No. 794,269. PATENTED JULY 11, 1905.

W. D. WOOLLEY.

AUTOMATIC ELECTRIC RAILWAY SWITCH.

APPLICATION FILED AUG. 3, 1904.

3 SHEETS—SHEET 1.

Fig. 1.

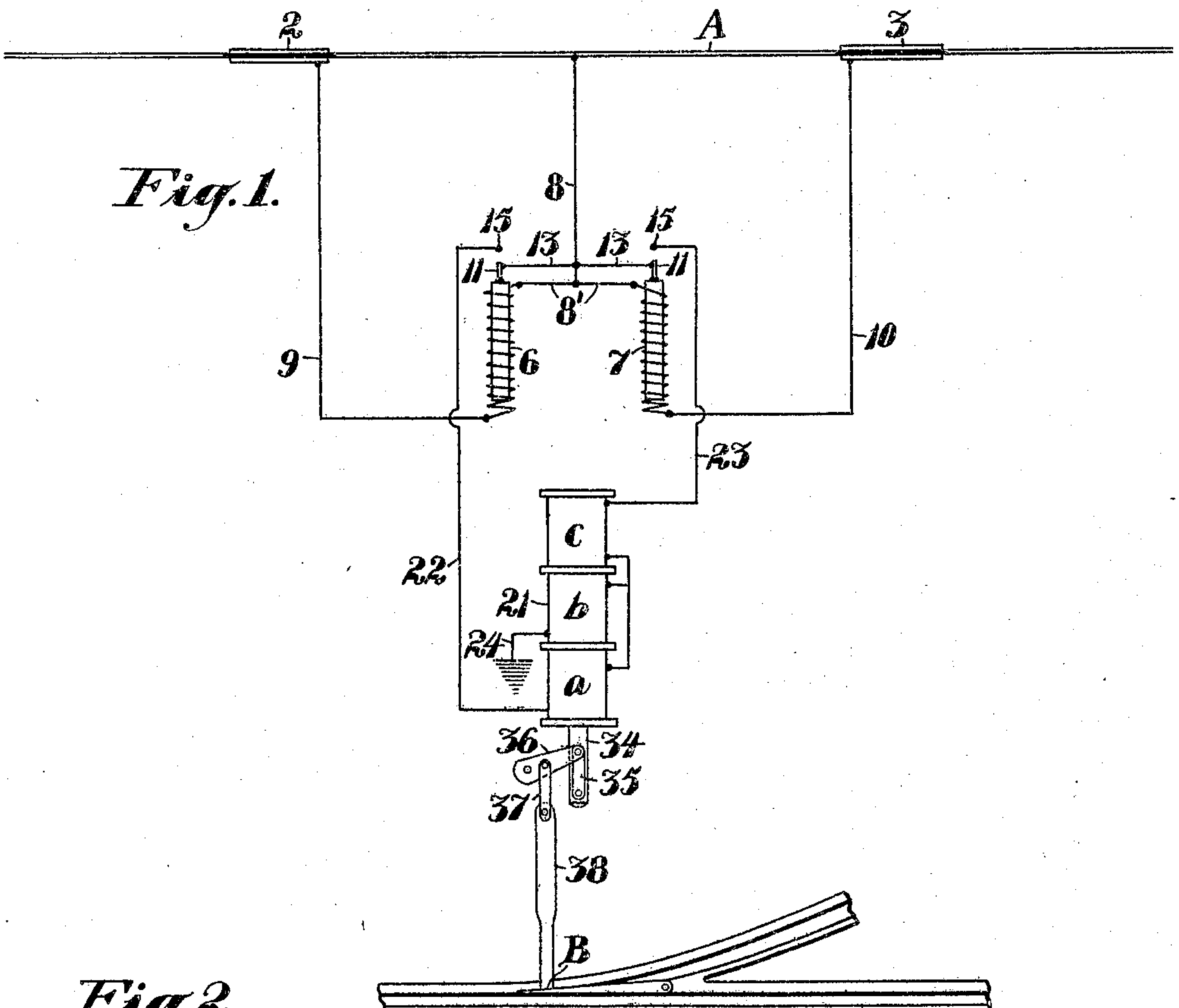


Fig. 2.

