

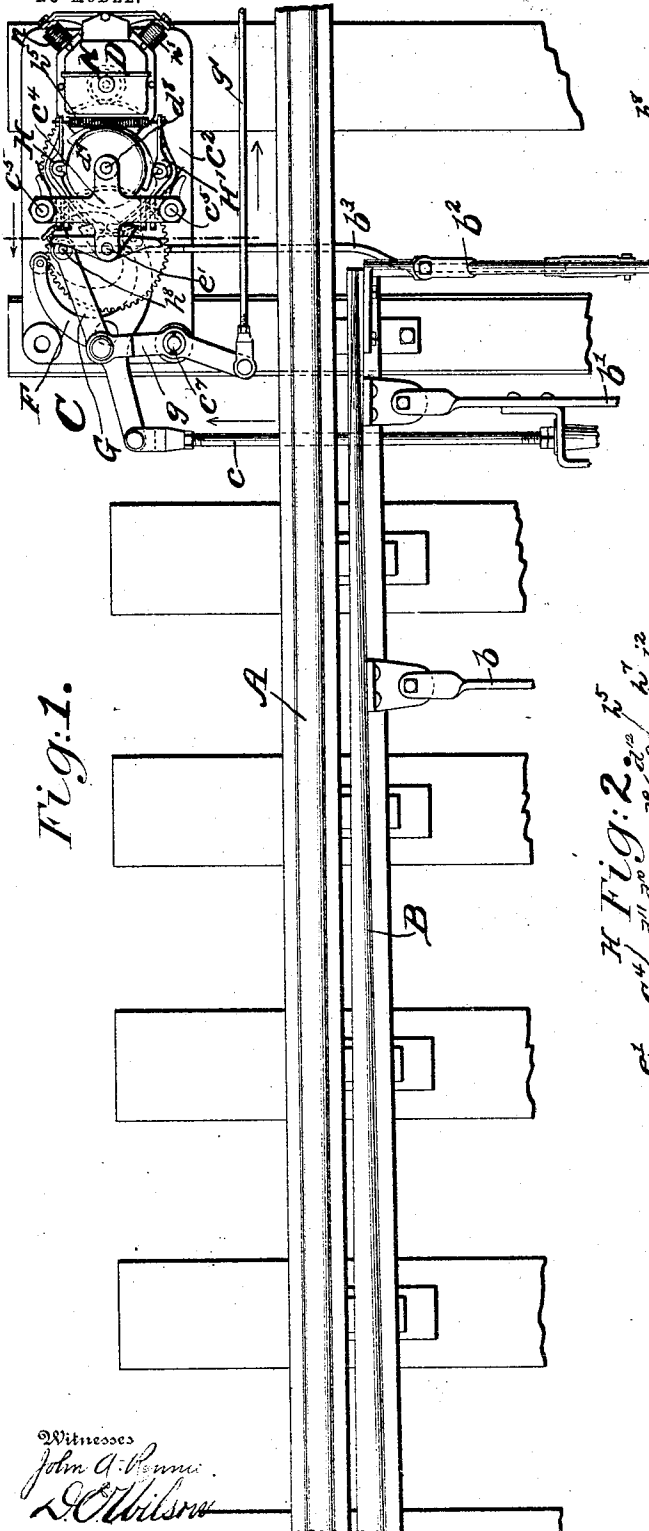
No. 764,043.

PATENTED JULY 5, 1904.

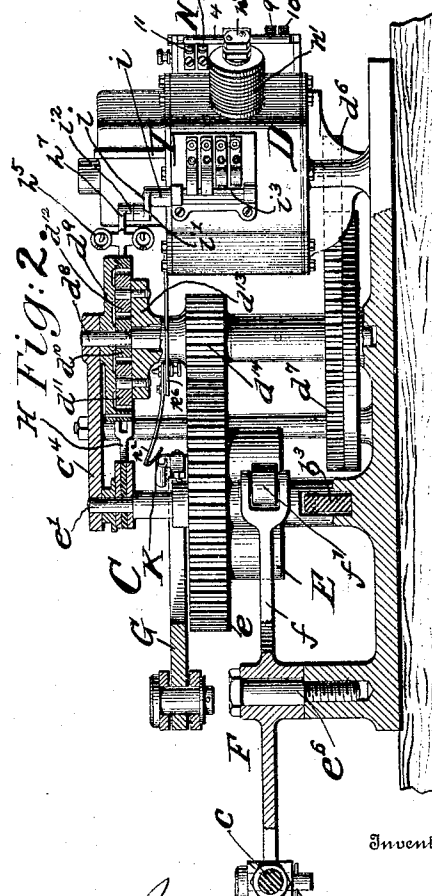
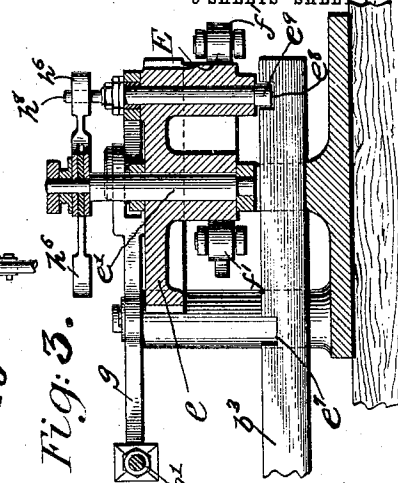
J. P. COLEMAN.
RAILWAY SWITCHING APPARATUS.
APPLICATION FILED OCT. 7, 1903.

NO MODEL.

