No. 696,024. Patented Mar. 25, 1902.

E. W. FARNHAM.

ELECTRIC RAILWAY.

(Application filed Feb. 6, 1902.)

(No Model.) 4 Sheets—Sheet 1.

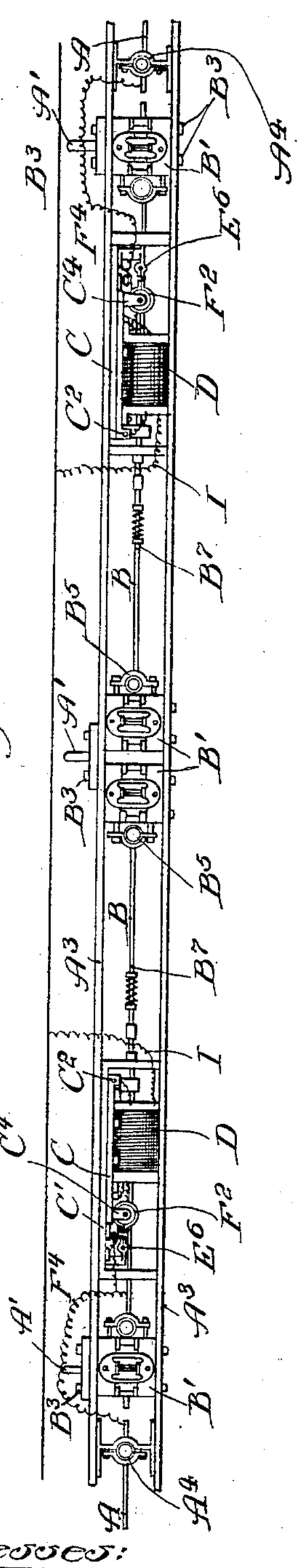

Fig. 2.

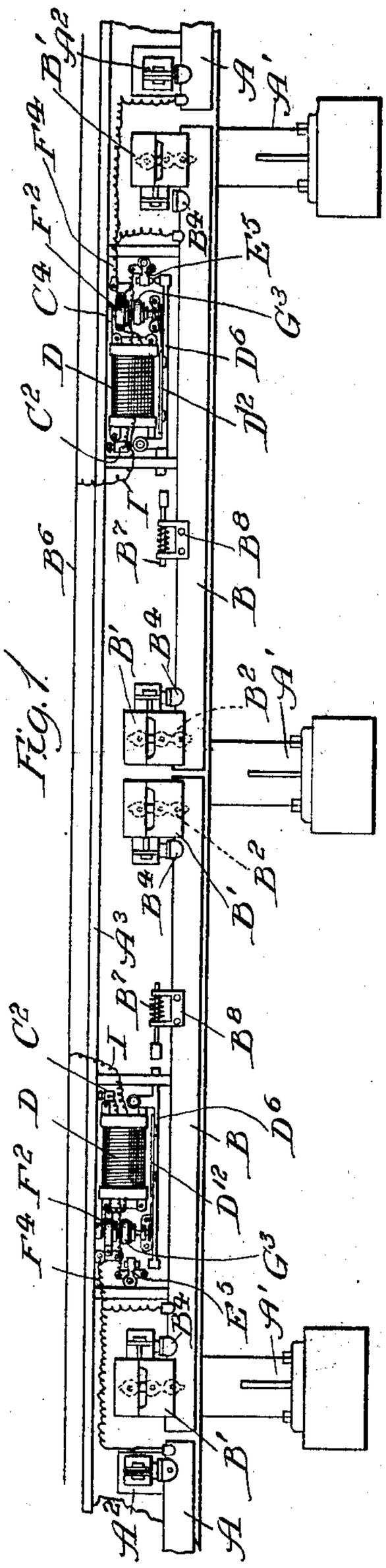

Fig. 1.

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(No Model.) 4 Sheets—Sheet 2.

Fig. 3.

