No. 647,637. Patented Apr. 17, 1900.

C. W. & J. B. SQUIRES.

SWITCH OPERATING MECHANISM FOR RAILWAYS.

(Application filed Apr. 12, 1899.)

(No Model.) 2 Sheets—Sheet 1.

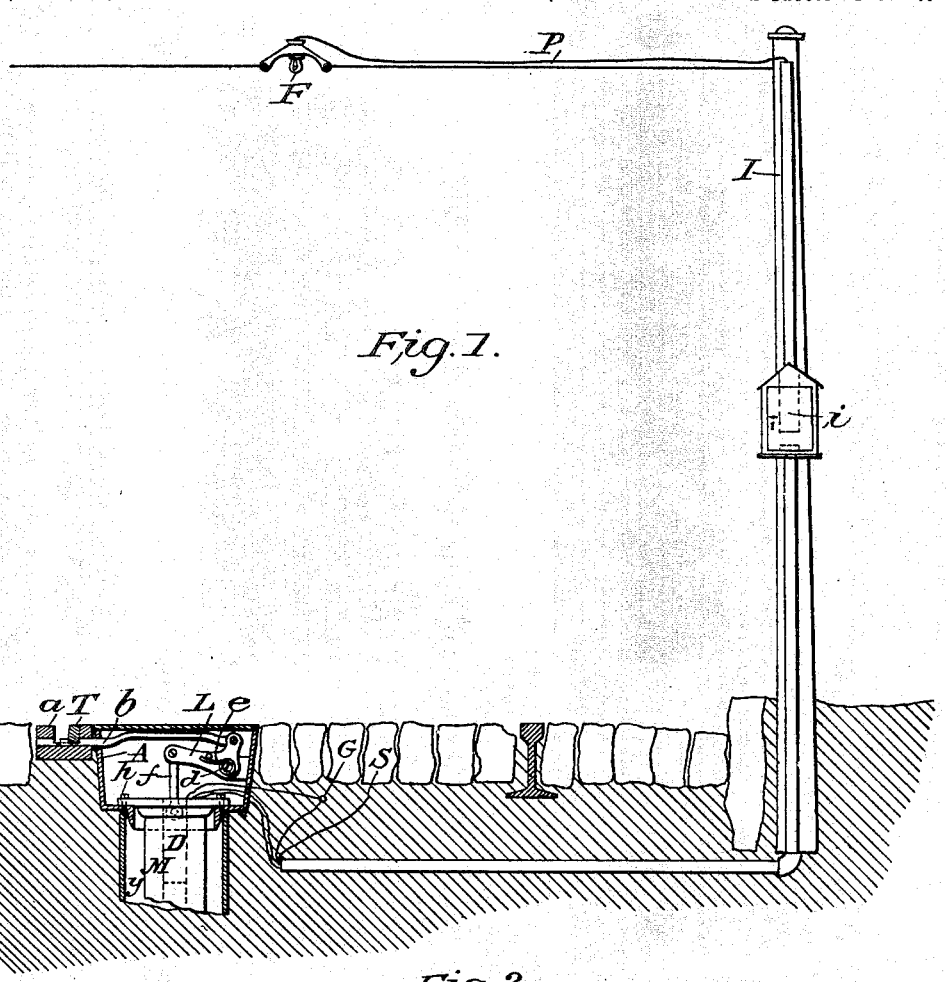

Fig. 1.

Fig. 2.

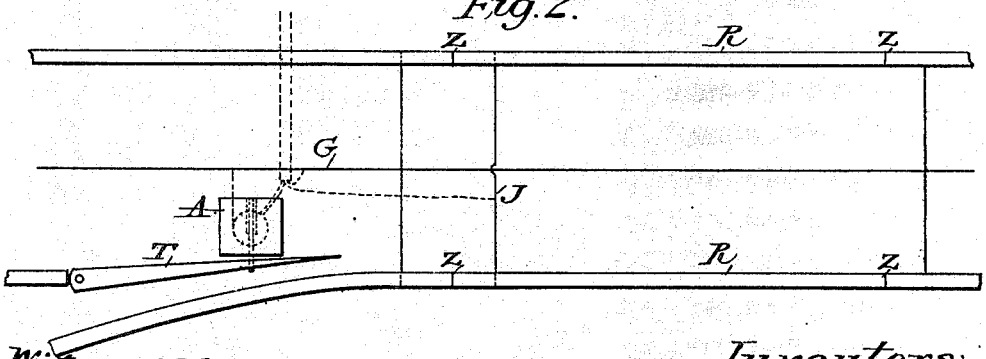

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Fig. 3.