5 SHEETS—SHEET 1



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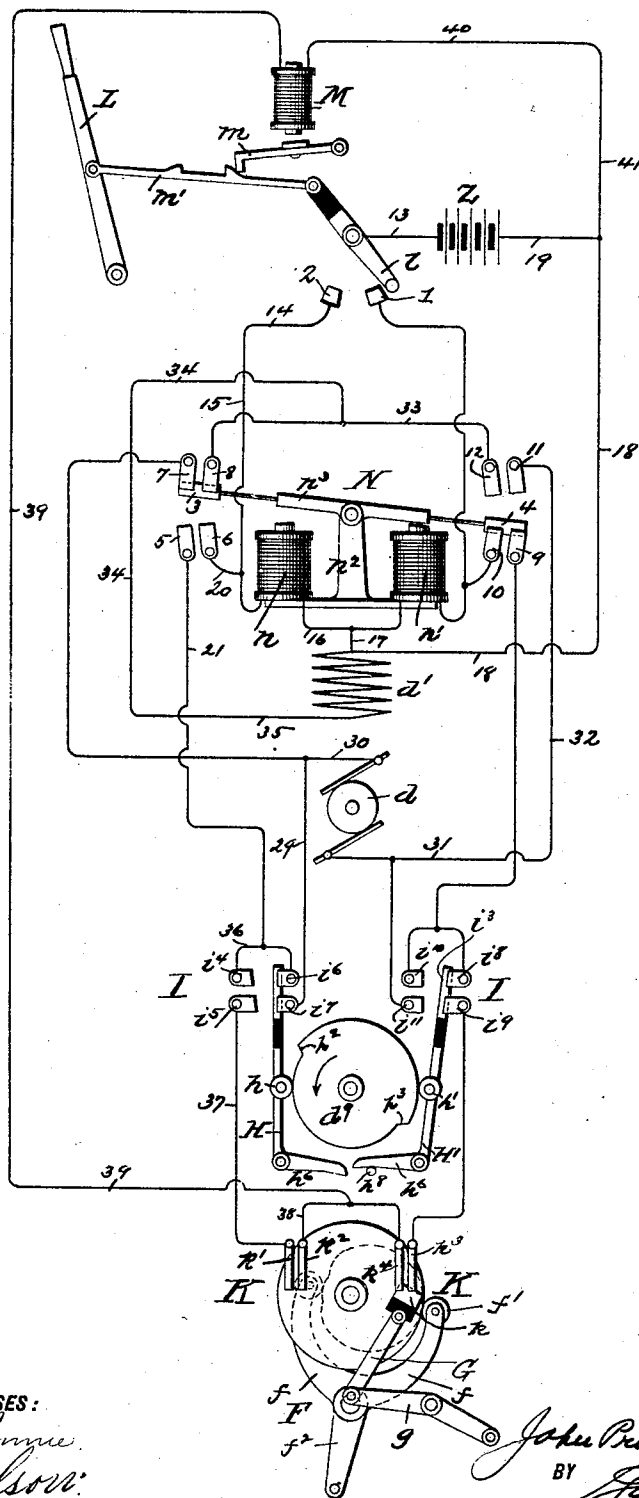
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NO MODEL.

5 SHEETS—SHEET 3.

Fig. 10.



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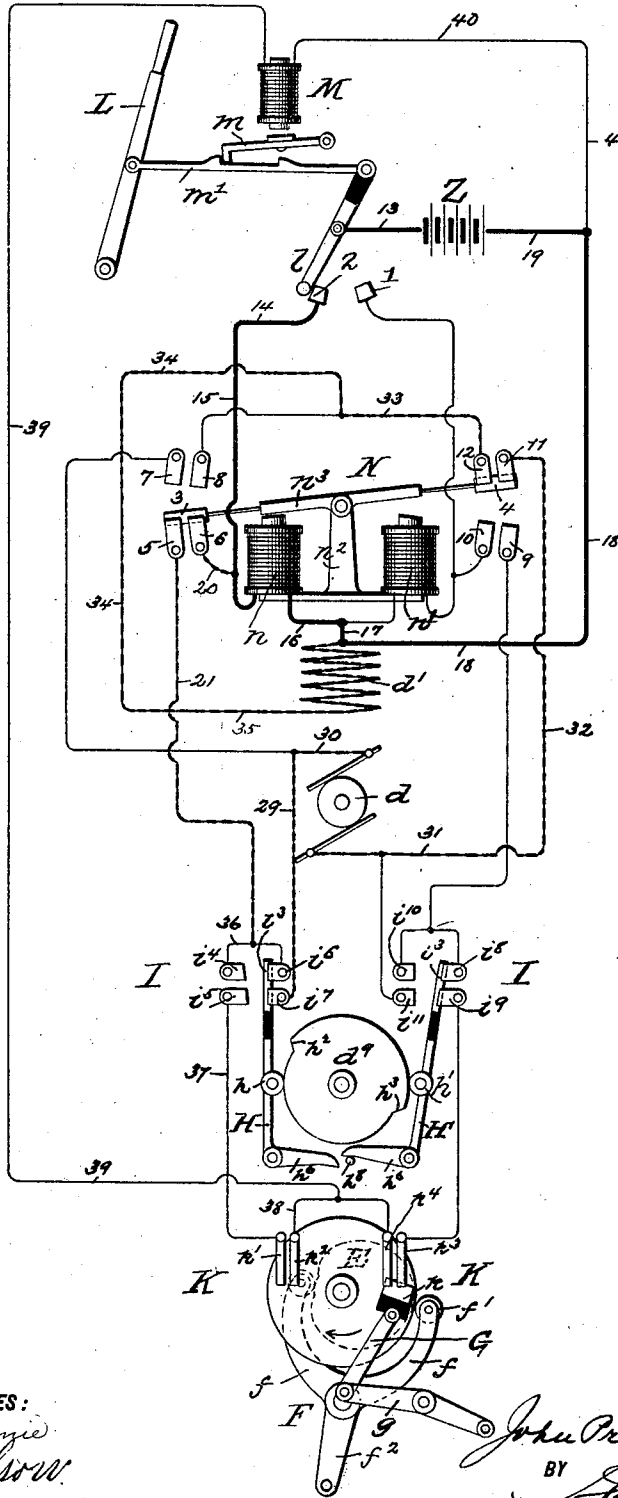
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APPLICATION FILED OCT. 7, 1903.

