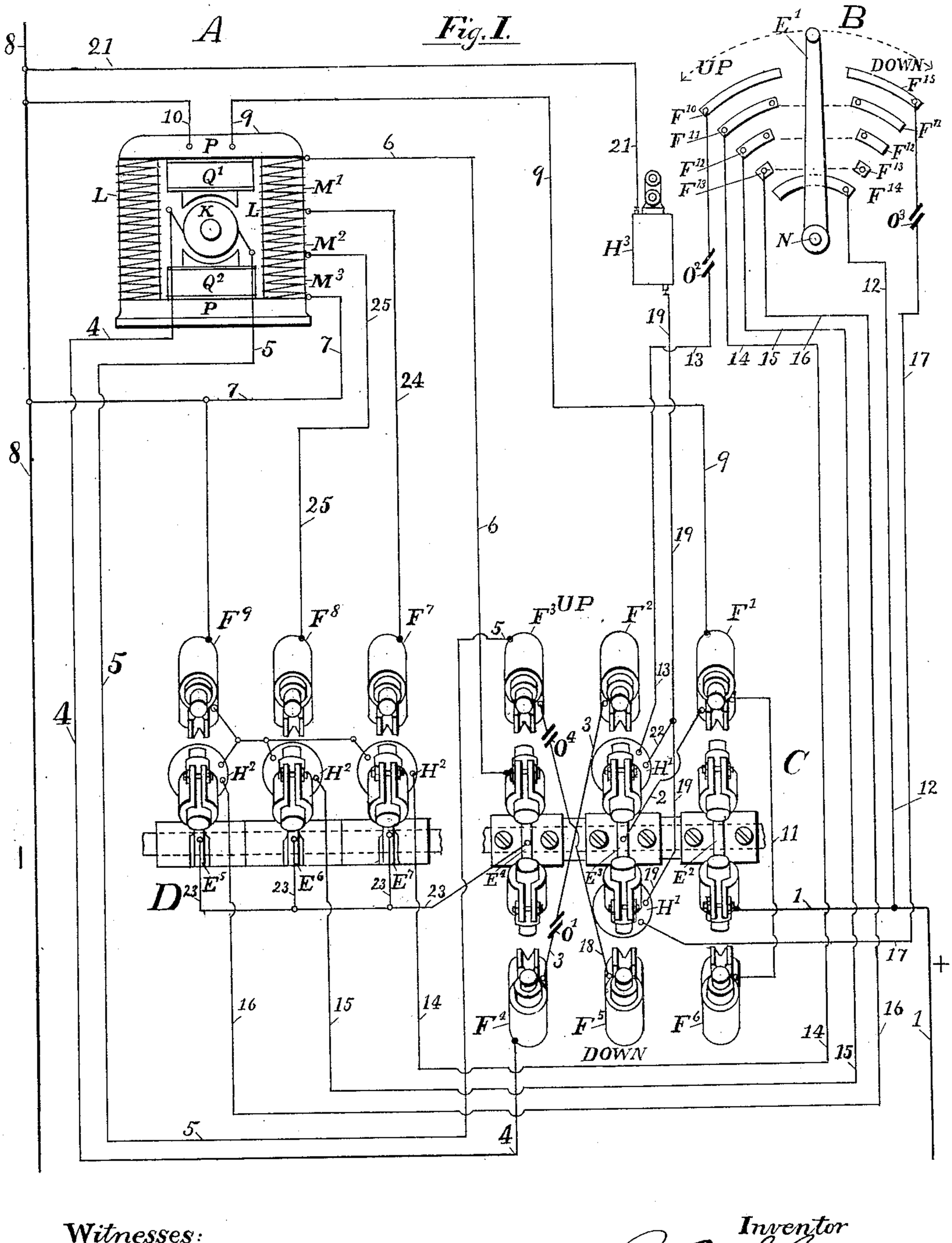
(No Model.) 3 Sheets—Sheet 1.

# B. C. VAN EMON.

## ELECTRICAL CONTROLLING APPARATUS.

No. 578,954. Patented Mar. 16, 1897.

*Fig. I.*

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(No Model.) 3 Sheets—Sheet 2.

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## ELECTRICAL CONTROLLING APPARATUS.

