(No Model.) 2 Sheets—Sheet 1.

E. W. RICE, Jr.

ELECTRIC ELEVATOR.

No. 556,866. Patented Mar. 24, 1896.

Fig. 2.

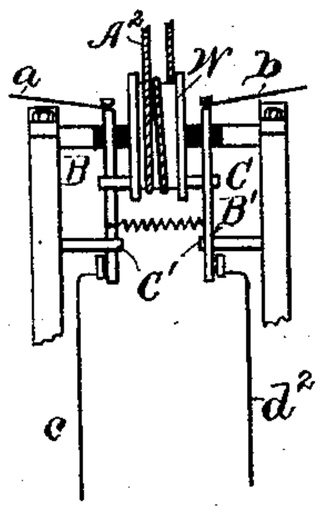
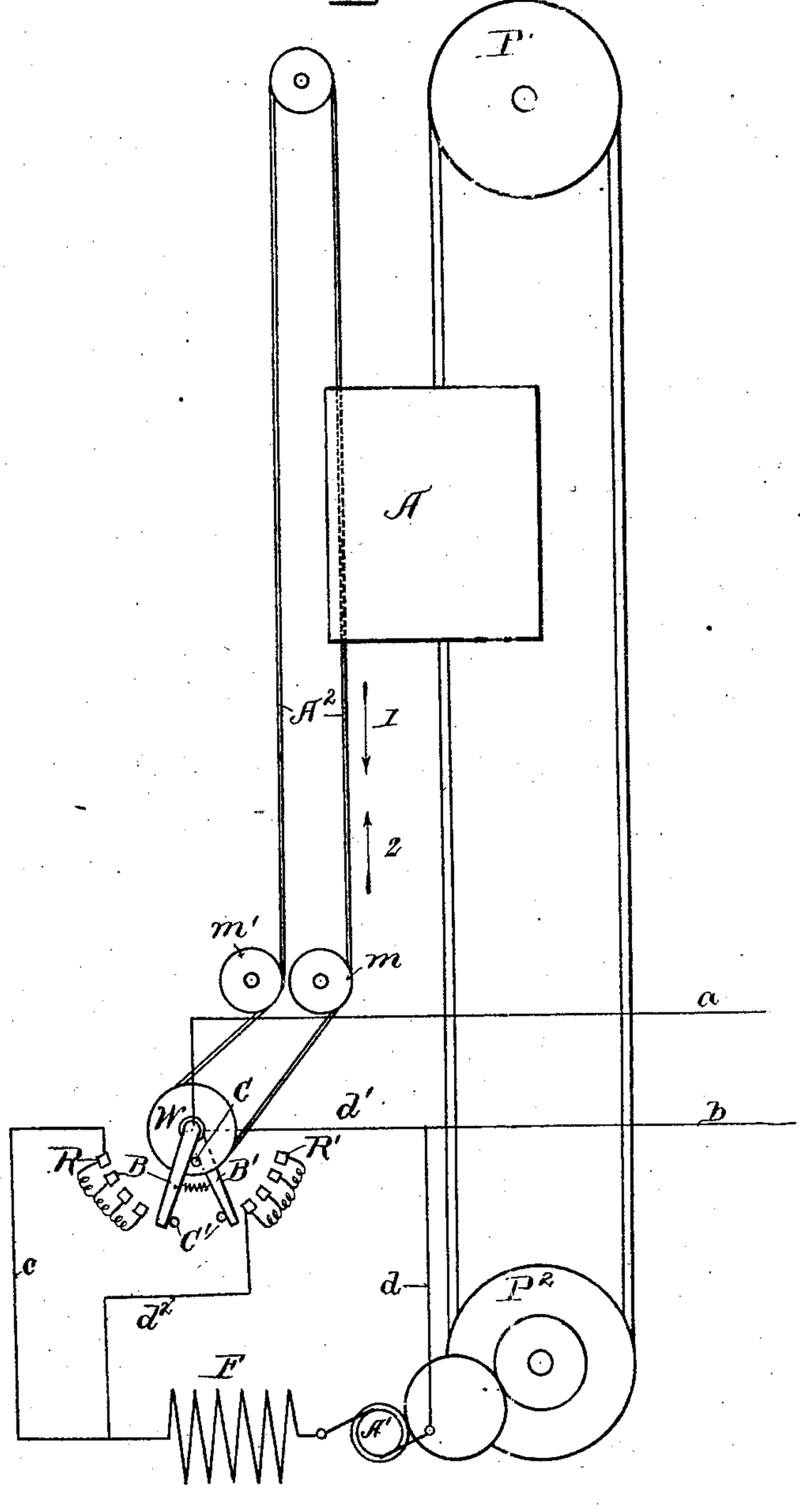