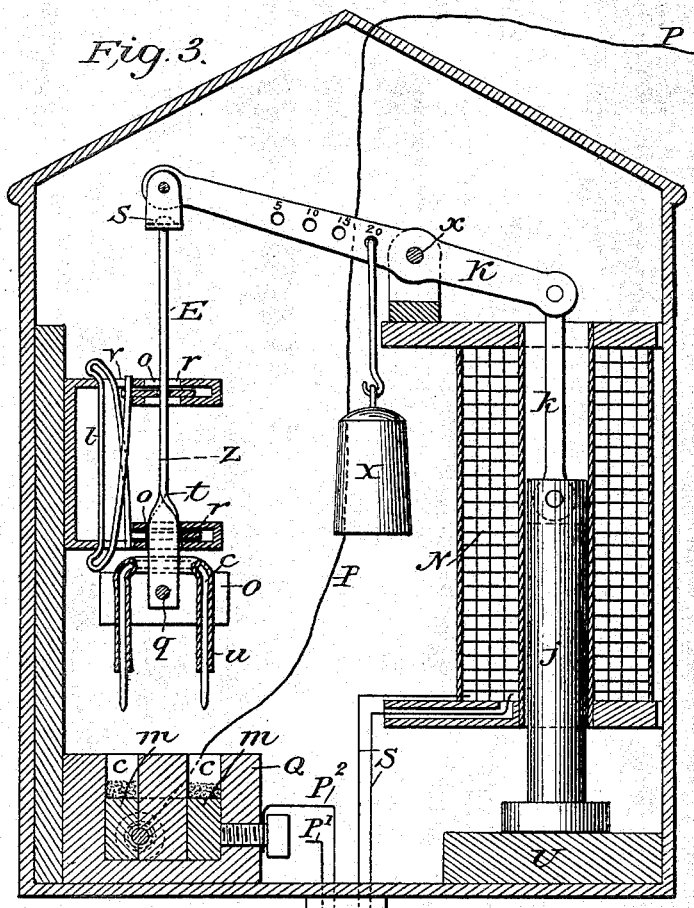


Fig. 5.

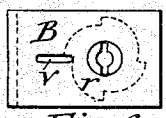


Fig. 6.

Fig. 7.

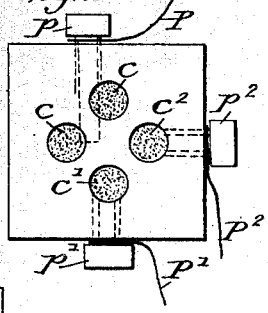
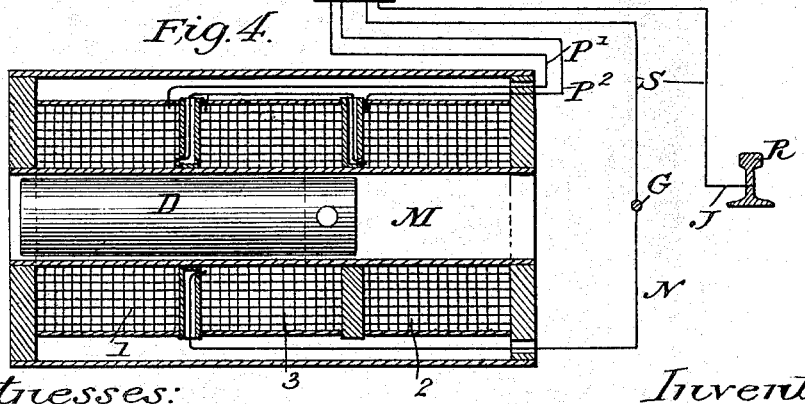


Fig. 4.



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UNITED STATES PATENT OFFICE.

