(No Model.) 2 Sheets—Sheet 1.

M. W. DAY.

ELEVATOR CONTROLLER.

No. 589,891. Patented Sept. 14, 1897.

FIG. 3.

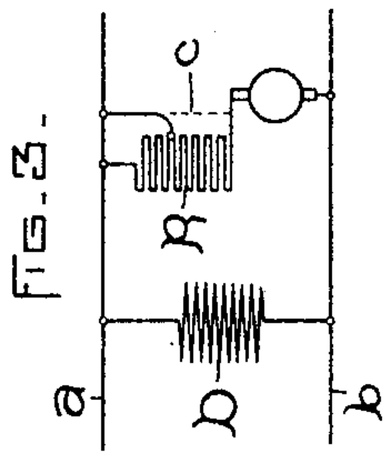


FIG. 4.

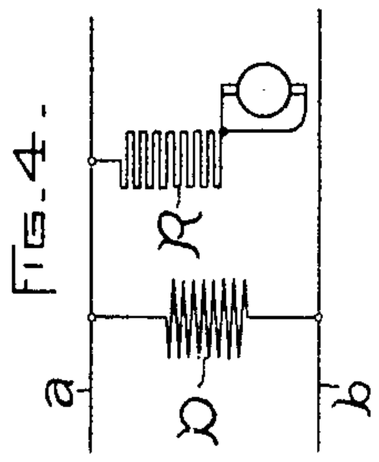


FIG. 5.

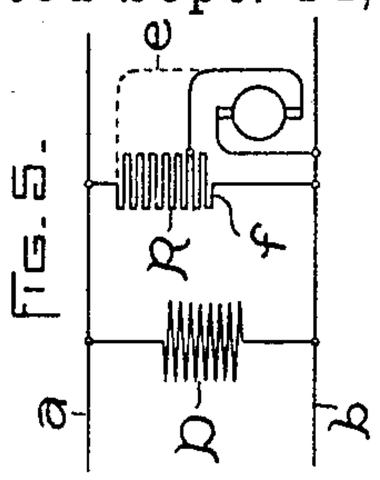


FIG. 2.

