(No Model.)

H. R. SMITH.

ELECTRICAL APPARATUS FOR OPERATING ELEVATOR DOORS.

No. 604,128. Patented May 17, 1898.

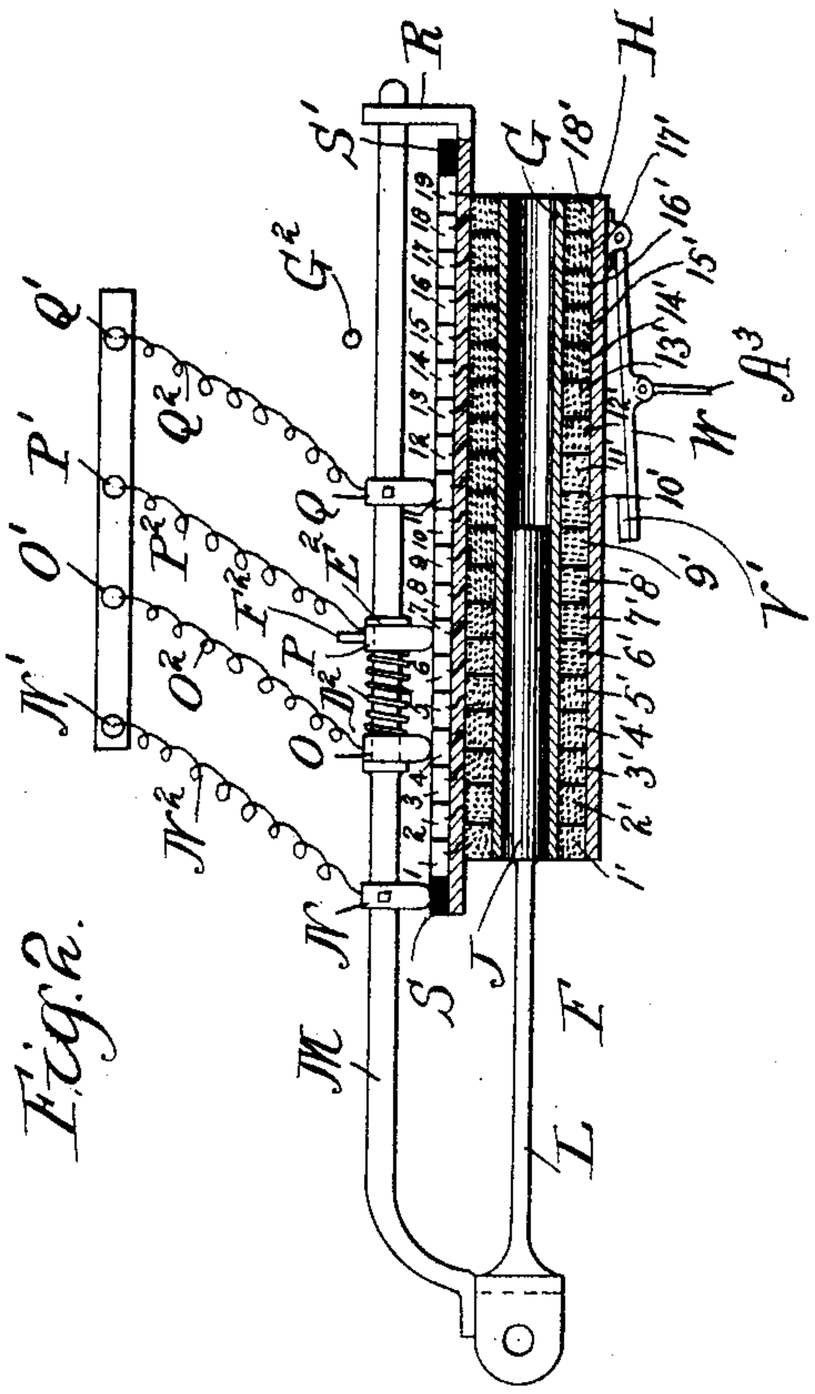

Fig. 2.