CHARLES WM. SQUIRES AND JAMES B. SQUIRES, OF SPRINGFIELD, MASSACHUSETTS.

SWITCH-OPERATING MECHANISM FOR RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 647,637, dated April 17, 1900.

Application filed April 12, 1899. Serial No. 712,824. (No model.)

To all whom it may concern:

Be it known that we, CHARLES WILLIAM SQUIRES and JAMES B. SQUIRES, citizens of the United States, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Switch-Operating Mechanisms for Railways, of which the following is a specification.

Our invention relates to electrically-operated switch-throwing mechanisms for electric railways in which the switch-tongue is operated automatically by a person on the car by the same means usually employed in running the car; and the objects of our invention are, first, to provide a simple and practical means of operating the switch from the car; second, to decrease the amount of insulation necessary for the insulated section of track, and, third, to produce uniform results in the operation of the switch independent of the amount of current passed from the car. We attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a sectional view of a road-bed, switch, and switch-throwing mechanism, with trolley or feed wire, pole for supporting the same, and box *i* on pole I, in which is located an electric circuit-governing device comprised in the switch-operating mechanism. Fig. 2 is a plan view of a section of car-track, showing location of switch-throwing mechanism, insulated rails, circuit-conductors, &c. Fig. 3 is a vertical sectional view of the electrical device contained in box *i* in Fig. 1. Fig. 4 is a detail sectional view of a solenoid-magnet for throwing the switch-tongue, also a plan of circuit-conductors with insulated rail, ground-wire, &c. Fig. 5 is a top view of parts B and *r* of Fig. 3. Fig. 6 is a top view of part E from line Z, Fig. 3, with adjuncts. Fig. 7 is a top view of contact-block Q of Fig. 3.

In Fig. 1 the box A contains the switch-throwing mechanism. The switch-tongue T in switch-bed *a* is connected by switch-rod *b* to angle-lever L, which is pivoted on stud *d* and counterbalanced by spring *e*, angle-lever L being connected by rod *f* to armature D of solenoid-magnet M, which is supported and held fast to switch-box A by means of magnet-flange *g* and screws *h h*. The pipe *y* is adapted to protect and drain magnet M.

The trolley or feed wire F is supported by pole I, on which is located box *i*, containing an electric governing device comprised in the said switch-operating mechanism, Fig. 3. Said electric device is comprised in an electric circuit P, extending from the feed-wire F, Figs. 1 and 3, to said electric device, where the circuit is broken by a switch comprised in contact-fork *c* and contact-cells C, C′, and C², thence continuing in two separate branches P′ and P² to the switch-throwing solenoid-magnet M, the coils of which are comprised therein, and thence to the ground-wire G. Said electric device is also comprised in a second or secondary electric circuit S, separate and distinct from the first-named circuit P, said secondary circuit S extending from the insulated rails R R to the ground-wire G, Figs. 2 and 4, and comprising in its circuit the coils of solenoid-magnet N in the aforesaid electrical device, Fig. 3.

In Fig. 3 the solenoid-magnet N, its armature *j*, and connecting-rod *k* operate the pivoted lever K, which is adapted to lower and raise plunger E.

Plunger E has attached thereto insulator-block *o*, which carries contact-fork *c*, which on being lowered comes in contact with and closes the circuit between the mercury contacts C and C′ or C and C², as the case may be, thereby making a continuous circuit from the feed-wire F to the ground-wire G, the coils of magnet M being comprised in said circuit.

The plunger E is connected to lever K by swivel *s*. Plunger E is guided in its movements by bracket B and ratchet-plates *r r*, the bracket B being provided with apertures *o o*, through which the plunger E moves in a downward-and-upward course. The bracket B supports the ratchet-plates *r r* and ratchet-spring *l*, by means of which and a spiral twist *t* in plunger E said plunger E is rotated one-quarter turn at each upward movement, which causes the contact-fork *c* to close circuits P and P′ and P and P² alternately. The ratchet-plates *r r* have four teeth and an aperture in the center, through which the plunger E passes, Fig. 5, and by which it is given its rotary movement.

The ratchet-spring *l* is held in position in apertures *v* in bracket B and coöperates with ratchet-plates *r r*. Contact-fork *c* is supported by insulator-block O, which is made in two sections and is attached to plunger E by screw *q*, Fig. 6.