Fig. 1.



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(No Model.) 2 Sheets—Sheet 2.

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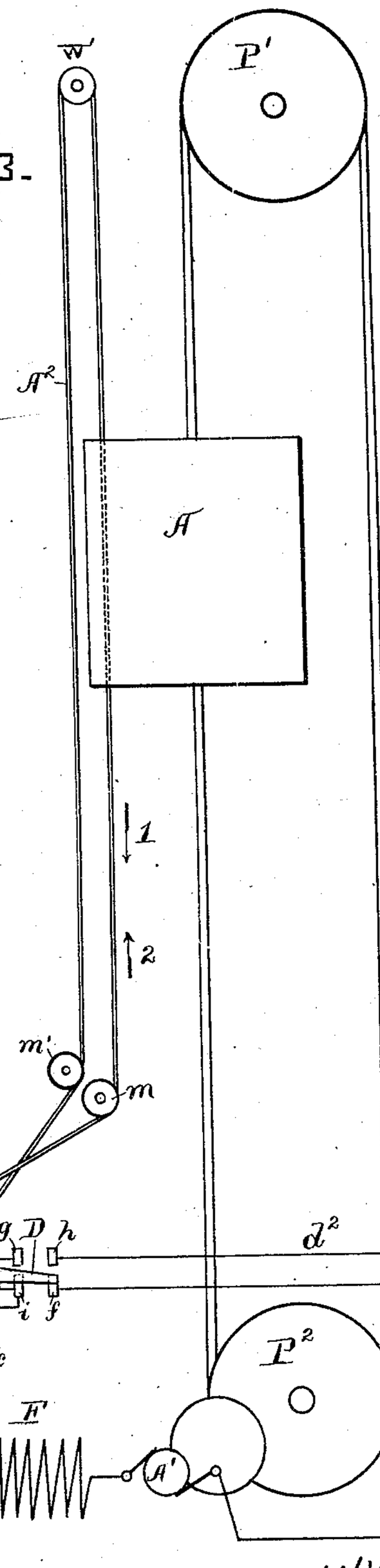
Fig. 3.



