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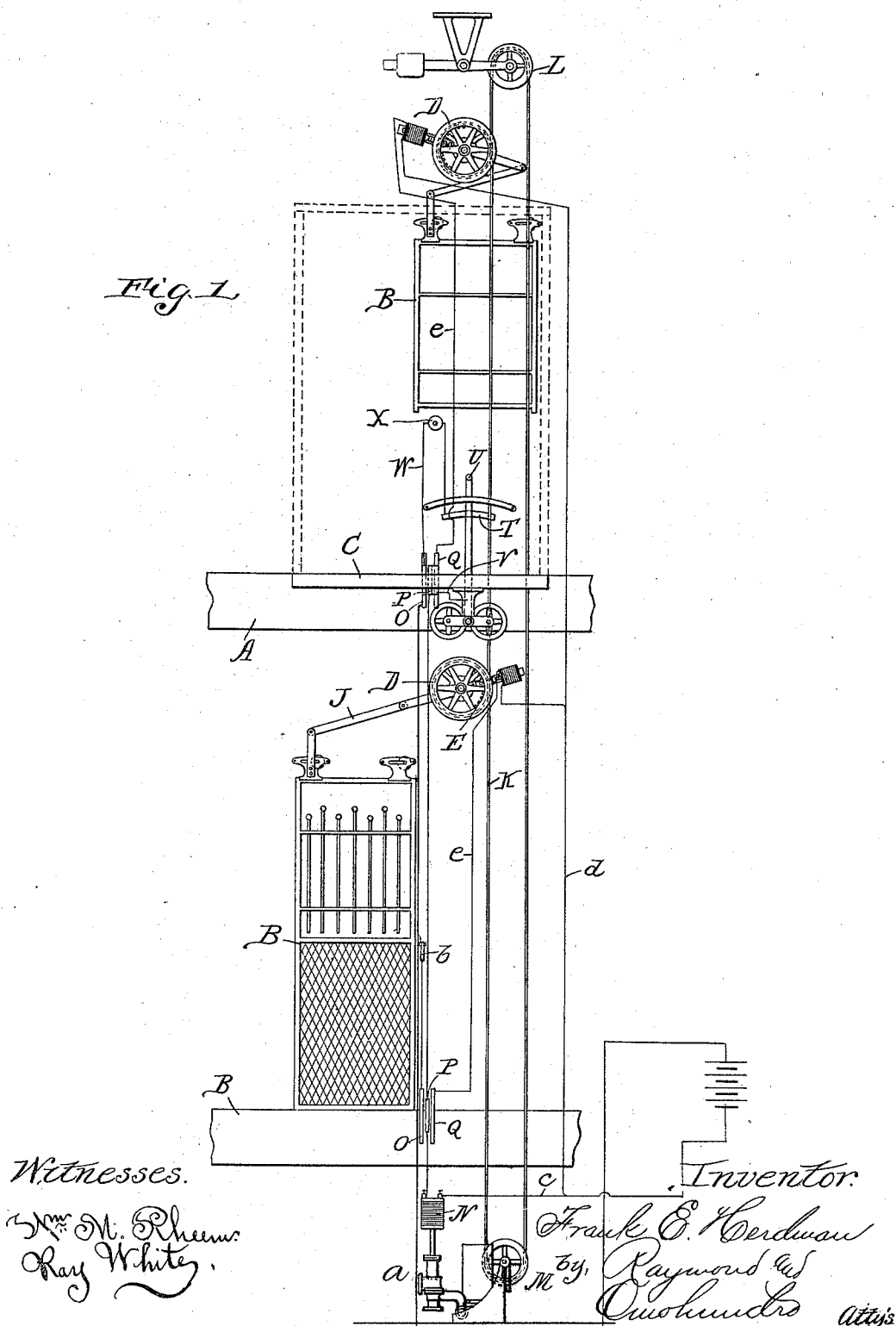
4 Sheets—Sheet 1.

