(No Model.) 2 Sheets—Sheet 1.

W. B. POTTER.

CLOSED CONDUIT ELECTRIC RAILWAY SYSTEM.

No. 589,788. Patented Sept. 7, 1897.

FIG. 1.

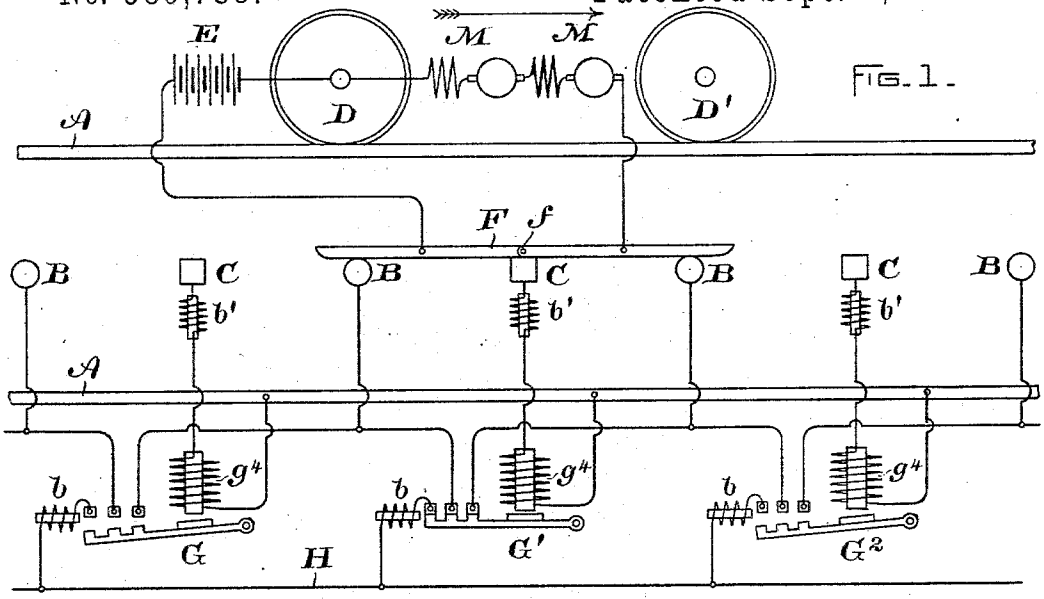


FIG. 2.

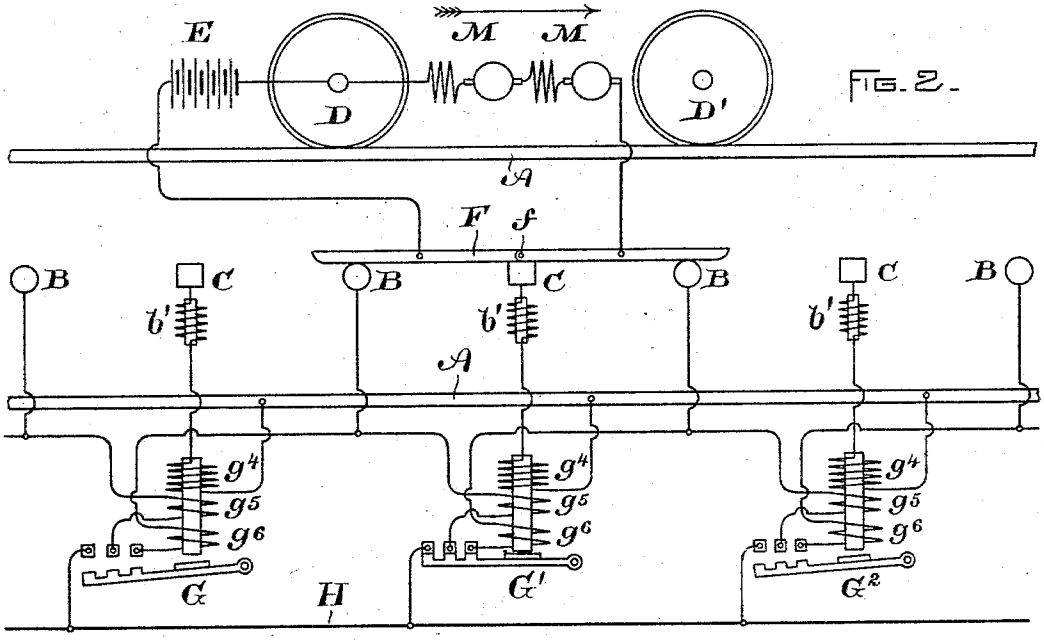
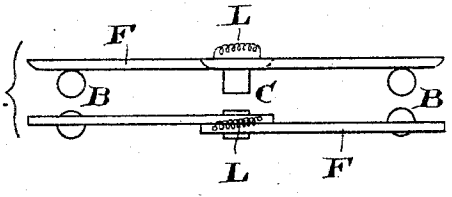


