(No Model.) 2 Sheets—Sheet 1.

R. WILSON.

ELECTRIC ELEVATOR AND MOTOR CONTROLLER.

No. 532,514. Patented Jan. 15, 1895.

Fig. 1.

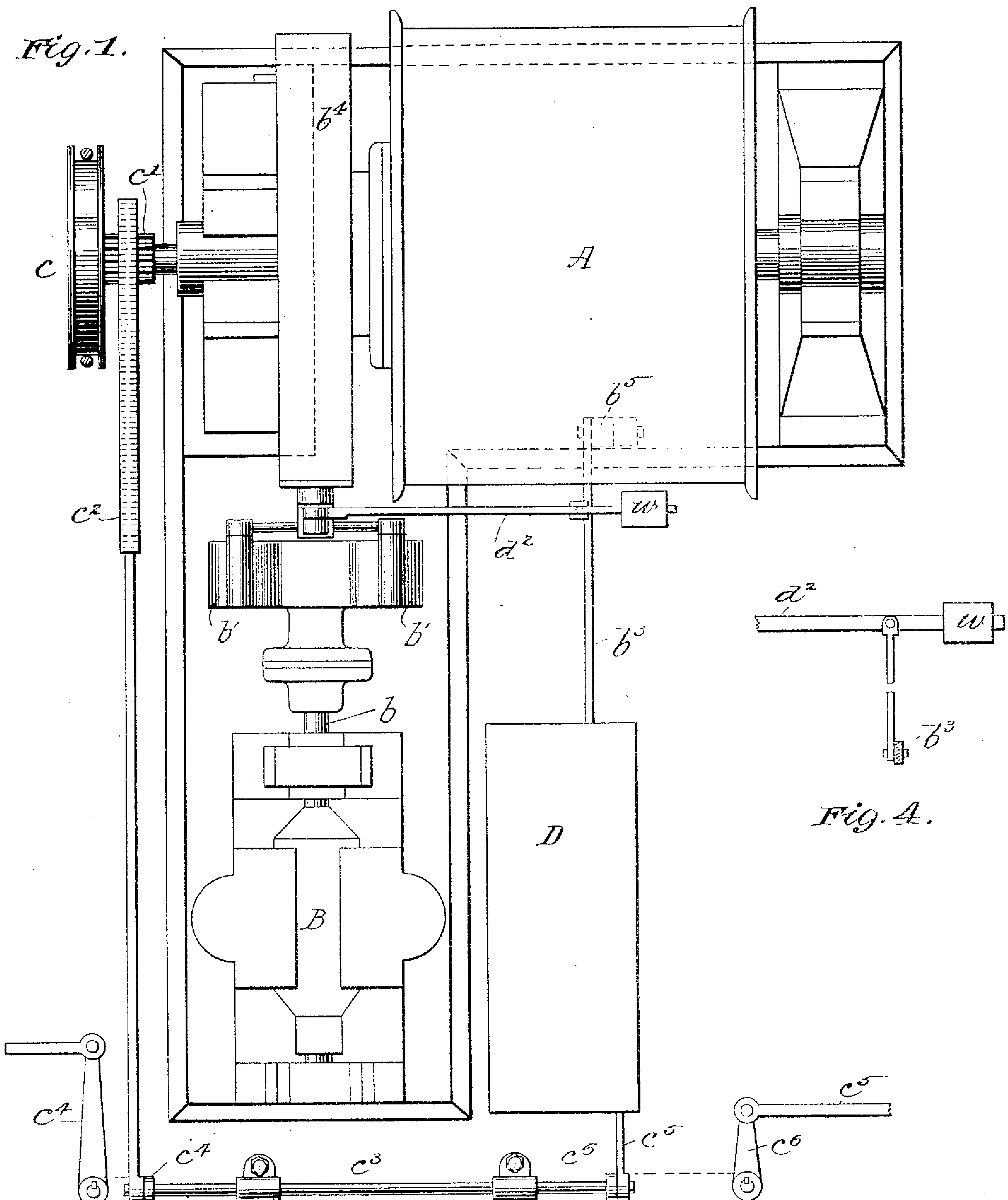

Fig. 4.

