No. 776,238. PATENTED NOV. 29, 1904.

L. GRIFFITH.

ELECTRIC SWITCH AND SIGNAL APPARATUS.

APPLICATION FILED OCT. 18, 1904.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.

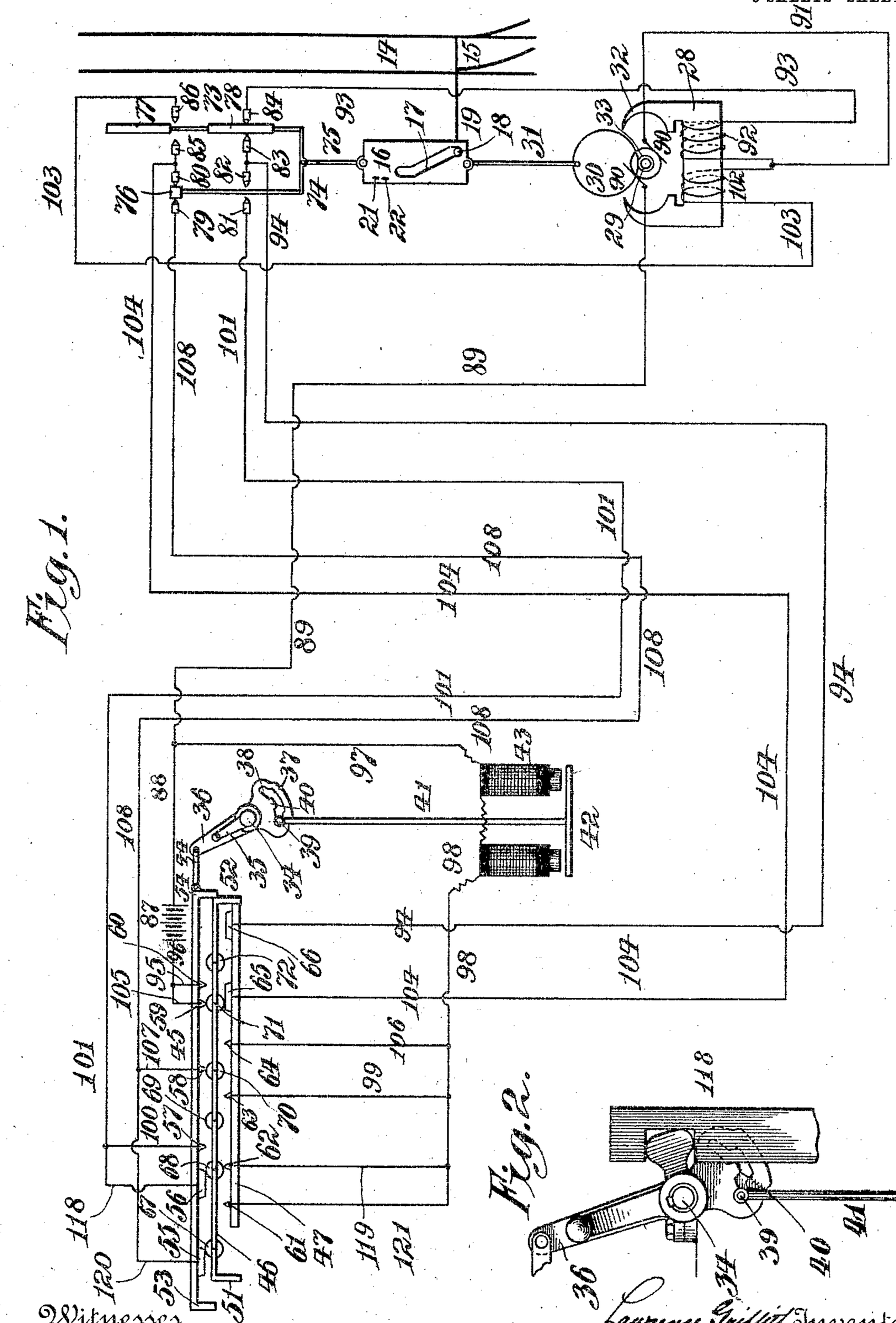

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Fig. 2.

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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 3

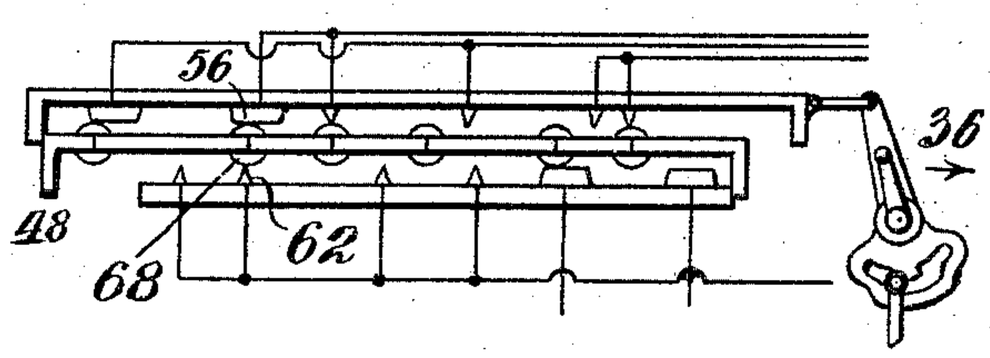


Fig. 4.