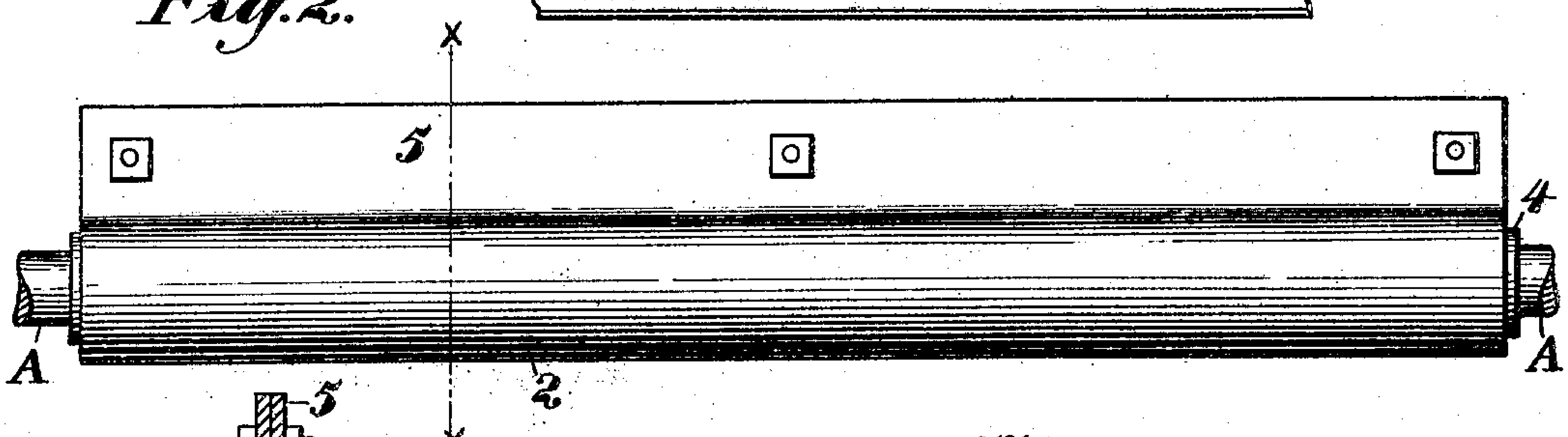


Fig. 3.

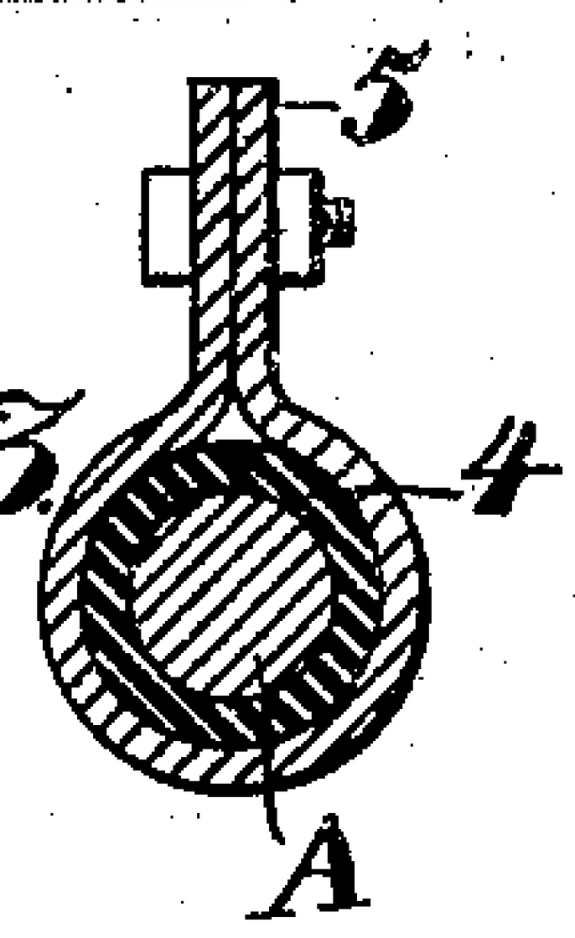
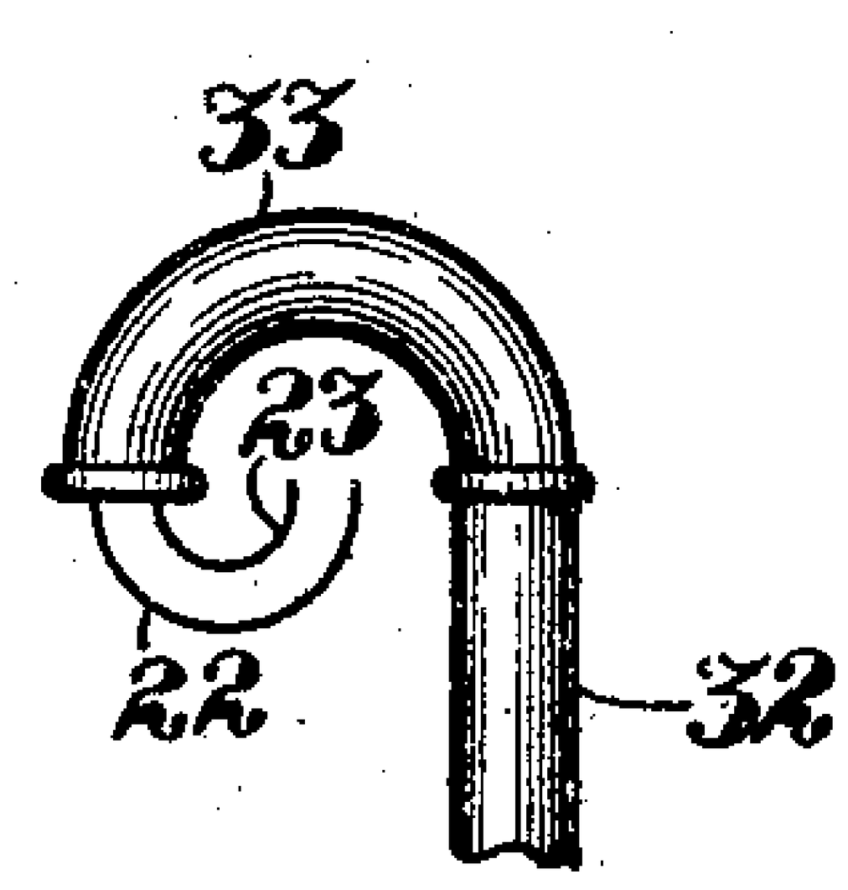