NO MODEL.

5 SHEETS—SHEET 4.

Fig. 11.



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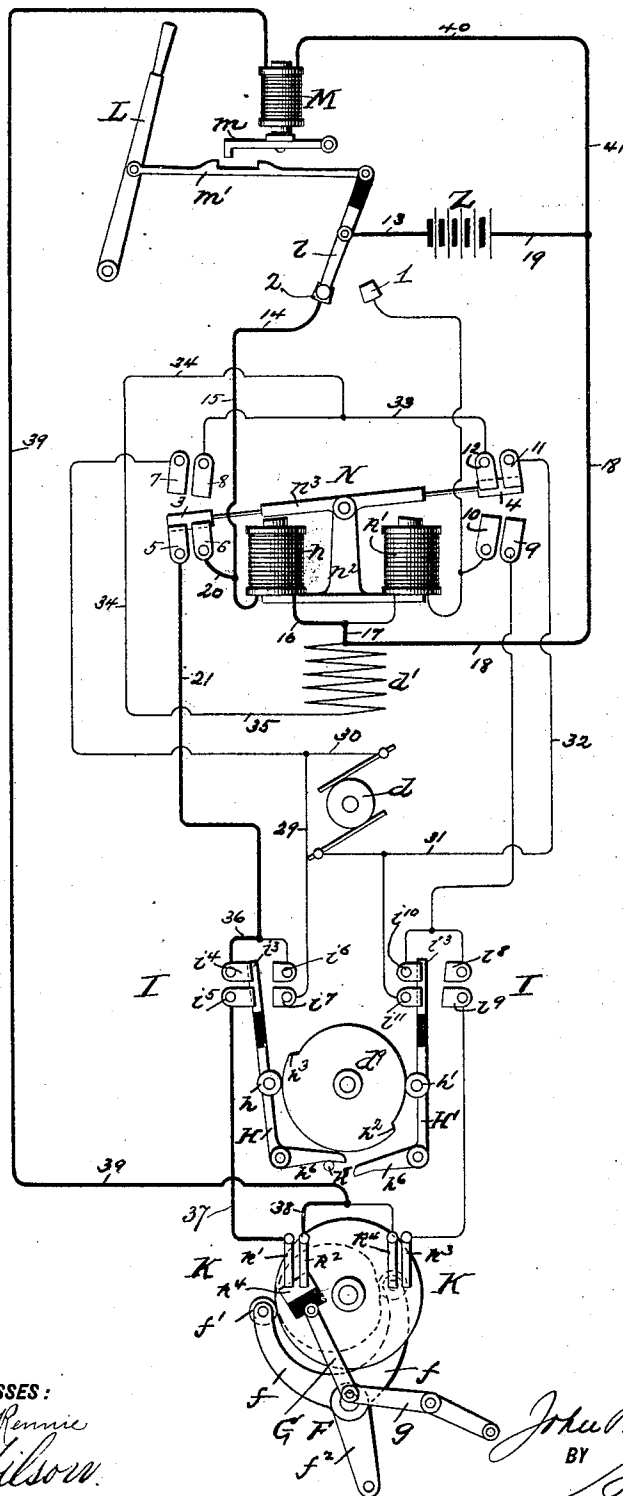
J. P. COLEMAN.
RAILWAY SWITCHING APPARATUS.

APPLICATION FILED OCT. 7, 1903.

NO MODEL.

5 SHEETS—SHEET 5.

Fig. 12.



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UNITED STATES PATENT OFFICE.

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RAILWAY SWITCHING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 764,043, dated July 5, 1904.

Application filed October 7, 1903. Serial No. 176,078. (No model.)

To all whom it may concern:

Be it known that I, JOHN PRESSLEY COLEMAN, a citizen of the United States, residing at Edgewood, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Railway Switching Apparatus, of which the following is a specification.

My invention relates to improvements in electrically-actuated mechanism for operating railway-switches and the several devices employed in connection with switches—such, for example, as a detector-bar, lock, &c.

My invention also has relation to the means for controlling the operation of such mechanism and to means whereby an indication or notification is received that the mechanism has performed its functions in completely moving the switch-rails and the devices employed in connection therewith.

I will describe an electrically-actuated mechanism, a means for controlling it, and a means whereby an indication or notification may be received, each embodying my invention, and then point out the novel features thereof in claims.

In the accompanying drawings, Figure 1 is a top plan view of an electrically-actuated mechanism embodying my invention and showing the connections between it and a switch-rail. Fig. 2 is a view, partly in side elevation and partly in vertical section, of the mechanism shown in Fig. 1. Fig. 3 is a detail view, partly in vertical section, of one end of the mechanism of Fig. 1. Fig. 4 is a view, partly in perspective and partly in vertical section, of the mechanism shown in Fig. 1. Fig. 5 is a detail top plan view of a portion of the mechanism shown in Fig. 1. Fig. 6 is a detail perspective view of another part of the mechanism of Fig. 1. Figs. 7, 8, and 9 are each detail views, partly in horizontal section, showing different positions of an operating-cam embodied in the mechanism and of the adjacent parts operated and locked thereby. Fig. 10 is a diagrammatic view of parts of the mechanism of Fig. 1 and circuits for the control of the motor embodied in such

mechanism and circuits by which an indication or notification is given that the mechanism has performed its functions in completely moving the switch rail or rails, &c. Fig. 11 is a view similar to Fig. 10 with the controlling-lever in a different position. Fig. 12 is a view similar to Figs. 10 and 11, showing the parts of the mechanism in a different position and just before the controlling-lever is moved to its complete reversed position.