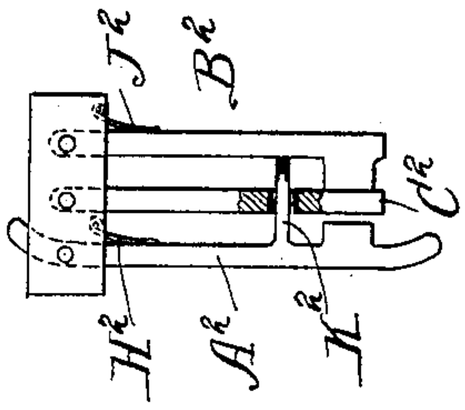

Fig. 3.

Fig. 1.

Witnesses.
Wm. M. Rheem.
Wm. F. Fleming

Inventor
Humphrey Russell Smith
by Brown & Darby Atty's

UNITED STATES PATENT OFFICE.

HUMPHREY RUSSELL SMITH, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE BURDETT ROWNTREE MANUFACTURING COMPANY, OF SAME PLACE.

ELECTRICAL APPARATUS FOR OPERATING ELEVATOR-DOORS.

SPECIFICATION forming part of Letters Patent No. 604,128, dated May 17, 1898.

Application filed April 14, 1897. Serial No. 632,087. (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 Electrical Apparatus for Operating Elevator-Doors, of which the following is a specification.

This invention relates to electrical apparatus for operating elevator-doors.

The object of the invention is to provide means for electrically opening or closing the door at the landings of elevator shafts or wells.

A further object of the invention is to provide for locking the doors.

Further objects of the invention will appear more fully hereinafter.

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

Referring to the accompanying drawings and to the various views and reference signs appearing thereon, Figure 1 is view in front elevation of an elevator-well door, showing the electrical appliances and arrangement for opening and closing and locking the same embodying the principles of my invention, the floor of the car being shown in vertical section. Fig. 2 is a detached detail view of the motor and its associated parts, the motor being shown in central longitudinal section. Fig. 3 is a detached detail view of the circuit-closer.

The same part is designated by the same reference sign wherever it occurs throughout the several views.

In the drawings reference sign A designates the floor of the car or cab, B a portion of the framing of the shaft or well, and C the door. The door C may be supported or hung in any suitable or convenient manner, as by means of roller-hangers D, suspended from and adapted to slide or travel upon a supporting-beam E.

F designates a motor suitably connected to the door for moving the same back and forth. This motor comprises a sleeve or hollow cylinder G, of suitable non-magnetic material, as brass, upon which are mounted a series of rings or coils, (marked 1′ 2′ 3′ 4′ 5′ 6′ 7′ 8′ 9′ 10′ 11′ 12′ 13′ 14′ 15′ 16′ 17′ 18′,) of conducting-wire, said rings or coils being arranged side by side. A sleeve H, of magnetic material, incloses the cylinder formed by said rings or coils. A series of contacts 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, and 19 are arranged, respectively, in electrical connection with the coils 1′ 2′, &c., and with each other. From this description it will be seen that I provide a solenoid composed of a series of sections or coils of conduction-wire.

J designates the core of the sectional solenoid and is of suitable magnetic material and arranged to be received snugly in the inner sleeve G, but permitting a relative movement of the core and the series of coils.

It is evident that the series of coils may be stationary and the core movable longitudinally through the coils, or the core may be stationary and the series of coils movable longitudinally upon the core. In the particular form shown, however, the coils are stationarily mounted and the core is movable.

To a convenient point on the door is connected a pivotally-mounted lever K, suitably supported on the framing of the shaft or well, and to the lever is pivotally connected the stem L of the core J. From this construction it will be seen that when the core is moved through the coils the door is moved to open or closed position, according to the direction in which the core is moved.

