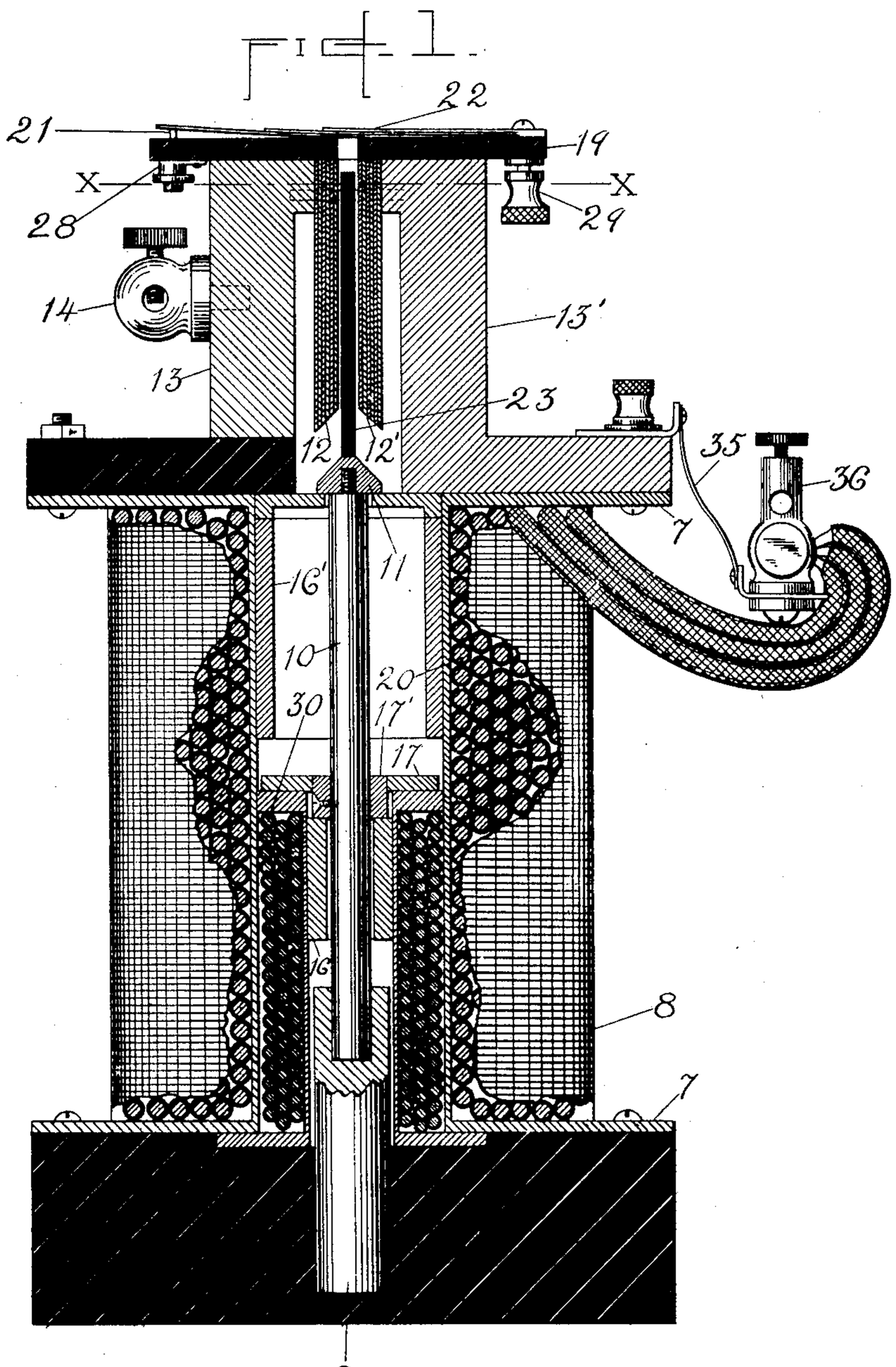
No. 750,966. PATENTED FEB. 2, 1904.

J. H. GUEST.

SURFACE CONTACT ELECTRIC RAILWAY.

