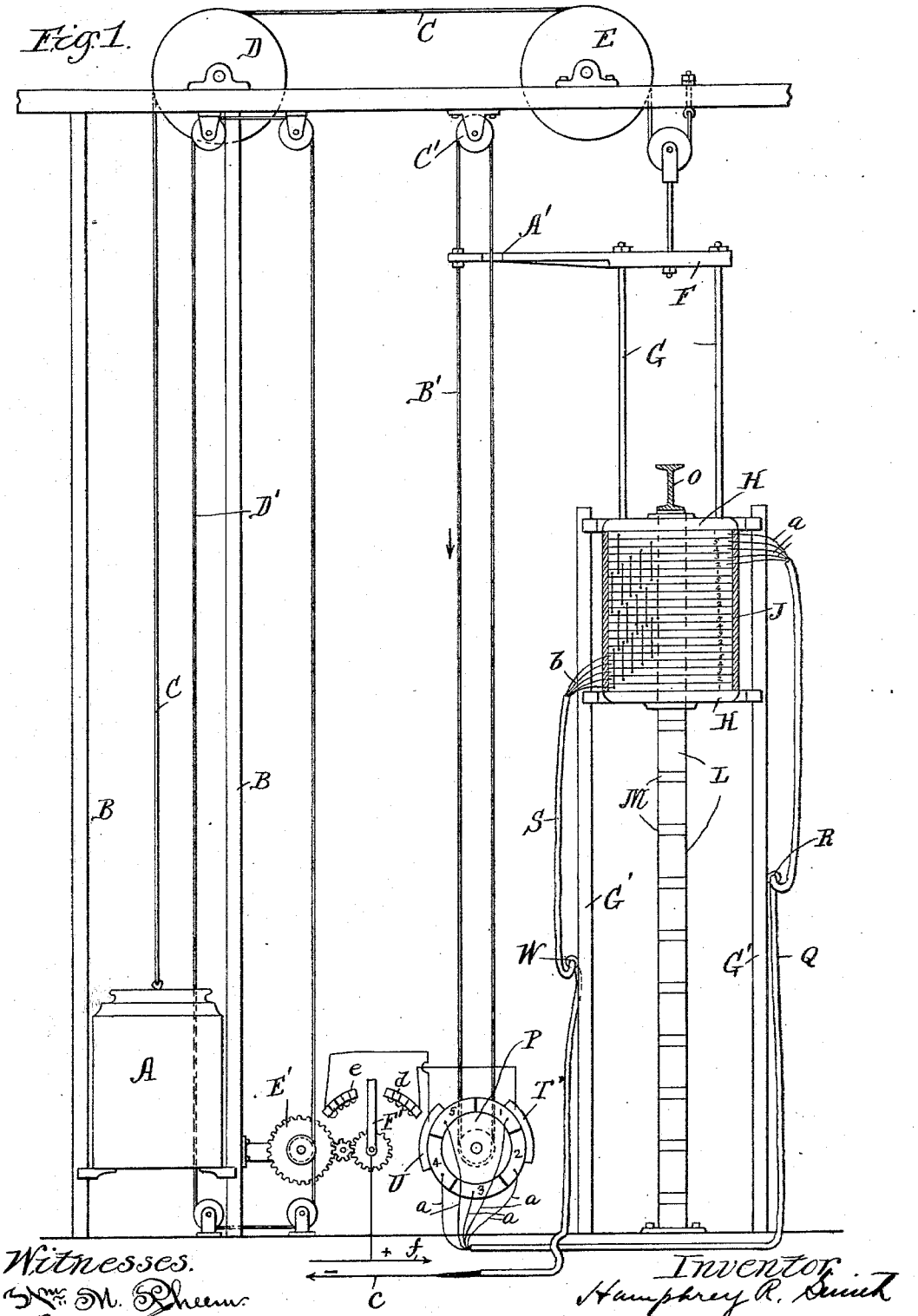
(No Model.) 2 Sheets—Sheet 1.

H. R. SMITH.

ELECTRIC ELEVATOR.

No. 561,828. Patented June 9, 1896.

Fig. 1.



Witnesses.
Wm. M. Sheem.
M. D. Cavanagh.

