

(No Model.)

2 Sheets—Sheet 1.

R. WATSON.
ELECTRIC ELEVATOR.

No. 469,361.

Patented Feb. 23, 1892.

Fig. 3.

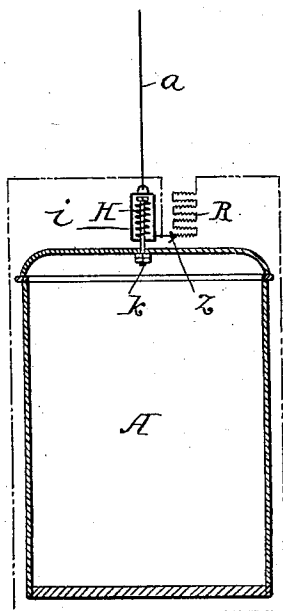
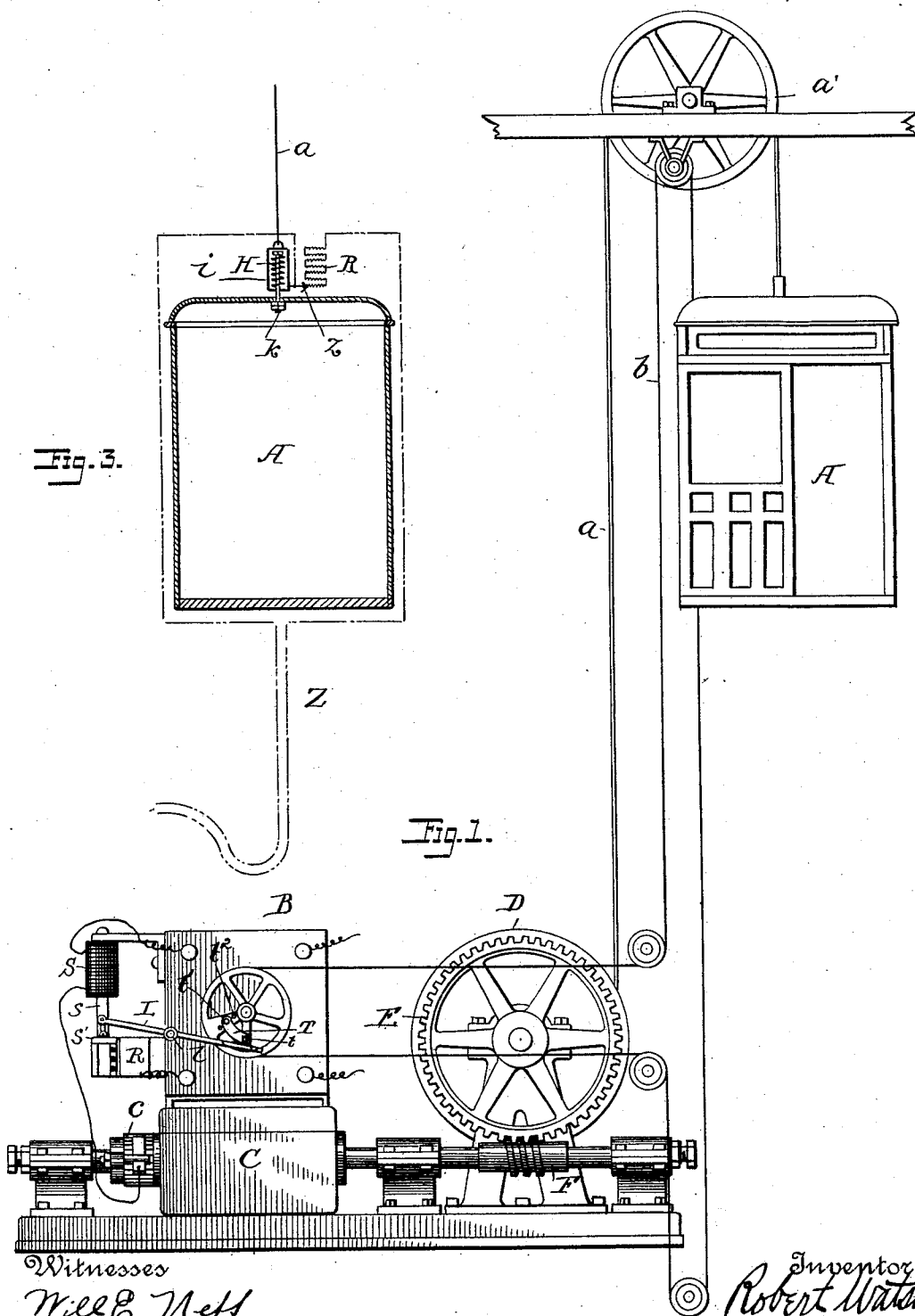


