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PATENTED MAY 17, 1904.

T. D. LOVELL.
ELECTRIC RAILWAY.

APPLICATION FILED JAN. 22, 1904.

NO MODEL.

2 SHEETS—SHEET 1.

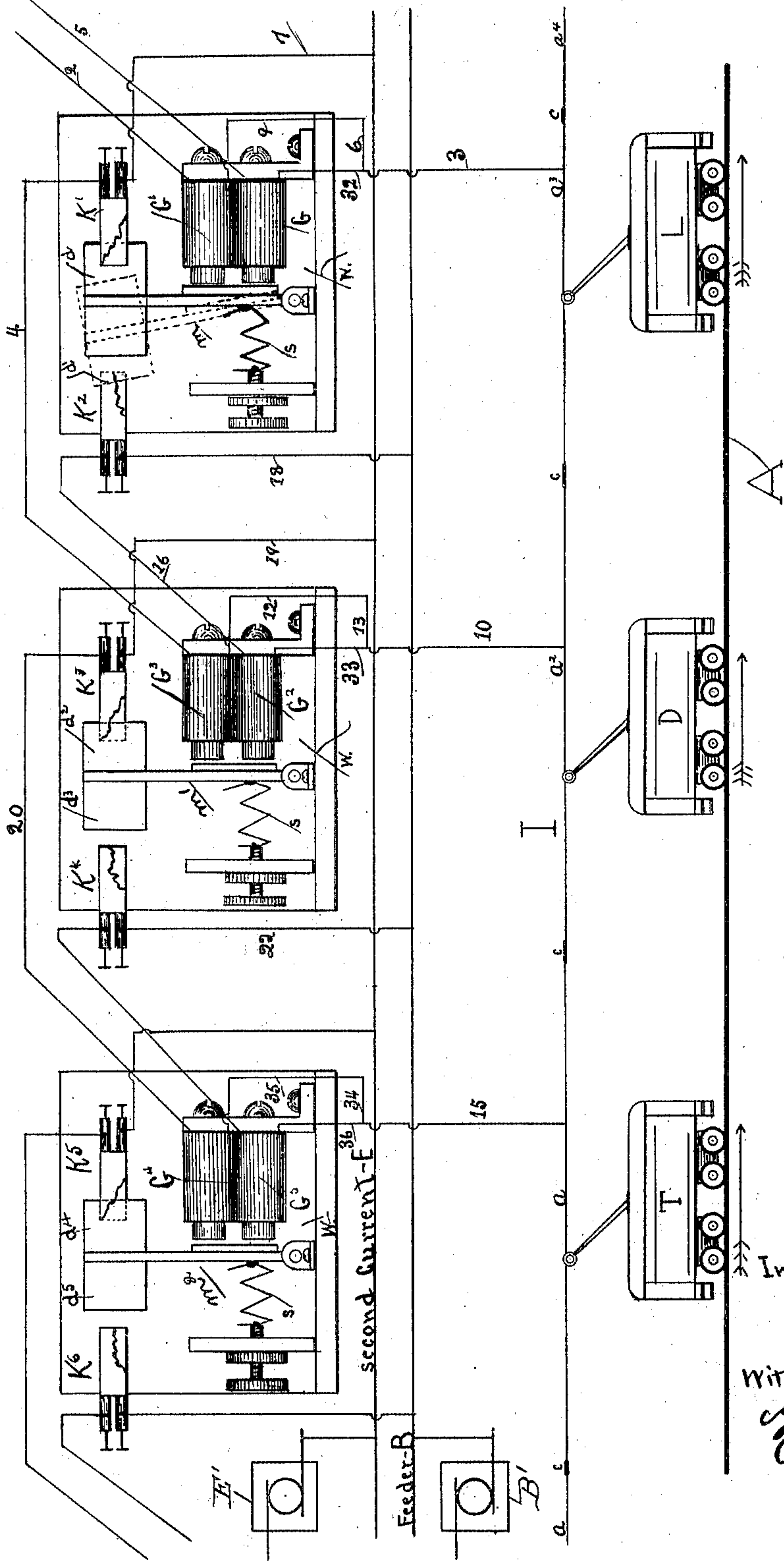


Fig. 1.



