No. 696,313. Patented Mar. 25, 1902.

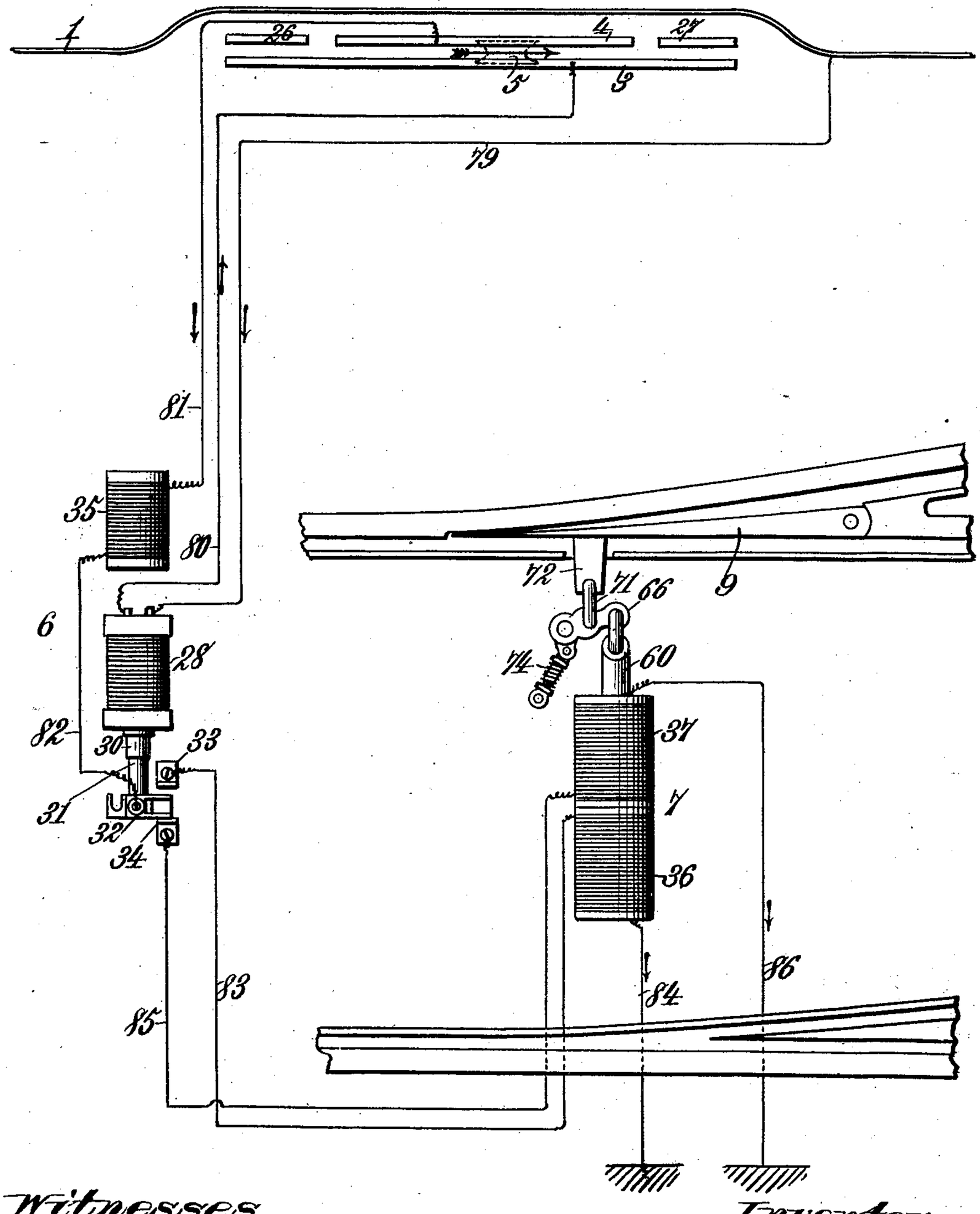
R. V. CHEATHAM.

ELECTRICALLY CONTROLLED RAILWAY SWITCH.

(Application filed Dec. 5, 1901.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1



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(No Model.) 4 Sheets—Sheet 2.

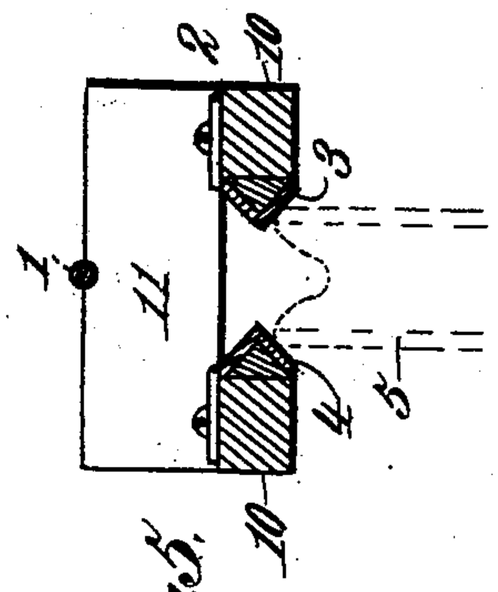

Fig. 5.

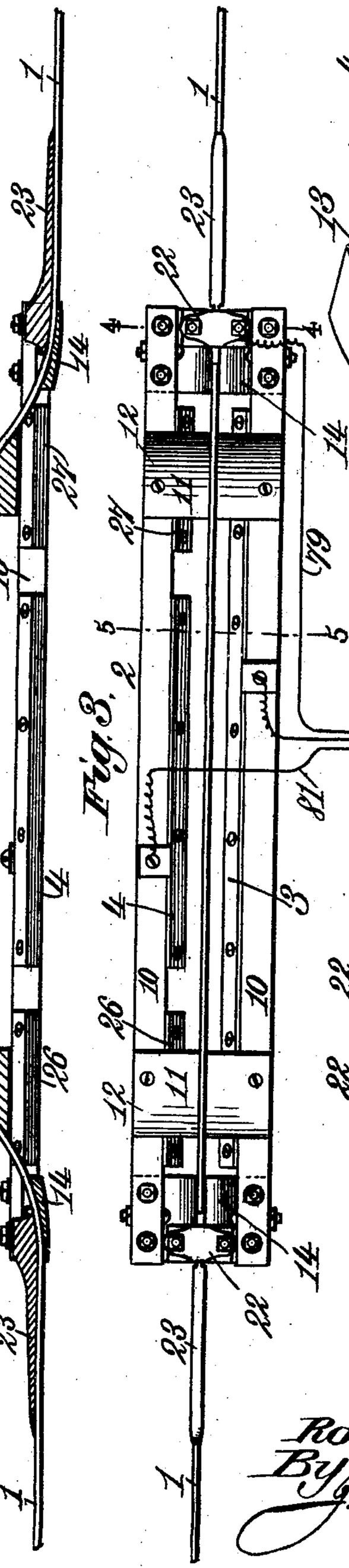

Fig. 2.

