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C. R. CAMPBELL.

METHOD OF OPERATING ELECTRIC RAILWAYS.

(Application filed May 6, 1902.)

(No Model.)

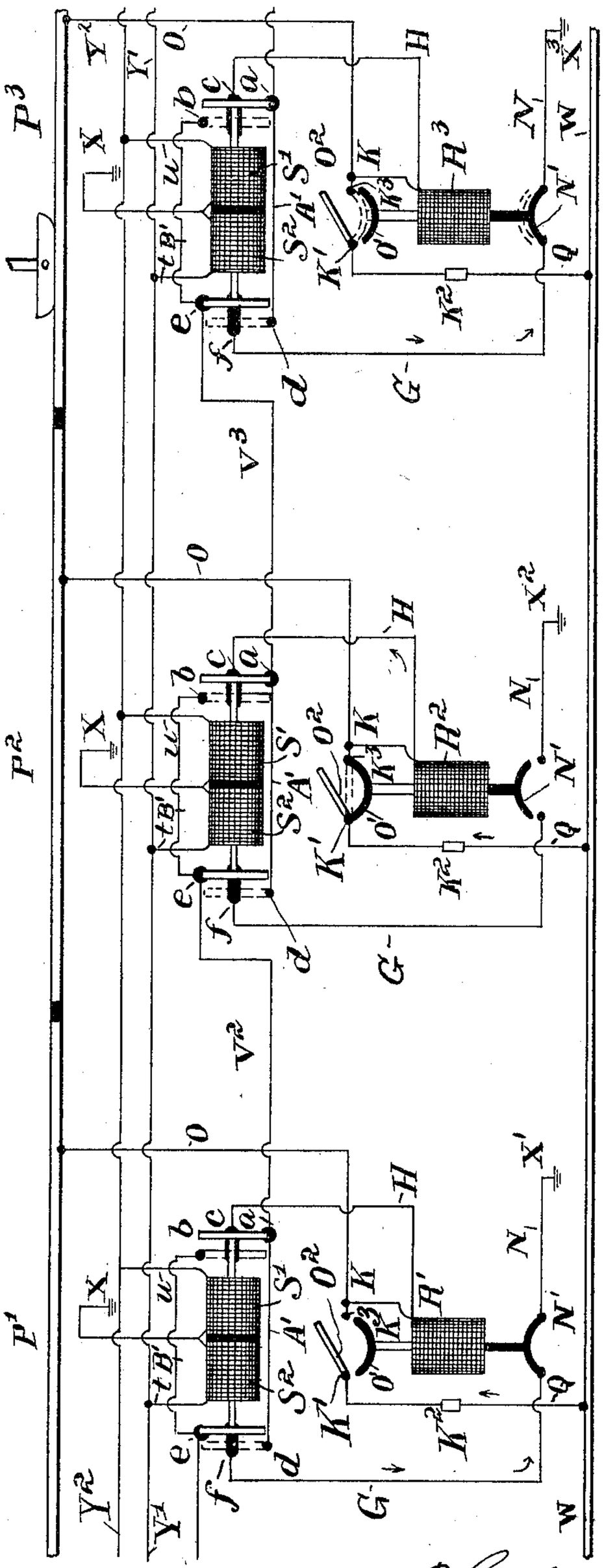

Fig. 1.

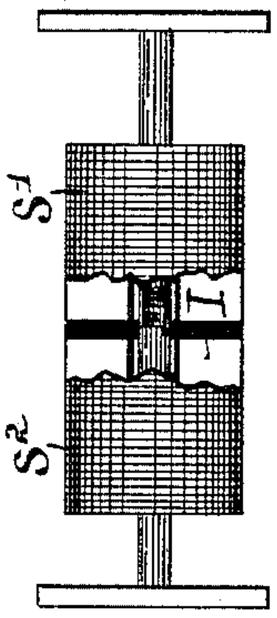

Fig. 2.

Witnesses
Edgworth Brune
Earle H. Smith

Charles R. Campbell
Inventor

UNITED STATES PATENT OFFICE.

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

METHOD OF OPERATING ELECTRIC RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 706,219, dated August 5, 1902.

Application filed May 6, 1902. Serial No. 106,170. (No model.)

To all whom it may concern:

Be it known that I, CHARLES R. CAMPBELL, a citizen of the United States, residing at the city of New York, borough of Richmond, in the State of New York, have invented, made, and applied to use a new and useful Method of Operating Electric Railways, of which the following is a specification.

Figure 1 is a diagrammatic view illustrating my invention. Fig. 2 is a separate enlarged view of my improved double solenoid.

