No. 887,291. PATENTED MAY 12, 1908.

J. D. TAYLOR.

SAFETY CONTROLLER FOR ELECTRIC SWITCH OPERATING APPARATUS.

APPLICATION FILED DEC. 8, 1906.

4 SHEETS—SHEET 1.

Fig: 1.

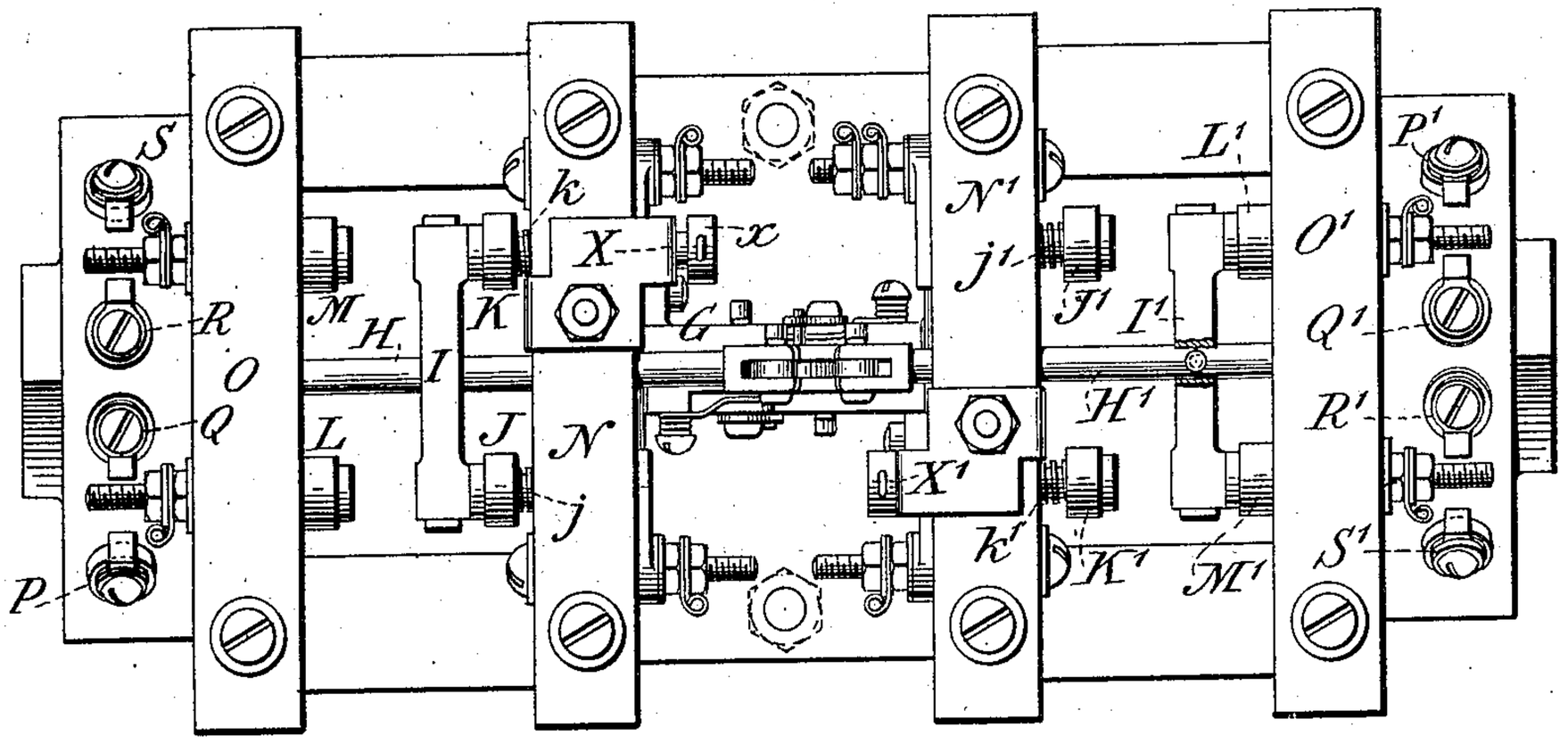


Fig: 2.

