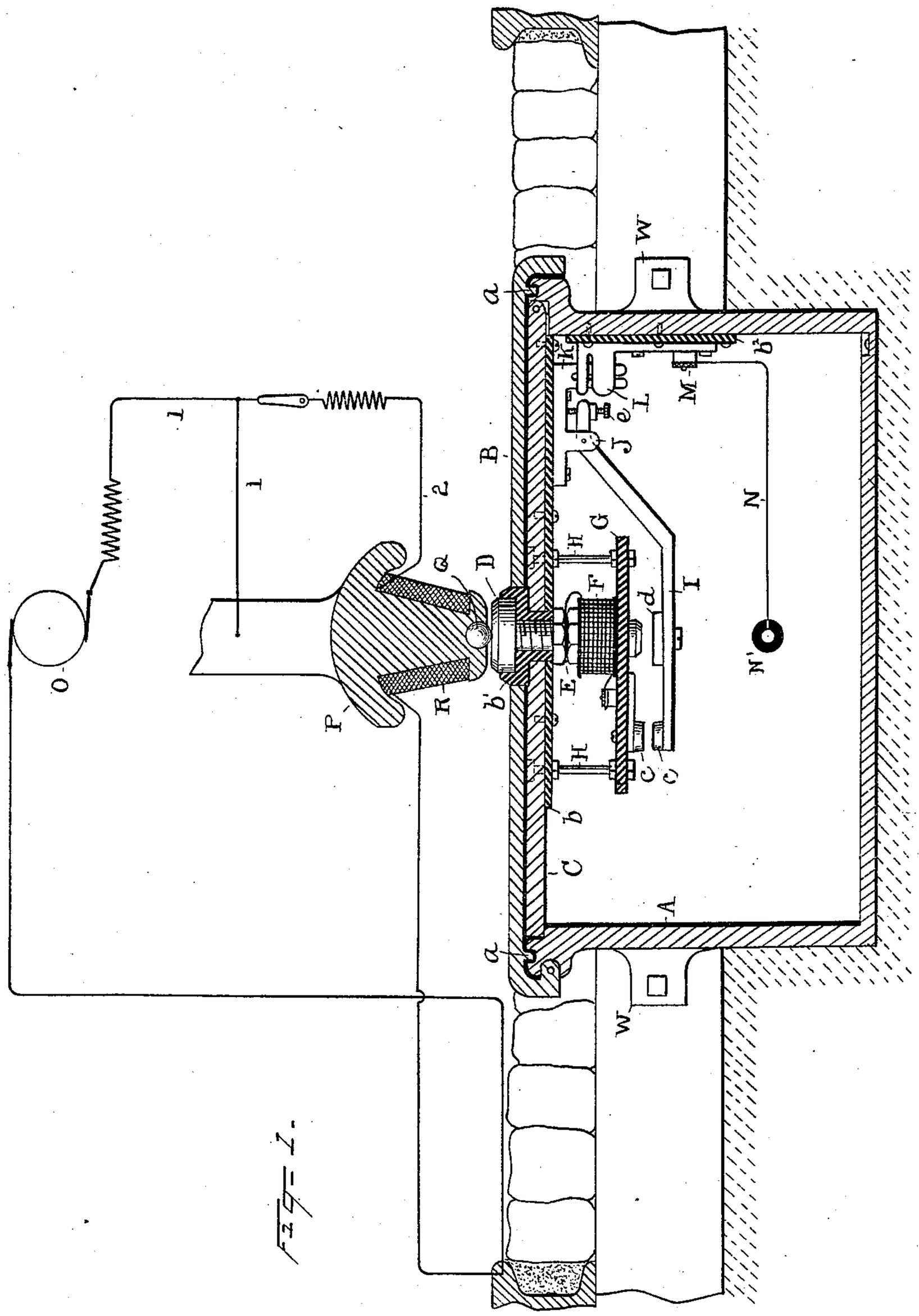
(No Model.) 2 Sheets—Sheet 1.

D. MacL. THERRELL.

ELECTRIC RAILWAY SYSTEM.

No. 560,551. Patented May 19, 1896.



