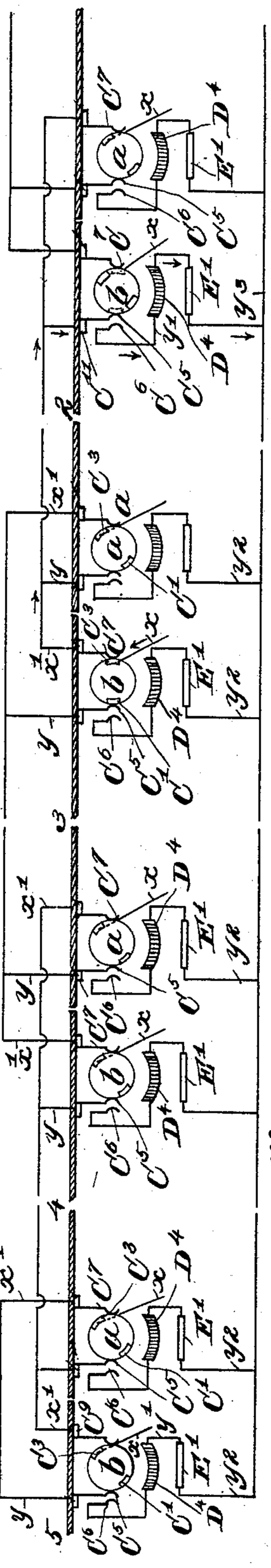
No. 716,995. Patented Dec. 30, 1902.

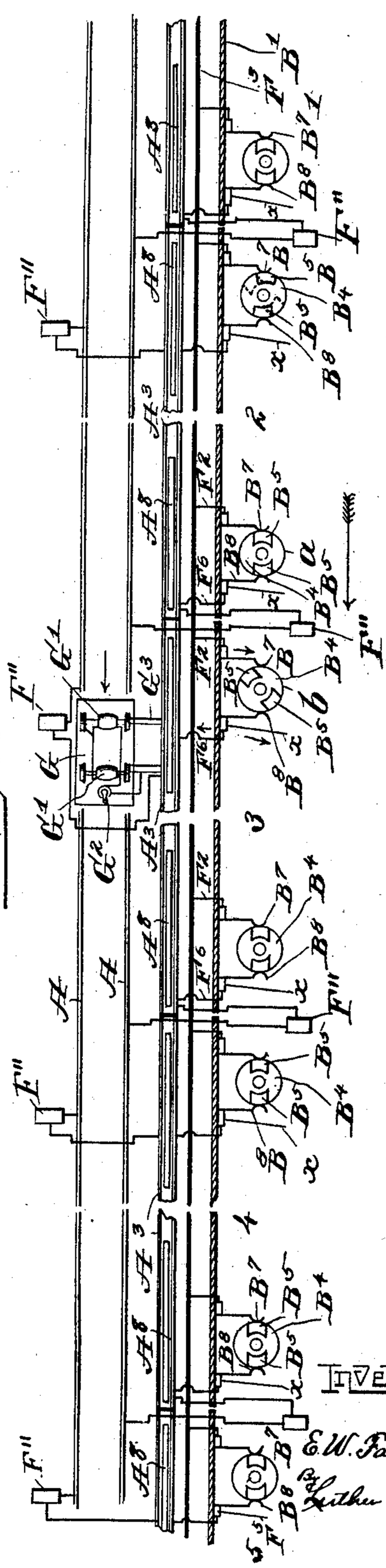
E. W. FARNHAM.

ELECTRIC RAILWAY.

(Application filed Apr. 11, 1902.)

(No Model.) 6 Sheets—Sheet 1.





Witnesses.

G. A. Rauchenbusch

Geo. L. Chindahl

Inventor.

E. W. Farnham

By Luther L. Miller

Atty.

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E. W. FARNHAM.

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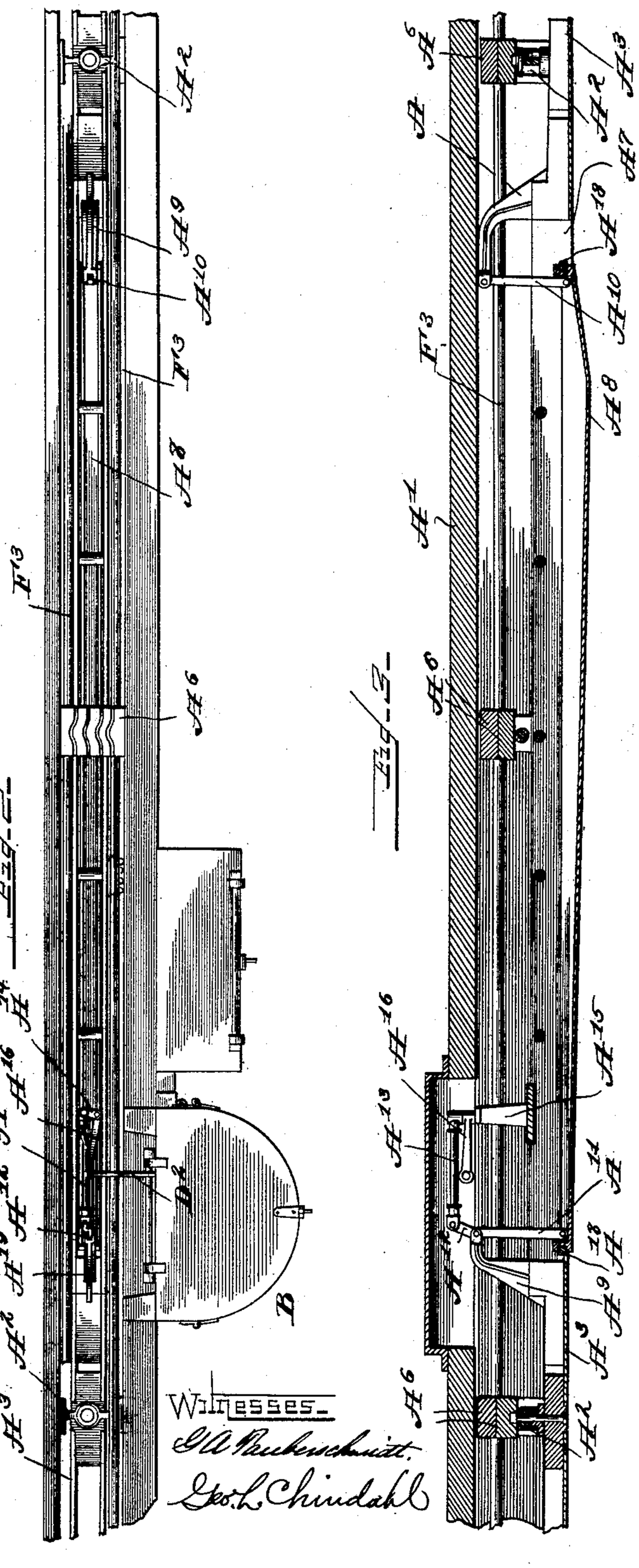

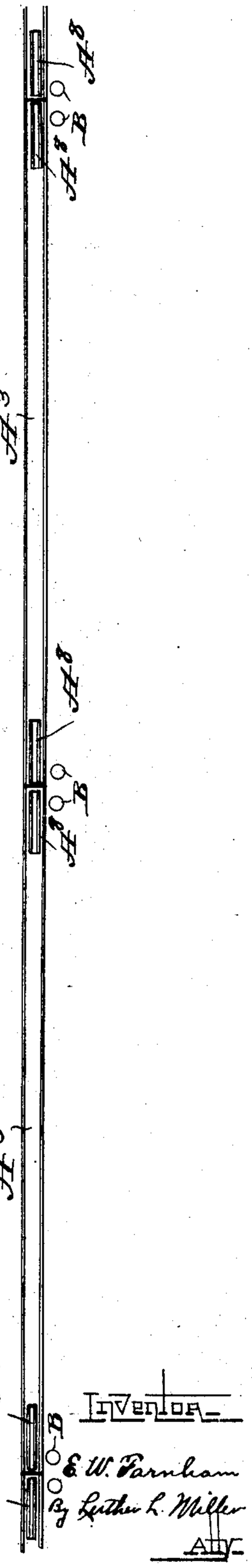

Witnesses.
G. A. Buckenschmidt.
Geo. L. Chindahl.