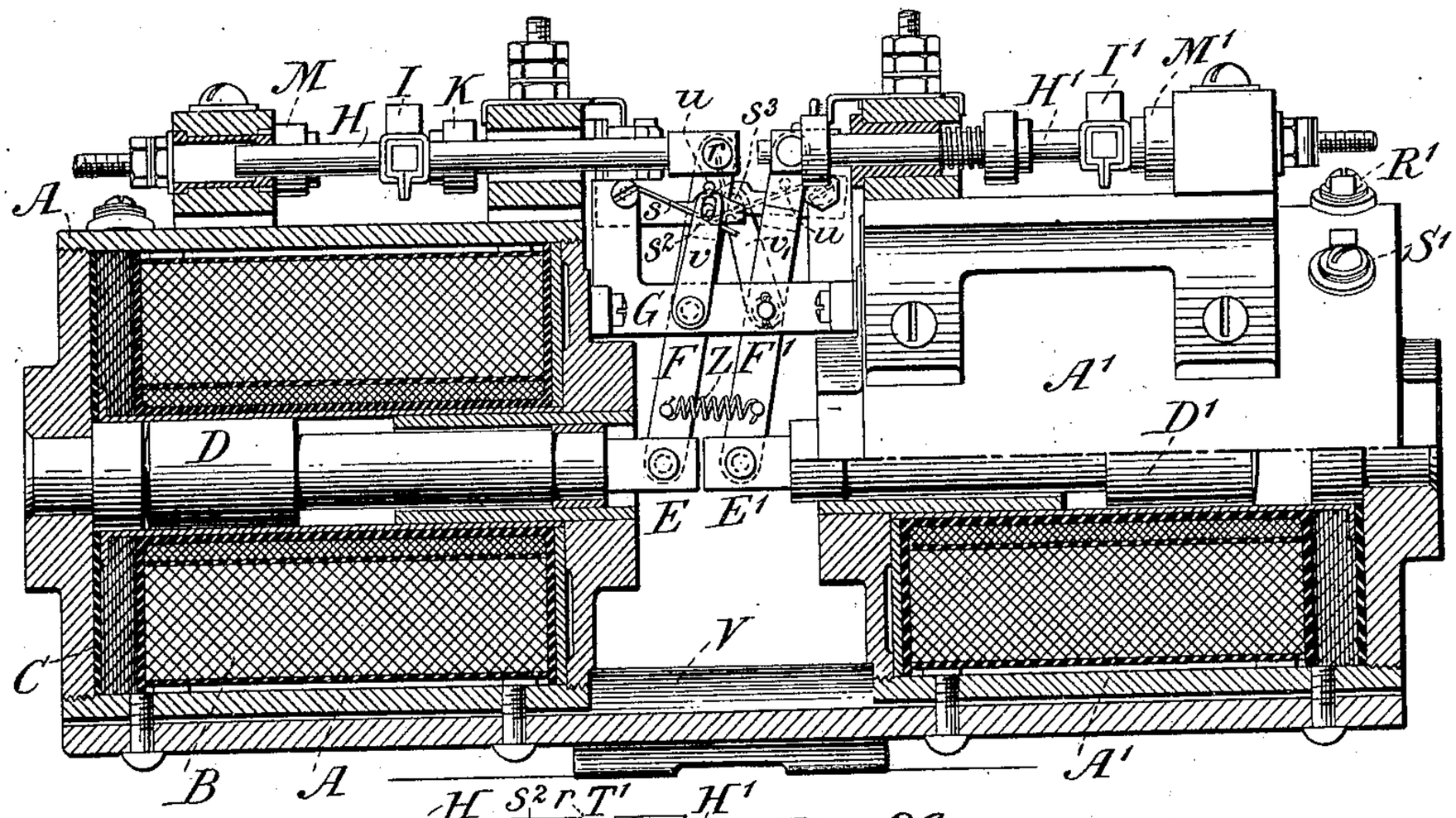
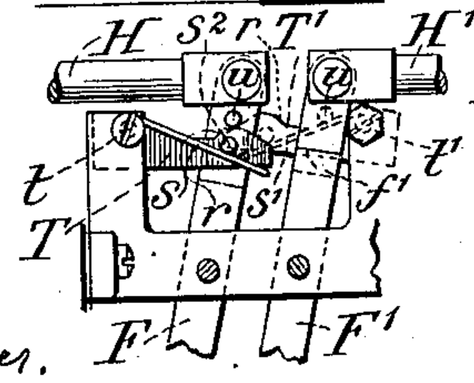


Fig: 2a.



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4 SHEETS—SHEET 2.

Fig: 3.