Fig. 2.

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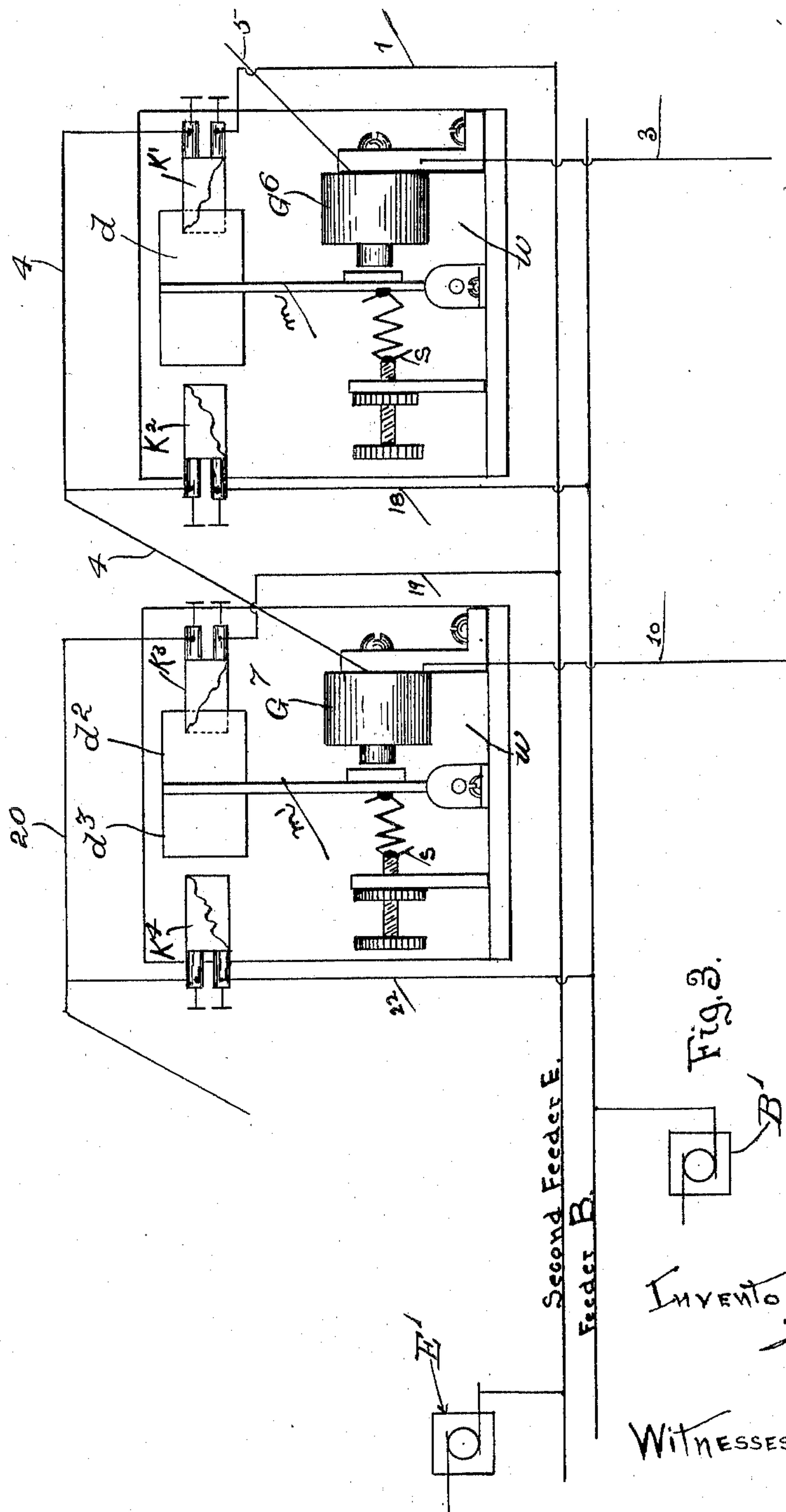
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UNITED STATES PATENT OFFICE.