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by Brown Darby Attys.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

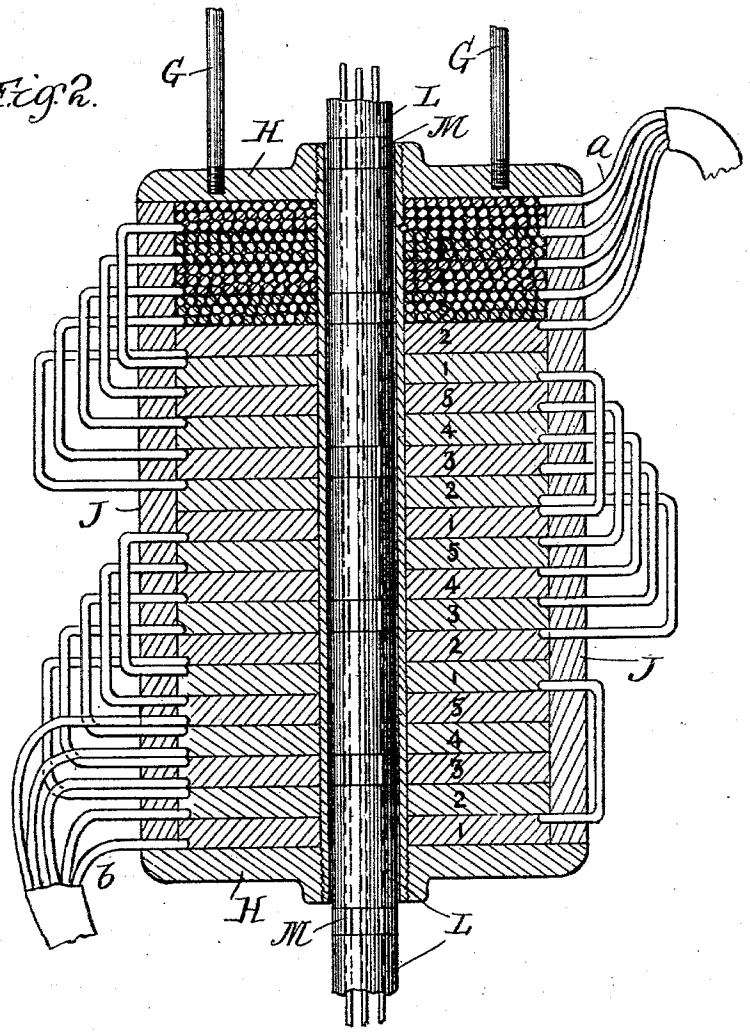
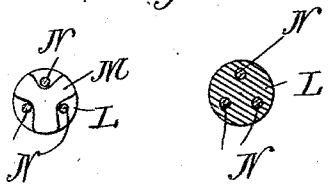


Fig. 3.



Witnesses.
Wm. M. Rheem.
M. L. Cavanagh.

Inventor.
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by Brown & Darby Atty's

UNITED STATES PATENT OFFICE.

HUMPHREY RUSSELL SMITH, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WINSLOW BROTHERS ELEVATOR COMPANY, OF SAME PLACE.

ELECTRIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 561,828, dated June 9, 1896.

Application filed March 16, 1896. Serial No. 583,374. (No model.)

To all whom it may concern:

Be it known that I, HUMPHREY RUSSELL SMITH, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Electric Elevators, of which the following is a specification.

This invention relates to electric elevators.

The object of the invention is to provide a simple, efficient, and inexpensive apparatus for operating elevators electrically.

The invention consists, substantially, in the construction, combination, location, and relative arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally pointed out in the appended claims.

Referring to the accompanying drawings, Figure 1 is a general view in elevation showing the arrangement of an illustrative apparatus embodying the principles of my invention. Fig. 2 is a longitudinal sectional view of the solenoid forming the hoisting-motor. Fig. 3 are transverse sections of the solenoid-core through the magnetic and non-magnetic sections, showing the methods of anchoring the sections thereof.

Reference-sign A designates the car, arranged to travel in a well, the sides of which are indicated by the reference-sign B. The hoisting-cable C is suitably attached to the car and leads over suitable guide-sheaves, as D E, in any convenient or desirable manner.

Suitably suspended from or in a bight of the hoisting-cable C is a frame of suitable or convenient construction, which in the form shown, to which I do not desire to be limited or restricted, may consist of a cross-bar F, carrying rods G, said rods in turn supporting a framework or casing of suitable and desirable construction, which in the present instance is composed of the end pieces or heads H and the cylindrical casing J. Arranged within this casing or framework are sets of coils, each set comprising a series of coils and numbered, respectively, 1, 2, 3, 4, and 5, there being in the instance shown five coils in each set. Of course this number may be varied at will, and as many sets as may be desired may be arranged in the casing. The end pieces or heads H and the several coils are centrally perforated, and a sleeve K is arranged within said perforations and secured at the ends thereof to the heads, thereby forming a lining.