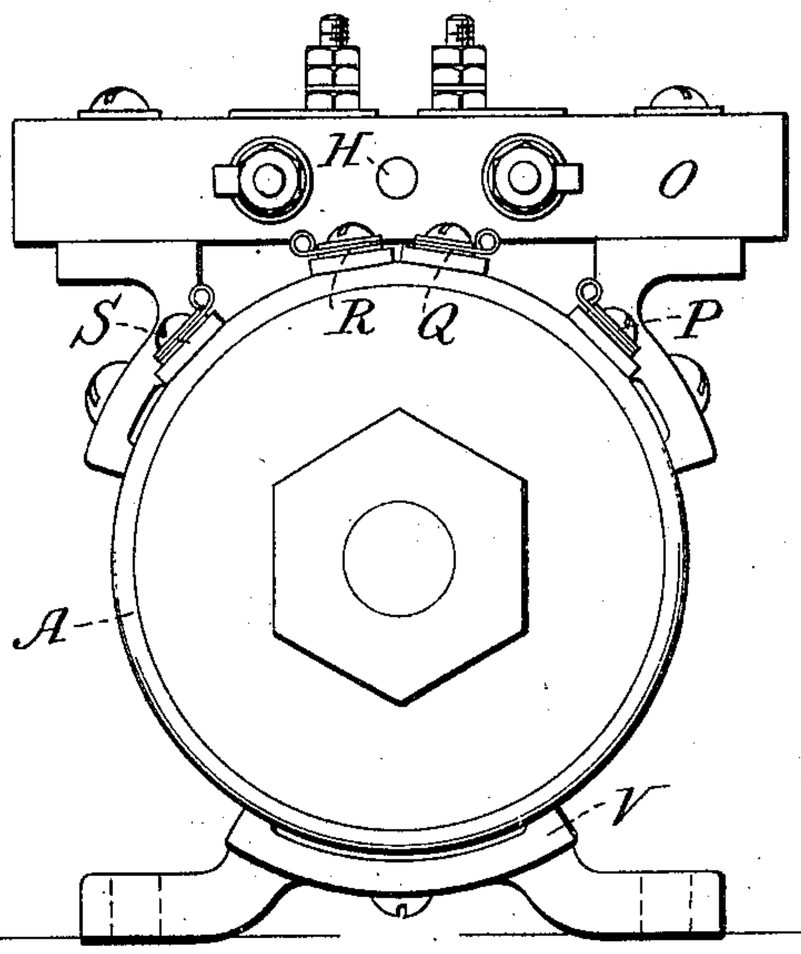
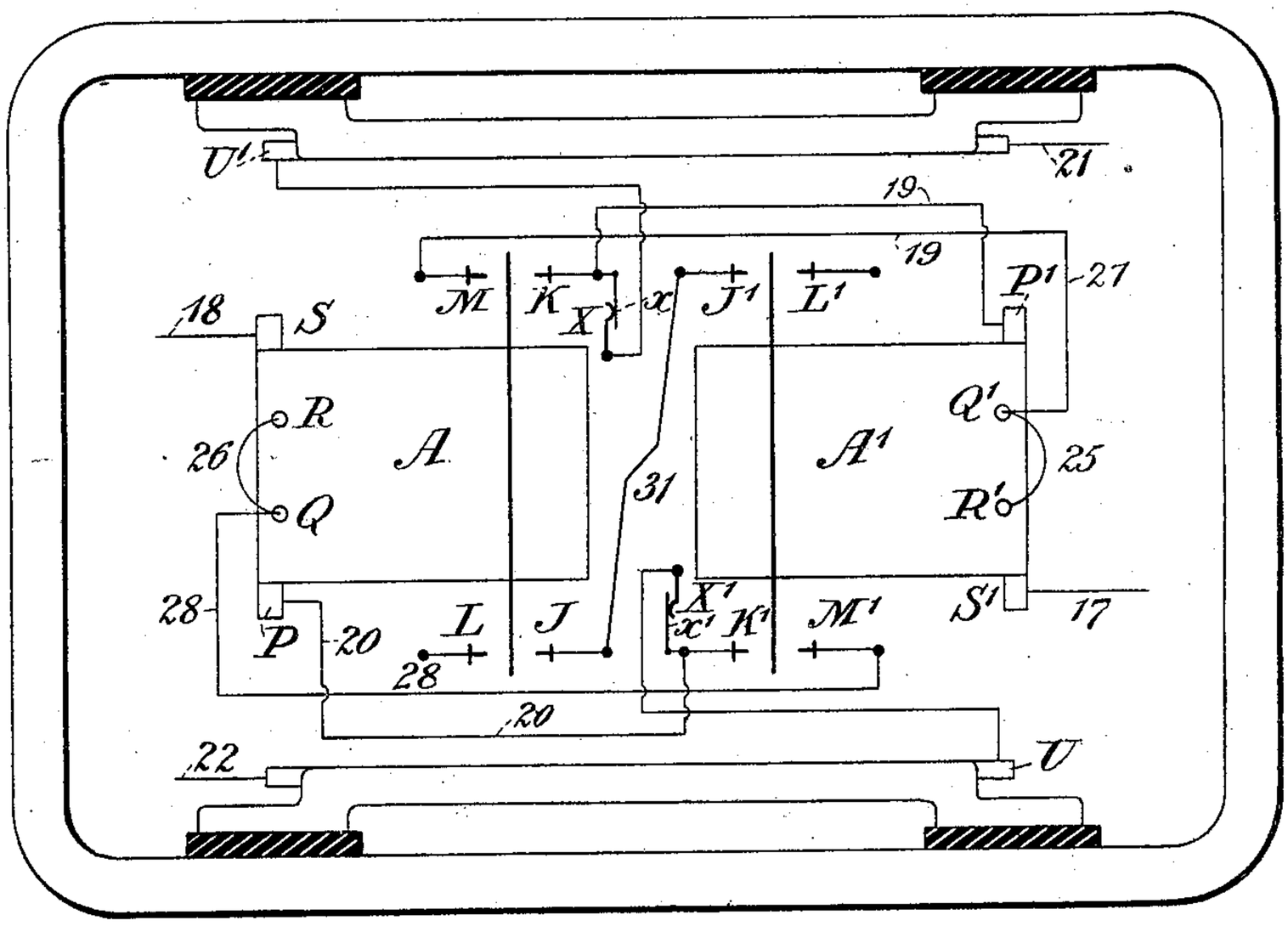


Fig: 4.



