J. T. CADE.

RAILWAY SWITCH AND SIGNAL CONTROLLING AND OPERATING SYSTEM.

APPLICATION FILED AUG. 8, 1908.

916,418.

Patented Mar. 30, 1909.

3 SHEETS—SHEET 1.

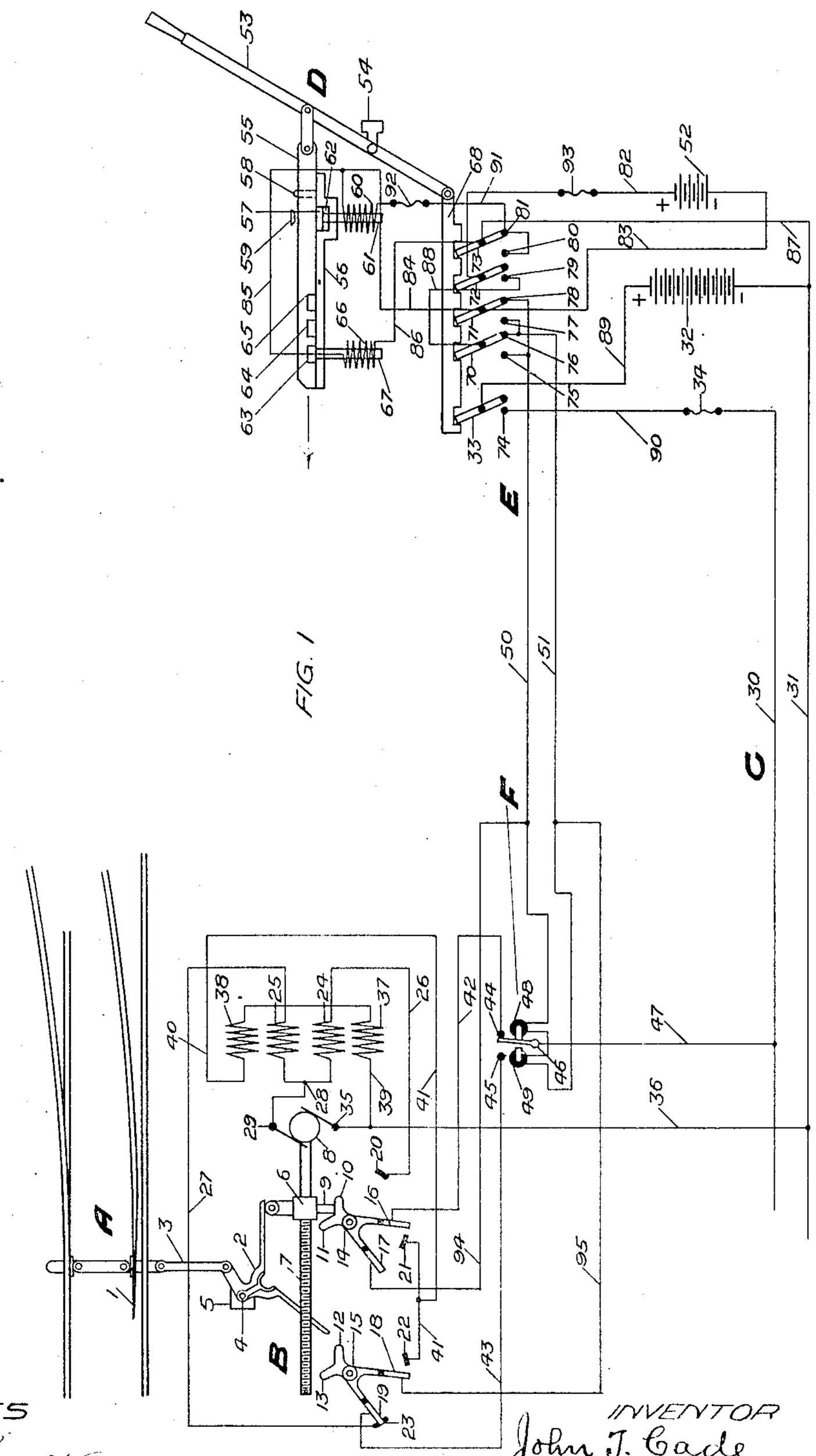

FIG. 1

WITNESSES

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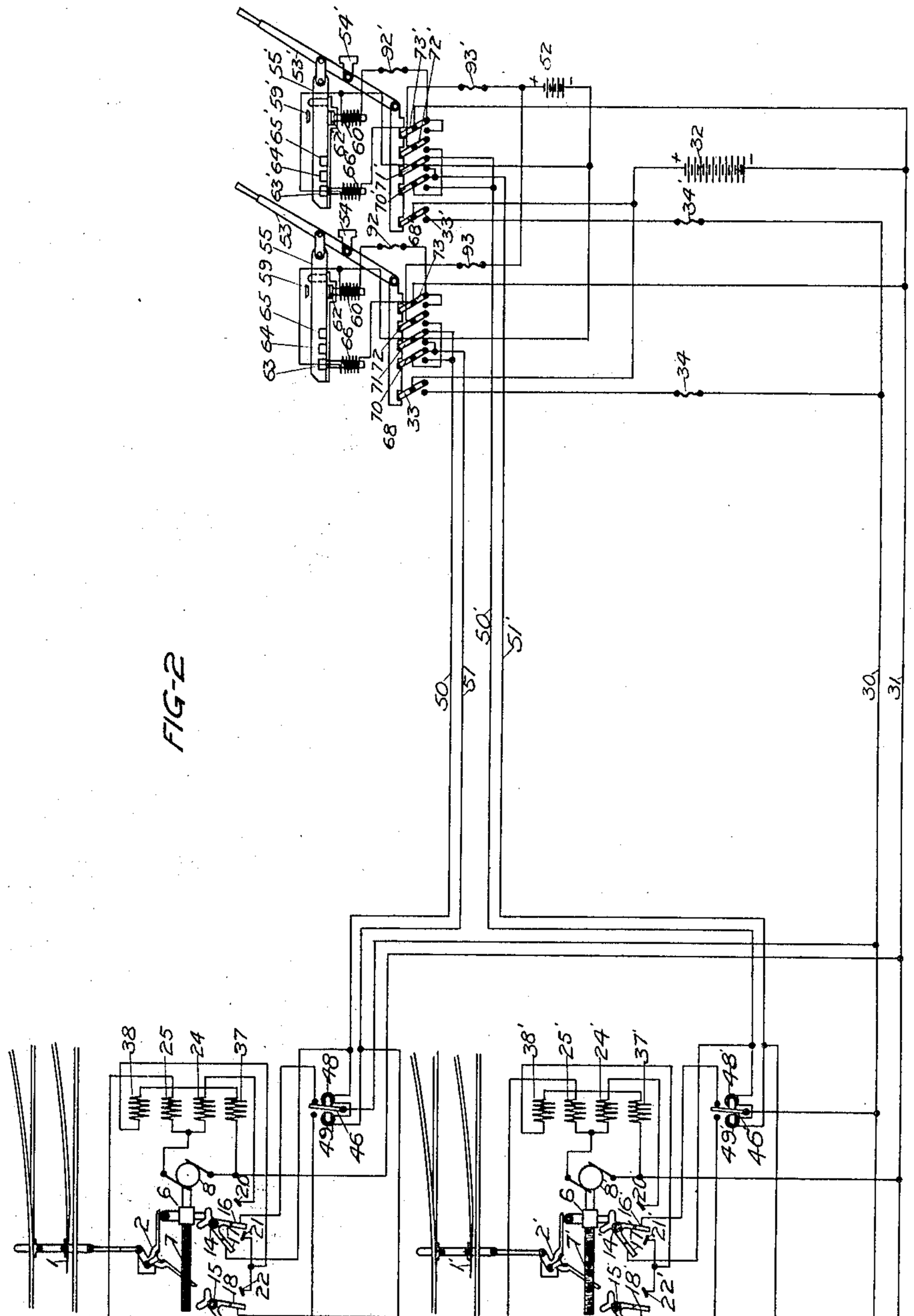