Fig. 3.

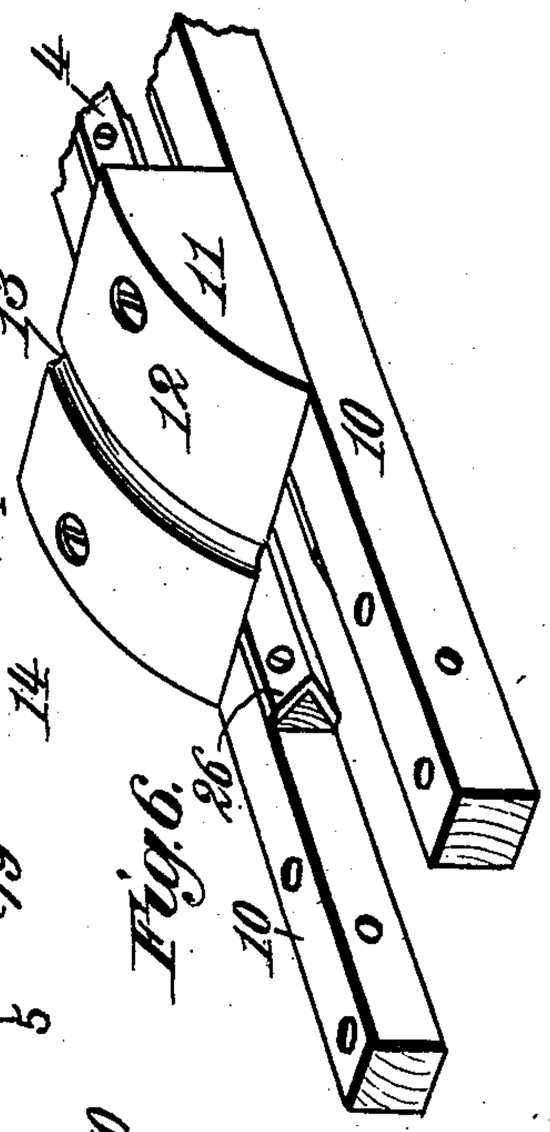

Fig. 6.

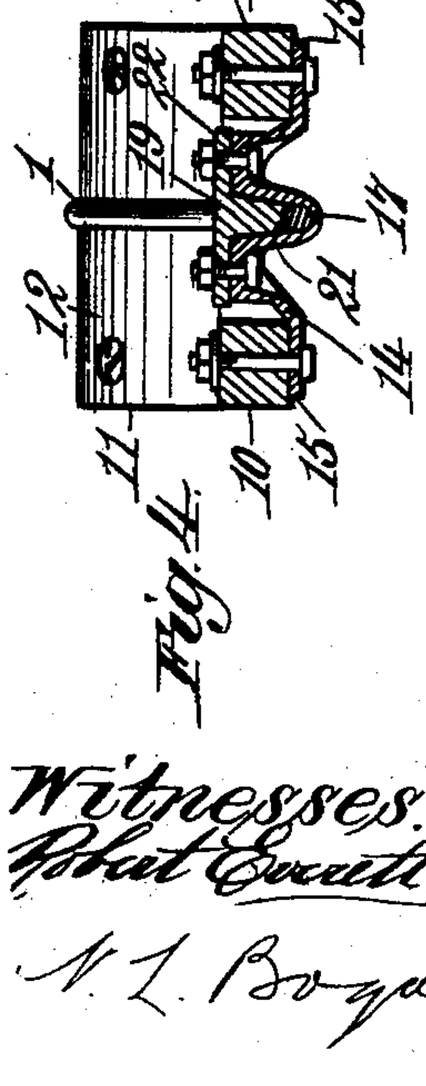

Fig. 4.

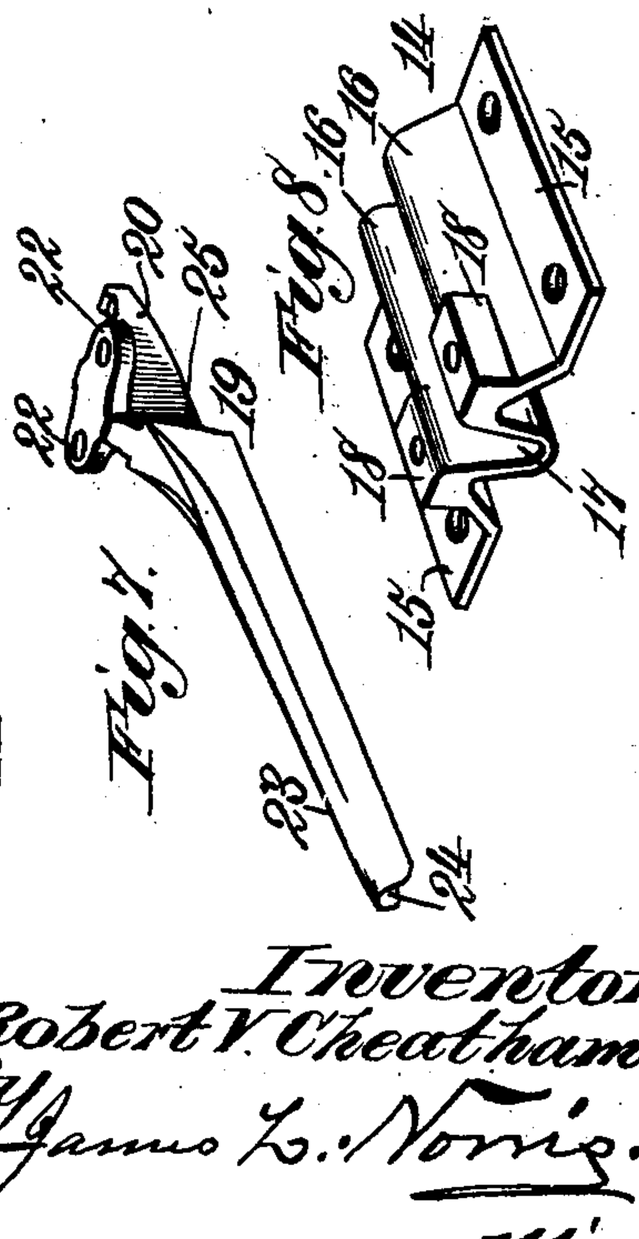

Fig. 7. Fig. 8.