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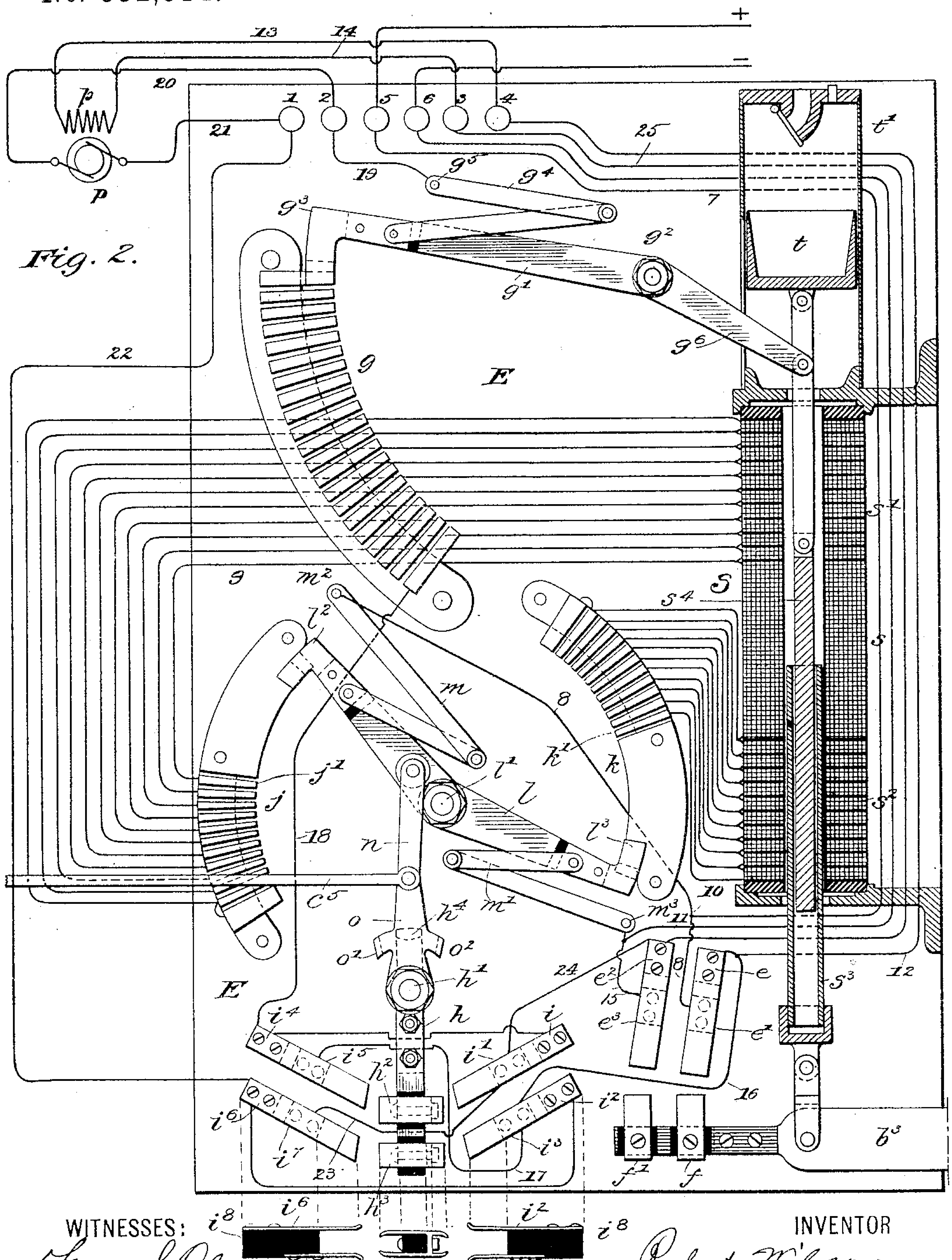

Fig. 2.