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*Fig. 2*

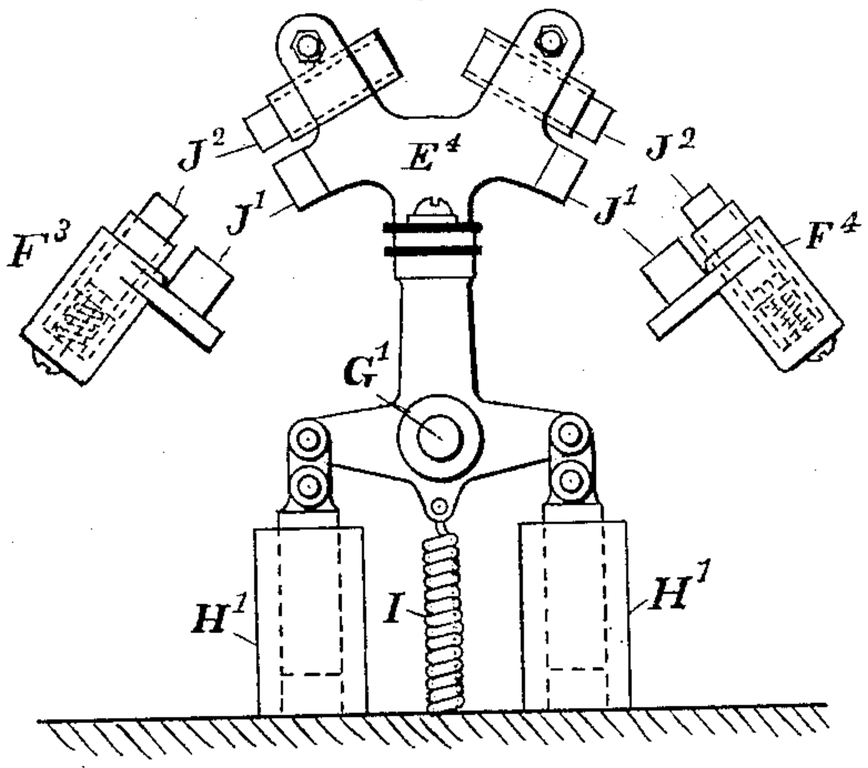



*Fig. 3*

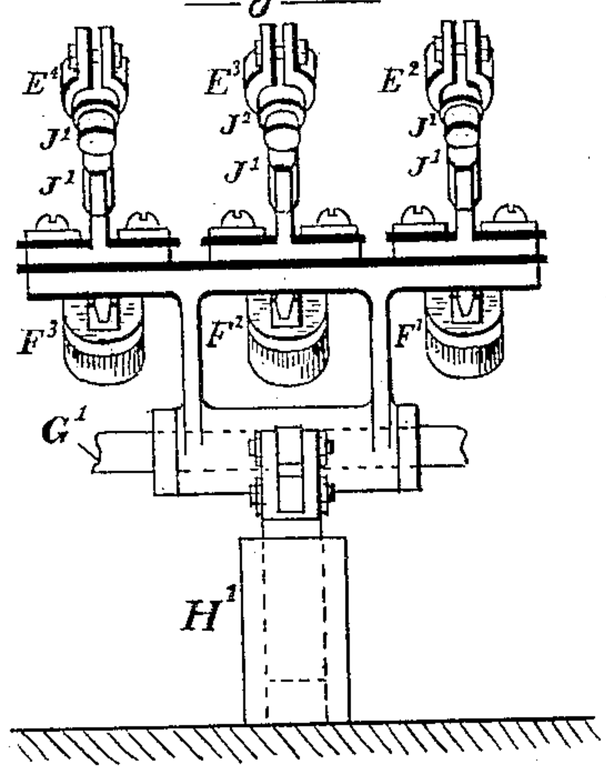



*Fig 4.*

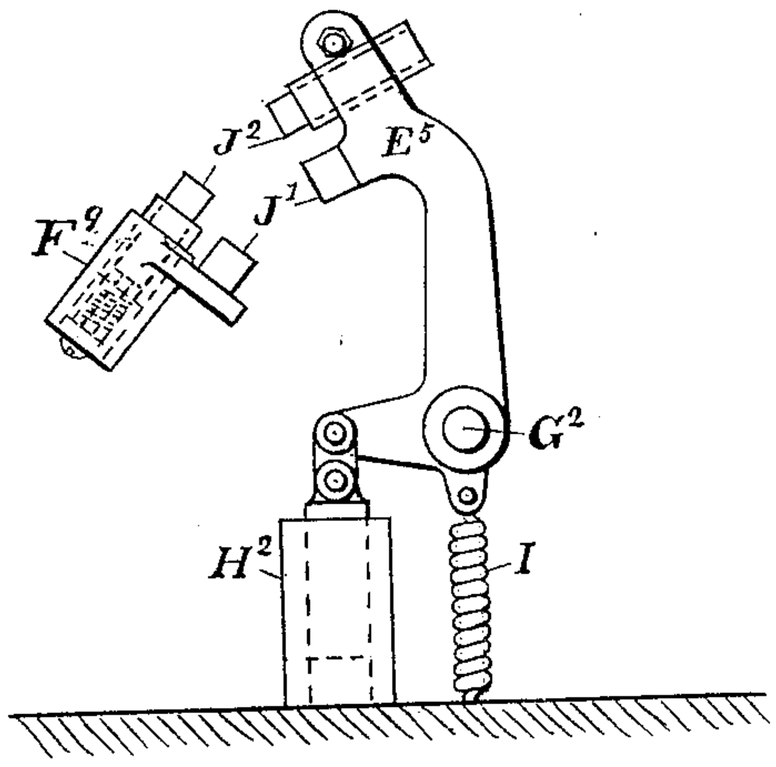
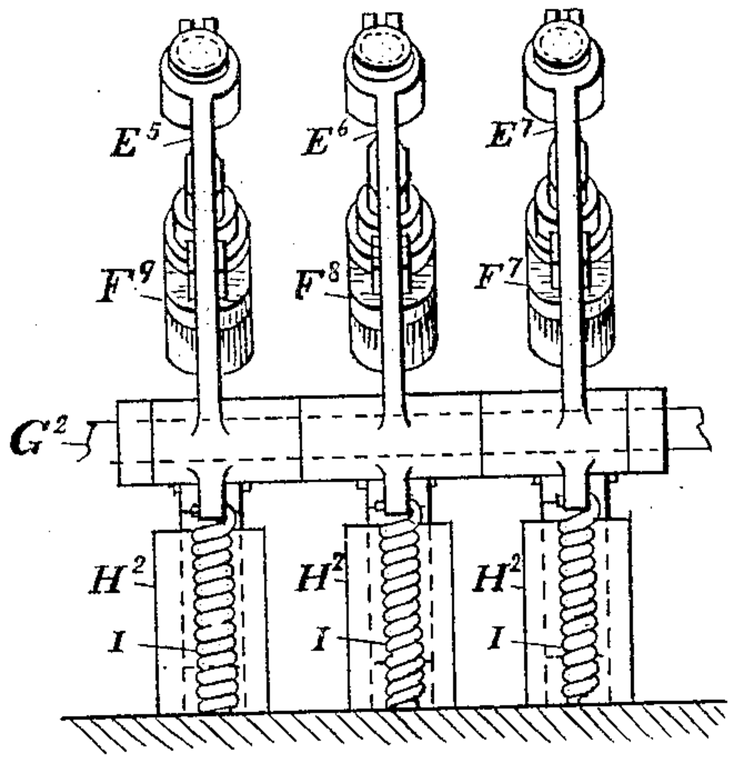



*Fig. 5.*

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(No Model.) 3 Sheets—Sheet 3.

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## ELECTRICAL CONTROLLING APPARATUS.

No. 578,954. Patented Mar. 16, 1897.