APPLICATION FILED FEB. 26, 1903.

NO MODEL. 3 SHEETS—SHEET 1.



WITNESSES:

C. A. Fischer Jr.

E. L. Lawler

INVENTOR

John H. Guest.

BY

Townsend & Dickerson

ATTORNEYS

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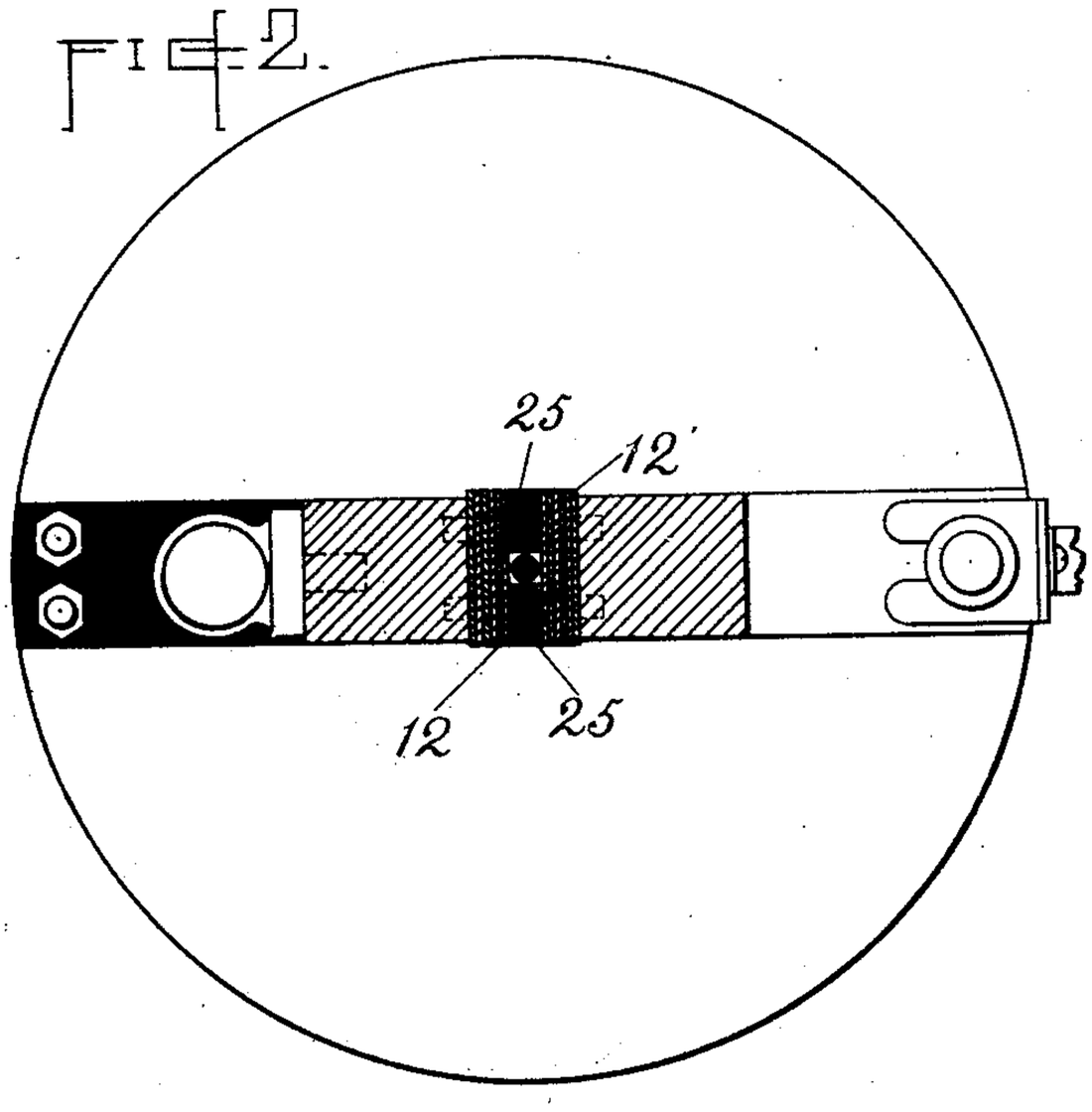
NO MODEL. 3 SHEETS—SHEET 2.