Inventor.
E. W. Farnham
By Luther L. Miller
Atty.

No. 716,995.

Patented Dec. 30, 1902.

E. W. FARNHAM.

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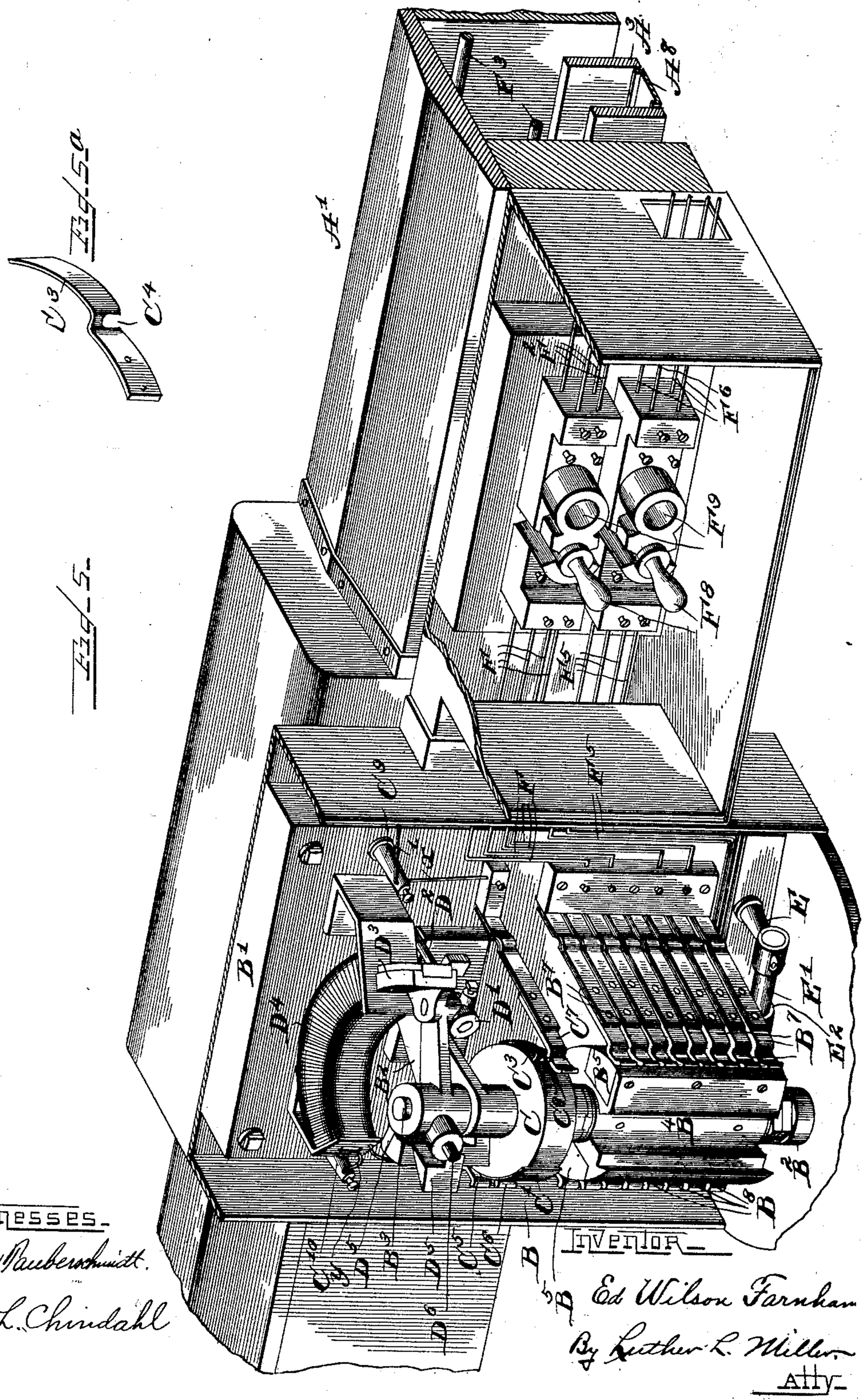
(No Model.)

6 Sheets—Sheet 3.



No. 716,995. Patented Dec. 30, 1902.

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(Application filed Apr. 11, 1902.)

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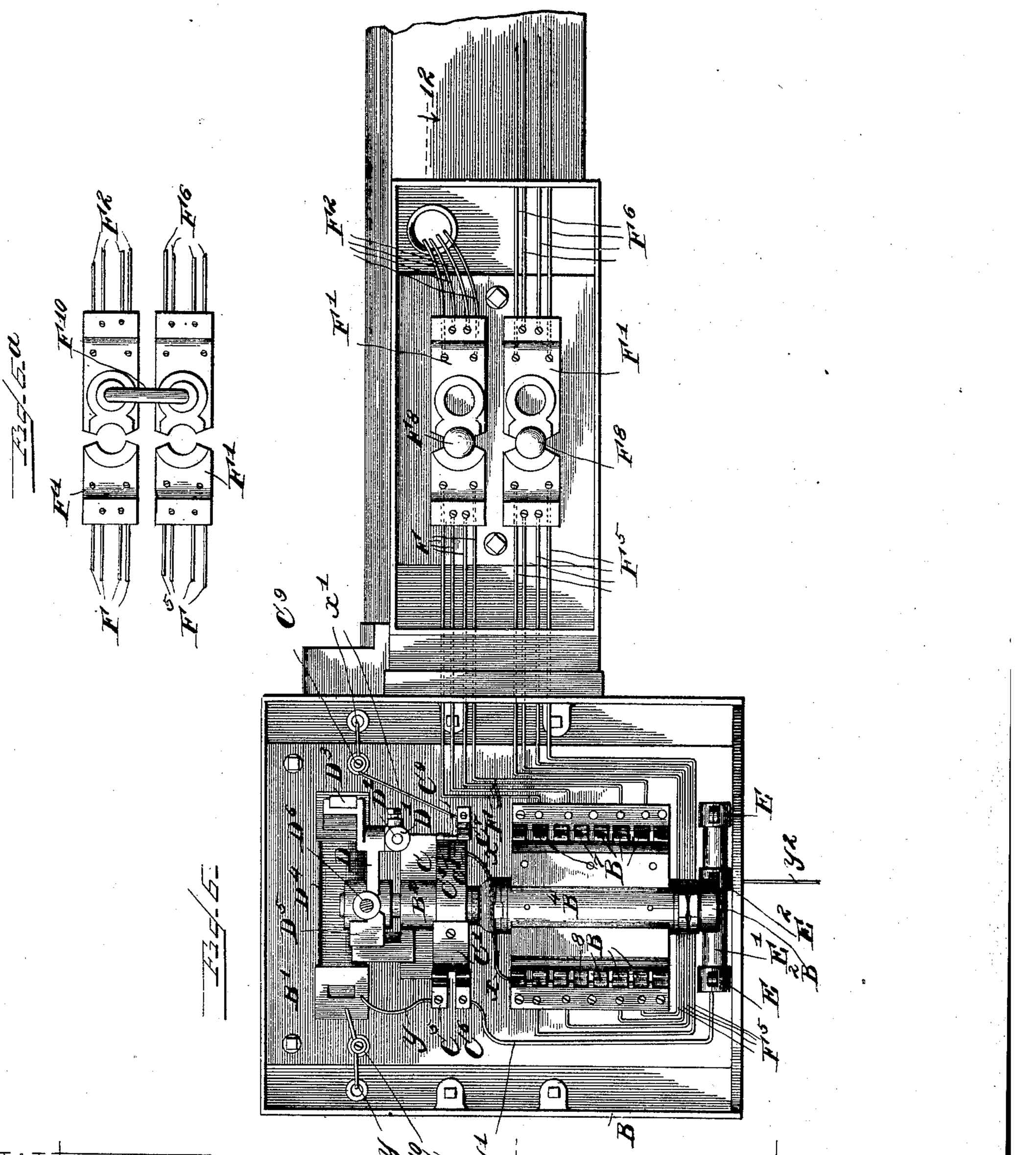