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.

The object of my invention is to institute a new method for sending cars in either direction over the same track, wherein the mode of directing the operative current is such as to complete its circuit independently of the motor carried by the traveling car. This differs from prior inventions for the same purpose, the prevailing methods being such as to require the motor-car as a necessary part of the circuit.

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 in illustration of a mode of applying my invention to use on a sectional third-rail railway, shown as in sections P' P^2 P^3, &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 is connected with a group of switches worked by suitable magnets, preferably in the form of solenoid-coils. As here shown, the solenoids are single and double acting, respectively, the latter comprising duplex magnets, and each solenoid has a core-armature playing back and forth therein, one of which for convenience is here arranged to move vertically and the other horizontally. The vertical solenoids R' R^2 R^3 are single-acting, being electrically actuated in one direction only—that is, when lifting their armature, which when deënergized falls by gravity. The horizontal solenoids are double-acting. In this instance there are two coils S' and S^2, which are independent of each other; but their armatures are united by an insulator I. They are balanced as to gravity, and hence may be positively and electrically operated in opposite directions. Each solenoid R' R^2 R^3 is provided with cross-arms or otherwise adapted for contacting with terminal points to form two switches—one for opening and closing the course of the power-current to the third rail and the other for opening and closing the divisionary current over a route which is changeable to a separate grounding, according to the direction the cars are to run, going or coming.

By "divisionary" is meant a shunt or portion split off the working current and independently grounded immediately upon operating means for switching in the working current to the third rail of one section and breaking the like shunt of a previous section and without at any time being used for active purposes to take part in operating the motor of a traveling car.

The duplex magnets S' and S^2 and their switches are for determining and reversing the direction in which the divisionary currents shall be grounded, to the right or left, according to the direction the cars are run, whether going or coming. These double solenoids represent the use of a plurality of magnets arranged to operate a number of electrical switches at one movement.

The armatures of the duplex solenoids or magnets S' and S^2 are adapted by cross-arms or otherwise to contact with terminal points and form multiple switches for changing the course and direction of the divisionary current, and said terminals have each their own wiring to form separate pathways for the course of the divisionary (to the right or left) to ground. For operating these switches supplementary currents are used, which are independent of that which drives the cars. For this purpose Y' Y^2 are special wires leading respectively to opposite coils of the double solenoid, over one or the other of which wires an independent current is sent for momentarily energizing one or the other of the double

solenoids to shift the contacts, with their respective switch connections, and to change the route and direction of the divisionary current, completing their own circuits by independent groundings, as at X X. The course of the working or power current to the third rail P′ P² P³ for driving the cars is from the feed-wire W by a branch Q to terminal point K′, thence to a terminal K³ of a wire O to the third rail. This course depends on closing a circuit between points K′ and K³, which at the outset is done by a manual switch until automatically served by switch O′, actuated by solenoid-coil R′. The holding of switch O′ closed automatically is done by maintaining its armature in the higher and energized position, and this is effected by means of a divisionary or shunt, as described, having a changeable route, and by the route of which shunt to a grounding, forward or back, depends the direction the insulated sections of the third rail will be successively energized. The divisionary current is here obtained by diverting a portion of the working current from the wire O, and which diverted portion is led through a branch wire K to energize solenoid-coil R and then passes out and follows a wire H to a terminal point *c*, part of one of the switches controlled by the double solenoid S. Before operation an independent current is sent over the course through the special wire Y′ and branch *t* to the solenoid-coil S² of the double solenoids, throwing the armatures thereof to the right-hand position, as shown. With the car on rail-section P² and going to the right, and assuming for the moment that this section is dormant and that the coil R², carrying the switch O′, is deënergized with its armature in its lower position, leaving the switch O′ open, this rail-section would be energized initially by closing the circuit between K′ and K³, as by a hand-switch O², allowing the power-current to flow into the rail-section P² by the wire O. At the same time a shunt-current from O energizes solenoid-coil R² by wire K. Previous to the moment of energizing rail-section P², as aforesaid, the independent current following Y′ to coil S² of the double solenoid has insured the grounding of the divisionary or 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 S² 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, *e*, is one of the terminals of the wire V³, the other terminal of said wire being the point *a* of the divisionary or shunt current. The solenoid R² being energized and the power-current having entered rail-section P² and energized coil R², as previously described, it now passes to its independent grounding by the following course: From the feed-wire O and wire K, energizing-coil R², and passing thence through wire H to point *c*, by switch to *a*, and thence by wire V³ to point *e*, by switch to *f* and through wire G, where it meets the grounding-switch N′ of the solenoid-coil R³. This coil not being yet energized, the armature rests in its lowest position, permitting the divisionary or shunt current, by the wire N, to ground at X³ under section P³, next to receive the car. This condition obtains so long as the car continues moving over rail P² going to the right. Now while moving from section P² to section P³ it next becomes necessary to energize rail-section P³ and deënergize rail-section P². This is done by the usual shoe-contact carried by the car and resting on the third rail passing over the space from rail P² to P³, whereby it bridges over the insulation between them, when the power-current flows into section P³ and follows down the wire O and wire K, energizing coil R³, causing the core thereof to rise, closing switch O′, at the same time opening switch N′, the grounding-switch of the divisionary or shunt current of solenoid R² of rail-section P² thus causing the armature of R² to drop, opening switch O′ of that solenoid, and by thus cutting off the power-current through wire O to section P² causing this section P² to become deënergized. It will hence be clear that no section can be energized without deënergizing the preceding section or sections. The rail-section P³ by the rise of the core of coil R³, as just described, and the divisionary or shunt current of this coil R³ having been grounded in course, as previously laid out in energizing the preceding section, the same operation is repeated as the car passes from section to section going to the right.