Suitably bolted to the floor or other support is a column composed of a series of sections of soft iron or other magnetic material L, alternating with interposed insulating-blocks M. This column may be arranged in any suitable or desirable manner. In the form shown I have strung the sections of soft iron or magnetic pieces and insulating-blocks upon rods N, which rods are suitably secured to the base-floor or other support at one end and to a conveniently-arranged cross-beam O at the other end, and said column is arranged to pass longitudinally through the sleeve K. The cylindrical casing J is of suitable magnetic material, while sleeve or lining K is of non-magnetic material.

From the construction above described it will be seen that I provide a solenoid with a stationary core, or, to speak more properly, I provide a series of solenoids, each magnetic section of the core forming a solenoid with the adjacent surrounding sections of coils.

It will be understood that a certain definite relative proportion of length of the magnetic sections L and thickness of coils 1 2 3 4 5 is maintained. For instance, in the particular form illustrated each section of magnetic material or soft iron is of a length equivalent to the thickness of four coils. The size, length, thickness, or relative proportions of the parts may be varied at will without departing from the spirit or scope of my invention. It will also be seen that the moving part of the solenoid—namely, the coils—is connected to the car-hoisting cable, and therefore operates not only as the hoisting-motor, but also as a counterweight for the car.

In the drawings the car is shown at the extreme lower limit of its travel, and hence the casing containing the sections of solenoid-coils is shown at the extreme limit of its upward movement. In order to effect a movement of the car from this position, it is necessary to energize such of the coils of the solenoid as will cause a downward movement of the casing containing the coils. For instance, suppose the coils 1 and 2 are energized by the passage therethrough of a current of elec-

tricity. The effect will be to tend to move each section of soft iron of the column or core to a medial position with respect to the coils 1 and 2 surrounding it—that is, to such a position that the ends of the soft-iron sections will project equally beyond the two sides of said coils 1 and 2. Now if all the sections 1 of coils are coupled together, and so on, it will be understood that the effect of a number of solenoids is secured, all exerting a pull on the core; but since the sectional core is held stationary the casing containing the coils is moved under the influence of such pull, and since the combined effect of the several solenoids is simultaneously exerted upon the framework containing the coils it will be seen that the frame carrying the coils is moved under the influence of a power dependent upon the number of sections of core included in the magnetic field of the energized coils, and since the solenoid-coils are connected to the hoisting-cable of the car the car is hoisted. Now by successively cutting into the exciting-circuit the next higher coil and cutting out the lower coil of each section the continued movement of the casing containing the coils is effected, and hence a continued hoisting of the car.

I will now explain the electrical connections whereby the successive cutting in and out of the coils of the solenoid is effected, and hence whereby the movement of the coils and their containing-casing up and down the sectional stationary core is effected, it being understood, however, that the specific embodiment and arrangement shown is merely illustrative of the principle involved, and that the same idea may be embodied in a wide variety of specific structures and arrangements and still fall within the spirit and scope of my invention.

In the form shown, P designates a suitable commutator having segments numbered, respectively, 1, 2, 3, 4, and 5. From each segment leads a wire *a*, the said wires connecting, respectively, the segments 1, 2, 3, 4, and 5 to the corresponding coils 1, 2, 3, 4, and 5 constituting the first or topmost set of said coils in the movable casing. For convenience these connections *a* may be formed into a flexible cable Q and supported, as at R, at a point intermediate the length of travel of the casing or coils. After forming the first coil 1 the wire extends to and forms the coil 1 of the second set, and thence to and forms coil 1 of the third set, and so on, and, finally, from the last or bottom coil 1 of the series of sets of coils it leads to a wire or connection *b* and thence to the negative line-wire *c*. In the same manner after the wire *a* leading from segment 5 forms the first or top coil 5 of the first set of coils it leads to and forms the coils 5 of the next set, and so on to the coil 5 of the last set, and from thence through a connection *b* to the next negative line-wire *c*. In the same manner all the coils 2, 3, and 4 of the several sets of coils are coupled up. For convenience the several return-wires *b* may be formed into a flexible cable S, suitably supported intermediate the length of travel of the coils, as at W. Any suitable arrangement may be provided for changing the circuit from one set of coils to another—as, for instance, by rotating the commutator P. This may be conveniently accomplished coincident with the movement of the coils and their containing-casing in the following manner: An arm A′ is connected to move with the cross-bar F and is connected to a run of a cable or other suitable connection B′, supported on a conveniently-arranged pulley C′. This cable is led around a pulley on the shaft of commutator P. Therefore when the cross head or bar F moves under the influence of the forces, as above indicated, in a downward direction from that shown, the cable B′ is caused to move in the direction indicated by the arrow, thereby rotating commutator P in a contrary direction to the hands of a clock. A pair of brushes T U are arranged to make contact with the segments of the commutator and to complete the circuit therethrough. Therefore, when the cable B′ is actuated in the direction above indicated, circuit is made through brush T and segment 2, and hence through the coil 2 of the several sets, while at the same time circuit is made through said brush T, segment 3, and thence through all the coils 3 of the sectional solenoid, and hence, in the same manner as above explained, causing the coils and their containing-casing to travel a corresponding distance downwardly, thereby causing a further rotation of commutator P, and hence effecting a cutting out of coils 2 and a cutting in of coils 4, and so on, thereby effecting a continuous movement of the coils of the solenoid, and hence a hoisting of the car.