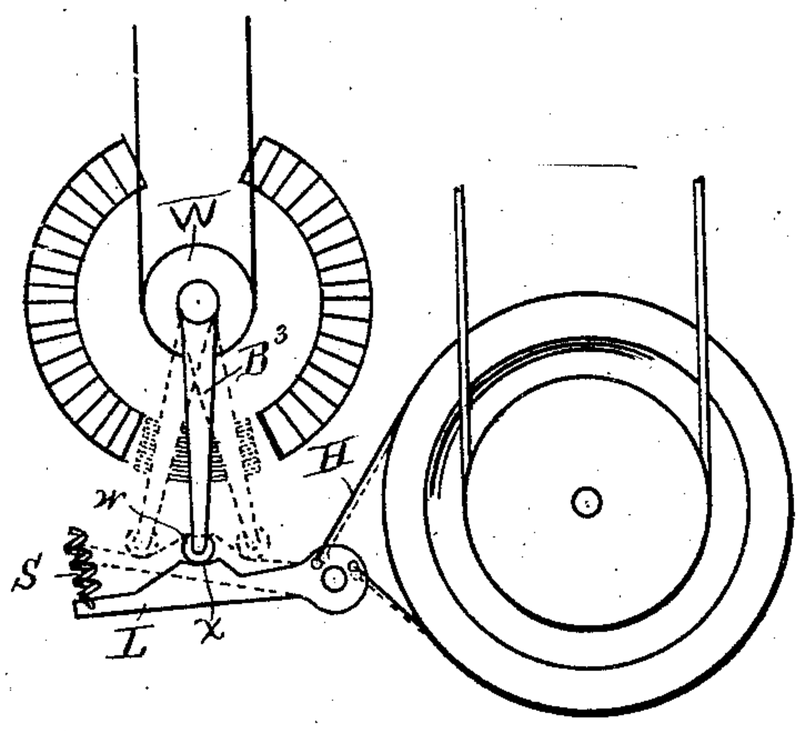


Fig. 4.

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UNITED STATES PATENT OFFICE.

EDWIN W. RICE, JR., OF SCHENECTADY, NEW YORK, ASSIGNOR TO THE GENERAL ELECTRIC COMPANY, OF NEW YORK.

ELECTRIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 556,866, dated March 24, 1896.

Original application filed April 2, 1890, Serial No. 346,272. Divided and this application filed June 18, 1894. Serial No. 514,909. (No model.)

To all whom it may concern:

Be it known that I, EDWIN W. RICE, Jr., a citizen of the United States, and a resident of Schenectady, in the county of Schenectady and State of New York, have invented a certain new and useful Electric Elevator, of which the following is a specification.

My invention relates to elevators or lifts operated by electric motors, and is designed to provide a simple and effective means for starting and stopping the elevator in its ascent and descent and controlling the speed of ascent and descent.

My invention consists in the combination, with an elevator or lift and an electrodynamic machine constructed and arranged to operate as a motor in causing the car to ascend and be operated on a short circuit as a generator by the car in descending, of electric controlling and regulating mechanism operated by a governing device on the car and adapted to operate upon the motor when moved in either direction from a central or intermediate position between its extremes of movement and a brake controlled also by the same governing device and adapted to be set when the said electric controlling mechanism occupies such intermediate position.

In the accompanying drawings, which form a part of this specification, Figure 1 is a side elevation of an apparatus embodying my invention, the electric controlling devices being illustrated diagrammatically. Fig. 2 illustrates in edge view the actuating or controlling mechanism which operates on the electric controlling and regulating devices. Fig. 3 is a side elevation of a modification of my invention, and shows the manner in which a single set of resistances may be made to take the place of the two sets of resistances shown in Fig. 1. Fig. 4 shows in detail the manner of operating the brake.

Referring to Fig. 1, A indicates the elevator-car or lift, and P′ P² the usual drums or wheels over which the elevator-ropes pass.

The armature or other revolving member of the electrodynamic motor or machine is connected through suitable gear with one of these drums, so that the power of the motor may be used to elevate the car and the car on its descent will communicate movement to the armature or will move with the same.

Any form of electrodynamic machine or motor may be employed for the purposes of my invention when connected to a proper organization of circuits and controlling devices, as set forth below.

A′ indicates the armature of such a machine, and F the field-magnet coils of a machine wherein the field is excited by the current which is supplied to the armature. In the present instance I have shown a series machine. The mains or connections from which current is derived for operating the machine are indicated at *a b*.

A² is a pull cord or rope which passes through the elevator-car in position to be operated by the attendant and is carried around suitable pulleys *m m′* and around the wheel or drum W, thus providing a controlling or actuating mechanism under the control of the attendant for imparting movement to the electric controlling devices of the motor.