Witnesses—
G. A. Fauberschmitt.
Geo. L. Chindahl

Inventor—
Ed Wilson Farnham
By Luther L. Miller
Atty.

No. 716,995. Patented Dec. 30, 1902.

E. W. FARNHAM.

ELECTRIC RAILWAY.

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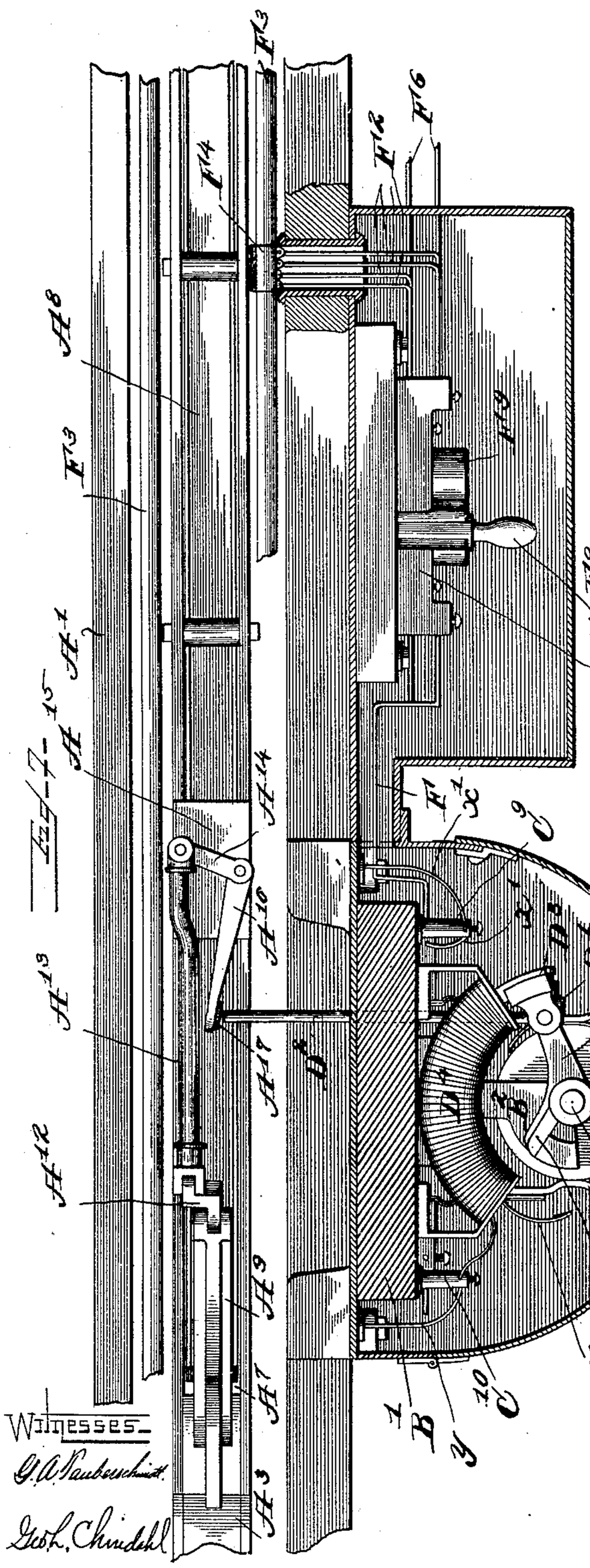

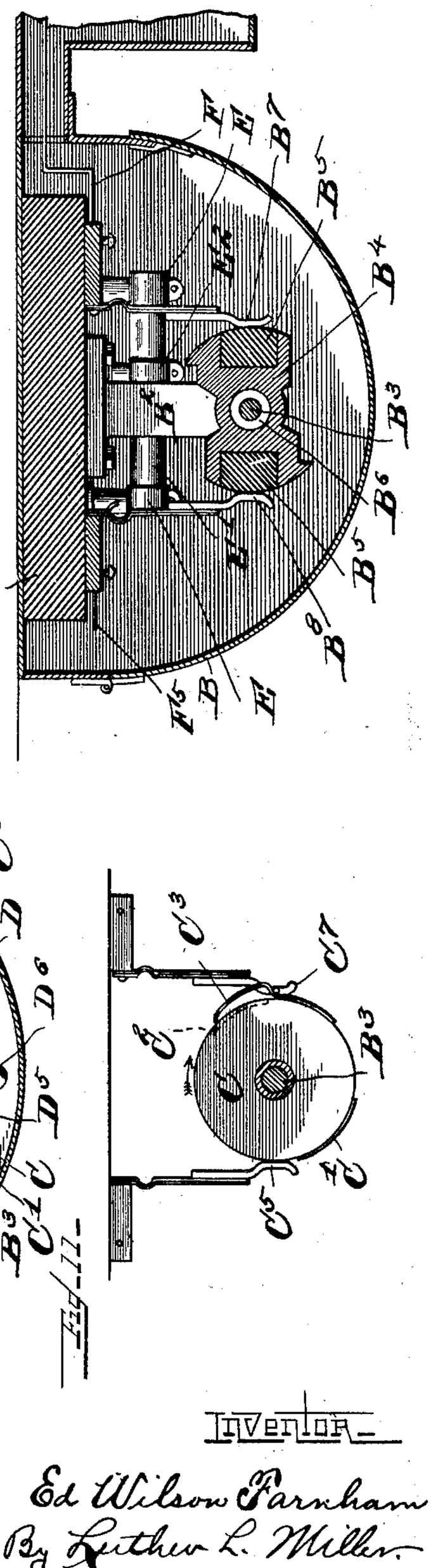

Witnesses—

G. A. Taubenschmidt.

Geo. L. Chindahl.

Inventor—

Ed Wilson Farnham

By Luther L. Miller.

Atty.

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E. W. FARNHAM.

ELECTRIC RAILWAY.

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(No Model.) 6 Sheets—Sheet 6.

Fig. 7.