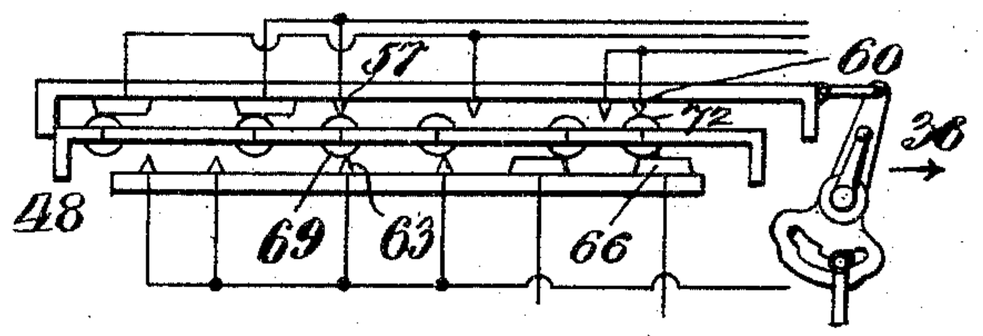


Fig. 5.

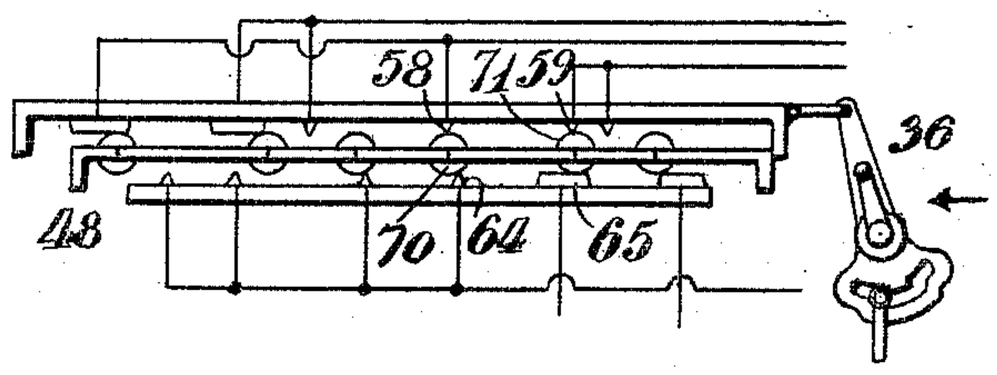


Fig. 6.

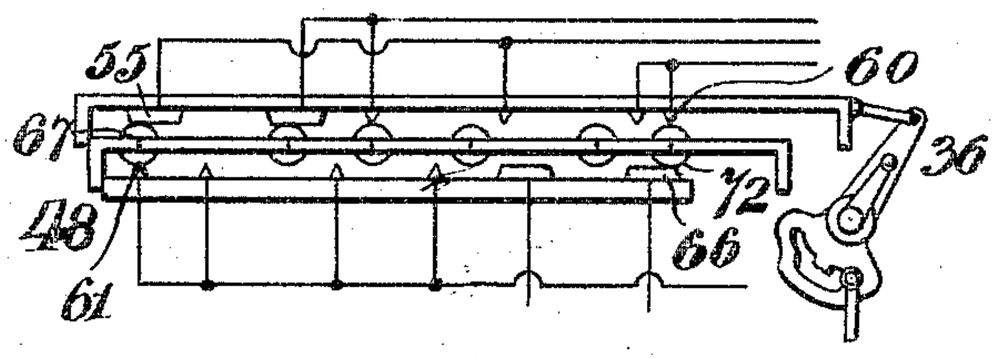


Fig. 7.

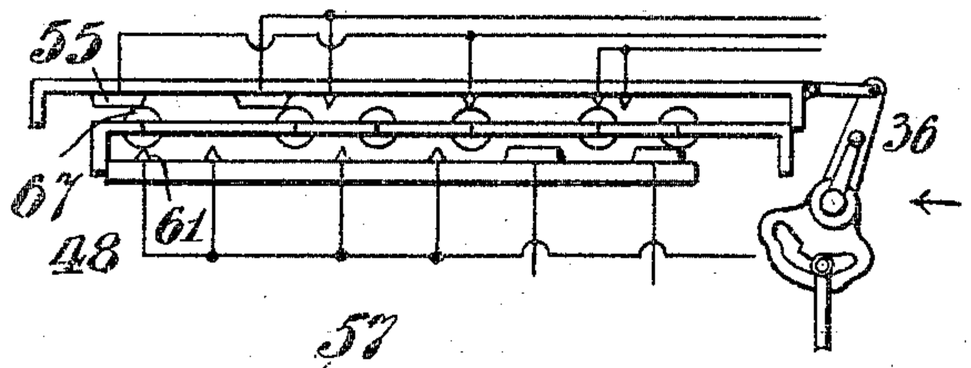
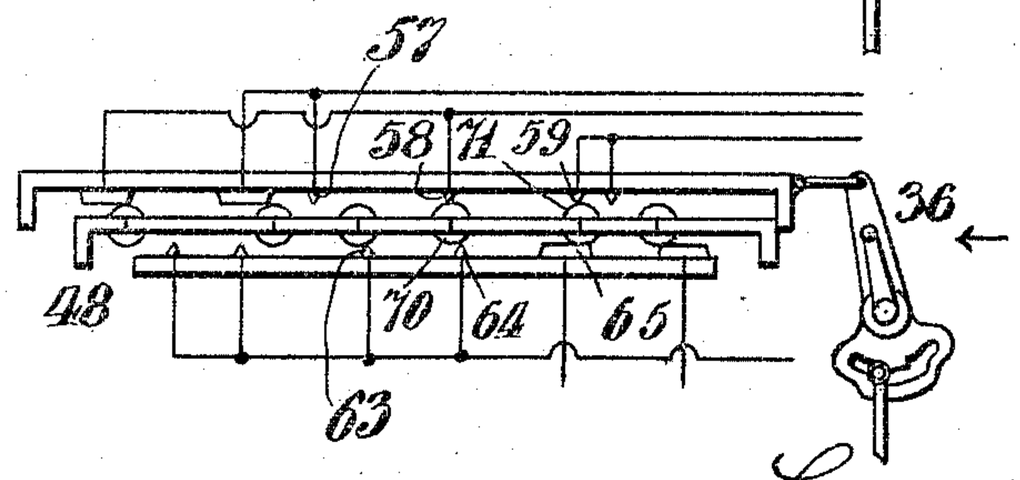