FIG-2

WITNESSES

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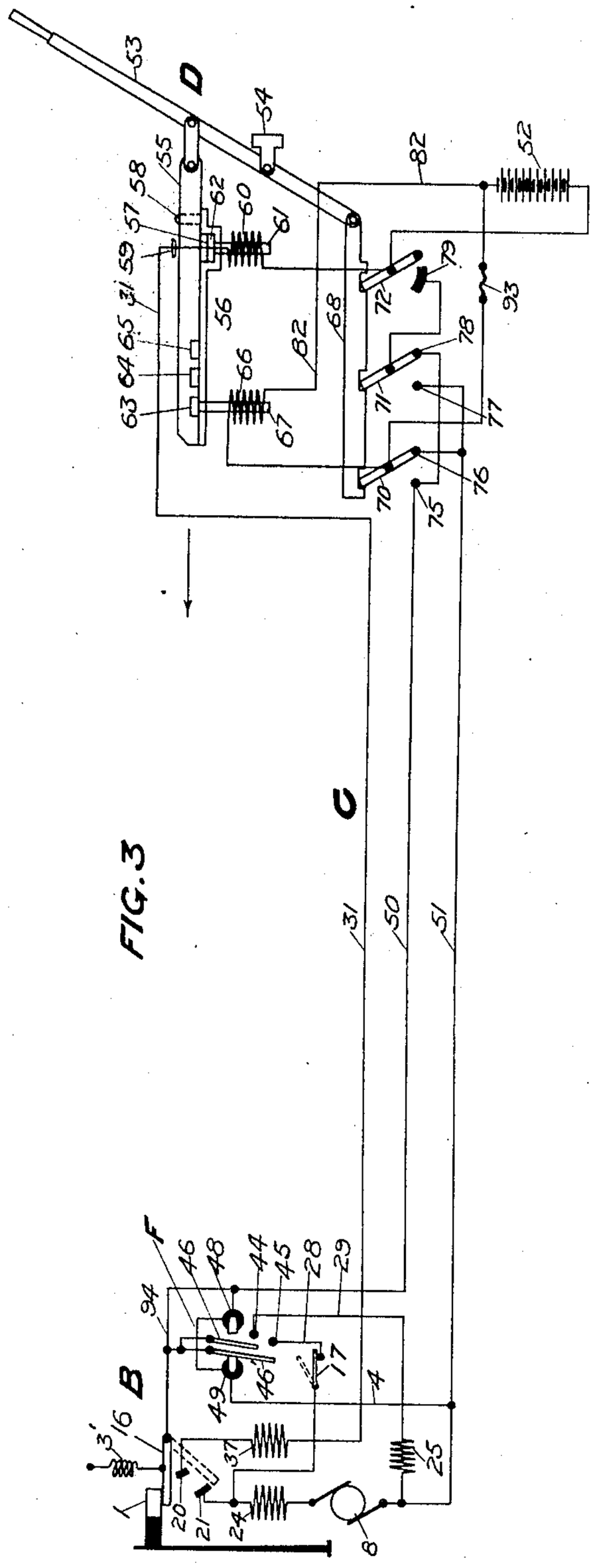

FIG. 3.

WITNESSES

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UNITED STATES PATENT OFFICE.

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RAILWAY SWITCH AND SIGNAL CONTROLLING AND OPERATING SYSTEM.

No. 916,418. Specification of Letters Patent. Patented March 30, 1909.

Application filed August 8, 1908. Serial No. 447,507.

To all whom it may concern:

Be it known that I, JOHN T. CADE, a subject of Great Britain, residing at Arcola, in the county of Bergen and State of New Jersey, have invented certain new and useful Improvements in Railway Switch and Signal Controlling and Operating Systems, of which the following is a specification.

My invention relates to that class of switch and signal apparatus which is operated by electrical energy and controlled by electrical means, located in a suitable tower or cabin, adjacent to and connected with the operating apparatus.

The objects of my invention are to provide a system in which the troubles due to imperfect insulation, incident to the use of high voltage are removed; to reduce the number of wires necessary for control and operation; to provide a new, effective and positive means of indicating to the operator that the apparatus operated has assumed a position corresponding to the position of the controlling lever, and to provide a system in which the trouble caused by crosses and grounds, common to all electrically operated systems is reduced to a minimum, and which can be easily located if it occurs. To accomplish these results I provide a controlling circuit and source of energy of comparatively low potential, say for example twenty (20) volts. I also provide, for operating switches, derails, frogs and like devices, a circuit and source of energy of relatively high potential, say one hundred and ten (110) volts. While for operating signals and the like I employ the same voltage as that for the controlling circuit. In addition I provide a controlling lever, the final movement of which is controlled by an indication magnet, the magnet being sensitive to an impulse, induced therein by the disrupting of the switch or signal motor circuit. I also provide a secondary winding for transmitting the said impulse, the said winding being arranged in such a manner that a high electric motive force is induced therein when the said operating switch motor or signal motor circuit is broken. Moreover the impulse which provides the indication originates at and emanates from the apparatus operated, which apparatus is controlled by a lever or similar device of which the indication magnet forms a part and which is connected in circuit with the secondary coils.