Suitably mounted to move with the core is a bar M, which I shall call the "contact-bar." Mounted on, but insulated from, said bar are a series of contacts or brushes N O P Q, preferably four in number, adapted and arranged to make contact with the contacts 1 2 3, &c., as said bar is moved back and forth. The contacts N O P Q are respectively connected electrically to suitable binding-posts N′ O′ P′ Q′ through suitable flexible connectors N^2 O^2 P^2 Q^2. The contact-bar M is held and guided in its movements by a suitable projection R. At the extreme ends of the contact-segments 1 2 3, &c., are the insulating-segments S S′.

Reference signs X Y designate, respectively, the positive and negative supply-conductors. The negative conductor Y is connected electrically through connection *a* and branch connection *b* with the binding-posts N′ P′, while the binding-posts O′ Q′ are respectively connected electrically through connections *c d* with the parts A^2 B^2 of the circuit-closer, presently to be more fully described. The part C^2 of the circuit-closer is electrically connected to the positive supply-wire X through the connection *f*. Now suppose the circuit to be closed between the parts A^2 C^2 of the circuit-closer, with the parts of the motor in the position shown in the drawings. Current will then flow from positive supply-wire X, through connection *f*, part C^2, part A^2, connection *d*, binding-post Q′, connection Q^2, contact Q, segment 11, the windings of coil 11′, thence through the windings of coils 10′ 9′ 8′ 7′, segment 7, contact P, connection P^2, binding-post P′, connection *b*, connection *a*, to the negative wire Y, and hence the series of coils 11′, 10′, 8′, and 7′ will become energized, and hence will exercise an attractive influence over magnetic core *j*, tending to move such core longitudinally through the coils to a position such that the said coils will occupy a medial position with respect to the energized coils—that is, to such position that the ends thereof will project an equal distance at both sides of the energized series of coils—and hence from the relative position of the parts shown in the drawings the core J will move toward the right. As the contact-arm M is mounted to move with the core, it is evident that the contacts Q and P will be carried from the segments 11 and 7, respectively, and into contact with segments 12 and 8, respectively, thereby cutting out the last coil 7′ of the series originally included in the energizing-circuit and cutting in the next coil 12 in advance of the originally-energized series of such coils, thus again disturbing the relation of the core to the energized series of coils, and hence exerting a further advancement of the core through the coils and a consequent advancement of the contacts P Q to contact with the next adjacent segments, and so on, thus successively cutting out the last coil of the energized series of coils and progressively cutting in the next coil in advance of such series, and hence effecting a uniform advancement of the core through the coils, and consequently through the connection thereof with the lever K effecting a movement of the door either with closed or open position, according to the arrangement of the parts, until finally the contact Q rides upon the insulated segment S′ at the end of the series of segments, whereupon the energizing-circuit is broken. In the meantime the contacts N and O have also been correspondingly advancing, and when contact Q is resting upon insulated segment S′ contacts N and O are resting, respectively, upon segments 9 and 13. Now suppose circuit is broken between parts A^2 and C^2 and is established between parts B^2 and C^2 of the circuit-breaker. Then the following energizing circuit will be established: from positive conductor X, through connection *f*, part C^2, part B^2, connection *c*, binding-post O′, connection O^2, contact O, segment 13, the windings of coils 13′, 12′, 11′, 10′, and 9′, in series, segment 9, contact N, connection N^2, binding-post N′, and connection *a* to the negative line-wire Y, thereby energizing the series of sections or coils included in such circuit, and hence exerting a force on the core J tending to move such core in the opposite direction to that above described, which movement of the core carries also the contact-bar M and the contacts N O, thereby effecting a successive cutting out of the coils 13′ 12′ 11′, &c., and a progressive cutting in of the coils 8′ 7′ 6′, &c., thereby advancing the core to its original position, and with it the door C, until finally the contact N rests upon the insulated segment S, thereby breaking the energizing-circuit.