Fig. 8.



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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 9.

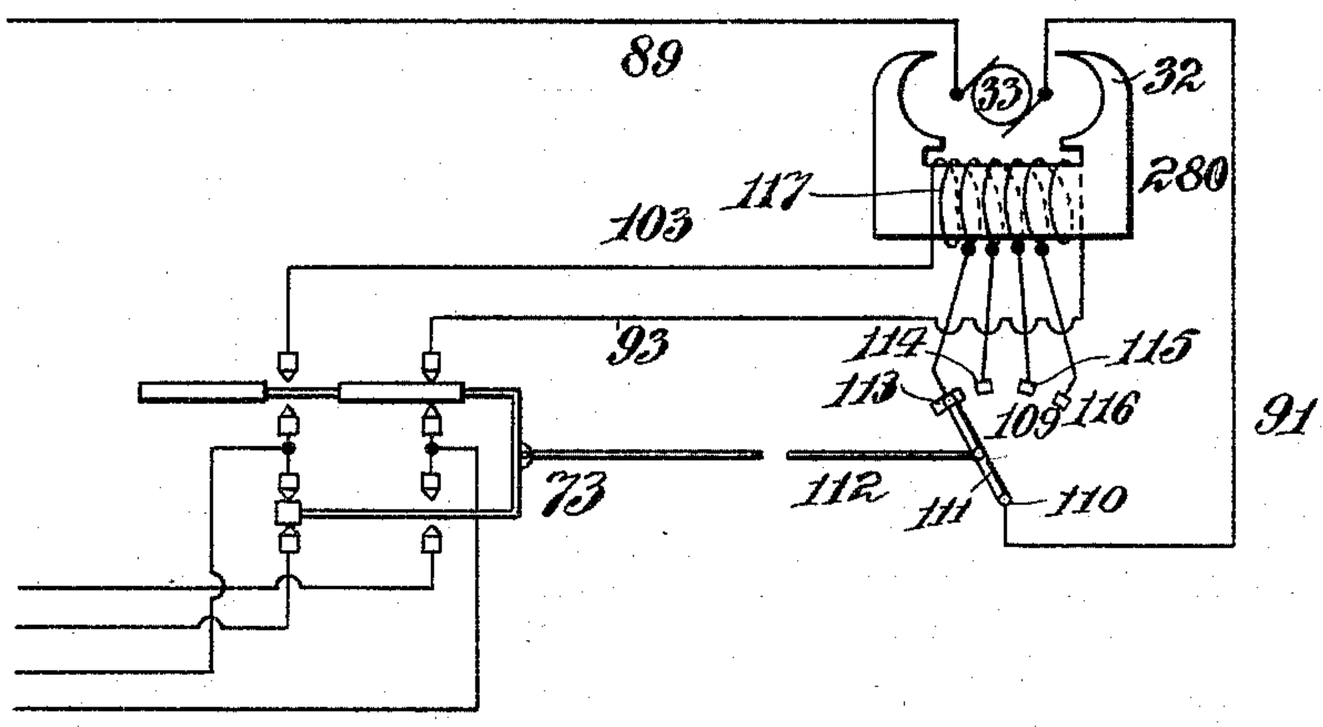

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PHOTO LITHOGRAPHED AT SACKETT & WILHELMS LITHO. & PTG. CO. NEW YORK.

No. 776,238. Patented November 29, 1904.

UNITED STATES PATENT OFFICE.

LAWRENCE GRIFFITH, OF YONKERS, NEW YORK.

ELECTRIC SWITCH AND SIGNAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 776,238, dated November 29, 1904.

Original application filed March 28, 1903, Serial No. 149,961. Divided and this application filed October 18, 1904. Serial No. 228,971.

(No model.)