FIG. 3.



WITNESSES.

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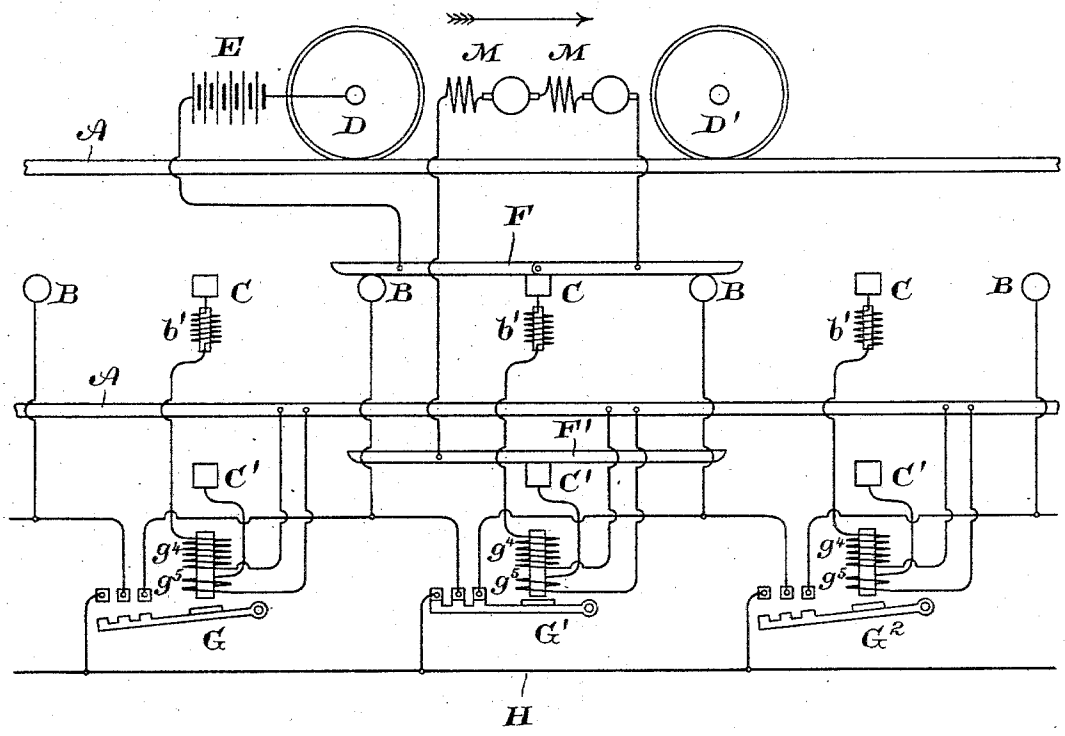
(No Model.) 2 Sheets—Sheet 2.

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No. 589,788. Patented Sept. 7, 1897.

FIG. 4.



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UNITED STATES PATENT OFFICE.

WILLIAM B. POTTER, OF SCHENECTADY, NEW YORK, ASSIGNOR TO THE GENERAL ELECTRIC COMPANY, OF NEW YORK.