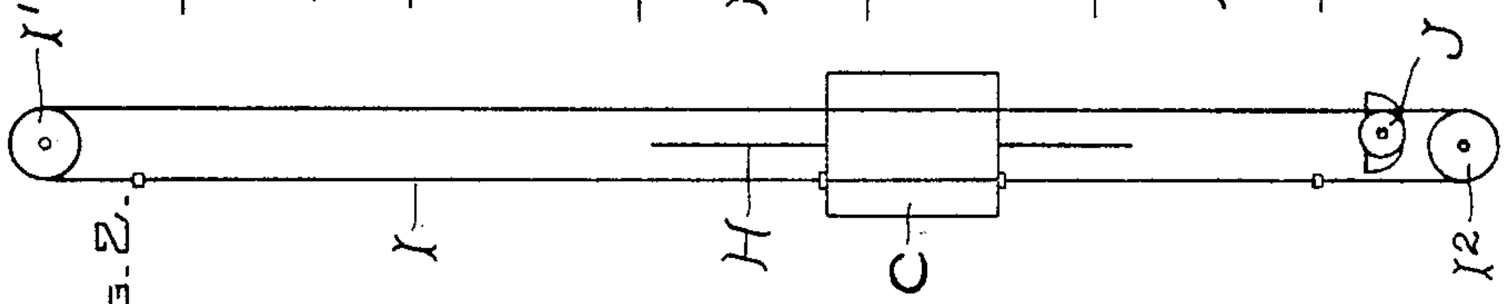
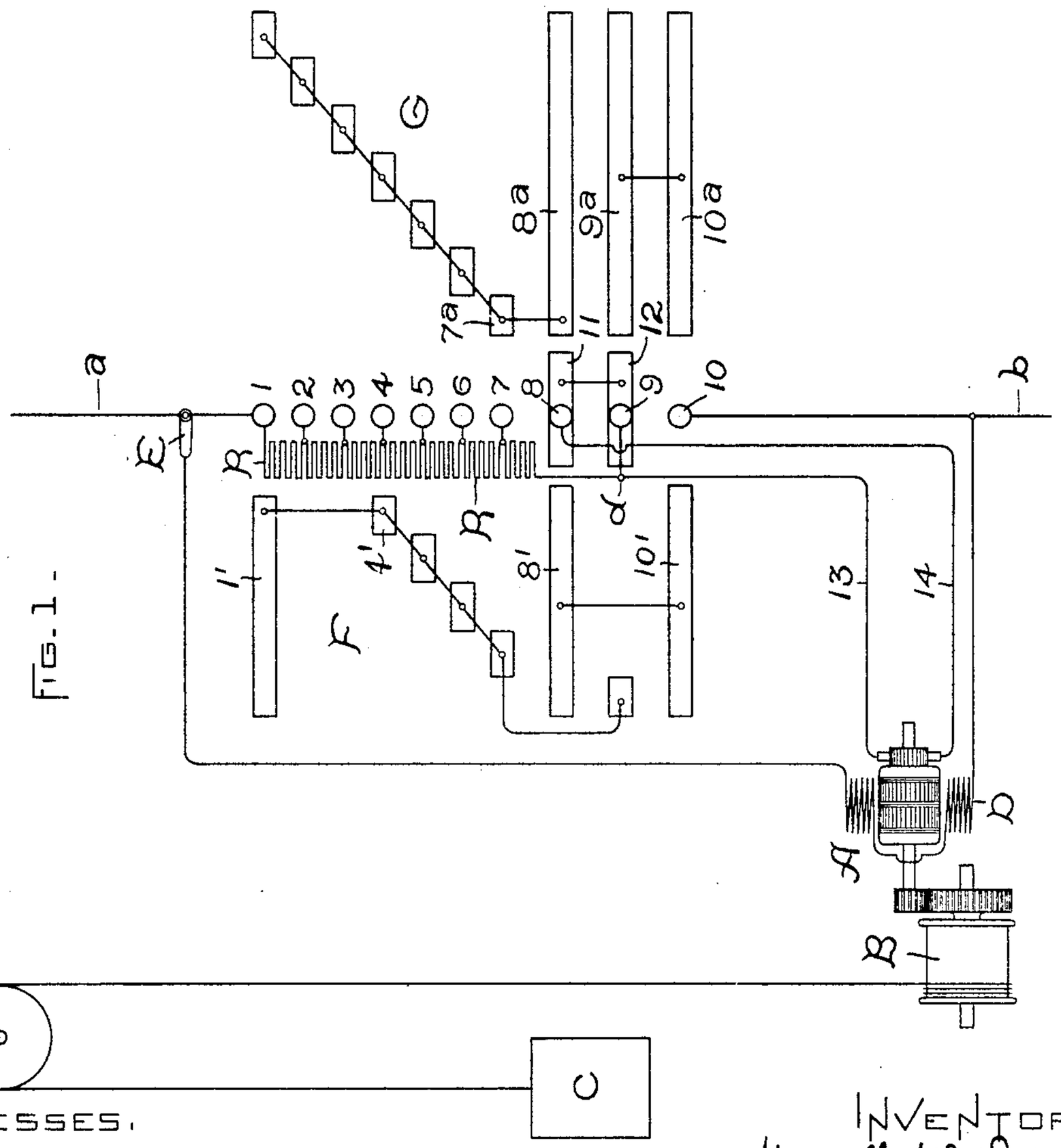


FIG. 1.



WITNESSES:

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(No Model.) 2 Sheets—Sheet 2.

M. W. DAY.

ELEVATOR CONTROLLER.

No. 589,891. Patented Sept. 14, 1897.

FIG. 7.

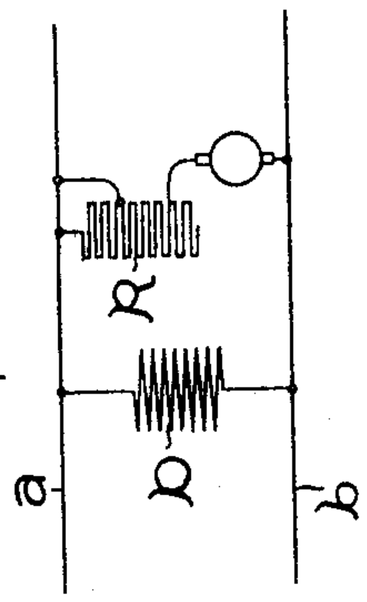


FIG. 8.

