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C. R. CAMPBELL.

ELECTRIC RAILWAY.

(Application filed Dec. 28, 1900.)

(No Model.)

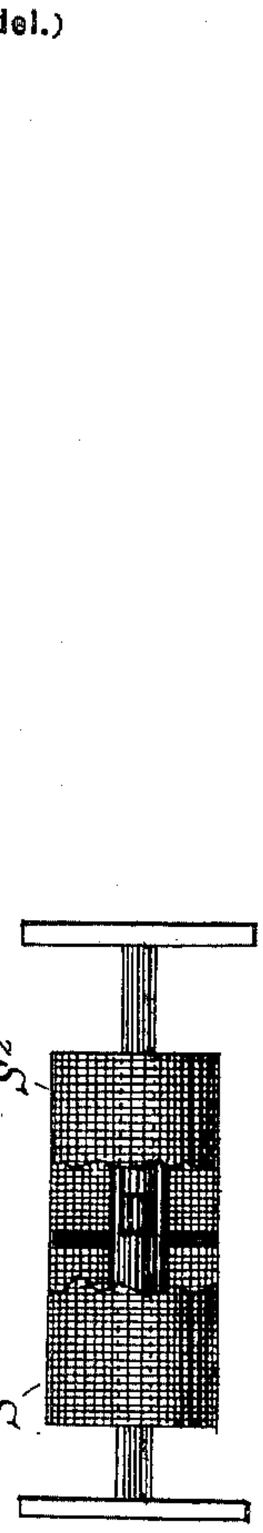

Fig. 2.

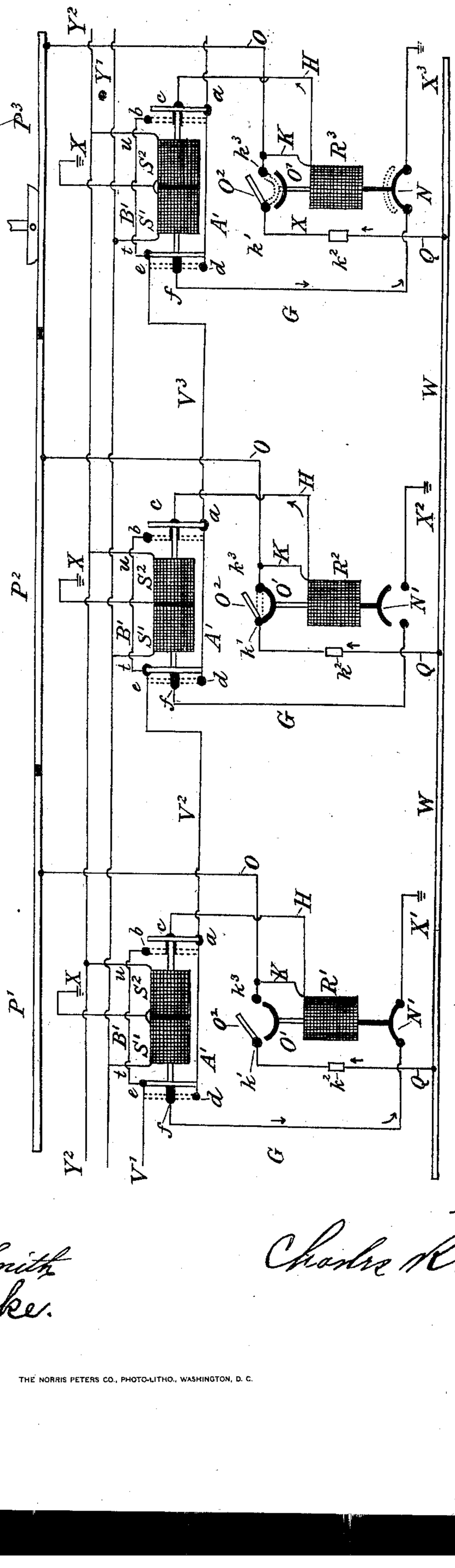

Fig. 1.

Witnesses.
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CHARLES R. CAMPBELL, OF NEW YORK, N. Y.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 706,156, dated August 5, 1902.

Application filed December 28, 1900. Serial No. 41,328. (No model.)

To all whom it may concern:

Be it known that I, CHARLES R. CAMPBELL, a citizen of the United States, and a resident of the city, county, and State of New York, have invented certain new and useful Improvements in Electric Railways, of which the following is a specification.

My improvements relate to electric railways wherein the electric force is communicated to the car-motor by a lineal conductor commonly in the form of a third rail, which is divided into sections insulated from each other, whereof only the section occupied by the car or cars for the time being requires to be electrically active, the remainder of the railway lying dormant.