In describing my invention reference is made to the accompanying drawing, in which:

Figure 1 shows a single operative switch unit of the system. Fig. 2 shows a plurality of switch units, and Fig. 3 a single signal unit.

Similar letter and numerals refer to similar parts throughout the several views.

In Fig. 1 is shown diagrammatically a railroad switch, A, with its operating means, B, an operating circuit, C, for the operating means, a controlling device, D, and controlling circuit, E. In Fig. 2 is shown like parts and devices, while in Fig. 3 is shown the operating means, B, the controlling means, D, and the source of energy and circuit C.

Referring to Fig. 1 the switch point, 1, is connected with the escapement crank, 2, by the rod, 3. The crank, 2, is pivoted at 4 to a suitable support 5. A traveling nut, 6, is moved from right to left by screw 7, which is revolved by the motor, 8. This nut is adapted to engage with the arms of the crank, 2, and cause it to swing on the pivot, 4, which movement will throw the switch point 1 open or shut. A projection, 9, on the nut, 6, is arranged to engage the horns 10 and 11—12 and 13 of the switches 14 and 15 which switches are suitably mounted adjacent to the traveling nut, 6. Blades 16, 17, 18 and 19 of the switches, 14 and 15, are insulated from the switch proper and from each other and are adapted to engage at different times with contacts 20, 21, 22 and 23. The motor, 8, is of reversible type and is provided with suitable field coils, 24 and 25. The terminal of coil, 24, connects with contact 20 by wire 26 and the terminal of coil 25 connects with contact 23 by wire 27. The opposite terminals of the field coils 24 and 25 are connected together at point 28 and from point 28 to brush terminal 29 of the motor 8. As the coils 24 and 25 are oppositely wound it is obvious that the direction of rotation of the motor armature, 8, is changed each time current is passed separately through first one coil then the other. An operating circuit, C, composed of wires, 30 and 31, extends from the tower, in which is located the controlling apparatus, D, to the switch A or farther, if desired. A source of energy, 32, is connected to the wires 30 and 31. A switch 33 and fuse 34 are also included in this circuit. The arma-

ture terminal, 35, of the switch motor is connected by wire 36 to wire 31, which is connected to negative pole of battery 32. The motor, 8, is provided with secondary coils, 37 and 38, which are wound on the motor field pieces. These coils are in series, one terminal, 39, being connected by the wires 36 and 31 to the negative pole of battery 32. The other terminal, 40, is connected to contacts 21 and 22 by means of wire 41. Wires 42 and 43 are connected respectively with switch blades 16 and 19 and terminals 44 and 45 of a polarized reversing device, F. The armature, 46, of the reversing device is arranged to swing freely between the pole pieces 48 and 49 and to engage contacts 44 and 45 when the reverser is suitably energized. The other end of the said armature 46 is connected with positive wire, 30, of the operating circuit by wire 47. This reverser F is located at or near the switch motor, 8, and is connected at certain times by wires, 50 and 51, to battery 52 of the controlling circuit E. When this reverser is energized by the controlling circuit the armature, 46, will swing over and engage one or the other of contacts 44 and 45, thus permitting current from the operating circuit, C, to flow to switch blades 16 and 19, thence through wires 26 or 27 to the motor, 8, causing it to rotate and move the switch 1.

