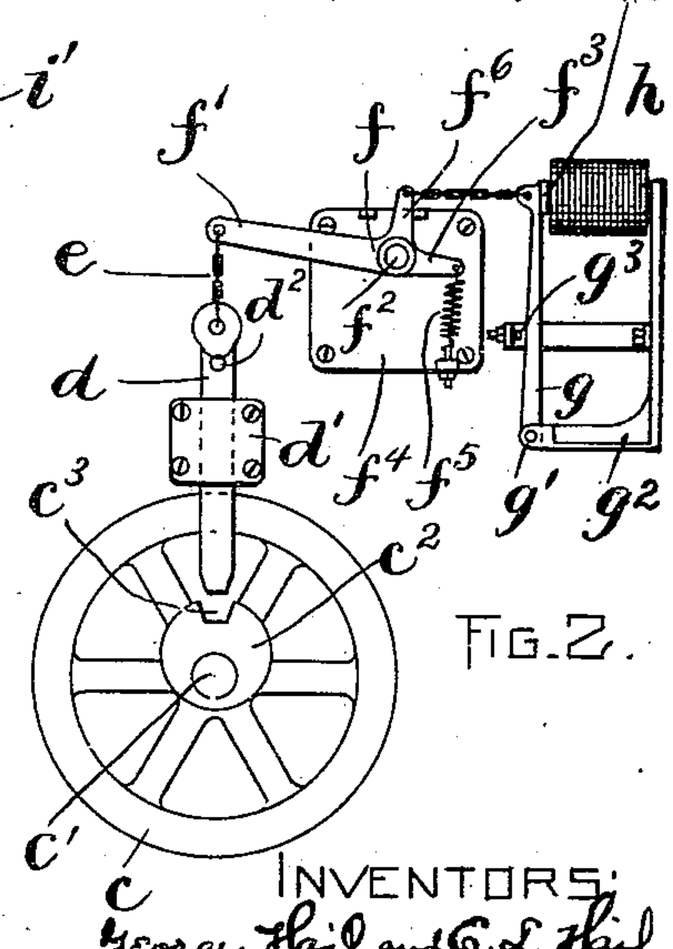

FIG. 2.

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No. 733,715. Patented July 14, 1903.

UNITED STATES PATENT OFFICE.

EDWARD L. HAIL AND GEORGE HAIL, OF PROVIDENCE, RHODE ISLAND.

ELECTRIC ELEVATOR SAFETY APPLIANCE.

SPECIFICATION forming part of Letters Patent No. 733,715, dated July 14, 1903.

Application filed April 1, 1902. Serial No. 100,958. (No model.)

To all whom it may concern:

Be it known that we, EDWARD L. HAIL and GEORGE HAIL, of Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Electric Elevator Safety Appliances, of which the following is a specification.

This invention has relation to elevator safety mechanisms by means of which the car is prevented from leaving a landing when the door thereat is open or ajar, and relates more particularly to that class of mechanisms in which the locking mechanism is electrically controlled.

The object of the present invention is to provide certain improvements in mechanisms of the class named by means of which the construction is simplified, the installation is more easily effected, the certainty of operation increased, and the general efficiency enhanced.

On the accompanying drawings, Figure 1 represents in diagrammatic view one embodiment of the invention. Fig. 2 represents the locking device in detail. Figs. 3 and 4 represent a door-controlled switch. Fig. 5 represents the main switch. Fig. 6 represents in section the switch on the car.

On the drawings the landing-doors, which open into the elevator-well, are indicated at a, the elevator-car at b, and the wheel by which the motor of the hoisting mechanism is controlled at c. The direct valve or motor-controlling mechanism, shown in this case as the wheel, is governed by the usual hand-rope or by a lever on the car, neither of which is shown, as they are well known, said wheel being illustrated as the valve-wheel of a hydraulic apparatus. To the shaft c' of the wheel is secured a locking member consisting of an eccentric or cam c^2, having a notch or socket c^3. With the member c^2 is adapted to engage a complemental locking member consisting of a vertically-movable bolt d, arranged to slide in a suitable guide d', attached to a stationary support. (Not shown.) A stop d^2 limits the extent to which the bolt may drop.