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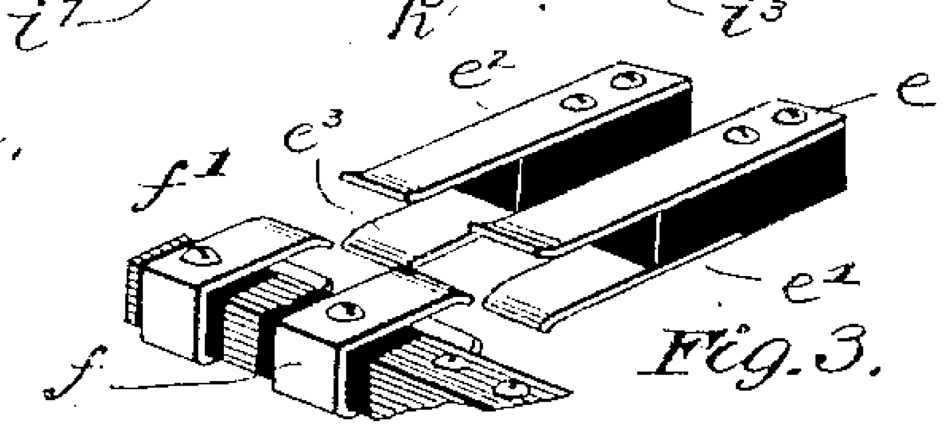

Fig. 3.

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UNITED STATES PATENT OFFICE.

ROBERT WILSON, OF LOUISVILLE, KENTUCKY, ASSIGNOR TO THE SULZER-VOGT MACHINE COMPANY, OF SAME PLACE.

ELECTRIC ELEVATOR AND MOTOR CONTROLLER.

SPECIFICATION forming part of Letters Patent No. 532,514, dated January 15, 1895.

Application filed June 23, 1894. Serial No. 515,501. (No model.)

To all whom it may concern:

Be it known that I, ROBERT WILSON, a citizen of the United States, residing at Louisville, in the county of Jefferson and State of Kentucky, have invented certain new and useful Improvements in Electric Elevator and Motor Controllers, of which the following is a full, clear, and exact description.

This invention relates to the control of electric motors especially adapted for operating elevators or hoists.

The object of the invention is to provide means for starting the motor and afterward regulating its speed, which will operate in a semi-automatic manner such as will prevent injury to the mechanism through the ignorance or viciousness of the operator in the car.

With this invention the operator first throws an electric switch which controls the circuit of a solenoid, which in turn starts the motor. The operator thereafter is able to increase the speed of the motor by cutting resistance out of the motor circuit, but not so rapidly as would injure the motor.

Among the advantages of my improved apparatus may be mentioned its extreme simplicity and perfection in operation.

The invention will be described in detail with reference to the accompanying drawings, in which—

Figure 1 is a plan, somewhat conventionally, of the elevator machinery. Fig. 2 is a front elevation of the controlling mechanism with a diagram of the circuits. Fig. 3 is a detail perspective view of the main switch, and Fig. 4 is a detail view of the brake levers.

Referring to the drawings by letters and figures, A is an ordinary hoisting drum, over which the cable suspending the car is wound and unwound as the car ascends or descends.

B is an electric motor supplying the power to rotate the drum. Upon the shaft b of the motor is a disk, upon the periphery of which are arranged two brake straps b' which are thrown into and out of contact with the surface of the disk by the rise and fall of the brake lever d^2 carrying a weight w at its outer end. This lever is raised and lowered by another lever b^3 which is operated in the manner hereinafter described. The shaft of the motor is provided with a worm and the shaft of the drum with a worm gear which is located in a casing b^4, and is therefore not seen in the drawings. This is the ordinary construction of elevator machinery of this type and therefore does not require a more detailed description.

c represents the check wheel, over which the check rope passes and leads thence up through the elevator shaft and the car therein, to be manipulated by the attendant in the car. The check wheel carries a pinion c' which is in engagement with a rack c^2. The rack bar is connected to one end of a rock shaft c^3 by the crank c^4 and the opposite end of the rock shaft is connected with a thrust rod c^5 by a crank c^6. The thrust rod enters a box D wherein is located the controlling mechanism. The lever b^3 controlling the brake also enters this box D.