By means of my improvements cars may be sent in opposite directions over the same track and its third rail by the same electric current operated over the same feed-wire and branch connections to and with such sectional third rail.

To enable others skilled in the art to practice my invention, I will proceed to describe the same, referring to the annexed drawings, wherein—

Figure 1 is a diagram which illustrates my invention as applied to use on a sectional third-rail electric railway. Fig. 2 is a separate view, enlarged, of my improved double solenoid.

In said diagram the electrical third rail is shown as in sections P′ P² P³, &c., insulated from each other. W is the electric feed-wire conveying the power-current from the generating source to the sectional third rail. Each rail-section has a group of switches worked by independent solenoid-coils—the style of magnet preferably used for actuating the electric switches of my new system. The solenoids are made in form of single and double acting and each coil is furnished with a core-armature playing back and forth therein, one of which is here arranged to move vertically and the other horizontally. These core-armatures are each provided with cross-arms or otherwise made for contacting terminal points to form the proper switch connections.

The "single-acting" solenoids R are so called because electrically actuated in one direction only—that is, when lifting the armature, which when deënergized falls by gravity. Each solenoid-coil R controls two switches, one for opening and closing the course of the power-current and the other for governing the grounding of the auxiliary or shunt current to be described.

My improved double-acting solenoid comprises two independent coils S′ and S². For convenience the armatures of the respective coils are disposed in the same line and united by an insulator and are arranged to move back and forth horizontally. Being balanced as to gravity, they may be positively and electrically operated in opposite directions. The cross-arms on each armature are adapted for contacting with terminal points to form multiple switches, four in this instance, two being opened and two others closed at each movement of the armature to the right or left. Said terminals have each their own wiring to form separate pathways for the course of the auxiliary current (toward the right or left) to ground.

Y′ Y² are supplementary wires leading, respectively, to opposite coils of the double solenoid, over one or the other of which wires an independent current is worked for momentarily energizing one or the other of the double solenoids to make and break contacts by their armatures with their respective switch connections for changing the course and direction of the auxiliary current and complete their own circuits by independent groundings, as at *x x*.

The course of the power-current to the third rail P for driving the cars is from the feed-wire W by a branch Q to a terminal point *k′*, thence to a terminal *k*³ of a wire O, thence to the third rail. This course depends on closing a circuit between points *k′* and *k*³, which at the outset is done by a switch O², controlled manually until automatically served by the switch O′, actuated by solenoid-coil R.

The holding of the switch O′ closed automatically is done by maintaining such armature in its higher and energized position, and this is effected by means of an auxiliary or shunt current having a changeable course, and on the course of which current to a grounding depends the direction that the insulated sections of the third rail will be suc-

cessively energized, and hence the direction the cars are to take to the right or left. Thus if the cars be moving to the right and occupying rail-section P^2 this auxiliary or shunt current requires to be grounded through a switch of the solenoid R^3—that is, of the adjoining third-rail section next to receive the car. This auxiliary current is obtained by diverting a portion of the electric force carried by the wire O, and which diverted portion is led through a branch wire to the solenoid-coil R. This auxiliary current having energized said coil, then passes out and follows a wire H to a terminal point *e*, part of one of the switches controlled by the double-acting solenoids S.

Before operation an independent current sent over the supplementary wire Y′ and branches *t* has charged the solenoid-coil S^2 of the double solenoids, thus throwing the armatures thereof to the right-hand position, as shown.

With the car on rail-section P^2 and going to the right, and assuming for the moment that this section is dormant and that the coil R^2 is deënergized, with its armature in its lower position, leaving the switch O′ open, this rail-section would be enegized initially by closing the circuit between *k′* and *k³*, as by a hand-switch O^2, allowing the power-current to flow into rail-section P^2. At the same time the shunt-current from O energizes solenoid-coil R^2, carrying switch O′. At the moment of energizing rail-section P^2, as aforesaid, the independent current following Y′ has insured the grounding of the shunt-current toward the right by directing the same over the course laid out for this purpose—that is to say, with the armature of solenoid S^2 in the right-hand position it opens two switches *d f* and *b c* and closes two others *c a* and *e f*, one of the latter of which is between the aforesaid terminal *c* of the auxiliary or shunt current and a terminal *a* of a wire V^3. Here the said current crossing by this switch to *a* follows wire V^3 to the terminal point *e* of the other switch now held closed by the double solenoid of the adjoining section of the third rail next to receive the car—viz., section P^3. Here the current is switched through a terminal *f* of a wire G, following which it meets the lower or grounding switch N′ of the solenoid-coil R^3 of the said adjoining section. This coil not yet being energized, the armature is in its lowest position, closing this switch, and so permitting the auxiliary or shunt current to ground, as at x^3. This condition obtains so long as the car continues moving over section P^2 going to the right. When it moves off this section to section P^3, it is necessary to immediately deënergize rail-section P^2, which is thus accomplished: The usual shoe carried by the car and resting on the third rail passes over the break between the two sections P^2 and P^3, bridges over the insulation between them when the power-current from the third rail passes into section P^3, and there backs down wire O and by wire K enters solenoid-coil R^3, causing the core thereof to rise and open its switch N′, thus cutting off the grounding of the auxiliary current of coil R^2 of the preceding section. The armature of R^2 then drops, opening switch O′ of that solenoid, and by thus cutting off the power-current through wire Q to section P^2 that section becomes deënergized. The rising of the armature R^3 before named closes its switch O′, (see dotted lines,) allowing the power-current to flow through this switch to rail-section P^3. This now being energized the operations described in connection with section P^2 are repeated for section P^3, and so on.