The controlling apparatus, D, consists of lever, 53, pivoted at 54, at a point on the lever, above 54, and connected to the said lever is a bar, 55, which slides on a bed plate 56. In this bed plate is constructed a pocket 57, into which a dog, 58, located in the bar, 55 can drop. A suitable lug, 59, is located above the bar, 55, in the path of the upper end of the dog 58. This lug is adapted to engage the end of the dog, 58, and force it down in the pocket 57. The normal position of the dog, 58, is up and only drops down when forced by the lug, 59. Below the pocket, 57, is located an indication solenoid, 60, a suitable plunger 61 with a T head, 62. If the dog, 58, is in the pocket 57 it will be noticed that the lever, 53, and bar, 55, cannot be moved any further. If however the indication coil, 60, be energized the plunger, 61, will lift and force up the dog, 58, permitting the final movement of the lever and bar, 55. On the under side of bar, 55, are located recesses, 63, 64 and 65. A safety coil, 66, is mounted under the bed plate, 56. A plunger, 67, is adapted to be lifted by this coil when the said coil is energized, the said plunger entering any of the recesses, 63, 64 and 65, as the case may be. When this plunger is lifted and enters one of the said recesses it will lock up the bar, 55, and prevent any further movement of the lever, 53. Below the pivot, 54, and connected with the lever, 53, is a bar, 68, which is arranged to engage with the upper ends of switches, 33, 70, 71, 72 and 73. These switches are mounted on a vertical spindle but are shown in this form to simplify description. A single contact, 74, is required for the switch, 33. Contacts 75 and 76 are required for switch 70. Contacts 77 and 78 are required for switch 71. A single contact 79 is required for switch 72 and contacts 80 and 81 are required for switch 73. The wiring of the controlling switches is as follows: The positive pole of low voltage battery, 52, is connected to switch, 72, by wire, 82. The negative pole of battery, 52, is connected to switch 71 by wire 83, also to indication coil, 60, by wire, 84. The indication coil is connected with one terminal of safety coil 66 by wire 85. The other terminal of the said safety coil is connected with switch 73 by wire 86 and from this point to negative pole of high voltage battery, 32, by wire 87. Contact 79 of switch 72 is connected to switch 70 by wire 88. Contacts 75 of the switch 70 and 78 of the switch 71 are connected together and are also connected to wire 50 leading to one terminal of the reverser, F. Contacts 76 of switch 70 and 77 of switch 71 are joined together and are connected to the other terminal of reverser F by wire 51. The positive pole of high voltage battery, 32, is connected with switch 33 by wire 89. A wire, 90, is connected to contact 74 of switch 33 and to fuse 34, thence to wire 30 of the operating circuit C. Contacts 80 and 81, of switch 73, are connected together, and a wire 91 connects contact 81 with one terminal of indication coil 60. A fuse 92 is included in this connection, and a fuse 93 is included in the connection from positive pole of battery 52 to switch 72. A wire 94 connects switch 14 with wire 50 and a wire 95 connects switch 18 with wire 51. In Fig. 2 are similar circuits and devices to those in Fig. 1, for the purpose of showing that the same operating circuit and source of energy, 32, is common to all switches or like apparatus, and that each unit though separately controlled is supplied by a source of energy, 52, common to all controlling devices. In this, Fig. 2, like designating characters denote like parts, the designating characters referring to one of the units being distinguished from the other by the prime (′) mark.

Referring to Fig. 3, 1 is a signal blade adapted to be moved by a suitable motor of which 8 is the motor armature and 24 is the motor field coil, 25 is what is called a slot coil, the function of which is to retain the signal in the position to which it is moved by the motor 8. Adjacent to the field coil 24 is an induction coil 37 which coil is mounted preferably on the field piece of the motor. A polarized device, F, with its magnet coils, 48 and 49, is connected in the controlling and operating circuit of signal moving device, the armatures 46 and 46′

mounted to swing freely between poles of the magnets 48 and 49 and to engage the contacts 44 and 45. A switch blade 16 is pivotally mounted and adapted to be actuated by the signal blade 1. This switch blade, 16, will be moved to the position shown in the dotted lines when the signal blade, 1, is operated, but normally is held in the position shown by a spring 3′ or other device. This switch blade, 16, when moved will pass over the contacts, 20 and 21. A suitable cut out switch, 17, is provided in the circuit to the signal motor, which is controlled by the movement of the signal blade 1. This switch, 17, will be opened by the signal blade, 1, upon its movement to the clear position and will be closed by the blade, 1, on its return to the stop position. The signal controlling apparatus consists of similar devices, as described in connection with Fig. 1, therefore further description here is unnecessary.