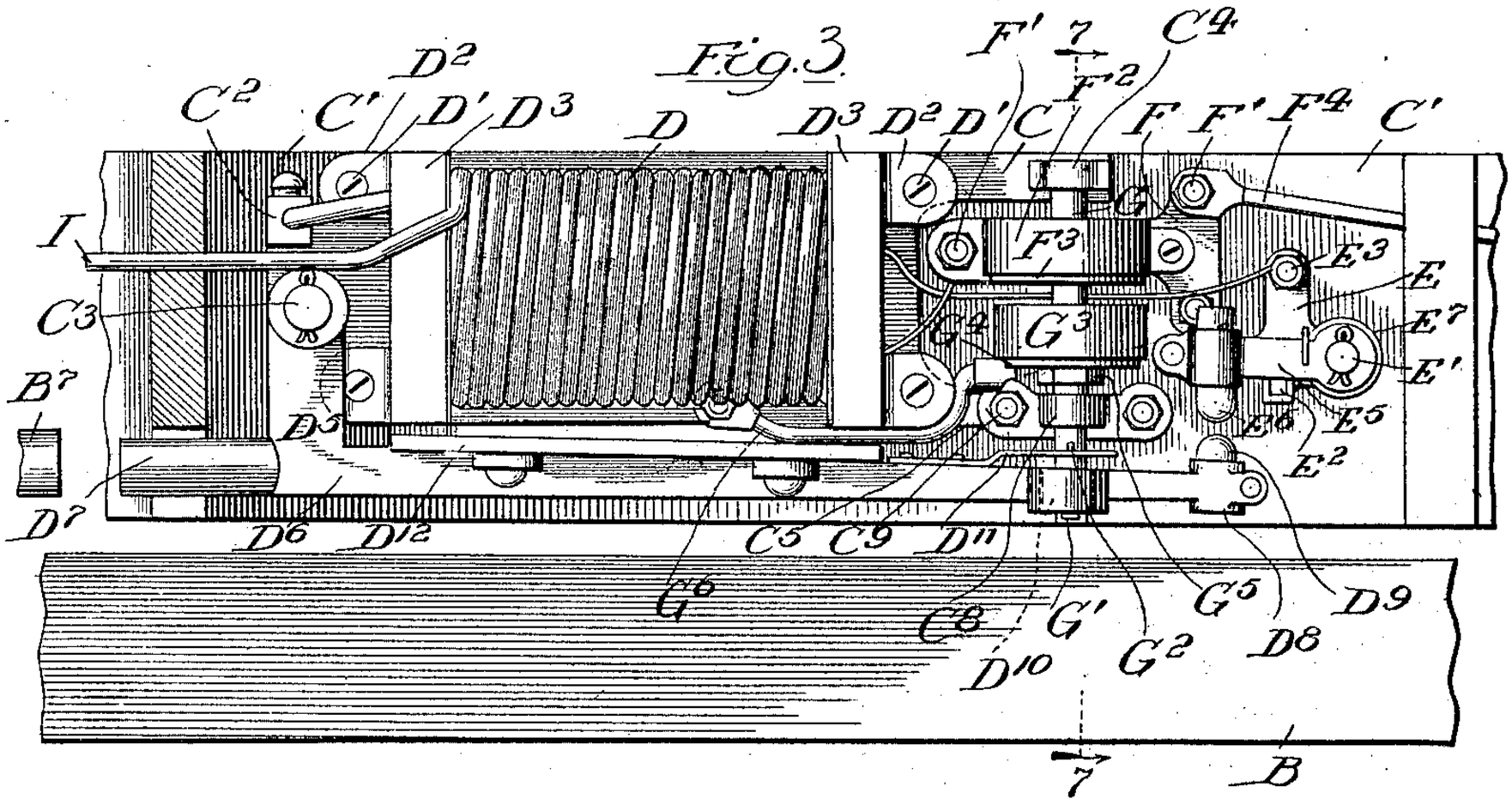
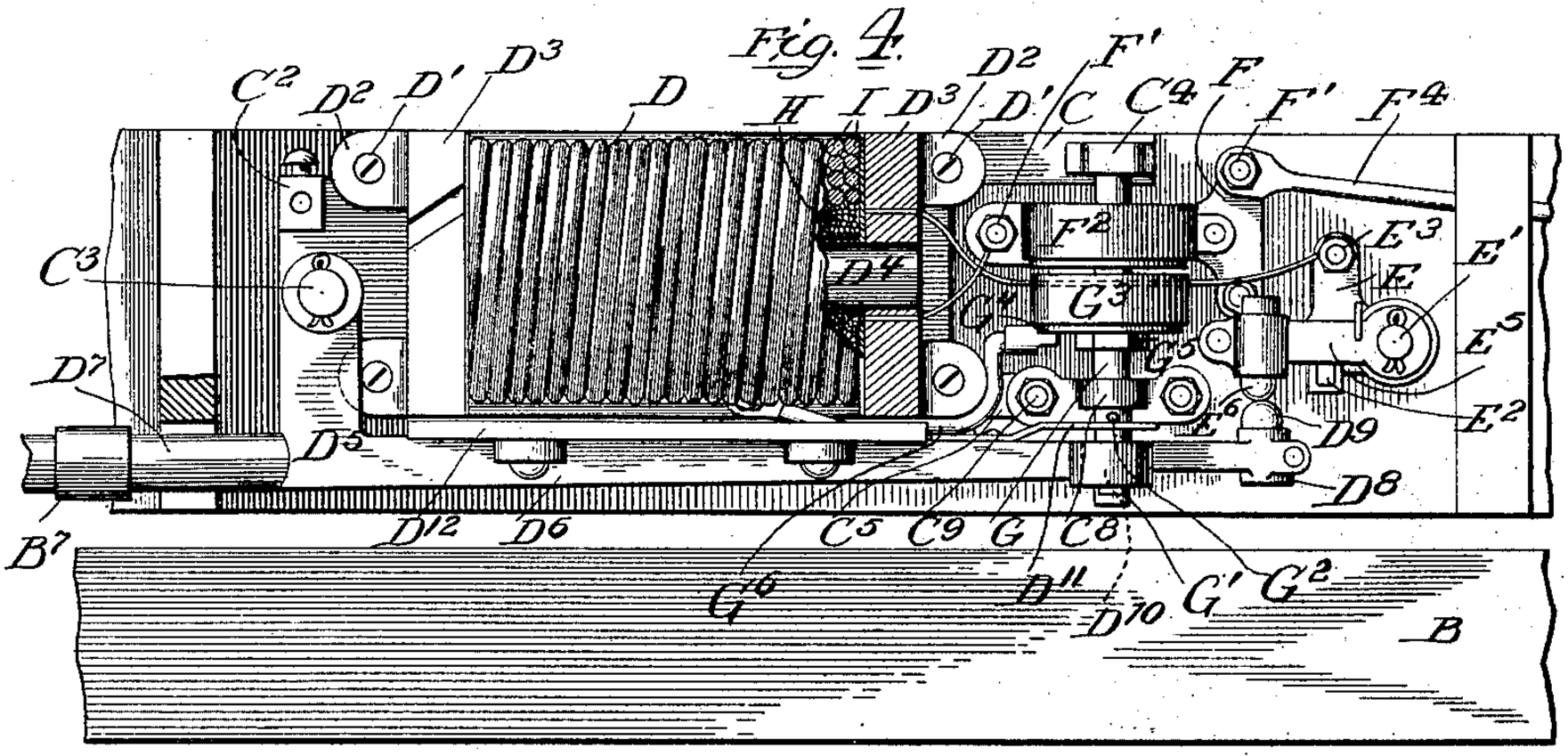


Fig. 4.



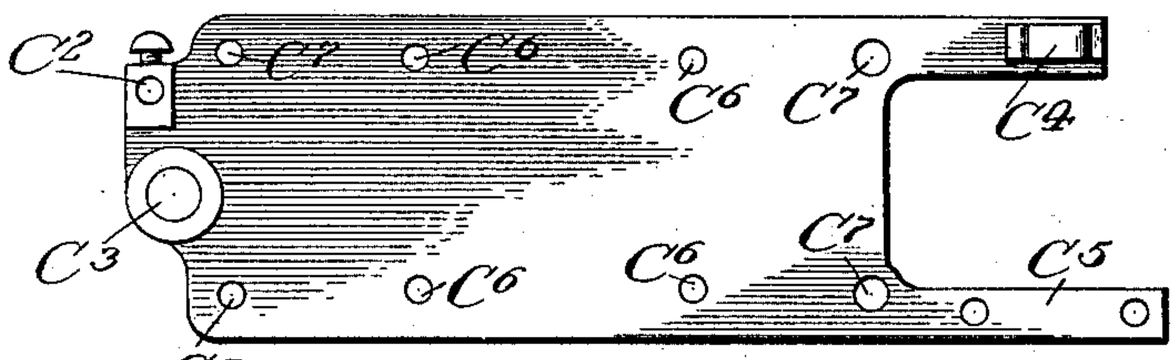


Fig. 9.

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(Application filed Feb. 6, 1902.)

(No Model.) 4 Sheets—Sheet 3.

Fig. 5.

