(No Model.) 2 Sheets—Sheet 1.

J. HARTMAN.

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS.

No. 547,784. Patented Oct. 15, 1895.

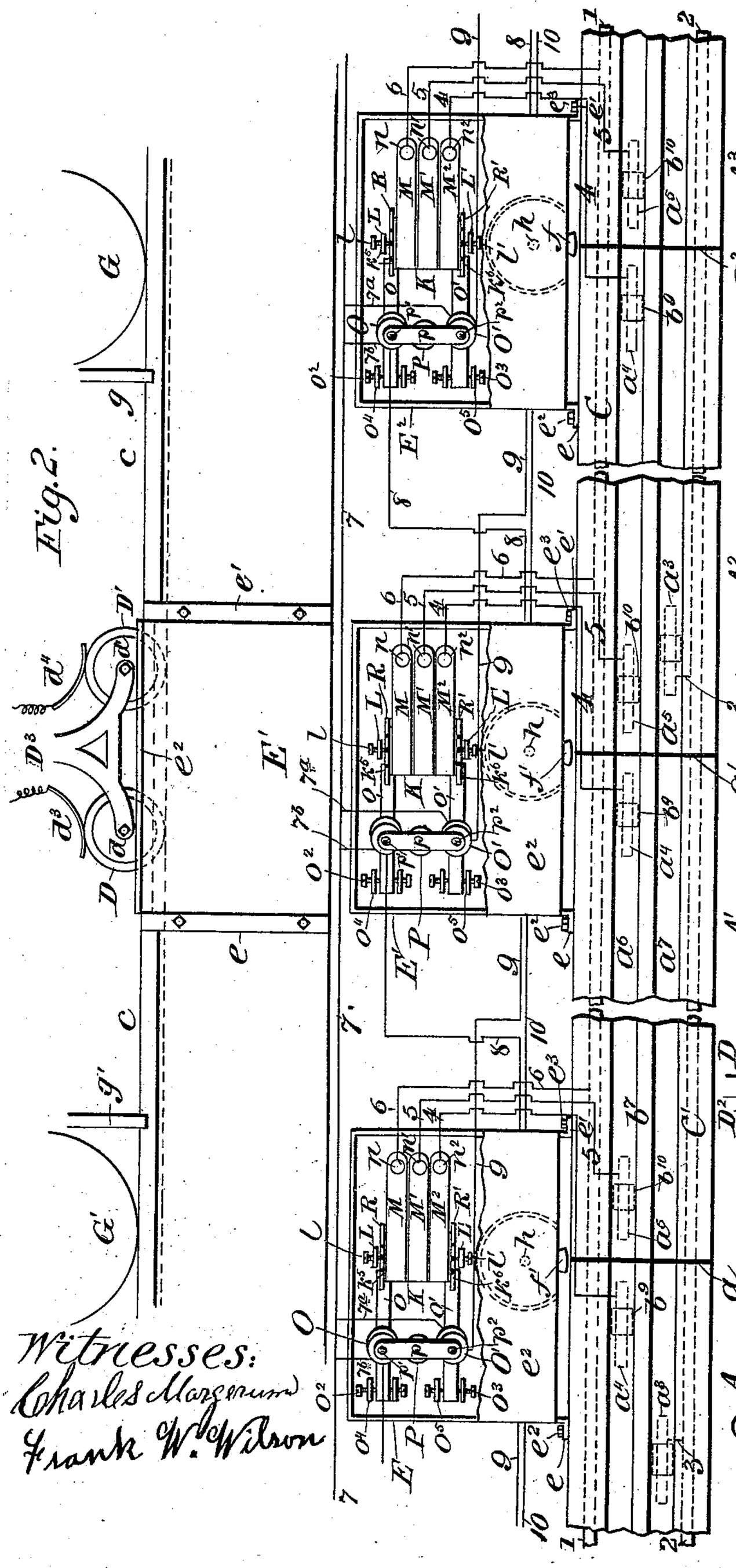

Fig. 2.