Fig. 4.



Witnesses:-

Inventor,

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3 SHEETS—SHEET 2.

Fig. 5.

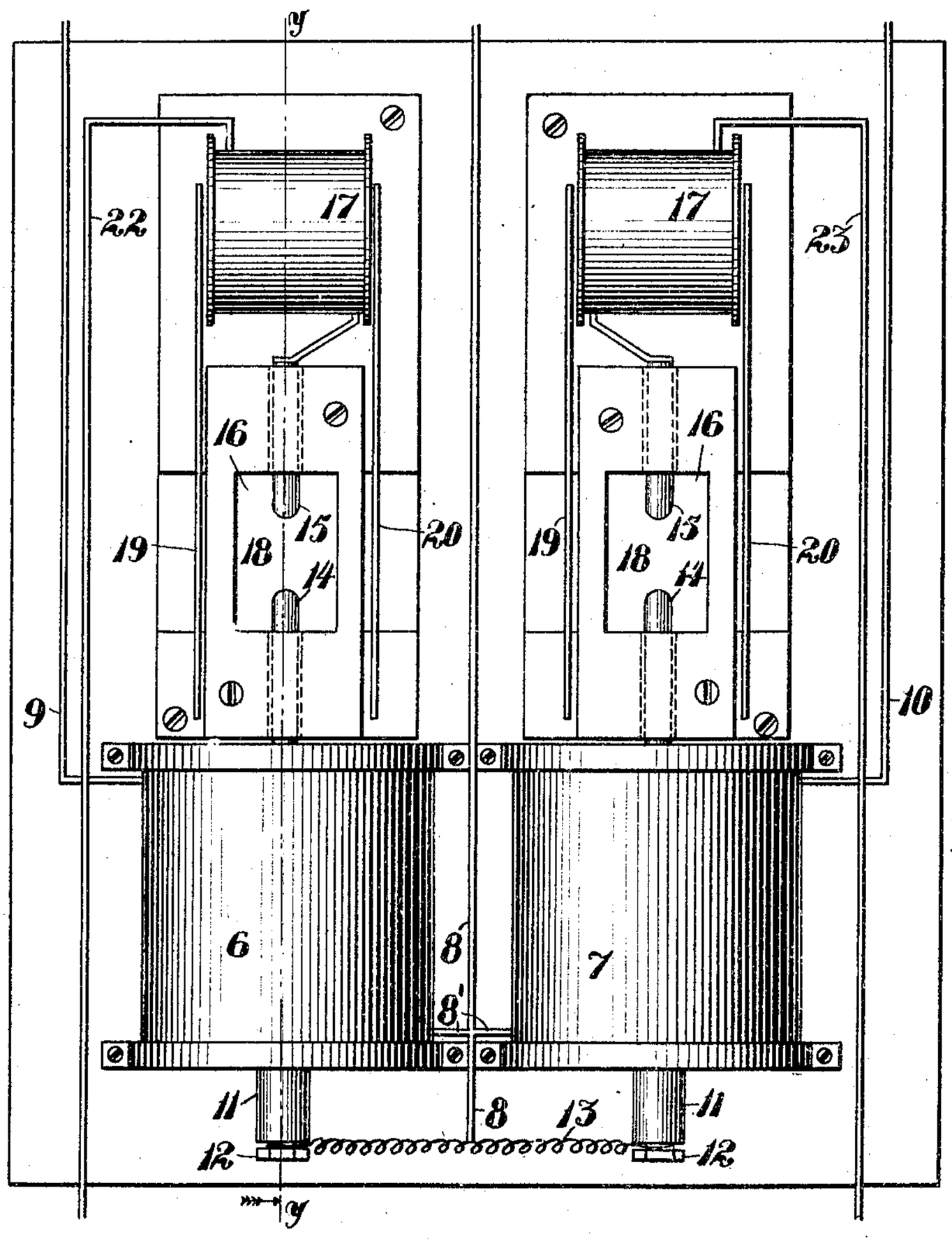