To all whom it may concern:

Be it known that I, LAWRENCE GRIFFITH, a citizen of the United States of America, residing in the city of Yonkers, county of Westchester, and State of New York, have invented certain new and useful Improvements in Electric Switch and Signal Apparatus, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates generally to apparatus for operating railway switches, signals, and the like by means of electricity, and comprises, among other features, two electric units, one for operating the traffic-controlling device and the other for operating a locking or indicating device connected through switches or controllers by four circuits, automatic means for indicating to the operator when an outside or accidental current is in the circuit, automatic means for locking the operator's electric switch against a return movement until the operator has received an indication that the railway-switch or traffic-controlling device has been fully opened or closed, automatic means for indicating to the operator after operating the electric switch to open or close the railway-switch when the railway-switch is not for any reason fully opened or closed thereby, automatic means for locking the electric switch against a return movement until it has been fully thrown and the railway-switch is fully opened or closed in case the operator has received no indication of any defect in the operation of the device, and automatic means for replacing the railway-switch independently of the operator's lever and electric switch in case it is moved from the position in which it has been left.

The electric switch above referred to is described in full in my pending application for a patent therefor, being application Serial No. 213,335, filed January 20, 1904, and divisional of my application Serial No. 149,961, of which application Serial No. 149,961 this is also a divisional application.

In order that my invention may be clearly understood, I shall first describe in detail the mode in which I carry the same into practice and then point out the novel features of the invention in the claims.

Reference is to be had to the accompanying drawings, forming part of the specification, in which similar parts are designated by like numbers in all the figures.

Figure 1 is diagrammatic view illustrating the principal parts of an electric railway-switch and signal apparatus embodying the main features of my invention. Fig. 2 is a detail view illustrating the mode of connecting the switch-operating lever with the tappet of a well-known interlocking device. Figs. 3, 4, 5, 6, 7, and 8 are diagrammatic detail views hereinafter described, illustrating six positions of the operator's electric switch in opening and closing the railway-switch. Fig. 9 is a diagrammatic view of a modification, illustrating a rheostat and connections for throwing the full power of the motor on the railway-switch at its initial movement in either direction.

In Figs. 1 and 2 the main rails 14, the switch-points 15, the motion-plate 16, the cam and locking-slot therein 17, the pin or friction-roller 18, riding in said cam and locking-slot 17, the bar 19, and the switch-locking lugs 21 and 22 on the motion-plate 16 are all of a well-known description and substantially as shown and described in my United States Letters Patent issued to me March 31, 1903, for pneumatic switch apparatus and valve therefor. The railway-switch and connecting parts are shown in Fig. 1 in closed or normal position, so that trains will keep the main track. To move the motion-plate 16 longitudinally in either direction, and thereby open or close the railway-switch and lock it in either position in the usual manner, I employ an electric motor 28, carrying on its armature-shaft a small gear-wheel 29, which engages a large gear-wheel 30, connected by a pitman 31 with the motion-plate 16, and the windings of the field-magnets 32 and the armature 33 of the motor are such that when an electric current is sent through one part of the field-coil the motion-plate 16 will be shifted in one direction to open the switch, and when the current is sent

through the other part of the field-coil the motion-plate will be shifted in the opposite direction to close the switch.

For controlling the action of the motor, and thereby the railway-switch, from the switch-tower, for example, I employ, as best shown in Figs. 1, 2, 3, 4, 5, 6, 7, and 8, an operating-shaft 34, which is suitably mounted in the switch-tower and has an operating-handle 35 for rocking it, an electric switch-operating arm 36, and a locking arm or plate 37. The locking-plate 37 is formed with a segmental slot 38, in which works an antifriction-roller mounted on a pin 39 and in the middle of which slot is a depending locking-lug 40, around which the slot is widened to permit the passage of pin 39 when the pin is lowered, and which lug engages the pin when the pin is elevated so as then to prevent the lever 36 from being thrown from either end position to the opposite position.

The locking-pin 39 is fixed on the end of an endwise-movable rod 41, suitably held against other than longitudinal movement and carrying on its opposite end an armature 42 in the magnetic field of an electric magnet 43. The arrangement is such that when a current is passed through the coils of the electromagnet 43 the armature will be attracted so as to raise the locking-pin 39 and lock the operating-lever 36 against movement from either end position; but when there is no current passing through the coils of the field-magnet 43 the locking-pin 39 is free to fall beneath the locking-lug 40, and the operating-lever 36 can thus be thrown by its handle 35 from either end position.

The operating-lever 36 is connected by a rod 44 with the top movable member 45 of an electric switch 48, the bottom member 47 of which is here shown fixed and the middle member 46 of which is shown movable over the bottom member 47.

Of course I do not limit myself to the particular arrangement of the three parts of the electric switch 48 as shown and described. It will be readily understood that the two movable parts could be arranged to move relatively with the stationary part were they placed horizontally instead of vertically or if they were arranged to move with reference to each other, as the parts of a fan, the main feature being an electric switch having two parts movable relatively to a third and one of the two parts depending for its motion upon the movement of the other moving part during part of its stroke. The top and middle members are mounted to slide longitudinally relatively to each other and to the bottom member in suitable guides. The middle switch member 46 has depending lugs 51 and 52 at its respective ends to abut against the ends of the bottom member 47 and limit the travel of the middle member thereon in either direction. The top member 45 has depending lugs 53 and 54 at its respective ends to abut against the ends of the middle member 46 and carry said member with it until stopped therewith at the end of its travel in either direction.