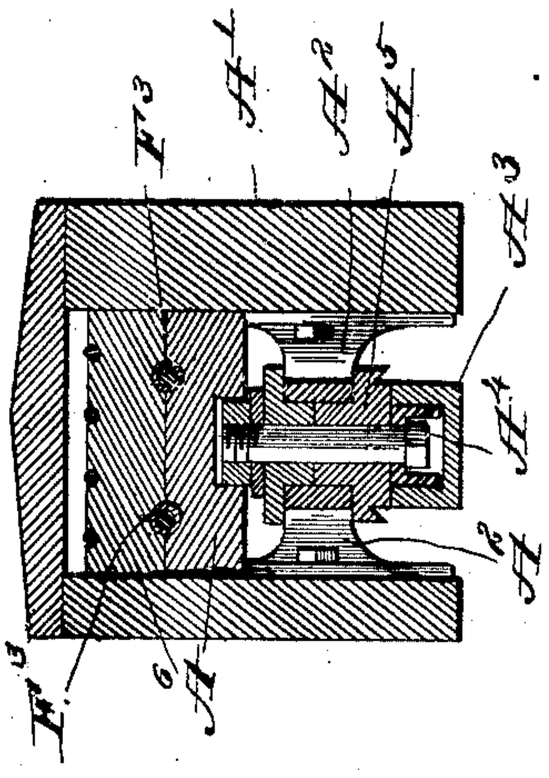


Fig. 11.

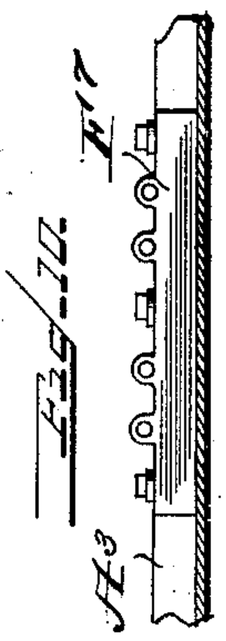
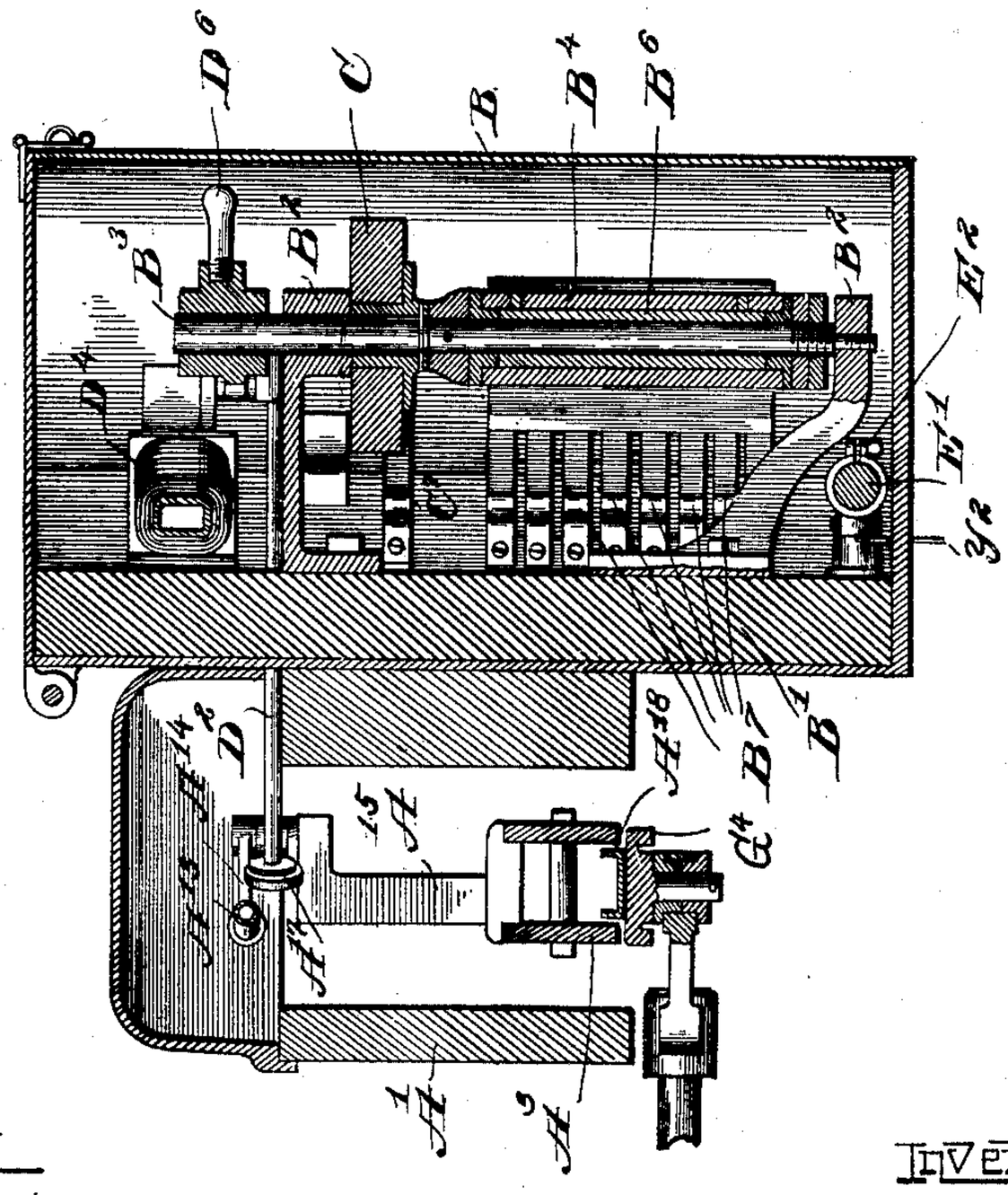


Fig. 8.



Witnesses

G. A. Pauberschmidt

Geo. L. Chindahl

Inventor

Ed Wilson Farnham

By Luther L. Miller

Atty

UNITED STATES PATENT OFFICE.

ED WILSON FARNHAM, OF CHICAGO, ILLINOIS.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 716,995, dated December 30, 1902.

Application filed April 11, 1902. Serial No. 102,408. (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 electric railways of the class that have a third or contact rail made up of insulated blocks or sections, with means for placing each section in electric connection with the source of electric energy when the car passes over said block or section.

One of the objects of this invention is to provide an improved system of this kind in its entirety.

A further object is the production of an improved mechanically-actuated means for connecting one of the blocks of the contact-rail with the source of electric energy.

A further object of the invention is the production of means for electrically disconnecting the last preceding block when the car enters successively upon each block or section of the system.

In the embodiment herein shown of this invention the contact-rail is in channel-iron form and is suspended in a continuous box or casing open at its under side, elevated slightly above the surface of the road-bed, and extending throughout the length of the system. This rail, it is obvious, may be placed within an underground conduit and the contact-shoe carried by the car arranged to bear upon it. The contact-rail comprises several fixed sections of any suitable length having at each end thereof a swinging or movable section projecting slightly below the surface of the fixed section and adapted to be moved longitudinally slightly when the contact-shoe carried by the car contacts one of said swinging sections. The movement of this swinging section is adapted to mechanically operate an electrical device that energizes the block or section of which the swinging section is a part, at the same time deënergizing the section from which the contact-shoe has passed.