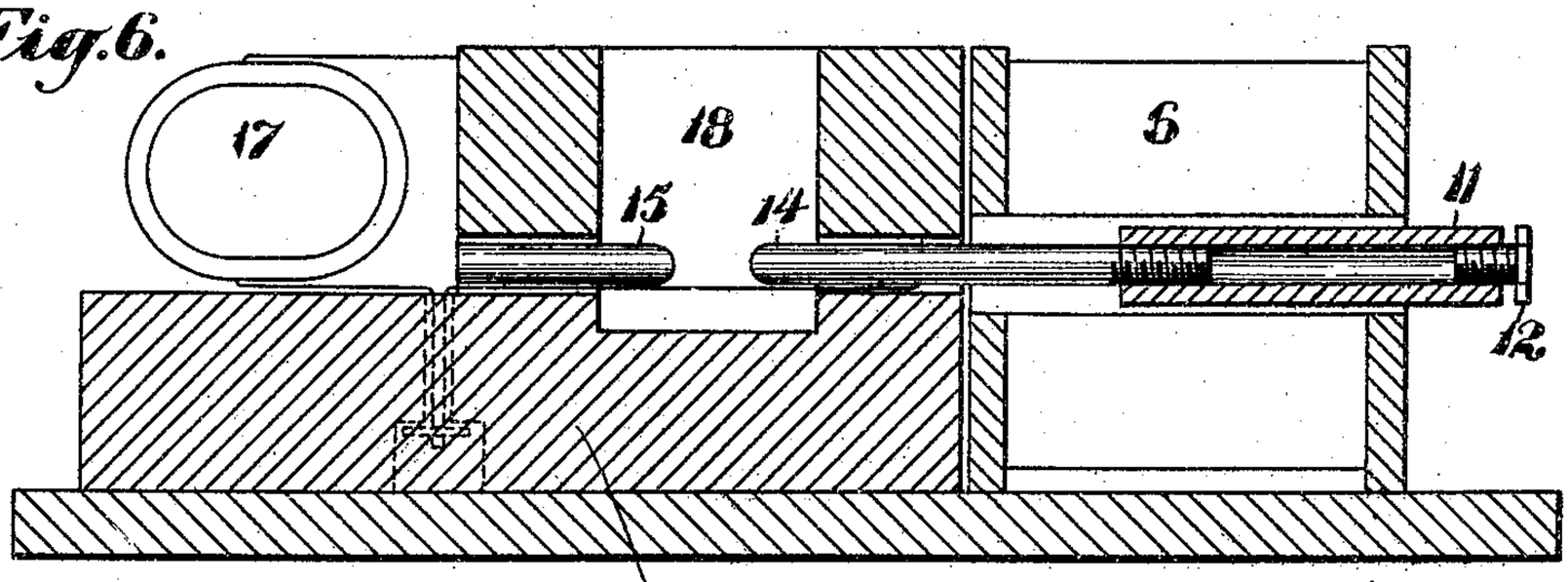


Fig. 6.



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3 SHEETS—SHEET 3.

Fig. 7.