The top member 45 of the electric switch 48 has on its under side insulated electric contact-heads 55, 56, 57, 58, 59, and 60, respectively, the bottom member 47 has on its upper side insulated electric contact-heads 61, 62, 63, 64, 65, and 66, respectively, and the middle member 46 has insulated in it electric double contact-heads 67, 68, 69, 70, 71, and 72, respectively, to engage in certain positions of the switch members certain of the contact-heads in both the top member and in the bottom member, and thereby act as circuit-makers or circuit-breakers between said top and bottom contact-heads, as shown in Figs. 1, 3, 4, 5, 6, 7, and 8 and hereinafter more fully described.

Another electric switch 73 is mechanically connected with the motion-plate 16 or otherwise adapted to be moved in correspondence with it, as indicated in Fig. 1. This switch 73 consists of a sliding forked member 74, which is connected by a rod 75 with the motion-plate 16, so as to be actuated thereby and with the railway-switch in both directions, and has on one branch a short insulated double contact-head or circuit-maker 76 and on the other branch two long insulated double contact-heads or circuit-makers 77 and 78, respectively. The short double contact-head 76 is adapted to engage and connect electrically both of either pair of insulated fixed contact-heads 79 and 80 or 81 and 82, accordingly as the motion-plate 16 and railway-switch is closed or opened, respectively. The long double contact-head 78 is adapted to engage and electrically connect both of a pair of insulated fixed contact-heads 83 and 84 while the railway-switch is closed and until it is fully opened, and the long double contact-head 77 is adapted to engage and electrically connect both of a pair of insulated fixed contact-heads 85 and 86 while the railway-switch is opened and until it is fully closed.

The electric motor 28 is electrically connected with a battery 87 or other source of electrical current and with the several contact-heads of the triple electric switch 48, the electromagnet 43, and the contact-heads of the electric switch 73, actuated by the motion-plate, by suitable wires or conductors, as shown diagrammatically in Fig. 1 and as will now be fully described in explaining the operation of the apparatus.

The railway-switch is shown closed in Fig. 1. In this position of the railway-switch the pairs of contact-heads 83 and 84 and 79 and 80 are electrically connected by the electric switch 73 and the pairs of contact-heads 85 and 86 and 81 and 82 thereof disconnected. At the same time the pairs of contact-heads 56 62 and 59 65 of the triple switch 48 are

electrically connected and all the other pairs of contact-heads disconnected. Under these conditions it will be seen that both the motor and the electromagnet circuits are broken, so that the operating-lever 36 is free to operate and open the railway-switch.

In opening the switch, when the operating-lever 36, and with it the triple switch 48, is thrown to the position indicated in Fig. 3, the top member 45 of said switch is moved until its lug 53 meets the corresponding end of the middle member 46; but the middle member 46 remains undisturbed. In this position the contact-heads 56 and 62 are electrically connected by the circuit-maker 68; but all the other pairs of contact-heads on the top and bottom switch members 45 and 47 are disconnected, so that, as will be seen, both the electromagnet 43 and the electric motor 28 are out of circuit with the battery 87, and the lever locking-rod 41 is free to drop by gravity beneath the locking-lug 40 and permit the said operating-lever to be thrown to its full extent in the direction of the arrow in Fig. 5 for opening the railway-switch, as hereinafter described. If, however, there should be any accidental or disturbing current in the electromagnet-circuit, said current would flow through the wires 101 and 118, the contact-heads 56, 68, and 62, the wires 119 and 98, and thence through the electromagnet 43, so that said magnet would attract the armature 42, raise the locking-rod 41 and through the engagement of the pin 39 with the lug 40 effectually bar the further movement of the operating-lever and consequent opening of the switch. The operator would thus be automatically notified that something was wrong with the circuit and could have the necessary correction made. When the operating-lever 36, being freed from its locking device, is then further swung to the position shown in Fig. 4, the top member 45 will by means of its end lug 53 have carried with it to the bottom member 47 the middle member 46, so that the contact-heads 60 and 66 will be electrically connected by the circuit-closer 72, the contact-heads 57 and 63 electrically connected by the circuit-closer 69, and all the other pairs of contact-heads on the top and bottom members disconnected. In this position the circuit of the locking-electromagnet 43 is still open, but the motor-circuit is closed and the current flows from the battery 87 through the wires 88 89, the brushes 90 and armature 33 of the motor, the wire 91, right-hand half 92 of the motor field-coil, the wire 93, contact-head 84 of the electric switch 73, the circuit-closer 78, the contact-head 83 thereof, the wire 94, the contact-head 66, circuit-closer 72, and contact-head 60 of the operator's electric switch 48, and thence through the wires 95 and 96 to the opposite pole of the battery 87, or vice versa. The field-magnets of the motor 28 are thus energized and the armature 33 thereof turned in one direction, so as through the connections described to pull the motor-plate 16 and open the railway-switch to its fullest extent. At the same time by this full operation of the motion-plate and switch-points the forked member of the electric switch 73 connected therewith is shifted, so that the contact-heads 81 and 82 thereof are electrically connected by the circuit-closer 76 and the contact-heads 85 and 86 electrically connected by the circuit-closer 77, while at the same time the contact-heads 79 and 80 are disconnected and the contact-heads 83 and 84 also disconnected. This automatic movement of the electric switch 73 breaks the motor-circuit, as will be seen, thus stopping the motor; but at the same time it closes the circuit of the electromagnet 43, and the current then flows from the battery 87 through the wires 88 and 97, the coils of the electromagnet 43, the wires 98 and 99, the contact-head 63 of the operator's switch 48, the circuit-closer 69 thereof, the contact-head 57, the wires 100 and 101, the contact-head 81 of the electric switch 73, the circuit-closer 76, the contact-head 82, the wire 94, the contact-head 66, circuit-closer 72, and contact-head 60 of the operator's switch 48, and thence through the wires 95 and 96 to the opposite pole of the battery 87. The electromagnet 43 is thus energized, its armature 42 attracted, and the operating-lever 36 locked by the raised pin 39, barring the lug 40 against a return movement to the left, as shown in Fig. 4, so that the operating-lever 36 cannot be thrown back until after it has been thrown forward to its fullest extent, as shown in Fig. 6. If, however, the railway switch-points should not be thrown to their fullest extent by this operation of the electric switch, the circuit-closer 76 of the automatic switch 73 would not close connection between the contact-heads 81 and 82 and the electromagnet 43 would not be energized and the locking-pin 39 would not be raised to locking position, thus indicating to the operator that the switch-points were not fully thrown. He would then throw the operating-lever 36 back again, which motion would bring the lug 54 of the top member 45 of the switch against the end of the middle member 46, thereby bringing the top contact-heads 58 and 59 into electric connection with the bottom contact-heads 64 and 65, as shown in Fig. 5. This will energize the locking-magnet 43 and raise the locking-pin 39 and allow the operating-lever 36 to be swung back to its original position until the fault in the railway-switch is corrected. When the operating-lever 36 is then thrown to its position shown in Fig. 6, the top member 45 of the operator's switch 48 will have moved and carried with it by means of its end lug 53 the middle member 46 until the end lug 51 of the latter is stopped by the end of the bottom member 47. In this position the contact-