Similar letters of reference designate corresponding parts in all of the figures.

Referring to the drawings, and particularly to Figs. 1 to 9, A designates one line of rails of a railway, and B one of a pair of switch rails or points. As shown in the drawings, Fig. 1, the switch-rail is in such position as not to affect the travel on the rail A. The two switch rails or points are connected by bars or rods b , b' , and b'' , so that they will move together. The bar b' has connected to it a rod c , which is moved by the mechanism or apparatus C when it is desired to move or change the switch-rails from one position to another and to operate other devices employed in connection with the switch-rails. The bar b'' has connected to it a rod b''' , generally termed a "locking-rod." This rod is adapted to be locked by the mechanism C, as will be hereinafter described.

The mechanism C is preferably mounted upon a base c' , which may be of metal and of any desired shape and proportions. The base may be secured on the ties of the railroad in any desired manner. The mechanism as here shown comprises an electric motor D, an operating-cam E, and mechanism intermediate the motor and cam comprising a yielding holding means which, among its other functions, governs the rotation of the cam. The motor D may be of any desired type and construction. The armature d is preferably arranged vertically and the field d' correspondingly arranged. The shaft d'' of the armature is mounted in a suitable step-bearing d''' at its lower end and at its upper end in a bearing d'''' , which bearing may be provided in a suitable casing d''''' , provided for the commutator.

An advantage of mounting the armature in a vertical direction is that it is less likely to be displaced or injured due to vibration caused by the passage of trains over the adjacent railway-track. The armature-shaft d^2 is provided with a gear-wheel d^6 , which meshes with a gear-wheel d^7 , fastened upon a shaft d^8 . The gear-wheel d^7 and shaft d^8 constitute a part of an arrangement of gearing included in the mechanism intermediate the motor-armature and cam. The remainder of the gearing will now be described.

d^9 designates an internal gear-wheel loosely mounted on the shaft d^8 , and d^{10} a gear-wheel fast upon the shaft d^8 . d^{11} and d^{12} designate two gear-wheels which are carried by a disk d^{13} , loosely mounted on the shaft d^8 . These gear-wheels are located intermediate the internal gear d^9 and the gear-wheel d^{10} . The arrangement of the gear-wheels just described is such that upon the rotation of the shaft d^8 the internal gear d^9 will be caused to rotate, provided it is not held against rotation. In the event that the internal gear-wheel d^9 is held against rotation the shaft d^8 will cause the gears d^{11} and d^{12} to travel on the teeth of the internal gear d^9 and carry with them the disk d^{13} , producing, in effect, the well-known sun-and-planet movement.

d^{14} designates a gear-wheel which, as here shown, is integral with the disk d^{13} , so that when the disk d^{13} rotates the gear d^{14} will rotate with it.

The means for at times holding the internal gear d^9 against rotation will be hereinafter described.

E designates a cam, shown as being substantially heart-shaped. It is provided with a gear-wheel e , here shown as being integral with it. The gear-wheel e meshes with and is rotated by the gear-wheel d^{14} . The cam E is mounted upon a shaft e' , the lower end of which is suitably journaled in a boss e^2 , provided on the base c^2 . The upper ends of the shafts e' and d^8 are suitably supported in a frame-piece c^4 , which is held by bolts c^5 , extending upward from the base c^2 . The lower end of the shaft d^8 is suitably journaled in a boss provided on the base c^2 .

F designates a yoke the arms f of which are provided at their ends with rollers f' . The yoke is suitably pivoted on a boss e^6 , provided on the base c^2 , and the end f^2 of the yoke is connected with the rod c . The cam E is provided with neutral or ineffective portions e^2 , which when they come into engagement with the rollers f^2 cause no movement of the yoke F, and with operating or effective portions e^3 , which when they come into engagement with the rollers f^2 cause the yoke to be rocked on its pivot. The cam E also has connected with it by a pin, stud, or other device h^8 one end of a bar G, which is connected at its other end to one end of a lever g , suitably pivoted on a boss e^7 , provided on

the base c^2 . The other end of the lever g is connected with a rod g' , which in turn is connected with a detector-bar the function of which is well understood in connection with railway-switches.

It will be apparent upon the rotation of the armature and the holding of the gear d^9 from rotation that the cam E will be rotated, and through it the yoke F will be rocked on its pivot to move the switch-rails. The rotation of the armature in one direction will move the switch-rails to one position—for example, that shown in Fig. 1—and the rotation of the armature in the opposite will move the switch-rails to their second position. At the same time that the switch-rails are being moved through the yoke F the bar G will rock the lever g to move the detector-bar. (Not shown.)

Before the switch-rails can be moved in either direction by the mechanism the switch-rails are unlocked. After each complete movement of the switch-rails they are again locked. In the mechanism shown the locking of the switch-rails is accomplished by means of a pin, stud, or projection e^9 , provided on the under face of the cam E. This pin e^9 is adapted to enter recesses e^7 e^8 , provided in the locking-rod h^3 . In one position of the switch-rails the pin e^9 is in the recess e^7 (see Fig. 7) and in the second position of the switch-rails the pin e^9 is in the recess e^8 . (See Fig. 9.)