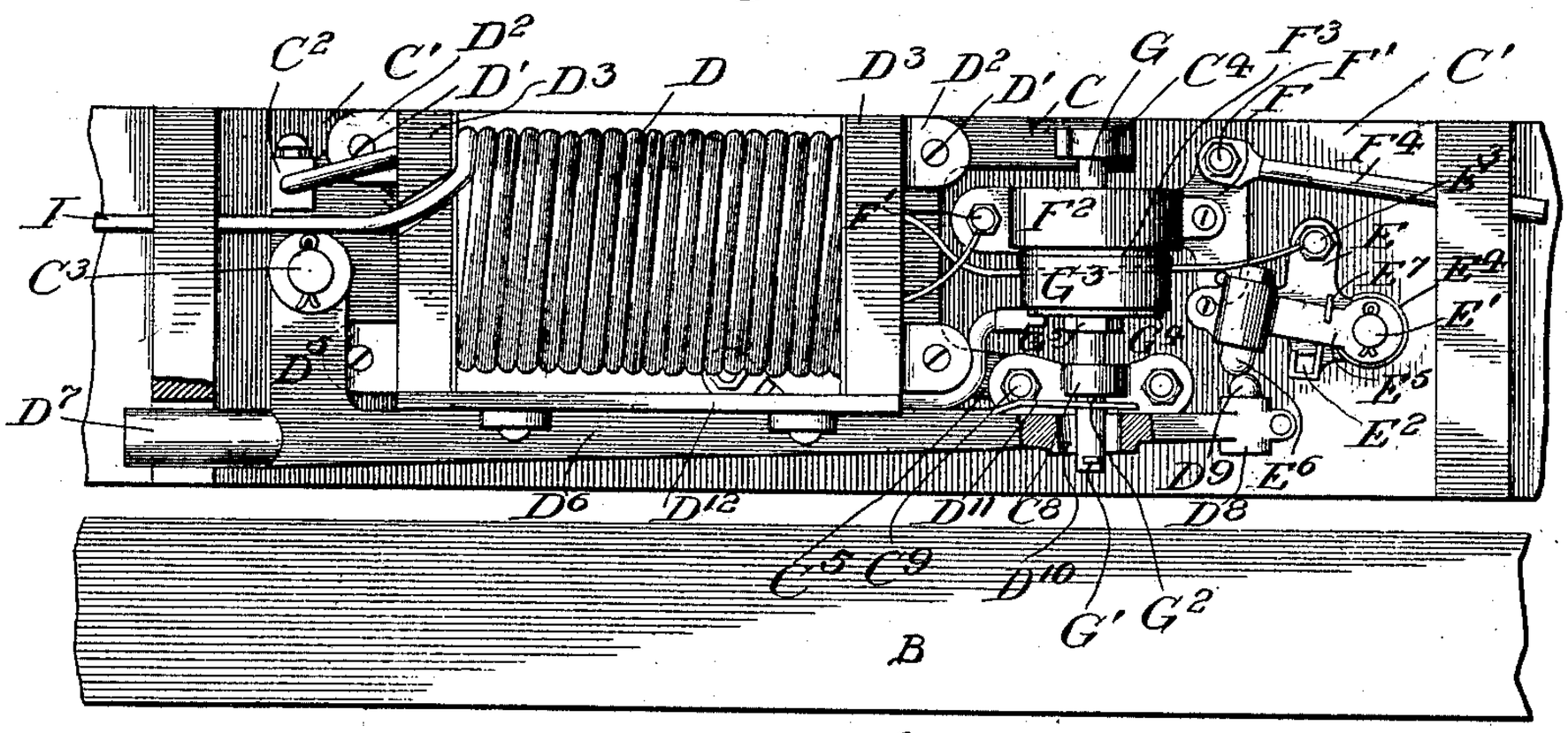


Fig. 6.

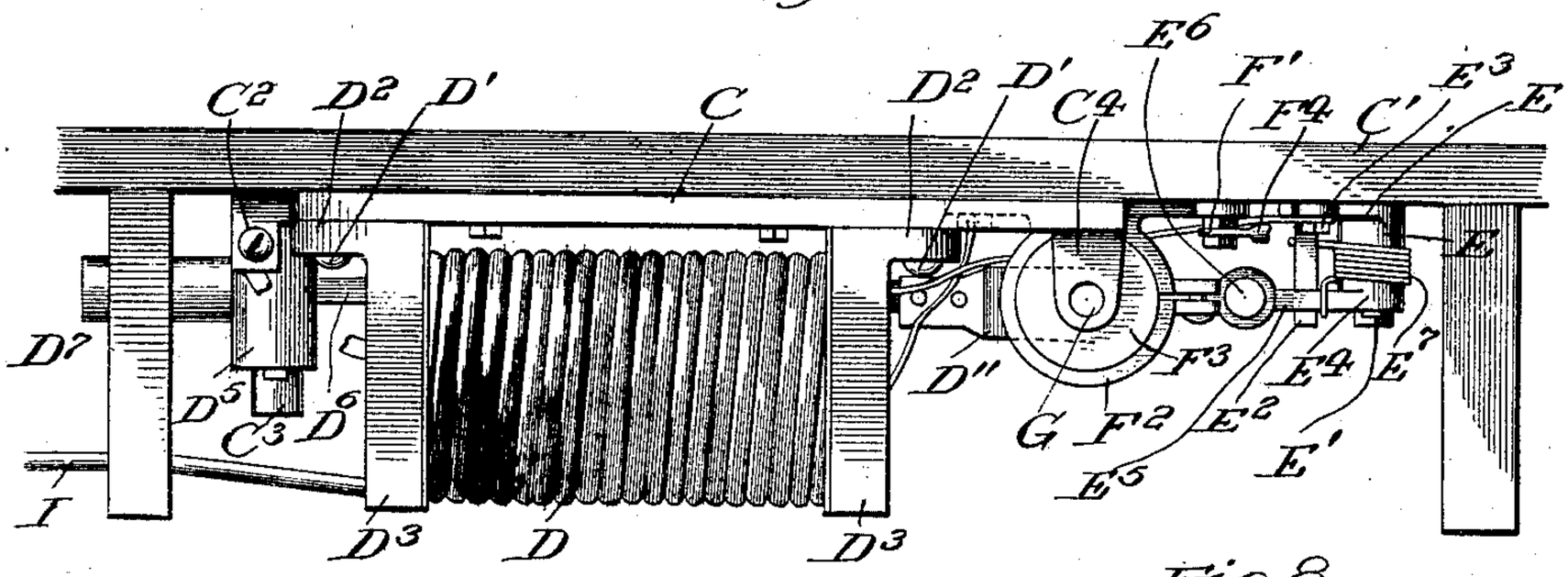


Fig. 8.

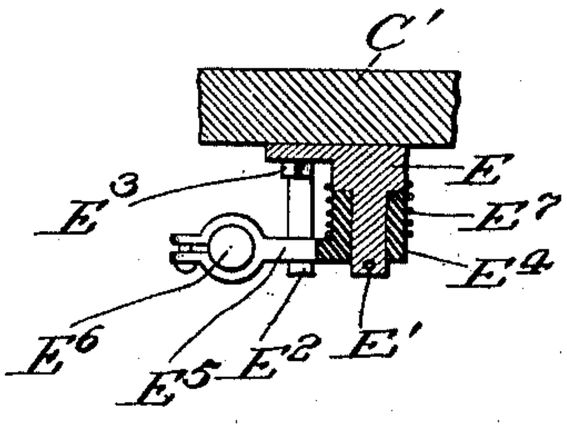
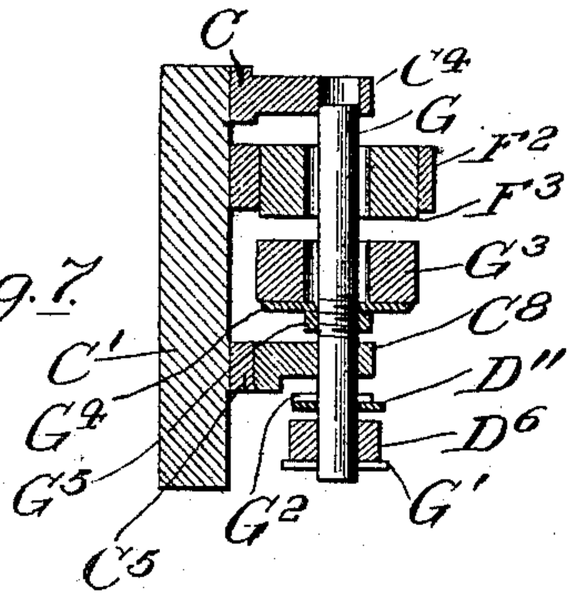


Fig. 7.



Witnesses:

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ELECTRIC RAILWAY.