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(No Model.) 4 Sheets—Sheet 3.

Fig. 9.

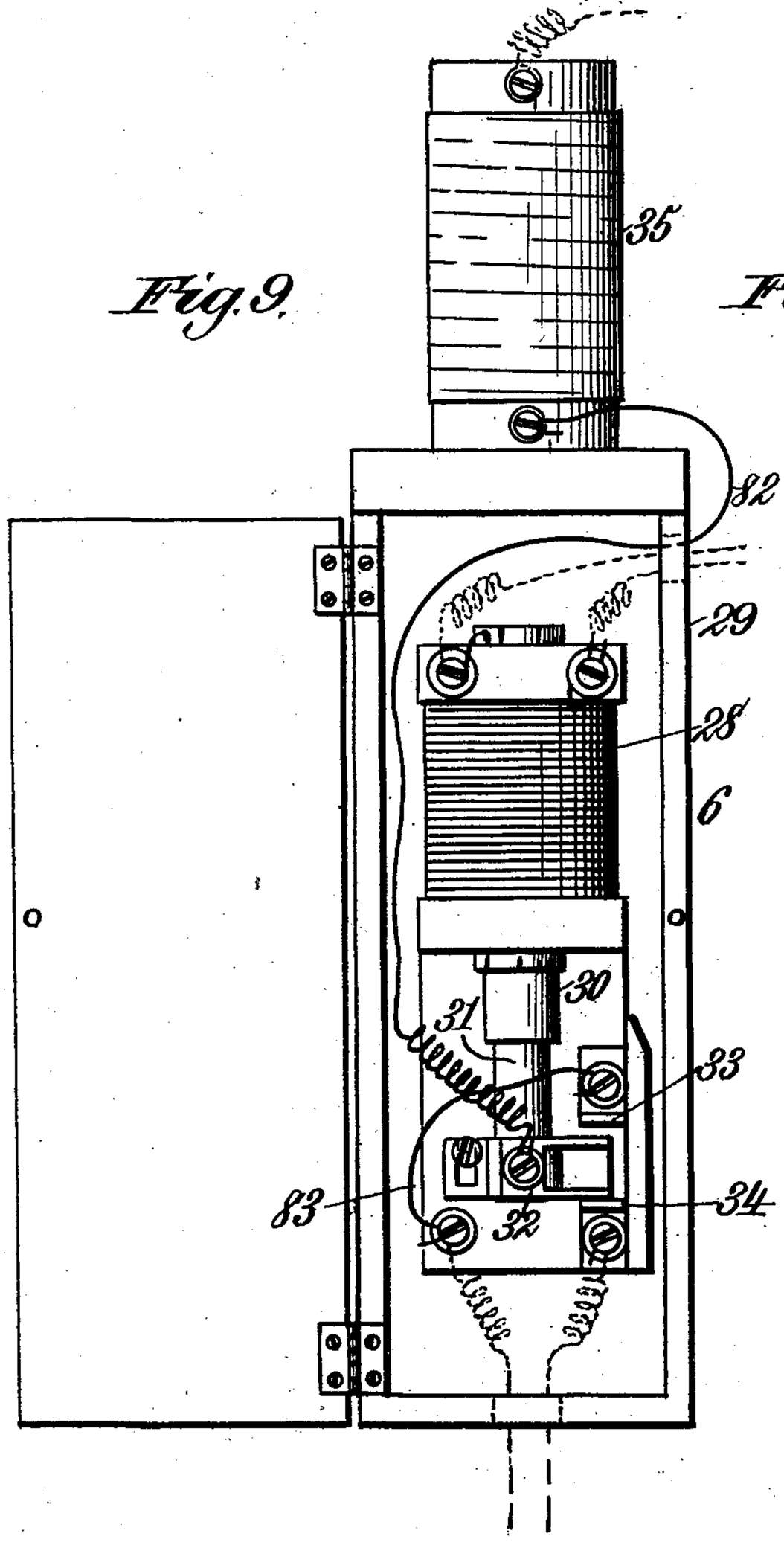
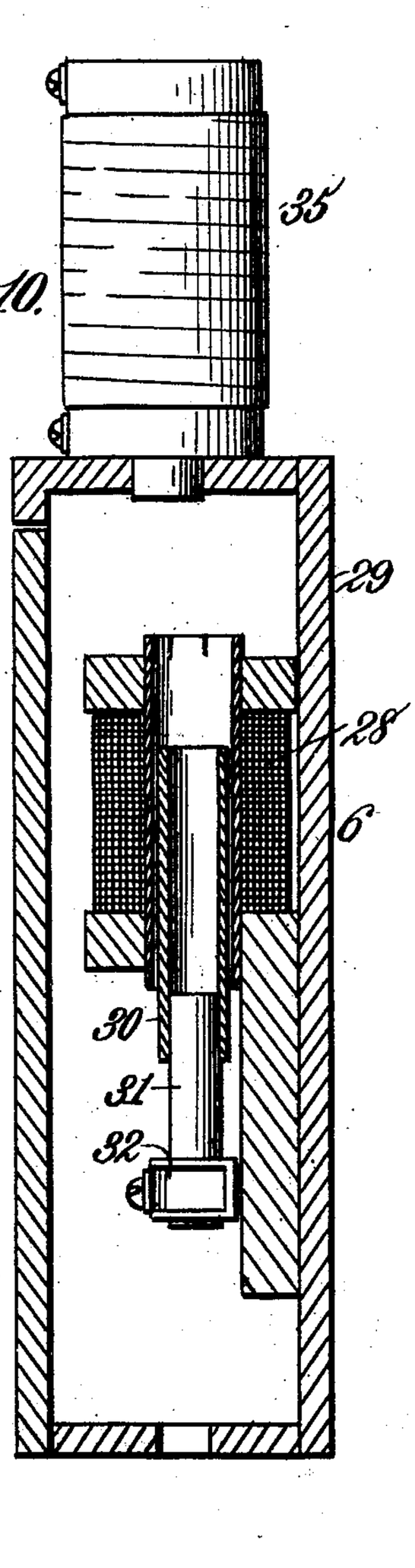


Fig. 10.