heads 55 and 61 are electrically connected by the circuit-closer 67 and the contact-heads 60 and 66 by the circuit-closer 72; but all the other pairs of contact-heads on the top and bottom members are disconnected, so that, as will be seen, not only does the motor-circuit remain open and the motor thus idle, but the electromagnet-circuit is opened, thereby freeing the armature 42 and locking-pin 39 and leaving the operating-lever 36 free to be thrown in a reverse direction for closing the switch. When the operating-lever 36 is then swung in a reverse direction, as shown by the arrow in Fig. 7 and reaches the position shown in said Fig. 7, the contact-heads 55 and 61 of the switch 48 are still electrically connected by the circuit-closer 67; but all the other pairs of contact-heads on the top and bottom members of the switch 48 are disconnected, so that both the motor and locking-magnet circuits are open and the lever locking-pin 39 free to drop beneath the locking-lug 40 and permit the operating-lever to be thrown reversely. In case, however, of an accidental current in the circuit and consequent energization of the locking-magnet 43 the barring of operating-lever 36 by the locking-pin 39 would notify the operator of the fact, the current flowing through the wires 108 and 120, contact-heads 55, 67, and 61, the wires 121 and 98, and thence through the electromagnet 43.

When the operating-lever, being unlocked, is thrown reversely to the position shown in Fig. 8, the top member 45 of the operator's switch 48 will, by means of its end lug 54, have moved the middle member 46 to the position shown in said figure. In this position the contact-heads 59 and 65 will be electrically connected by the circuit-closer 71 and the contact-heads 58 and 64 by the circuit-closer 70, and all the other pairs of contact-heads will be disconnected, so that the motor-circuit will be closed, and the current will flow from the battery 87 through the wires 88 and 89, motor-brushes 90, armature 33, wire 91, through the left-hand part 102 of the motor field-coil in a reverse direction to that previously described, through the wire 103, the contact-heads 86 and 85, now electrically connected by the circuit-closer 77 of the switch 73, through the wire 104, the contact-heads 65 and 59, connected by the circuit-closer 71, and thence by the wires 105 and 96 to the other pole of the battery 87, or vice versa. The motor 28 is thus energized so as to throw the motion-plate 16 in a reverse direction and return the switch to the original closed position. (Shown in Fig. 1.) At the same time the motion-plate 16 moves the forked member of the switch 73 back to the position previously described and shown in Fig. 1, in which position the pairs of contact-heads 83 and 84 and 79 and 80 are electrically connected and the pairs of contact-heads 81 and 82 and 85 and 86 disconnected. In this position (shown in Fig. 8) the motor-circuit is broken and the motor stopped; but the locking-magnet circuit is closed, and the electric current flows from the battery 87 through the wires 88 and 97, the coils of the magnet 83, the wires 98 and 106, the electrically-connected contact-heads 64 and 58, the wires 107 and 108, the electrically-connected contact-heads 79 and 80 of the switch 73, the wire 104, the electrically-connected contact-heads 65 and 59, and thence through the wires 105 and 96 to the battery 87. The locking-magnet 43 is thus energized and the operating-lever locked by the pin 39 against a new forward movement, so that it must be thrown reversely to its full limit before it can be freed. If, however, as before described, the railway-switch is not fully thrown by said operation of the electric switch 48, the circuit-closer 76 of the automatic switch 73 will not have connected the contact-heads 79 and 80 and would not be raised to locking position, thus indicating to the operator that the railway-switch has not been fully thrown. He will then throw the operating-lever back again, as previously described, in the other direction, bringing the top contact-heads 57 and 60 into electrical contact with the bottom contact-heads 63 and 66. When the operating-lever is then thrown reversely to its fullest extent, the switch 48 is thrown to its original position first described and shown in Fig. 1, in which position both the motor and locking-magnet circuits are opened and the operating-lever free to be thrown to open the railway-switch, as previously described.