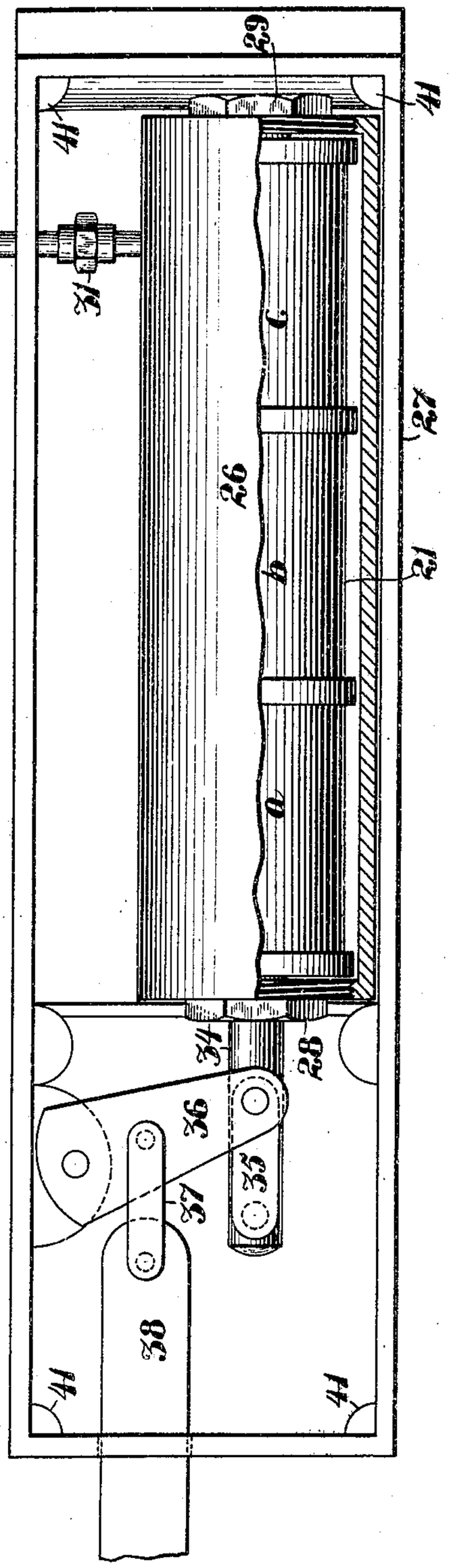
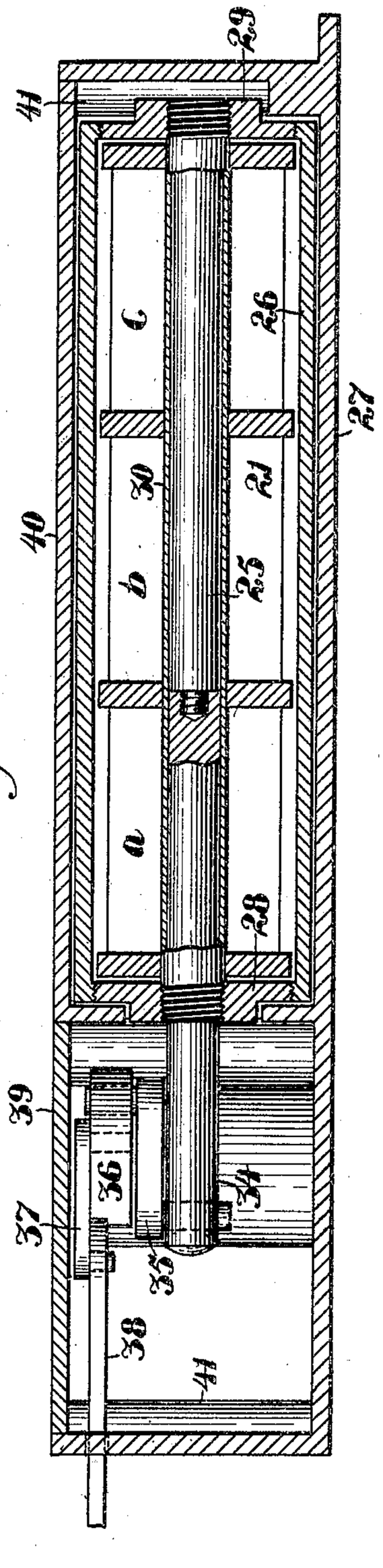


Fig. 8.



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UNITED STATES PATENT OFFICE.

WALTON D. WOOLLEY, OF NORMANDY, MISSOURI.

AUTOMATIC ELECTRIC RAILWAY-SWITCH.

SPECIFICATION forming part of Letters Patent No. 794,269, dated July 11, 1905.

Application filed August 3, 1904. Serial No. 219,304.

To all whom it may concern:

Be it known that I, WALTON D. WOOLLEY, a citizen of the United States, residing at Normandy, in the county of St. Louis and State of Missouri, have invented new and useful Improvements in Automatic Electric Railway-Switches, of which the following is a specification.

My invention relates to railway-switches, and particularly to such switches as are designed to be operated electrically from a moving car. Its object is to provide an electric railway-switch which will be simple in construction and operation, automatic, practical, and durable, and which will avoid any possibility of permanently grounding the main current from the trolley-wire.