(Application filed Feb. 6, 1902.)

(No Model.) 4 Sheets—Sheet 4.

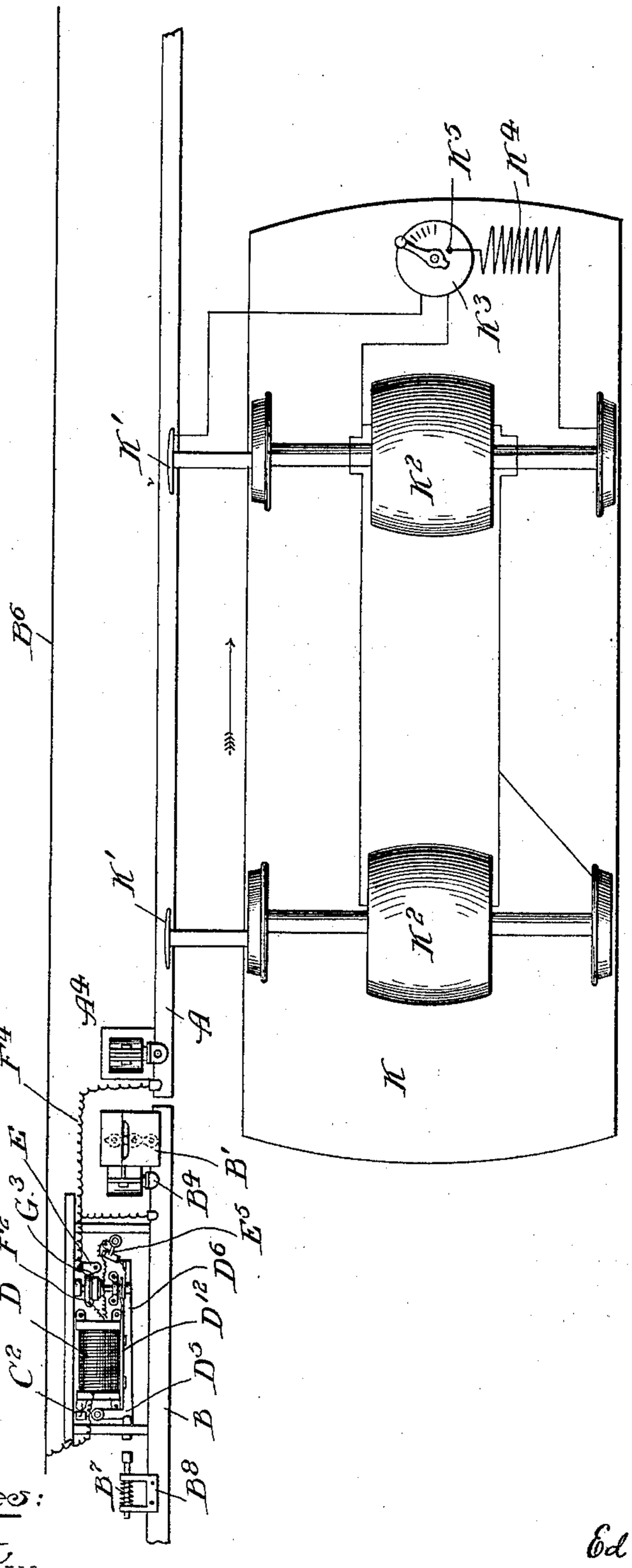

Fig. 10.

Witnesses:
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UNITED STATES PATENT OFFICE.

ED WILSON FARNHAM, OF CHICAGO, ILLINOIS.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 696,024, dated March 25, 1902.

Application filed February 6, 1902. Serial No. 92,897. (No model.)

To all whom it may concern:

Be it known that I, ED WILSON FARNHAM, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electric Railways, of which the following is a specification.

This invention relates to those systems of electric railways wherein the third or contact rail is made up of a series of insulated sections, which sections are charged one after another as the car passes over them and places each by the movement of the car or otherwise in electric communication with the conductor main or cable that supplies the current to the system.

The object of my present invention is to produce an electric railway wherein the contact-rail consists of successive "blocks," each of said blocks having a fixed section of contact-rail of a considerable length normally out of electric connection with the conductor-main, but capable of being placed in connection therewith, and thus charged with the electric current by the movement of a short section of contact-rail, one of which short sections is located at each end of said fixed section. When the contact-shoe attached to a car moving toward any particular block comes into engagement with either one of the short movable sections of said block, it swings said section upon its supporting-pivots in the direction in which the car is traveling, and by means of a mechanical device operated by the movement of said short section and by a circuit-closer electric communication is established between said block and the conductor-main. By an arrangement to be hereinafter described the electric connection between the three sections of contact-rail of the block and the conductor-main is maintained as long as the contact-shoe of the car remains in contact with any one of said three sections. As soon as the contact-shoe leaves said sections the electric connection with the conductor-main is broken and said block is deënergized. The stopping of the car, and consequently the cutting off of all electric current through its motor, will not disconnect the block, nor will it be cut off by the reversal of the direction of movement of the car.

A further object of this invention is the production of mechanical means for attaining the objects mentioned.

The contact-rail of this invention is adapted to be placed within a conduit beneath the surface of the ground or supported in any suitable manner beside the track.

In the system herein shown and described the contact-rail is divided into blocks, each consisting of a long fixed section and two swinging sections. The movement of each swinging section is adapted to operate a circuit-closer to place the fixed section and the two swinging sections of each block in electric connection with the conductor-main. The swinging sections are located one at each end of the fixed section, so that the block may be placed in electric communication with the conductor-main by a car approaching the block from either direction. Each swinging section is provided with its own switch device.

In the accompanying drawings, Figure 1 is a side elevation of a fragmental portion of the contact-rail of my invention. The adjacent ends of two blocks are shown in this figure. Fig. 2 is a top plan view of the parts shown in the preceding figure. Fig. 3 is an enlarged side elevation of the switch mechanism operated by the movement of the short section of swinging contact-rail, one of which switch mechanisms is provided for each of said swinging rails. In this view the parts of the switch are illustrated as being in the position which they occupy when the contact-shoe of the car is not in contact with the contact-rail of its block. Fig. 4 illustrates the position of the switch shown in the last preceding figure after the first movement thereof—that is to say, after the contact-shoe of the car has engaged the section of swinging contact-rail—mechanically placing the two carbon pencils of the primary contact together, thus completing a circuit through the wire constituting the shunt-coils of the electromagnet. This circuit magnetizes the poles of the magnet and attracts the armature, placing the parts in the position illustrated in the next succeeding figure. Fig. 5 shows the switch in its final position. By the final movement the main carbon contact-points are brought together and the entire current from the conductor-main thrown into the outer or main

windings of the coil, which are also in electric connection with the fixed contact-rail of the block and with the swinging switch-section at each end of the fixed section, thus connecting the main circuit with the conductor-main. Fig. 6 is a top plan view of the switch mechanism. Fig. 7 is a transverse vertical section on dotted line 7 7 of Fig. 3. Fig. 8 is a horizontal section through the pivotal arm which supports the upper pencil of the primary contact. Fig. 9 shows the base-piece for the switch mechanism. This base-piece is in circuit when the block of which it is a part is in electric connection with the conductor-main. Fig. 10 is a diagrammatic view illustrating the application of my improved switch.