F. E. HERDMAN.

DOOR OPENING OR CLOSING APPARATUS FOR ELEVATORS.

No. 570,476

Patented Nov. 3, 1896.



Witnesses.

Mr. M. Rheem
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Inventor:

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(No Model.)

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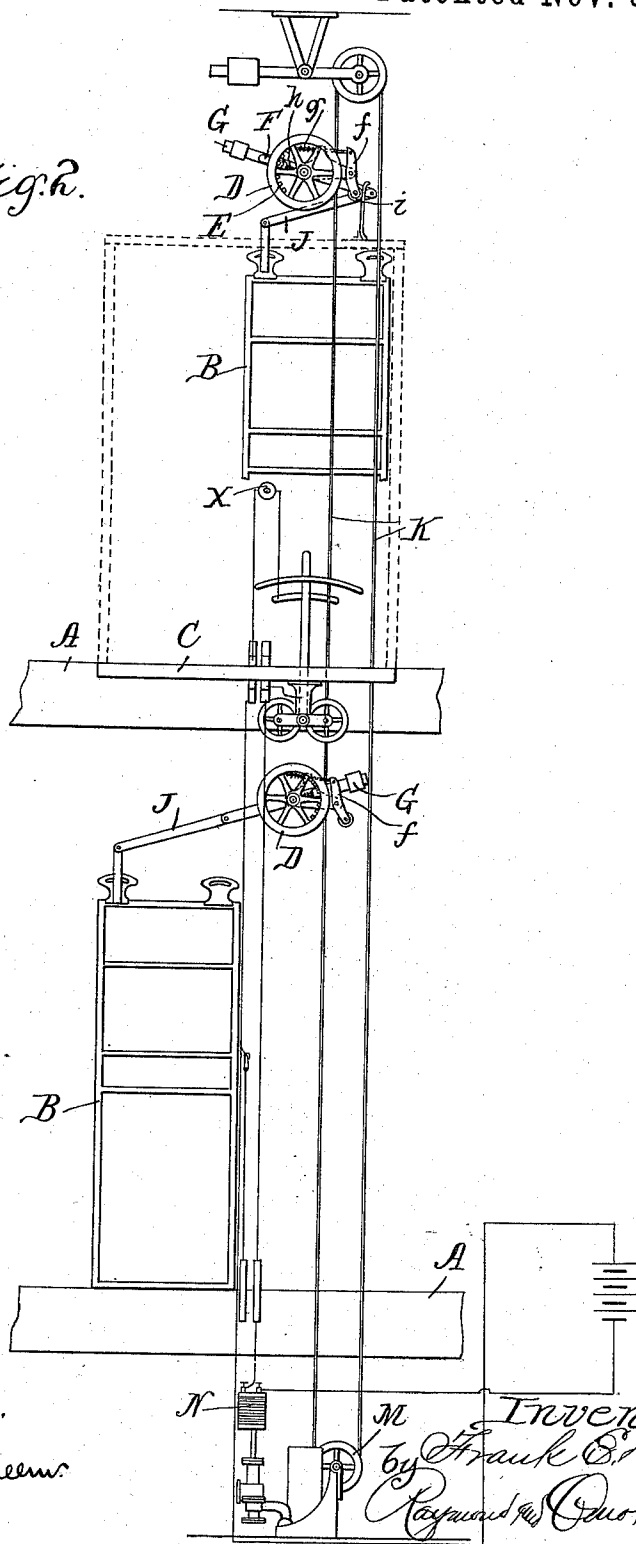
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Fig. 2.