Contact-fork *c* is insulated by a covering *u* of rubber or other suitable material.

The contact-cells C, C′, and C² are fitted with binding-screws *p*, *p′*, and *p²*, by which connections are made to the proper circuit-wires. The contact-cells each contain a suitable quantity of mercury *m m* for conducting the electric current between the contact-fork *c* and the binding-screws *p*, *p′*, and *p²*.

The contact-block Q is made of suitable non-conducting material, a block of which is also placed under armature *j*.

Pivoted lever K has four aperatures 5, 10, 15, and 20, by means of which and the hook 4 a weight X may be suspended from said lever K at different distances from its fulcrum *x*, the suspension of the weight at the different points on said lever K requiring a proportional increase or decrease in the amount of energy required to operate the magnet N, the number of amperes of current required being indicated by the number on the lever where the weight is hung.

The magnet M, Fig. 4, as shown, is divided into three sections 1, 2, and 3, two of which, 1 and 2 or 3 and 2, are energized by the electric current each time the circuit is closed by the operation of magnet N. As will be seen in Fig. 4, the coils of sections 1 and 2 of magnet M are comprised in circuit P′ and when energized by the passage of an electric current attract the armature D to the position shown in Fig. 4. Sections 3 and 2 are comprised in circuit P², and when energized by the passage of an electric current attract the armature D to a position opposite the one shown in Fig. 4, thereby attaining the reverse movement for the switch-throwing mechanism.

In Figs. 1 and 2 are shown pipes leading from the box *i* on trolley-supporting pole I into the ground adjacent to the switch-box A for the protection of the circuit-wires.

It is not essential that the electric device for controlling the circuit P should be on the pole; but it is placed there for convenience of access and to exclude the necessity of carrying a live wire into the ground where the feed-wire is located above the ground. In case the feed-wire was located in the road-bed, as is the case in the third-rail system, the said electric device would be located in or adjacent to switch-box A.

In Fig. 2 the rails R R are connected by bond-wire J and are insulated at points *z z z z*. The ground-wire G is connected by bonds to the rails in the customary manner.

The operation of the switch is as follows: The electric current applied from a car on the insulated section of rail R R passes from said rail through circuit-conductor S to the ground-wire G and comprising in its circuit the coils of magnet N energizes said magnet, attracting its armature *j* and by the mechanism described connects circuit-conductor P with one of the circuit-conductors P′ or P², as the case may be, thereby allowing the electric current to flow from the feed-wire F through the coils of magnet M to the ground-wire G. As each successive flow of current from the insulated rails R R causes the mechanism to close circuits P′ and P² alternately, it is evident that the armature D in magnet M will be attracted to reverse positions successively, causing a like action of the switch-tongue T, with which it is connected. The switch-throwing magnet M is wound with fine wire capable of offering a suitable resistance to the high voltage used on the feed-wire and also to economize in the amount of current used, as well as to avoid the increased danger with which heavy currents are attended. A safety-fuse may also be used, as is customary in connections with high-voltage circuits. In the winding of the circuit-closing magnet N coarse wire is used, as little energy is required and it is desirable that this circuit should offer as little resistance to the current as possible. The mechanism connected with this magnet N is arranged to operate with a greater or less amount of current, according to the adjustment of the weight X on lever K. For instance, it is found that in summer it is desirable to have the electric-circuit switch operate on the passage of a small amount of current from a car, when the weight X would be suspended from a point marked "5" on lever K, which means that five amperes of current are sufficient to raise the armature *j*.

In winter, especially on cold days, it will be found that the electric heaters on the cars are passing an amount of current (five to fifteen amperes) which would interfere with the working of the electric-circuit-switch-operating magnet N by means of the controller on the car unless the current in the heaters were first shut off. In this case the weight X is shifted to a point on lever K requiring more current than is passed by the heaters to raise armature *j* of magnet N. In this way all trouble which the heaters might occasion in the operation of the switch is effectually overcome.

The cells C, C′, and C², containing the mercury *m*, also contain a small quantity of dry sand or other substance, which floats on the mercury and smothers the spark which would otherwise result on breaking circuit.