Fig. 1.



Witnesses

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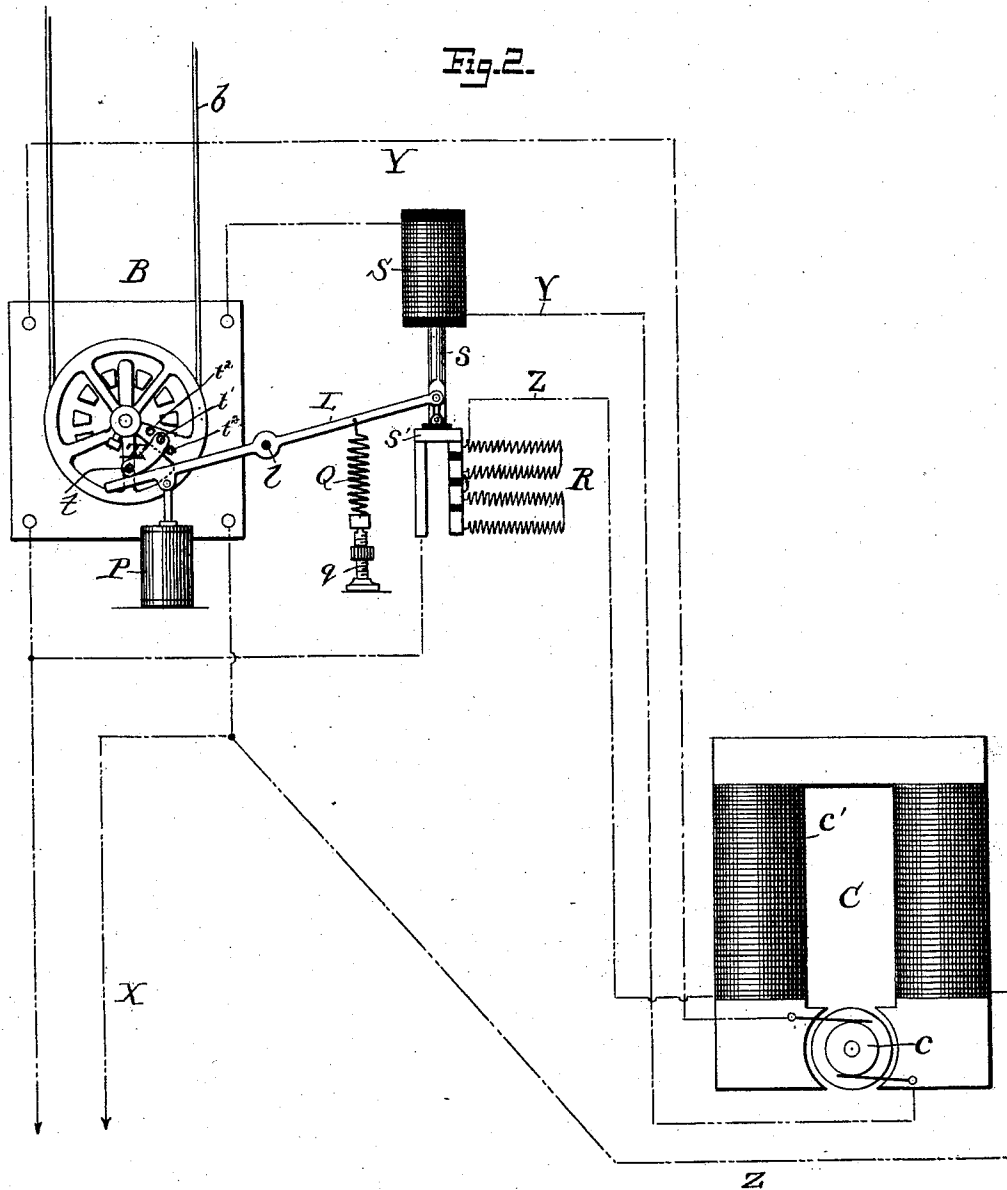
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UNITED STATES PATENT OFFICE.