*Fig. 6.*

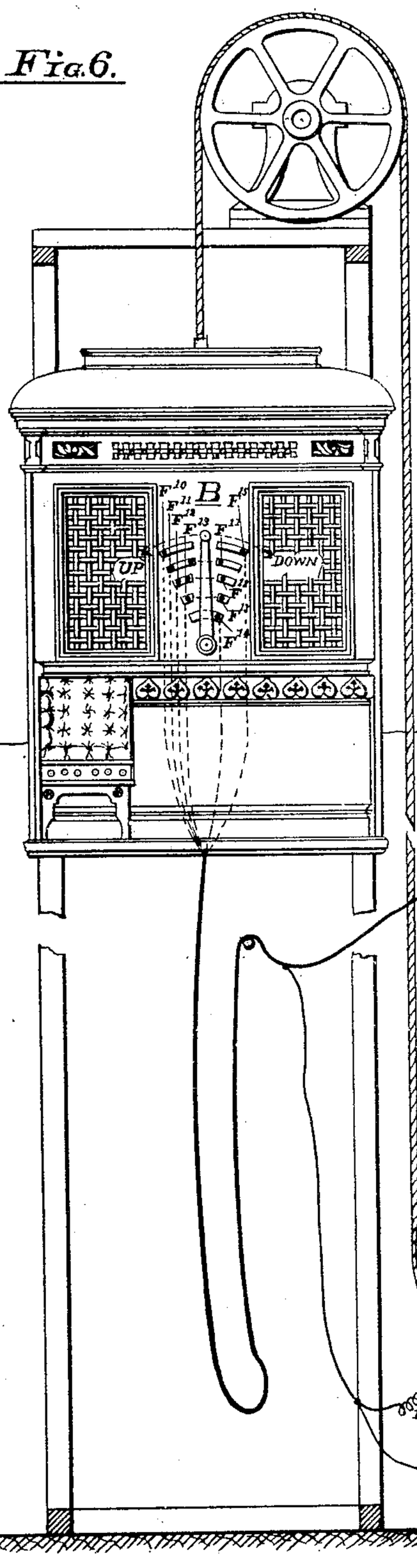
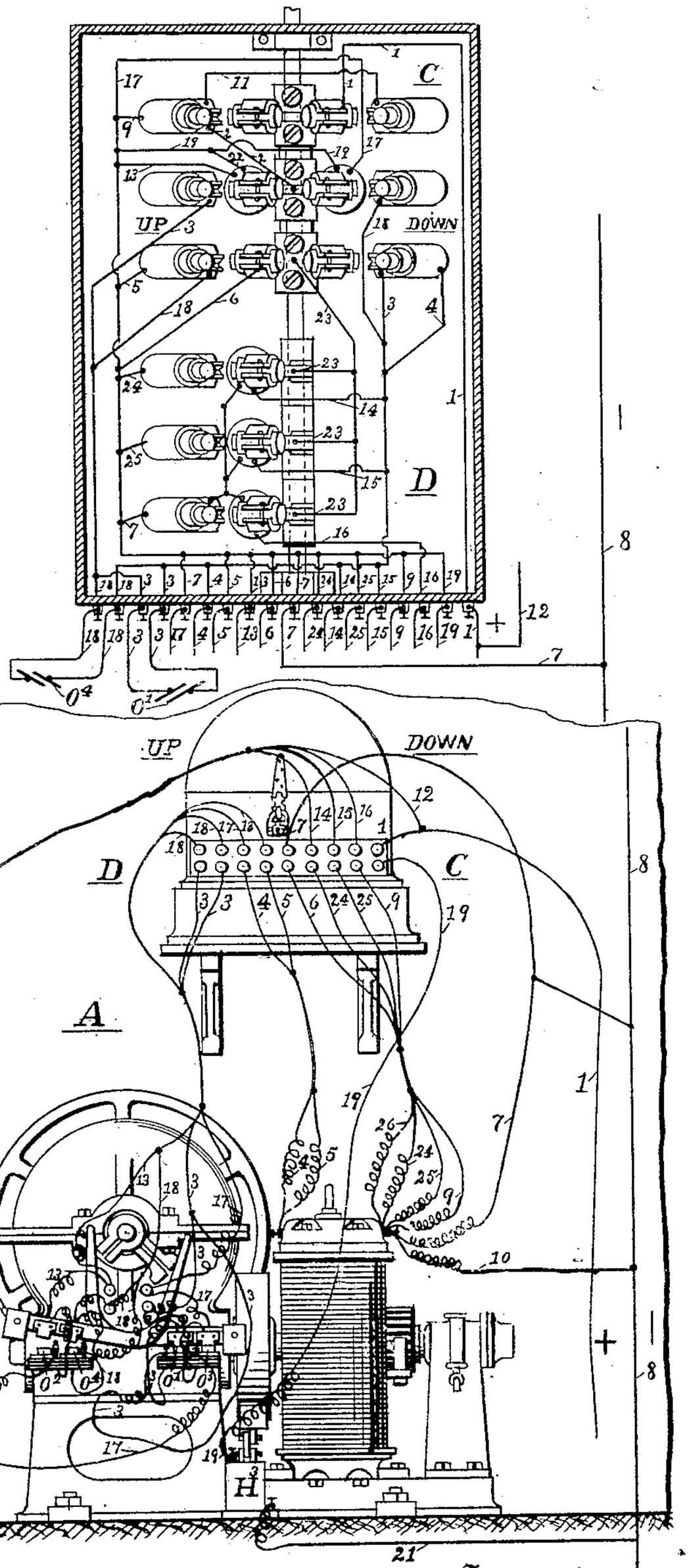