Witnesses
Norris A. Clark.
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Inventor
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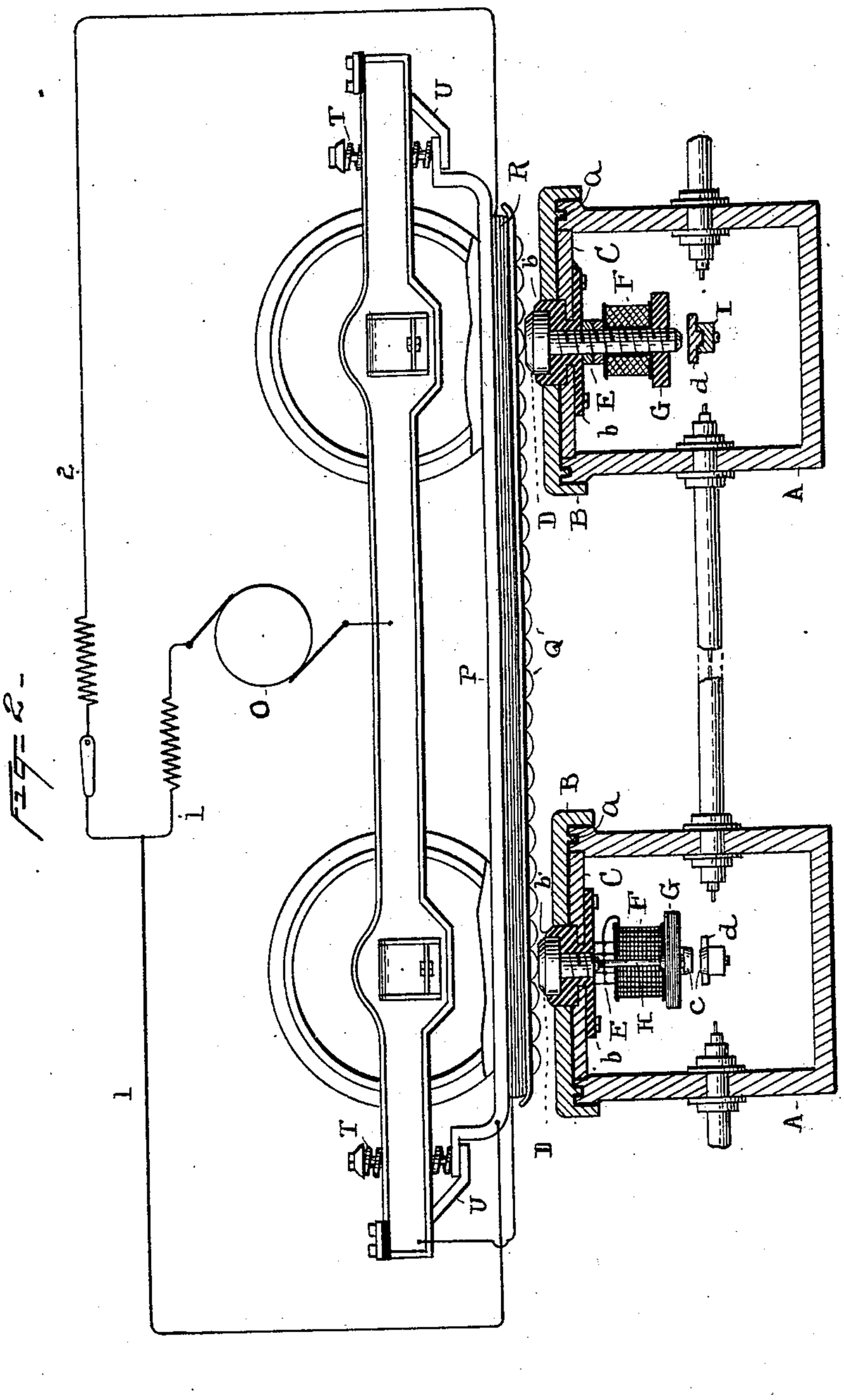

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UNITED STATES PATENT OFFICE.

DANIEL MACLAUCHLIN THERRELL, OF CHARLESTON, SOUTH CAROLINA.

ELECTRIC-RAILWAY SYSTEM.

SPECIFICATION forming part of Letters Patent No. 560,551, dated May 19, 1896.

Application filed January 9, 1896. Serial No. 574,840. (No model.)

To all whom it may concern:

Be it known that I, DANIEL MACLAUCHLIN THERRELL, a citizen of the United States, residing at Charleston, in the county of Charleston and State of South Carolina, have invented a certain new and useful Improvement in Electric-Railway Systems, of which the following is a specification.

