(No Model.)

J. D. IHLDER.

ELECTRIC MOTOR FOR ELEVATORS.

No. 585,760. Patented July 6, 1897.

Fig. 1

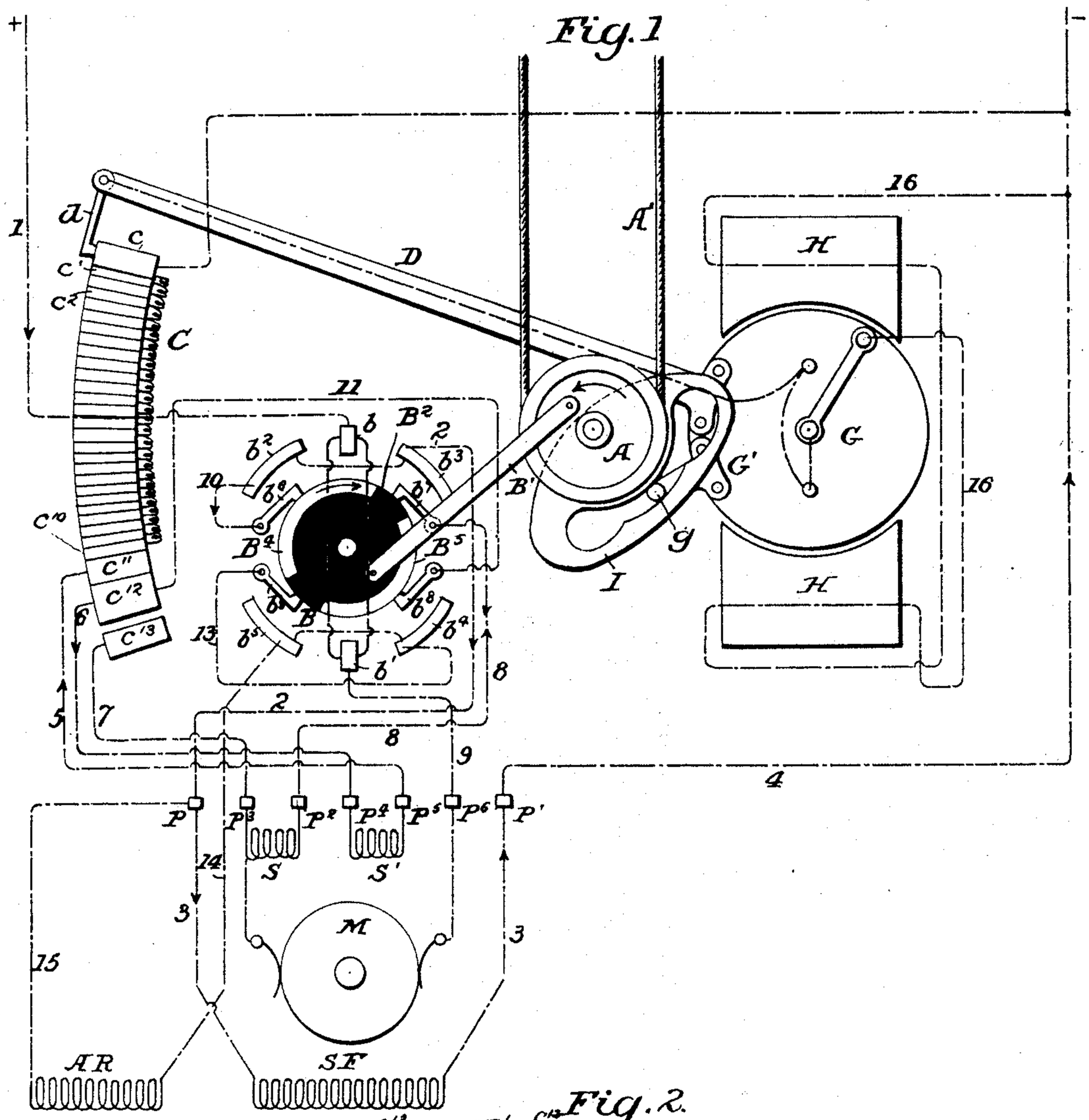


Fig. 2.