In the accompanying drawings, Figures 1 and 1ª are diagrammatic views illustrating the general arrangement of parts in a railway system embodying my invention, Fig. 1 illustrating the setting-switches that place the insulated blocks or sections of the contact-rail in electrical connection with the feeder-main. This figure also shows signals between adjacent sections, not further described or claimed in this application. Fig. 1ª shows the restoring devices for electrically cutting out the section last passed by the car. Fig. 2 is a plan view, and Fig. 3 a side elevation, of a swinging rail-section and its mechanical connection with the electrical switching device, by means of which switching device the block or section of which the swinging rail-section is a part is placed in electrical connection with the source of electric energy. Fig. 4 is a diagram representing several blocks or sections of the contact-rail of this system. Fig. 5 is a perspective view illustrating an electric switching device, the operation of which cuts in and cuts out the block or section of contact-rail that it controls. In practice one of these switching devices is provided for each end of each block or section of the contact-rail. Fig. 5 also shows a plug cut-out for temporarily cutting out said switching device, also for connecting two adjacent blocks or sections when either of the switching devices in one is disabled. Fig. 5ª is a perspective view of the guide-finger mounted on the restoring-disk and overlying one of the contact-plates thereon. Fig. 6 is a side elevation of the switching device and plug cut-out shown in the last preceding figure, and Fig. 6ª is a view of the plug cut-outs, illustrating the connection for joining two adjacent blocks or sections and causing both to be electrically controlled by the switch devices of one of said blocks or sections. Fig. 7 is a plan view of the switching device and the means for mechanically actuating the same, the housing for said device being shown in section. This view also illustrates one of the plug cut-outs and the wiring therefor. Fig. 8 is a transverse vertical central section through the switching device, also showing in section the rail and its casing. Fig. 9 is a transverse vertical central section through one of the brackets employed to support the fixed rail-section, also showing the grooves for carrying the feeder-wires and the signal and other communicating wires. Fig. 10 illustrates the means for making the electric

connection between the fixed contact-rail of a block and the switching device. Fig. 11 is a diagram illustrating that part of the switching device employed to deënergize the section from which the car has moved. Fig. 12 is a transverse section through the switching device on dotted line 12 12 of Fig. 6.

In the construction of a railway embodying this invention I provide the usual track, the rails A of which are bonded to form a return connection between the motor in the car and the source of electric energy. At the side of the track I support by any suitable means a continuous casing A′, of wood or other substance, open at its under side and extending throughout the length of the system, and within this casing secure by brackets A^2 the fixed contact-rail A^3, of channel form in transverse section. The rail A^3 is supported within the brackets A^2 by means of the bolts A^4, but is electrically insulated from said brackets by the insulators A^5. Within the casing, above the brackets A^2 and resting upon the latter, are two insulating-blocks A^6, grooved in their adjacent faces to carry the feeder-wires in the upper part of the casing, the upper one of said blocks being also grooved in its upper face to carry signal-wires or other communicating wires. At a little distance from each end of each fixed rail-section A^3, I provide an opening A^7, formed in the bottom of the fixed rail, for receiving a swinging rail-section A^8, suspended from the brackets A^9 by means of the links A^{10} and A^{11}, the latter one of which links is provided with an upwardly-extending bell-crank arm A^{12}, having at its upper end a connecting-rod A^{13}, connecting it with the bell-crank lever A^{14}, pivotally mounted upon the standard-support A^{15} on the fixed rail A^3. The free arm A^{16} of the bell-crank lever is provided with a head A^{17}, adapted to strike against a sliding rod, to be hereinafter mentioned, which rod extends through an opening in the side of said casing and is connected with and operates the switch-actuating mechanism, to be described later herein. The endwise movement of the swinging rail-section is limited by the buffer A^{18}, which also serves to take up the force of the blow struck by said rail-section when carried forward by the contact-shoe.

At each end of each block or section of the fixed contact-rail and adjacent to the swinging rail thereof I provide a housing B for containing the electrical switching mechanism, with a hinged door to provide access to the interior of said housing. The housing B is fixed upon the side of and is supported by the rail-casing A′ and is provided with an insulating base-plate B′, of slate or other suitable material. Two brackets B^2 extend outwardly from this base-plate B′ and support at their outer ends a vertical oscillatory shaft B^3, upon the lower end of which shaft is fixed a switch-head B^4, of conducting material, into which head are set at diametrically opposite points two insulating-blocks B^5, and the switch-head B^4 is insulated from the shaft B^3 by means of the insulating-bushing B^6. A number of flexible primary contact-fingers B^7 are secured to the insulating base-plate B′ and extend outward therefrom, the outer ends of said fingers lying in contact with the head B^4. A number of similar secondary fingers B^8 are secured to and extend outward from the said base-plate B′, their forward ends contacting the head B^4 on the opposite side thereof. The insulating-blocks B^5 are placed in said switch-head diametrically opposite, so that the two series of contact-fingers B^7 and B^8 both rest upon the insulating-blocks when said switching device is in its normal position of rest.

A restoring-disk C, of insulating material, is fixed upon the vertical shaft B^3 above the switch-head B^4, and this disk carries upon its periphery a contact-plate C′ and at a point diametrically opposite a contact-plate C^2. Over the contact-plate C^2 is a spring guide-finger C^3, offset from the periphery of said disk at one point and curving toward said disk at its end. In the offset portion of this spring-guide C^3 is provided a notch or opening C^4 for a purpose to be hereinafter mentioned. Two contact-fingers C^5 and C^6 are secured side by side to the insulating base-plate B′ and extend outward therefrom, their ends lying in contact with the periphery of said restoring-disk C, on one side thereof, and being adapted to contact the contact-plate C′ upon said disk. A single spring-finger C^7 is secured to the insulating base-plate B′ at a point opposite to the fingers C^5 and C^6 and extends outward into a position to contact with its outer end, the restoring-disk C, and the contact-plate C^2. The spring-finger C^7 carries a pin C^8, adapted to pass through the notch C^4 in the offset portion of the spring-guide C^3 when the disk is rotated in one direction and to ride upon said guide when the disk is rotated in the opposite direction. The effect of this is that the spring-finger C^7 contacts the contact-plate C^2 when the restoring-disk C is rotated mechanically by the passing of the car and is raised from contact with said contact-plate when the disk C is electrically restored to its normal position of rest. A flexible wire x connects the secondary fingers B^8 with the contact-plate C^2, and a wire x' joins the finger C^7 with a binding-post C^9. A similar binding-post C^{10} on the opposite side of the base-plate B′ carries a wire y, that forms the windings of the solenoid, to be later herein described, and extends to and has electrical connection with the base of the finger C^5. The finger C^6 has a wire y', which connects it with a graphite resistance-rod, to be later herein described.

An arm D is fixed to the upper end of the shaft B^3 and carries near its outer end a pivotally-mounted sleeve D′, within which the rod D^2 lies and is secured. This rod D^2 is the one hereinbefore alluded to as the switch-

actuating rod, and from its connections it will be seen that a movement of the swinging section A^8 of the contact-rail slides the rod D^2 longitudinally and that by means of the pivotal sleeve connection between said rod and the shaft B^3 said shaft and the switching device are thereby rotated. The arm D also carries at its outer end a core D^3, curved in the arc of a circle concentric with the pivotal center of the shaft B^3. This core is adapted to be reciprocated within a solenoid D^4, also formed concentric with the axial center of said shaft B^3. As hereinbefore stated, the windings of this solenoid are composed of the wire *y*, which wire also passes to the contact-finger C^5. The arm D extends rearwardly of its pivotal bearing, forming stop projections D^5, adapted to impinge upon a portion of the upper one of the supporting-brackets B^2 for the shaft B^3 to limit the movement of said arm and said shaft in either direction. A handle D^6, connected with said arm, provides a means for manually operating the switching device.