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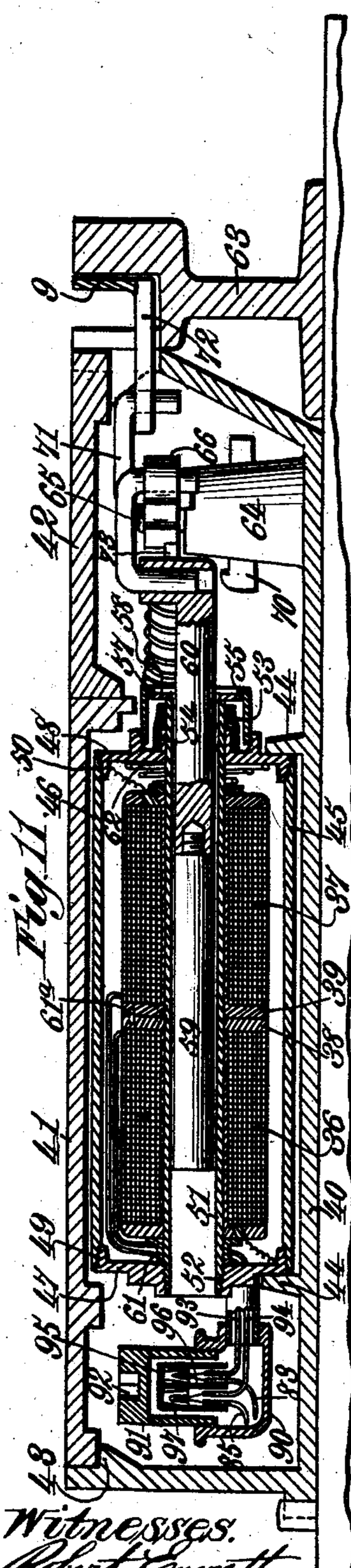

Fig. 11.

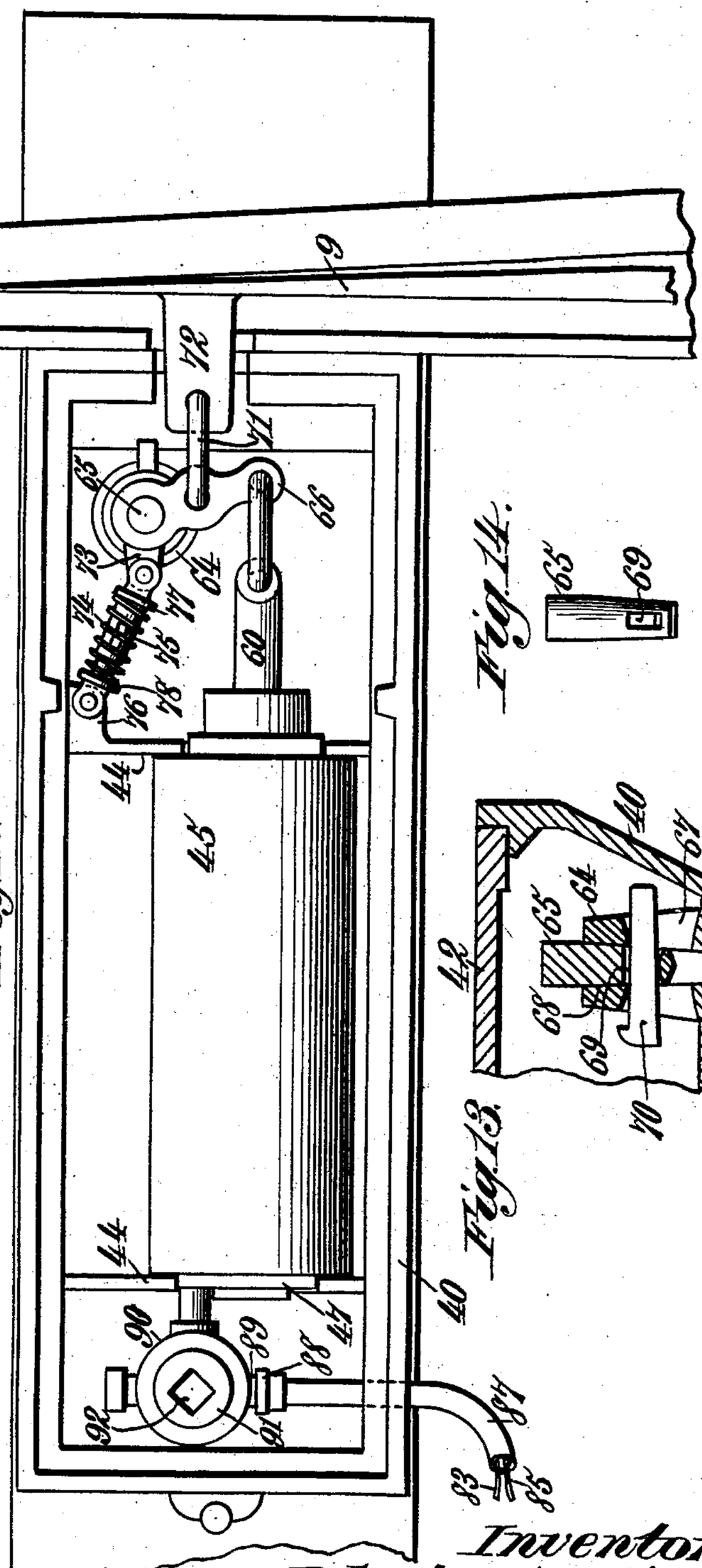

Fig. 12.

Fig. 13.

Fig. 14.

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UNITED STATES PATENT OFFICE.

ROBERT V. CHEATHAM, OF LOUISVILLE, KENTUCKY, ASSIGNOR TO CHEATHAM ELECTRIC SWITCHING DEVICE CO., OF LOUISVILLE, KENTUCKY, A CORPORATION OF KENTUCKY.

ELECTRICALLY-CONTROLLED RAILWAY-SWITCH.

SPECIFICATION forming part of Letters Patent No. 696,313, dated March 25, 1902.

Application filed December 5, 1901. Serial No. 84,799. (No model.)

To all whom it may concern:

Be it known that I, ROBERT V. CHEATHAM, a citizen of the United States, residing at Louisville, in the county of Jefferson and State of Kentucky, have invented new and useful Improvements in Electrically-Controlled Railway-Switches, of which the following is a specification.

My invention relates to electrically-controlled railway-switches, the same being designed as an improvement upon the device described and claimed in United States Patent No. 612,702, granted to me October 18, 1898.

The object of the invention is to simplify and otherwise improve the details of construction of the former apparatus above referred to, so as to render the same cheaper in construction and more efficient in operation.

The details of the invention will be hereinafter set forth, and that which I regard as new will be set forth in the claims.