THOMAS D. LOVELL, OF BEVERLY, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO ROBERT M. BAILEY, OF DEDHAM, MASSACHUSETTS.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 760,223, dated May 17, 1904.

Application filed January 22, 1904. Serial No. 190,099. (No model.)

To all whom it may concern:

Be it known that I, THOMAS D. LOVELL, a citizen of the United States, and a resident of Beverly, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Electric Railways, of which the following is a specification.

This invention is designed to provide a continuous automatic block system whereby cars or trains obtaining motive power from one general source of supply—such as the overhead trolley-wire, third rail, or any other subsurface conductor—have complete control at all times of cars or trains that may be following in the same direction on the same track, and thereby reduce the ever-present liability of rear-end collisions to an absolute minimum, the numerous signal systems failing to accomplish this result. This system is devoid of all auxiliary mechanical devices, such as the commonly so-called “trips,” “flops,” “giggers,” &c., so arranged as to come into physical contact with the trolley-pole, wheel, or other projection carried by a passing car to cause impulsive contacts, all such devices being only a continual source of trouble and necessitating constant repair and adjustment. In overcoming these particular objections I have provided means whereby the cars or trains act as their own physical agents by virtue of their comprising at all times a part of the circuits themselves and each having control of its own respective circuit as well as others in such a manner as to destroy the propelling power in the immediate succeeding section or block and at the same time furnishing to the said succeeding section or block a second current for the purpose of lighting and heating, but not sufficient to propel blocked cars or trains. This said secondary electrical condition of a section affords means whereby a car or train stalled on a section or block also controls its own immediate succeeding section or block in a like manner, said conditions repeating themselves in each succeeding section or block, according to the position of the cars or trains which follow. This arrangement affords protection to all cars following one another in that

it prevents cars from approaching within a specified distance of the preceding car or train. 50

The particular manner of carrying out my invention will be described in detail with reference to the accompanying drawings, and the novel features will be particularly pointed out in the claims at the close of the specification. 55

In the drawings, Figure 1 is a conventional plan and diagram of the apparatus and circuits illustrating the invention. Fig. 2 shows an end view of the contact-points included in the said apparatus. Fig. 3 shows a modification 60 in which one magnet instead of two is employed in each set of apparatus, the cars and trolley-wire being omitted in this figure, because they would be the same as in Fig. 1.

The drawings show three cars whose course 65 is in the same direction on a single track and, in combination with their respective apparatus, show the car L as having blocked the following car D, which in turn has the following car T also blocked. 70

A indicates a single track, which constitutes the return-circuit for the currents B and E, which are supplied by the generators B' and E'.

I is a trolley-wire or subsurface conductor from which the cars or trains obtain their power-currents. This conductor is divided into sections by means of insulated joints *c*. Along the roadside, at a convenient point where it will be properly protected, there is arranged for each section or block one set of 80 electromagnetic apparatus, each set consisting of similar parts comprising two electromagnets G and G', controlled by the two different currents B and E, and adapted to work independent of each other at different intervals in operating an armature-lever *m*, carrying contact-points *d* and *d'*, said contact-points alternating between two pairs of fixed terminals K' and K², connected with the two currents B and R, and all arranged on a base 90 W. Each set of apparatus while being similar in parts will for the convenience of illustrating the system be indicated by different reference characters, as will hereinafter appear. 95

Let it be assumed that the car L is travel-

ing from west to east and that its preceding section or block a^4 is clear of cars. The imaginary apparatus connected with section or block a^4 would be in its normal condition—that is, the armature-lever would be in such a position as to allow the power-current B to flow through the pair of normally closed terminals connected with block a^4 to the wire 5, magnet G, wires 32 and 3, section or block a^3 , car L to track A, thus allowing the car L to proceed to the section or block a^4 .