Near the lower edge of the insulated base-plate B′, I secure in the clamping-brackets E a rod E′, of resistance material. I have used a graphite composition for this rod. The wire *y′* connects the base of the finger C^6 with the resistance-rod E′, and the movable sleeve E^2, frictionally engaging said rod, has a wire y^2 running to a common return-wire y^3 or to the bonded rails A of the track.

The fingers B^7 are connected by means of the wires F with one end of one of the plug cut-outs F′, the opposite end of which cut-out is connected by means of the wires F^2 with the feeder-main F^3, the connection between the wires F^2 and the feeder-main being made by means of the sleeve F^4, which surrounds and is clamped upon said feeder-main. The other plug cut-out F′ is connected at one end with the wires F^5 from the fingers B^8 and at its opposite end with the wires F^6, connected with a section of the fixed contact-rail, this connection being made by means of the connecting-block F^7, secured within the channel of said rail. Each of the plug cut-outs F′ is made in two parts electrically connected by means of the plug F^8, lying within the socket formed between said parts. Each cut-out is also provided with a socket F^9 for connecting the two cut-outs together by a plug-line F^{10} should it be desirable to cut out the switching device of said section and place the contact-rail of said section in direct electrical connection with the feeder-main.

An automatic visual signal F^{11} may be used in connection with my improved railway system to guard each end of each section; but such signal system is not included in this application.

G represents a car having the motors G′ thereon and the controller G^2, also the arms G^3, extending from the side of the car, for supporting the contact-shoes G^4.

A car running upon the traction-rails A places its contact-shoes G^4 in contact with the under side of the contact-rail, passing from section to section of said contact-rail as the car progresses. As the forward contact-shoe of the car strikes the swinging rail A^8 at the approached end of a section the shoe raises and moves forward said swinging rail, moving the rail upon its pivotal links A^{10} and A^{11}. The connecting-rod (A^{13}) connection between the bell-crank arm A^{12} of the link A^{11} and the bell-crank lever A^{16} moves said bell-crank lever and causes the head A^{17} thereof to thrust the sliding rod D^2 longitudinally and by means of the connection between said rod and the arm D oscillates the vertical shaft B^3 of the switching device and rotates the switch-head B^4 and the restoring-disk C. In its normal position the head B^4 lies with its insulating-blocks B^5 in contact with the fingers B^7 and B^8, cutting off the electrical current in the feeder-main (which current is also in the primary fingers B^7) from the section of the contact-rail with which said switching device is in circuit. The partial rotation just described of the switch-head B^4 moved the insulating-blocks B^5 from under the ends of the contact-fingers B^7 and B^8, causing said fingers to rest upon the periphery of the switch-head, and, as said head is of conducting material, establishing electrical connection between the fingers B^7 and B^8, thus placing a section of the contact-rail in electrical communication with the feeder main. The restoring-disk C being fixed upon the shaft B^3 was rotated with it, the contact-plate C^2 being turned into contact with the finger C^7. The wire *x* connects the contact-plate C^2 with the secondary fingers B^8, so that when said secondary fingers are in circuit with the feeder-main and receive current therefrom the contact-plate C^2 is also in circuit with said feeder-main. Current passes from the contact-plate C^2 through the finger C^7, the wire *x′*, and the wire *y* (these wires of different switching devices being connected) to the solenoid of the switching device at the approached (farther) end of the section last passed by the car. After traversing the windings of the solenoid of said switching device the current passes to the contact-finger C^5, through the contact-plate C′ to the contact-finger C^6, through the wire *y′* to the resistance-rod E′, and through the wire y^2 to a common return-wire or the traction-rails A. This establishes an electric current through the coils of the solenoid, attracting the core of said solenoid, rotating the shaft B^3 of said switching device, and restoring the head B^4 of said switching device to a position of rest—that is to say, to a position wherein the insulating-blocks B^5 lie under the ends of the contact-fingers B^7 and B^8—cutting out the last preceding section of contact-rail over which the car has just passed from electrical connection with the feeder-main.

In the restoring oscillation of the restoring-disk C the finger C^7 is raised from contact with the contact-plate C^2, the pin C^8 of said

finger riding upon the guide C^3 and lifting said finger over said contact-plate C^2. The object of this is to prevent making a contact that would restore the switching devices in the section upon which the car is running, and thereby deënergizing said section.

The car passes from section to section, mechanically cutting in that section of contact-rail upon which the forward contact-shoe enters and electrically restoring the switching device at the approached end of the last preceding section. The wire x' extends to the solenoids of both switching devices on the section last passed by the car, so that in case the movement of the car was reversed when either of the contact-shoes was in contact with the swinging rail at the near end of the last preceding section and both switching devices thereby were set both will be restored when the car leaves said section. The wire x' of the switching device at the forward end of each section runs into and continues the wire y of both switching devices of the next preceding section.

For convenience and certainty of description I will refer to Figs. 1 and 1^a, wherein I have designated the sections shown in said figures by the numerals 1, 2, 3, 4, and 5, and the switching devices of each of said sections by the letters a and b. The car, we will suppose, is passing in the direction indicated by the arrows in said figures and is just entering section 3. At this point its forward contact-shoe has moved the movable section of contact-rail at the approached end of section 3, and the movement of this rail mechanically oscillates the switch-head b of said section into the position indicated in Fig. 1. This movement of the switch-head places section 3 of the contact-rail in electrical communication with the feeder-main, the current passing through the wires F^2 to the plug-block F', through the wires F to the primary contact-fingers B^7, across the switch-head B^4, through the secondary fingers B^8, through the wires F^5, through the plug cut-out F', through the wires F^6, connecting with the contact-rail by means of the connecting-block F^7, secured within the channel of said rail. The car completes the circuit with the dynamo at the power-station through its contact-shoes G^4, its controller G^2, its motors G', its wheels, and the traction-rails A. The oscillation of the switch-head B^4 also rotated the restoring-disk C, which is secured to the shaft B^3, but, like the switch-head B^4, is insulated from said shaft. The rotation of said restoring-disk moves the contact-plate C^2 into contact with the spring-finger C^7 and also moves the contact-plate C' into contact with the spring-fingers C^5 and C^6. When the secondary fingers B^8 are supplied with current from the feeder-main, a current passes through the wire x to the contact-plate C^2, through the contact-finger C^7, through the wire x', and, as illustrated in Fig. 1^a, passes from the switching device b of section 3 to the fingers C^5 and C^6 of both switching devices (a and b) of section 2, also to the finger C^7 of the switching device a in section 1. From this description it will be understood that the circuit for operating the restoring device is in shunt relation to the main circuit. As the car in traversing section 2 set only the switching device b at the head of said section, said switching device only is restored. If the car had moved in contrary directions at opposite ends of said section 2 and had set both switching devices a and b of said section, the movement of the switching device b would restore both switching devices a and b of section 2. Had the car entered section 2 and by moving in contrary directions at opposite ends of said section set both switching devices a and b of said section 2 and then departed from said section 2 into section 1, the wiring from the restoring-disk C in the switching device a of section 1 is calculated to restore both switching devices a and b of section 2.

The course of the electric current in passing through the restoring-circuits is secondary fingers B^8, wire x, contact-plate C^2, contact-finger C^7, wiring x' to one or more adjacent switching devices, and therein wire y, solenoid, contact-finger C^5, contact-plate C', contact-finger C^6, wire y', resistance-rod E', wire y^2 to return-wire or traction-rails A. It is understood that the circuit is complete to secondary fingers B^8 from the feeder-main F^3 by wires F^2, plug cut-out F', wires F, primary contact-fingers B^7, and switch-head B^4.