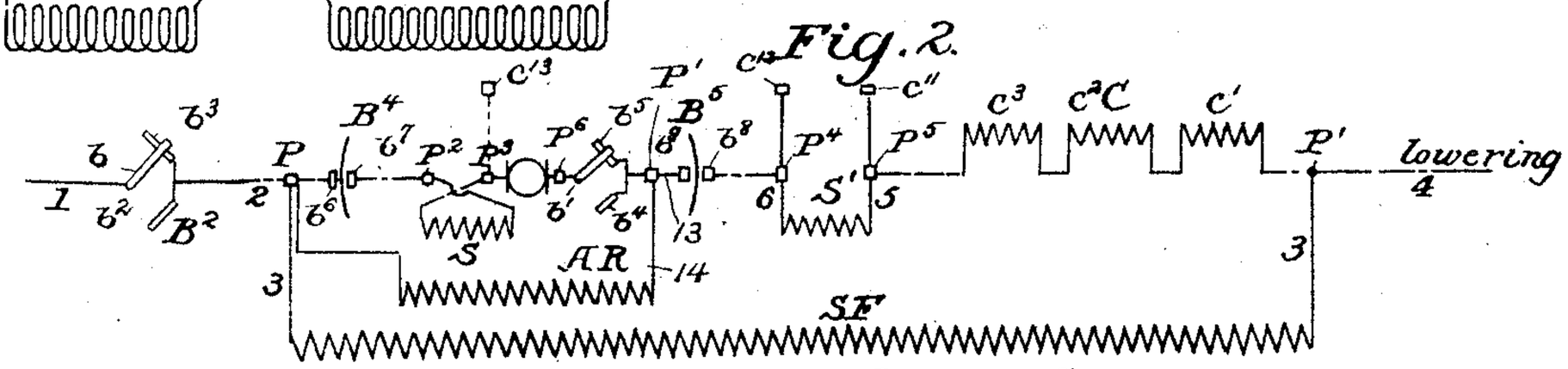
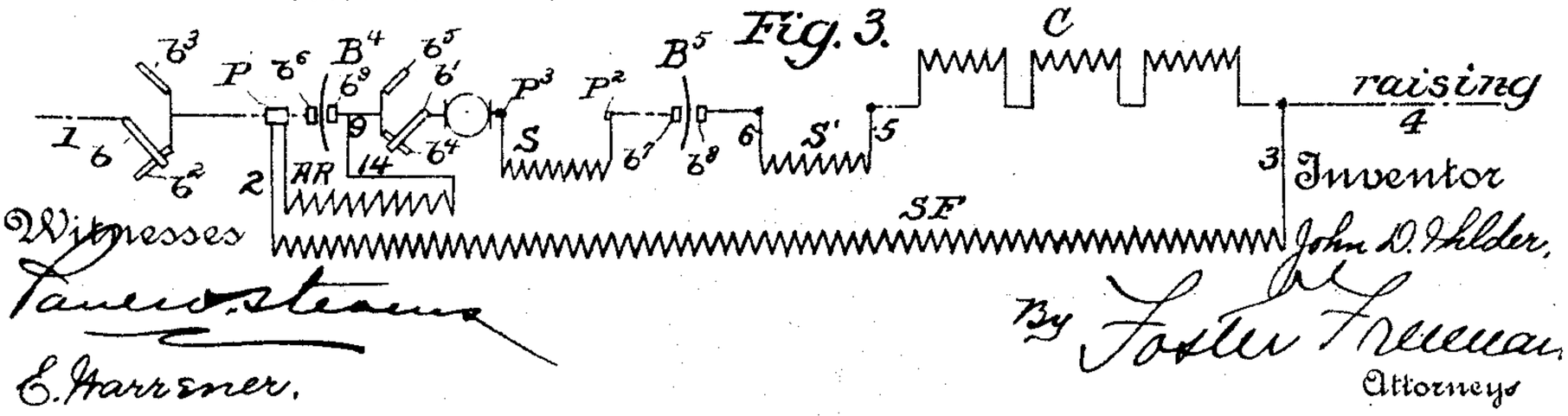


Fig. 3.



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ELECTRIC MOTOR FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 585,760, dated July 6, 1897.

Application filed August 11, 1896. Serial No. 602,430. (No model.)