FIG. 2.



WITNESSES:

C. F. Riechmann Jr.

E. L. Lawler

INVENTOR

John H. Guest.

BY

Townsend & Dickson

ATTORNEYS

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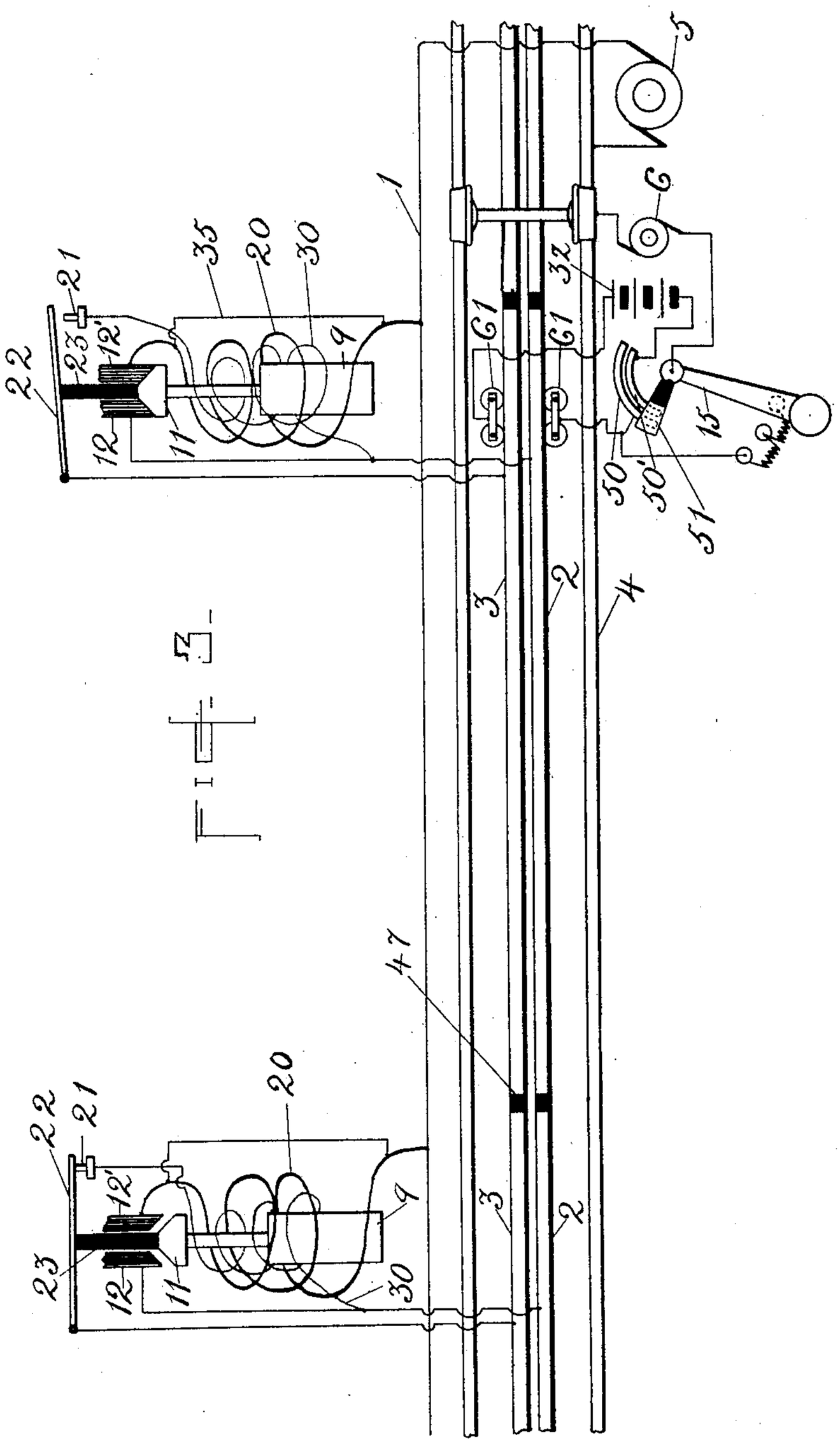

WITNESSES:

C. C. Fischer Jr.

E. L. Lawlek.

INVENTOR

John H. Guest

BY

Townsend & Decker

ATTORNEYS

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UNITED STATES PATENT OFFICE.