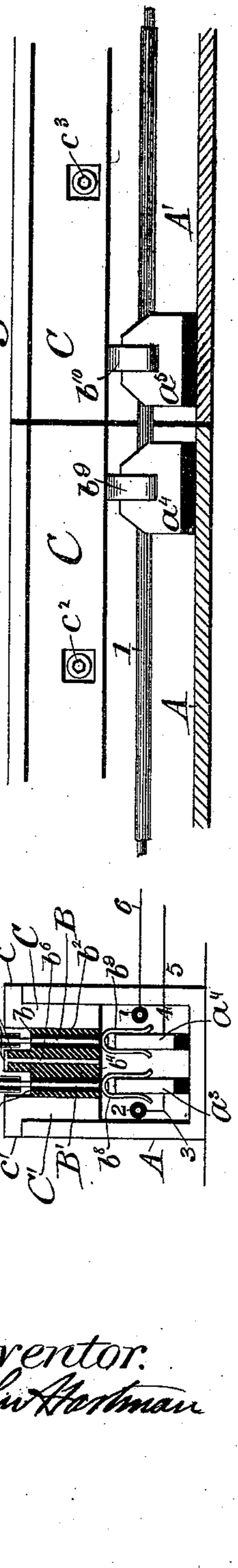

Fig. 3.

Fig. 1.

Fig. 4.

Witnesses:
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Frank W. Wilson

Inventor:
John Hartman

(No Model.) 2 Sheets—Sheet 2.

J. HARTMAN.

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Fig. 7.

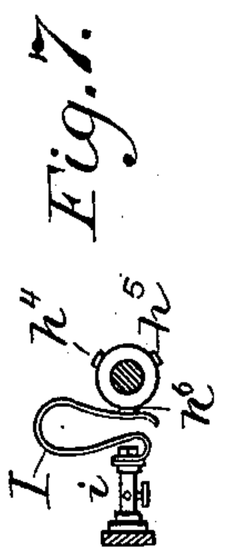


Fig. 5.

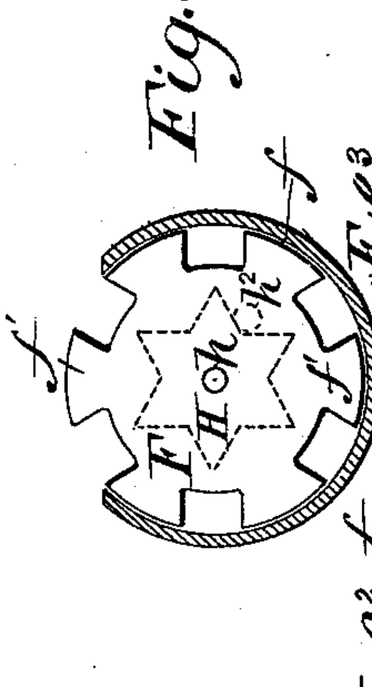


Fig. 6.

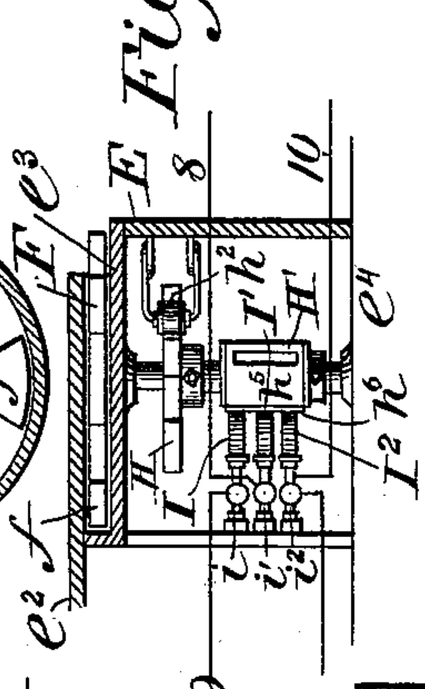


Fig. 10.