As hereinbefore stated, the contact-rail of the railway embodying my invention is made up of successive blocks, one of which I will now describe. Each block has a long contact-rail A, rigidly supported in any suitable manner, as by the standards A′, and held by the bracket A^2 in a casing A^3, which protects it at the sides and top and extends the entire length of the system. This bracket is provided with a wooden bushing A^4, which insulates the rail from the bracket. The fixed contact-rail A is provided at each of its ends with a short swinging section B, supported in the brackets B′ by the pivotal links B^2. These brackets lie within the casing A^3 and are supported by bolts B^3, which pass through the casing and secure the casing and said brackets to the standards A′. The brackets B′ are provided at their sides with the bifurcated guides B^4 for engaging the upper edge of the swinging rail B, which guides are insulated by means of the wooden bushing B^5 in said bracket. Within the casing and secured to one side thereof is the switch mechanism by means of which the conductor-main B^6 is placed in electric connection with the fixed section of contact-rail. The conductor is placed in any suitable position within the casing A^3, or it may be put within a conduit underneath the ground. Each swinging section B of the contact-rail is provided with a spring-plunger B^7, mounted in the bracket B^8, secured near the upper edge of said swinging rail. By means of this spring-plunger movement is communicated by the swinging rail to the switch mechanism to operate the latter.

The switch mechanism comprises a base-plate C, secured within the casing A^3 upon a base-board C′, formed from some insulating material—as, for instance, hard wood. The base-plate C is provided with the binding-socket C^2, the pivotal stud C^3, the vertically-perforated guide-ear C^4, and the forwardly-extending arm C^5. It also has four central perforations C^6 for securing the base-plate to its base-board C′, also four other perforations C^7 for securing to said base-plate C the heads of the magnet to be later described. The forwardly-extending arm C^5 of the base-plate C is provided with a guide-sleeve C^8, secured to said arm by means of the bolts C^9, passing through suitable perforations in the base which supports said sleeve.

The electromagnet D is secured to the base-plate C by screws D′, passing through suitable lugs D^2, securing the soft-iron heads D^3 of the magnet rigidly to the base-plate C. The magnet is provided with a core D^4. Upon the pivotal stud C^3, extending from the base-plate C, is a bell-crank lever D^5, having a long forwardly-extending arm D^6 and a short integral rear extension D^7. The rear extension is adapted to be engaged by the spring-plunger B^7, mounted upon the swinging section B of the contact-rail. The forward end of the arm D^6 is provided with a clamping-socket D^8, adapted to receive a pencil D^9 of carbon. Rearward of this socket is a vertical opening D^{10} through said arm and over said opening a leaf-spring D^{11}, perforated to correspond with said opening D^{10} and at its rear end secured to the arm D^6. Intermediate the rear end of the arm and the opening D^{10} is rigidly secured an armature-plate D^{12} for the electromagnet.

A bracket E, having an integral trunnion E′, also an integral stop projection E^2, is secured by means of the bolts E^3 to the insulating base-board C′. The arm E^5 is rotatably mounted upon the trunnion E′ of the bracket E, while the outer end of the arm is in the form of a socket-clamp adapted to receive the carbon pencil E^6. A coil-spring E^7 is secured at one end to the stop projection E^2 and after making several turns about the sleeve E^4 of the arm E^5 engages the upper side of said arm, the function of said spring being to hold the arm in yielding contact with the stop projection E^2.

A second bracket F is secured by the bolts F′ to the base-board C′. This bracket has the outwardly-extending split clamping-ring F^2, adapted to hold the annular contact-carbon F^3, forming one of the main contacts in the main electric circuit. A wire F^4 for conducting the main current from the bracket F to the fixed section of the contact-rail and to the adjacent swinging rail B is secured at one end under the binding-nut of one of the bolts F′.

A rod G extends vertically through the split ring F^2 last mentioned and through the perforation in the guide-ear C^4 of the base-plate C, its lower end lying within the opening D^{10} of the bell-crank lever D^5. It also passes through the perforation in the flat spring D^{11} of the bell-crank arm D^6 and is provided with a cotter-pin G′ below said arm D^6 and a pin G^2 just above the flat spring D^{11}. A contact-carbon G^3 of annular form is secured to said rod G about midway of its length, and the lower face of the contact-carbon G^3 is provided with a plate G^4, held in contact with said carbon by means of the nut G^5, and this plate G^4 and its carbon G^3 are in electric communication with the base C by means of the wire G^6.

The core D^4 of the electromagnet D has several windings of fine wire H, one end of which wire is secured under the binding-nut of one of the bolts F′ for holding the bracket F to the insulating base-board C′, while the other end of said wire H passes to the binding-nut of one of the bolts E^3, that secure the bracket E to said base-board. The outer or main winding of the electromagnet is composed of the wire I, one end of which wire is in electric connection with the conductor-main B^6, the other entering the socket C^2 of the base C.

K refers to a car, K′ being the contact-shoes in frictional engagement with the fixed section of the contact-rail.

K^2 represents two motors, one on each axle of the car.

K^3 is the controller, by means of which current is turned on or off from the motors, and K^4 is a fine wire connecting a contact-point K^5 within the radius of the controller-lever with the axle of the car. The object of this wire is to provide a path of high resistance between the contact-rail and the traction-rails, so that a small amount of current may continue to flow through the coils of the electromagnet D and retain the armature-plate D^{12} of said magnet elevated, and thereby keep the switch closed and maintain the circuit so long as the contact-shoes of the car are in contact with the fixed section of contact-rail or either of its adjacent swinging sections. The purpose of this is to prevent the rail from becoming deënergized, which would occur if the electromagnet became demagnetized and permitted the arm D^6 to fall and open the switch. It will thus be seen that the main circuit includes the outer or main windings of the electromagnet and is normally open at the main contacts F^3 and G^3 and that the primary contact-points D^9 and E^6 are the terminals of a normally open circuit in shunt to the main contact-points.

I have called the carbon pencils D^9 and E^6 "primary contact-points" from the fact that they are first contacted when the main circuit is to be closed. Their contact is also the last to be broken when the switch is opened, and by reason of the high resistance of the shunt-circuit injurious sparking in the switch is avoided.

It is clear that any one of several different forms of circuit-closers may be employed in place of those shown and described and that the main windings and the shunt-windings of the electromagnet may be changed in relative positions or said windings placed upon separate cores without departing from the scope and spirit of my invention.