In the drawings forming a part of this specification, Figure 1 is a diagrammatic view illustrative of my invention. Fig. 2 is a longitudinal section of the contact-block which is attached to the trolley-wire in advance of one of the switches. Fig. 3 is a top plan view of the same. Fig. 4 is a cross-section of the same on the line 4 4 of Fig. 2. Fig. 5 is a similar view on the line 5 5 of Fig. 3. Fig. 6 is a detail perspective view, on an enlarged scale, of one of the contact-blocks. Figs. 7 and 8 are perspective details of the trolley-wire clamp by means of which the contact-block is attached to the trolley-wire. Fig. 9 is a front elevation of the circuit-changer. Fig. 10 is a sectional side elevation of the same. Fig. 11 is a vertical longitudinal section of the double solenoid through which the switch point or tongue is operated, the casing in which the same is located, and the parts coöperating therewith. Fig. 12 is a plan view of the same, and Figs. 13 and 14 are views of details of construction.

Like reference-numerals indicate like parts in the different views.

In carrying out my invention I secure to the trolley-wire 1 at points in advance of the railway-switch a contact-block 2, having the contact-strips 3 4 arranged in parallel relation on the under side thereof and designed to be engaged by the trolley-wheel 5, carried by the car. In connection with each contact-block 2 I employ a circuit-changer 6 and a double-solenoid magnet 7, whose core is connected with the switch point or tongue 9 for operating the same in one direction or the other. The contact-block 2, the circuit-changer 6, and the double solenoid 7 are electrically connected in such manner, as will be hereinafter more fully described, that when the trolley-wheel 5, carried by the car, moves in contact with the contact-strips 3 and 4 the same will act to bridge the circuit between said strips, and a flow of current will be caused to pass from the trolley-wire through the circuit-changer 6 and thence to one or the other of the coils of the double solenoid 7, so as to move the core or armature thereof and turn the switch-point 9 in one direction or the other.

The contact-block 2 is made up of two parallel longitudinally-extending strips 10 10 of wood or other suitable insulating material, and the conducting-strips 3 and 4 are secured to the inner adjacent surfaces thereof. The said conducting-strips 3 and 4 are preferably constructed of angle-iron, secured by screws or other analogous devices to the strips 10, the faces of said angle-iron strips being set at an angle to each other and to the faces of the strips 10. Adjacent to the opposite end of the strips 10 the same are provided on their upper sides with guide or deflecting blocks 11, having convex upper surfaces 12 and provided with longitudinally-extending grooves 13. These blocks 11 are secured to the strips 10 and serve to deflect or arch the trolley-wire 1 and to maintain a rigid firm structure of the block 2 as a whole. Beyond the blocks 11 at each end of the strips 10 said strips have secured to them the brackets 14, each of which is preferably made of a casting of brass or other like conducting material. Each of said brackets constitutes one member of a clamp by means of which the contact-block 2 is connected with the trolley-wire 1. The same is formed with outwardly-extending horizontal flanges 15, which rest

upon the lower surfaces of the two adjacent strips 10 and are provided with openings for the passage of screws, bolts, or other like securing devices. Between the flanges 15 each of said brackets is formed with raised portions 16 and between the raised portions with a depression constituting a central longitudinally-extending groove or channel 17. At one end of each of the raised portions 16 the same is formed with a boss or enlargement 18, by means of which the correlative part 19 of the clamp may be secured thereto. The channel 17 in each of the brackets 14 gradually increases in depth toward the outer ends of the strips 10, as clearly shown in Fig. 2 of the drawings—that is to say, the bottom wall of the channel or groove 17 is inclined. The part or member 19 of the trolley-wire clamp which coöperates with the bracket 14 at each end of the strips 10 is formed with a tongue 20 at one end, which fits down within the channel 17 and is provided with a groove or concave lower edge, as shown at 21 in Fig. 4. Said member 19 is also provided above the tongue 20 with outwardly-extending horizontally-disposed ears 22, by means of which the same may be secured to the bracket 14, as shown in Figs. 2, 3, and 4 of the drawings. The ears 22 are provided with openings for the reception of bolts, which pass through the same and through corresponding openings in the bosses 18. Beyond the tongue 20 on the member 19 of the clamp the same is formed with an extension 23, provided with a groove 24 on its under side, and between said extension and the tongue 20 a shoulder 25 is produced, which bears against the end of the bracket 14 when the two parts of the clamp are in place. Now when the contact-block 2 is originally constructed the same consists of the strips 10, the contact-strips 3 and 4, the blocks 11, and the brackets 14. When it is desired to connect up one of the said-blocks with the trolley-wire 1, it is merely necessary to bend said trolley-wire and introduce the same into the grooves 13 in the blocks 11 at opposite ends of the strips 10. The same is also passed down into the channel 17 in the brackets 14, and the members 19 of the two clamps at opposite ends of the device are then applied. When in place the trolley-wire 1 fits between the two parts of the clamps 14 to 19 and lies within the channels 17, 21, and 24. The wire 1 and the contact-block 2 are thereby firmly and securely connected one to the other without danger of accidental detachment. As the wire 1 passes up over the blocks 11, forming part of the contact-block 2, the same is deflected out of its normal horizontal line, and at the point of its deflection it is located above the contact-strips 3 and 4, so that when the trolley-wheel 5 reaches a point below the blocks 11 it will pass from contact with the trolley-wire 1 into contact with the contact-strips 3 and 4. This separation of the trolley-wheel 5 from the wire 1 to the strips 3 and 4 is effected without any material lateral or vertical movement on the part of said trolley-wheel, due to the fact that the strips 3 and 4 lie in substantially the same plane with the trolley-wire 1. It should be stated in this connection that the contact-strip 3 extends practically throughout the length of the strip 10, to which it is secured, whereas the contact-strip 4 is shorter than the strip 3, as clearly shown in Figs. 1 and 3 of the drawings. At opposite ends of the strip 4 I provide supplemental strips 26 27, which are in line with the strip 4 and parallel to the strip 3. The strips 26 27, however, are insulated or separated from the strip 4 and perform no function in the operation of the circuit connections of the device, but merely serve as supports or abutments against which one side of the trolley-wheel 5 bears when the same is in contact with one end or the other of the contact-strip 3.