I will now describe the operation of grounding the shunt-current toward the left for the travel of the car in that direction and from section P^3 as a live rail, leaving solenoid R^3 still energized and raised and R^2 deënergized and down, all as last described, (premising that the course of the power-current remains the same as before traced to the third rail by the wires Q and O and that of the shunt-current from wire O the same as formerly traced to its terminal point *c* and that an independent current has been sent over wire Y^2 and branches *u*, energizing solenoids S′ a sufficient time to throw the armatures thereof to the left-hand position, as shown in dotted lines.) The car starting at the insulation between P^3 and P^2, the first necessity is to open communication of the feed-wire with rail-section P^2, for which purpose the switch O′ there must be closed. This is done automatically by the act of the car-shoe in passing from rail-section P^3 to P^2, such action bridging over the insulation between the two sections and causing the current to back down wire O from rail-section P^2, energizing solenoid R^2 and lifting its armature to the position there shown. The car now having entered upon section P^2, the double-acting solenoid-armature having moved to the left, has opened the switches *c* to *a* and *f* to *e* and closed switches connecting terminal *c* with the terminal *b* of a wire B′, leading the shunt-current toward the left to the switch-point *e*. The switch there now being open, the said current follows wire V^2 to terminal *a* of the double solenoid of rail-section P′, then following wire A′ to terminal *d*, thence, crossing by a closed switch to *f* of this section, follows the wire G thereof to switch N′ of solenoid R′. This being deënergized, its armature is in its lowest position, the switch N is closed, and the shunt-current grounds at *x′*, being under the section P′, which is the one next to receive the car going to the left.

From the foregoing description it will now be understood that in energizing a fresh section of rail the portion of the power-current diverted and called the "auxiliary" or "shunt" current is independently grounded

through the single-solenoid switch of that section next to receive the car going in either direction.

The wires Y′ or Y^2 are electrified by closing a circuit with either of the rail-sections P or any of the wires Q, O, or W by switches, contacts, or other suitable means. The groundings X are returned to the starting-point through the road-bed rails or by direct wiring.

In order to provide against damage from overcharging or short-circuiting at the sectional conductor P, branch Q, wire O, or otherwise, I provide a local blow-out or fuse-wire K^2—one for each section of the railway—arranged between the feed-wire W and the rail-conductor P—in this instance placed on branch Q. When thus arranged, the action of such blow-out has the effect of intercepting the flow of the working current to the conductor P and deënergizes that section, thus preventing accidents from overheating, &c., while the other sections remain operatively intact.

The manual switch O^2 is normally held open by a spring, so as to be adapted to be temporarily closed at will, and is useful in case of unseen emergency interrupting the power-current, as by the accidental dropping of the armature of solenoid R or its refusal to work, or otherwise, when connection may be artificially established between points k' and k^3 to complete a circuit.

I claim as my invention—

1. In a sectional third-rail electric railway, the combination, for sending electric cars in opposite directions over the same track, of the third-rail conductor, the main feed-wire carrying the working current, means for diverting an auxiliary or shunt therefrom having changeable groundings through mesne contacts, multiple switches and wiring adapted to form separate pathways for grounding the auxiliary current in opposite directions, and supplementary wires carrying independent currents for actuating said switches.

2. In a sectional third-rail electric railway, the combination of the following instrumentalities, to wit: an electric feed-wire, a sectional third-rail conductor, a series of single-acting solenoid coils or magnets, a series of double-acting solenoid coils or magnets, and suitable wires and switches connecting said coils to each other, to the feed-wire, and to the sections of said third rail, substantially in the manner and for the purpose herein described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 4th day of December, 1900.

CHARLES R. CAMPBELL.

Witnesses:
EARLE H. SMITH,
E. O. B. KISSAM.