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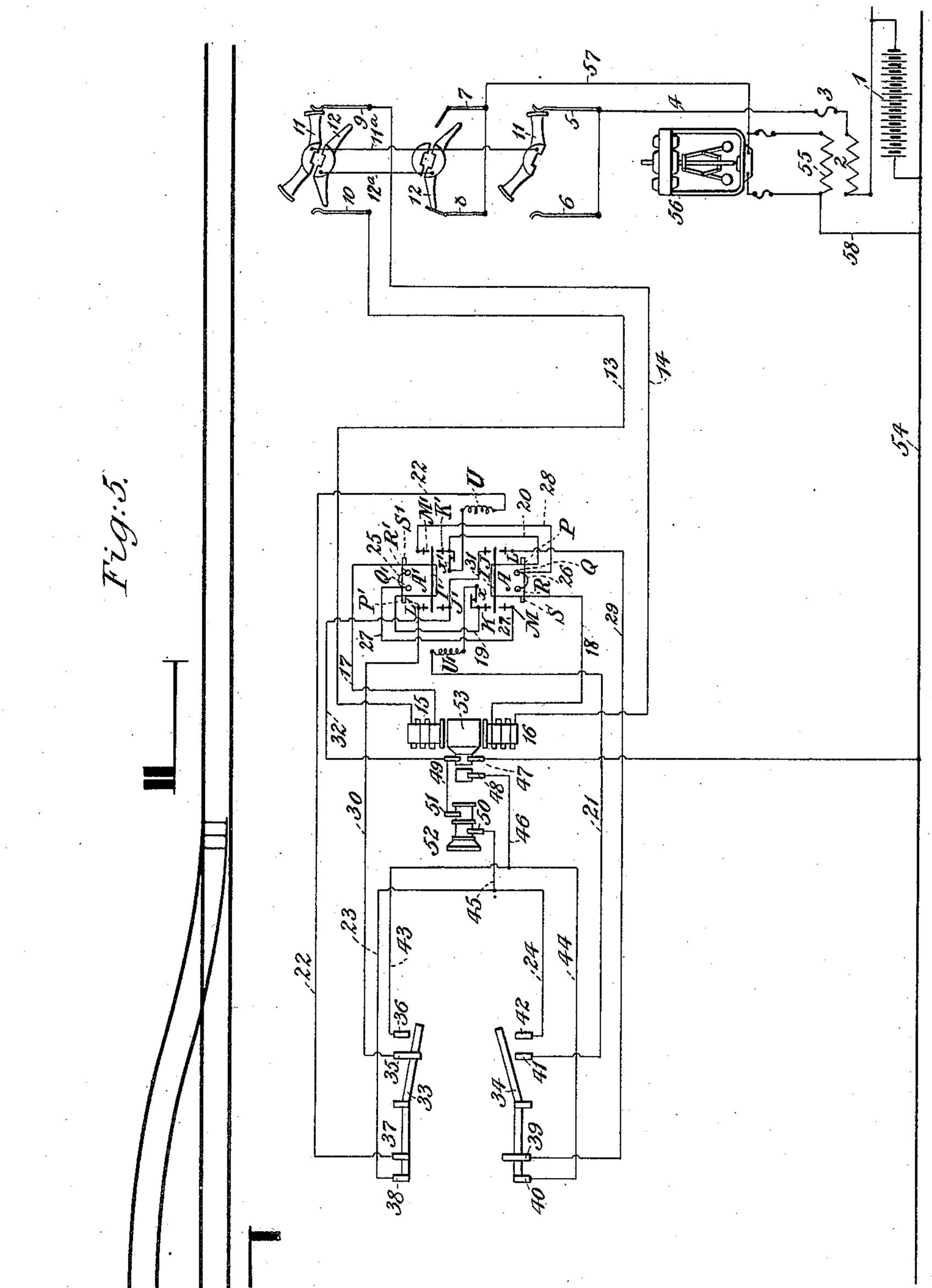
4 SHEETS—SHEET 3.

Fig. 5.