It will be seen that after the locking-lug 40 is swung by the operating-lever 36 in either direction past the locking-pin 39 the said pin locks the operating-lever against a return movement until the throw of the switch-points and the motion-plate by the motor shifts the electric switch 73 and frees the locking-pin 39 and lever 36, as described, thus notifying the operator that the switch is fully thrown.

The motor 28 (shown in Fig. 1) has the field-coil divided into two parts 92 and 102, said parts each leading to the two terminals of the motor. It will be readily understood that by this device a useful method of reversing the motor is provided. In Fig. 9 I have illustrated another form of motor 280 and its connecting-wires 89, 91, 93, and 103, in which the wire 91 instead of leading to the common terminal of the two parts of the field-coil of the motor, as indicated in Fig. 1, leads to pivoting-post 110 of the switch-lever 111, which is mechanically connected by a rod 112 with the movable member of the switch 73 and with the motion-plate 16, so as to be moved therewith. The free end of the switch-lever 111 is adapted to make electrical contact with any of a series of contact-heads 113, 114, 115, and 116, electrically connected with successive

turns of the motor-coil 117. The arrangement is such that when the railway-switch is closed and is to be opened the switch-lever will engage the contact-head 113 at the opposite end of the motor-coil from the wire 93, as indicated in Fig. 9, so that when the current is switched on, as previously described herein, it will flow through the wire 91, switch-lever 111, contact-head 113, and thence through the entire length of the coil to the return-wire 93, so that the full power of the motor will be available to start the switch-points. Then as the switch-points move with the motion-plate the switch-lever will be thrown therewith and successively engage the contact-heads 114 and 115, thus gradually reducing the active length of the field-coil 117 and power of the motor until the switch is fully opened and the switch-lever 111 engages the contact-head 116, when the circuit is broken by the switch 73, as previously described herein. Reversely, when the railway-switch is to be closed the rheostatic arrangement described sends the current through the contact-head 116 and the full length of the field-coil 117 to start the switch-points and then gradually reduces the power of the motor until the motor-circuit is broken by the closing of the railway-switch. It will be understood that the intermediate contact-heads 114 and 115 may be omitted, thereby doing away with the rheostatic feature of the motor last described.

It will be understood that should there be any physical displacement of the switch-points and motion-plate after they have been set by the operator and without his knowledge, electric connection always existing between either contact-heads 83 and 84 or 85 and 86, as the case may be, the motor will automatically be at once energized to force the motion-plate and switch-points back to their proper position.

Fig. 2 shows a method of connecting the operating-lever 36 with the tappet or follower 118 of a well-known interlocking device. Of course for the electric units described—the motor for the motion-plate and the magnet for the locking device—other units—as, for instance, a solenoid—may be substituted.

What I claim, and desire to secure by Letters Patent, is—

1. In electric apparatus for operating railway switches, signals, and the like, the combination with the motion plate or device to be moved and the electromotive circuit, of an electric switch in said circuit, a device for operating said switch, and an electrically-controlled locking device for automatically locking said switch-operating device against a complete return after it has been moved in either direction to energize the electromotive current, said locking device comprising a mechanical device operated by a single electric unit.

2. In electric apparatus for operating railway switches, signals, and the like, the combination with the motion plate or device to be moved and the electromotive circuit, of an electric switch in said circuit, a device for operating said switch and an electrically-controlled locking device for automatically locking said switch-operating device against a complete return in either direction after it has been moved to energize the electromotive circuit, until after the motion plate or device has been moved thereby to its full extent, said locking device comprising a mechanical device operated by a single electric unit.

3. In electric apparatus for operating switches, signals and the like, the combination with the motion plate or device to be moved, and the electromotive circuit, of an electric switch in said circuit, a device for operating said switch, an electrically-controlled locking device for locking said switch-operating device against a complete return in either direction after it is moved to energize the electromotive circuit, said locking device comprising a mechanical device operated by a single electric unit, and automatic means for unlocking the switch-operating device when the motion plate or device is fully thrown and the handle is moved farther to its full extent.

4. In electric apparatus for operating switches, signals and the like, the combination with the motion plate or device to be moved and the electromotive circuit, of an electric switch in said circuit having an operating device, a locking device actuated by a single electric unit for said operating device, means for automatically releasing said locking device when the operating device is moved partially in either direction, and means for automatically preventing the release of said locking device if an accidental current is in the circuit, so as to indicate to the operator that fact.