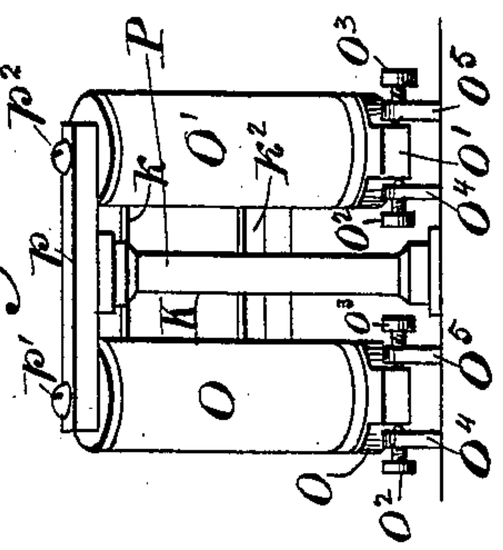


Fig. 8.

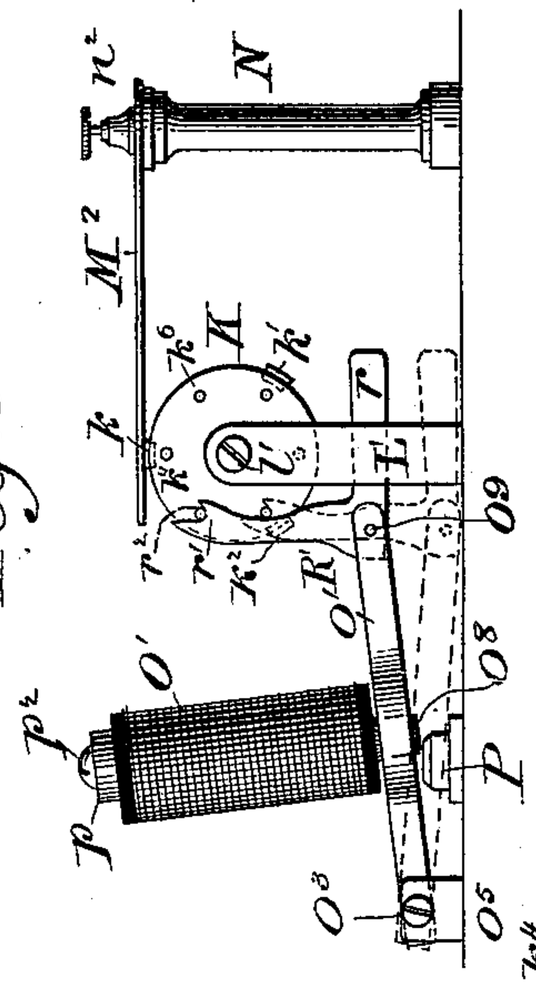


Fig. 9.

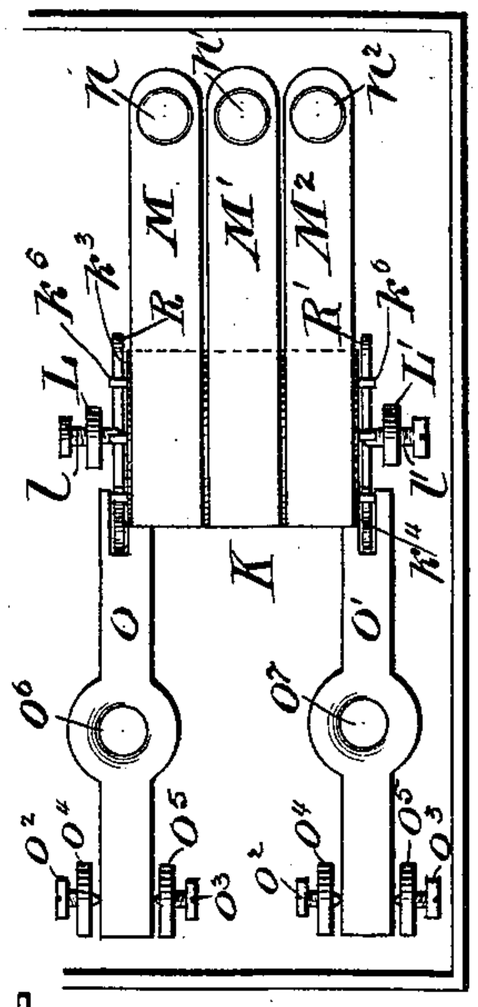


Fig. 11.