I claim as my invention—

1. In an electric railway, in combination, a feeder-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 oscillatory upon a vertical center and having a connection with said movable contact-rail, whereby said switch device is mechanically set by the movement of said movable rail.

2. In an electric railway, in combination, a feeder-main; and a contact-rail made up of a plurality of blocks, each block comprising a fixed contact-rail, a movable contact-rail, a switch device oscillatory upon a vertical center and having a connection with said movable contact-rail, whereby said switch device is mechanically set by the movement of said movable rail, and means for electrically restoring said switch device to a position of rest.

3. In an electric railway, in combination, a feeder-main; and a contact-rail made up of a plurality of blocks, each block comprising a switch-head oscillatory upon a vertical center, a circuit in shunt to said switch-head, a restoring device in said shunt-circuit, and mechanical means for oscillating said switch-head.

4. In an electric railway, in combination, a feeder-main; and a contact-rail made up of a plurality of blocks, each block comprising a switch-head, oscillatory upon a vertical cen-

chanically set by the movement of the movable rail, a restoring-switch adapted to be actuated by said switch device, a solenoid in circuit with said switch, a core for said solenoid, and a mechanical connection between the core and the movable rail for moving said device to restore the power-circuit to a deënergized condition.

18. In an electric railway, in combination, a feeder-main; and a contact-rail made up of a plurality of blocks, each block comprising a fixed contact-rail, a movable contact-rail, an oscillatory switch device adapted to be mechanically set by the movement of the movable rail, a restoring-switch adapted to be actuated by said switch device, a solenoid in circuit with said switch, a core for said solenoid, an arm for supporting said core, a rod connected with said arm, pivotal links for suspending the movable contact-rail, a bell-crank lever, and a connecting-rod for connecting one of said pivotal links with said bell-crank lever.

19. In an electric railway, in combination, a feeder-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, said switch device comprising an oscillatory shaft, a switch-head fixed on said shaft but insulated therefrom, a contact-finger in electric connection with said feeder-main adapted to contact said switch-head, a contact-finger in electric connection with said contact-rail also adapted to contact said head, an insulating-block in said head for carrying one of said fingers, an arm fixed to said shaft, and mechanical means actuated by said movable contact-rail for oscillating said shaft.

20. In an electric railway, in combination, a feeder-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, said switch device comprising an oscillatory shaft, a switch-head on said shaft, a contact-finger in electric connection with said feeder-main adapted to contact said switch-head, a contact-finger in electric connection with said contact-rail also adapted to contact said head, an arm fixed on said shaft, and a pivoted lever adapted to be moved by said movable contact-rail for moving said arm.

21. In an electric railway, in combination, a feeder-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, said switch device comprising an oscillatory shaft, a switch-head on said shaft, two insulating-blocks inserted in said switch-head on opposite sides thereof, a contact-finger in electric connection with said feeder-main adapted to contact said switch-head, a contact-finger in electric connection with said contact-rail also adapted to contact said switch-head, an arm fixed on said shaft, a rod pivotally connected with said arm, pivotal links for sustaining said movable contact-rail, a pivoted bell-crank lever, and a connecting-rod for connecting one of said links with said bell-crank lever.

22. In an electric railway, in combination, a feeder-main; and a contact-rail made up of a plurality of blocks, each block comprising a fixed contact-rail, a movable contact-rail, a switch-head oscillatory upon a vertical center, a circuit in shunt to said switch-head, a restoring device in said shunt-circuit, and mechanical means for oscillating said switch-head.

23. In an electric railway, in combination, a feeder-main; and a contact-rail made up of a plurality of blocks, each block comprising a fixed contact-rail, a movable contact-rail, a switch-head oscillatory upon a vertical center, a circuit in shunt to said switch-head, a restoring device in said shunt-circuit, and a mechanical connection between the movable rail and said switch-head for oscillating the latter.

24. In an electric railway, in combination, a feeder-main; and a contact-rail made up of a plurality of blocks, each block comprising a fixed contact-rail, a movable contact-rail, an oscillatory switch-head, a circuit in shunt to said switch-head, a restoring device in said shunt-circuit, and a mechanical connection between the movable rail and said switch-head for oscillating the latter, which mechanical connection comprises a connecting-rod, a crank-arm and a sliding rod.

25. In an electric railway, in combination, a feeder-main; and a contact-rail made up of a plurality of blocks, each block comprising a fixed contact-rail, a movable contact-rail, a switch-head oscillatory upon a vertical center, a circuit in shunt to said switch-head, a restoring-switch and a solenoid in said shunt-circuit, a core for said solenoid, and mechanical means for oscillating said switch-head.

26. In an electric railway, in combination, a feeder-main; and a contact-rail made up of a plurality of blocks, each block comprising a fixed contact-rail, a movable contact-rail, an oscillatory switch-head, a circuit in shunt to said switch-head, a restoring-switch and a solenoid in said shunt-circuit, a core for said solenoid, said core being adapted to be moved with said switch-head, and mechanical means for moving said switch-head.

27. In an electric railway, in combination, a feeder-main; and a contact-rail made up of a plurality of blocks, each block comprising a fixed contact-rail, a movable contact-rail, an oscillatory switch-head, a circuit in shunt to said switch-head, a restoring-switch and a solenoid in said shunt-circuit, a core for said solenoid, an arm for supporting said core, which arm is fixed with relation to the switch-head, and mechanical means adapted to be actuated by a passing car for oscillating the switch-head.

28. In an electric switch device, in combination, a main circuit normally open; a switch-head oscillatory upon a vertical center for

ter, a circuit in shunt to said switch-head, a restoring-switch and a solenoid in said shunt-circuit, a core for said solenoid, and mechanical means for oscillating said switch-head.

5. In an electric railway, in combination, a feeder-main; and a contact-rail made up of a plurality of blocks, each block comprising a switch-head oscillatory upon a vertical center, a circuit in shunt to said switch-head, a restoring-switch and a solenoid in said shunt-circuit, a core for said solenoid, said core being adapted to be moved with the switch-head, and mechanical means for oscillating said switch-head.

6. In an electric railway, in combination, a feeder-main; and a contact-rail made up of a plurality of blocks, each block comprising a switch-head oscillatory upon a vertical center, a circuit in shunt to said switch-head, a restoring-switch and a solenoid shunt-circuit, a core for said solenoid, an arm for supporting said core, which arm is fixed with relation to said switch-head, and mechanical means adapted to be actuated by a passing car for oscillating said switch-head.

7. In an electric railway, in combination, a feeder-main; and a contact-rail made up of a plurality of blocks, each block comprising a fixed contact-rail, a movable contact-rail, a switch-head oscillatory upon a vertical center, adapted to be mechanically set by the movement of the movable rail, means for electrically restoring the switch-head of another block to a position of rest, and mechanical means for actuating said setting means and said restoring means.

8. In an electric railway, in combination, a main circuit; and a contact-rail made up of a plurality of blocks, each block comprising a fixed contact-rail, a movable contact-rail, a switch-head oscillatory upon a vertical center, adapted to electrically incorporate one of said blocks in said main circuit, a circuit in shunt to said switch-head, a restoring-switch and a solenoid in said shunt-circuit; and mechanical means for oscillating said switch-head.

9. In an electric railway, in combination, a feeder-main; and a contact-rail made up of a plurality of blocks, each block comprising a fixed contact-rail, a movable contact-rail, a switch-head oscillatory upon a vertical center, adapted to be mechanically set by the movement of the movable rail, and means for electrically restoring said switch-head to a position of rest.