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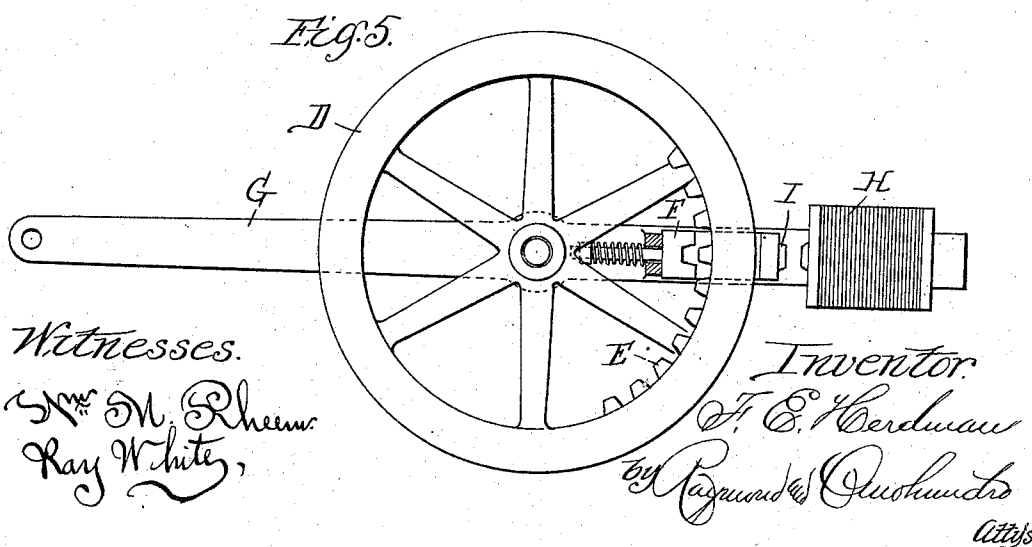
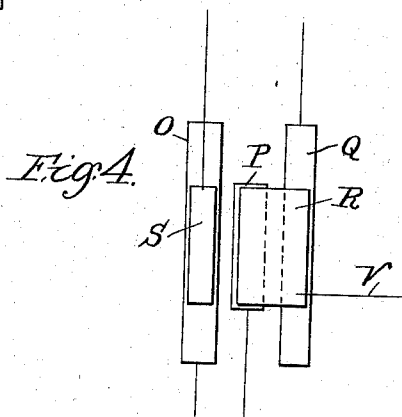
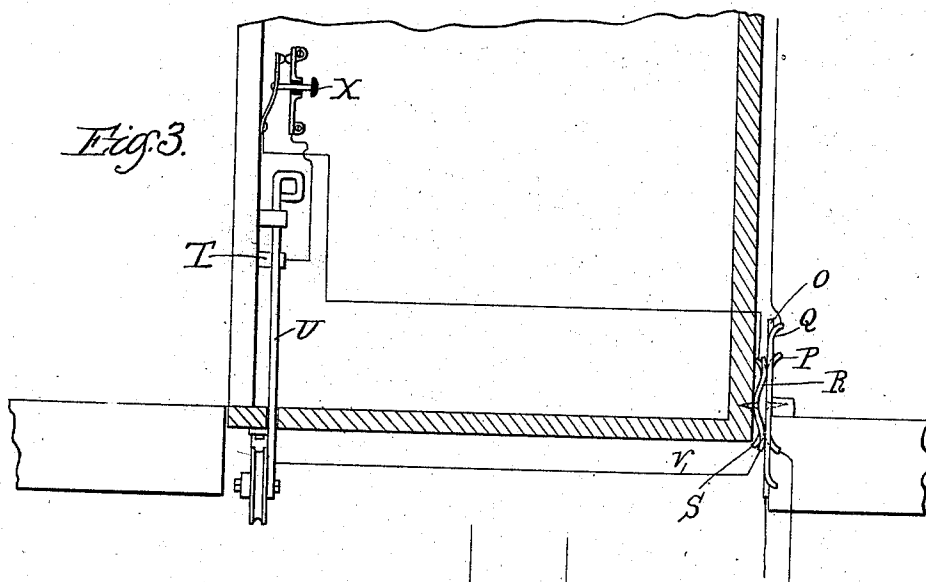
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4 Sheets—Sheet 4.

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Fig. 6.