As hereinbefore stated, before the cam E can be rotated the gear d^9 must be held against rotation. It will be understood that should the cam E in its rotation meet with such a resistance from the switch-rails or should the presence of a train on or adjacent the switch-rails offer such resistance to the movement of the detector-bar as to prevent the rotation of the cam unless the holding means for the gear d^9 be of a yielding nature injury might result to the mechanism or the parts moved thereby. I therefore employ a yielding holding means which, in addition to its function of releasing the gear d^9 under the conditions stated, acts also to open the motor-circuit.

In the ordinary or usual operation of the yielding holding means they yield to open the motor-circuit only when an entire operation of the mechanism has taken place—that is, when a complete movement of the switch-rails and detector-bar has been effected in either direction and when further motion of these devices is in consequence impossible. The excessive strain thrown upon the yielding holding means at such times causes it to yield to open the motor-circuit, incidentally establishing in part an indication-circuit and operating a brake or brakes to stop the rotation of the motor or the intermediate gearing, or both.

In the mechanism shown the gear d^9 is held against rotation by means of levers H H', suitably pivoted on the shaft e' or other pivot and carrying rollers h h' , which engage with

shoulders or projections h^2 h^3 , provided on the gear d^9 . As shown, these shoulders are formed by a concentric enlargement h^4 preferably integral with the gear d^9 . The levers H H' are substantially bell-crank levers. The arm h^6 of each lever is adapted to be engaged by a pin or stud carried by the cam E , which conveniently may be the pin h^8 , and when the cam E is rotated the stud will engage one of the arms h^6 and cause its lever to be rocked on its pivot and disengage the roller carried thereby from its shoulder on the gear d^9 . The arms h^7 of the levers H H' are joined by a resilient connection, which may be a spring or springs h^5 , the tension of which is preferably adjustable. Ordinarily these springs are of such tension that they will under ordinary or usual conditions of operation of the mechanism hold the rollers h h' into engagement with the shoulders of the gear d^9 .

Each lever H H' when rocked on its pivot operates a circuit-controller I , as shown diagrammatically in Figs. 2, 10, 11, and 12. Each circuit-controller I , as shown, comprises a vertically-arranged shaft i , suitably journaled and carrying at one end a slotted arm i' , in the slot of which a pin i^2 , carried by the arm h^7 of a lever H or H' , projects, a contact-plate i^3 , carried by the shaft i , and two pairs of contact-plates, suitably insulated from each other, with which the contact-plate i^3 alternately engage. The pairs of contact-plates alternately engaged by the plate i^3 , operated from the lever H , are i^4 i^5 and i^6 i^7 . The pairs of contact-plates alternately engaged by the plate i^3 , operated from the lever H' , are i^8 i^9 and i^{10} i^{11} . One pair of contact-plates operated by each lever are included in the motor-circuits and the other pair of contact-plates operated by each lever are included in the indication-circuits. Each of the levers H H' , also, when moved on its pivot will operate a brake to prevent further rotation of the gear d^9 . As here shown, (see Fig. 6,) the gear d^9 is provided with a downwardly-extending annular flange j , which is engaged by a brake-shoe J . The brake-shoe J is pivotally connected to an arm j' , carried by a vertically-arranged rod or shaft j^2 . The upper end of the rod j^2 is provided with an arm j^3 , which when a lever H or H' is moved outward on its center engages the arm j^3 , and thereby rotates the rod j^2 to cause the brake-shoe J to engage the flange j . Preferably a resilient part j^4 is carried by each arm j^3 , with which the lever H and H' engages.

The operation of the mechanism so far as described is substantially as follows, assuming that the rollers h h' are in engagement with the shoulders h^2 h^3 of the gear d^9 . Under these conditions with no obstruction or unusual or abnormal resistance offered to the movement of the switch-rails the spring or springs h^5 will hold the rollers h h' in engage-

ment with the shoulders h^2 h^3 . Upon the rotation of the armature d the gearing intermediate it and the cam E will cause the cam E to be rotated. The first part of the rotation of the cam causes the unlocking of the switch-rails. (See Figs. 7 and 8.) By referring to Fig. 7, which illustrates the position of the cam E , yoke F , locking-rod b^3 , and lever g after a complete movement of the switch rails or points to one of their two positions and prior to a reverse movement of the switch rails or points, it will be seen that the first part of the movement of the cam E causes the pin e^9 to move out of the recess e^7 in the rod b^3 . At the same time the lever g is being operated to move the detector-bar. While these two operations are taking place (the unlocking of the switch-rails and movement of the detector-bar) the rollers f' are engaged by the neutral or ineffective portions of the cam E , and consequently there will be no movement of the yoke F . Should the detector-bar meet with no resistance in its rise above the rail, the cam E will continue to rotate and the operative or effective portions of the cam E will engage the rollers f' and cause the yoke F to rock on its pivot, and thus move the switch-rails or points. At about the time the cam E has completed a half-revolution the parts will be in the position shown in Fig. 9, and the circuit for the motor will have been broken to stop further rotation of the armature to move the cam farther in one direction. As hereinbefore stated, the motor-circuit will be broken by the moving of one of the levers H H' on its pivot. As the cam is about to complete its half-revolution the pin h^8 engages an arm h^6 and causes its lever to be rocked, thus disengaging the roller carried by the lever H or H' , which by its engagement with a shoulder h^2 or h^3 prevents the gear d^9 from rotating. The gear d^9 will then be rotated instead of the cam E , and the enlargement h^4 , acting on the roller carried by the lever H or H' , moves the lever on its pivot, thus breaking the motor-circuit and allowing the armature of the motor to come to a state of rest without injury to the mechanism. The position of the gear d^9 , the levers H and H' , and the circuit-controllers I after their operation will be seen in Fig. 10.