The operation of the system is as follows: As the car K runs upon the traction-rails with its contact-shoes K′ in engagement with the contact-rail and the forward shoe of the car strikes the swinging section B of the contact-rail of any particular block it causes said swinging section to move upon its pivotal bearings in the direction in which the car is proceeding. The spring-plunger B^7 on said swinging section engages the rear end D^7 of the lever D^5 and by its forward movement raises the forward end D^6 of said lever D^5, placing the primary carbon contact-points D^9 and E^6 in electric engagement. The lever D^5 is in electric connection with the conductor-main B^6, and the carbon contact-pencil E^6 is in electric connection with the shunt-windings of the electromagnet D. Said shunt-windings are also in electric connection with the contact-rail, so that the circuit is closed by a meeting of the primary carbon contact-points D^9 and E^6 and a current caused to flow through the wire H comprising said shunt-windings. This current is sufficient to cause the ends of the electromagnet to attract and raise the armature-plate D^{12}, and this in its upward movement carries with it the lever D^6. The vertical rod G, resting upon the flat spring D^{11}, is raised by the upward movement of said lever, and with it the annular carbon contact-ring G^3, making contact with the similar annular ring F^3. The lower carbon contact-ring forms one terminal of the open main circuit and the carbon ring F^3 forms the other terminal of said main circuit, so that when said rings are brought together the circuit is completed, and the current from the conductor-main B^6 flows through the connecting-wire F^4 to the fixed section of contact-rail and to the two swinging sections at either end of the fixed section. This circuit is complete through the contact-shoe K′ of the car, the wiring of the car, the axles and the wheels thereof, and the traction-rails. So long as this current flows through the electromagnet the strength of the latter will be sufficient to retain the contact-points G^3 and F^3 together, and even though the current be cut off entirely from the motors K^2 a sufficient quantity of current will pass through the resistance-wire K^4 to maintain the electromagnet D energized and to retain the armature elevated. The controller is so arranged that when all current is cut off from the motors K^2 an inner contact is made with the contact-point K^5, connected to one end of said resistence-wire K^4, completing the main circuit through said wire. When the contact-shoe passes wholly from engagement with the fixed contact-rail and the swinging contact-rail at the farther end thereof, the main circuit of the switch mechanism is opened, the electromagnet becomes demagnetized, and the lever D^6 drops of its own weight. Thus the main annular contact-rings G^3 and F^3 are first separated and the carbon-pencil contacts D^9 and E^6 are separated an instant later. The rear contact-shoe K′ of the car, however, remains in contact with that fixed section A of the contact-rail that is energized until after the next succeeding block has been placed in electric connection with the conductor-main by means of the action of the switch which controls the forward or adjacent end of said block. This it does in the

manner just described, and this action is repeated through the entire series of blocks or so far as the car may travel. The fixed rail and its two swinging rails of each block are electrically connected, so that when one is energized all are charged with the current.

The main circuit through the switch mechanism is traced as follows: Conductor-main B^6, main windings I of electromagnet, base C, binding-socket C^2, wire G^6, annular contact-carbon G^3, annular contact-carbon F^3, bracket F, wire F^4, contact-rails A B B.

The shunt-circuit is as follows: Base C, bell-crank lever D^5, arm D^6, primary contact-pencil D^9, primary contact-pencil E^6, arm E^5, bracket E, shunt-windings H of electromagnet, bracket F, wire F^4.

I am aware that many changes in the arrangement of this device might be made by others skilled in the art without departing from the spirit and scope of my invention. Hence I wish it understood that I do not limit myself to the form or arrangement of parts shown and described or to the precise details herein set forth.

I claim as my invention—

1. In an electric railway, in combination, a conductor-main; and a contact-rail made up of a plurality of "blocks," each block comprising a fixed contact-rail, a movable contact-rail, and means adapted to be actuated by the movement of said movable rail, to place the block in electric communication with the conductor-main.

2. In an electric railway, in combination, a conductor-main; and a contact-rail made up of a plurality of "blocks," each block comprising a fixed contact-rail, a movable contact-rail, a projection on said movable rail, and means adapted to be engaged by said projection, to place the block in electric communication with the conductor-main.

3. In an electric railway, in combination, a conductor-main; and a contact-rail made up of a plurality of "blocks," each block comprising a fixed contact-rail, a movable contact-rail, a projection on said movable rail, and a circuit-closer adapted to be engaged by said projection, to place the block in electric communication with the conductor-main.

4. In an electric railway, in combination, a conductor-main; and a contact-rail made up of a plurality of "blocks," each block comprising a fixed contact-rail, a movable contact-rail, and a circuit-closer adapted to be actuated by a movement of said movable rail, to place the block in electric communication with the conductor-main.

5. In an electric railway, in combination, a conductor-main; and a contact-rail made up of a plurality of "blocks," each block comprising a fixed contact-rail, a movable contact-rail having a projection extending therefrom, and a switch adapted to be engaged by said projection, to place the block in electric communication with the conductor-main.

6. In an electric railway, in combination, a conductor-main; and a contact-rail made up of a plurality of "blocks," each block comprising a fixed contact-rail, a movable contact-rail having a spring-plunger, and means adapted to be actuated by the movement of said movable contact-rail, to place the block in electric communication with the conductor-main.

7. In an electric railway, in combination, a conductor-main; and a contact-rail made up of a plurality of "blocks," each block comprising a fixed contact-rail, a movable contact-rail having a spring-plunger, and a circuit-closer adapted to be actuated by the movement of said movable contact-rail, to place the block in electric communication with the conductor-main.

8. In an electric railway, in combination, a conductor-main; and a contact-rail made up of a plurality of "blocks," each block comprising a fixed contact-rail, a movable contact-rail, and a switch device adapted to be actuated by a movement of said movable rail, said switch device comprising an electromagnet, an armature, and two contact-points for closing the electric circuit.

9. In an electric railway, in combination, a conductor-main; and a contact-rail made up of a plurality of "blocks," each block comprising a fixed contact-rail, a movable contact-rail, and a switch device adapted to be actuated by the movement of said movable rail, to place the block in electric communication with the conductor-main, said switch device comprising an electromagnet, a movable armature, a fixed contact-point, and a contact-point adapted to be moved by said armature.

10. In an electric railway, in combination, a conductor-main; and a contact-rail made up of a plurality of "blocks," each block comprising a fixed contact-rail, a movable contact-rail, and a switch device adapted to be actuated by the movement of said movable rail, said switch device having an electromagnet, an armature, the primary windings of said electromagnet being in circuit with the conductor-main, also with the fixed contact-rail, and two contact-points adapted to close said circuit to energize said electromagnet when the switch device is actuated by said movable rail.

11. In an electric railway, in combination, a conductor-main; and a contact-rail made up of a plurality of "blocks," each block comprising a fixed contact-rail, a movable contact-rail, and a device comprising an electromagnet, the main windings of said magnet being in electric connection with said conductor-main, also with the fixed contact-rail, the shunt-windings of said magnet also being in electric connection with said conductor-main and said fixed contact-rail, an armature, two main contacts, and two primary contacts, the latter adapted to close the circuit through the shunt-windings of the magnet to cause it to attract its armature and to complete the main

circuit through the main contacts when the device is actuated by the movement of the movable rail.

12. In an electric railway, in combination, a conductor-main; and a contact-rail made up of a plurality of "blocks," each block comprising a fixed contact-rail, a movable contact-rail, and a switch device having a main circuit normally open, in electric connection with said conductor-main, an electromagnet, the main windings of which are included in said main circuit, a circuit normally open, in shunt to the break in said main circuit, which shunt-circuit includes the shunt-windings of said electromagnet, and means actuated by the movement of said movable rail, for closing said shunt-circuit to place the block in electric communication with the conductor-main.

13. In an electric railway, in combination, a conductor-main; and a contact-rail made up of a plurality of "blocks," each block comprising a fixed contact-rail, two movable contact-rails, a switch device for each of said movable contact-rails, each switch device having a main circuit normally open, in electric communication with said conductor-main, an electromagnet, the main windings of which are included in said main circuit, and a circuit normally open, in shunt to the break in said main circuit, which shunt-circuit includes the shunt-windings of said electromagnet, and means for actuating each of said switch devices by the movement of its movable contact-rail.