In some cases it may be desirable to provide a cushion at one or the other or both limits of travel of the door in order to avoid shock and jar. I have shown an illustrative embodiment of the idea, wherein I mount the contact P, for instance and by way of illustration, movably upon and with reference to the bar M, and I provide a spring D^2 to hold the same in its normal position—as, for instance, against a stop or shoulder E^2—upon the contact with a finger or projection F^2, in the path of movement of which I arrange a stop G^2, somewhat in advance of the normal final position of said contact P when the contact-bar M is moved to the limit of its movement in the desired direction—that is to say, before the bar M attains the limit of its movement to the right, as shown in the drawings, and hence before the energizing-circuit is broken by the contact Q reaching the insulated segment S′, the finger F^2 of contact P engages stop G^2, whereby further movement of the contact P is arrested, while the bar M and contact Q continue to advance, and hence while there is from that point on a progressive cutting in of the coil in advance of the previously-energized coils there is not a cutting out of circuit of the last coil. By this means the resistance of the circuit is increased, and by the lengthening of the energized coil the medial position of the core is more quickly reached, and hence there will be a corresponding decrease of the power exerted upon the core J, tending to still further advance it through the coils. In other words, I interpose, by the arrangement described, a magnetic buffer or cushion which is developed in the motor itself and which prevents undue shock or jar when the door attains the limit of its movement.

I will now describe the construction and arrangement of circuit-closer shown and which I have found to be simple and efficient, though

I desire it to be understood that I do not limit or confine myself to the specific details thereof, as many changes therein and variations therefrom would readily suggest themselves to persons skilled in the art.

In the particular form shown in a convenient location upon the framing of the shaft or well I rigidly mount a bar or arm C^2 and on either side thereof I pivotally mount the levers or arms A^2 B^2. The arms A^2 B^2 C^2 are preferably conductors of electricity and suitably insulated or carry conduction portions adapted to contact with each other, as will be readily apparent. A spring H^2 or other suitable means may be employed to normally hold the part A^2 out of electrical contact with part C^2, and a spring J^2 is arranged to normally hold the parts B^2 and C^2 in electrical contact, and means are provided for breaking the contact between parts B^2 and C^2 simultaneously with the making of contact between parts A^2 and C^2. I have shown a simple manner of effecting this result, wherein I provide the part A^2 with a pin or projection K^2, suitably insulated from or out of contact with part C^2 and having an insulated end arranged, when the part A^2 is moved into contact with part C^2, to engage part B^2 and separate the same from part C^2.

Many different arrangements may be provided for effecting the proper movements of the parts A^2 or B^2 for controlling the energizing-circuit at the proper time to effect an opening of the door. In the particular form shown, to which, however, I do not desire to be limited or restricted, I mount on the car a suitable engaging projection or arm L^2, adapted, when the car reaches the particular landing where a movement of the door is desired, to engage the part A^2 of the circuit-controller at that landing to effect a proper control of the circuit through the motor, and in order to facilitate the engagement of the arm or projection L^2 with the part A^2, I suitably curve the ends of said part, as clearly shown. It is desirable that the circuit-closer be controllable from the car, in order that landings may be passed without opening the doors at those landings, according to the exigency of use—that is to say, in practice it is not desirable that the door at each landing be always opened as the car approaches that landing—and in order to avoid this objection I make the arm L^2 movable and connect the same to one arm of a bell-crank lever M^2, and I connect a suitable foot-treadle R^2 to the other arm of said lever. A spring S^2 serves to maintain said arm L^2 normally in a position to clear the part A^2 of the circuit-closers as the car travels up and down. From this description it will be readily seen that by the car-conductor depressing the treadle R^2 as the car approaches a landing where a stop is to be made the outer end of the arm L^2 is projected into position to engage the part A^2 of the circuit-controller, thereby establishing the proper circuits for effecting an opening of the door. The treadle R^2 may be arranged in any suitable or convenient location on the car—as, for instance and as shown, upon the floor A of the car in convenient position to be engaged by the foot of the car-conductor.