CLOSED-CONDUIT ELECTRIC-RAILWAY SYSTEM.

SPECIFICATION forming part of Letters Patent No. 589,788, dated September 7, 1897.

Application filed November 28, 1896. Serial No. 613,743. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM B. POTTER, a citizen of the United States, residing at Schenectady, in the county of Schenectady and State of New York, have invented certain new and useful Improvements in Closed-Conduit Electric Railways, (Case No. 448,) of which the following is a specification.

My invention relates to electric railways, sometimes called "surface-contact" railways or "closed-conduit" railways, in which the motor-circuit is completed through a series of normally-insulated sectional contacts which are brought into electrical connection with a feeder or distributing-main through electromagnetic switches closed in sequence as the car travels over the line. I set forth herein certain improvements in a system of this character and have aimed to devise a system in which the number of sectional contacts is kept as small as possible, also one in which the cars may move with equal facility in either direction, whether they are turned around at the end of the line or not, and one in which a sufficient overlap or time allowance is secured without increasing unduly the length of the contact-shoe. The means devised for these purposes and constituting the improvements of this application for a patent are hereinafter set forth in detail and are illustrated in the accompanying drawings, wherein—

Figure 1 is a diagram of a railway system embodying the invention; Fig. 2, a diagram of a similar system with certain additional features; Fig. 3, a detail view of an improved contact-shoe for use in electric-railway systems of this general character, and Fig. 4 a diagram of a railway system with still further modifications.

In the diagrams, A A are the track-rails.

B B are insulated sectional contacts, which I hereinafter term "motor-contacts," since they form part of the motor-circuit; and C C also a set of contacts, which I term "switch-contacts," their primary object being to provide a circuit through the magnets operating the switches, as hereinafter described.

Switches G G' G^2 serve to connect the motor-contacts B B with a feeder or distributing-main H, forming the positive branch of the generator-circuit. A blow-out-magnet coil *b* is provided for each of the line-switches to extinguish arcs forming at the switch-contacts. Magnet-coils g^4 g^4 of relatively high resistance are connected between the switch-contacts C C and the rail A, which is assumed to be grounded. These coils serve to pick up the switches and receive, in the arrangement herein shown, the full line potential. The shoe or collector F is connected to the positive terminal of the motors M M upon the car, whose wheels are represented at D D'. In Fig. 1 the negative terminal of the motors is grounded through the wheels. The shoe is shown in Fig. 1 as long enough to somewhat more than bridge three of the road-contacts. A storage battery E is shown connected between the shoe F and the car-wheels D in a manner now well known in the art, and may be used to pick up one or more of the switches if the line-current fails to be operative for this purpose. The shoe F is jointed at *f*, or given flexibility by any equivalent means at this point, so that its two parts may have sufficient independence of movement to insure making good contact with three studs at the same time, notwithstanding minor changes in the level of the studs or contacts. Blow-out-magnet coils *b'* are also inserted in the connections between the switch-contacts C and magnets g^4 to extinguish arcs at the street-surface should contact be ruptured at this point while the full potential is operating.

I have thus far described the system illustrated in Fig. 1 of the drawings, since the remaining diagrams differ only in showing certain additions which may be made when desired.

Still referring to Fig. 1, with the parts shown in the position illustrated, the switch G' is closed and current passes from either or both of the motor-contacts B B upon which the shoe F rests to the motors, and thence to the ground. A shunt-circuit is also formed through switch-contact C and the high-potential magnet-coil g^4, corresponding to switch G'. Both the motor-contacts B B are connected to the feeder through the same switch G'. If now the car advances in the direction of the arrow, the collector will next touch a new switch-contact C, closing the switch G^2

and connecting with the feeder the pair of motor-contacts B B on either side of the switch-contact. One of these motor-contacts is already connected through the switch G'. By connecting it through the switch G^2, however, the shoe F may leave the switch-contact C, which it engages in the diagram, allowing the switch G' to open without changing at all the electrical condition of the motor-contact B, located between the two switch-contacts just mentioned. In this way, as will be apparent, each of the motor-contacts is connected, first, to the feeder through one switch, and then through the next switch in advance. Then the first switch opens, and finally the second switch opens, the net result, however, being that each switch-contact is in this peculiar way maintained in connection with the feeder for a longer interval of time than that during which the switches, individually considered, are held closed.