In the position of the parts Fig. 9 the stud or projection e^9 will have entered the second recess e^8 to again lock the switch rails or points in the position to which they have been moved. The detector-bar will also have been lowered below the rail-level. With this mechanism the detector-bar during the first part of the half-revolution of the cam is raised above the rail and during the last part of the same half-revolution the detector-bar is lowered in the same direction in which it is raised—that is to say, the raising and lowering of the detector-bar is done by an oscillatory move-

ment. Of course the detector-bar may be raised and lowered by a single movement in one direction.

It will be understood that should the detector-bar be prevented from being raised—as, for example, when a train should be above the detector-bar—the resistance offered to its being raised will cause a roller h h' to become disengaged from a shoulder on the gear d'' and the gear d'' to be rotated instead of the cam, and, as stated, when the levers move outward the circuit of the motor is opened or broken, as will be hereinafter described; also, should the switch rails or points meet with any abnormal resistance or with any resistance in their movement the same result would be obtained as regards the motor and cam, as above described. In short, any resistance to the movement of the cam and parts operated thereby which is greater than the resistance to the rotation of the gear d'' afforded by the spring or springs h^5 will have the effect of causing the levers to be moved outward to disengage the rollers from the gear d'' and allow the gear to rotate instead of the cam. Obviously the desired resistance to the movement of the gear may be obtained through the tension of the springs or the position of the centers of the rollers relatively to their point of contact with the shoulders and the pivot of the levers, or both. With this arrangement of mechanism it can be adapted, through the adjustment of the yielding holding means, to operate under widely varying conditions.

The functions of the yielding holding means which is intended to relieve the motor of operating-current when the operation of the switch-rails is attempted while a train stands over the detector bar or bars of the switch-rails or when a resistance is encountered by the moving switch-rails may be unnecessary by the use in connection with a controlling-lever L of well-understood means for preventing such attempts. It may also be under some conditions that the sudden arrest of the motor's movement by obstructions to the switch-points or from causes other than the presence of a train upon the detector-bar that no material damage will result other than the blowing of a fuse in the motor-circuit or that when damage is incurred the infrequency of it may not warrant the use of the yielding holding means in this capacity—that is, of breaking the motor-circuit. In such cases the yielding holding means is easily rendered inoperative by any other than the means referred to acting upon it only after the mechanism has operated to completely move the switch-points, and in such cases the complete closure of the indication-circuit (on interruption of the motor-circuit) by the yielding means may be depended upon for the control of the operating-lever.

The indication-circuits in addition to the

circuit-controllers I , which are operated by the levers H and H' , are provided with additional circuit-controllers K , which are also operated from the cam E . A circuit-controller K is so arranged as to be operated only at the end of the movement of the cam E , which is necessary to completely lock the switch-rails after they have been completely moved in either direction. These circuit-controllers are in series with the indication-circuit members of the controllers I . An advantage of having these circuit-controllers for the indication-circuits in series with the circuit-controllers for the motor is that the indication-circuit might be established, were it not for the second controller K , by the closing of the circuit-controller I , due to a train being over the detector-bar or an obstruction between a switch-rail and a stock-rail, in which case, should the indication-circuit be complete, the operator would be enabled to put his lever in its complete position, thus unlocking signal or other levers controlling passage over the switch-rails attempted to be operated. With the circuit-controllers in circuit the indication-circuit is only established after a complete movement and locking of the switch-rails by the mechanism.

Each circuit-controller K comprises a pair of contact-plates, with which a contact-plate k coacts. k' k^2 designate the contact-plates of one circuit-controller, and k^3 k^4 the contact-plates of the other circuit-controller. The contact-plate k , which is common to both circuit-controllers, is, as here shown, carried by the end of the lever G . It is adapted when the cam E reaches the end of its rotation to move the switch-rails in one direction to bridge one pair of contacts, and when the cam E reaches the end of its rotation in the opposite direction to bridge the other pair of contacts. The contact-plates k' k^2 and k^3 k^4 are suitably mounted on a supporting-piece k^5 , and the contacts of each pair are suitably insulated from each other.

Referring now to Figs. 10, 11, and 12, which are diagrammatic views, L designates one of a number of levers which may be located at some central point—as, for example, a tower. Some levers L are used to control the movement of switch rails or points and other lever to control the movement of signals, and these levers are arranged side by side in a frame. Means are provided, generally termed “mechanical interlocking,” whereby the complete movement of one lever may be made to release or lock certain other lever or a number of levers, as service conditions may call for. Primarily this interlocking is arranged in order that before a lever operating a signal may be moved to pass a train over a given piece of track all levers operating switches within the piece of track must first be in their proper positions to insure safe passage of trains over the switches.

In addition to the mechanical interlocking referred to an electric lock is provided for each lever, which lock is adapted to be released on the lever only after the apparatus or mechanism controlled from the lever has performed its functions. As shown, this lock consists of an electromagnet *M* and an armature *m*, operated by the electromagnet. The armature *m* is adapted to engage a rod *m'*, connected with the lever *L*.

The lever *L* is permitted a movement from either its normal or reversed position sufficient only to close a break in the motor-circuit whereby current is supplied the motor. After the complete operation of the motor the lock is released and the lever is then free to be moved to its final position to release other levers.

The electromagnet and the lock operated thereby constitute an "indication means," as it is generally known in the art. The indication or notification of the complete movement of the switch-rails is obtained by the unlocking of the lever.

The lever *L* operates a switch-arm *l*, and when the lever *L* is moved the switch-arm *l* is moved into engagement with contact-plates 1 2. Any desired form of circuit-controlling devices may be used instead of the arm *l* and the contact-plates 1 and 2.