JOHN H. GUEST, OF BROOKLYN, NEW YORK.

SURFACE-CONTACT ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 750,966, dated February 2, 1904.

Application filed February 26, 1903. Serial No. 145,198. (No model.)

To all whom it may concern:

Be it known that I, JOHN H. GUEST, a citizen of the United States, and a resident of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Surface-Contact Electric Railways, of which the following is a specification.

My invention relates to the construction of electric switches employed in those systems of electric propulsion wherein power is supplied to a vehicle over sectional rails, buttons, or conductors which are normally dead, but are energized in turn as the car or vehicle passes over them.

My invention relates more particularly to those systems wherein each switch is subjected to the action of two coils, one of which is an initially-acting coil and places the switch in a position to close the power-circuit through another coil which carries the heavy power-current or a portion thereof and keeps the switch in closed position until the car leaves the section. In this class of apparatus the initially-acting coil is usually connected to the circuits in such manner as to be subjected to practically the whole potential of the power-current, either for the purpose of initially actuating the switch or as a necessary incident to the organization after the switch has been closed. Hence it is necessary to make the circuit of said initially-acting coil of very high resistance, which is usually done by winding such coil of fine wire with a large number of turns. Previous constructions of this class of apparatus are also frequently subject to the objection that by short-circuiting some of the conductors or rails on the permanent way the switch will be operated and the section of power-circuit rendered alive, with consequent possibility of destruction to life or property.

The object of my invention is mainly to overcome both of the above objections, making it possible to use a comparatively coarse coil for the initial coil and at the same time to avoid the danger of accidental operation of the switch.

To these ends my invention consists, essentially, in employing two lines of insulated section of conductor, which may be either buttons or rails, and in using one both as a power-circuit conductor and as a means operating in conjunction with the other rail or section of rail or conductor to complete the circuit through the initially-acting coil from a suitable generator, such as a battery, which is independent of the power-generator and which is preferably carried on the car, all as hereinafter more particularly described and then specified in the claims.

The invention consists in the novel features of construction and the combinations of apparatus, as hereinafter more particularly described and then specified in the claims.

In the drawings, Figure 1 is a general vertical section of the electromagnet-switch, the part of the power-circuit coil being shown in elevation. Fig. 2 is a cross-section through the switch on the line x x, Fig. 1. Fig. 3 is a general diagram of the circuits of the apparatus, showing the switches for two adjoining sections of rail, one in action and the other out of action.

Referring to Figs. 1 and 2, the switch-electromagnet is a double-wound magnet, one set of coils 20 of which are of heavy wire suitably secured between spool-heads 7, as shown, and adapted to carry the power-current. 30 indicates the initially-acting coils, which may be located within the shell 8, as shown, or otherwise disposed and may be of any number of turns or gage of wire adapted to the comparatively low potential of a local source independent of the power-current. The two sets of coils are adapted to operate upon the core 9, so as to raise the same first by the action of the set of coils 30, which raise the core sufficiently to complete the power-circuit through the exterior coils, after which the switch is held in position to keep said connection completed until the car passes off the section of rails temporarily energized. Connected with the core 9 is a stem or rod of aluminium or other non-magnetic material 10, and at the upper end thereof is mounted the contact-block 11, of copper or other good conductor, which is adapted when the rod is raised to engage between the beveled ends of two laminated brushes 12 12′, which are made of copper. When these two brushes are