*Fig. 7.*




Witnesses
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# UNITED STATES PATENT OFFICE.

BURTON C. VAN EMON, OF SAN FRANCISCO, CALIFORNIA.

## ELECTRICAL CONTROLLING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 578,954, dated March 16, 1897.

Application filed May 22, 1896. Serial No. 592,656. (No model.)

*To all whom it may concern:*

Be it known that I, BURTON C. VAN EMON, a citizen of the United States, and a resident of the city and county of San Francisco, State of California, have invented certain new and useful Improvements in Controlling Devices for Electrical Apparatus Employed to Operate Elevators, of which the following is a specification.

My invention relates to electrical apparatus to operate elevators for raising and lowering passengers and freight, especially to devices for controlling the electrical current so applied.

My improvements consist in devices which are supposed to be in the cage or on the platform of an elevator and to move therewith to cut in and out series resistance to modify and control the force and rate or speed and torque of the electric motor, so as to meet the varying conditions of raising and lowering loads; also, apparatus to reverse the motion in raising and lowering loads, such devices consisting of a series of switches operated by means of solenoids controlled from the cage or platform of the elevator, and in various connected details of a constructive and operative nature that will be set forth and explained in the specification.

The object of my invention is to secure from a station on the cage or platform of an elevator or other suitable or convenient place complete control of the actuating or motive power in starting, stopping, and moving loads upward or downward in respect to both speed and intensity of the power applied, as hereinafter explained, and set forth in the claims at the end of this specification.

The elements of my invention include the ordinary gearing of an elevator, a series resistance, a controlling-switch to be placed in a cage or on the platform of the elevator or other suitable or convenient place, a reversing-switch operated by electric solenoids, a series of switches to control the resistance, also operated by solenoids, and the various wires, connections, and accessories to constitute the whole a complete operative apparatus for the objects hereinbefore stated.

In the drawings, Figure I is a diagram showing the position, relation, and connections of the various elements involved in my invention, also the circuits and distribution of the current. Fig. II is a diagram showing a detached end view of the reversing elements to change the motion of the electric motor for ascending and descending or raising and lowering loads. Fig. III is a side view of Fig. II. Fig. IV is a diagram showing an end view of the elements for cutting in and out the field series or resistance coils to regulate the speed and power of the electric motor. Fig. V is a side view of Fig. IV. Fig. VI is an organized view of all the elements A, B, C, and D set up as in practice. Fig. VII is an enlarged plan of the case containing the elements C D, with the exception that the binding-posts connecting wires 1 3 3 4 5 6 7 9 13, &c., are set in single instead of double row, so the connections of the wires can be more easily traced.

Similar letters and numerals of reference are employed to designate corresponding parts throughout the different figures of the drawings.

Referring first to Fig. I, there are four groups of elements—namely, an electric motor at A, a primary controlling-switch at B, a reversing-switch at C, and a series switch at D, the whole controlled by the lever E′ and its contacts, as will be hereinafter described.

Referring to Figs. II, III, IV, and V, the moving contact elements or switches are marked with the letter E and numerals to distinguish, and stationary contact elements are marked with the letter F and numerals to distinguish.