14. In an electric switch device, in combination, a main circuit normally open; an electromagnet, the main windings of which are included in said main circuit; a circuit normally open, in shunt to the break in said main circuit, which shunt-circuit includes the shunt-windings of said electromagnet; a circuit-closer mechanically actuated by the passing of a car for closing said shunt-circuit; and means actuated by the electromagnet for closing the main circuit.

15. In an electric switch device, in combination, a main circuit normally open; an electromagnet, the main windings of which are included in said main circuit; a circuit normally open, in shunt to the break in said main circuit, which shunt-circuit includes the shunt-windings of said electromagnet; an armature mechanically actuated by the passing of a car for closing said shunt-circuit; and means actuated by the electromagnet for closing the main circuit.

16. In an electric switch device, in combination, a main circuit normally open; an electromagnet, the main windings of which are included in said main circuit; an armature, the movement of which is adapted to close the main circuit; a circuit normally open, in shunt to the break in said main circuit, which shunt-circuit includes the shunt-windings of said electromagnet; and a circuit-closer mechanically actuated by the passing of a car for closing said shunt-circuit.

17. In an electric switch device, in combination, a main circuit normally open; an electromagnet, the main windings of which are included in said main circuit; an armature for said magnet; a contact-point in the main circuit, movable with said armature; a circuit normally open, in shunt to the break in the main circuit, which shunt-circuit includes the shunt-windings of said electromagnet; and a circuit-closer mechanically actuated by the passing of a car for closing said shunt-circuit.

18. In an electric switch device, in combination, a main circuit normally open; an electromagnet, the main windings of which are included in the main circuit; a circuit-closer in said main circuit; a circuit in shunt to the break in the main circuit; a circuit-closer normally open in the shunt-circuit; mechanical means for operating the last-mentioned circuit-closer; and means controlled by the circuit-closer in the shunt-circuit for closing the main circuit.

19. In an electric switch device, in combination, a main circuit, normally open; an electromagnet, the main windings of which are included in the main circuit; a circuit normally open, in shunt to the break in the main circuit; an armature for said magnet, adapted to be mechanically actuated by the passing of a car to close the shunt-circuit, and to be electrically actuated by said magnet to close the main circuit.

20. In an electric switch device, in combination, a main circuit; an electromagnet, the main windings of which are included in said main circuit; a movable contact-point for the main circuit; a fixed contact-point for said main circuit; a circuit normally open, in shunt to said main contact-points, which shunt-circuit includes the shunt-windings of said electromagnet; a circuit-closer mechanically actuated by the passing of a car for closing said shunt-circuit; and means actuated by the electromagnet for moving said movable contact-point to close the main circuit.

21. In an electric switch device, in combination, a main circuit; an electromagnet, the main windings of which are included in said main circuit; a movable contact-point for the main circuit; a fixed contact-point for said main circuit; a circuit normally open, in shunt to said main contact-points, which shunt-circuit includes the shunt-windings of the electromagnet, and two primary contact-points (one fixed and one movable); means mechanically actuated by the passing of a car for moving one of said primary contact-points into engagement with the other of said points; and means actuated by the electromagnet for moving one of said main-circuit contact-points into engagement with the other of said contact-points.

22. In an electric switch device, in combination, a main circuit normally open; an electromagnet, the main windings of which are included in said main circuit; an armature,

the movement of which is adapted to close the main circuit; a circuit in shunt to the break in said main circuit, which shunt-circuit is normally open and includes the shunt-windings of said electromagnet; a circuit-closer mechanically actuated by the passing of a car for closing the shunt-circuit; and means actuated by the electromagnet for closing the main circuit.

23. In an electric switch device, in combination, a main circuit; an electromagnet, the main windings of which are included in said main circuit; an armature for said magnet; a movable contact-point for the main circuit; a fixed contact-point for said main circuit; a circuit in shunt to said main contact-points, which shunt-circuit includes the shunt-windings of the electromagnet and two primary contact-points, one of said primary contact-points being movable with said armature; and means mechanically actuated by the passing of a car for moving one of said primary contact-points into engagement with the other primary contact-point to close the main circuit.

24. In an electric switch device, in combination, a main circuit; an electromagnet, the main windings of which are included in said main circuit; a movable armature for said magnet; a contact-point for the main circuit, movable with said armature; a fixed contact-point for said main circuit; a circuit in shunt to said main contact-points, which shunt-circuit includes the shunt-windings of the electromagnet and two primary contact-points; and mechanical means for moving one of said primary contact-points.

25. In an electric switch device, in combination, a main circuit; an eleotromagnet, the main windings of which are included in said main circuit; an armature for said magnet; a movable arm for supporting said armature; a contact-point for the main circuit movable with said armature; a fixed contact-point for said main circuit; a circuit in shunt to said main contact-points, which shunt-circuit includes the shunt-windings of the electromagnet and two primary contact-points; and mechanical means for moving one of said primary contact-points.

26. In an electric switch device, in combination, a main circuit; an electromagnet, the main windings of which are included in said main circuit; an armature for said magnet; a pivoted arm for supporting said armature; a movable contact-point for the main circuit, carried by said pivoted arm; a fixed contact-point for said main circuit; a circuit in shunt to said main contact-points, which shunt-circuit includes the shunt-windings of the electromagnet and two primary contact-points, one of which primary contact-points is carried by said pivoted arm; and mechanical means for moving said arm.

27. In an electric switch device, in combination, a main circuit; an electromagnet, the main windings of which are included in said main circuit; a movable armature for said magnet; a contact-point for the main circuit, movable with said armature; a fixed contact-point for said main circuit; a circuit in shunt to said main contact-points, which shunt-circuit includes the shunt-windings of the electromagnet and two primary contact-points, one of which primary contact-points is movable with said armature, and the other of which primary contact-points is yieldingly supported; and mechanical means for moving the first mentioned of said primary contact-points.

28. In an electric switch device, in combination, a main circuit; an electromagnet, the main windings of which are included in said main circuit; an armature for said magnet; a pivoted arm in said main circuit, for supporting said armature; a movable contact-point for the main circuit, carried by said pivoted arm; a base-plate in said main circuit; an electric connection between said base-plate and said movable contact-point; a fixed contact-point for said main circuit; a circuit in shunt to said main contact-points, which shunt-circuit includes the shunt-windings of the electromagnet and two primary contact-points, one of which primary contact-points is carried by said arm; and mechanical means for moving said arm.

29. In an electric switch device, in combination, a main circuit; an electromagnet, the main windings of which are included in said main circuit; an armature for said magnet; a pivoted arm in said main circuit, for supporting said armature; a rod yieldingly supported by said pivoted arm; a movable contact-point fixed to said rod; a base-plate in said main circuit; an electric connection between said base-plate and said movable contact-point; a fixed contact-point for said main circuit; a circuit in shunt to said main contact-points, which shunt-circuit includes the shunt-windings of the electromagnet and two primary contact-points, one of which primary contact-points is carried by said arm, the other of said primary contact-points being pivotally mounted and yieldingly held in its normal position; and mechanical means for moving said arm.