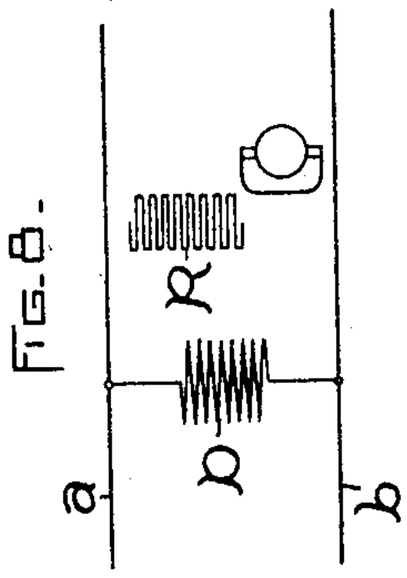


FIG. 9.

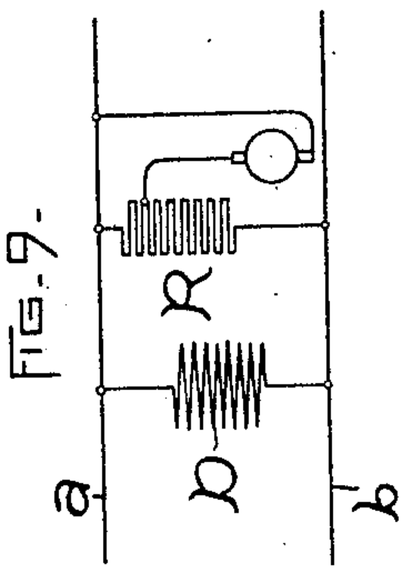
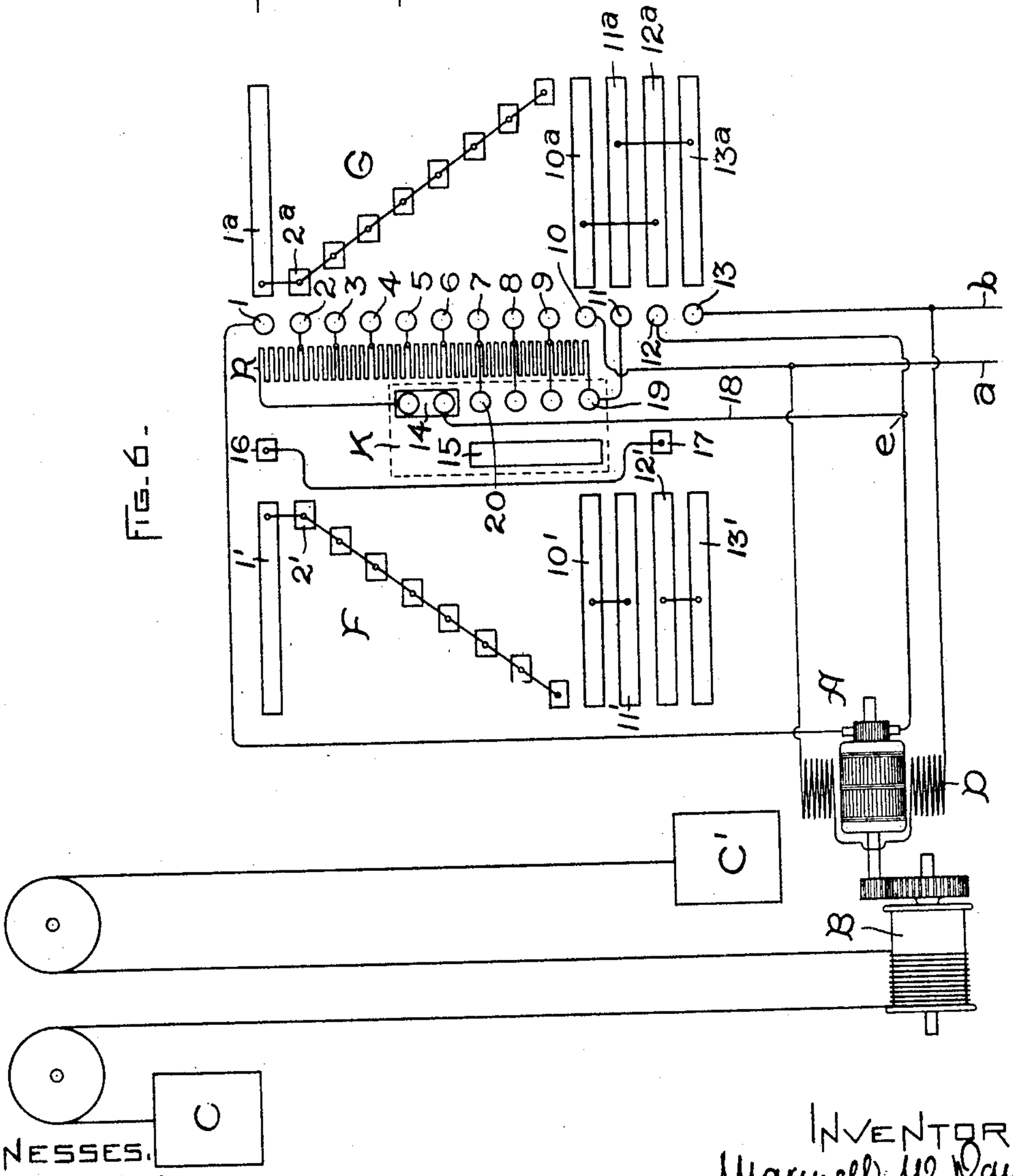