The invention consists of the parts and the construction and combination of parts as hereinafter more fully described and claimed, having reference to the accompanying drawings, in which—

Figure 1 is a diagrammatic view illustrating my invention. Fig. 2 is a side view of a contact on the trolley-wire. Fig. 3 is a section on line *x x* of Fig. 2. Fig. 4 is a view showing means for excluding moisture from the solenoid-box. Fig. 5 is a plan view of the boxes on the pole. Fig. 6 is a section on line *y y*, Fig. 5. Fig. 7 is a plan view, in partial section, of solenoid and container with cover removed. Fig. 8 is a section through solenoid-box.

A represents the trolley-wire upon which are secured the contacts 2 3 at points suitably separated from each other and in advance of the switch-point B. Each of these contacts consists of a piece of sheet-iron or steel bent around the trolley-wire and insulated therefrom by suitable means, as a split fiber tube 4, the meeting edges of the metal sheet being bolted or otherwise suitably secured together above the wire to form a radial guide-flange, as 5. Any tendency of a contact to turn may thus be corrected by the passing trolley-wheel engaging the flange.

Suitably disposed on a pole or other support approximate to the switch are two electromagnets 6 7, properly housed from the elements. The coil of each magnet has one terminal connected with the trolley-wire by connections 8 8′. The other terminal of magnet 6 is connected with contact 2 by wire 9, and similarly magnet 7 is connected with contact 3 by wire 10. Each coil is herein represented as having a hollow reciprocal core 11, provided with suitable means, as the binding-post 12, for the attachment of a flexible connection 13 with wire 8. To the inner end of the core is secured a copper rod or contact 14, which is adapted to close the circuit between an opposed contact 15 on support 16 and the trolley-wire on the excitation of its respective solenoid 6 or 7. Contact 15 is connected with a blow-out coil 17, from which the current passes to the switch-operating mechanism in the ground. It is understood that each solenoid 6 7 has a core, an opposed contact, as 15, and a blow-out coil. To avoid any danger arising from sparking at the points 14 15, they are inclosed in a chamber 18, formed in support 16, and the chamber is provided with the opposed plates 19 20, these plates serving to nullify or destroy the spark by reason of the said plates being magnetized by the current in the coil 17.

The switch-operating mechanism in the ground includes a triple solenoid 21, divided into separately-wound parts *a b c*. One terminal of an end section, as *a*, is connected by wire 22, through a coil 17, with the contact 15, associated with magnet 6, and one terminal of the opposite end section *c* is connected by wire 23 with the contact 15, associated with magnet 7. These two end sections have their other terminals connected with a terminal of the central station *b*, while the free terminal of the latter is grounded, as shown at 24. Thus is formed a three-part or triple solenoid, wherein sections *a b* are adapted to coöperate as a double solenoid on the excitation of coil-magnet 6 to throw the core 25, which controls the switch, in one direction, and sections *c b* are adapted to coöperate similarly on the excitation of coil-magnet 7 to throw core 25 in the opposite direction. The solenoid 21 is incased in a box 26, adapted to be rendered water-tight. Box 26 in turn seats in an outer protecting-box 27. Box 26 is open at each end, the opening at one end being right threaded to

receive a perforated plug 28 and that at the other end left threaded to receive a similar plug 29. The perforations in both plugs are right threaded and each plug is adapted to screw over an end of the brass tube 30, on which the solenoid 21 is wound. In practice plug 29 is screwed onto the end of the tube 30 and then into its corresponding end of box 26. Head 28 is then screwed simultaneously onto tube 30 and into the box 26. The several wires from the solenoid having been passed through an opening in the side of box 26, the latter is filled with melted paraffin or other wax and the opening then closed by a union 31 between the box and pipe 32. The paraffin hardens and serves to entirely exclude moisture from the coil. The pipe 32, carrying the wires, extends through the outer box and its exposed end terminates in a half-turn 33, opening downward to exclude the rain that might otherwise follow the wires and penetrate to the interior of box 26. The core 25, which reciprocates in tube 30, has a non-magnetic extension 34, connecting by link 35 with a lever 36, which is connected by a removable link 37, and a rod 38 with the switch-point B, the boxes standing at right angles to the switch-point. The portion of box 27 unoccupied by the solenoid-box 26 affords a housing for the operating-lever 36 and its connections with the core and rod 38. The box 27 is closed by two removable cover-sections 39 40, supported on the studs 41. Access is had to the solenoid-box by removing cover 40. Access is had to the lever 36 or its immediate connections by removing cover 39.