While the car L is occupying the section or block a^3 under the above-said conditions, car L is energizing the magnet G and attracts the armature-lever m , and its contact-point d bridges the terminals K' , and Fig. 2 shows the mode of electrical contact between said lever and pairs of terminals. The armature in making this movement causes its contact-point d' to open the power-current B across the terminals K^2 , which furnish the succeeding section or block a^2 with this particular current and causes the car D to come to a standstill, thus blocking said car D on the section or block a^2 . The contact-point d of the said lever m bridges the terminals K' , furnishing the car D on section a^2 with a weaker or reduced current E through wire 7, terminals K' , wire d , magnet G^3 , wires 12 13 10, and section a^2 . The stalled car D is thereby energizing the magnet G^3 with the current E, which attracts the armature-lever m' , and its contact-point d^2 bridges the terminals K^3 and allows its contact-point d^3 to open the power-current B in the terminals K^4 , taking the power-current B from the succeeding section a' and furnishing the car T with the weaker current E through wires 19, terminals K^3 , wire 20, magnet G^4 , wires 35 34 15, and section a' . Car T being thus blocked on section a' is furnished with means provided by the weaker current E, whereby that car can also repeat the previously-described operations produced by the cars L and D. This blocking process becomes continuous if the following cars come within the specified distance of the preceding car or train. The second or weaker current E lights and heats all stalled cars, but is insufficient to propel them.

Having described the method of blocking, I will now describe how the said blocked cars are released. Returning to the car L, I will assume that that particular car has passed from the section a^3 to the section a^4 . In so doing the power-current B, which the car L has been drawing through the magnet G while occupying the section a^3 , opens and deenergizes the said magnet G, allowing the armature-lever m to be pulled back by the spring s to its normal position, and the contact-point d' bridges the terminals K^2 , taking from the car D on section or block a^2 the weaker current E and restoring to said car D the power-current B through wire 18, termi-

nals K^2 , wire 16, magnet G^2 , wires 33 10, and section a^2 . This allows the car D to proceed. Car D in proceeding along the section a^2 is still blocking the car T on the succeeding section a' , because the car D is now drawing the current B through the magnet G^2 , thereby continuing to supply the weaker current E to the car T; but as the car D passes to the section a^3 , previously cleared by the car L, the power-current B is opened through the magnet G^2 , deenergizing said magnet and allowing the armature-lever m' to be pulled back. The contact-point d^2 opens the weaker current E through terminals K^3 , and the contact-point d^3 bridges the terminals K^4 , thus furnishing to car T the power-current B and taking therefrom the weaker current E. This allows the car T to proceed and allows said car T to block and release a following car in precisely the same manner as previously described relative to the cars L and D.

It will be seen that the two pairs of terminals in each set of apparatus are connected by two respective wires, each including an electromagnet in each succeeding apparatus. While this arrangement is not absolutely necessary to produce the above results, as one wire instead of two can be used, including the two terminals, and employing one magnet instead of two, as shown in Fig. 3, I prefer the double wire and separate magnets, as they conform to a more perfect and absolute block, all conditions considered.

When one magnet is used in each set of apparatus, as in Fig. 3, instead of two magnets, the terminals K' and K^2 are connected with wire 4, leading to the single magnet G^7 , and the set of apparatus for each block is similarly connected.

I have described in the above my method for producing a perfect block and the releasing of the same, and while the system will work with perfect satisfaction on the ordinary street electric railway the system is adapted to be applied more particularly to elevated and long-distance electric traction, where, as a rule, heavy trains of cars are generally run.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an electric railway, the combination of a track-block, a sectional conductor extending along the same and supplying power-current to the cars or trains, branch conductors extending from sections of the sectional conductor, including a pair of electromagnets connected with two respective pairs of terminals in the preceding section, said terminals leading to two respective distinct current-feeders, said pairs of terminals being under control of the preceding section's likewise-arranged circuits and apparatus, a circuit-controller, one pair of said terminals leading to the power-current and normally closed, affording means

whereby a car or train occupying one section or block of the sectional conductor will energize either of said magnets, thereby operating said circuit-controller, said circuit-controller opening the pair of said normally closed terminals in its own respective apparatus and thereby taking the power-current away from the immediate succeeding section or block of the sectional conductor.