5. In electric apparatus for operating switches, signals and the like, the combination with the motion plate or device to be moved, and the electromotive circuit of an electric switch in said circuit having an operating device, a locking device actuated by a single electric unit, for automatically locking said operating device against a return movement in either direction after it is moved to energize the electromotive circuit, automatic means for unlocking the switch-operating device and thereby indicating to the operator when the motion plate or device is fully thrown, and means whereby, when the motion plate or device is not fully thrown and the locking device not released, and the operating device is then thrown back again, the locking device will be automatically released to permit the said return of the operating-handle.

6. In electric apparatus for operating switches, signals and the like, the combination with the electromotive circuit of an electric switch in said circuit, a device for operating said switch provided with a lug or shoulder, a movable pin or stop to engage said lug

or shoulder, an electromagnet and connection for operating said pin or stop, and automatic means whereby, after said switch is moved by its operating device in either direction to energize the electromotive circuit, the magnet causes the pin or stop to engage the lug or shoulder and lock the operating device against a return movement and when the operating device and switch are moved to their full extent the magnet frees the pin or stop from said lug or shoulder and thus releases the operating device or switch.

7. An electric apparatus for operating switches, signals and the like, the combination with the motion plate or device to be moved and the electromotive circuit, of an electric switch to govern the current in said circuit having an operating device, a device actuated by a single electric unit for locking said switch and operating device, an electric switch operated automatically by the movement of the motion plate or device, means whereby the operation of said automatic switch causes the operator's switch and operating device to be temporarily locked by the electromagnet locking device against a return movement in either direction after being operated to energize the electromotive circuit.

8. In electric apparatus for operating switches, signals and the like, the electric switch to be automatically operated by the motion plate or device, comprising four pairs of fixed insulated contact-heads; and a forked movable member, having on one branch two long-circuit closers to engage and connect alternately two alined pairs of said contact-heads, and on the other branch a short-circuit closer to engage and connect alternately the other two alined pairs of said contact-heads, substantially as described.

9. In electric apparatus for operating switches, signals and the like, the combination with the motion plate or device, the electric motor to move the same, and the motor-circuit, of a rheostatic device operated automatically by the motion plate or device to throw on the full power of the field-magnets of the motor to start the motion plate or device and reduce the power of said field-magnets as the motion plate or device progresses.

10. In electric apparatus for operating switches, signals and the like, the combination with the motion plate or device, the electric motor operatively connected therewith and the motor-circuit, of a switch in said circuit automatically operated by the motion plate or device to reverse the direction of the current through the motor field-coil, after the motion plate or device is fully moved.

11. In electrical apparatus for operating switches, signals and the like, the combination with the motion plate or device, the electric motor operatively connected therewith and the motor-circuit, of a rheostatic device operated automatically by the motion plate or device to lead the circuit into opposite ends of the motor field-coil as the motion plate or device moves in opposite directions, and a switch in said motor-circuit automatically operated by said motion plate or device to lead the current from the end of the field-coil opposite to that into which the current enters, at the initial movement of the motion plate or device in either direction so as to utilize the full power of the motor at that time.

12. In electric apparatus the combination of a motion plate or part to be moved with an electric motor to move the same, a motor-circuit, a rheostatic device operated automatically by said motion-plate to throw on the full power of the field-magnets of the motor to start said motion-plate and reduce the power of said field-magnets as said motion-plate progresses.

13. In electric apparatus for operating switches, signals and the like, the combination with the motion plate or device, the electric motor to move the same, and a switch with means whereby connection is made through said switch for operating the motor upon a movement of said motion-plate.

14. In electric apparatus for operating switches, signals and the like, the combination with the motion plate or device, the electric motor to move the same, said motor having two fields each for producing a different movement of the motor, and the motor-circuit of an electric switch to govern said motor, said switch comprising a stationary part and two parts movable with reference to said stationary part.

15. In electric apparatus for operating switches, signals and the like, the combination with the motion plate or device, the electric motor to move the same, said motor having two fields each for producing a different movement of the motor, the motor-circuit and indicator operated by a single electric unit, an electric switch to govern said motor and said single electric unit, said switch comprising a stationary part and two parts movable with reference to said stationary part.

16. In electric apparatus for operating switches, signals and the like, the combination of the motion plate or device to be moved with an electric unit to move the same, two electric switches each adapted to make and break four electric circuits, an indicator operated by a single electric unit and four circuits connecting said first-mentioned unit and said second electric unit through said electric switches.

17. In electric apparatus for operating switches, signals and the like, the combination of the motion plate or device to be moved with an electric motor to move the same, said motor having two fields each for producing a different movement of the motor, two electric

switches each adapted to make and break four electric circuits, an indicator operated by a single electric unit and four circuits connecting said motor and said single electric unit through said electric switches.

18. In electric apparatus for operating switches, signals and the like, the combination of the motion plate or device to be moved with an electric motor to move the same, said motor having two fields each for producing a different movement of the motor, two electric switches each adapted to make and break four electric circuits, an indicator operated by a single electric magnet and four circuits connecting said motor and said magnet through said electric switches.

In testimony whereof I have hereunto set my hand this 4th day of October, 1904.

LAW. GRIFFITH.

In presence of—

FRANCIS F. FIELD,

J. F. BONDREAU.