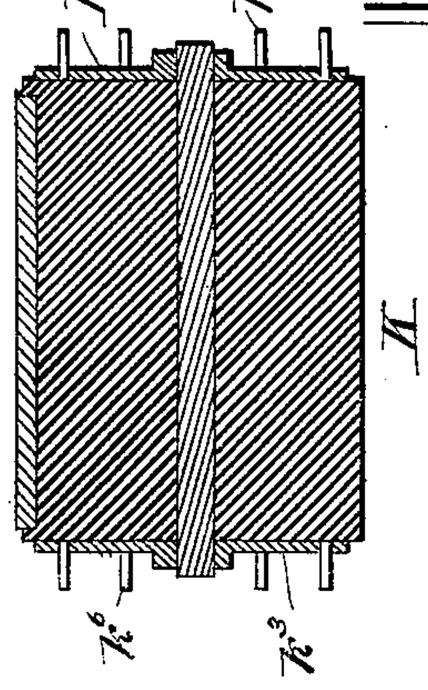
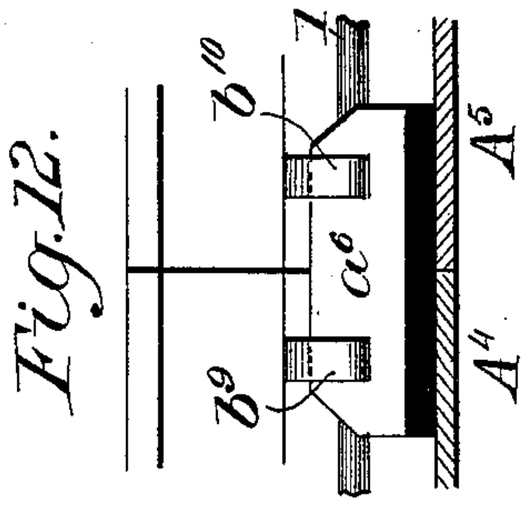


Fig. 12.



Witnesses:
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UNITED STATES PATENT OFFICE.

JOHN HARTMAN, OF PHILADELPHIA, PENNSYLVANIA.

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 547,784, dated October 15, 1895.

Application filed August 7, 1893. Serial No. 482,547. (No model.)

To all whom it may concern:

Be it known that I, JOHN HARTMAN, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Systems for Electrical Propulsion of Railway-Cars, of which the following is a specification.

My invention has relation to closed-conduit systems for the electrical propulsion of railway-cars, and has for its object the provision of certain new and useful improvements therein, to the end that the construction thereof may be simplified, the efficiency increased, and immunity from danger secured.

My invention consists of an underground supply system for electric railways in which the conduit and conductors are divided into blocks each insulated from the other and having stationary as distinguished from depressible conductors adapted to become active upon the approach and passage thereover of a car and inactive at all times thereafter, and a series of switches, for the purpose mentioned, of novel form, each adapted for operation through the motion instead of the weight of the car and inoperative upon the passage of other vehicles.

My invention also consists in the details of construction and the combinations of parts necessary for the attainment of this end, all as hereinafter fully described and claimed, and as illustrated in the accompanying drawings, wherein—

Figure 1 is a plan view, partly broken away, of the improved system; Fig. 2, a side elevation of the ends of adjoining blocks of such system, a switch-box, the trolley-wheels, and switch-operating arms in operative relation. Fig. 3 is a side elevation of the interior of such ends; and Fig. 4, an end view of one of them, showing the trolley-wheels in contact with the conductors thereof. Fig. 5 is a plan view, partly in section, of the switch and its box or casing; and Fig. 6, a side elevation, partly in section, of the same. Fig. 7 is a plan view, partly in section, of a spring-brush and commutator. Figs. 8 and 9 are a side elevation and plan view of the circuit-controlling mechanism; Fig. 10, an end view of the magnets, and Fig. 11 a longitudinal section of the cylinder which forms part of such mechanism. Fig. 12 is a detail of the form of coupling which unites the conduit-sections which compose the blocks of the improved system.