30. In an electric switch device, in combination, a main circuit normally open; an electromagnet, the main windings of which are included in said main circuit; a circuit normally open, in shunt to the break in said main circuit, which shunt-circuit includes the shunt-windings of said electromagnet; means for closing said shunt-circuit; means actuated by the closing of the shunt-circuit, for closing the main circuit; a controller in said main circuit; and a circuit in shunt to said controller.

31. In an electric switch device, in combination, a main circuit normally open; an electromagnet, the main windings of which are

included in said main circuit; a circuit normally open, in shunt to the break in said main circuit, which shunt-circuit includes the shunt-windings of said electromagnet; mechanical means for closing said shunt-circuit; means actuated by the closing of the shunt-circuit, for closing the main circuit; a controller in said main circuit; and a circuit in shunt to said controller.

32. In an electric switch device, in combination, a main circuit, normally open; an electromagnet, the main windings of which are included in said main circuit; an armature, the movement of which is adapted to close the main circuit; a circuit normally open, in shunt to the break in said main circuit, which shunt-circuit includes the shunt-windings of said electromagnet; mechanical means for closing said shunt-circuit; a controller in said main circuit; and a circuit in shunt to said controller.

33. In an electric switch device, in combination, a main circuit normally open; an electromagnet, the main windings of which are included in said main circuit; an armature for said magnet; a contact-point in the main circuit, movable with said armature; a circuit normally open, in shunt to the break in the main circuit, which shunt-circuit includes the shunt-windings of said electromagnet; mechanical means for closing said shunt-circuit; a controller in said main circuit; and a circuit in shunt to said controller.

34. In an electric switch device, in combination, a main circuit normally open; an electromagnet, the main windings of which are included in the main circuit; an armature for said magnet; a contact-point for said main circuit, movable with said armature; a circuit normally open, in shunt to the break in said main circuit, which shunt-circuit includes the shunt-windings of said electromagnet and two primary contact-points, one of which primary contact-points is movable with said armature; mechanical means for moving said last-mentioned primary contact-point; a controller in said main circuit; and a circuit in shunt to said controller.

35. In an electric switch device, in combination, a main circuit; an electromagnet, the main windings of which are included in said main circuit; a movable contact-point for the main circuit; a fixed contact-point for said main circuit; a circuit in shunt to said main contact-points, which shunt-circuit includes the shunt-windings of said electromagnet and two primary contact-points; a controller in said main circuit; and a circuit in shunt to said controller.

36. In an electric switch device, in combination, a main circuit; an electromagnet, the main windings of which are included in said main circuit; a movable contact-point for the main circuit; a fixed contact-point for said main circuit; a circuit in shunt to said main contact-points, which shunt-circuit includes the shunt-windings of said electromagnet; means for closing said shunt-circuit; a controller in said main circuit; and a circuit in shunt to said controller.

37. In an electric switch device, in combination, a main circuit; an electromagnet, the main windings of which are included in said main circuit; a movable contact-point for the main circuit; a fixed contact-point for said main circuit; a circuit in shunt to said main contact-points, which shunt-circuit includes the shunt-windings of the electromagnet and two primary contact-points; mechanical means for moving one of said primary contact-points; a controller in said main circuit; and a circuit in shunt to said controller.

38. In an electric switch device, in combination, a main circuit, normally open; an electromagnet, the main windings of which are included in said main circuit; a circuit in shunt to the break in said main circuit, which shunt-circuit is normally open and includes the shunt-windings of said electromagnet; mechanical means for closing the shunt-circuit; means actuated by the closing of the shunt-circuit, for closing the main circuit; a controller in said main circuit; and a circuit in shunt to said controller.

39. In an electric switch device, in combination, a main circuit; an electromagnet, the main windings of which are included in said main circuit; an armature for said magnet; a movable contact-point for the main circuit; a fixed contact-point for said main circuit; a circuit in shunt to said main contact-points, which shunt-circuit includes the shunt-windings of the electromagnet and two primary contact-points; mechanical means for moving one of said primary contact-points; a controller in said main circuit; and a circuit in shunt to said controller.

40. In an electric switch device, in combination, a main circuit; an electromagnet, the main windings of which are included in said main circuit; a movable armature for said magnet; a contact-point for the main circuit, movable with said armature; a fixed contact-point for said main circuit; a circuit in shunt to said main contact-points, which shunt-circuit includes the shunt-windings of the electromagnet and two primary contact-points; mechanical means for moving one of said primary contact-points; a controller in said main circuit; and a circuit in shunt to said controller.

41. In an electric switch device, in combination, a main circuit; an electromagnet, the main windings of which are included in said main circuit; an armature for said magnet; a movable arm for supporting said armature; a contact-point for the main circuit, movable with said armature; a fixed contact-point for said main circuit; a circuit in shunt to said main contact-points, which shunt-circuit includes the shunt-windings of the electromagnet and two primary contact-points; mechan-

ical means for moving one of said primary contact-points; a controller in said main circuit; and a circuit in shunt to said controller.

42. In an electric switch device, in combination, a main circuit; an electromagnet, the main windings of which are included in said main circuit; an armature for said magnet; a pivoted arm for supporting said armature; a movable contact-point for the main circuit, carried by said pivoted arm; a fixed contact-point for said main circuit; a circuit in shunt to said main contact-points, which shunt-circuit includes the shunt-windings of the electromagnet and two primary contact-points, one of which primary contact-points is carried by said pivoted arm; mechanical means for moving said arm; a controller in said main circuit; and a circuit in shunt to said controller.

43. In an electric switch device, in combination, a main circuit; an electromagnet, the main windings of which are included in said main circuit; a movable armature for said magnet; a contact-point for the main circuit, movable with said armature; a fixed contact-point for said main circuit; a circuit in shunt to said main contact-points, which shunt-circuit includes the shunt-windings of the electromagnet and two primary contact-points, one of which primary contact-points is movable with said armature, and the other of which primary contact-points is yieldingly supported; mechanical means for moving the first-mentioned of said primary contact-points; a controller in said main circuit; and a circuit in shunt to said controller.

44. In an electric switch device, in combination, a main circuit; an electromagnet, the main windings of which are included in said main circuit; an armature for said magnet; a pivoted arm in said main circuit, for supporting said armature; a movable contact-point for the main circuit, carried by said pivoted arm; a base-plate in said main circuit; an electric connection between said base-plate and said movable contact-point; a fixed contact-point for said main circuit; a circuit in shunt to said main contact-points, which shunt-circuit includes the shunt-windings of the electromagnet and two primary contact-points, one of which primary contact-points is carried by said arm; mechanical means for moving said arm; a controller in said main circuit; and a circuit in shunt to said controller.

45. In an electric switch device, in combination, a main circuit; an electromagnet, the main windings of which are included in said main circuit; an armature for said magnet; a pivoted arm in said main circuit, for supporting said armature; a rod yieldingly supported by said pivoted arm; a movable contact-point fixed to said rod; a base-plate in said main circuit; an electric connection between said base-plate and said movable contact-point; a fixed contact-point for said main circuit; a circuit in shunt to said main contact-points, which shunt-circuit includes the shunt-windings of the electromagnet and two primary contact-points, one of which primary contact-points is carried by said arm, the other of said primary contact-points being pivotally mounted and yieldingly held in its normal position; mechanical means for moving said arm; a controller in said main circuit; and a circuit in shunt to said controller.

ED WILSON FARNHAM.

Witnesses:
B. R. NOBLE,
L. WOODBURY.