ROBERT WATSON, OF BROOKLYN, NEW YORK.

ELECTRIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 469,361, dated February 23, 1892.

Application filed October 3, 1891. Serial No. 407,648. (No model.)

To all whom it may concern:

Be it known that I, ROBERT WATSON, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Electric Elevators, of which the following is a specification.

My invention relates to electric elevators; and it consists in a device for automatically controlling the speed of such elevators.

The word "elevator" will be used in this specification broadly, so as to include cranes, derricks, and other hoisting mechanism, to all of which my invention is applicable.

In operating elevators with constant-speed motors it has been customary to proportion the motor and adjust the gearing to the maximum load which the elevator is intended to carry. It thus happens that when a load lighter than the maximum is placed upon the elevator it is raised at the same speed with which the maximum load is elevated, although the power of the motor, if properly applied, is sufficient to raise the lighter load at a greater speed.

The object of my invention is to provide an automatic governor for the so-called "constant-speed motors," at present largely used in connection with elevators, which governor shall be controlled by the load upon the elevator, and in turn shall govern the motor, so as to increase the speed of the latter as the load is decreased, and vice versa. Thus, for example, a constant-speed motor of ten-horse power will raise three thousand pounds at the rate of one hundred feet per minute, and as at present constructed, if the load is reduced to one-half or one-fourth of three thousand pounds the speed will be the same. By the use of my improvements, however, as the load decreases the speed will be increased, (within safe limits,) so that the work done, measured in foot-pounds, will be nearly constant, and thus much time be saved and the range of usefulness of the elevator greatly increased.

My invention is herein illustrated in connection with a shunt-wound constant-potential motor, and its operation, in this connection, depends upon the principle that when the field-magnet circuit is weakened in such a motor the speed of the motor will increase,

provided, of course, that it is not loaded down to its full capacity.

In carrying out the invention I arrange a variable resistance or rheostat in the shunt or field circuit, and provide a device for automatically varying the amount of resistance in said circuit inversely as the load upon the elevator, within certain limits, which will be hereinafter pointed out.

In the accompanying drawings, Figure 1 is a side view of an elevator-shaft, showing the motor and gearing for operating the elevator, part of the apparatus being shown in diagram. Fig. 2 is a view partially in diagram, showing the circuits and one form of controlling device for the field-magnet; and Fig. 3 shows another form of controlling device.

One form of elevator in which my invention may be embodied is shown in Fig. 1, in which A indicates an elevator-cage, which is supported within the well by a rope *a*, passing over a pulley *a'* to the drum D. The movements of the elevator are controlled by a hand-rope *b*, which operates a switch B, the latter being located at any convenient point. C indicates the motor, which is geared to the drum through the medium of a worm-wheel E and worm F, the worm-wheel being rigidly connected to the drum.