2. In an electric railway, the combination of a track-block, a sectional conductor extending along the same and supplying the cars or trains with power-current, branch conductors extending from sections of the sectional conductor, including a pair of electromagnets connected with two respective pairs of terminals in the preceding section, said terminals leading to two respective distinct current-feeders one of which supplies the power-current and the other a weaker current, said pairs of terminals being under control of the preceding section's likewise-arranged circuits and apparatus, a circuit-controller, one pair of said terminals leading to the power-current and normally closed and the other pair of said terminals leading to the weaker or reduced current and normally open, means whereby a car or train occupying one section of the sectional conductor will energize either of said magnets operating said circuit-controller, said circuit-controller closing the pair of said normally open terminals in its own respective apparatus, thereby admitting the weaker or reduced current to the immediate succeeding section or block of the sectional conductor.

3. In an electric railway, the combination of a track-block, a sectional conductor extending along the same and supplying currents to the cars or trains, branch conductors extending from sections of the sectional conductor, including a pair of electromagnets connected with two respective pairs of terminals in the preceding section, said terminals leading to two respective distinct current-feeders one of which supplies the power-current and the other a weaker current, said pairs of terminals being under control of the preceding section's likewise-arranged circuits and apparatus, one pair of said terminals leading to the power-current and normally closed, and the other pair of said terminals leading to the weaker or reduced current and normally open, means whereby a car or train occupying one section or block of the sectional conductor, with the preceding section or block also occupied, will energize one of said magnets, thereby closing said pair of normally open terminals in its own apparatus and thereby rendering its own immediate succeeding section or block of the sectional conductor in the same secondary electrical condition as said intermediate section.

4. In an electric railway, the combination of a track-block, a sectional conductor extending along the same and supplying currents to the

cars or trains, branch conductors extending from sections of the sectional conductor, including a pair of electromagnets connected with two respective pairs of terminals in the preceding section, said terminals leading to two respective distinct current-feeders one of which supplies the power-current and the other a weaker current, said pairs of terminals being under control of the preceding section's likewise-arranged circuits and apparatus, one pair of said terminals leading to the power-current and normally closed, means whereby a car or train passing from one section or block of the sectional conductor will deenergize one of said magnets thereby rendering normal the normally closed terminals previously opened by said car and thereby restoring the power-current to the immediate succeeding section or block of the sectional conductor.

5. In an electric railway, the combination of a track-block, a sectional conductor extending along the same and supplying currents to the cars or trains, branch conductors extending from sections of the sectional conductor, including a pair of electromagnets connected with two pairs of terminals in the preceding section, said terminals leading to two respective distinct current-feeders one of which supplies the power-current and the other a weaker current, said pairs of terminals being under control of the preceding section's likewise-arranged circuits and apparatus, one pair of said terminals leading to a second or weaker current, means whereby a car or train passing from one section or block of the sectional conductor will deenergize one of said magnets, thereby rendering normal the normally open terminals previously closed by said car and thereby taking the weaker or reduced current from the immediate succeeding section or block of the sectional conductor.

6. In an electric railway, a track-block in combination with a trolley-wire divided into sections by means of insulating-joints, said sections being subject to two distinct electrical conditions, one of said conditions containing the power-current and the other of said conditions containing a weaker current, each section and conditions thereof being controlled by a preceding section, an electromagnetic influencer, means whereby a car or train on one section will energize said electromagnetic influencer and thereby simultaneously take from the immediate succeeding section the power-current and admit to said succeeding section the weaker or reduced current, affording means whereby the said succeeding section will render the same said conditions in its own respective immediate succeeding section.

7. In an electric railway, a track-block in connection with a trolley-wire divided into sections by means of insulating-joints, said

sections being subject to two distinct electrical conditions, one of said conditions containing the power-current and the other a weaker or reduced current, each section and
 5 condition thereof being controlled by a preceding section, an electromagnetic influencer, means whereby the passing of a car or train from one section or block will deenergize said
 10 electromagnetic influencer and thereby simultaneously restore the power-current to the immediate succeeding section or block and take from it the weaker current, substantially as described and for the purpose set forth.