FIG. 6.



WITNESSES.
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Atty.

UNITED STATES PATENT OFFICE.

MAXWELL W. DAY, OF SCHENECTADY, NEW YORK, ASSIGNOR TO THE GENERAL ELECTRIC COMPANY, OF NEW YORK.

ELEVATOR-CONTROLLER.

SPECIFICATION forming part of Letters Patent No. 589,891, dated September 14, 1897.

Application filed June 12, 1897. Serial No. 640,506. (No model.)

To all whom it may concern:

Be it known that I, MAXWELL W. DAY, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Elevator-Controllers, (Case No. 550,) of which the following is a specification.

The present invention relates to controllers used for regulating electric motors which are employed for operating hoists or similar kinds of work, and has for its object to provide a controller for shunt-wound motors which will regulate the speed of the armature as the load descends in a smooth and gradual manner, at the same time arranging the circuit relations so that when the load is light current will be admitted to the armature in the usual manner and the load driven down and when the load is heavy the motor will act as a generator and feed current to the supply-mains.

In the accompanying drawings, attached to and made a part of this specification, Figure 1 is a diagrammatic view of a controller and hoist-motor. Fig. 2 is a diagrammatic view showing means for operating the controller. Figs. 3, 4, and 5 are diagrammatic views of the motor-circuits in various positions of the controller. Fig. 6 is a modification of my improved controller used in connection with a single motor employed for operating two hoists, and Figs. 7, 8, and 9 are diagrams of the motor combinations.

Referring to Fig. 1 of the drawings, I have shown a shunt-wound motor A geared to a hoisting-drum B by spur-gears. By employing spur-gears instead of the usual worm-gearing a heavy load in cage C will, when lowering, drive the motor, causing it to act as a generator and supply current to the mains *a* and *b*. On the other hand, if the load in cage C is light current will be supplied to the machine in the usual manner and it will act as a motor and drive the drum. The motor field-coils D are connected across the mains *a* and *b*, and a switch E is employed when it is desired to interrupt the circuit.

Mounted in a vertical row for engagement with the moving contacts F and G are brushes 1 to 10, inclusive. Between certain of the brushes are sections of resistance R, which are included in circuit in a manner hereinafter described. With the brushes in the position shown the armature of the motor is short-circuited through contacts 11 and 12, and the field is in circuit with mains *a* and *b*. This is the "off" position of the controller and the connections are as shown in Fig. 4.

The contacts F and G are mounted upon a suitable drum or other support, and are adapted to be moved into engagement with the row of stationary brushes. If desirable, however, the contacts may be stationary and the brushes movable.

Assuming that it is desired to raise the load in cage C, the contacts F are moved to the right into engagement with the row of stationary brushes and the circuit will be as follows: Current entering from the main *a* will pass through switch E to field-coils D of motor A to main *b*. A second path will be from main *a* to brush 1, to contact 1′, thence by cross-connection to contact 4′, to brush 4, thereby short-circuiting the sections of resistance between brushes 1 and 4, thence through the remaining sections of resistance, by wire 13, to armature of motor, through the armature of the motor, by wire 14, to brush 8, to contact 8′, thence by cross-connection to contact 10′, to brush 10, to main *b*. The motor is now connected as shown in Fig. 3, and a further movement of the contacts F to the right cuts out one section after another of the resistance, until finally all the resistance is short-circuited and the armature connection would be as shown by the dotted line *c*, Fig. 3.