Referring more particularly to Fig. 2, X indicates the electric main, which is divided into the armature-circuit Y and the field-circuit Z, the former passing through the armature *c* and the latter around the field-magnet *c'*. In the circuit Z is arranged the rheostat or variable resistance R. In the circuit Y is arranged a solenoid S, having a movable soft-iron core *s*, to which is attached a metallic bridge-piece *s'*, which is preferably insulated from the core and moves back and forth over terminals of the field-circuit Z to cut in and out the rheostat R.

It is important to cut out the resistance R from the field-circuit when the motor is stopped in order to insure full strength of the field at the moment of starting. This may be accomplished in various ways. A simple means is shown in Fig. 2, in which L is a lever mounted upon a fixed pivot *l* and connected at one end to the core *s*. The other end of the lever is in position to be operated

on by a cam T, which is adjustably connected to the reversing-switch. As shown, one end of the cam is pivoted to the sheave at *t* and the other end is held in any desired position by means of a pin *t'* or other suitable fastening. The pin *t'* may be inserted through the cam into any one of the series of holes *t''* to hold the cam in different positions. The cam is of such form that when the switch is turned to stop or reverse the motor it will depress one end of the lever and raise the core of the solenoid, so as to entirely or partially cut out the resistance from the field-circuit. The cam can be adjusted so as to permit any desired amount of resistance to be cut into the field when the switch is in the usual position for permitting the load to descend, and thus the elevator may be regulated so as to have any desired speed of descent. In order to prevent the motor from starting too suddenly with a light load on the elevator, a dash-pot P may be used. As shown, it is connected to the lever L. A spring Q may be attached to aid in drawing down the core of the solenoid, when necessary, the tension on the spring being regulated by a screw *q*.

The operation of the apparatus above described is as follows: Should the load to be lifted on the elevator be equal to the maximum capacity of the motor, the current in the armature-circuit will be sufficient to hold the core of the solenoid in its highest position, as shown in Fig. 2, thus cutting out the entire rheostat from the field-circuit, in which case the motor will run at its normal speed. If, however, the elevator is loaded more or less below its maximum lifting capacity, the current in the armature-circuit will be more or less diminished, the solenoid will be correspondingly weakened, and its core will move outward to cut in a corresponding amount of resistance. This in turn will weaken the field-magnet and the speed of the motor will increase, the increasing speed depending upon amount of resistance inserted in field-circuit. The maximum speed may be limited by limiting the total resistance in the rheostat. Thus, taking the case mentioned above under normal conditions the elevator will raise three thousand pounds at the rate of one hundred feet per minute. By properly adjusting and limiting the rheostat and solenoid it may be made to carry fifteen hundred pounds at the rate of about two hundred feet per minute and intermediate amounts at intermediate speeds; but if the maximum speed is to be two hundred feet per minute then the total resistance introduced in the circuit should be such that this speed cannot be exceeded. This result may be obtained by arranging a stop to limit the outward movement of the core of the solenoid. The cam T may be suitably shaped to form such a stop.

The means for varying the resistance in the field-circuit may be either electrical or mechanical. In Fig. 2 I have shown electrical means, while in Fig. 3 is shown mechanical

means. In the latter figure Z indicates the field-circuit, the wires being hung from the cage and extending to the top. Between the cage and the rope *a* is interposed a spring II in such manner that it will be more or less compressed, according to the weight of the load. As shown, the rope is connected to a frame *i*, which extends around and forms a support for the spring, while the cage is attached to a rod K, which extends through and is connected to the upper end of the spring. A rheostat R is mounted upon the cage and connected to one terminal of the circuit Z. The other terminal is a contact-piece carried by the frame *i*.

The operation is as follows: When the maximum load is upon the cage, the spring will be compressed and the rheostat entirely cut out of the circuit Z. If, however, the load is below the maximum, the spring II will expand and the contact Z will cut in more or less resistance, according to the load upon the cage. The effect upon the motor and the speed of the elevator will be the same as above described.