B B′ are the movable arms of the electric controlling mechanism, here shown as consisting of switch or contact arms adapted to move over the contacts of two sets of variable electric resistances indicated at R R′. The arms B B′ are insulated from one another and connect respectively to the mains *a b*. They are actuated by means of pins C projecting from drum W and arranged with relation to the arm so that when the core A² and drum W are moved in one direction the arm B will be moved from the position shown, where it rests against the stop C′ over the series of resistance-contacts for R, thereby first closing circuit through the resistance and then gradually decreasing such resistance. When the arm is against the stop C′, there is no electrical connection between the circuit *a* and the connection *c*, leading to the field F of the motor through the armature and by way of connection *d* to the other main or wire *b*. When the drum W is moved from the position shown in a direction opposite to that above described, the arm B′ is first operated to close circuit by wire *d′* with one terminal of the motor-circuit and then to gradually throw into the circuit the resistance R′. The

other terminal of the motor being connected by wire *d* and connection *d'* with the arm B', the obvious effect is to first put the motor on short circuit by way of arm B', and then to gradually throw resistance into the circuit, thus gradually decreasing the resistance of the armature to rotation when it is actuated as a dynamo-armature by the descent of the car.

A spring, as shown, connecting the arms B B' may serve to hold them in the position indicated, where they will be out of connection with the contacts over which they are designed to move. In Fig. 1 of the drawings I have shown the action of the motor as controlled by an electric controlling device which throws resistance into and out of the circuit of the motor; but it is obvious that the efficiency of the motor in raising the elevator might be governed by any other electric controlling device suitable for the purpose of changing the power and speed of the motor. For controlling the resistance of the armature to rotation on the descent of the elevator-car, I have also shown a resistance R' as a means for gradually decreasing such resistance to rotation; but it is obvious that, as in the case of the resistance R, any other means may be used, as well understood in the art, for the purpose of governing the efficiency of the machine as a dynamo and decreasing the power necessary to drive the same when the car descends. I therefore wish to be understood as not limiting myself to the employment of the resistance arranged in the particular way shown, but include by my claims any electric controlling or regulating devices suitable for changing the speed and power of the motor in lifting the car or for changing the resistance of the armature to rotation when the circuit of the armature is closed through the independent circuit described, which is independent of the supply wires or mains *a b*.

When the controlling mechanism and the electric regulating devices are in the intermediate position shown the motor is cut off from connection with the supply source owing to the fact that contact is broken between B and the initial contact of the series connected to *c*, and the short circuit of the motor, whereby it may resist the descent of the car, is also broken by reason of the fact that the contact-arm B' is out of connection with the short-circuiting contact. In this intermediate position of the parts there would, therefore, be nothing excepting friction to prevent the free descent of the car. In order to hold the car from descent when the parts are in this position as well as to bring the car and motor promptly to rest when the controller is moved to position to stop the motor, I provide a brake which is brought into action through the operation of some part of the controlling mechanism or devices when such parts hold the position shown. Any suitable electrical or mechanical brake may be employed for this purpose; but I have shown one consisting of a friction-band H, Fig. 4, adapted to be tightened upon a pulley or wheel, as P^2, of the elevator-lifting mechanism by means of a lever L, to which the ends of the band are connected, as shown. A spring S tends to move the lever so as to unset the brake, while an arm B^3 or other actuating or controlling device connected to the pulley W or other part of the controlling devices before described engages with the arm L when the parts are in the position shown in Fig. 1 and throws the arm L down, so as to tighten the band H and hold the elevator-car against movement. The arm B^3, as will be presently shown, might be an arm of the electric controlling or regulating devices. A friction-wheel *w* rides upon the cam-surface of the lever L, as indicated, and the surface *x*, where the wheel engages when the brake is set, is made very slightly concave, so that when the mechanism is in this position it will be in a condition of stability, and the arm B^3 will not slip off the lever to either side. The concavity must be very slight, so as not to loosen the band H on the pulley.