Z designates a source of supply of electrical energy, here shown as being in the form of a battery. Usually a set of storage batteries is employed. In this invention the battery *Z* is employed to furnish current for the motor, the electric lock, (indication means,) and a magnetic direction-controller for the motor.

N designates the magnetic direction-controller for the motor *D*. In this invention the motor *D*, being a series-wound motor, by reversing the direction of current through the armature the armature may be made to run in reverse directions. Whatever the type of motor the direction-controller *N* is adapted to control the supply of current to it in such manner that the motor will move the switch-rails to one position and again to another position. The magnetic controller as here shown comprises two magnets *n n'*, suitably mounted on a frame *n²*, and a pivoted armature *n³*, carrying contact-plates 3 and 4, which are suitably insulated from each other. If desired, the pivoted armature may be operated from the field of the motor in a manner well understood in the art.

The contact-plate 3 is adapted to bridge the contact-plates 5 6 and 7 8, and the contact-plate 4 is adapted to bridge the contact-plates 9 10 and 11 12.

Referring now particularly to Fig. 10, the parts there illustrated are in the positions they occupy after the switch-rails have been completely moved to one of their two positions, which for convenience will be designated the "reverse" position, the controlling-

lever *L* having been put in its reversed position to correspond with the position of the switch-rails.

Referring now to Fig. 11, all of the parts are shown in precisely the same position they occupy in Fig. 10 with the exception of the lever *L*, which has been moved to place the arm *l* onto contact-plate 2, and the direction-controller *N*. This movement of the lever is prior to the starting of the motor and is primarily to supply current to the magnet *n* of the magnetic direction-controller *N* in order that the magnetic direction-controller may be operated to be in position to supply current in the proper direction to the motor. The circuit for the magnet *n*, starting from the battery *Z*, is wire 13, arm *l*, contact-plate 2, wires 14 and 15, magnet *n*, wires 16, 17, 18, and 19 to battery. This circuit is shown in heavy lines. The magnet *n* will then attract the armature *n³*, and in doing so the contact-plate 3 is moved between the contact-plates 5 and 6 and the contact-plate 4 is moved between the contact-plates 11 and 12. As soon as this movement of the armature *n³* takes place a circuit for the motor is completed, which, starting from the battery *Z*, is wire 13, arm *l*, contact-plate 2, wires 14, 15, and 20, contact-plates 6, 3, and 5, wire 21, contact-plates *i⁶*, *i³*, and *i⁷*, wires 29 and 30, through the armature *d* of the motor, wires 31 and 32, contact-plates 11, 4, and 12, wires 33, 34, 35, and 36, field *d'* of the motor, and wires 18 and 19 back to battery. This circuit is indicated in dotted lines and in part by heavy lines. The armature of the motor then rotates, and as the gear *d⁹* is not held by the yielding holding means (see Figs. 10 and 11) the gear will revolve until the shoulder *h²* comes into engagement with the roller carried by the lever *H*. As soon as the roller engages the shoulder *h²* the gear *d⁹* will be held from rotation and the cam *E* will then be rotated to unlock the rod *h³* of the switch-rails and move the detector-bar and the switch-rails. Coincident with the engagement of the shoulder *h²* with the roller *h* the shoulder *h³* is carried to a position which permits the lever *H'* to shift the roller *N'* into engagement therewith and to move the contact-plates *i³* from between the contacts *i⁸* *i⁹* to bridge the contact-plates *i¹⁰* *i¹¹*.

By referring to Fig. 10 it will be observed that the mechanism after moving the switch-rails from the normal position to the reversed position the circuit-controllers *I* are operated through the levers *H H'* to such position that upon the movement of the lever *L* from its reversed to normal position they will open the circuit to the motor (circuit-controller *I*, operated by lever *H'*) in one direction and close the circuit to the motor (circuit-controller *I*, operated by lever *H*) ready to receive current in the opposite direction.

By referring to Fig. 11 it will be seen that upon the movement of the lever *L* from its

reversed toward its normal position the armature *m* will engage the lever in such manner as to prevent the lever *L* being moved to its complete position. In case the switch-rails are not completely moved by the motor for any reason the lever *L* is free to be moved to the contact-point 1, (assuming that it has been moved onto contact-point 2,) thereby operating the direction-controller *N* to reverse the direction of current through the motor. The mechanism may be operated in this manner until the resistance to the movement of the switch-rails has been done away with.

Referring again to Fig. 11, the operation of the motor to move the switch-rails will cause the plate *k* of the circuit-controller *K* to move between the contact-plates *k'* *k''* at the end of the cam's movement and before the pin *c''* engages the arm *h'* of the lever *H* to move the lever *H* to the position shown in Fig. 12. Of course when the lever *H* is moved by the enlargement *h'* the lever *H'* will be caused to move with it by the spring *h''*. Also when the lever *H'* is moved by enlargement *h'* the lever *H* will be moved with it by the same means. When the lever *H* is moved to the position shown in Fig. 12, the circuit to the motor is broken by the circuit-controller *I*, operated by that lever, but made by the circuit-controller *I*, operated by the lever *H'*, ready for a reverse movement of the motor upon the operation of the armature of the direction-controller.

Immediately that the lever *H* is operated, due to the switch-rails being completely moved and locked, the circuit (indication-circuit) for the electromagnet *M* is made, which, starting from the battery *Z*, is wire 13, lever *L*, contact 2, wires 14, 15, and 20, contact-plates 6, 3, and 5, wires 21 36, contact-plates *i''*, *i'*, and *i''*, wire 37, contact-plates *k'*, *k*, and *k''*, wires 38 and 39, electromagnet *M*, and wires 40, 41, and 19 back to battery. The electromagnet will then attract its armature *m* to release the lever, allowing it to be moved to its complete normal position to unlock other levers.