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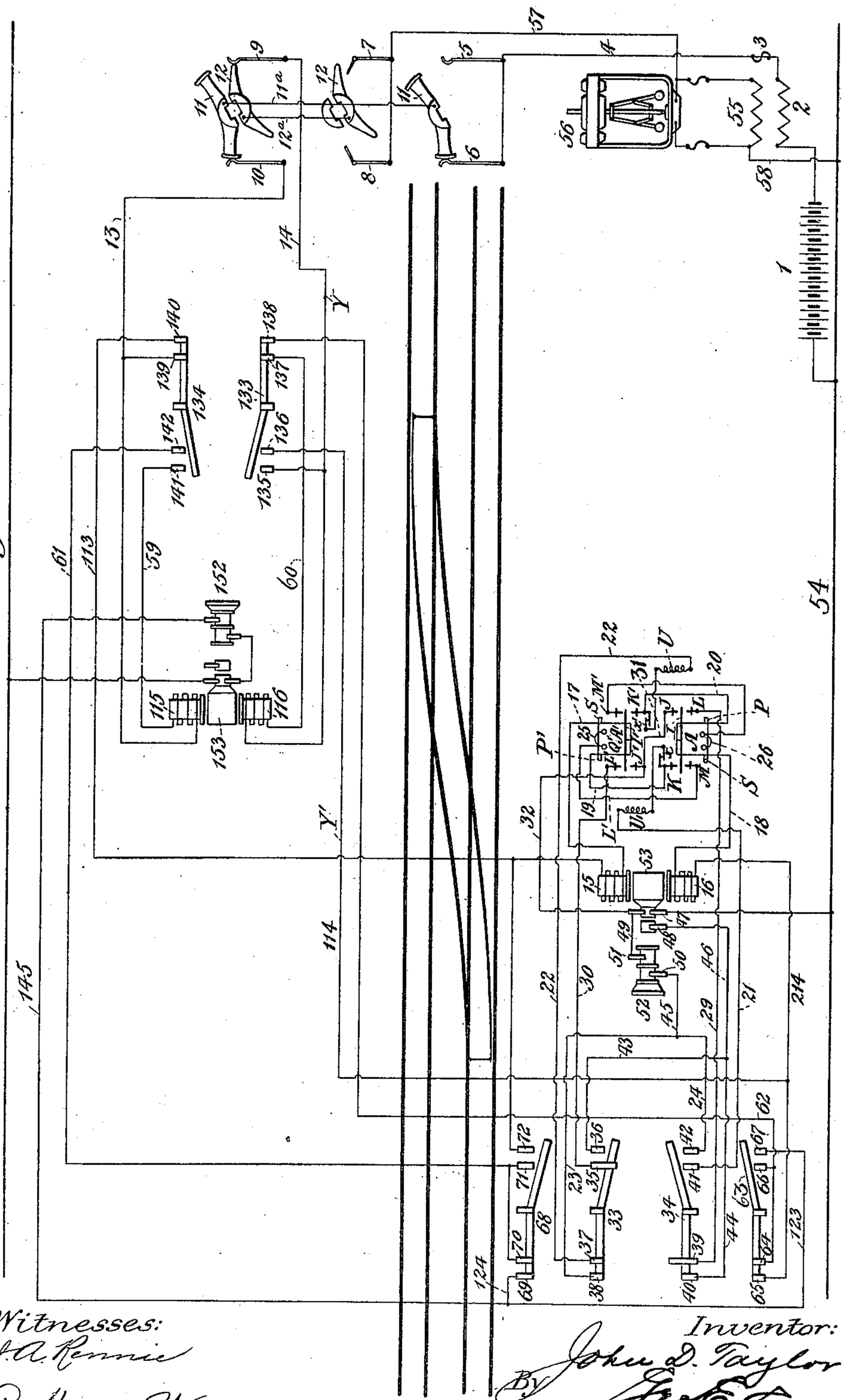
4 SHEETS—SHEET 4.

Fig. 6.



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UNITED STATES PATENT OFFICE.

JOHN D. TAYLOR, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO THE UNION SWITCH AND SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

SAFETY-CONTROLLER FOR ELECTRIC SWITCH-OPERATING APPARATUS.

No. 887,291. Specification of Letters Patent. Patented May 12, 1908.

Application filed December 8, 1906. Serial No. 346,853.

To all whom it may concern:

Be it known that I, JOHN D. TAYLOR, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented new and useful Improvements in Safety-Controllers for Electric Switch-Operating Apparatus, of which the following is a specification.

This invention relates to safety controllers for electrically operated switches, and the object of the invention is to provide a controller which will cut off the driving current when the operating lever is moved to its final position and which also will prevent any movement of the switch by stray currents due to crossed wires or faulty insulation.

I will describe an apparatus embodying a preferred form of my invention and then point out the novel features in claims.

In the accompanying drawings: Figure 1 is a plan view of a controller embodying my invention; Fig. 2 is a side elevation partly in section; Fig. 2^{A} is a view of a detached detail; Fig. 3 is an end view; Fig. 4 is a diagram showing the system of wiring in the controller; Fig. 5 is a diagrammatic view of the circuits employed with my invention in connection with a single switch; Fig. 6 is a similar view in connection with a cross-over.

The controller comprises two solenoids A and A′, supported on a cast iron base V. Each solenoid has a core, that of the solenoid A being marked D, and that for the solenoid A′ being marked D′. These cores are connected respectively by means of jaws E and E′ to levers F and F′, and the levers are pivoted substantially midway their length to a bracket G. The upper end of the lever F is connected to a rod H which is free to move longitudinally, and carries a contact bridge I which will connect the contacts J and K when the core D is drawn into the solenoid A, and will also connect the contacts M and L when the solenoid is in its outer position.

The lever F′ is connected at its upper end to a rod H′ which is free to slide longitudinally, and carries a bridge I′ which will connect the contacts K′ and J′ when the core D′ is drawn inwardly, and will also connect the contacts M′ and L′ when the core is in its outer position. The levers F and F′ are connected near their lower ends by a spring Z, which will cause them to move in unison and will also provide a limited movement of one core without affecting the movement of the other core.

The contacts J and K are mounted on a slate block N with springs *j* and *k* interposed to permit a yielding movement of the contacts for a purpose to be hereinafter described. The contacts L and M are fixed to a slate block O. The contacts K′ and J′ are mounted in a slate block N′ and have the springs *j*′ and *k*′ interposed to permit a yielding movement in a manner similar to the contacts J and K; and the contacts L′ and M′ are mounted on a slate block O′. When, for example, the core D is drawn inwardly, the bridge I will engage the contacts K and J before the bridge I^{8} engages the contacts L′ and M′, and this will happen before the core D has completed its stroke. A further movement of the core will cause the bridge I′ to engage the contacts L′ and M′ and the contacts K and J will be pushed in against the tension of the springs. This also will occur before the core has fully completed its stroke and in the completion of the stroke the spring Z will permit the lever F to move independently of the lever F′, since the latter can have no further movement on account of the contacts L′ and M′ being rigid. This spring compensation insures perfect contact.