When it is desired to stop the motor, the contacts F are moved to the left, gradually cutting in the resistance, until the contacts assume the position shown and the armature is short-circuited.

If it is desired to lower the cage, the contacts G are moved into engagement with the brushes and the circuit is as follows: from main *a* to switch E, through the field-coils D to main *b*. A second path is from main *a* to brush 1, through the sections of resistance R to brush 7, where the circuit divides, one path being to contact 7^a, by cross-connection to contact 8^a, to brush 8, wire 14, armature

of motor, wire 13, to point *d*. Starting at brush 7, the second path is through the last section of resistance R to point *d*, where the circuit unites with the one previously described, to brush 9, contact 9^a, by cross-connection to contact 10^a, to brush 10, to main *b*. The connections thus established are as shown in Fig. 5, and a further movement to the left will change the relation between the resistance R and the armature, until finally the connections will be as indicated by dotted line *e* in Fig. 5. It will be seen that the field D is connected across the mains *a b*, as is also the resistance R, and that the armature-terminals have been reversed and the armature shunted by a certain amount of resistance. When it is desired to stop the cage, the contacts G are moved back again to the right, which changes the relation between resistance R and the armature, until finally the circuit through the resistance is interrupted and the armature-terminals short-circuited through contacts 11 and 12 and the connections are as indicated in Fig. 4.

Assuming that cage C is lightly loaded, it will be necessary to drive the cage down by the motor A. By the arrangement shown in Fig. 5 a certain amount of the current will flow through the armature, the amount being dependent upon the relative resistances of the section *f* of the resistance and that of the armature, and the motor A will operate in the usual manner. If, however, the load in the cage C is a heavy one, it will, by means of the drum B and spur-gearing, propel the armature A, and a portion of the current thus generated in the armature will be fed to the resistance R and the balance to mains *a b*.

In Fig. 2 I have illustrated a means employed in actuating the circuit-controlling mechanism. The cage C is supported by wire ropes H in any customary manner. The operating-rope I is passed around pulleys $I' I^2$ and its ends united. The controller is provided with a sheave J, to which is secured rope I. By this arrangement the controller, which is situated, preferably, at the bottom of the hoist, may be controlled both from the top and bottom, and by passing the rope through the cage it may be controlled from this point also.

In Fig. 6 I have shown a modification of my invention in which a single motor A by means of the winding-drum B is employed to raise and lower cages C and C'. The arrangement of the cages and the ropes on the winding-drum is such that as one cage is hoisted the other is lowered. In a hoist provided with two cages adapted for simultaneous movement it is necessary to alternately drive the motor in each direction to overcome the load in the cages.

The sets of contacts F and G are shown as developed on the same plane, with the row of stationary brushes 1 to 13, inclusive, located between them. The sets of contacts F and G are similar, with the exception that the armature-contacts of F are reversed relative to those of G, so that the armature of motor A will revolve in opposite directions when the brushes engage with the sets of moving contacts.

In addition to the two sets of contacts F and G a separate commutating-switch K is provided, having mounted thereon contacts 14 and 15. The position of the switch is determined by the relative weights of the cages C and C'. When the load in cage C' is heavy, it will be thrown so that the contact 15 is in engagement with the stationary brushes, but when the cage C is heavily loaded and the cage C' lightly loaded the switch will be thrown to the position shown in the drawings. Contact 14 is employed when the load in either cage is sufficient to overhaul the motor, and contact 15 when the motor is employed to drive the load. As it is desirable to employ more resistance for lowering than hoisting, the contact 15 is so arranged that it will short-circuit a number of sections of resistance at that time.