The circuit-changer 6 is preferably supported upon a pole on one side of the street adjacent to a contact-block 2. The same comprises a magnet 28, preferably in the form of a solenoid and wound with heavy wire. This is mounted in a box or casing 29, is vertically disposed, and is provided with a core 30, carrying upon its lower end a bar 31, of insulating material. Secured to and carried by the bar 31 is a contact-plate 32, which moves between two contact-points 33 34, supported in stationary position within the box or casing 29. The contact-points 33 and 34 are located one above the other, and the normal position of the contact-plate 32 is upon the contact-point 34, the same being maintained in this position by gravity.

Upon the box or casing 29, in which the circuit-changing mechanism above described is located, is a resistance-coil 35 of any suitable or preferred construction.

The double solenoid 7, by which the switch-point 9 is operated, is made up of coils 36 37, wound upon the spools 38 39 and set end to end within a box or casing located underground and adjacent to the switch point or tongue 9. The outer box or casing 40, in which the solenoid 7 is located, is provided with a two-part top 41 42, the same being supported upon the lugs or shoulders 43, adjacent to the upper edges of the sides of said box 40. The bottom of the box 40 is provided with upwardly-extending lugs or projections 44, which serve to prevent the longitudinal movement of the inner box or casing 45, the said inner box or casing being located between said lugs or projections 44, as clearly shown in Fig. 11 of the drawings. The said inner casing 45 has the cylindrical body thereof preferably constructed of a section of six-inch pipe 46, with the heads 47 48 secured to the opposite ends thereof. The means of securing the heads 47 48 to the pipe 46, so as to provide close joints and to prevent the entrance of water to the interior of the box 45, consists of the taper threads 49 50, which are respectively formed upon the ends of the pipe

46 and outer edges of the heads 47 48. Said heads 47 48 are annular in form and have extending through the same a central tube 51, which is secured to the head 47 by the taper threads 52 and fits closely the bore at the center of the head 48. To form a close joint or seal between the tube 51 and the head 48 of the inner box or casing 45, I employ a rubber packing-ring 53, which lies in close contact with the outer surface of the tube 51 and tightly embraces a tubular extension 54 on the head 48. This packing-ring 53 is itself protected by a metallic cap 55, which is screwed upon an extension 56 on the head 48 and is provided with an inwardly-extending flange 57, which holds a disk or washer 58 in contact with the extreme outer end of the tube 51. The coils 36 37 of the double solenoid 7 are provided with a common core or armature 59, the said core or armature having connected to one end thereof a bar or extension 60, of brass, copper, or other like non-magnetic material. The core 59 fits and moves within the tube 51, and the extension 60 thereof projects out beyond the box or casing 45, in which the double solenoid 7 is located. Said solenoid 7 is held against longitudinal movement in the box or casing 45 by means of a collar 61 at one end and a coil-spring 62 at the other. The two spools on which the coils 36 and 37 are wound are held against axial displacement by means of a stud or key 61[a]. The outer casing 40 extends out to a point adjacent to the rail 63 and has secured to or formed integral with the bottom thereof a post or standard 64, which serves as a support for the pivot-stud 65 of a lever 66. The said post or standard is provided with a transversely-extending slot or opening 67 and with the vertically-disposed tapering opening 68, which intersects this latter opening 67 and receives the pivot-stud 65. The latter is itself tapering in form at its lower end and is itself provided with a transverse slot or opening 69. The slots 67 and 69 are provided for the reception of a key 70, by means of which the stud 65 is firmly secured to its support 64 and by means of which said stud 65 can be readily removed from the support 64—that is to say, when the key 70 is introduced through the slots 67 and 69, as shown in Fig. 13 of the drawings, the same serves to draw downwardly the stud 65 into the tapering opening 68 and to lock the same firmly in place. When it is desired, however, to remove the stud 65, it is merely necessary to disengage the key 70 from the slot 69 and introduce the same into the slot 67 beneath the lower end of the stud 65. When this is done, an upward pressure is applied to the stud 65 and serves to remove the same from the opening 68.

The lever 66 is connected, through a link 71, with a laterally-extending arm 72 on the switch-point 9, the said arm 72 projecting into the casing 40 through an opening in the end thereof, as clearly shown in Figs. 11 and 12 of the drawings. By this construction it will be noted that when the lever 66 is rocked in one direction or the other it will serve to move the switch-point 9 in one direction or the other on its pivot. In order to retain the lever 66 and the switch-point 9 in any position to which they may be moved, I provide said lever 66 with a crank-arm 73, against which acts an expansible spring 74. The said spring has been shown as a coil-spring surrounding a two-part extensible rod 75, one part of which is pivoted to the crank-arm 73 and the other part of which is pivoted to a stationary bracket or support 76 in the outer box or casing 40. The two parts of said rod 75 are provided with shoulders 77 78, against which the ends of the spring 74 bear. Now the crank-arm 73 is so disposed on the lever 66 that when the free end of said lever is in its outermost position and the switch-point 9 is set for the passage of the car along the main track the point of pivotal connection between said crank-arm 73 and one part of the rod 75 will be on one side of the line of connection between the pivot 65 and the pivot of the other part of the rod 75 on the bracket 76. Said spring 74 will therefore act to maintain the lever 66 and the switch-point 9 in the positions to which they have been moved. When, however, the lever 66 is moved inwardly and the switch-point 9 is set for the passage of a car onto the branch track, the point of pivotal connection between the crank-arm 73 and the rod 75 will be on the opposite side of the line of connection between the stud 65 and the point of pivotal connection between the rod 75 and the bracket 76. Said spring 74 therefore acts to hold said lever 66 and the switch-point 9 in either position to which these parts are moved.

The circuit connections between the different parts of the device are as follows: Leading from the trolley-wire 1 to the coil of the magnet 28 is a wire 79, and leading from said magnet 28 to the contact-strip 33 is a wire 80. Connecting the contact-strip 4 with the resistance-coil 35 is a wire 81, and leading from resistance-coil 35 to the contact-plate 32 is a wire 82. The coil 36 of the double solenoid 7 is connected with the contact-point 33 through a wire 83 and to ground through a wire 84, and the coil 37 of the double solenoid 7 is connected to the contact-point 34 through the wire 85 and to ground through the wire 86. The wires 83 and 85 extend from the contact-points 33 and 34 down the pole on which the circuit-changer 6 is mounted and then across the street to the double solenoid 7, the same being inclosed within a lead or other suitable pipe 87, which is provided with a coupling 88, by means of which it may be connected to a nipple 89 from one side or the other of the junction-box 90, located within the outer box or casing 40, but outside the inner box or casing 45. The pipe 87, containing the wires 83 and 85, passes through one side of the outer box or casing 40, as

clearly shown in Fig. 12 of the drawings. The junction-box 90 is screwed into the end 47 of the inner box or casing 45 and is closed on its upper side by a cap 91, having a key-socket 92 therein. The cap 91 screws into a tubular extension on the box 90 and prevents access of water or other foreign matter to the interior of said box. The wire 83 is connected with a wire 93, which leads directly to the coil 37 of the double solenoid 7, and the wire 85 is connected to the wire 94, which leads directly to the coil 36 of the double solenoid 7. The wires 83 and 93 and 85 and 94 are connected to each other within the junction-box 90 by means of a rubber cap 95, having a central partition or diaphragm 96 and provided with clips or connectors 97 in the two compartments formed by said partition 96, the said clips or connectors serving to conect and hold in close contact with each other the ends of the wires 83 and 93 and 85 and 94, respectively.