bridged by the block 11, the power-circuit is complete through the outer or heavy coil, as shown more clearly in the diagram Fig. 3. The laminated brushes 12 are supported between the two heavy conducting-blocks of brass or other good conductor 13 13′. One of these blocks, 13′, may be secured to and in direct electrical connection with the brass spool-head 7, and one terminal of the power-coil may be in electrical connection with said spool-head, and hence with the block 13′ and the laminated brush 12′, which, together with its associate brush 12, is fastened between the blocks 13 13′ and partially sustained in position by suitable insulating-pins. (Shown in dotted lines in Figs. 1 and 2.) The other block 13 is secured to a piece of insulation fastened upon the spool-head 7 and is provided with suitable binding-posts 14 for attachment of the wire or conductor, by which it may be joined to the section of normally insulated sections of conductor 2, as shown in the diagram, from which the circuit continues in the usual manner by a suitable brush or collector to and through the power-controller 15 and the motor 6 to the car wheels and axles and the rails 4, which form the return-circuit to the power-generator 5. The usual feed-wire or conductor 1 is connected to the opposite pole of said generator, and from said feed-wire the connections are taken to the opposite terminal of the power-coil 20 for the electric switch, as also shown in the diagram, the other terminal being connected, as already described, to the block 13′. Within the spool for the inner or initially-acting coil 30 is the cylinder 16, of iron, whose office is to strengthen the pull of the solenoid-coils upon the core 9, and within the cylindrical spool upon which the power-coil 20 is wound is another iron cylinder 16′, placed in position to act upon the disk armature 17, which is carried by a brass sleeve 17′, fastened to the rod 10. When the core 9 is raised by the action of the solenoid 30, the disk armature 17 is brought into proximity to the cylinder 16′, and the circuit of the power-coil having been closed at the leaf-springs 12 12′ by the block or conductor 11 the said armature 17 will be strongly held up by the action of the cylinder 16′, and thus keep the conductor firmly engaged with the ends of the laminated springs 12 12′. It will be seen that owing to the beveling of the ends of the brushes 12 12′ and the inclination of the contact-faces of the block 11 the latter will enter between the springs by a wedging and spreading action, and each leaf of the leaf-springs will be firmly engaged individually by the contactor 11, and each will carry its portion of the current.

The circuit for the initial coil or cylinder-coil 30 is through the normally closed switch adapted to be opened by the direct action of the core 9 when raised by the operation of said initially-acting coil 30, thus breaking the circuit of the battery or independent source of power used for securing this initial action, said battery-circuit remaining broken so long as the core 9 is held raised by the action of the power-current flowing through the laminated brushes 12 12′ and contact-block 11. The switch or circuit breaker which thus opens the circuit for said battery is preferably mounted upon a block of insulation 19, supported upon the blocks 13 13′ and carrying, as shown, a contact 21, normally engaged by the circuit-closing springs 22. The springs 22 extend across the plate 19 of insulation and over an opening therein, through which they may be engaged by a rod 23, preferably of insulating material, which extends vertically from the rod 10 or contact-piece 11, as shown, upward through a space in a separate insulating-plate 25, located, as shown in Fig. 2, between the pair of leaf-springs 12 12′. The spring 22 being normally connected, as shown, to the conductor 3 of the other line of sectional conductors, as shown in Fig. 3, it will be obvious that normally or when the spring 22 is on the stop 21, as shown in the diagram, there will be a circuit through the initially-acting coil from one to the other of the insulated conductors 3 2 in the two lines of normally insulated sections of conductors, and so that by bridging said conductors in a suitable manner through a source of electric power the coil 30 will act on the switch and complete the connection already described for the power-current. For the purpose of making connection from the spring 22 to the conductor 3 a clamping device 29 may be provided to form the connection from the contact 21 to one end of the initially-acting coil. A suitable collector or trolley 61 rides on the rail of conductor 3 and establish connection from one pole of the battery or generator 32, which is preferably carried on the car and has its other pole connected with the trolley or collector moving on the sectional power-rail 2, so that when the car reaches a section of rails 2 3 the circuit of said battery 32 through the coil 30 will be closed, and the core 9 will be raised so as to establish the power-circuit connection, as shown at the right of the diagram Fig. 3, and at the same time break the initially-energizing circuit containing the battery 32 at the contact 21, as shown at the right of the figure.