In said drawings, the improved conduit is shown to be composed of a series of continuous sections or blocks A A′ A^2 A^3, insulated each from the other through the interposition of insulating material, as at a a' a^2, between the meeting ends thereof, and is designed to occupy a position between the car-tracks or rails. Such conduit contains the main lead and return wires 1 and 2, connected with a suitably-located generator of high electromotive force, (the form of which is not of the essence of this invention and need not, therefore, be particularly shown or described herein,) and each said section having therein, at any convenient point, a contact-piece a^3 in permanently-closed circuit, through the branch wire 3, with said return-wire, also a pair of similar pieces a^4 a^5, one at each end, in alternately closed and open circuit with said lead wire, as hereinafter described.

Each section of the conduit is closed by the copper lead and return conducting-strips B B′ and their supporting-plates C C′, which latter, by their flanges c c', rest upon the upper edges of the sides of the sections. The conducting-strips of each of the latter have on each of their sides a protecting-strip of iron, as at b b', preserving the same against undue wear and increasing their conducting surface or area, said strips being insulated from each other and from the plates C C′ by the strips b^2 b^3 b^4 b^5, of insulating material, also from those of the adjacent sections by the insulation a a' a^2 aforementioned. The strips b^3 b^4 are separated by a T-rail b^6, whose head b^7 extends over and affords protection against the wearing of their upper edges by the trolley or the wheels of passing vehicles, while such edges and the upper edges of the plates C C′ are in a higher plane than the upper edges of the conducting-strips, forming parallel trolley-grooves a^6 a^7, said plates, the T-rail, and insulation being secured together as a whole by the bolts c^2 c^3, which pass through the same from plate to plate, forming an effective closure for the conduit to the exclusion of moisture.

As shown clearly in Fig. 4 of the drawings, the conducting-strips are provided at the

proper intervals with forked contact-pieces b^8 b^9 b^{10}, which straddle the pieces a^3 a^4 a^5 and form electrical connections for said strips therewith.

The trolley-wheels employed have the protecting disks or plates d d' d^2, properly insulated therefrom. There are four such wheels, (only three D D′ D² being shown,) the same being supported by a suitable truck D³ beneath the body of the car, and having the brushes d^3 d^4 for connection with the car-motor, (not shown,) the purpose of which arrangement will hereinafter appear.

Secured to one side of the conduit-sections, opposite the junctions of their meeting ends, are the switch-boxes E E′ E², the same having lateral flanges e e', through which the bolts e^2 e^3 pass into the walls of such sections, each said box having in its upper part, at the end nearest the conduit-sections, a circular chamber f, within which is located a rotatable notched disk F, which almost fills said chamber, the teeth f' of said disk having a tendency to carry any dirt around and out of the chamber, preventing its accumulation therein. As will be observed, this chamber has a portion of its walls on a line parallel with the adjacent side of the conduit removed, affording an opening through which extend, one at a time, the teeth f' of said wheel into the path of the arms or projections g g', located at the inner sides of the axles of the wheels G G′ of the car. At the same time the lid e^2 of each box terminates at such distance from the side of the conduit as to afford clearance for the passage of said arms or projections into engagement with such teeth. The axis of the disk F of each box is diametrically opposite the junctions of the meeting ends of the respective sections, and the shaft h thereof is journaled in the partition e^3, which forms the bottom of the disk-chamber, and the bottom e^4 of the switch-box, said shaft having secured thereon the star-wheel H and the commutator H′, said star-wheel having in engagement therewith the spring-controlled roller h^2 and the copper strips h^4 h^5 h^6 and the intervening spaces of said commutator successively receiving the impact of the spring-brushes I I′ I², the same being secured on the ends of the binding-posts i i' i^2, which latter are horizontally supported on the standard e^5, which upholds the partition e^3, and being of such shape as to permit of the rotation of the commutator in either direction.