Any suitable arrangement of apparatus for controlling the direction of the current through the coils of the solenoid and for making and breaking the circuit may be employed. It is desirable that such apparatus be controllable from the car in order that the movement of the car can be under the constant control of the elevator-conductor. I have shown an illustrative embodiment of the idea; but it is evident that the idea may be embodied in a wide variety of specific forms of apparatus and still fall within the spirit and scope of my invention. I do not desire, therefore, to be limited or restricted to the specific form shown. As shown, a control-cable D′ of the standing-cable arrangement is arranged to pass through the car and adapted, when actuated, to rotate a gear E′, which through suitable gearing effects a rocking of the switch-lever F′ to make contact with either point *d* or *e*, which points are respectively connected to the brushes T U. The contacts *d e* each may comprise a series of resistance-coils, as shown, adapted to be cut in or out according to the extent to which lever F′ is moved, thereby varying from the car the strength of

current employed in energizing the coils of the solenoid. The lever F′ is suitably connected to the positive line-wire *f*. Of course any other form of controlling apparatus operated from the car may be employed, whereby circuit from the positive line-wire *f* is made through points *d* or *e*, as may be desired. When circuit is made through contact *d*, the action of the solenoid is the same as above described and the car moves upward, whereas if circuit is made through point *e* instead of cutting out the lower coil and cutting in the next upper coil of each set the said lower coil is cut into live circuit and the next higher coil is cut out, thereby reversing the movement above explained, including a reversal of the direction in which commutator P is rotated, which reversal effects a continuous action in the solenoid, and hence of the car.

It will be understood that the connection of the solenoid-coils with the hoisting-cable may be directly to the end of said cable, or else in any suitable distance-multiplying bight.

If desired, the movement of the casing containing the coils may be guided—as, for instance, by means of the side guides G′.

It will be understood that the sectional core may be extended to any desired length and without any great amount of expense, as the soft-iron sections and interposed insulating or non-magnetic blocks are comparatively cheap and inexpensive and by the construction described reduce to a minimum the cost of the solenoid-coils, and by the arrangement of a series of simultaneously-acting solenoids, the combined effect of which is simultaneously applied to moving the car, I produce not only an exceedingly simple arrangement, but one that is highly efficient in operation and economical and inexpensive in construction.

Having now explained the object and nature of my invention and an illustrative embodiment of the principles involved, and having explained the construction, function, and mode of operation thereof, I desire it to be understood that I do not limit myself to the exact details of construction and arrangement of parts shown and described, as many variations therefrom would readily suggest themselves to persons skilled in the art and still fall within the spirit and scope of my invention; but

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

1. In an electric elevator, a hoisting-motor, comprising a solenoid having a stationary core, and a movable coil, said coil connected to the car-hoisting cable, as and for the purpose set forth.

2. In an electric elevator, a hoisting-motor, comprising a solenoid having a sectional core, and a series of coils, one of said parts being connected to the car-hoisting cable; as and for the purpose set forth.

3. In an electric elevator, a hoisting-motor, comprising a solenoid having a sectional core, and a series of coils, one of said parts being connected to the car-hoisting cable, and means for simultaneously exciting two or more of said coils; as and for the purpose set forth.

4. In an electric elevator, a hoisting-motor, comprising a solenoid having a stationary sectional core, and a series of movable coils, said coils connected to the car-hoisting cable; and means for energizing simultaneously two or more of said coils; as and for the purpose set forth.

5. In an electric elevator, a hoisting-motor comprising a stationary core, a series of movable coils connected to the car-hoisting cable, said coils arranged in sets, and means for energizing simultaneously two or more coils of each set; as and for the purpose set forth.

6. In an electric elevator, a hoisting-motor, comprising a stationary core, a series of movable coils connected to the car-hoisting cable, said coils arranged in sets, means for making circuit simultaneously through two or more coils of each set, said means controllable from the car; as and for the purpose set forth.