The power-winding 20 is preferably constructed with two or more strands wound in parallel, and to further assist in carrying the heavy current required for the motor 6 of the car I propose to provide a shunt around said power-coil, said shunt being adapted to carry a part of said heavy power-current, a portion of which only is required for energizing the coil 20. Said shunt is indicated at 35 (diagram Fig. 3 and also in Fig. 1) by a strip of fuse-wire, which may be clamped at one end to the base of the block 13′, as shown, and at

the other to a suitable clamp post or connector 36, to which one end of the power-coil 20 is connected. Said post 36 may serve as a means for attachment of the conductor which joins the coil to the feed-wire 1.

By preference the circuit of the battery is taken through a switch or circuit-breaker properly connected with the power-controller 15 in such manner that when said power-controller 15 is thrown to cut off the power the circuit of the battery 32 will also be automatically broken. By this means the vibratory action of the circuit-breaker spring 22, coöperating with contact 21, will be prevented in case the car should be brought to rest on any section of the track; otherwise it is obvious that when the power is cut off the coil 30, acting on the core 9 and on the circuit-breaker 22, would produce a vibratory action similar to that of an automatic circuit-breaker, and there would be also a useless consumption of the power of source 32. The means for thus breaking the circuit when the power is turned off may consist of a pair of contact-plates 50 50′, adapted to be bridged by circuit-closing plate 51, carried on an insulating-arm of the power-controller 15, as clearly shown in the diagram. When plate 50′ is connected to the battery 32 and the other plate 50 is connected to the trolley or collector moving on the supplemental rail 2, the parts are so arranged that when the controller 15 is moved sufficiently to cut off the power the plate 51 will leave the bars 50 50′ and open the circuit; but when the controller is turned to put on the power the circuit of the battery will be closed by the connector 51 and will continue to be closed during the manipulation of the controller and while the connector 51 slides over the segments 50 50′.

The operation of the apparatus is as follows: It will be understood that, as usual in the art, each insulated section of conductor 2 and 3 is provided with its automatic switch constructed as already described and that said sections may each be of any desired length. It will be also understood that the collector wheels or shoes which ride on said sections of rail are of suitable length to bridge the space between the successive sections of rail 2 or 3 and that while I have shown rails said conductor-sections might be buttons and the trolley's collectors or contact-shoes be suitably lengthened to form a bridge from one to the other of two successive buttons, as well understood in the art. In the diagram Fig. 3 the switch at the left of the figure is shown in normal position. That at the right is shown in action, and in conjunction with it the circuits upon the car are illustrated, the power-controller 15 being in position to permit power-current to flow through the motor 6. In the switch at the left of the figure the normal circuit for the initially-operating coil 30 is through the contact 21 and spring 22 of the circuit-breaker which is actuated by the core 9, and said circuit is normally open between the two rails of contacts 2 and 3. It will be observed that under these conditions no accidental short circuit of any of the conductors shown in the system will produce an action of the switch, since both terminals of the coil are in no way connected with the power-circuit nor with any generator by which current could be caused to flow through it. Moreover, even if current were flowing through the power-coil 20 from the conductor to one of the lines of sectional conductor there would be little difference of potential across the terminals of the coil 30 from the power-current, as will be seen by an examination of the parts at the right of Fig. 3, since the circuit, if traced, would be from conductor 2, through the coil 30, to the other rail 3, by collector 61, and back to that part of the power-circuit which is joined to the motor 6. Hence it is not necessary to use a high resistance. The circuit of the power-coil 20 is open between the leaf-springs 12 12′ and also at the contact rail or section 2. When the trolleys or collectors 61 engage the sectional contacts 2 3, as shown at the right of the figure, the initial controlling-circuit is completed and current flows from the battery or generator 32 to trolley or shoe 61, rail or contact 3, spring 22, contact 21, coil 30, rail 2, and thence by the other trolley or collector to and through the bars 50 50′ and connector 51 to the opposite pole of said battery. This charges the magnet and causes the core 9 to be lifted to position shown at the right of the figure, thus completing the power-circuit by the path from generator 5, feed-wire 1, through coil 20, circuit-closer 11, leaf-springs 12 12′, to the lower contact-rail 2, through the collector or trolley 61, and to and through the power-controller 15, and by way of the motor 6 and the car-wheels to the return rail or conductor 4 back to the battery. It will be observed that the instant this power-circuit is completed the initially-operating circuit which includes battery 32 is broken at the contact 21 and that said initial controlling-circuit will remain broken while the car is taking current from the section, the switch in the meantime remaining energized by the power-current flowing through the coil 20. Should a motorman when on any section bring his car to rest by throwing the controller 15 so as to cut off the power-current, it will be obvious that the core 9 would drop and circuit be opened at the contactor 11 through coil 20, so that the spring 22 would be allowed to close contact at 21, and in the absence of some special provision to prevent such action the circuit of the battery 32 will be completed and the core 9 would be immediately drawn up by the action of the coil 30, whose circuit would, however, be immediately broken by the operation of the rod 23 in engaging the spring 22. This would allow the core to drop again, and the action would be repeated, so