In Fig. 2 it is easy to trace on the diagram all the parts already described in connection with Fig. 1, and their operation is the same. In the system shown in this figure, however, the magnets operating the switches G G' G^2 are provided not only with the shunt pick-up coils g^4, but also with the series hold-up coils $g^5 g^6$, forming part of the circuit between the feeder and the different motor-contacts B B, so that the armature of the magnet is attracted not only by the shunt-coils, but by the series coils, and the switches would be held closed even should the shoe F for one reason or another fail to make the proper contact with the switch-contacts.

In Fig. 3 I show an alternative arrangement of the shoe F, which may be adopted. Here there are two shoes side by side and overlapping for a portion of their length. The shoes are capable of independent motion and are cross-connected by a cable L or other suitable means, so that the two shoes from an electrical standpoint are the equivalent of a single shoe.

In Fig. 4 a series hold-up coil has been added to the switch-operating magnets, but in this case the hold-up coils g^5 g^5 are connected between an additional row of sectional contacts C' C' C' and the rail, so that the magnet-coil is connected in series between the negative terminal of the motors M M and the ground. In this case a second collector or shoe F' is provided which rides upon the contacts C' C', and the negative terminal of the motor M is connected to the shoe F' instead of being grounded directly, as in the systems of Figs. 1 and 2. I have shown the sectional conductors arranged outside of the rail to reduce the danger of leakage-current from the positive contacts B B, holding the switches closed through the low-resistance coils g^5.

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

1. In a surface-contact railway system, a single row of sectional contacts, some of which are directly connected to the feeder by the closing of suitable electromagnetic switches, while others are connected to ground through high-resistance magnets actuating the switches, the high-resistance coils of these magnets forming a shunt to the motor-circuit, and permanent electrical connections connecting each of the motor-contacts with more than one of the switches and each of the switches likewise with a plurality of motor-contacts, as set forth.

2. In an electric-railway system, the combination of a feeder, sectional motor-contacts and switch-contacts arranged alternately in a single row, electromagnetic switches for connecting the sectional motor-contacts with the feeder in sequence, and permanent electrical connections between the contacts and switches such that current may flow from a given contact to the motor, first through one of the line-switches and then through a second switch, said switches operating successively; whereby each motor-contact is connected to the feeder for a longer interval of time than that during which any line-switch individually considered is held closed.

3. The combination in an electric railway, of sectional motor-contacts and switch-contacts arranged alternately in a single row, grounded high-potential magnets connected to the switch-contacts, switches, permanent electrical connections for connecting the motor-contacts in pairs to the source of supply through the switches, and a collector for maintaining during normal operation a circuit through the magnets in shunt to the motor-circuit.

4. In an electric railway, the combination of switch-contacts C alternating with motor-contacts B in a single row, grounded high-potential magnets connected to the switch-contacts, switches picked up by the magnets, permanent electrical connections from each switch to a pair of the motor-contacts and from each motor-contact to a pair of the switches, and a collector adapted to bridge three of the sectional contacts, as set forth.

5. In an electric railway, the combination of a feeder, sectional motor and switch contacts, electromagnetically-operated switches connecting the motor-contacts with the feeder, permanent electrical connections between the motor-contacts and switches, whereby each switch makes connection with a pair of motor-contacts and each motor-contact may also be connected through a pair of switches, a collector completing the motor-circuit from the motor-contacts, magnets operating the switches having a shunt-coil forming part of a circuit around the motor, and a series coil in circuit with the motor, for the purposes set forth.

In witness whereof I have hereunto set my hand this 13th day of November, 1896.

WILLIAM B. POTTER.

Witnesses:
B. B. HULL,
C. L. HAYNES.