It is sometimes desirable to lock the door either in open or closed position. I have a convenient arrangement for effecting this purpose, wherein I provide a suitable latch T, arranged in position to engage the door—as, for instance, by means of a notch U, formed in the door-frame—when in the closed or open position of the door, as the case may be. In order that said latch may be raised out of its engagement with the door when it is desired to move the door, I suitably connect thereto an armature V, of magnetic material, arranged to be attracted and moved by the magnetization created by the energizing of the coils 1′ 2′ 3′, &c. A convenient arrangement for accomplishing the desired result is shown, wherein the armature V′ is mounted upon a lever W, suitably hinged or pivoted to the casing of the solenoid-coils, and a rod A^3 connects said lever W with an arm B^3, arranged to engage and raise the latch T when the armature is attracted. From this construction and arrangement it will be readily seen that whenever any of the coils of the solenoid are energized—that is, whenever it is desired to move the door—the energization of the coils forms an electromagnet which attracts the armature V′, thereby, through the connections described, effecting a disengagement of the latch T from the door.

From the foregoing description it will be seen that I produce an exceedingly simple and efficient electrically-operated apparatus for opening, closing, and locking the doors of elevator shafts or wells and wherein the opening or closing of the doors is under the control of the elevator-conductor, and while I have shown and described a specific form of apparatus embodying my invention I do not desire to be limited or restricted thereto, as many variations therefrom and changes therein would readily suggest themselves to persons skilled in the art and still fall within the spirit and scope of my invention; but,

Having now set forth the object and nature of my invention and a form of apparatus embodying the same, and having explained the construction, function, and mode of operation of such apparatus, what I claim as new and useful, and desire to secure by Letters Patent of the United States, is—

1. In an apparatus for operating elevator-doors, the combination with a car, a series of coils and a core, said coils and core being relatively movable, of a door, connections between said door and movable part, a circuit for said coils, means for controlling said circuit from the car, and means actuated by the movement of said movable part for succes-

sively and progressively controlling the circuits of said coils, as and for the purpose set forth.

2. In an apparatus for operating elevator-doors, the combination with a car, a series of coils and a core, said core and coils being relatively movable, of a door connections between said door and movable part, a circuit for said coils said circuit controllable from the car and means for successively cutting out of live circuit from a car said coils and progressively cutting in other of said coils, said means actuated by the movements of said movable part as and for the purpose set forth.

3. In an apparatus of the class described, a car a motor comprising a sectional solenoid and a core, said core and solenoid being relatively movable, a circuit for the coils of said solenoid, said circuit controllable from the car and means for successively cutting out of and progressively cutting into live circuit certain of the sections of said coils, said means actuated by the movements of said movable part in combination with a door and connections between said door and the movable part of said motor, as and for the purpose set forth.

4. In an apparatus of the class described, a car, a motor comprising a sectional solenoid, a movable core therefor, a circuit for the coils of said solenoid, said circuit controllable from the car and means for successively cutting out of said circuit and for progressively cutting into said circuit certain of said sections or coils, said means actuated by the movements of said core in combination with a door and connections between said door and core, as and for the purpose set forth.

5. In an apparatus of the class described, the combination with a series of coils and a core therefor, said coils and core being relatively movable, of a door, connections between said door and movable part, a circuit for said coils, means operated from the car for controlling said circuit and means actuated by the movements of said movable part for successively cutting out of said circuit and for progressively cutting into said circuit said coils, as and for the purpose set forth.

6. In an apparatus of the class described, the combination with a series of coils and core therefor, said coils and core being relatively movable, of a door, connections between said door and movable part, a circuit for said coils, means actuated by the movements of said movable part, for successively cutting out of live circuit said coils and progressively cutting in other of said coils, and means controllable from the car for opening and closing said circuit, as and for the purpose set forth.

7. In an apparatus of the class described, a series of coils and a core therefor, said coils and core being relatively movable and a circuit for said cores, means actuated by the movement of said movable part for successively cutting said coils out of live circuit and progressively cutting in other of said coils, in combination with a door and connections between said door and movable part, as and for the purpose set forth.

8. In an apparatus of the class described, a series of coils and a core therefor, said coils and core being relatively movable, a circuit for said coils, and means actuated by the movement of said movable part for successively cutting said coils out of live circuit and progressively cutting in other of said coils, in combination with a door and connections between said door and movable part, and means controllable from the car for opening and closing said circuit as and for the purpose set forth.