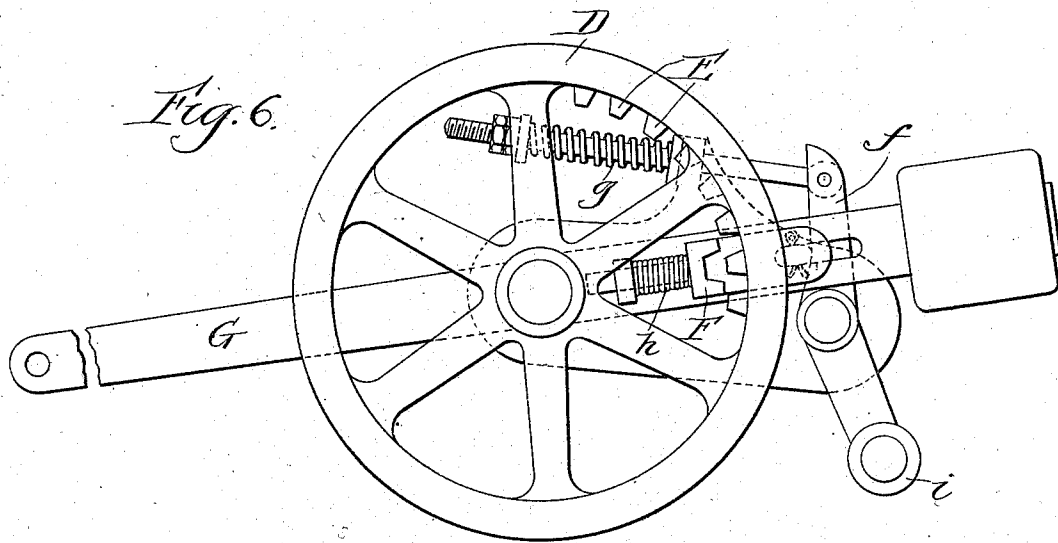


Fig. 7.

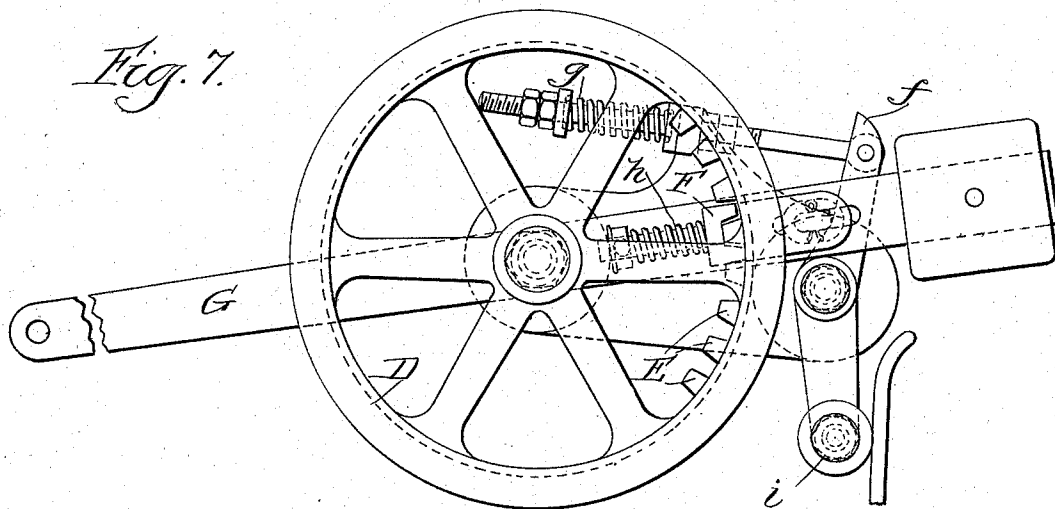
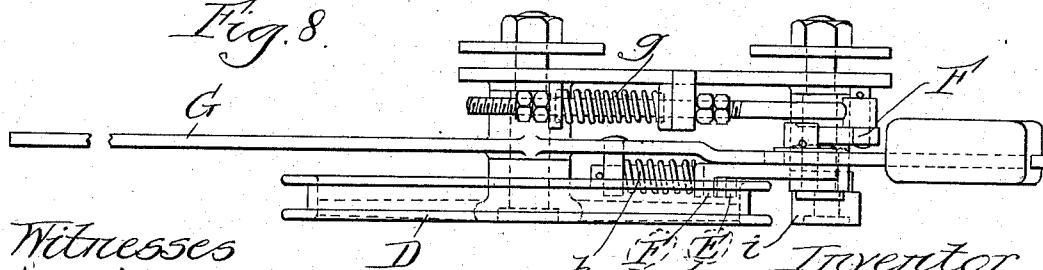