Each solenoid has two coils of wire indicated respectively by B and C and B′ and C′. The coils C and C′ have a comparatively small number of turns and the coils B and B′ have a comparatively large number of turns, substantially in about the proportion of 10 to 1 as compared with the coils C and C′. Resistance coils U and U′ are also provided, and are in series with the coils B and B′ respectively at the starting of a movement and the circuits including the coils B, B′ and C, C′, and the resistances may be termed the starting circuits. The coil B is connected to terminals P and Q, the coil C is connected to terminals R and S, the coil B′ is connected to terminals P′ and Q′ and the coil C′ to the terminals R′ and S′.

At the beginning of a movement, the current flows through coils C, B and resistance U in series and draws in the core D, causing the bridge I′ to connect L′ and M′, which shunts the coil B and resistance U so that the operating and indication currents flow only

through the coil C which is of very low resistance, but has sufficient turns to hold the core D in place. The bridge I will touch the contacts K and J before the bridge I′ touches the contacts L′ and M′ so that if the current happens to come from a crossed wire without the operating lever having been moved, current would also flow through the last operating wire, which is still in connection with the battery, through the coils C′, B′, bridge I and the motor, and would hold the bridge I′ away from the contacts L′ and M′ by drawing in the core D′. This current would run the motor light in the direction it ran in making the last movement and without energizing the clutch. The contact K has a stem which extends through the slate block N and carries at its inner end a head *x*, which engages a contact X when the contact K is pushed outwardly by the spring *k*, but when the contact is pushed inwardly by the bridge I the head *x* will disengage the contact X. The object of this is to cause the cut-off current to flow only through the safety contacts J and K, and thus afford a test of their condition at each movement of the switch.

Referring now to Fig. 5, which shows the circuits employed in the operation of a single switch, the parts are shown in the position they occupy at the beginning of what may be termed a reverse movement. Current will flow from battery 1 through primary 2, fuse 3, wire 4, bridge 11 (the parts marked 11, 11ª and 11 in this diagram are one piece on a machine), spring contact 9, wire 14, field 16, wire 18, coil C of solenoid A, connector 26, coil B of solenoid A, wire 20, contacts K′, X′, resistance U, wire 22, contacts 37 and 38 of knife switch 33, wire 23, wire 45, clutch 52 by brushes 50 and 51, armature 53 by brushes 49 and 47, thence by common wire to the battery. This circuit will energize the solenoid A, and the bridge I will connect the contacts J and K, and the bridge I′ will connect the contacts L′ and M′. The circuit will still remain the same up to the wire 18, when it will pass through the coil C of the solenoid A, to wire 28, contact M′, bridge I′, contact L′, wire 30, contact 35, knife 33, contact 38 to wire 23, whence it is the same as before described. The current through the coil C will hold the core D and the bridges I′ and I in position, as just referred to.

When the switch movement is completed the knife 33 is moved from the contact 38 to the contact 36, but still remains in engagement with contact 35. This cuts off the current from clutch 52 and causes it to flow through wires 43, 46, indication brush 48, armature 53, brush 47, through common to battery. The current will still flow through the coil C, thus holding the bridges I′ and I in the position noted. The current entering the armature 53 by way of the brush 48, which bears on a ring connected to a segment of the commutator, is thereby rendered pulsating in character. In flowing through the primary 2 of the transformer it develops magnetism of a like character in the iron core of the transformer, which in turn, develops an alternating current in the secondary 55 which flows through the induction motor 56, by means of which the latch is lifted in order to release the lever to make its final movement.

The final movement of the lever puts the bridge 12 in contact momentarily with spring contacts 8 and 10, which closes a branch circuit and current flows from the armature 53 by way of the brush 49, wires 32, and 31, to contact J, bridge I, contact K, wire 19, coil B′ of solenoid A′, connector 25, coil C′ of solenoid A′, wire 17, field 15, wire 13, spring contact 10, bridge 12, spring contact 8, wire 57, motor 56 and secondary 55 in parallel, and wire 58 to battery. This current energizes the solenoid A′ and draws in its core D′ and pulls the bridge I′ away from the contacts L′ and M′, thus cutting off all current.

When the core D is drawn completely into the solenoid A, a latch T will be forced down into the path of a projection *f′* on the lever F′, so that if the solenoid A′ is energized while the solenoid A is still holding its core in, the core D′ will be stopped by the latch T before it puts the bridge I′ into engagement with contacts J′ and K′. A similar latch T′ stops the core D under similar conditions. Fig. 2ª shows this feature in detail and it will be seen that the latches T and T′ are pivoted respectively at *t* and *t′*. The latches are held in elevated position by means of springs *s* and *s′* which engage pins s^2 and s^3 which project outwardly from the respective latches. Each latch is provided with an inclined surface *r* with which pins *u* on the lever F and F′ are adapted to engage when the cores are at their innermost position and these pins bearing on the said inclined surfaces will force the latches downward against the force of the springs. The pins s^2 and s^3 project through slots in the upper ends of arms *v* and *v′* respectively, which arms are pivoted at their lower ends to the bracket G and serve as guides and retainers for the latches T and T′. These latches come into play when a solenoid is energized by the cut off current flowing in the circuit established by the final movement of the lever just mentioned. If at this point of the operation the bridge I′ was allowed to move far enough to touch the contacts J′ and K′, the safety circuit, to be directly described, would be temporarily closed and cause sparking at the contacts.