The general operation of the devices is as follows: The parts being in the intermediate position shown, the car is locked against movement by the brake just described. On the operation of the pulley-cord in the direction of the arrow 1, the connection of the motor with the mains is closed by arm B, and as the arm moves over the resistance the resistance is gradually cut out, thus gradually increasing the power and speed of the motor in raising the car. To stop the motor the pull-cord is moved back, so as to cause the parts to again assume the intermediate position shown, in which operation the resistance is gradually inserted, thus gradually decreasing the power or speed of the motor. The movement of the controlling mechanism which produces a movement of the arm B, as just described, to close the circuit will obviously unset the brake, because at that time the arm B^3 moves off the cam-surface upon the brake-lever L. The reverse movement to restore the parts to the original position will obviously reset the brake by moving the lever L down through the action of arm B^3 so as to tighten the band H. To cause the elevator to descend, the controlling or actuating mechanism is actuated by the attendant on the car in the reverse direction from the intermediate position. The effect of this is to close the short circuit for the motor by way of the connection d^2, and at the same time to release the brake so that the car may now descend, but in so doing will be compelled to rotate the motor, the armature of which now generates currents that flow on the short circuit and thus cause resistance of such armature to rotation. The car will now gradually descend, but as the arm B is moved over the resistance-contacts of R', inserting resistance in the circuit of the armature, the speed of the armature may

gradually increase as its resistance to rotation decreases. To stop the car on descent the controlling or actuating mechanism must be moved by the attendant back to the original intermediate position, so that the arm B′ will gradually increase the resistance of the armature to rotation by decreasing the resistance of the local or short circuit, and, finally, through restoration of the arm B^3 to the intermediate or central position, the brake will be applied and the motor and elevator-car brought to rest.

In the modification shown in Fig. 3 the electric controlling devices require but a single set of resistances R, a supplemental circuit closing and breaking switch D being employed, and being operated by means of the resistance-arm B or other device so as to change the connections and produce the same changes of connections and establish the same circuits as are established by the operation of the devices in Fig. 1. D is a supplemental switch-lever, the forked end of which, as shown, is adapted to be engaged by the arm B. Contacts *i f*, which are connected by means of the switch-arm D, are connected respectively with the arm B and the supply-wire *a*. Contacts *g h* when engaged by the arm D establish the short circuit for the motor by way of the connection d^2 connected to *h* and the connections from *g* to *i* to the arm B, and to that terminal contact of the series of resistance-contacts which connects directly by wire *c* with the opposite terminal of the motor from that which connects to d^2. When the controlling or actuating mechanism is operated so as to move the arm B of the electric regulating or controlling devices into a central or intermediate position, where it will be between the two arms of the forked end for lever D, the latter will stand out of connection with its contacts, and the circuit from *a* to *b* through the motor will consequently be broken. On movement of the pull-cord in the direction of arrow 1 the arm B will turn the arm D into the position shown in full lines, thus establishing connection from *a* to *b* through the motor and the resistance R, which is gradually cut out by the continued movement of the arm B, just as in the case of arm B and resistance R, Fig. 1. Here, as before, to stop the motor it is necessary to restore the arm B to its original position, since in its advance movement it would finally be stopped by engaging with the outside of one arm of the fork connected to D. When the switch-arm B has been brought back so as to engage with the inside of said fork, it will throw the switch D, out of contact with *i f*, thus cutting off the current from the motor and at the same time setting the brake which may be operated in the same manner as before and, if desired, by an extension B^3 from the arm B.

To permit the car to descend under the control of the motor the pull-cord or other mechanism is moved in the direction of the arrow 2, thus throwing the contact-arm B over to connection with *g h*, unsetting the brake and bringing arm B into full connection with the contact which connects directly with the motor. The motor is thus on short circuit and the brake relieved. The elevator may now descend, rotating the armature slowly as a generator, and the speed of rotation may be increased by continuing the movement of the arm B, so as to gradually insert resistance as it moves around over the resistance-contacts in the direction of the arrow 4. To stop the descent the arm B must be brought back to original position, gradually increasing the resistance of the armature to rotation, and finally applying the brake and open-circuiting the armature.