My invention relates to improvements in electric-railway systems, and more particularly to electric railways in which an underground feeder is used to supply the current to the motor or motors upon the car, efficient devices being provided to establish automatic connection between the feeder and the motor and operating so as to avoid all danger due to the presence of electrical conductors used to convey current at high potential. These objects are accomplished by means of a series of automatic switch-boxes placed at short intervals along the track below the track-level and connected consecutively with source of power by a feeder. Through the top of each switch-box a stud projects slightly above the surface of the road-bed. When the automatic devices in the switch-box are operated, this stud is put in connection with the feeder or permanent conductor of the power-current, thus constituting the stud a working conductor. When the car passes over the switch-box, a hanging shoe in electrical connection with the motor upon the car engages the stud and operates the automatic devices in the switch-box, establishing the circuit across the line from the feeder through the motor to the earth or other return-conductor. This circuit is automatically broken beneath the ground-surface as the car passes beyond the switch-box, when a similar operation takes place at the next farther switch-box.

In the accompanying drawings, Figure 1 is a cross-section, taken at right angles to the track, of a switch-box with a shoe engaging with the stud; and Fig. 2 is a view taken parallel to the track, showing in elevation a car-truck and shoe and in section two adjacent switch-boxes.

Similar letters and numerals refer to similar parts in the two figures.

The switch-box A, containing the operating device, is bolted between the cross-ties in any suitable manner, the method shown in the drawings being by means of the ears W.

B is the outer lid of the box, working on a hinge and provided with a vertically-projecting flange *a*, extending around the rim of the lid, and which fits into a channel in the upper face of the sides of the box A. This channel when filled with tar or other proper material makes the box perfectly water-tight when cover B is fitted down.

C, the inside cover of the switch-box, serves to support the automatic mechanism while being insulated therefrom by the slab *b*, of any proper insulating material.

D is a soft-iron stud which projects through the lids C and B, being separated therefrom by insulation *b'*. D is screw-threaded to receive the nuts E, which, when tightened against *b b'*, prevent any upward movement of the stud, thus holding it rigid.

F is a spool of coarse wire fitting upon the shank of the stud D and held against the lower face of the nuts E by means of the insulation-slab G. This insulation-slab is supported from C by means of the bolts H. One end of the wire of the spool F is bound between the nuts E, thus electrically connecting F with the stud D. The other end is connected by a binding-post with the upper of two contact-points *c c*, of carbon or other non-arcing material. A gravity-lever I, suspended from C at J, holds the lower contact-point immediately below the one on slab G and in such position that normally they are separated and no current can pass between them. Just below the lower end of the stud D, which projects through G, and upon the gravity-lever I, is a soft-iron armature *d*, placed so as to be attracted by the stud when it is magnetically energized. The normal or retracted position of I is adjustable by means of the adjusting-screw *e*.

K is the blade of a knife-switch, which is mounted upon the insulation *b* on the cover C and is connected with I, and when the lid is down engages the fork L, mounted on insulation b^2 on the side of the box A; but when C is raised K is disengaged from L, thus automatically breaking, when the switch-box is opened, the connection between the blade K, attached to C, and the branch wire N, which

leads from the feeder or permanent conductor N′ through the binding-post M to the fork L. The automatic controlling device being pendent from the lid C and free to move with it, C may be thrown back and expose the whole device above the ground-surface when examination or repair is necessary.

The actuating device upon the car necessary to operate the switch-box devices consists of a shoe P, made of hard steel, so as to be capable of permanent magnetization. This shoe is of sufficient length to bridge two adjacent switch-boxes. The guard-arms U, which are insulated from the car-truck, afford means of suspension for the shoe P, and are so arranged as to allow the shoe a limited vertical movement. The thrust-springs T are provided to keep the shoe down upon the studs under all ordinary circumstances. To insure the permanency of the magnetism in the shoe and to counteract the loss caused by vibration, P is provided with a helix R, so wound on P longitudinally as to give it the same magnetic polarity when current passing through R makes P an electromagnet as when P simply relies on its permanent magnetism. An adjustable resistance regulates the current passing through this helix R, which is intended merely to maintain the magnetic intensity in P, and not necessarily to use P as an electromagnet. In the lower face of the shoe there is a channel, which carries balls Q, of material which is non-magnetic, but which is a good electrical conductor. This ball-bearing device normally rests upon the studs in the switch-boxes and greatly reduces the friction consequent upon the contact of the moving and stationary surfaces. For simplicity the drawings show but one channel of balls, but there may be more.