Referring first to the oscillating reversing-switches $E^2$ $E^3$ $E^4$, (shown enlarged in the diagrams, Figs. II and III,) these are mounted on an axis G′, so as to oscillate and engage the contacts F′ $F^2$ $F^3$ or the opposite contacts $F^4$ $F^5$ $F^6$, reversing the main circuit and motion of the armature at A, so as to cause an elevator to ascend or descend accordingly. These oscillating reversing-switches $E^2$ $E^3$ $E^4$ are closed, right or left, by the solenoids H′, energized by connections to be hereinafter described, and are held in a central or neutral position by the spring I when the circuit is open. The switches $E^2$ $E^3$ $E^4$ and their corresponding contacts F′ to $F^6$, consecutive, are

provided with positive metallic contact-points J′ and yielding carbon contact-points $J^2$, as seen in Figs. II and III.

Referring next to the series switch, (shown by the diagrams, Figs. IV and V,) the elements are the same in construction, as indicated by the references thereon, but have only contacts at one side and movement one way, turning on the axis $G^2$ by means of the solenoids $H^2$ and the springs I, as in Figs. II and III.

Referring now to Fig. I and tracing the direct armature-circuit, when the switches $E^2$ $E^3$ $E^4$ are moved in the direction marked "Up" in the drawings and engage the contacts F′ $F^2$ $F^3$, then current from the positive main wire 1 passes to the oscillating reversing-switch $E^2$, through contact F′ and wire 2 to switch $E^3$, then through contact $F^2$ and wire 3 to contact $F^4$ and wire 4 to the armature K of the motor at A. From the armature K the circuit is continued through the wire 5 to the contact $F^3$ and switch $E^4$, to wire 6, to the coil L, thence through the wire 7 to the negative main 8, the series switches at D being open and inert.

In the adjustment just explained the field-circuit is from the contact F′ through the wires 9 and 10 to the negative main 8.

Supposing next that the switches $E^2$ $E^3$ $E^4$ are moved the opposite way, in the direction marked "Down" in Fig. I, and engage the contacts $F^4$ $F^5$ $F^6$, then the armature-circuit will be reversed in the following manner: Current will pass from the main wire 1 through the switch $E^2$, contact $F^6$, wire 11, contact F′, wire 2, switch $E^3$, contact $F^5$, and wire 18 to contact $F^3$, thence through wire 5 to the armature K. This constitutes the main circuit for operating the motor at A at a constant speed or with a constant electromotive force, but the requirements for starting, raising, and lowering loads of various weights and at different rates of speed demand various elements of control that are supplied by my invention in the following manner: The series coils L are placed in the field so as to be cut in or out in proportions or sections as illustrated by the diagram at M′ $M^2$ $M^3$ in Fig. I, the coils L at each side of the field-frame being uniform, and connected across the frame are cut in and out in like sections or units. To explain this, I will now refer to the controlling elements at B in Fig. I, these being in the cage or moving with the load to be raised or lowered, the connecting-wires being made flexible and extensible in the usual manner. The central switch-lever E′ is pivoted at N and is continually in contact with the segmental contact-bar $F^{14}$, connected by the wire 12 with the positive main wire 1. At the side marked "Up" and engaged by the switch-lever E′ are contacts $F^{10}$ $F^{11}$ $F^{12}$ $F^{13}$, to which are connected the wires 13, 14, 15, and 16, that are in turn connected to the solenoids H′ $H^2$, that operate the switches in the groups C and D. If it is required to stop the motor or an elevator operated thereby at the extremes of movement each way, I provide cut-out switches at O′, $O^2$, $O^3$, and $O^4$ in the wires 3, 13, 17, and 18, as indicated in Fig. I. Such switches when employed are arranged to be opened automatically by contact of some moving part of the machinery or of the cage and correspond to what are called "automatic" top and bottom stops in elevators operated by hydraulic or other gearing. Coincident with all stops of the motor A and of an elevator operated thereby a brake is applied to some suitable part of the running mechanism, preferably the shaft of the armature K, by means of a solenoid $H^3$, energized and controlled by the switch-lever E′ and the wires 17, 19, and 21, the latter connecting to the negative main wire 8, as seen in Fig. I.