To all whom it may concern:

Be it known that I, JOHN D. IHLDER, a citizen of the United States, residing at Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Electric Motors for Elevators, of which the following is a specification.

My invention relates to electric motors, and more especially to motors used in connection with electric elevators, although of course the principles of my invention may be applied to any and all motors wherever it is applicable.

My invention has for its object to provide means for regulating the operation of the motors under various conditions; and to these ends it consists in the various features of construction and arrangement of parts having the mode of operation substantially as hereinafter more particularly set forth.

Referring to the accompanying drawings, wherein I have illustrated the general principles of my invention sufficient to enable those skilled in the art to understand the same, Figure 1 is a diagrammatic representation of so much of an electric-motor apparatus as is necessary for a clear understanding of the invention. Figs. 2 and 3 are diagrams showing the circuits, with the motor running in opposite directions.

I will now describe my invention in connection with electric elevators, as that is one of the principal uses for which it is intended, and its application for other conditions can be utilized in accordance with the principles described in connection with electric elevators.

In an electrically-operated elevator where the car is substantially balanced by the counterweight or balance, or is not overbalanced, or perhaps only slightly overbalanced, so that the motor is always doing work when the car is ascending and little or no work when the car is descending, when the car is heavily loaded it tends to acceleration of the speed of the car on the down trip. It is well known that a compound-wound motor is the most economical and desirable for many purposes in operating an elevator, especially in raising it, but a compound-wound motor has more tendency to acceleration under the conditions above stated than a shunt-wound motor. In order to combine the advantages of the compound-wound motor and shunt-wound motor under these conditions, I make use of a compound-wound motor to raise the car and a shunt-wound motor to lower it. In the present instance I use a compound-wound motor with the series field divided into two or more sections, of which one section is connected in the armature-circuit, so as to reverse with the reversal of the armature-circuit, and another section is connected in the armature-circuit outside of the reversing apparatus, receiving the current, therefore, always in the same direction from the supply-circuit.

For use in elevators for heavy duty I provide an additional resistance connected to the terminals of the series-field magnets, and so proportioned and arranged that the current flowing through it when the armature makes the maximum potential at full speed is just sufficient to supply the brake-power which is necessary to resist the accelerating tendency of the load on the car, with the consequent result that the armature never furnishes current back to the line, all the current furnished by the armature acting as a generator being consumed in the reverse part of the series field and in the auxiliary resistance.

With this general statement of my invention, I will describe it in connection with the accompanying drawings.

A is the usual wheel or pulley around which the hand-rope A′ passes, which hand-rope is under the control of the operator in the car of the elevator, and this wheel is mechanically or manually operated by the hand-rope or some equivalent device in order to start and stop the electric motor, which may be connected in any of the usual ways with the elevator-car or with other machinery which it may drive.

M represents diagrammatically an electric motor, with the circuits displayed for convenience.

B represents a pole-changer or circuit-reverser, which may be of any usual and well-known type, and which in the present instance is connected by a bar or rod B′ with the wheel or pulley A to be operated thereby. This circuit-reverser B in the present instance is also a circuit-closer, the contacts *b b′* being

supported on the arm B^2 (shown in dotted lines) and being insulated from each other and adapted to make contact with the plates $b^2\,b^3\,b^4\,b^5$ as the circuit-reverser is turned one way or the other. There is a resistance device C included in the armature-circuit, composed of a number of plates c c' c^2 c^{10} c^{11} c^{12} c^{13}, &c., and these, or part of them, are provided with intermediate resistance-coils between the plates, as indicated. Connected to operate with this resistance is a lever-arm D, carrying on its extremity a spring-arm or contact-piece d, adapted to sweep over the various contact-plates c as it is moved in the manner hereinafter set forth. This lever-arm is shown as mounted on or connected with a disk or armature G, of magnetic material, which is arranged to move in the magnetic field produced by the magnets H H, which are energized in the manner hereinafter set forth. This arm is further controlled by a cam I, mounted on the shaft of the hand-wheel A, and there is an arm G' on the disk G, having a projection g, fitting the cam and controlled by it in a manner well understood and more particularly set forth in my prior patent, No. 560,216.

With this general description of the apparatus, I will now describe the various circuits and their mode of operation.