that there would be a vibratory action of the parts. The power of the battery 32 would thus be drawn upon to no useful purpose. This draft upon the power of the battery, however, is effectually prevented under such conditions by reason of the fact that when the power-controller 15 is thrown to cut off the power as just assumed the circuit of the battery 32 will be also broken by the circuit-breaker contact 51. Inasmuch as the battery 32 is in use but for an instant of time as the car enters each section, but little power is required and it becomes possible to use open-circuit batteries of the usual type and to obtain long service from it.

What I claim as my invention is—

1. In a sectional-contact electric railway, the combination substantially as described of two lines of normally insulated sections of conductor, an automatic electromagnetic switch having a power circuit-coil for holding the switch closed, an initially-acting coil whose terminals are connected respectively to insulated conductors of the said lines, a source of current on the car and a double trolley or collector for connecting said source to the said lines of conductors, and at the same time forming a connection from one of said lines of conductors to the motor on the car.

2. In a sectional-contact electric railway, an electromagnetic switch having a power-circuit coil and an initially-acting coil whose terminals are normally open-circuited at insulated conductors located respectively in two normally insulated lines of sectional conductor, a connection from the power-coil to a conductor in one of said lines of normally insulated sectional conductors, and two collecting devices bearing respectively on said lines of conductors and joined to opposite poles of a generator on the vehicle, and a motor on the car connected to a trolley or collector bearing on the conductor which is connected to the power-coil.

3. In a sectional-contact electric railway, the combination substantially as described, of a normally insulated conductor from which power-current is taken to the car, a supplemental insulated conductor or contact rail, an automatic switch having two coils one of which carries the power-current while the other carries the initially-acting current, connections from the two terminals of the latter coil to the power-conductor and a supplemental conductor respectively, a circuit-breaker in the circuit of said coil, means for acting upon the same when the switch is closed, a generator on the car and a double trolley or collector for connecting the two poles thereof to said conductors respectively to furnish current to the initially-acting coil and at the same time to furnish a power connection for the power-circuit coil when the switch is closed.

4. In a sectional-contact electric railway, a power-circuit closer comprising a number of laminated brushes beveled at their ends and a coöperating wedge-shaped contactor adapted to enter the spaces between said beveled ends in a direction parallel to the laminations and by a wedging action to separate the same so as to create a series of individual contacts.

5. In a switch for a sectional-contact electric railway, the combination substantially as described with the pair of leaf-springs and power-circuit closer engaging the same, of a circuit-breaker mounted above said leaf-springs and an actuating-rod for said circuit-breaker extending axially through the space between said leaf-springs.

6. The combination with the conductor-blocks 13, 13′, of the laminated spring-contacts 12, 12′, mounted between them, a circuit-closer 11 adapted to engage the end of said springs by an endwise motion parallel to the laminations, a spring 22 and coöperating contact 21 mounted upon but insulated from the blocks 13, 13′, and means connected with the circuit-closer or contactor 11 for actuating the spring 22.

Signed at New York city, in the county of New York and State of New York, this 24th day of February, A. D. 1903.

JOHN H. GUEST.

Witnesses:
J. GALLWITZ,
E. L. LAWLER.