K represents a horizontal rotary cylinder of non-conducting material, having at equal distances apart three longitudinal peripheral strips k k' k^2 of copper, and pivotally supported by the standards L L′ through the medium of the pivot-screws l l', said cylinder having in each of its end plates k^3 k^4 a series of six pins k^5 k^6, there being a pin of each series for each said strip and one for each of the spaces between them. M M′ M² are the brushes for this cylinder, at their outer ends being adapted for alternate contact with said strips and spaces, and at their inner ends each supported by its own standard N, upon which it is secured by the binding-posts n n' n^2. The latter receives the ends of the wires 4 5 6, which connect, respectively, the two last-mentioned brushes with the contact-pieces a^4 a^5 in the contiguous ends of the adjacent conduit-sections and the brush M with the main lead wire 1.

Cylinder K is subject to the impulse of the alternately-operating armatures o o' of magnets O O′, which armatures are pivoted on the screw-pivots o^2 o^3 in the lugs o^4 o^5, and have central openings o^6 o^7 for reception of the cores o^8 of said magnets, the latter depending from the cross-head p of the standard P, to which they are secured by the screws p' p^2 at an angle corresponding with the inclination of said armatures when in the position shown in full lines in Fig. 8. In this figure it will also be seen that the free ends of the armatures have pivoted on the pins o^9 therein the L-shaped levers R R′, the lower ends r of which operate as counterbalances for the upper ends r', the effect being that when said levers are in the position shown in dotted lines the weight of the counterbalances will insure the location of the notch r^2 in the end r' directly beneath the pin k^5 or k^6 which is next above it.

In Figs. 1 and 6 it will be seen that the commutator-brush I of each box is connected through wire 9 with the magnet O′ of the preceding switch-box, and the brush I′ of each box is connected through wire 8 with the magnet O of the succeeding box, while line-wire 10, which is connected with a generator separate from and of lower potential than that with which the main wires 1 and 2 are connected, or with a suitable battery, neither of which it is necessary to illustrate, connects the brushes I² of all the boxes, and line-wire 7, which is also connected with the weaker generator or battery, has branches 7^a 7^b, which connect with the magnets O O′ of each box. Said generator or battery is located in a power-house. The circuit is from said brush I through wire 9 to said magnet O′, through the latter and branch 7^a to the lead or line wire 7, and through the same back to the generator.

Now suppose a car provided with the arms g g', which extend downwardly to the side of and slightly below the plane of the top of the conduit, to be approaching the junction of any of the conduit-sections—say, for example, sections A′ A², (shown more clearly in Fig. 1,)—the lead conducting-strip B of the section A′, over which the car is running, being active, the current thereof passes through the trolley-wheels D D′ to the motor and back through the trolley-wheels D², the return conducting-strip B′ of such section, and return-wire 2 to the generator, upon reaching which junction the arm g at the forward end of the car strikes that one of the teeth f' of the disk F which projects outside of the chamber f of the switch-box E′ into the path of said arm,

carrying such tooth around until it rests just within the chamber and bringing the next tooth into the position just vacated thereby. This causes a one-sixth revolution of the shaft h of said disk and of the commutator H′ thereon, and brings one of the copper strips h^3 h^4 h^5 of the same into contact with the brushes I I′ I², electrically connecting the latter and closing the circuit composed of wire 10 and its brush I², brush I′, wire 8, magnet O of the next box E², wire 7 and its branch 7^b, also the circuit composed of said wire 10 through such strip, the brush I, wire 9, magnet O′ of the preceding box E, and wire 7 and its branch 7^a. This effects the upward impulse of the armatures o' and o of the boxes E E² and the partial rotation of the cylinders K in each through the engagement of the notched ends of the levers R of said armatures with the cylinder-pin next above. This brings one of the strips of the cylinder in box E² into contact with the brushes M M′ M² therein and closes the circuit composed of the lead wire 1, wire 6, said brushes, wires 5 and 4, pieces a^4 a^5, and the conductor-strips B in the conduit-sections A² A³, which terminate at this box. This energizes said strips in both directions to their points of insulation from the adjoining strips, while it causes the strip of the cylinder in box E, with which the brushes M M′ M² in the latter have previously been in contact, to pass from beneath said brushes and the latter to rest in one of the intervening spaces, breaking the circuit composed of such brushes and the wires which connect them with the main lead wire and the pieces a^4 a^5 and lead-conducting strip B in sections A A′, which terminate at this last-mentioned box, and cutting out the conductor-strip in said section A. The progress of the car being continued causes the arm g' at the rear end of the car to strike that tooth of the disk F of box E′ which now projects into its path and effects the rotation of the shaft of said disk another one-sixth turn, bringing the brushes I I′ I² in this box opposite one of the spaces of the commutator thereon. This breaks the circuit thereat and allows the armatures o' and o in boxes E E², respectively, to drop back to their normal positions, ready for subsequent operation by a succeeding car. At this stage, it will be remembered, the brushes M M′ M² of the box E² are still in contact with one of the strips of the cylinder therein through the previous operation of the disk in the box E′, in which position they remain until the forward arm g of the car strikes the projecting tooth of the disk in the box E³, when, in the manner hereinbefore described, this cylinder will be given a one-sixth turn, which brings said brushes opposite one of the spaces, effecting the cutting out of the conductor B in conduit-section A², and so on successively.