The operation of my improved apparatus is as follows: When it is desired to run the car along the main track, it is merely necessary for the motorman to cut off his motor when passing the contact-block 2 and allow the momentum of the car to carry the same past said contact-block. Assuming the car to be approaching the switch and moving in the direction of the arrows in Fig. 1 of the drawings, it will be observed that when the trolley-wheel 5 reaches the contact-block 2 the same will pass from the trolley-wire 1, due to the fact that said trolley-wire is deflected upwardly. The flanges of said trolley-wheel will therefore be brought into contact with the contact-strips 3 and 4, bridging the circuit between the same. A small current of about three amperes will then flow from the trolley-wire 1 through the wire 79, magnet 28, and wire 80 to contact-strip 3, thence through trolley-wheel 5 to contact-strip 4, and then through wire 81, resistance-coil 35, wire 82, contact-plate 32, contact-point 34, wire 85, coil 37 of solenoid 7, and wire 86 to ground. The said current is too small to energize the magnet 28 sufficiently to disconnect the contact-plate 32 from the contact-point 34. The coil 37 of the solenoid 7, however, will be energized and, acting upon its core or armature 59, will draw the same outwardly and move the switch-point 9 to the position shown in Fig. 1 of the drawings. Of course if the switch-point 9 were already in this position there would be no action on the part of the coil 37 on its core 59, and consequently no movement of the switch-point 9 would be effected. In other words, said switch-point 9 would remain in the same position that it was in before. Assuming it to be turned to this position, however, it is held in place through the action of the spring 74 on the crank-arm 73 of the lever 66. When the car approaches the switch, therefore, it will pass along the main track thereof, as was intended. If it be desired, on the other hand, to have the car move onto the branch track, the motorman leaves on the current through his motor when approaching the switch-block 2, and the operation of the device is as follows: When the trolley-wheel 5 reaches the fore end of the contact-strip 3, the circuit is closed from the trolley-wire 1 through the wire 79 to the coil of the magnet 28 and thence through the wire 80 to contact-strip 3. From the strip 3 the current is taken from the trolley-wheel 5 down through the motor of the car and thence to ground. A heavy current is therefore drawn from the wire 1, which, passing through the magnet 28, energizes the same sufficiently to raise the core 30 thereof and separate the contact-plate 32 from the contact-point 34. Said contact-plate is thus brought into engagement with the contact-point 33, and when the trolley-wheel reaches the fore end of the contact-strip 4 a portion of the current drawn from the trolley-wire 1 is shunted from the contact-strip 3 through the trolley-wheel 5 to the contact-strip 4 and thence through the wire 81, resistance-coil 35, wire 82, contact-plate 32, contact-point 33, wire 83, coil 36 of double solenoid 7, and wire 84 to ground. With the flow of current through the coil 36 the same is energized and acts to withdraw its core 59 from the position it formerly occupied—that is, the same is drawn inwardly and swings the lever 66 on its pivot, so as to move the switch-point 9 from the position in which it is shown in Fig. 1 of the drawings to the position necessary to cause the car to travel from the main to the branch tracks. Said switch-point is held in this position even after the coil 36 is deënergized by the action of the spring 74 on the crank-arm 73 of the lever 66. It will thus be seen that the operation of the device is automatic throughout. It is not necessary that the motorman or operator of the car know what the position of the switch is; but it is only necessary when it is desired to continue traveling along the main track to cut off the current to the car-motor when approaching the contact-block 2 and when it is desired to move from the main to the branch track to merely leave on the current to the car-motor when approaching the contact-block 2.

While the coils 36 and 37 of the double solenoid 7 have been shown as grounded through the wires 84 and 86, respectively, it is obvious that said coils may be grounded in any other suitable manner. For example, they may be grounded through the hubs of the spools on which they are respectively wound; the lower or inner layer of the wire from which the two coils is made being bared of insulation, so as to be in electrical contact with the hubs of said spools.

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

1. In an electrically-controlled switch-operating mechanism, a trolley-wire having an

upwardly-deflected portion, parallel contact-strips arranged adjacent thereto, a trolley-wheel adapted to pass in a straight line from said trolley-wire to said contact-strips and make electrical connections between the same, a circuit-changer comprising a vertically-disposed magnet, a contact-plate connected with the armature of said magnet, two contact-points between which said contact-plate is movable, one of which serves normally as a support for said contact-plate and the armature by which it is carried, a double solenoid, a core therefor, a switch-point connected with and adapted to be operated by said core, circuit connections between said trolley-wire and one of said contact-strips which include said magnet, circuit connections between the other of said contact-strips and said contact-plate, and ground connections from said contact-points and including, respectively, the coils of said solenoid.

2. In an electrically-controlled switch-operating mechanism, the combination with a trolley-wire, a circuit-changer, a double solenoid, a switch-point and connections between said switch-point and the core of said solenoid, of a contact-block comprising a frame, clamps for the trolley-wire at opposite ends thereof, means for deflecting said trolley-wire upwardly between said clamps, contact-strips between said clamps adapted to be engaged by the flanges of a trolley-wheel and to be electrically connected with each other through said wheel, and circuit connections between said trolley-wire, said contact-strips, said circuit-changer and said solenoid, as and for the purpose set forth.

3. In an electrically-controlled switch-operating mechanism, the combination with a trolley-wire, a circuit-changer, a double solenoid, a switch-point and connections between said switch-point and the core of said solenoid, of a contact-block comprising a frame made up of parallel side strips, clamps at the ends of said frame, deflecting-blocks secured to said side strips between said clamps having grooves therein and contact-strips secured to the inner surfaces of said side strips, and circuit connections between said trolley-wire, said contact-strips, said circuit-changer and said solenoid.