The operation is as follows: As a car approaches the switch the motorman runs over one or the other of the contacts only with his power on, according as to whether he wishes to continue on the main track or to switch off onto a branch line. If he wishes to continue on the main track, he throws off his controller and coasts over contact 2, so that magnet 6 remains inert; but he turns on the current again before the trolley-wheel comes onto contact 3, so that on the closing of the circuit through magnet 7 the sections *b c* are excited to reciprocate the core 25 and draw the switch over into position. (Indicated in full lines, Fig. 1.) Thus it is noted that there are two circuits: first, a controlling-circuit—to wit, from the trolley-wire through wire 8, a connection 8′, magnet 7, wire 10, contact 3, through the car to ground; secondly, the controlled circuit—to wit, from the trolley-wire through wire 8, a connection 13, core 11 of magnet 7, its contact 15 and blow-out coil 17, wire 23 to sections *c b* to ground at 24. If it is desired to switch the car off from the main line, the motor-current is kept on while the car-trolley is passing over contact 2, which thus completes the controlling-circuit through magnet 6 and cuts in the controlled circuit to sections *a b*, causing a reciprocation of core 25 and a movement of the switch-point in an opposite direction to that just described. It will be observed that the switch is thrown in either direction by going over one or the other of the contacts 2 3 with the power on, and it is not necessary that the operator should see the switch-point.

The advantages of the foregoing construction are that the contacts 2 3 are very light, inexpensive, and self-adjusting. The trolley-wire does not have to be cut to put them on. They can be placed on a tightly-drawn or perfectly straight rigid wire, because no kink in the wire is necessary, no danger of grounding the main current, and no live wire enters the ground. The switch will not burn out, for the current never remains on more than an instant on any part of the device, as under ordinary conditions the car passes immediately over the contacts without stopping. If the car does stop, everything of course is dead. The construction of the inner box, the method of packing with paraffin, and the use of the return-bend 33 absolutely inhibits the access of moisture to the switch-solenoid.

The use of a three-part solenoid is advantageous over the ordinary double solenoid in the matter of economized space and wire-wrapping. While either end section and the central section coöperate as a double solenoid, the combined length of my solenoid need not exceed one and a half times the length of one part of an ordinary two-part solenoid.

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

1. In electric railway-switch mechanism, the combination with a trolley-wire and a switch, of two contact members upon the trolley-wire at separated points, an electromagnet associated with the switch, means operated by the magnet for throwing the switch in one direction or the other, electrical connections between the solenoid and trolley-wire and means including two solenoids each in series with the trolley-wire and a respective contact member, governing the flow of current between the trolley-wire and solenoid whereby the switch is thrown in one direction by the passage of the car-trolley over one of said contacts with the power on, and in the opposite direction by a similar passage of the car-trolley over the other of said contacts.

2. In an electric railway-switch, the combination with the trolley-wire and a switch, of a solenoid-magnet comprising three separately-wound sections, electrical connections between the several sections and with the trolley-wire, two separated insulated contacts on the trolley-wire and means including constantly-maintained electrical connections between the contacts and trolley-wire whereby on the passage of the car-trolley with the power on over one of said contacts an end section and the central section of said solenoid are excited, and

on the similar passage of the car-trolley over the other contact the other end section and the central section of the solenoid are excited.

3. In an electric railway-switch, the combination with the trolley-wire and a switch, of a solenoid-magnet comprising three separately-wound sections, electrical connections between the several sections and with the trolley-wire, two separated insulated contacts on the trolley-wire and means whereby on the passage of the car-trolley with the power on over one of said contacts an end section and the central section of said solenoid are excited, and on the similar passage of the car-trolley over the other contact the other end section and the central section of the solenoid are excited, said means including a controlling-circuit between each contact and the trolley-wire, and an electromagnetic switch in each of said circuits, said electromagnetic switches having one terminal of their coils and their cores connected directly with the trolley-wire.

4. In electric railway-switch mechanism, the combination with the trolley-wire and switch, of two separated insulated contacts on the trolley-wire, a solenoid associated with the switch, a core reciprocal in the solenoid and connections between said core and switch, electrically-controlled connections between the solenoid and trolley-wire, and electrical connections between the trolley-wire and each of said contacts whereby the switch is operated in one direction or the other according to the passage of the car-trolley over one or the other of said contacts with the power on.

5. In an electric railway-switch, the combination with a trolley-wire and a switch-point of a plurality of contact members on said wire at separated points in advance of the switch, said contacts comprising each a plate bent around said wire and insulated therefrom, each of said plates having their meeting edges bolted together to form a radial flange extending lengthwise of the wire and adapted by engagement with the passing trolley to limit the turning of the contact on the wire, an electromagnet in relation to the switch-point having means for operating the switch-point and electrical connections between the contacts, trolley-wire and magnet for exciting the latter.