Referring now to Fig. 6, which is a diagrammatic view of the circuits, etc. employed with my invention when used in connection with a cross over, the parts illustrated are all in normal position. In order to reverse the

position of the cross over the bridge 11 will be moved by the lever to connect the contacts 5 and 9, when current will flow from the battery 1 through primary 2, fuse 3, wire 4, spring contact 5, bridge 11, spring contact 9, wire 14, field 116, wire 60, contacts 137 and 138 of the knife switch 133, wire 62, contacts 64 and 65 of knife switch 63, wire 214, field 16, wire 18, coil C of solenoid A, connector 26, coil B of solenoid A, wire 20, contacts K′, X′, resistance U, wire 22, contacts 37, 38 of knife switch 33, wire 23, wire 45, clutch 52, wire 49, armature 53, thence by common to the battery. This current energizes solenoid A, thereby causing the bridge I to connect contacts J and K and the bridge I′ to connect the contacts L′, M′. The connection of L′ and M′ shunts the coil B and resistance U out of the motor circuit, as heretofore explained in connection with a single switch. When the mechanism connected to the armature 53 has moved a short distance, the knife switch 63 is moved from contacts 64 and 65 to contacts 66 and 67 which breaks the circuit through the armature 53 and continues the circuit from wire 62 through contacts 66, 67, wires 123, 145, clutch 152, armature 153, thence through common to battery.

The switch operated by the motor 153 then makes its complete movement at the end of which the knife 133 is shifted from contacts 137 and 138 to contacts 135 and 136, which stops the current through the field 116 and armature 153 and continues the circuit from wire 14, contacts 135, 136, wires 114, 214, to field 16, thence it is the same as that above traced which caused the preliminary movement of the mechanism operated by the armature 53. The current in this last circuit causes the armature 53 to complete the movement and indicate, which it does in the same manner as already described with reference to the single switch.

The action of the cross-over mechanism may be briefly stated as follows: The armature 53, which is governed by the safety controller, starts the movement and after a short preliminary movement opens its own circuit and closes the circuit of the armature 153. This latter armature then completes the movement of the switch to which it is connected, opens its own circuit and again closes the circuit through the armature 53, which then completes the movement and indicates.

In order to explain the action of the controller in protecting the switch against movement by stray currents caused by crossed wires, I will refer to Fig. 6, which shows the operating lever in normal position. Assuming the live wire to be crossed with wire 14 at the point marked Y, current would flow through the solenoid A just the same as though the lever had been reversed. This would cause the bridge I to engage contacts J and K, when a circuit would be closed and current would flow from battery 1 through secondary 2, fuse 3, wire 4, spring contact 6, bridge 11, spring contact 10, wire 13, contacts 139, 140, wire 113 to field 15, wire 17, coils C′ and B′ of solenoid A′, wire 19, contact K, bridge I, contact J, wire 31, wire 32, armature 53 by way of brushes 49 and 47, through common to battery. This current would energize solenoid A′ and would hold the bridge I′ away from contacts L′ and M′. It would also turn the armature 53 in the direction it ran in making the last movement, because the current goes through the same field 15 that was then used. The rotation of the armature produces a back E. M. F. which limits the current to such a small amount that there is no danger of burning out the solenoid A′. This condition would continue as long as wires remain crossed. When the cross has been removed, the apparatus will replace itself automatically in proper condition for use. If the cross occurred at Y′ on wire 114, the action would be the same as just stated in connection with the cross at Y.

In the foregoing description the parts have been described as occupying positions to first energize the solenoid A, but it will be understood that a reversal of the positions described would result in the energization of the solenoid A′, and in such case the solenoid A would be energized by the final movement of the operating lever. Thus, if the bridge 11 in Fig. 5 was moved to engage contacts 6 and 10, current would flow by wire 13 to field 15 and thence by wire 17 to the windings of solenoid A′. In such case the high resistance winding B′ and resistance U′ will be cut out by the movement of core D′. In other words, under these conditions the solenoid A′ will operate and perform the same functions as described in connection with solenoid A and solenoid A will operate and perform the same functions as described in connection with solenoid A′.

Having described my invention, I claim:

1. In railway switch operating mechanism comprising a motor, operating circuits, and a source of current, a safety device comprising two solenoids, means actuated by one of said solenoids for closing a circuit of the other solenoid, and means actuated by said other solenoid for holding the operating circuits of the motor open.

2. In railway switch operating mechanism comprising a motor, operating circuits, and a source of current, a safety device comprising two solenoids, a circuit controller closed by the action of one solenoid when not prevented by the action of the other solenoid, for controlling an operating circuit of the motor, and a circuit closer actuated by the said one solenoid for closing the circuit to the said other solenoid to prevent the closing of said operating circuit.