I will now proceed to describe the most important feature of my invention—the control of the power and speed of the electric motor at A by means of the series coils L, divided into sections at M′, $M^2$, and $M^3$, and the distribution of current or circuits thereto by the switches $E^5$ $E^6$ $E^7$, and solenoids $H^2$ to operate these switches. The series or resistance coils L, which are identical at each side and connected across the field-frame P, are thus placed in order to increase the strength of the fields and utilize the electrical energy that would otherwise be lost in heating detached rheostat-coils. The coils L (shown in the diagram as a single wire) are in practice layers of coils around the side members of the field-frame, consisting of layers superimposed, or one on the top of the other, and brought into circuit in sections, as indicated at M′ $M^2$ $M^3$, the amount of wire thus employed being adjusted to the electromotive force of the circuit from which the motor is to be operated.

Referring now to the controlling switch-lever E′, this lever engages the contacts $F^{10}$, $F^{11}$, $F^{12}$, and $F^{13}$, connecting to the wires 13, 14, 15, and 16. The latter wires are all or severally placed in circuit with the contact $F^{14}$ and the main wire 1 as the lever E′ is moved to left to connect with the elements marked "Up." It will be noticed that in moving the lever E′ through the dotted arc at B, or in that direction to engage the elements marked "Up," it first connects with contact $F^{10}$, then with contact $F^{11}$, and so on up to contact $F^{13}$, establishing circuits accordingly, first through the wire 13 and the solenoid H′ in the group of contacts F′ $F^2$ $F^3$ marked "Up," moving the switches $E^{12}$ $E^{13}$ $E^{14}$ to the contacts F′ $F^2$ $F^3$. From this solenoid H′ the current passes through the wire 22 into wire 19 and to the solenoid $H^3$, that releases brake mechanism employed to stop and lock the armature-shaft, as before explained, thence through wire 21 to the negative main wire 8. This by engaging the switches $E^2$ $E^3$ $E^4$ closes the armature and field circuits and sets the motor in operation in the direction to raise the elevator cage or load.

I will now follow through the various mo-

tions, connections, and circuits, including the series coils, beginning at the group B.

To start the armature K in the direction to raise a load, and by means of the elements marked "Up" in the diagram Fig. I, the central lever E′ is moved to the contact $F^{10}$ on the left. This, by means of the wire 13, will energize the solenoid H′ at the side marked "Up" in the group C, pulling the switches $E^2$ $E^3$ $E^4$ into contact at F′ $F^2$ $F^3$. Current from the main wire 1 through the various wires, as before described, to the armature K, back through wire 5 to contact $F^3$, and by wire 6 to the series coils L, and then by wire 7 to the negative main 8, as previously traced. Another portion of the current from the contact F′ passes through wire 9 to the field-coils Q′ and $Q^2$ and by wire 10 to the negative main wire 8. A second portion of the current passes through the wire 12 to the contact $F^{14}$, the lever E′, and contact $F^{10}$ and through the wire 13 to the solenoid H′ on the side marked "Up" in the group C, thence by wire 22 to wire 19, through the solenoid $H^3$ and wire 21 to the negative main wire 8. During this condition or position of the various elements just described the series coils L are all in circuit and the armature K is operating at low velocity, but increased torque. If the lever E′ is farther moved to contact $F^{11}$, then current from the wire 12 is sent through the wire 14 to the first solenoid $H^2$, which closes the switch $E^7$ and establishes a main circuit from the switch $E^4$ through the wires 23 and 24, through a portion of the series coils L, cutting out the section M′, reducing resistance, and increasing the speed of the motor accordingly. If the lever E′ is farther moved to the contact $F^{12}$, current from the main wire 1 and wire 12 and lever E′, contact $F^{12}$ to wire 15 and to the second solenoid $H^2$ in group D, closing the switch $E^6$, so current will pass from wires 23 and 25 to the series coils L, cutting out the second section $M^2$ and further diminishing resistance and increasing the armature's speed. If the lever E′ is moved farther to contact $F^{13}$, then current passes from wire 12 through wire 16 to the third solenoid $H^2$ in the group D, closing switch $E^5$ and cutting section $M^3$ of the series coils. So there are four stages of resistance and four conditions of operation, beginning with the maximum resistance of the series coils and consequent high torque of the armature and gradually cutting out the resistance or series coils and increasing the speed as the load is set in motion or as its weight and resistance may demand.