The operation of the controlling device and the signal is as follows: considering all parts of the apparatus to be in their normal positions. If lever, 53, is moved in direction of arrow the bar, 55, which is attached to the said lever will slide in the bed plate, 56, the dog, 58, will be forced down into recess, 57, by the lug, 59, the bar, 68, will also be moved in a reverse direction to that of the arrow and the notches on its under side will engage with and throw the switch blades, 70, 71 and 72 which engage contacts 75, 77 and 79, current will now flow from battery 52, fuse 93 to switch 70, current will also flow from battery 52, wire 82 through safety coil 66, also to switch 70. The coil, 66, being of higher resistance than the parallel circuit from battery 52 to switch 70, will not be sufficiently energized to lift the safety plunger 67, therefore current will flow from the switch 70, contact 75, wire 50, through polarized device F, wire 4, wire 51, to contact 77, switch 71, long contact 79, switch 72 to battery 52. The current flowing in this circuit will energize the polarized device F and cause the armatures 46 and 46′ to engage contacts 44 and 45, current will now flow from wire 50, wire 94, armatures 46 and 46′, contacts 44 and 45 wires 28 and 29 through the motor 24 and 8 and the slot coil 25, wire 51 as above described to battery 52. The motor will now clear the signal blade 1, which blade in moving will shift the switch 16 to the position shown in the lotted lines 16′. As the signal blade 1 reaches the clear position the motor cut out switch, 17, will be opened thus cutting off current from the said motor but current will still pass through the slot coil, 25, and hold the signal clear. As the devices employed for the purpose of cutting out the motor are well understood to those familiar with the art a detailed description is unnecessary, inasmuch as no claims are made for such devices. As the switch, 16, is moved to the dotted position 16′ it passes over the contacts 20 and 21, in so doing a current will pass from the switch 16, contact 20, coil 37, wire 31, coil 60 to battery 52. This current while sufficient to energize the indication coil, 60, and lift its plunger, 61, does not interfere in any way with the operation of the controlling apparatus, as no indication is required for a signal going to the clear position. As long as the lever, 53, is in the position just described the signal blade, 1, will remain clear, as the slot coil, 25, remains energized. If now the lever, 53, is returned to its normal position, as shown in Fig. 3, the switches 70 and 71 will disengage contacts 75 and 77 and engage contacts 76 and 78, the switch 72 still remaining in contact with 79 owing to the fact that the dog 58 is down in the recess 57 of the bed plate 56, and will so remain until the plunger 61 with its T head 62 is lifted and forces up the dog 58. Upon the switches 70 and 71 disengaging contacts 75 and 77 the circuit through the polarized device, F, is broken temporarily thus deënergizing the said device, and when the switches engage contacts 76 and 78 the current from battery 52 flows through the polarized device F, over the same circuit as before but in a reverse direction, thus energizing the coils of device F and changing its polarity, thus causing the armatures 46 and 46′ to leave contacts 44 and 45, thereby breaking the circuit of the motor. Current however will flow from battery 52, over wire 51 and through armature 8 and field coil 24 to contact 21. When signal blade, 1, returns to its stop position the switch, 16, will return to its normal position being pulled to that position by a suitable spring, 3, or other device, such as a counterweight, or may be forced up by the signal blade, 1, itself. As this switch, 16, returns it first engages contact 21 before touching contact 20.

I have stated above that current flows from battery 52 through motor to contact 21, therefore it will pass through switch 16, wire 94 and wire 50 back to battery 52. The current passing over this circuit will energize the motor but will not move the signal blade, 1, as the slot 25 is not energized. This energization of the motor is only temporary as the switch 16 passes quite rapidly over the contacts. At the instant the motor circuit is energized the switch 16 engages contact 20, thus closing the secondary circuit through coil 37, the field coil, 24, being the primary of the induction coil. The making of this secondary circuit will not cause it to become energized as the primary circuit through field coil, 24, is already made, but as the switch 16 still moves it breaks the circuit through field coil 24 at contact 21 before it breaks the secondary circuit at contact 20. Therefore

while switch 16 is still in contact with 20 and just disengaged contact 21 a high electro motive force will be generated in coil 37 for an instant. This electro motive force will cause an instantaneous flow of current or at least an inductive impulse to pass over the circuit, starting at coil 37, wire 94, wire 50, contact 78, switch 71, contact 79, switch 72, indication coil 60, wire 31 back to coil 37. This momentary inductive impulse will energize the indication coil 60 sufficiently to cause it to lift its armature 61 and force up the dog 58, which releases the lever 53, permitting it to be moved to its full normal position. It may be noted that while current is passing through the motor, while the switch 16 engages both contacts 20 and 21, that current may flow through the coil 37 and over wire 31 to the indication coil, but it must be observed that these coils are then in series with the motor and therefore not sufficient current would flow to energize the coil 60. The switch 16 finally moves upward until it disengages contact 20 and thus opens the circuit through coil 37.