When the lever *L* is moved from the normal position, Fig. 12, toward its reversed position, Fig. 10, the lever *l* is moved onto the contact 1, in which event the direction-controller would be operated to move its armature to the position shown in Fig. 10. With the armature in this position and the levers *H* *H'* in the position shown in Fig. 12 the circuits for the motor may be easily traced, the current in this circuit passing through the armature in a reverse direction.

What I claim as my invention is—

1. The combination in a mechanism for moving switch-rails, of an electric motor, a cam rotated thereby, and a pivoted yoke connected with the switch-rails and rocked on its pivot by the rotation of the cam.

2. The combination with a mechanism for

moving switch-rails comprising an electric motor and a cam operated thereby; of means connected with the switch-rails and actuated by the cam for moving the switch-rails; a detector-bar operated by the cam, and a locking-rod connected with the switch-rails and engaged by said cam.

3. The combination in a mechanism for operating switch-rails, of an electric motor, a cam operatively connected with the switch-rails, gearing intermediate the armature of the electric motor and cam for rotating the cam, said gearing comprising a part adapted to be held against rotation, and means for at times holding said part against rotation.

4. The combination in a mechanism for operating switch-rails, of an electric motor, a cam operatively connected with the switch-rails, gearing intermediate the armature of the electric motor and cam for rotating the cam and comprising a part which when held from rotation permits the gearing to rotate the cam, and means comprising a resilient connection for holding said part at times against rotation.

5. The combination in a mechanism for operating switch-rails, of an electric motor, a cam operatively connected with the switch-rails, gearing intermediate the armature of the electric motor and cam for rotating the cam comprising a part which when held from rotation permits the gearing to rotate the cam, means comprising a resilient connection for holding said part against rotation, and other means for actuating said holding means to release the part and permit it to rotate.

6. The combination in a mechanism for operating switch-rails, of an electric motor, a cam operatively connected with the switch-rails, gearing intermediate the motor and cam for rotating the cam, comprising a gear-wheel, and means for yieldingly holding said gear-wheel against rotation.

7. The combination in a mechanism for operating switch-rails, of an electric motor, a cam operatively connected with the switch-rails, gearing intermediate the cam and motor for rotating the cam comprising a gear, means for yieldingly holding said gear against rotation, and means operated from the cam for operating said yielding holding means to release the internal gear and permit it to rotate.

8. The combination in a mechanism for operating switch-rails, of an electric motor, a cam operatively connected with the switch-rails, gearing intermediate the cam and motor for rotating the cam comprising a gear having shoulders, a pair of pivoted levers for engaging the shoulders on the internal gear, a spring for holding the levers in engagement with the shoulders, and means operated from the cam engaging said levers to disengage them from the shoulders.

9. The combination in a mechanism for operating switch-rails, of an electric motor, a

cam operatively connected with the switch-rails, gearing intermediate the motor and cam for rotating the cam and thereby moving the switch-rails and yielding means for at times holding a part of the gearing against rotation and which yielding means are released by the cam upon a complete movement of the switch-rails.

10. In combination with a mechanism for moving switch-rails which comprises an electric motor and a cam rotated thereby, of a rod connected with the switch-rails, and a means carried by the cam for engaging said rod to lock it against movement.

11. In combination with a mechanism for moving switch-rails which comprises an electric motor and a cam operated thereby, of a rod connected with the switch-rails, and provided with recesses, and a pin carried by the cam for fitting in either of the recesses to lock the rod against movement.

12. The combination in a mechanism for moving switch-rails, of a pivoted yoke connected with the switch-rails, and a motor for moving the switch-rails.

13. The combination of a mechanism for operating switch-rails, which comprises an electric motor, a cam rotated from said motor through intermediate gearing and a yielding holding means for a part of said gearing, circuits for said motor, and a controller in each of said circuits which, when either is operated by the yielding holding means, will open the motor-circuit in which it is included.

14. The combination with a mechanism for operating switch-rails comprising an electric motor, of a source of electrical energy, circuits between said source of energy and the motor, a lever for controlling said circuits, an electric lock for said lever—comprising an electromagnet, circuits for said electromagnet which include the source of energy, and

a plurality of circuit-breakers included in each circuit, which circuit-breakers are in series with each other, and are operated by the mechanism when moving the switch-rails.

15. The combination with a mechanism for operating switch-rails comprising an electric motor, two circuits for the motor, a lever for controlling said circuits, a lock for said lever comprising an electromagnet, two circuits for said electromagnet, two circuit-breakers in series and operated by the mechanism for each circuit of the electromagnet, and a source of electrical energy for said circuits.

16. The combination with a mechanism for operating switch-rails comprising an electric motor, two circuits for the motor, a lever for controlling said circuits, a lock for said lever comprising an electromagnet, two circuits for said electromagnet and two circuit-breakers in series and operated by the mechanism for each circuit of the electromagnet, and a common source of electrical energy for all of said circuits.

17. The combination with a mechanism for operating switch-rails comprising an electric motor, two circuits for the motor, a lever for controlling said circuits, a lock for said lever comprising an electromagnet, two circuits for the electromagnet, a circuit-breaker operated by the mechanism in each of the motor-circuits, two circuit-breakers in series and each operated by the mechanism for each circuit of the electromagnet and a source of electrical energy for all of the circuits.

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

JOHN PRESSLEY COLEMAN.

Witnesses:

W. L. McDANIEL,
GEO. E. CRUSE.