It will now be in order to explain the moving of the car in the reverse direction. With the car now resting upon section P³, we will now describe the going of the car to the left. A current is first sent over the special wire Y² by wire *u* to and energizing coil S′ of the double solenoid, throwing the core-armature of the double solenoid to the left and the cross-arms thereon to the position as shown in dotted lines. This operation opens switches *c a* and *f e* and closes switch-contacts *c* with *b*, connected by wire B′ to *e*, one of the terminals of wire V³; also closes switch-contacts *f d*, and by wire A′ to *a*, the other terminal of wire V³, and under P². It is next necessary to open communication between the feed-wire W with rail-section P², for which purpose the switch O′ must be closed. This is done automatically by the act of the shoe on the car passing from rail-section P³ to P², such action bridging over the insulation between the two sections and causing the current in section P³ to pass by way of the shoe into rail P², down wire O, and by wire K energizing solenoid-coil R², then passing out and following wire H to point *c*, thence by switch to *b* and by wire B′ to point *e*, thence by wire V², of which *e* is one of the terminals, to the other terminal *a*, and by wire A′ to point *d*, then by switch *f* and wire G to switch N′ under section P′. Here coil R′

being deënergized and said switch N′ closed, it follows by wire N to ground at X′ under section P′. The coil of solenoid R^2 now being energized, as previously described, this operation closes switch O′, allowing the power-current to flow to rail-section P^2. The same action opens switch N′ of coil R^2, which being the grounding-switch of the divisionary or shunt current of solenoid R^3, deënergizes said coil R^3, opening switch O′ and cutting off the power-current, thereby deënergizing rail-section P^3. This operation is repeated as long as the car passes from section to section going to the left.

From the foregoing description it will be understood that the divisionary or shunt current is a portion of the power-current which instead of passing to the car-motor is diverted to energize the solenoid-coils R and then independently grounded in the manner as described, and at no time is it used in passing through or assisting in the movement of the car.

The wires Y′ or Y^2 are electrified by closing a circuit with either of the rail-sections P′ P^2 P^3 or any of the wires Q, O, or W by switches, contacts, or other suitable means. The groundings 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 or rail P′ P^2 P^3, 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 normally stands open and is thus adapted to be temporarily closed at will, as before described. It is also useful in case of an 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 artifically established between points K′ and K^3 to complete a circuit.

I claim as my invention—

1. The method of operating electrically-driven cars in either direction, consisting in leading a power-current along the line, diverting a portion of the power-current to form a divisionary shunt controlled by switches for use in fixing the direction the cars shall take, going or coming, leading two supplementary currents along the line independent of but paralleling the power-current for momentarily energizing one or the other of the double solenoids, providing a changeable route for such divisionary, and controlling by switches the grounding of said shunt independently toward the right or left.

2. The method of electrically operating motor-cars in either direction over the same track, consisting in leading a power-current along the line, diverting a portion of the power-current to form a divisionary or shunt for use in fixing the direction the cars shall take, leading two supplementary currents along the line independently of but paralleling the power-current for momentarily energizing one or the other of the double solenoids, providing a changeable path for such divisionary current controlled by switches, grounding said shunt independently through its own switch toward the right or left, whereby the route of such divisionary to ground forward or backward determines the direction the car shall take, as set forth.

CHARLES R. CAMPBELL.

Witnesses:
EARLE H. SMITH,
MARX L. HASLEHURST.