Referring now to Fig. 2, we have a face view of the interior of the box D. E is a slab of slate or other suitable non-conducting material upon which the devices are mounted. The main switch consists of the contact pieces e, e', and e^2, e^3. The pair e, e' is adapted to be connected together electrically by clip f and the pair e^2, e^3 is adapted to be connected together by the clip f'. These two clips are insulated from each other and are mounted upon the end of the lever b^3 which operates the brake and which extends into the box as before described. g is a row of contact pieces forming the terminals of an ordinary rheostat for the motor armature. These are fixed to the insulating base and the resistance coils are disposed of behind the insulating plate, or in any other way. An arm g' pivoted to the insulating base at the point g^2 carries an insulated contact spring g^3 which is adapted to travel over the row of contact pieces g. The circuit from the piece g^3 leads through a hinged arm g^4 pivoted to the base at g^5, at which point a wire is attached. This arrangement permits the arm to move while maintaining connection with the circuit. At the lower end of the insulating base is mounted a motor reversing switch consisting of an arm h pivoted between its extremities upon a stud h' with one end carrying two clips h^2 and h^3 which are adapted to electrically connect two pair of contact pieces to the right, or two pair to the left, in accordance with the direction in which the motor is to rotate. The pair of contact pieces to the right are lettered i, i', and i^2, i^3, respectively and those to the left are lettered i^4, i^5, and i^6, i^7, respectively. The contact pieces of each pair are fixed to a block of insulating material i^8, as indicated in the sub-figure below Fig. 2. j and k respectively represent two segments of contact pieces which, in conjunction with the double armed lever l, I shall designate a commutator or commutating switch. The lever is pivoted upon a stud l' and at each end carries a contact spring, one of which is lettered l^2 and the other l^3. These are insulated from the lever. As the lever l swings on its pivot the pieces l^2, l^3, travel over their respective rows of segments in opposite directions and, the arm being rigid, at the same speed. In order that the pieces l^2, l^3, may be constantly in circuit, they have attached to them hinged arms m and m' which are pivoted to the slate base at the points m^2, m^3, at which points the electrical conductors are connected, as will be hereinafter referred to. To the arm l is attached a link n which is connected to thrust rod c^5 operated, as before described, by the attendant in the elevator car. To the end of this rod c^5 is also attached a short lever o which is pivoted upon the stud h' and is provided with two lugs o' and o^2 respectively, between which stands an extension h^4 of the lever h. The reciprocating movement of the rod c^5 swings the lever l on its pivot and at the same time throws the arm h of the reversing switch. There is, however, as will be seen, a small amount of independent motion between the lugs o', o^2, and the lever h^4.

S represents an electro-magnet in the form of a solenoid. Its winding is divided into three sections, s, s' and s^2. The end sections, s' and s^2, are divided into an equal number of sub-sections. This solenoid has a compound or double core consisting of the two parts s^3, which is tubular, and s^4, which is solid. The solid core is telescoped inside of the tubular core and one is adapted to slide upon the other. The tubular core is connected at its lower end with the lever b^3 which controls the brake and the main switch. The solid core is connected at its upper end with the extension g^6 of the lever g' and also with the piston t of a dash pot or air cushion t'. It will be seen that any reciprocating movement imparted to the core s^3 will either raise or lower the lever b^3, while a similar movement imparted to the core s^4 will either lower or raise the arm g' and the piston t. Both cores of the solenoid are about the same length; that is, equal to the length of the middle section of the solenoid plus that of either end section. The sub-sections of winding in section s' of the solenoid are connected respectively with the contact pieces in the segment j of the commutating switch, the top sub-section being connected, as shown, with the last or lower contact piece in the segment, while the other sub-sections are successively connected with the contacts above, until the lowest sub-section in section s' is connected with the first contact piece of the segment j. Likewise the sub-sections of winding in section s^2 are connected with the contact pieces in segment k except that the order of connection is reversed; that is, the lowest sub-section is connected with the first contact piece in the segment of contacts, while the highest or inner sub-section of the section s^2 is connected with the last or upper contact piece of the segment k. In the diagram, Fig. 2, the armature of the motor driving the elevator is represented by P and the field magnet by p. The wires from the brushes of the motor extend to binding posts 1 and 2 on the box d, while the wires from the field magnet extend to binding posts 3 and 4. The main wires supplying the power current are attached to the binding posts 5 and 6.