4. In an electrically-controlled switch-operating mechanism, the combination with a trolley-wire, a circuit-changer, a double solenoid, a switch-point and connections between said switch-point and the core of said solenoid, of a contact-block comprising a frame made up of parallel side strips, trolley-wire clamps at the ends of said frame, deflecting-blocks for the trolley-wire secured to said side strips adjacent to said clamps having convex upper surfaces provided with grooves and angularly-arranged contact-strips secured to the inner surfaces of said side strips, and circuit connections between said trolley-wire, said contact-strips, said circuit-changer and said solenoid.

5. In an electrically-controlled switch-operating mechanism, the combination with a trolley-wire, a circuit-changer, a double solenoid, a switch-point and connections between said switch-point and the core of said solenoid, of a contact-block comprising a frame made up of parallel side strips, deflectors for the trolley-wire intermediate the ends of said frame, contact-strips secured to the inner surface of said side strips beneath said deflectors and trolley-wire, clamps at the ends of said frame, each of said clamps comprising two members, one of which is secured to said side strips and has a central groove or channel therein with an inclined bottom wall and bosses adjacent to said channel and the other member of which is provided with a tongue which fits within said channel and has a groove in its lower edge, ears projecting laterally from said tongue providing means for securing said tongue in place and an extension projecting outwardly from said tongue and provided with a grooved lower edge which receives the trolley-wire, and circuit connections between said trolley-wire, said contact-strips, said circuit-changer and said solenoid.

6. In an electrically-controlled switch-operating mechanism, the combination with a trolley-wire, parallel contact-strips adjacent thereto, a trolley-wheel adapted to pass from said trolley-wire to said strips and form electrical connections between the two, a double solenoid and a switch-point connected with and adapted to be operated by the core of said solenoid, a vertically-disposed solenoid-magnet, a contact-plate secured to and insulated from the core of said magnet, contact-points between which said contact-plate is movable and on one of which said plate and the core by which it is carried is normally supported, a resistance-coil, circuit connections between said trolley-wheel and one of said contact-strips including said magnet, circuit connections between the other of said contact-strips and said contact-plate including said resistance-coil, and ground connections from said contact-points which include, respectively, the coils of said double solenoid.

7. The combination with a pivotally-mounted switch-point, of a double solenoid, a lever connected with the core of said solenoid, a link connection between said lever and said switch-point, a crank-arm on said lever, a fixed bracket, a two-part extensible rod, the members of which are pivoted respectively to said bracket and to said crank-arm and are provided with shoulders, and a spring surrounding said rod and acting upon said shoulders for extending said rod, and thereby retaining said lever and said switch-point at the limits of their movements in opposite directions.

8. The combination with a pivotally-mounted switch-point and a lever connected therewith for operating it, of a pivot-stud for said lever having a tapering lower end, and a trans-

verse slot extending therethrough, a post or standard having a transverse slot therein and a tapering opening in which said stud fits and a wedge-shaped key adapted to be introduced through the slot in said post and through the slot in said stud for forcing and maintaining said stud in place, and also adapted to be introduced into the slot in said post and beneath the lower end of said stud for removing the latter from its seat.

9. In an electrically-controlled switch-operating mechanism, the combination with a pivotally-mounted switch-point, a double solenoid and intermediate connections between the core of said solenoid and said switch-point, whereby the latter is operated, of an underground box or casing having a removable lid or cover, an inner box or casing in which said solenoid is located, the said inner box or casing comprising a cylindrical or tubular body, annular heads connected to the opposite ends thereof by taper threads, and a tube extending centrally through the inner box and secured to one of said heads by taper threads, and a rubber packing-ring lying in close contact with the projecting end of said tube and embracing a flange or extension on the other of said heads.

10. In an electrically-controlled switch-operating mechanism, the combination with a pivotally-mounted switch-point, a double solenoid and intermediate connections between the core of said solenoid and said switch-point, whereby the latter is operated, of an underground box or casing having a removable lid or cover, an inner box or casing in which said solenoid is located, the said inner box or casing comprising a cylindrical or tubular body, annular heads connected to the opposite ends thereof by taper threads, and a tube extending centrally through the inner box and secured to one of said heads by taper threads, a rubber packing-ring lying in close contact with the projecting end of said tube and embracing a flange or extension on the other of said heads, a cap for protecting said packing-ring secured to the head 48 of said box and having an inwardly-extending flange at its outer end, and a washer held in contact with the end of said tube by said flange.

11. In an electrically-controlled switch-operating mechanism, the combination with a pivotally-mounted switch-point, a double solenoid and intermediate connections between the core of said solenoid and said switch-point, whereby the latter is operated, of an underground box or casing having a removable lid or cover, an inner box or casing in which said solenoid is located, the said inner box or casing comprising a cylindrical or tubular body, annular heads connected to the opposite ends thereof by taper threads, a rubber packing-ring lying in close contact with the projecting end of said tube and embracing a flange or extension on the other of said heads, a cap for protecting said packing-ring secured to the head 48 of said box and having an inwardly-extending flange at its outer end, and a washer held in contact with the end of said tube by said flange.

12. In an electrically-controlled switch-operating mechanism, the combination with a pivotally-mounted switch-point, a double solenoid and intermediate connections between the core of said solenoid and said switch-point, whereby the latter is operated, of an underground box or casing having a removable lid or cover and provided with ledges or projections on the bottom thereof, an inner box or casing in which said solenoid is mounted, located between said ledges or projections and held from longitudinal movement thereby, said inner box or casing comprising a tubular or cylindrical body and annular heads at the opposite ends thereof, a collar located between said solenoid and one of said heads, and a spring located between said solenoid and the other of said heads, the said collar and spring serving to maintain said solenoid in central position.

13. In an electrically-controlled switch-operating mechanism, the combination with a pivotally-mounted switch-point, a double solenoid and intermediate connections between the core of said solenoid and said switch-point, whereby the latter is operated, of an underground box or casing having a removable lid or cover, an inner box or casing in which said solenoid is mounted, said inner box being closed at all points, a junction-box secured to the end of said inner box or casing and located within said outer box or casing, wires connected respectively with the two coils of said double solenoid and extending outwardly into said junction-box, circuit-wires leading from a source of energy into said junction-box, a pipe in which the latter circuit-wires are inclosed extending through said outer box or casing and secured to said junction-box, a cap for closing the open end of said junction-box, and a hood of insulating material having a diaphragm or partition therein dividing the same into two compartments, and clips or connectors in each of said compartments for connecting the terminals of the two sets of wires one with the other.

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

ROBERT V. CHEATHAM.

Witnesses:
JACOB LOSEY,
J. A. STEWART.