Fig. 8.



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UNITED STATES PATENT OFFICE.

FRANK E. HERDMAN, OF WINNETKA, ILLINOIS.

DOOR OPENING OR CLOSING APPARATUS FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 570,476, dated November 3, 1896.

Application filed September 27, 1895. Serial No. 563,887. (No model.)

To all whom it may concern:

Be it known that I, FRANK E. HERDMAN, a citizen of the United States, and a resident of Winnetka, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Door Opening and Closing Apparatus for Elevators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

This invention relates to improvements in door opening and closing apparatus for elevators, and has for its prime object the provision of devices whereby the doors of an elevator-shaft will be automatically opened and closed by the stopping of the elevator-car at any floor of the building.

Another object is to have the door opening and closing mechanism operated, in whole or in part, by electricity, in such manner that the entire apparatus may be electrically operated and controlled, or mechanically operated but electrically controlled.

A further object is to have in an apparatus of this character the capability of complete automatic operation in both opening and closing the doors or manually controlled, whereby the opening of the doors need not take place until the elevator-car arrives at a landing, and the closing of the doors may take place before the car leaves a landing or floor.

These and such other objects as may hereinafter appear are attained by the devices illustrated in the accompanying drawings, in which—

Figure 1 is a diagrammatic elevation of two floors of a building, showing devices applied thereto embodying my invention electrically operated and controlled; Fig. 2, a similar view to Fig. 1, but showing the devices mechanically operated but electrically controlled. Fig. 3 is a detail section of the car, showing the circuit making and breaking devices applied thereto; Fig. 4, a detail view of the contact-plates, and Fig. 5 a detail view of the electrically-operated door-opening mechanism. Figs. 6, 7, and 8 are detail views showing the construction and arrangement of parts of the door opening and closing mechanism,

in which the devices are mechanically operated and electrically controlled.

Similar letters of reference indicate the same parts in the several figures of the drawings.

In the preferred form of my invention the control devices are automatically operated by the control-lever of the elevator-car, which operates the valve controlling the lifting-cable of the car in such manner that, when the lever is at a central or "stopped" position the door-opening mechanism will be brought into play, while, if the lever is in a position for either an "up" or "down" travel of the car, the door opening and closing mechanisms will remain inoperative, or, rather, when moved from stopped to up or down position the door-operating mechanism at the floor at which the car has stopped will be permitted to close the door and then remain inoperative until it is desired to again open it. It is within the contemplation of my invention, however, to have the control devices of such character that the door may be either opened and closed or closed only, without movement of the control-lever, the motor in all cases, however, being controlled electrically. It is also within the purview of my invention to have the door opening and closing mechanism purely mechanical in its character and simply electrically controlled in its operation.

With these ends in view I have illustrated in the drawings different embodiments of my invention, which I will now proceed to describe, it being understood that but two floors of a building are illustrated in Figs. 1 and 2, and the elevator-car is supposed to have stopped at the upper or second floor, at which the door is shown open, while the lower door is closed.