6. In an electric railway-switch, the combination with a trolley-wire and a switch, of an electromagnet associated with the switch, means connected with the switch operable by the electromagnet for throwing the switch, electrically-controlled connections between the magnet and trolley-wire, means for effecting said control, a conduit for the magnet connections, said conduit having a vertical portion terminating in a curved portion opening downward by which ingress of moisture along the wires to the magnet is prevented.

7. The combination with an electromagnet, of a containing-receptacle therefor, and a conduit for the coil-wires leading from the receptacle, said conduit having a vertical section terminating in a curved portion opening downward whereby ingress of moisture to the receptacle along the wires is prevented.

8. In an electric railway-switch mechanism, the combination with the trolley-wire and switch-point of two separated and insulated contacts thereon, electromagnetic switches, each having its coil directly connected with the trolley-wire and one of said contacts, a three-part solenoid associated with the switch-point, a core for said solenoid, connections between the core and switch-point, and electrical connection between the solenoid and trolley-wire through the medium of said electromagnets whereby the switch-point is operated in one direction in the passage of the car-trolley with the power on over one of said contacts and in the opposite direction on the similar passage of the car-trolley over the other contact.

9. In an electric railway-switch mechanism, the combination with the trolley-wire and switch, of contacts on the trolley-wire at separated points in advance of the switch, a solenoid in series with each of said contacts and the trolley-wire, each of said solenoids having a core electrically connected with the trolley-wire, a three-part solenoid having a core connected with the switch, connections between the section of said three-part solenoid and connections between said sections and contacts in the path of the cores of the first-named solenoids whereby on the excitation of one of the latter one end section and the central section of the three-part solenoid are energized, and on the excitation of the other of said first-named solenoids the other end section and central section of the three-part solenoid are energized.

10. In an electric railway-switch mechanism, the combination with a trolley-wire and a switch-point, of a solenoid-magnet, connections between the core thereof and the switch-point, connections between the magnet and trolley-wire, a water-tight closure for said magnet consisting of a box closed except at the ends, and oppositely-threaded plugs upon the ends of the magnet fitting said openings said plugs having perforations, a tube fitting said perforations, and a core for the magnet reciprocal in said tube.

11. In an electric railway-switch mechanism, the combination with a trolley-wire and a switch-point, of a solenoid-magnet, connections between the magnet and trolley-wire, a water-tight closure for the magnet, consisting of an open-ended box, oppositely-threaded plugs on the magnet fitting the end openings of the box, a filling of insulating matter inclosing the magnet and occupying the space between the latter and the sides of the box, said plugs having threaded perforations, a

tube fitting said perforations, a core reciprocal in said tube and connections between said core and the switch-point.

12. In an electric railway-switch mechanism, the combination with a trolley-wire and switch-point of a controlled circuit governing the movements of the switch-point and a controlling-circuit including a contact member on the trolley-wire and an electromagnetic switch having one terminal of its coil connected directly with the trolley-wire and the other connected directly with said contact member, and a core reciprocal in said coil and having direct connections also with the trolley-wire.

13. In an electric railway-switch mechanism, the combination with a trolley-wire and switch-point, of a controlled circuit, a solenoid in said controlled circuit governing the movements of the switch-point, a controlling-circuit comprising an insulated block on the trolley-wire, an electromagnet having one terminal connected directly with the trolley-wire and the other with said contact member, a core reciprocal by said electromagnet, said core connected with the trolley-wire and operating as a circuit-closer, a contact in the path of said circuit-closer, connections between said contact and the switch-point-actuating solenoid, a blow-out coil in said connections and spaced metallic plates connected with said blow-out coil between which said circuit-closer operates in opening and closing the circuit.

14. In an electric railway-switch mechanism, the combination with a trolley-wire and switch-point of a controlled circuit, a solenoid in said controlled circuit governing the movements of the switch-point, a controlling-circuit comprising a contact member on the trolley-wire and insulated therefrom, an electromagnet having one terminal connected with said contact member and the other directly with the trolley-wire, a core disposed in the controlled circuit and reciprocal by said electromagnet, a contact in the path of said core, and means to prevent arcing between said contact and core on the breaking of the circuit.

15. The combination with a trolley-wire or like conductor, of a contact thereon and comprising a member embracing the wire and insulated therefrom said member having a part which forms a radial guide adapted to be engaged by the passing trolley, to limit the movement of the contact.

16. The combination with a trolley-wire, of a contact thereon and comprising a plate embracing the wire and having its ends brought together to form a radial guide said guide adapted by engagement with the trolley to limit the angular movement of the contact.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

WALTON D. WOOLLEY.

Witnesses:
J. Y. JOHNSON,
FRED F. ESPENSCHEID.