We will now consider that all parts shown and described are in their normal position and it is desired to operate switch A. The lever, 53, is pulled forward in direction of arrow, this movement of the lever, 53, will slide the bar, 55, forward until the dog, 58, is forced down in the pocket, 57, of the bed plate, 56, the lever can now be moved no farther until the dog, 58, is again forced up. The movement of the bar, 55, places the recess 64 over the plunger, 67, of the safety coil 66. This movement of the lever also operates the bar 68 in a reverse direction to that of the arrow, and by its engagement with the upper ends of the switches 33, 70, 71, 72 and 73 moves them to the right, in so doing switch 33 will rest on contact 74, closing the operating circuit from battery 32. Switch 70 will disengage contact 76 and engage contact 75. Switch 71 will disengage contact 78 and engage contact 77. Switch 72 will engage contact 79 for a short interval and then pass off the said contact. Switch 73 will disengage contact 81 and engage contact 80. Up to this point the apparatus at A has not moved. However the switch 72 in passing over contact 79 closes the circuit of the reverser, F, and current will flow from the positive side of the low voltage controlling battery, 52, through wire 82, fuse 93 to switch 72, contact 79, wire 88, switch 70, contact 75, wire 50, through reverser and back over wire 51 to contact 77, switch 71, wire 83, back to negative side of battery 52. The switches 70 and 71 are arranged to engage the contacts 75 and 77 before the switch 72 has passed entirely off the contact 79. As this circuit is completed through the reverser the polarized armature 46 will swing to the left disengaging contact 44 and engaging contact 45. The operating current will now flow from positive pole of operating battery, 32, wire 89, switch 33, contact 74, wire 90, fuse 34, wire 30, wire 47, armature 46, contact 45, wire 43, switch 19, contact 23, wire 27, field 25 of motor 8, contact 29, armature of motor 8, contact 35, wire 36, wire 31, to negative side of battery 32. This will cause the motor armature to revolve and the nut 6 to travel on the screw 7, in so doing the projection 9 of the nut will engage the horn 11 of the switch 14, and thus throw the switch 14 to its reverse position. The nut will continue to travel until it throws the escapement crank, 2, and operates the switch 1. As the switch 1 completes its stroke the projection 9 of the nut 6 strikes the horn 13 of the switch 15 and throws it into a reverse position. In so doing the switch blade 18 will engage contact 22 before the switch blade 19 disengages contact 23. As switch blade 19 leaves the contact 23 the motor circuit is broken.

The breaking of the motor circuit induces in the secondary windings, 37 and 38, which may or may not be wound on the motor field pieces, a high electro motive force. This induction is only temporary, in fact lasts only a fraction of a second, due to the fact that only a single impulse is possible as the motor circuit is only broken once. This impulse is transmitted to the indication coil, 60, as follows: from the coils 37 and 38, wire 39, wire 36, wire 31, wire 87, switch 73, contact 80, fuse 92, coil 60, wire 84, switch 71, contact 77, wire 51, wire 95, switch blade 18, contact 22, wire 41, wire 40, to coil 38. This impulse will energize the induction coil 60 and its plunger will lift and drive up the dog 58 in the bar 55. After the dog 58 is lifted the stroke of the lever 53 can be completed. The current which energizes the coil 60 also passes from switch 73, wire 86, safety coil 66, wire 85, wire 84 to wire 51 as in case of indication coil. These coils 60 and 66 are in parallel but their resistances are such that the coil 66 will not be sufficiently energized to lift its plunger 67, by the impulse which operates the indication coil plunger 61. Coil 66 is of say 100 ohms and coil 60 is say 5 ohms. If however current from the positive side of battery 32 should come in contact with 51 current will flow over wire 51 in a reverse direction to that just described and would pass through coils 60 and 66 in a reverse direction energizing both cores for the instant. The coil 60 being of low resistance would take a great quantity of current and consequently the fuse 92 would open. This would cause the plunger 61 to drop. The plunger 67 of coil 66 would however stay up, locking the lever against further movement, the circuit through the coil 66 not being fused and the resistance being high. The lever 53 would remain locked until the cross was removed.