Referring by letter to the accompanying drawings, let A indicate the floors of a building and B doors of the elevator-shaft, in which works, in any usual or preferred manner, an elevator-car, the floor C of which is shown in the drawings. The door opening and closing mechanism at each floor comprises a wheel D, suitably journaled at the side of the elevator-shaft and provided with a segmental rack or teeth E, with which engages a spring-

actuated lock-bolt F, which is normally held out of engagement with the teeth by its spring. This lock-bolt is mounted upon a lever G, loosely journaled upon the axle or pivot of the wheel D, and having mounted upon one end thereof an electromagnet H, the armature I of which is secured to a projection on the lock-bolt F, so that when the said magnet is energized to attract its armature the lock-bolt is thrown into engagement with the teeth or projections E on the wheel D, and thereby locks the lever G to the wheel, so as to cause said lever to turn with the wheel. This lever is connected by a link J with the door B, so that when the lever is turned upon its pivot in one direction the door will be opened, and when turned in the opposite direction the door will be closed, the attachment of the link to the door and the pivot of the lever being so arranged that the pivotal connection between the lever and the link when the door is closed will be brought to a dead-center, and thereby serve as a lock for the door to prevent the opening of the same except by rocking the lever.

The series of wheels D are actuated by an operating-cable K, which is trained around and preferably secured to each of the wheels D, and is also trained over a pulley at the top of the shaft and a drum M at the bottom of the shaft, which latter is driven by any suitable motor, a hydraulic motor being shown in the drawings, the valve of which is actuated and controlled by the electromagnet N, so that when said magnet is energized the valve of the motor will be opened and the operating-cable driven to cause the opening of a door. Of course, at all of the landings, except that at which the car has come to rest, the electromagnets H are not energized, and hence the wheels D at such landings are free to turn without causing the opening of the door.

I do not desire to limit myself, however, to a hydraulic motor, or to a motor of any particular kind or construction, it simply being necessary to my construction to have some form of motor whose operation can be controlled by the electromagnet N and which will actuate the operating-cable. For the carrying out of my invention in its preferred form I employ at each landing three contact-blocks O P Q, and upon the elevator-car two contact-plates R and S, as will be more clearly seen in Fig. 4, the contact-plate R being broad enough to close the circuit between the blocks P and Q, while the contact-plate S closes the circuit through the contact-block O.

The contact-blocks O and P are in the main circuit containing the magnet N, while the contact-block Q is in a branch circuit containing the magnet H of the door opening and closing mechanism. In the car is a metallic plate T, adapted and arranged to be engaged by the operating-lever U of the car whenever the latter is in a central position, the lever being connected with the contact-plate R by the wire V and the contact-plate T being con-

nected by the wire W with the contact-plate S. This lever U is connected with the elevator-control cables, and for this purpose it may be provided with pulleys on which said cables can be trained. In the line between the plates T and S, I prefer to insert a push-button X, through which the circuit is normally closed, so that when desired the circuit may be broken at this point to permit the closing of a door before the elevator-car leaves a landing. One line of the main circuit, which comes in over wire *a*, is connected serially through the contact-blocks O, the connection at the first landing, however, having an ordinary switch *b*, so that when the elevator-car is at the bottom of the shaft this switch may be thrown so as to break the circuit at that point and prevent the operation of the door-opening mechanism while the operator is away from his car. The other line of the circuit, coming in over the wire *c*, is connected serially with the contact-blocks P, and also in branches by wires *d* with the electromagnets H of the door-opening mechanism, which latter are in turn connected by wires *e* with the contact-blocks Q, and from thence through the contact-plate R to the other line of the circuit.

The purpose of making the contact-blocks P shorter than the contact-blocks O and Q is to energize and actuate the magnet H of the door opening and closing mechanism before the motor is started up and, through the operating-cable, made to open the door. It is preferable that the locking of the door-opening mechanism and the operation of the motor should be successive, although no particular harm would result if they were practically simultaneous, and, indeed, the locking might occur after the motor had commenced operation without defeating the object of my invention, but such operation would be liable to injure the mechanism.

B' designates the battery or other source of electrical energy.