Among the advantages of the mechanism described are the following: By using an electric current direct from the feed-wire to the switch-throwing magnet we get an operating force which in strength is independent of that supplied from the car; that the circuit leading from the insulated rail to the ground-wire has so little resistance that the amount of insulation required for the insulated rails

is reduced to a minimum; that by using a high-voltage current direct from the feed-wire we are enabled to use fine wire on the switch-throwing magnet, thereby producing a great saving in material and space; that by using a compound or double-acting magnet, as described, the switch-throwing mechanism is reduced to the utmost simplicity, and that the electrical circuit-governing device comprised herein overcomes any trouble which the use of electric heaters in the cars might occasion in the working of the switch.

The essential feature of our invention is the using of two separate electric circuits, the principal circuit direct from the feed-wire to operate the switch-throwing magnet, and the secondary circuit—the one passing from the car through the insulated rail—for operating the magnet which closes the first-named or principal circuit.

Having thus described our improvements, what we claim as our invention, and desire to secure by Letters Patent, is—

1. The combination of a switch-tongue, a magnet for throwing the tongue, an electric-circuit conductor leading from a feed-wire to a return-wire, and comprising in its circuit the coils of said magnet and an electric-circuit switch, and an insulated section of track, a second electric-circuit conductor separate from the said first-named electric-circuit conductor, said second electric-circuit conductor connecting said insulated section of track with a return-wire, and comprising in its circuit the coils of a magnet for operating said electric-circuit switch, substantially as described.

2. The combination with a switch-throwing mechanism, of two distinct electrical circuits, as follows: a first or principal electrical circuit leading from a feed-wire to a return-wire exclusive of the car or track and comprising in its circuit the coils of a car-switch-throwing magnet, and an electric-circuit switch, and a second or secondary circuit connecting an insulated section of track with a return-wire and comprising in its circuit the coils of a magnet for operating the said electric-circuit switch comprised in the said principal electric circuit.

3. In combination with an electrically-operated car-switch-throwing mechanism, an electric-circuit switch comprising a number of mercury contacts, a contact fork or bar adapted to coöperate with and close the circuit between said mercury contacts, a magnet and its armature adapted for operating said electric-circuit switch, circuit-conductors comprising the coils of said magnet, an insulated section of track and a return-wire; a second circuit-conductor comprising a feed-wire, the said electric-circuit switch, the coils of a car-switch-operating magnet, and a return-wire.

4. The combination with an electrically-operated car-switch-throwing mechanism, of an electric circuit-governing device in which is comprised an electric-circuit switch, an insulated section of rail, and suitable circuit-conductors.

5. In combination with an electrically-operated car-switch-throwing mechanism, an electric circuit-governing device comprising a solenoid-magnet and its armature, a lever operated by said armature, a plunger with swivel attachment to said lever, a bracket for guiding the movements of said plunger, a ratchet plate and spring coöperating with said plunger, a contact bar or fork carried by said plunger, a block of non-conducting material containing mercury contacts with which said contact bar or fork coöperated, and a weight for controlling the operation of before-mentioned lever, all substantially as set forth.

6. In a car-switch-throwing mechanism, the combination of a switch-tongue, a switch-rod, a lever, a magnet and its armature for operating said mechanism, an electric-circuit conductor in which is comprised the coils of said magnet, and an electric-circuit switch with suitable feed and return wires, a section of insulated rail, a second electric-circuit conductor, comprising in its circuit said insulated section of rail, the coils of a magnet for operating said electric-circuit switch, and a return-wire, substantially as described.

7. In an electrically-operated car-switch-throwing mechanism for railways, in combination, an electric-circuit conductor leading from a feed-wire to a ground or return wire exclusive of the car and comprising in its circuit an electric-circuit switch and the coils of a magnet for operating said car-switch-throwing mechanism, electric-circuit conductors adapted to form a continuous electric circuit from the trolley or feed wire through the car when adjacent the switch to the ground or return wire and comprising in said circuit the coils of a magnet by means of which and the said electric-circuit switch the first-named electric circuit is closed only upon passage of the electric current through the car-circuit and means by which the said switch-throwing mechanism is made to assume a reversed position at each successive passage of electric current through the car-circuit, substantially as set forth.

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