9. In an apparatus of the class described, a series of coils and a core therefor, said coils and core being relatively movable, a circuit for said coils, a switch arranged in said circuit for controlling the same, means operated from the car for controlling said switch, and means actuated by the movements of said movable part for successively cutting out of and progressively cutting into live circuit said coils, in combination with a door and connections between said car and said movable part, as and for the purpose set forth.

10. In an apparatus of the class described, a series of coils and a core therefor, said coils and core being relatively movable, a circuit for said coils, means for successively cutting out of live circuit said coils and progressively cutting in other of said coils, and means for arresting the cutting out of said coils near the end of the movement of said movable part, while the progressive cutting in of other coils continues, in combination with a door and connections between such door and movable part, as and for the purpose set forth.

11. In an apparatus of the class described, a series of coils and a core, said coils and core being relatively movable, a circuit for said coils, means actuated by the movement of said movable part for successively cutting out of live circuit said coils and progressively cutting in other of said coils, and means for arresting the cutting out of said coils near the end of the movement of said movable part, while the progressive cutting in of other coils continues, in combination with a door and connections between such door and movable part, as and for the purpose set forth.

12. In an apparatus of the class described, a series of coils and a core therefor, said coils and core being relatively movable, a circuit for said coils, means for successively cutting out of live circuit said coils and progressively cutting in other of said coils, in combination with a door, connections between said door and movable part, means for magnetically cushioning said movable part at the limit of travel thereof as and for the purpose set forth.

13. In an apparatus of the class described, a series of coils arranged in series, a core mounted to move through said coils, a series of contact-segments respectively connected

electrically to the windings of said coils, a series of contacts mounted to move with said core and adapted to complete the circuit of said coils through said segments, and means for opening and closing said circuit in combination with a door and connections between said door and core, as and for the purpose set forth.

14. In an apparatus of the class described, a series of solenoid-coils arranged in series, a core arranged to move through said solenoid, a series of segments respectively connected electrically to the windings of said coils, a bar connected to move with said core, and carrying a series of contacts adapted to contact with said segments and complete therethrough an electric circuit through a portion of said coils, in combination with a door and connections between said door and core, as and for the purpose set forth.

15. In an apparatus of the class described, a series of coils arranged in series, a core arranged to move through said coils, a series of segments respectively connected electrically to the windings of said coils, a bar connected to move with said core and carrying a series of contacts adapted to contact with said segments and complete therethrough an electric circuit through a portion of said coils, one of said contacts being movable with respect to said bar, and a stop arranged in the path of movement of said movable contact, in combination with a door and connections between said door and core, as and for the purpose set forth.

16. In an apparatus of the class described, a motor comprising a relatively-movable solenoid and core, contacts for completing the circuit of said solenoid, said contacts arranged in pairs, a pair of hinged arms and an intermediate arm, said intermediate arm electrically connected to a line-wire, one pair of said contacts connected to another line-wire and the other pair of said contacts respectively connected to said hinged arms, and means carried by the car for making and breaking the circuit between said hinged arms and said intermediate arm at will in combination with a door and connections between said door and the movable part of the motor, as and for the purpose set forth.

17. In an apparatus of the class described a motor comprising a relatively-movable solenoid and core, a door and connections between said door and the movable part of said motor, in combination with an armature arranged to be actuated by the energization or deënergization of said solenoid, and a lock for the door operated by the actuation of said armature, as and for the purpose set forth.

18. In an apparatus of the class described, a motor comprising a relatively-movable solenoid and core, a door and connections between said door and the movable part of said motor, in combination with a pivoted latch arranged to lock said door, an armature arranged to be attracted by said solenoid when energized, and connections between said armature and latch for releasing the latter whereby the door is unlocked when said solenoid is energized, as and for the purpose set forth.

In witness whereof I have hereunto set my hand, this 12th day of April, 1897, in the presence of the subscribing witnesses.

HUMPHREY RUSSELL SMITH.

Witnesses:
FRANK T. BROWN,
S. E. DARBY.