The wheel may be directly locked by the engagement of the locking-bolt therewith or by engaging a recess in an auxiliary or locking member connected to the shaft and movable therewith and being in locking effect identical therewith. Therefore in the statement in the claims that the locking-bolt directly engages the said wheel it is apparent that the member c^2 is to all intents and purposes a part of the wheel. This is in contradistinction to locking the valve-rope, which extends around the wheel and which is subject to stretching and shrinking under varied atmospheric or thermal conditions.

A chain or other flexible or articulated connection e connects the bolt with the long arm f' of a three-arm lever f, fulcrumed at f^2 to a plate f^4 and having a rotating motion about a center. To the arm f^3 of the lever is attached the rod of a helical spring f^5, which exerts a tension slightly less than the weight of the bolt d, so as to partially balance it and yet permit the bolt to drop by gravity into engagement with the notched member c^2. This spring constitutes a counterbalancing member for minimizing the amount of energy necessary to operate or lift the bolt d and to swing or oscillate the lever f about its center of motion. This member therefore acts in the same direction as the armature and permits of the employment of a less powerful magnet than would be required were the spring or its equivalent omitted.

The short arm f^6 of the lever f plays between two stops on the plate f^4 and is connected by a chain or other connection with a lever g, fulcrumed at g' to a bracket g^2 and limited in its movement by an adjustable stop g^3. The end of the lever g carries the armature h' of a magnet h, which when a circuit is passed through its coils attracts the armature and lifts the bolt to an inoperative position. Upon the circuit being broken the armature is released and the bolt is allowed to drop into engagement with the complemental member.

The lever f operates as a device for multiplying the movement imparted from the armature to the bolt, since the movement of the armature is much smaller than is requisite for the bolt. It is evident that other electromagnetic devices, such as a solenoid and core, might be employed in lieu of the magnet and armature thus described.

The current of electricity is supplied from a generator i through the main conductors i' i^2 and a branch circuit comprising the conductors j j' j^2 j^3, the magnet h, and a series of normally closed door-controlled switches, (in-

dicated as a whole at $k\,k$.) Any form of switch may be employed, though the one shown in Figs. 3 and 4 is satisfactory. Referring to said figures, k' indicates the switch-lever or movable contact, and k^2 the stationary contact, from which the movable contact is drawn by a spring k^3 when the door a is opened. The plate k^4, on which the lever k' is fulcrumed and which is attached to the door-frame, has a tubular guide k^5 for a finger k^6, pivoted to the lever k' and projecting into the path of the door in such a way that when the door is fully closed its edge engages the finger and thrusts it to the position shown in Fig. 3 to close the electrical connection between the lever k' and the contact k^2. Upon the initial movement of the door to open position the spring k^3 effects the breaking of the electrical connection, and consequently the bolt d is released by the magnet h.

In the branch circuit between the conductors i' i^2 is placed a main switch m, having a normally operable lever m' and a stationary contact m^2, (see Fig. 5,) and an illuminating-lamp n, which may be located in some place where a light is continuously needed. Between the conductors j and j^3 is inserted a circuit consisting of a conductor o and a rheostat or resistance o', and between the conductor j and the conductor j^2 is a shunt or loop circuit consisting of a conductor p, leading to the car, and a normally open spring-switch p'. (See Fig. 6.) The provision of the last-mentioned shunt or loop circuit provides for the attendant on the car temporarily closing the circuit through the magnet to retract the bolt d in case any one of the doors be opened at a landing different from that at which the car happened to be located or in case a door be opened when the car is between two landings. The spring-switch, being held normally open, will return automatically to said normal position when the attendant removes his finger, and there is no chance for him to permanently throw the door-switches out of action.

The provision of the gravity-lock in conjunction with the normally closed door-circuit provides against the apparatus getting out of order without the knowledge of the attendant, as is often the case when a normally open circuit is employed, since the breaking of the circuit releases the lock, which by its weight is caused to lock the controlling mechanism. Again, the breaking of the circuit at night by means of the main switch m effectively prevents any one from accidentally or maliciously starting the car after the attendant has left it, as for the night.

The flexible line by means of which the attendant controls the valve-wheel is subject to changes and variations from thermal and other atmospheric conditions, as well as from its usage, and it is therefore desirable in many cases to relieve it from all unnecessary strain and wear. Consequently for this reason we so arrange the safety apparatus that the bolt engages the valve-wheel or some part directly connected thereto.