It will be obvious that the principle of my invention may be applied advantageously to other mechanisms in which variable loads are moved by electric motors—such, for instance, as electric railways. It is, however, especially useful in connection with elevators.

What I claim is—

1. The combination, with an electric motor and a load connected to be moved thereby, of a governor arranged to increase or decrease the speed of the motor as the load is decreased or increased, respectively, said governor being automatically controlled by said load, substantially as described.

2. The combination, with a shunt-motor working on a constant-potential circuit and a load connected to be moved thereby, of a governor arranged to increase or decrease the speed of the motor as the load is decreased or increased, respectively, said governor being controlled by said load, substantially as described.

3. The combination, with an elevator, of an electric motor and current-controlling devices for said motor, arranged to increase or decrease the speed of the motor as the load upon the elevator is decreased or increased, respectively, the said devices being automatically controlled by the load upon the elevator, substantially as described.

4. The combination, with an elevator, of a shunt-motor working on a constant-potential circuit and means for automatically weakening or strengthening the field-circuit of said motor as the load upon the elevator is decreased or increased, respectively, said means being controlled by the said load, substantially as described.

5. The combination, with an elevator, of a shunt-motor working on a constant-potential circuit, a rheostat in the shunt or field circuit, and devices controlled by the load upon the

elevator for automatically adjusting said rheostat to cut in or out resistance as the said load is decreased or increased, respectively, substantially as described.

5 6. The combination, with an elevator, of a shunt-motor working on a constant-potential circuit, a rheostat in the field-circuit, and means governed by the armature-circuit for
10 adjusting said rheostat to cut in or out resistance as the load upon the elevator is decreased or increased, respectively, substantially as described.

7. The combination, with an elevator, of a shunt-motor working on a constant-potential
15 circuit, a rheostat in the field-circuit, a solenoid in the armature-circuit, and devices controlled by the solenoid for adjusting the rheostat to weaken the field-circuit as the armature-circuit becomes weaker, and vice versa,
20 substantially as described.

8. The combination, with an elevator, of a shunt-motor, a rheostat in the field-circuit thereof, means controlled by the load for automatically varying the field-circuit when said
25 load is ascending, and devices for cutting out the rheostat when the load is stationary, substantially as described.

9. The combination, with an elevator, of a shunt-motor, a rheostat in the field-circuit
30 thereof, a solenoid in the armature-circuit, said solenoid being arranged to control the rheostat when the load is ascending, and means for cutting out the rheostat when the load is stationary, substantially as described.

35 10. The combination, with an elevator, of a shunt-motor provided with a reversing-switch, a rheostat in the field-circuit thereof, and a cam connected to the reversing-switch and ar-

ranged to control the rheostat when the load upon the elevator is stationary or descending, 40 substantially as described.

11. The combination, with the elevator, of a shunt-motor provided with a reversing-switch, a rheostat in the field-circuit thereof, and a
45 cam connected with the reversing-switch and arranged to control the rheostat when the load upon the elevator is stationary or descending, said cam being adjustable to regulate the motor's speed when the elevator is descending, substantially as described. 50

12. The combination, with an elevator, of a shunt-motor provided with a reversing-switch, a rheostat in the field-circuit, a solenoid in the armature-circuit, arranged to control the
55 rheostat when the load is ascending, a cam connected to the reversing-switch, and a pivoted lever connected at one end with the rheostat-bridge and having its other end in operative contact with the cam, said cam being
60 formed to control the rheostat when the load is stationary or descending, substantially as described.

13. The combination, with an elevator, of a shunt-motor provided with a reversing-switch, a rheostat in the field-circuit, a solenoid in
65 the armature-circuit, a cam connected to the reversing-switch, a lever intermediate the cam and the rheostat, and a dash-pot arranged to control the movement of the lever, substantially as described. 70

In testimony whereof I affix my signature in presence of two witnesses.

ROBERT WATSON.

Witnesses:

CHAS. E. MCKAY,
JOHN WARD.