Assuming the + current to enter the apparatus by the conductor 1, which leads to the contact b on the switch-arm B^2, as the hand-wheel is turned to the right or left b makes contact with the plate b^2 or b^3, as the case may be, and b' makes contact with the plate b^4 or b^5, as the case may be, thus making a double break in the main circuit and armature-circuit. Plates $b^2\,b^3$ are connected by a conductor 2 with a binding-post P of the electric motor, and from this post leads the conductor 3, including the shunt-field coil S F, which is connected to the post P' of the motor, and thence by the conductor 4 the current passes to the main line. It will be seen that whichever way the switch-arm B^2 is turned, either to the right or the left, the current through the shunt-field is always in the same direction, as the contacts $b^2\,b^3$ are connected together. The binding-posts P^4 P^5 are connected to the terminals of the shunt-field coils S', and these posts are connected by conductors 5 and 6 to the contact-plates c^{11} and c^{12}, respectively, in the resistance device C, and the current flowing through these field-magnet coils S' is always in the same direction.

Binding-posts P^3 P^6 are the terminals of the armature-coils of the motor, and these are connected so that the current through the armature can be reversed on the movement of the circuit-reverser B. Also connected to the binding-post P^3 and for convenience of illustration to the binding-post P^2 are the field-magnet coils S, which are so arranged that the current passing through these coils is reversed with the reversal of the current in the armature of the motor. The binding-post P^3 is connected by a conductor 7 with the contact-plate c^{13} of the resistance device C, and the binding-post P^2 is connected by a conductor 8 to the brush b^7 on the circuit-reverser. The binding-post P^6 is connected by a conductor 9 to the contact b' on the switch-arm B^2. Brush b^6 is connected by conductor 10 to the contact-plate b^2. Brush b^8 is connected by a conductor 11 to the contact-plate c^{12}, and brush b^9 is connected by a conductor 13 with the contact-plates b^4 b^5, which are electrically connected, as shown, and the plate b^5 is connected by a conductor 14 to the auxiliary resistance A R, which is also connected by a conductor 15 to the binding-post p. Under these conditions suppose the hand-rope or other device A' and the wheel A are rotated in the direction of the arrow, rotating the pole-changer B in the direction of its arrow, the brushes $b^6\,b^7$ will come upon the conducting-plate B^4, while brushes $b^8\,b^9$ will be on the conducting-plate B^5 and the contact b will bear on the contact-plate b^3 and the circuit from the main line will pass by the conductors 1 2 to the binding-post P, through the shunt-field-magnet coils to the binding-post P' and out. A branch of the current would also pass from the contact b^2, electrically connected to b^3, through the conductor 10, to the brush b^6, onto the conducting-plate B^4, thence by the brush b^7, by the conductor 8, to the pole P^2, through the field-magnet coils S, through the armature-coils, to the pole P^6, thence by conductor 9 to the contact-plate b', to the plate b^5, which is electrically connected to b^4, thence by the conductor 13 to the brush b^9, conducting-plate B^5, brush b^8, conductor 11, to the plate c^{12} of the resistance, thence through conductor 6, binding-post P^4, through the field-magnet coils S', binding-post P^5, conductor 5, to the contact-plate c^{11}, through the resistance C, contact-piece d, arm D, disk G, conductor 16, around the magnets H H and to line. It will thus be seen that on the closing of the circuit at the beginning of the movement of the lever-arm D the current passes in the direction just traced, and it will be understood that the contact-piece d does not pass beyond the contact-plate c^{10} of the resistance C.

Supposing now the wheel A be operated in the opposite direction, turning the reverser B in the direction opposite to the arrow, the current through the contacts b b' and the shunt-field S F will be the same as before. The armature-circuit, however, may be traced from the plate b^2, by the conductor 10, brush b^6, conducting-plate B^4, brush b^9, conductor 13, plate b^4, contact b', conductor 9, binding-post P^6, armature-coils, field-magnet coils S, in the direction opposite from which it went before, binding-post P^2, conductor 8, brush b^7, conducting-plate B^5, brush b^8, conductor 11, contact-plate c^{12}, conductor 6, binding-post P^4, coil S', binding-post P^5, conductor 5, and out through the resistance, and it will thus be seen that the current through the

field-magnet coils S has changed in direction in accordance with the direction of the current through the armature-coils. If now the arm D moves farther down, so that the contact-piece d reaches the contact c^{12}, the coil S′ is cut out, and if it reaches the contact-plate c^{13} the coil S is also cut out or short-circuited and the motor runs as a shunt-motor only. When the auxiliary resistance A R is used in this connection and the contact-piece d is on the contact c^{13}, this resistance is short-circuited through the conductor 14, connected to the contact-plate b^5, and the conductor 15, connected to binding-post P.