We do not herein claim, broadly, the electric system including the arrangement of the circuit j^3 and the resistance-circuit o and the door-circuit in multiple, as it forms the subject-matter of an application, Serial No. 101,922, filed concurrently herewith by George Hail.

Having thus explained the nature of the invention and described a way of constructing and using the same, although without attempting to set forth all of the forms in which it may be made or all of the modes of its use, we declare that what we claim is—

1. A safety appliance for elevators, comprising a valve-wheel located at the bottom of the well, a car movable relatively thereto, a gravity-lock for said wheel, an electromagnet and its armature, connections between said armature and said lock by which the unlocking movement imparted to the lock is multiplied in transmission from the armature, and a normally closed electric circuit including said magnet and also including one or more door-controlled switches, whereby when the doors are closed the lock is held in operative position, but drops by gravity into position to prevent the actuation of said valve-wheel upon the opening of a door and the breaking of the circuit.

2. A safety appliance for elevators, comprising a valve-wheel having a locking member, a plurality of doors, a car movable relatively to said valve-wheel, a sliding lock for engaging with the locking member on the said valve-wheel, an electromagnet having its armature connected to said lock, switches adapted to be operated by the doors, and a normally closed electric circuit including said switches and said electromagnet for holding said sliding lock in an inoperative position, whereby the breaking of the circuit effects the release of the lock and permits it to slide into engagement with the locking member on the valve-wheel.

3. A safety appliance for elevators, comprising a plurality of doors, a valve-wheel, a lock to prevent the actuation of the said valve-wheel, an electromagnet and its armature connections between the armature and the lock comprising a flexible member, switches adapted to be operated by said doors, and a normally closed electric circuit including said switches and said electromagnet for holding said lock in an inoperative position while the said doors are closed.

4. A safety device for elevators comprising a valve-wheel and a locking member connected thereto, a car movable relatively to said valve-wheel, a lock adapted when released to move into engagement with the said locking member, an electromagnet having an armature, flexible connections between the armature and locking member by which the movement imparted to the locking member is multiplied in transmission from the armature,

door-controlled switches, and an electric circuit including said switches and said magnet, substantially as described.

5. A safety appliance for elevators, comprising a valve-wheel, a car movable relatively to said valve-wheel, a locking member adapted when released to move into position to prevent actuation of the said wheel, an electromagnet having an armature, connections between the armature and the locking member, by which the unlocking movement imparted to the locking member is multiplied in transmission from the armature, door-controlled switches, and a normally closed electric circuit including said switches and said magnet, substantially as described.

6. A safety appliance for elevators, comprising a valve-wheel, a car movable relatively to said valve-wheel, a counterbalanced locking member adapted to move into position to prevent the actuation of the said wheel, an electromagnet, an armature, and means for multiplying the movement transmitted from the said armature to the operative portion of the said locking member, door-controlled switches, and a normally closed electric circuit including said switches and said magnet.

7. A safety appliance for elevators, comprising a valve-wheel, having a locking member connected thereto, a rectilineally-movable locking-bolt to engage the said locking member connected to the valve-wheel, a bell-crank lever having a short arm and a longer arm, its longer arm loosely connected to the bolt, an electromagnet and its armature, connections between said armature and the shorter arm of said bell-crank, and a door-controlled electric circuit including the magnet.

8. A safety appliance for elevators comprising a direct motor-controlling mechanism at the bottom of the well, a locking member to prevent the actuation of the motor-controlling mechanism, a fulcrumed lever having a short arm and a longer arm, an electromagnet and its armature, connections between said armature and the short arm of said lever, yielding connections between the longer arm of said lever and said locking mechanism, and a door-controlled electric circuit including said magnet.

9. A safety appliance for elevators comprising a plurality of doors, a valve-wheel, a lock to prevent the actuation of said valve-wheel, a car movable relatively to said valve-wheel, an electromagnet and its armature, an articulated connection between said armature and said lock, switches adapted to be operated by said doors, and an electric circuit including said switches and said electromagnet whereby the lock is in an inoperative position when said doors are closed but prevent the actuation of the said valve-wheel when the doors are opened.

10. A safety appliance for elevators, including a car, a controlling device, a lock therefor, an electromagnet which when energized holds the lock in inoperative position, a door-controlled normally closed electric circuit including the magnet, and a loop-circuit in multiple with the magnet and including a normally open switch on the car for temporarily closing the circuit through the magnet when the door-controlled circuit is broken.