Assuming, for example, that cage C is heavily loaded and cage C' lightly loaded and that it is desired to lower cage C, the commutating-switch K would be moved to the position shown in Fig. 6 and the contacts G moved to the left until the stationary brushes engaged therewith, and the circuit would be as follows: from main *a* through the field-magnet coils D of the motor to main *b*. A second path would be from the main *a* to brush 10, to contact 10^a, by cross-connection to contact 12^a, to brush 12, to point *e'*. Here the circuit divides, one path being through the armature of motor A to brush 1, to contact 1^a, by cross-connection to contact 2^a, to brush 2. Starting again at point *e'*, the circuit is by wire 18 to contact 14 on the commutating-switch, to resistance R, where it joins the circuit through the armature of the motor and continues through the various sections of resistance to brush 19 on the commutating-switch K, thence to brush 11, to contact 11^a, by cross-connection to contact 13^a, to brush 13, to main *b*. The motor is now connected as shown in Fig. 9, the field-magnet being connected across the mains *a b*, as is also the resistance R, and the armature of the motor is working on a closed circuit through a portion of the resistance R. The motor is now being driven as a generator and is supplying current to the resistance R. If, on the other hand, the load in cage C is light, the armature of the motor will receive current from the mains *a b* and drive the winding-drum B, which will lower the cage in the ordinary manner.

Assuming that cage C is being lowered and it is desired to stop the motor, the contacts G are moved to the right until the circuit between them and the stationary row of brushes is interrupted and brushes 1 and 12 rest, re-

spectively, upon contacts 16 and 17. This causes the armature of the motor to be short-circuited and stopped.

Assuming that it is desired to raise cage C, the commutating-switch K is moved to the right, so that contact 15 is in engagement with the stationary brushes and contact 14 is out of circuit. With the contacts F in engagement with the vertical row of brushes the circuit will be as follows: from main *a* to the field-coils D of the motor, to main *b*. A second path will be from main *a* to brush 10, to contact 10′, by cross-connection to contact 11′, to brush 11, to brush 19, to contact 15, to brush 20, which short-circuits the sections of resistance between brushes 19 and 20, to brush 7, thence through the sections of resistance R to brush 2, to contact 2′, by cross-connection to contact 1′, to brush 1, to the armature of the motor, to brush 12, to contact 12′, by cross-connection to contact 13′, to brush 13, to main *b*. A further movement to the right of contact F will cut out one section after another of resistance until the armature is connected directly across the mains.

To stop the motor, contacts F are moved to the left until the circuit between them and the stationary row of brushes is interrupted and the brushes 1 and 12 rest, respectively, upon the short-circuiting contacts 16 and 17. It will be seen that the short-circuiting contacts 16 and 17 are employed in stopping the motor when it is employed in hoisting and lowering. When the brushes 1 and 12 rest upon 16 and 17, the connections are as indicated in Fig. 8.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In an electric controller, the combination of contacts for connecting the motor with the source of supply, means for disconnecting the motor from said source and connecting a resistance across the mains, and means for shunting the armature by a portion of the resistance.

2. In an electric controller, the combination of a set of contacts for establishing connection between the source of supply and the motor, a second set of contacts for connecting a resistance across the supply-mains and coupling the armature in shunt thereto, and contacts for short-circuiting the armature for stopping.

3. The combination with an electric hoist-motor having its field-coils connected across the supply-mains, of a controller having a set of contacts for connecting the armature in circuit with the source of supply, a second set of contacts for connecting a resistance across the mains and coupling the armature in shunt to a portion of the resistance, and means for varying the amount of resistance which shunts the armature.

4. The combination of a shunt-wound motor having its field-winding permanently connected to the source of supply, a winding-drum geared to the motor by spur-gearing so that under certain conditions the drum can drive the motor as a generator, contacts for connecting the armature and a regulating-resistance across the mains and regulating the amount of resistance included in such circuit, contacts for short-circuiting the armature for stopping, a second set of contacts for coupling a resistance across the supply-mains and the armature in shunt thereto, and means for varying the amount of resistance which shunts the armature.

5. In a controller for an electric hoist-motor, the combination of a resistance, a set of contacts controlling the speed of the motor-armature when rotating in one direction, a second set of contacts for regulating the armature when rotating in the opposite direction, and a separate commutating-switch provided with a set of contacts for short-circuiting a portion of the controlling-resistance when in one position, and a second set of contacts for completing a portion of the lowering-circuit.

In witness whereof I have hereunto set my hand this 11th day of June, 1897.

MAXWELL W. DAY.

Witnesses:
B. B. HULL,
E. W. CADY.