7. In an electric elevator, a hoisting-motor comprising a stationary core, a series of movable coils connected to the car-hoisting cable, said coils arranged in sets, the corresponding members of each being coupled together in series, and means for energizing two or more of said coupled-up sets simultaneously; as and for the purpose set forth.

8. In an electric elevator, a hoisting-motor, comprising a stationary core, a series of movable coils connected to the car-hoisting cable, means for successively energizing the coils of said series; as and for the purpose set forth.

9. In an electric elevator, a hoisting-motor, comprising a stationary sectional core, movable coils arranged in sets and connected to the car-hoisting cable, means for simultaneously energizing two or more adjacent coils in each set, and means for progressively cutting in and successively cutting out said coils; as and for the purpose set forth.

10. In an electric elevator, a hoisting-motor, comprising a stationary core composed of alternating magnetic and non-magnetic pieces and a series of coils, and means for energizing separated coils of said series; as and for the purpose set forth.

11. In an electric elevator, a hoisting-motor, comprising a solenoid having a sectional core and a series of sets of coils, corresponding coils of each set being electrically coupled up, and means controllable from the car for energizing one or more of said coupled-up coils; as and for the purpose set forth.

12. In an electric elevator, a hoisting-motor, comprising a solenoid having a sectional core and a series of coils arranged in sets, corresponding coils in each set, being in electrical connection with each other, means controllable from the car for energizing one or more of said coupled-up coils, and means for shifting the energizing-current to the next adja-

cent coupled-up coils; as and for the purpose set forth.

13. In an electric elevator, a hoisting-motor, comprising a solenoid having a sectional core, and a series of coils arranged in sets, corresponding coils in each set being in electrical connection with each other, a commutator arranged in circuit with said coils, and means actuated by the movement of said solenoid for operating said commutator, whereby current is shifted from one to another of said coupled-up sets of coils; as and for the purpose set forth.

14. In an electric elevator, a hoisting-motor comprising a solenoid, having a sectional core and a series of coils arranged in sets, corresponding coils in each set being in electrical connection with each other, a commutator having as many segments as there are coupled-up sets of coils, each segment included in circuit with a coupled-up set of coils, and means for moving said commutator coincidently with the actuation of said solenoid; as and for the purpose set forth.

15. In an electric elevator, a hoisting-motor comprising a solenoid, having a sectional core, and a series of coils arranged in sets, corresponding coils of each set being coupled together, a commutator having its segments respectively included in circuit with said several coupled-up sets of coils, a cable arranged to be moved by the actuation of said solenoid, said cable arranged to operate said commutator; as and for the purpose set forth.

16. In an electric elevator, a hoisting-motor, comprising a solenoid having a sectional core and a series of coils arranged in sets, corresponding coils of each set being coupled together, a commutator having its segments respectively included in circuit with said several coupled-up sets of coils, brushes arranged to contact with said commutator, means for controlling the circuit through said brushes, and means actuated by said solenoid for moving said commutator; as and for the purpose set forth.

17. In an electric elevator, a hoisting-motor, comprising a solenoid having a sectional core and a series of coils arranged in sets, the corresponding coils of each set being coupled together, a commutator having its segments respectively included in circuit with said several coupled-up sets of coils, means for actuating said commutator, brushes arranged to contact with said commutator, means controllable from the car for making or breaking the current through said brushes and varying the current; as and for the purpose set forth.

18. In an electric elevator, a hoisting-motor, comprising a stationary core, a casing suspended from the car-hoisting cable, a coil arranged in said casing, said casing and coil adapted to travel upon said core, and means controllable from the car for energizing said coil at will; as and for the purpose set forth.

19. In an electric elevator, a hoisting-motor, comprising a stationary core, a hollow cylindrical casing, comprising an outer magnetic and an inner non-magnetic sleeve, a coil arranged within said casing, said inner sleeve adapted to be received upon said core, and means for controlling from the car the energizing-current of said coil; as and for the purpose set forth.

20. In an electric elevator, a hoisting-motor, comprising a stationary core, a hollow cylindrical casing comprising the end pieces, an inner non-magnetic and an outer magnetic sleeve, a coil arranged in said casing, said casing suitably suspended from the car-hoisting cable, and means, controllable from the car, for governing the energizing-current of said coil; as and for the purpose set forth.

In witness whereof I have hereunto set my hand, this 10th day of March, 1896, in the presence of the subscribing witnesses.

HUMPHREY RUSSELL SMITH.

Attest:
S. E. DARBY,
M. I. CAVANAGH.