The arrangement of circuits under the different conditions of raising and lowering will be more easily appreciated on reference to Figs. 2 and 3, where they are graphically indicated, more clearly though not quite so much in detail as in Fig. 1. Thus Fig. 3 shows the condition of the circuits in raising the elevator, and Fig. 2 the condition in lowering, the parts being lettered the same as in Fig. 1. It will be observed on reference to Fig. 3 that when the motor is operated to raise the car it is a true compound-wound motor, the shunt-field S F receiving the current outside of the circuit-reverser B^4 B^5, and the current through the circuit-reverser passing to the armature of the motor through the series-field-magnet coils S and S′ in the same direction and through more or less of the resistance C, and the motor is in condition to do the work necessary for raising to the best advantage, giving the maximum magnetization to the motor. In Fig. 2 it will be seen that the shunt-field receives the current as before, and as the motor starts the series field S receives current from the supply-circuit in opposition to the series field S′, thus neutralizing each other, leaving the motor with a winding practically as a shunt-machine pure and simple, its field magnetism depending upon the current in the shunt-winding only and its starting torque upon the magnetism produced by the shunt-field only and upon the current in the armature, which is considerably less than in the case represented in Fig. 3, where the motor starts as a regular compound motor.

The starting torque represented in Fig. 2 is sufficient under the conditions specified, where only small power is required, to start the car on the downward trip. Where heavy duty is required, the additional resistance X is preferably used, and this is so proportioned that the current flowing through it when the armature makes its maximum potential at full speed is just sufficient to supply the brake-power which is necessary to resist the accelerating tendency of the load on the car, with a consequent result that the armature never furnishes back-current to the line and through the series coils S′. All the current furnished by the armature acting as a generator is consumed in the reverse part of the series field S and in the auxiliary short-circuited resistance A R. The series field S thus helps to magnetize the motor and the series field S′ is inoperative. Even with the heaviest load the motor under these conditions cannot accelerate. As will be seen above, on the raising of the car the auxiliary resistance is short-circuited by the reversing-switch, so that it does not affect the operation of the motor. As above explained, the contact-piece d is limited on the downward motion of the car, so that the resistance only is cut off, while on the upward motion of the car it is not limited and cuts off the resistance and both series fields.

From the above description the general principles of my invention will be understood, and it will be seen that they may be carried out in various ways and by various devices, depending upon the particular construction and arrangement of the parts to which my invention is applied, and I do not limit myself to any particular mechanical construction.

What I claim is—

1. In an electric motor in which the current through the armature is reversed, a series field in sections, one section of which is reversed with the reversing of the armature, substantially as described.

2. In a compound electric motor in which the current from the armature is reversed, a shunt-field, and a series field in sections, one of the sections of which is reversed with the reversing of the armature, substantially as described.

3. The combination with a compound-wound motor, of a circuit-reverser connected to the armature-coils, and a series field in sections, one of the sections of which is connected to the circuit-reverser, substantially as described.

4. The combination with a compound-wound motor, of a circuit-reverser and a resistance device, a shunt-field-magnet circuit, an armature-circuit including the resistance device, and a series field in sections, one of which is connected to the circuit-reverser, and another of which is connected to the resistance device, whereby the latter may be cut out of circuit and the former may be reversed with the armature, substantially as described.

5. The combination with a compound-wound motor having a shunt-field and a series field in sections, of a circuit-reverser connected to the armature-circuit and to one of the sections of the series field, and an auxiliary resistance connected to the circuit-reverser to be active under one condition and short-circuited under another, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN D. IHLDER.

Witnesses:

M. K. COUZENS,

EDWARD A. FORSYTH.