10. In an electric railway, in combination, a feeder-main; and a contact-rail made up of a plurality of blocks, each block comprising a fixed contact-rail, a movable contact-rail, a switch-head oscillatory upon a vertical center, adapted to be mechanically set by the movement of the movable rail, and a solenoid for electrically restoring said switch-head to a position of rest.

11. In an electric railway, in combination, a feeder-main; and a contact-rail made up of a plurality of blocks, each block comprising a fixed contact-rail, a movable contact-rail, a switch-head oscillatory upon a vertical center, adapted to be mechanically set by the movement of the movable rail, means for electrically restoring said switch device to a position of rest, and means operated by each movable rail for actuating the restoring means in another block.

12. In an electric railway, in combination, a feeder-main; and a contact-rail made up of a plurality of blocks, each block comprising a fixed contact-rail, a movable contact-rail, an oscillatory switch-head, a crank-arm for oscillating said head, and a mechanical connection between the crank-arm and the movable rail.

13. In an electric railway, in combination, a feeder-main; and a contact-rail made up of a plurality of blocks, each block comprising a fixed contact-rail, a movable contact-rail, an oscillatory shaft, a switch-head fixed on said shaft, an arm also fixed on said shaft, a sliding rod pivotally connected with said arm, and means adapted to be actuated by the movement of said movable rail for sliding said rod and oscillating said shaft.

14. In an electric railway, in combination, a feeder-main; and a contact-rail made up of a plurality of blocks, each block comprising a fixed contact-rail, a movable contact-rail, an oscillatory shaft, a switch-head fixed on said shaft, an arm also fixed on said shaft, a sliding rod pivotally connected with said arm, and a bell-crank lever having a connecting-rod connection with said movable rail, one arm of which bell-crank lever is adapted to impinge upon said sliding rod to oscillate said shaft and said switch-head.

15. In an electric railway, in combination, a feeder-main; and a contact-rail made up of a plurality of blocks, each block comprising a fixed contact-rail, a movable contact-rail, an oscillatory switch-head, a crank-arm for oscillating said head, pivotal links for supporting said movable rail, a bell-crank lever having a connecting-rod connection with one of said pivotal links, and a sliding rod extending between one arm of said bell-crank lever and said crank-arm.

16. In an electric railway, in combination, a feeder-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, said switch device comprising an oscillatory shaft, a switch-head on said shaft, a contact-finger in electric connection with said feeder-main adapted to contact said switch-head, a contact-finger in electric connection with said contact-rail also adapted to contact said head, means for insulating one of said fingers from said head, and means for mechanically oscillating said head.

17. In an electric railway, in combination, a feeder-main; and a contact-rail made up of a plurality of blocks, each block comprising a fixed contact-rail, a movable contact-rail, an oscillatory switch device adapted to be me-

closing said main circuit; a circuit in shunt to the break in said main circuit; a restoring device in said shunt-circuit; and mechanical means for oscillating said switch-head for said main circuit, which mechanical means comprises a connecting-rod, a crank-arm and a sliding rod.

29. In an electric switch device, in combination, a main circuit normally open; a switch-head oscillatory upon a vertical center for closing said main circuit; a circuit in shunt to the break in said main circuit; a restoring-switch and a solenoid in said shunt-circuit; a core for said solenoid; and mechanical means for oscillating said switch-head, which mechanical means comprises a connecting-rod, a crank-arm and a sliding rod.

30. In an electric switch device, in combination, a main circuit normally open; a circuit-closer for said main circuit, which circuit-closer comprises a switch-head oscillatory upon a vertical center; a circuit in shunt to the break in said main circuit; a restoring-disk, contact-fingers for said disk, and a solenoid in said shunt-circuit; and a mechanical connection between the oscillatory switch-head and a means moved by the contact-shoe of a car, which mechanical connection comprises a connecting-rod, a crank-arm and a sliding rod.

31. In an electric switch device, in combination, a main circuit normally open; a circuit-closer for said main circuit; a circuit in shunt to the break in said main circuit; a restoring-switch and a solenoid in said shunt-circuit; a core for said solenoid, said core being adapted to be moved with the circuit-closer for the main circuit; and mechanical means for moving said circuit-closer.

32. In an electric switch device for electric railways, in combination, a main circuit normally open; a circuit-closer for said main circuit; a circuit in shunt to the break in said main circuit; a restoring-switch and a solenoid in said shunt-circuit; a core for said solenoid; an arm for supporting said core, which arm is fixed with relation to the circuit-closer for the main circuit; and mechanical means adapted to be actuated by a passing car for moving the circuit-closer for the main circuit.

33. In an electric switch device, in combination, an oscillatory shaft; a switch-head and a restoring-disk fixed on said shaft; main-circuit contact-fingers for said switch-head; means for insulating said contact-fingers from said switch-head; shunt-circuit contact-fingers for said restoring-disk; and mechanical means for moving said switch-head in one direction.

34. In an electric switch device, in combination, an oscillatory shaft; a switch-head and a restoring-disk fixed on said shaft; main-circuit contact-fingers for said switch-head; means for insulating said contact-fingers from said switch-head; shunt-circuit contact-fingers for said restoring-disk; an arm fixed on said shaft; and a sliding rod pivotally connected with said arm.

35. In an electric switch device, in combination, an oscillatory shaft; a switch-head and a restoring-disk fixed on said shaft; main-circuit contact-fingers for said switch-head; means for insulating said contact-fingers from said switch-head; shunt-circuit contact-fingers for said restoring-disk; an arm fixed on said shaft; a sliding rod pivotally connected with said arm; a solenoid; and a core for said solenoid fixed on said arm.

36. In an electric switch device, in combination, an oscillatory shaft; a switch-head and a restoring-disk fixed on said shaft; main-circuit contact-fingers for said switch-head; means for insulating said contact-fingers from said switch-head; shunt-circuit contact-fingers for said restoring-disk; an arm fixed on said shaft; a solenoid; and a core for said solenoid fixed on said arm.

37. In an electric switch, in combination, a movable surface of insulating material; a contact-plate on said surface; a contact-finger adapted to contact said surface and said contact-plate; a guide-finger secured to said surface and curved over said contact-plate, said guide-finger being offset from said surface and having an opening in said offset portion; said contact-finger having a pin adapted to pass through said opening when the insulating-surface is moved in one direction relative to said finger and to ride up on said guide-finger when said surface is moved in the opposite direction.

38. In an electric switch, in combination, an oscillatory shaft; a switch-head and a restoring-disk fixed on said shaft, said restoring-disk being provided with contact-plates and having an offset inclined guide-finger with an opening in its offset portion; main-circuit contact-fingers for said switch-head; means for insulating said contact-fingers from said switch-head; shunt-circuit contact-fingers for said restoring-disk, one of said contact-fingers being provided with a pin adapted to enter the opening in said inclined guide-finger when the restoring-disk is rotated in one direction and to ride up on said inclined surface when the disk is rotated in the contrary direction; and mechanical means for moving said switch-head in one direction.

39. As a means for actuating a switch device for electric railways, in combination, a movable contact-rail; pivotal links for supporting said rail; a pivoted bell-crank lever; a connecting-rod extending between one of said pivoted links and one of the arms of said bell-crank lever; and a rod adapted to be moved by said bell-crank lever, said rod having an operative engagement with a switch to move the latter.

ED WILSON FARNHAM.

Witnesses:
GRACE L. WOODBURY,
L. L. MILLER.