It will be noticed that the system is de-energized when the lever 53 is either full normal or full reversed. If the lever be again put toward its normal position the switch 1 at A will be operated in a reverse direction and the different contacts would break and make in the same sequence as before described, but in a reverse direction. Therefore a description for the normal movement is unnecessary. Although I show the secondary coils, 37 and 38, as part of the motor, I can arrange a suitable induction coil outside the motor using the motor current to give the required impulse. It is however more compact and cheaper to make the induction coil part of the motor itself.

It is to be understood that the system as herein shown and described while operative is not absolutely correct in detail, only such devices being included as are essential to the description, and therefore I do not wish to be limited to the devices shown or to be limited in the use of the system as the same principle could be applied to the operation of switches, derails, crossovers and signals, and it should be further understood that the drawings are only diagrammatical and that the different parts may only resemble the actual devices employed. The claims will however be made on new features which embody new principles.

What I claim as my invention and desire to secure by Letters Patent is:

1. With a switch or signal operating device and controlling means for the said device, a device for indicating the position of the switch or signal, actuated by an inductive impulse originating at the device operated.

2. A switch or signal operating device, means for operating the said device; means for controlling the said operating means, and means for producing, at the operating device, an inductive indication in the controlling means, showing that the operating device has completed its operation.

3. The combination of a switch or signal operating device; a controlling electric circuit for said device; an induction coil associated with said operating device; an indicating device connected with the induction coil and adapted to indicate the position of the operating device, upon the breaking of the circuit of the operating device.

4. The combination of a switch or signal operating device; electrical means for operating the said device; controlling devices for the said operating means and means for indicating the position of the operating device dependent upon the breaking of the electrical circuit of the operating device at the completion of its movement in either direction.

5. The combination of an electrically operated switch or signal moving device; electrical means for controlling the operation of the said device; an indicating device associated with the said controlling means; a device adapted to operate the indicating means by an induced current; the said induced current emanating from the switch or signal moving device, and means for generating the induced current; said means becoming operative only on breaking the electrical circuit of the switch or signal moving device.

6. The combination of an electrically operated switch or signal moving apparatus; a coil connected therewith and so arranged that an electro motive force will be induced therein only after breaking the electrical circuit of the said switch or signal moving apparatus and an electrical circuit and source of energy for moving the said apparatus.

7. The combination of an electric motor for operating a switch or signal; an operating electric circuit and source of energy for the said motor, and a coil located adjacent to the motor field coils and arranged to have an electro motive force induced therein upon the rupture of the motor circuit.

8. The combination of an electrically operated switch or signal moving device; an electrical circuit and source of energy for operating the said device; an electrical circuit and source of energy for controlling the said operating circuit; said controlling circuit and source of energy being independent of the operating circuit; an indicating device connected with the operating circuit and the controlling circuit; said device adapted to be operated by an inductive impulse emanating from the switch or signal moving device and an induction coil associated with the switch or signal moving device for generating the inductive impulse for the indicating device; the electro motive force of the induction coil being induced therein by the rupture of the operating circuit.

9. The combination of a switch or signal operating device; an electrical circuit and source of energy for the said device; an electrical circuit and source of energy for controlling the said operating device independent of the operating circuit; means connected with the controlling circuit for indicating the position of the operating device; said means operating when energized by an inductive impulse due to the breaking of the circuit of the operating device.

10. The combination of a plurality of switch or signal operating devices; an operating circuit and source of electrical energy common to all the said operating devices; a separate controlling circuit for each operating device and means connected with each controlling device for indicating the position of the operating device which it controls; each of said indicating devices adapted to op-

erate when energized by an impulse generated by the breaking of the electrical circuit of their respective operating devices.

11. The combination of a plurality of switch or signal operating devices; an electrical circuit and source of energy for all the operating devices; a separate controlling circuit and source of energy for each operating device and means associated with the operating circuit and the controlling circuit of each operating device for indicating the position of the operating devices.

12. The combination of a plurality of switch or signal operating devices; a plurality of controlling circuits for the said devices; an operating circuit and source of energy common to all the operating devices; means associated with each switch or signal operating device for transmitting an inductive impulse; means associated with each controlling circuit for receiving the said impulse transmitted by its respective operating device and means also associated with each controlling circuit for indicating that its respective operating device has completed its movement; said means being responsive to the said inductive impulses transmitted by the operative devices.

In testimony whereof I have affixed my signature in presence of two witnesses.

JOHN T. CADE.

Witnesses:

C. W. BERDAN,

J. F. ZABRISKIE.