The division of the series coils L into sections M′ $M^2$ $M^3$ may be of any number and bear any proportion that is required by the circumstances of use, and as the amount of wire in the relative sections or divisions. The disposition of these coils may also be varied. I have shown them diagrammatically, so as to enable explanation more clear. When the switch-lever E′ is moved the other way toward the elements marked "Down," then the first contact $F^{15}$ energizes the solenoid H′ in the group C on the side marked "Down," the switches $E^2$ $E^3$ $E^4$ engage the contacts $F^4$ $F^5$ $F^6$, and the armature-circuit and motion of the armature are reversed, current from the main wire 1 then passing through elements as follows: $E^2$, $F^6$, wire 11, F′, $E^3$, $F^5$, $F^3$, and wire 5 to the armature K, then by wire 4, $F^4$, $E^4$, and wire 6 to and through the coils L, and through wire 7 to the negative main wire 8. In this reversal of the armature-current and its motion the operation of the elements in the group D remain the same, the contacts at the right of the lever E′ coming successively into contact, closing circuits through $F^{11}$, $F^{12}$, and $F^{13}$, the same as when the lever E is moved to the left, so the resistance is cut in and out for descending, the same as in ascending.

Having thus described my invention, its nature and objects, I claim—

1. In electrical controlling devices the combination of the main switch-lever E′ placed in the elevator car or cage, contacts $F^{10}$ and $F^{15}$, double oscillating switches $E^2$, $E^3$, $E^4$ turning on a central axis, solenoids for closing said switches to the right or to the left, and springs adapted to return and hold said switches in a central or neutral position when they are open, substantially as described.

2. In electrical controlling devices a main switch E′ with successive contacts at each side for the series circuits, connected and in combination therewith the independent pivoted switches $E^5$ $E^6$ and $E^7$ each closed by independent solenoids $H^2$ and opened by the springs I in the manner substantially as herein shown and described.

3. In electrical controlling devices, a triple oscillating reversing-switch, mounted and turning on an axis with a series of parallel contacts at both sides, two solenoids to move the switch, and a spring or springs to disengage and hold the same out of contact, in the manner and for the purposes substantially as shown.

4. In electrical controlling devices, a reversible motor and a triple reversing armature-circuit switch, mounted and turning on an axis in the manner described, solenoids to move the switch either way and reverse the motor, in the manner substantially as shown and described.

5. In electrical controlling devices, a reversible motor and a triple reversing armature-circuit switch, mounted and turning on an axis in the manner described, wires to cross and reverse the armature-circuit, solenoids to close the switch, and a spring or springs to open and hold it out of contact when the solenoid-circuit is open, substantially as described.

6. In electrical controlling devices, an electric motor, an oscillating reversing-switch with triple contacts at each side, solenoids to close the switch, and cross reversing-wires having supplementary switches O′ and $O^4$ to

open the armature-circuit independent of the main reversing-switch, in the manner substantially as described.

7. In electric controlling devices, an electric motor, main controlling switch-lever E′ and an independent reversing-switch, series coils in the armature-circuit and in the motor-field, the series coils divided into sections, and the circuits therethrough closed by means of the switches $E^5$, $E^6$ and $E^7$, actuated by the solenoids $H^2$, substantially as described.

8. In electrical controlling devices an electric motor having series coils wound upon the field-frame and divided into sections M′ $M^2$ $M^3$ in the manner described, and in combination therewith the main switch E′ dividing switches $E^5$ $E^6$ $E^7$ and independent solenoids to operate the same all combined and operating in the manner substantially as described.

9. In electric controlling devices, the combination of the main controlling-switch E′, with a reversing-switch in the armature-circuit, and a series of switches in the series circuit successively closed by solenoids, the latter energized and controlled by the main switch E′, in the manner substantially as described.

10. In electric controlling devices, the main controlling-switch E′, contacts $F^{10}$ and $F^{15}$, solenoids H′, $H^2$ and $H^3$ with reversing and series switches combined and operating, in the manner and for the purposes substantially as described.

In testimony whereof I have hereunto affixed my signature in the presence of two witnesses.

BURTON C. VAN EMON.

Witnesses:
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W. T. GROVER.