The main or motor circuit 1 upon the car leads from the shoe-support through an adjustable resistance or other form of controller for the control of the motor or motors to the motor or motors O. The return-circuit leads from the motors to the car-wheels, which, being in contact with the rails, makes them the return-conductors. In case any other return-conductors are used suitable contact devices are placed upon the car. An independent circuit 2 leads through the helix R to the return-conductor. This circuit is provided with an adjustable resistance and a cut-out switch to regulate or to prevent the flow of current in the helix.

In operation, when the shoe P, whose lower edge, say, constitutes the north pole of the magnet, passes over the stud D, it immediately attracts D and causes a south pole to appear at its upper end and a north pole at its lower end. The soft-iron armature *d* is attracted toward D and lifts the lever I up until the contact-points *c c* touch. This makes connection between the main or feeder N′ and the stud through the circuit already described. The helix F is wound so as that when current is passing through it it gives the upper end of D the same polarity as the lower edge of P, which in the illustration used would be north, so that when the circuit is once made the shoe P and the stud D are magnetically repellent. In other words, the connection *c c* being made, the magnetic field of D is reversed, and while still attracting the soft-iron armature *d* strongly and making close contact between *c c* the tendency is to repel P. This device serves the important purpose of eliminating all drag upon the movement of the car due to the magnetic attraction of the circuit-making devices. Should the current for any reason be temporarily withdrawn from the permanent conductor N′, the permanent magnet P would hold the lever I up and keep the circuit through *c c* closed until the current is again turned on. When the car carries the shoe beyond the stud, the circuit is broken, and the helix F being deënergized the temporary magnet D immediately loses its strength and the lever I falls away from D, thus breaking the connection *c c* and separating D from the feeder N′, rendering the device harmless by breaking the connection beneath the ground-surface.

What I claim is—

1. In an electric-railroad system, a series of switch-boxes containing automatic circuit-controllers connected with the source of current, which controllers when actuated to close the circuit by means of a magnet upon the car, operate by the closing of the circuit to repel the actuating-magnet upon the car while keeping the circuit closed until after the car has passed, substantially as set forth.

2. The combination in an automatic circuit-controller for an electric-railroad system, of a containing switch-box, an iron stud projecting therefrom and placed so as to be magnetized by the actuating-magnet upon the car, and a helix upon the shank of the stud, which helix, when current passes through it, causes the stud to operate to keep the circuit closed while exercising a repellent action upon the actuating-magnet of the car, substantially as set forth.

3. The combination, in an automatic circuit-controller for an electric-railroad system, of a containing-box, an iron stud serving both as a circuit-maintaining magnet and as a working conductor, projecting through the lid of such box and insulated therefrom, a helix placed upon the shank of the stud and an insulation-slab supporting the helix, the insulation-slab being hung by bolts from the lid of the containing-box, substantially as set forth.

4. In an electric-railroad system, the combination of a car, a magnetized shoe suspended therefrom, and a ball-bearing device upon the shoe carrying balls of non-magnetic material of good electrical conductivity, substantially as set forth.

5. In an electric-railroad system, the combination of a car, a permanently-magnetized

shoe suspended therefrom, a helix attached to the shoe, and a ball-bearing device upon the shoe carrying balls of non-magnetic material of good electrical conductivity, substantially as set forth.

6. In an electric-railroad system, the combination of a car having a hanging shoe, permanently magnetized, which shoe has a helix attached thereto and a ball-bearing device that bears upon the working conductor, with a series of automatic circuit-controllers each having for a working conductor and armature of the controller-magnet an insulated iron stud serving both as a circuit-maintaining magnet and working conductor projecting from the box containing the automatic device, the stud being in position to engage the actuating-magnet and current-conveying device upon the car, a helix in position upon the shank of such stud, a gravity contact-lever bearing an armature under the lower end of the stud and devices for making connection between such lever and the power-feeder, substantially as set forth.

This specification signed and witnessed this 2d day of January, 1896.

D. MACLAUCHLIN THERRELL.

Witnesses:
J. P. DE VEAUX,
NATHANIEL ISRAEL.