8. In an electric railway, the combination of
 15 a track-block, a sectional conductor extending along the same and supplying current to the cars or trains, branch conductors extending from sections of the sectional conductor, including an electromagnetic influ-
 20 encer connected with two respective pairs of terminals, leading to two respective distinct current-feeders, in and under control of the preceding section's likewise-arranged circuits and apparatus, a circuit-controller, one pair
 25 of said terminals leading to the power-current and normally closed, affording means whereby a car or train occupying one section or block of the sectional conductor will energize said
 30 electromagnetic influencer thereby operating said circuit-controller, said circuit-controller opening the pair of said normally closed terminals in its own respective apparatus and thereby taking the power-current away from
 35 the immediate succeeding section or block of the sectional conductor.

9. In an electric railway, the combination of a track-block, a sectional conductor extending along the same and supplying the cars or
 40 trains with current, branch conductors extending from sections of the sectional conductor, including an electromagnetic influencer connected with two respective pairs of terminals in the preceding section, said terminals leading to two respective distinct cur-
 45 rent-feeders one of which supplies the power-current and the other a weaker current, said pairs of terminals being under control of the preceding section's likewise-arranged circuits and apparatus, a circuit-controller, one pair
 50 of said terminals leading to a weaker or reduced current and normally open, means whereby a car or train occupying one section of the sectional conductor will energize said
 55 electromagnetic influencer, operating said circuit-controller, said circuit-controller closing the pair of said normally open terminals in its own respective apparatus, thereby admitting the weaker or reduced current to the im-
 60 mediate succeeding section or block of the sectional conductor.

10. In an electric railway, the combination of a track-block, a sectional conductor extend-
 ing along the same and supplying currents to

the cars or trains, branch conductors extend-
 ing from sections of the sectional conductor, 65 including an electromagnetic influencer connected with two respective pairs of terminals in the preceding section, said terminals leading to two respective distinct current-feeders one of which supplies the power-current and
 70 the other a weaker current, said pairs of terminals being under control of the preceding section's likewise-arranged circuits and apparatus, one pair of said terminals leading to the power-current and normally closed, and the
 75 other pair of said terminals leading to the weaker or reduced current and normally open, means whereby a car or train occupying one section or block of the sectional conductor, with the preceding section or block also oc-
 80 cupied will energize said electromagnetic influencer thereby closing said pair of normally open terminals in its own apparatus and thereby rendering its own immediate succeeding
 85 section or block of the sectional conductor in the same secondary electrical condition as said intermediate section.

11. In an electric railway, the combination of a track-block, a sectional conductor extend-
 ing along the same and supplying currents to 90 the cars or trains, branch conductors extending from sections of the sectional conductor, including an electromagnetic influencer connected with two respective pairs of terminals in the preceding section, said terminals lead-
 95 ing to two respective distinct current-feeders one of which supplies the power-current and the other a weaker current, said pairs of terminals being under control of the preceding section's likewise-arranged circuits and appa-
 100 ratus, one pair of said terminals leading to the power-current and normally closed, means whereby a car or train passing from one section or block of the sectional conductor will deenergize said electromagnetic influencer,
 105 thereby rendering normal the normally closed terminals previously opened by said car and thereby restoring the power-current to the immediate succeeding section or block of the
 110 sectional conductor.

12. In an electric railway, the combination of a track-block, a sectional conductor extend-
 ing along the same and supplying currents to 115 the cars or trains, branch conductors extending from sections of the sectional conductor, including an electromagnetic influencer connected with two pairs of terminals in the preceding section, said terminals leading to two
 120 respective distinct current-feeders one of which supplies the power-current and the other a weaker current, said pairs of terminals being under control of the preceding section's likewise-arranged circuits and appa-
 125 ratus, one pair of said terminals leading to the second or weaker current, means whereby a car or train passing from one section or block

of the sectional conductor will deenergize said
electromagnetic influencer thereby rendering
normal the normally open terminals previ-
ously closed by said car and thereby taking the
5 weaker or reduced current away from the im-
mediate succeeding section or block of the
sectional conductor.

In testimony whereof I have affixed my sig-
nature in presence of two witnesses.

THOMAS D. LOVELL.

Witnesses:

WILLIAM A. COPELAND,
ROBT. M. BAILEY.