The operation of the mechanism is as follows: When the elevator is stationary the mechanism in the box D is in the position shown in Fig. 2; that is to say, the lever b^3 is in its lower position, at which the brake is applied and the main switch is opened. The lever of the reversing switch stands midway between its two sets of contacts. The contact pieces l^2 and l^3 of the commutating switch are resting upon surfaces out of circuit. The solid core of the solenoid is standing at the lowest limit of its throw, at which point its magnetic center is substantially coincident with the magnetic center of the lower two-thirds of the solenoid. The tubular core is standing with its magnetic center below the magnetic center of the lower two-thirds of the solenoid. The arm g' is standing on the last contact piece of the rheostat, in which position the entire resistance is in the motor armature circuit. To start the motor the attendant in the car pulls upon the check rope in the proper direction to start the car either upward or downward. This motion is transmitted through rack c^2, rock shaft c^3 and thrust rod c^5 to the levers o and n. We will assume that the thrust rod is pushed toward the solenoid. The double arm l will be swung on its pivot in a direction to carry the contact pieces l^2 and l^3 toward the first contacts in segments j and k respectively. Before reaching that point, however, the lug o' has struck the extension h^4 of lever h and thrown the clips h^2 and h^3 respectively into contact with the two pair of terminals i^4 and i^5, and i^6, i^7. As soon as the contact pieces l^2 l^3 strike the first piece in their respective segments, which they do at the same instant, the following circuit is established: from binding post 5, by wire 7 and wire 8 to the double arm m, contact spring l^2, contact piece j', wire 9 through the two sections s and s^2 of the solenoid, wire 10, contact piece k', spring l^3, arm m' and wire 11 to binding post 6. This circuit, it will be observed, is entirely independent of the motor and includes the lower two-thirds only of the solenoid. This portion only of the solenoid becomes vitalized, but as the magnetic centers of the solenoid and core s^4 are coincident, the latter does not move. The core s^3, however, which is in a lower position, is at once attracted and raises until its center is substantially coincident with the magnetic center of the solenoid. This movement simultaneously closes the main switch and releases the brake.

It will be seen in Fig. 4 that the lifting of the lever b^3 which is pivoted at the point b^5 raises the weight w and this, it will be understood, releases the brake.

The main switch being closed, the following circuit is established: from binding post 5, by wires 7 and 8 to contact e' of the switch, clip f, contact e, wire 12, binding post 4, wire 13, coils of the field magnet p, wire 14, binding post 3, wire 25, contact e^2 of the switch, clip f', wire 15 and wire 11 to the binding post 6. At the same time another circuit is established as follows: from binding post 5 by wires 7 and 8, contact piece e', clip f, contact e, wire 16, contact i^3, wire 17, (from the same contact,) contact i^5, clip h^2, contact i^4, wire 18 to the first segment on the rheostat g through the entire resistance of the rheostat to contact spring g^3, arm g^4, wire 19, binding post 2, wire 20, armature of the motor p, wire 21, binding post 1, wire 22, contact i^6, clip h^3, contact i^7, wire 23, contact i', wire 24, (which is connected to the same contact,) contact e^2, clip f', contact e^3, wire 15 and wire 11 to binding post 6. Thus the circuits of the field magnet and armature of the motor are completed, that through the armature including the entire resistance of the rheostat. The motor now starts at its lowest speed, at which it may continue to run if desired, but in order to increase the speed the attendant in the car continues the movement of the check rope in the same direction and thus causes the contacts l^2 and l^3 to travel over the contact pieces of the two segments j and k and successively cuts into circuit the lower sub-sections of the section s' of the solenoid and simultaneously cuts out the lower sub-sections of section s^2 of the solenoid, thus gradually shifting the center of magnetism of the solenoid from its lowest position toward its highest position. As the magnetic center of the solenoid ascends, the solid core follows it and causes the arm g' to swing downward and gradually cut the resistance out of the armature circuit of the motor. The speed of the motor increases as this operation progresses until the contact spring g^3 reaches the first contact piece of the segment g, at which point all of the resistance is out of the armature circuit and the motor is running at its highest speed. Thus it will be seen that it is within the power of the attendant in the car to increase the speed to any point from the lowest to the highest at will, but in order that the armature may be protected against a sudden rush of current due to the too speedy removal of resistance from its circuit, the dash pot t' is provided, which may be adjusted so that the upward movement of the solenoid will not be too rapid at any time. The springs l^2 and l^3 may of course be left at any point upon the commutating switch and thus allow the car to move at any particular constant speed.