It will thus be seen that where the mechanism is electrically operated and controlled whenever the car reaches a landing or floor the circuit will be first closed through the electromagnet operating the clutch of the door opening and closing mechanism at such floor by the operating-lever U being brought to the center and making contact with the plate T, which closes the electric circuit through not only such magnet, but also the control-magnet N of the motor. When the control-lever is thrown to either side of the center to cause the car to move up or down in the shaft, the circuit will be broken and the door will be re-closed through the operation of the motor in the escape of the operating-fluid, or by any suitable connections which it may be desired to make that will be thrown into operation upon the breaking of the electric circuit, such connections being common and well understood. If, however, it should be desirable to close the door before the car starts to leave a landing, then the operator, by pressing upon

the push-button X in the car, will break the circuit and cause the same result as if the control-lever were thrown over to break the circuit. It is also obvious that the connection for the operating-lever to make and break the circuit may be entirely dispensed with and the circuit be closed at each floor by the passage of the car, but such passage would be made with sufficient speed to prevent the motor from getting under operation and cause the opening of the door unless the car stopped at a floor. In such case when the car left the floor the doors would close automatically, or by the employment of the push-button the circuit might be broken and the door closed before the car started to leave the floor.

In the electromechanical construction illustrated in Figs. 2, 6, 7, and 8 the only difference in the operation is as to the door opening and closing mechanism, which is purely mechanical, and thus saves considerable wiring and the location of magnets in the shaft. In this construction the locking-bolt is normally held out of engagement by the lever *f*, actuated by a spring *g*, of greater strength than the spring *h*, which works upon the lock-bolt, and hence when the lever is unrestrained the lock-bolt would be normally held out of engagement with the teeth or projections on the wheel D. On the top of the car is located a shoe or engaging device, which strikes the free end of the lever *f*, or a roller *i* thereon, overcomes the tension of the spring *g* actuating this lever, and permits the spring *h* of the lock-bolt to shoot the bolt out into engagement with the teeth or projections on the wheel. This action will, of course, occur at each floor as the car passes, but unless the control devices have been actuated to put the motor for the operating-cable into action the door will not be opened.

The mechanically-operated door opening and closing mechanism just described is not claimed specifically in this application.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a door opening and closing apparatus for elevators, the combination with an elevator-car, a door-opening mechanism, an operating-cable therefor, and a motor, of an electric circuit, an electromagnet in said circuit operating the valve of said motor, and means upon the elevator-car for making and breaking said electric circuit, substantially as described.

2. In a door opening and closing apparatus for elevators, the combination with an elevator-car, a door-opening mechanism, an operating-cable therefor, and a motor for said cable, of an electric circuit, an electromagnet included in said circuit for operating the valve of said motor, and means carried by the car for automatically making and breaking said circuit, substantially as described.

3. In a door opening and closing apparatus for elevators, the combination with an elevator-car, a door opening and closing mechanism comprising an electromagnetic clutch, an operating-cable for such mechanism, and a motor for said cable, of an electric circuit in which is included the magnet of the said clutch, an electromagnet for operating the valve of the motor, and means carried by the car for making and breaking said circuit, substantially as described.

4. In a door opening and closing apparatus for elevators the combination of a door-opening mechanism, a motor at the bottom of the elevator-shaft adapted to actuate said mechanism, and lever-control devices upon the car connected in electric circuit with the motor and adapted to set the latter in operation, substantially as described.

5. In a door opening and closing apparatus for elevators the combination with an elevator-car, a door-opening mechanism, an operating-cable therefor, and a motor for said cable, of an electric circuit, an electromagnet included in said circuit for operating the valve of said motor, contact-blocks secured in the elevator-shaft and contact-plates carried by the car and adapted to close the circuit through engagement with said contact-blocks, substantially as described.

6. In a door opening and closing apparatus for elevators the combination with an elevator-car, a door opening and closing mechanism comprising a clutch, an operating-cable for such mechanism and a motor for said cable, of an electric circuit including the magnet of said clutch, an electromagnet for operating the valve of the motor, three contact-blocks secured in the elevator-shaft and two contact-plates carried by the car and adapted to engage said contact-blocks and close the circuits, substantially as described.

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