The cylinders of the different boxes are limited against further than the necessary movement by the contact of the end r' of the arms R with the pin next below the one with which it is in engagement, as shown clearly in Fig. 8, while the commutators H are prevented from excessive movement and the projecting tooth of the disk F secured in proper alignment relatively to the arms g g' of the car by the roller h^2, which latter is supported by the spring h^3, said roller engaging with the notches of the star-wheel H and bearing upon the inclined sides of the points of said wheel sufficiently to force the shaft h to the desired extent in either direction.

The distances apart of the switch-boxes, or the length of the blocks between them, may be varied at will, and while Fig. 1 of the drawings shows each block as consisting of but a single conduit-section it is quite obvious that in order to locate said boxes at such points as to secure the most effective result without unnecessarily multiplying the number thereof it will be necessary for convenience of construction to have each block composed of a number of smaller conduit-sections A⁴ A⁵, electrically connected through the use of a single contact-piece or coupling a^6, common to both, as shown in Fig. 12, instead of a pair of contact-pieces at the meeting ends of such sections, the conductor B having the usual forked contacts for embracing said coupling and the blocks composed of the conduit-sections being insulated from each other and in multiple arc, as explained.

What I claim as my invention is as follows:

1. In an electric railway system, the combination of a continuous slotted conduit divided into blocks insulated from each other, containing the lead and return wires; a lead conductor, in one slot, in alternately closed and open circuit with the lead wire and a return conductor, in the other slot, in permanent electrical connection with the return wire; and a circuit-controlling device, at the junction of said blocks, actuated through the collision therewith of projections on the car and rendering active and inactive said lead transmitter progressively, for the purpose specified.

2. In an electric railway system, the combination of a continuous slotted conduit divided into blocks, insulated from each other, comprising one or more conduit-sections electrically connected and containing the lead and return wires; a lead conductor, in one slot, in alternately closed and open circuit with the lead wire, and a return conductor, in the other slot, in permanent electrical connection with the return wire; and a circuit-controlling device, at the junctions of said blocks, actuated through the collision therewith of projections on the car and rendering active and inactive said lead conductor progressively, for the purpose specified.

3. In an electric railway system, the combination of a continuous slotted conduit divided into blocks, insulated from each other, comprising one or more conduit-sections electrically connected and containing the lead and return wires; lead and return conductors in

the slots of the conduit; each of said blocks having in each end thereof a contact piece in alternately closed and open circuit with said lead wire, and a suitably located similar piece in permanent electrical connection with said return wire, said conductors being electrically connected with the respective contact pieces; and a circuit-controlling device, at the junctions of said blocks, actuated through the collision therewith of projections on the car and rendering active and inactive said lead conductor progressively, for the purpose specified.

4. An electric railway system divided into blocks insulated from each other and having at each of the junctions thereof a pair of alternately operating magnets; a cylinder, for each pair of magnets, having copper peripheral strips; brushes in contact with said cylinder and electrically connected with the blocks which terminate thereat and with the main lead wire; and a circuit-controlling device connected with one of the preceding pair of magnets and with the other of the succeeding pair and operating, when suitably actuated, to bring the brushes of the preceding cylinder over a space thereof, effecting the cutting out of the block in advance of the same, and to bring the brushes of the succeeding cylinder into contact with one of the strips thereof, energizing the blocks adjacent thereto, for the purpose specified.