To stop the elevator, it is only necessary to pull the check rope in the opposite direction far enough to carry the springs l^2 and l^3 off of the first contact pieces in their respective segments, leaving the clips h^2 and h^3 in contact with their respective contact pieces. The solenoid circuit will then be entirely broken and its cores will immediately drop to the lowest limit, thus opening the main switch and applying the brake. If the direction of movement of the car is to be changed, the check rope is pulled to a greater distance, thus carrying the clips h^2, h^3 out of the contacts on the left hand side and into the contacts on the right hand side. The commutating switch then acts as before in starting the motor and regulating its speed.

The construction of the clip of the reversing switch and the relative lengths of the levers operating that switch and the commutating switch are such that while the arm of the commutating switch is traveling over its series of contact pieces, the clips h^2 and h^3 of the reversing switch slide into the pairs of contacts which they connect with, until when the commutating switch reaches the end of its movement the clips have entered the contacts to the deepest point. On the reverse movement, the clips h^2 h^3 do not actually break their contact only as the direction of movement of the elevator is to be changed.

Having thus described my invention, I claim—

1. A device for controlling electric motors, consisting of the combination of a rheostat in the motor circuit, a solenoid having its core connected with and operating the arm of the rheostat, said solenoid being wound in three main sections, two of which are at the ends and the third between the other two, the end sections being subdivided into sub-sections, a commutator whose segments are connected with the several sections and sub-sections on the solenoid, and two switch arms adapted to travel over the commutator and switch the current into any number of the sections at one end of the solenoid and out of a corresponding number of the sections at the other end, whereby the center of magnetism in the solenoid will be changed.

2. A device for starting and controlling the speed of electric motors, consisting of the combination of a rheostat in the motor circuit, a make and break switch also in the motor circuit, a solenoid in an independent circuit, said solenoid having two independent movable cores, one operating the rheostat arm and the other the make and break switch, substantially as described.

3. A device for starting and controlling the speed of electric motors, consisting of the com-

bination of a rheostat in the motor circuit, a make and break switch also in the motor circuit, a solenoid in an independent circuit, said solenoid having two independent movable cores, one operating the rheostat arm and the other the make and break switch, and means for changing the position of the center of magnetism in the solenoid, substantially as described.

4. A device for starting and controlling the speed of electric motors, consisting of the combination of a rheostat in the motor circuit, a make and break switch also in the motor circuit, a solenoid in which the position of the center of magnetism is gradually variable from end to end and normally located at or near one end, a movable core whose magnetic center is normally coincident with the position of the magnetic center of the solenoid at said end, said core being connected with the rheostat arm, and a second movable core of the same solenoid, whose magnetic center is normally beyond the position of the magnetic center of the solenoid at said end, said second core being connected with the make and break switch, whereby when the solenoid is first energized the switch will be thrown and as the magnetic center of the solenoid changes the rheostat will be operated.

5. In electric elevator machinery, the combination of a motor, a main switch controlling the circuit thereto, a rheostat controlling the speed of the motor, a solenoid operating both the main switch and the rheostat and a switch in the solenoid circuit, the last being operated from the elevator car, substantially as described.

6. In electric elevator machinery, the combination of an electric motor, a main switch therefor, a brake lever and a solenoid, a core of the solenoid being connected with the switch and brake lever to operate the same, as set forth.

7. A controlling device for electric motors consisting of a solenoid having two movable cores, one acting upon the main switch to start and stop the motor and the other operating a speed controlling device such as a rheostat.

8. A controlling device for electric motors, consisting of a solenoid having two movable cores, one telescoping the other, and one acting upon the main switch to start and stop the motor and the other operating a speed controlling device such as a rheostat.

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

ROBERT WILSON.

Witnesses:
C. H. GERRARD,
T. J. KIME.