I do not herein broadly claim the combination, with an elevator-car and an electric motor connected therewith, of regulating mechanisms controlled from the car and adapted to operate upon the motor when moved in either direction from a central or intermediate position and adapted to be set when the said electric controlling devices occupy such intermediate position, as this forms the subject-matter of claims in my original application, Serial No. 346,272, filed April 2, 1890, of which this is a division.

What I claim as my invention is—

1. The combination with an elevator-car or lift, of an electric motor operated on a short circuit as a generator by the car in descending, electric controlling devices under the control of the attendant on the car for governing the speed of movement of the motor when moving in either direction, and a mechanical brake for stopping the car when the controlling devices are in an intermediate position where the electric controlling devices are in position to bring the motor to rest.

2. The combination with an elevator or lift, and an electric motor continually connected therewith and operated on a short circuit as a generator by the car in descending, of a governing mechanism under the control of an attendant on the car, electric controlling and regulating mechanisms actuated thereby and adapted to operate upon the motor when moved in either direction from a central or intermediate position between its extremes of movement, and a brake controlled also by the said governing mechanism and adapted to be set when the said electric controlling devices occupy such intermediate position.

3. The combination with an elevator-car or lift, of an electric motor connected therewith and operated on a short circuit as a generator by the car in descending, an electric controlling device adapted to throw the motor out of operation when in an intermediate or central position and when moved in either direction from such position to vary respectively the speed of the motor in raising the car and the speed of the motor when operated as a generator by the car in descending, a mechanical brake for stopping the car when the

electric controlling devices are in such intermediate position, and a single mechanical controlling device accessible to an attendant on the car or platform for controlling both the action of the electric controller and said brake, as and for the purpose described.

4. The combination with an elevator-car or lift, of an electric motor connected therewith and operated on a short circuit as a generator by the car in descending, a movable switching device adapted, according to its position, to open and close the motor-circuit and to vary the resistance thereof in both the ascent and descent of the car, according to the extent to which it may be moved from the position of open circuit, mechanical means accessible to an attendant on the car or platform for controlling the position of said movable switching device, and a mechanical brake controlled also by the same devices that are used to control the position of the said switching device, as and for the purpose described.

5. The combination with an elevator car or platform, of an electric motor connected therewith and operated on a short circuit as a generator by the car in descending, a movable switching device for closing and opening the motor-circuit, a variable resistance in said circuit, a mechanically-operated friction-brake in operative relation to the elevator mechanism, a single controlling device operatively connected to both the switching and brake devices, and a line or rope accessible to the operator on the car or platform for varying such single controlling device.

6. The combination with an elevator-car or lift, of an electric motor geared thereto and operating on a short circuit as a generator by the weight of the car in descending, controlling mechanism operated by the attendant on the car for closing the connection of the motor with the mains and adjusting the speed of the motor when such controlling mechanism is moved in one direction from the position of rest, a variable resistance in the circuit so closed, a normally-open short circuit for the motor which is closed on the movement of said controlling mechanism in the opposite direction from the position of rest, and a variable resistance in such circuit which is gradually increased in amount as the movement of the controlling mechanism is continued.

7. The combination with the electric controlling or regulating devices, of an arm as B^3, connected thereto and provided with an antifriction-wheel at its free end, a strap-brake operating upon a drum on the armature-shaft, and the operating-lever for said brake provided with a cam-surface concaved at its middle to receive said wheel for the purpose set forth.

Signed at Schenectady, in the county of Schenectady and State of New York, this 13th day of June, 1894.

EDWIN W. RICE, JR.

Witnesses:
B. B. HULL,
A. F. MACDONALD.