3. In railway switch operating mechanism comprising a motor, operating circuits, and a source of current, a safety device comprising two solenoids with movable cores, a circuit controller in an operating circuit of the motor, a yielding connection between the circuit controller and one of said cores through which the movement of said core tends to close said operating circuit, a rigid connection between said circuit controller and the other of said cores through which the attraction of said other core by its solenoid, holds said operating circuit open, and a circuit controller actuated by said core with the yielding connection, for closing a circuit through the other solenoid.

4. In railway switch operating mechanism comprising a motor, operating circuits, and a source of current, a safety device comprising a circuit controller in an operating circuit, a solenoid for acting on said circuit controller to hold said operating circuit open, against the tension of a spring tending to close it, a second solenoid and circuit controller actuated thereby for closing a circuit of the first solenoid, and a lever and circuit controller actuated thereby for opening the circuit of said first solenoid to permit the closing of said operating circuit.

5. A safety device for a railway switch operating mechanism comprising a motor, operating circuits, a lever and a source of current; the said safety device comprising two solenoids, circuit controllers actuated thereby for controlling the operating circuits to the motor, and means actuated by the solenoids for holding the operating circuits of the motor open when the lever is in either extreme position.

6. In electric switch operating mechanism, two oppositely disposed solenoids each having a winding of high resistance and a winding of low resistance connected to each other and a resistance in series with the winding of the high resistance, combined with switch operating devices, circuits connecting said devices with the respective solenoids, circuit controlling devices for energizing either of said solenoids, circuit controlling devices actuated by the movement of the core of the energized solenoid for cutting out its high resistance winding and the resistance in series therewith, and devices also operated by said core for limiting the movement of the core of the other solenoid should the latter be prematurely or accidentally energized before the other solenoid is deënergized.

7. In electric switch operating mechanism, two oppositely disposed solenoids each having a high resistance winding and a low resistance winding connected to each other, and a resistance in series with the high resistance winding and mechanical connections between the cores of the solenoids combined with switch operating devices, circuits connecting said devices with the respective solenoids, and mechanical circuit controlling devices operating first to energize one of said solenoids, to cause its core and the connected core to establish a working circuit through its low resistance winding and cut out its high resistance winding and the resistance in series therewith, and operating finally to energize the other solenoid to cause its core to cut off the working current.

8. In electric switch operating mechanism, two oppositely disposed solenoids, circuit controlling devices operated by the cores of the respective solenoids, movable stops, and means actuated by one core on the completion of its inner movement to move one of said stops into position to limit the inward movement of the other core.

9. In electric switch operating mechanism, a safety controller comprising two oppositely disposed solenoids, movable levers to which the cores of the solenoids are connected, a contact bridge connected to each lever, two pairs of contacts for each solenoid with which the respective bridges coöperate to close circuits, and circuit connections between said contacts, the solenoids and the switch operating devices.

10. In electric switch operating mechanism, a safety controller, comprising two oppositely disposed solenoids, two pivoted levers connected at their lower ends to the cores of the solenoids, a spring connecting the lower ends of the levers to cause them to move together, sliding rods connected to the upper ends of the levers, a bridge carried by each rod, two pairs of contacts with which each bridge may engage, and circuits connecting the contacts, the switch operating devices, and the solenoids.

11. In electric switch operating mechanism, a safety controller comprising two oppositely disposed solenoids, two pivoted levers connected at their lower ends to the cores of the solenoids, a spring connecting the lower ends of said levers to cause them to move together, a sliding rod connected to the upper end of each lever, a bridge carried by each rod, a pair of fixed contacts and a pair of yielding contacts supported in position to be engaged by each bridge, circuits connecting the several contacts, the solenoids and the switch operating devices, a resistance included in each solenoid circuit, and contacts carried by said yielding contacts to cut out the resistances when said yielding contacts are moved by the bridges.

12. In electric switch operating mechanism, a safety controller comprising two oppositely disposed solenoids each having a winding of high resistance and a winding of low resistance connected to each other, and a resistance in series with the high resistance winding, and means controlled by the movement of each core of the respective magnets

to cut out its high resistance winding and the resistance in series with it.

13. In electric switch operating mechanism, a safety controller comprising two oppositely disposed solenoids each having a winding of high resistance and a winding of low resistance connected to each other, and a resistance in series with the high resistance winding, combined with switch operating devices, circuits connecting said devices and the windings of the solenoids, and means operated by the movement of each core of the magnets to cut out its high resistance winding and the resistance in series with it.

14. In electric switch operating mechanism, a safety controller comprising two oppositely disposed solenoids, a sliding rod supported on each solenoid, a pair of fixed contacts and a pair of yielding contacts on each solenoid, a bridge carried by each rod to move between the respective pairs of contacts and to engage them, two levers pivoted between their ends to a fixed support and connected at one end to the cores of the solenoids and at their other ends to the respective rods, a spring connecting the levers near their connections to the cores to cause them to move together and move the bridge on one solenoid into engagement with its fixed contacts when the other bridge is engaged with its yielding contacts, a pair of latches and means operated by the movement of a lever, when the core to which it is connected is drawn fully into its solenoid, to move its latch into the path of the other lever and limit its movement.

In testimony whereof I have signed my name to this specification in the presence of two subscribed witnesses.

JOHN D. TAYLOR.

Witnesses:
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W. L. MCDANIEL.