11. A safety appliance for elevators, including a car, a valve-wheel, a lock therefor, a door-controlled circuit including a magnet coacting with said lock, and a branch circuit in multiple with the magnet and including a switch located on the car for releasing the controlling device from the lock.

12. A safety appliance for elevators comprising a plurality of doors, a direct motor-controlling mechanism located entirely at the bottom of the well, a car movable relatively to said direct motor-controlling mechanism, a lock including a movable bolt adapted to engage said controlling mechanism, an electromagnet and its armature, a movable connection between said armature and said lock, switches adapted to be operated by said doors, and an electric circuit including said switches and said electromagnet whereby the lock is in an inoperative position when said doors are closed but prevents the actuation of said controlling mechanism when the doors are opened.

13. A safety appliance for elevators comprising a controlling device, located entirely at the bottom of the well, a car movable relatively to said motor-controller, a locking member adapted to move into engagement with said motor-controller, an electromagnet, an armature, a counterbalancing means connected with said locking member and acting in the same direction as the armature for counterbalancing the locking member and reducing the power required to operate said locking member, said locking member, said electromagnet, said armature, and said counterbalancing means, being all located at the bottom of the well in juxtaposition to the controlling device, door-controlled switches, and an electric circuit including said switches and said electromagnet.

14. A safety appliance for elevators comprising a motor-controller, a car movable relatively thereto, a locking member relatively to which the car is movable adapted to move into engagement with said motor-controller, a plurality of doors, operative means between said doors and said locking member whereby when any one of said doors is open, said motor-controller is locked by the locking member, and counterbalancing means connected with said locking member and acting in the same direction as the operative means whereby a relatively small amount of power is required to operate said locking member.

15. A safety appliance for elevators comprising a plurality of doors, a motor-controller, a car movable relatively to said motor-controller, and a lock relatively to which the car is movable adapted to engage said motor-controller and consisting of a locking mem-

ber, an electromagnet, an armature, a counterbalancing member for minimizing the amount of energy required to operate the said lock, door-controlled switches, and an electric circuit including said switches and said magnet.

16. A safety appliance for elevators, comprising a direct motor-controlling mechanism located at the bottom of the well, a car movable relatively thereto, a gravity-lock for said controlling mechanism and including a bolt, an electromagnet and its armature, connections between said armature and said bolt by which the movement imparted to the said bolt is multiplied in transmission from the armature, an electric circuit including said electromagnet and also including one or more door-controlled switches, whereby the lock is in an inoperative position when said doors are closed but engages the said controlling mechanism when the doors are open.

17. A safety appliance for elevators, comprising a direct motor-controlling mechanism located at the bottom of the well, a car movable relatively thereto, a lock for said controlling mechanism including a counterbalanced member adapted to make a locking engagement with the said controlling mechanism, an electromagnet and its armature, and means by which the movement imparted by the armature is multiplied in transmission from the armature to the point of said locking engagement.

18. In a safety device for elevators, the combination of a direct motor-controlling mechanism, a locking member, a flexible connection, a rotating member, a door, an electric circuit including a make-and-break device to be actuated by the said door, and an electromagnetic device to operate the said locking member.

19. In a safety device for elevators, the combination of a direct motor-controlling mechanism, a locking member, a rotating member, a flexible connection operated by said rotating member, a door, an electric circuit including a make-and-break device to be actuated by said door, and an electromagnetic device to operate the said rotating member.

20. A safety appliance for elevators, comprising a direct motor-controlling mechanism, a car movable relatively to said motor-controlling mechanism, an electromagnet having an armature, a lock adapted to prevent actuation of said motor-controlling mechanism, said lock including a locking member and yielding connections, whereby said locking member may be retracted when the said lock is in locking position, door-controlled switches, and an electric circuit including said switches and said magnet.

21. A safety appliance for elevators, comprising a direct motor-controlling mechanism, a car movable relatively to said motor-controlling mechanism, an electromagnet having an armature, a locking member to prevent actuation of said motor-controlling mechanism, yielding connections between said armature and said locking member whereby said locking member may be retracted independently of said armature, door-controlled switches, and an electric circuit including said switches and said magnet.

In testimony whereof we have affixed our signatures in presence of two witnesses.

EDWARD L. HAIL.
GEORGE HAIL.

Witnesses:
HENRY A. GREENE,
AUGUSTA ALLEN.