5. In an electric railway system, the combination of a continuous conduit provided with parallel trolley-grooves, the latter having therein the lead and return conductors respectively, each having on each side a metallic protecting strip and being insulated from the other and from the sides of said grooves, for the purpose specified.

6. In an electric railway system, the combination of a continuous conduit divided into blocks, insulated from each other, provided with parallel trolley-grooves, the latter having therein the lead and return conductors similarly divided, each having on each side a metallic protecting strip and being insulated from the other and from the sides of said grooves, said lead conductor being in alternately open and closed circuit with the main lead wire and said return conductor in permanently closed circuit with the return wire, for the purpose specified.

7. In an electric railway system, the combination of a continuous conduit divided into blocks insulated from each other and comprising one or more conduit sections in permanent electrical connection, said conduit being provided with parallel trolley-grooves having respectively therein the lead and return conductors similarly divided, each having on each side a metallic protecting strip and being insulated from the other and from the sides of said grooves, the lead conductor of each block being in alternately open and closed circuit with the main lead wire and the return conductor in permanently closed circuit with the return wire, for the purpose specified.

8. In an electric railway system, the combination of a continuous conduit provided with parallel trolley-grooves, the latter having respectively therein the lead and return conductors, each having on each side a metallic protecting strip and being insulated from the other and from the sides of said grooves, the insulation between said conductors being separated by a T plate whose head extends over the edges of said insulation, said conductors; protecting strips; insulation and T plate being secured between flanged plates which rest upon the sides of and form a closure for the conduit, for the purpose specified.

9. An electric railway system divided into blocks insulated from each other and having, at the junctions thereof, a pair of magnets; a cylinder for each such pair having pins on its ends, the armatures of the magnets having L shaped, counterbalanced, notched levers for engagement with said pins, said cylinder having brushes in contact therewith, the same being electrically connected with the blocks which terminate thereat and with the main lead wire, said magnets being alternately actuated, and said brushes brought into contact alternately with the strips and intervening spaces of said cylinder thereby, through the operation of a suitably located circuit-controlling device, for the purpose specified.

10. An electric railway system divided into blocks insulated from each other and having, at the junction thereof, a pair of magnets; a cylinder for each such pair and having pins on its ends, and the armatures of the magnets being provided with L shaped, counterbalanced, notched levers for engagement with said pins, said cylinder having brushes in contact therewith, the same being electrically connected with the blocks which terminate thereat and with the main lead wire; and a circuit-controlling device electrically connected with the preceding and the succeeding pair of magnets, each such device being operated by the passage thereover of a car and effecting the rotation of the preceding cylinder to such extent as to bring its brushes over one of the spaces and the rotation of the succeeding cylinder sufficiently to bring the brushes thereof into contact with a strip, for the purpose specified.

11. An electric railway system divided into blocks having at the junctions thereof a circuit-controlling device consisting of a rotary shaft, provided with a toothed disk, and having thereon a commutator, the teeth of said disk projecting, singly, into the path of arms on the car, said commutator having suitable brushes adapted for contact with a strip thereof, upon the collision of one such arm with a tooth of the disk, and with an intervening space upon the collision of the other arm with the next tooth; also, at each junction, a pair of magnets; a cylinder for each

such pair, having pins on its ends, the armatures of the magnets being provided with L shaped, counterbalanced, notched levers for engagement with said pins, said cylinder having brushes in contact therewith, the same being electrically connected with the blocks which terminate thereat and with the main lead wire, one of the commutator-brushes being connected with one of the magnets of the preceding pair; another with the other one of the succeeding pair of magnets, and a third brush being on one of the line wires, the other line wire having branches leading to each magnet of the system, for the purpose specified.

In testimony whereof I have hereunto set my hand this 3d day of August, A. D. 1895.

JOHN HARTMAN.

Witnesses:
WM. H. POWELL,
R. DALE SPARHAWK.