C. W. SQUIRES.

SWITCH OPERATING MECHANISM FOR RAILWAYS.

APPLICATION FILED AUG. 15, 1908.

936,381.

Patented Oct. 12, 1909.

3 SHEETS—SHEET 1.

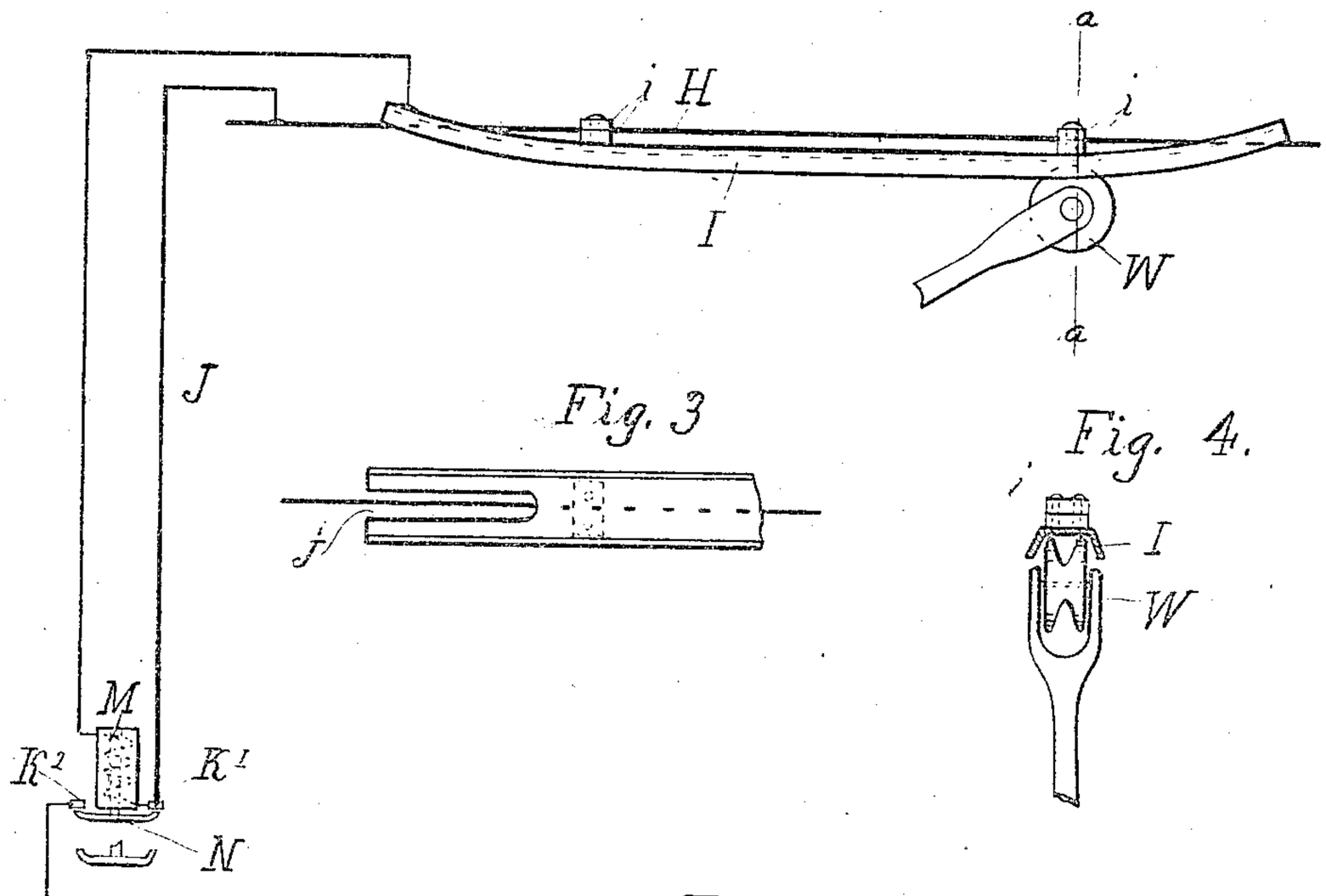


Fig. 3

Fig. 4.

Fig. 1.

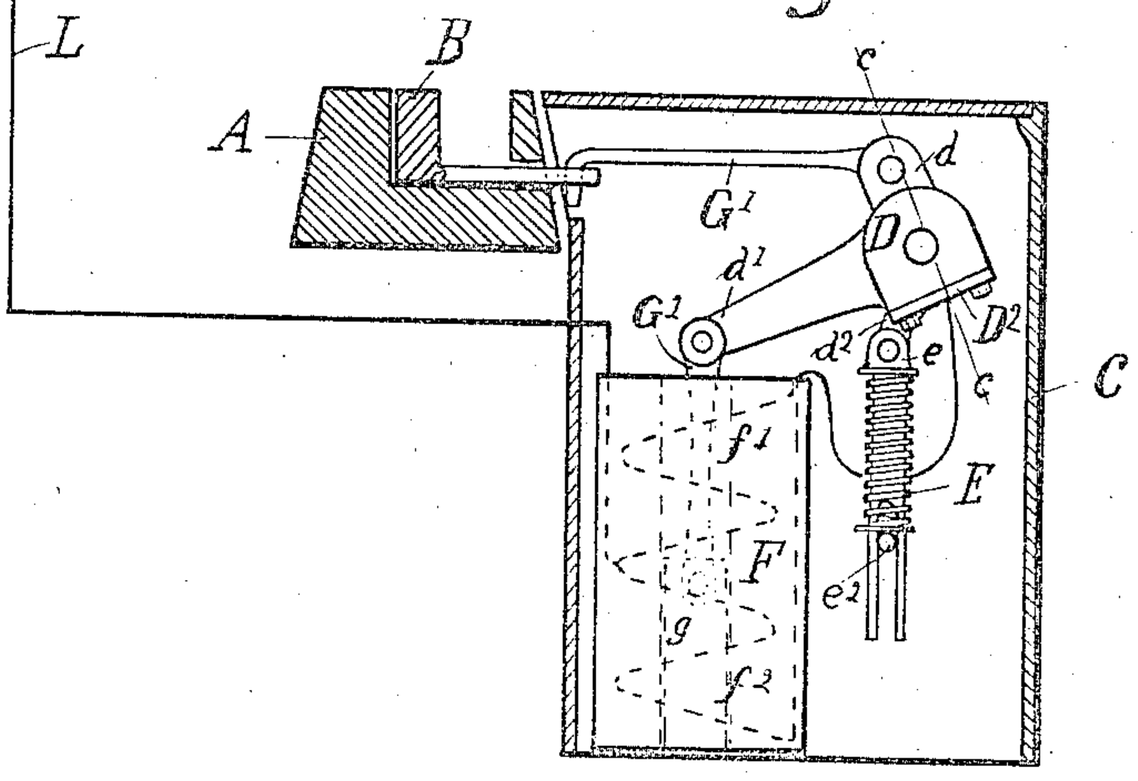
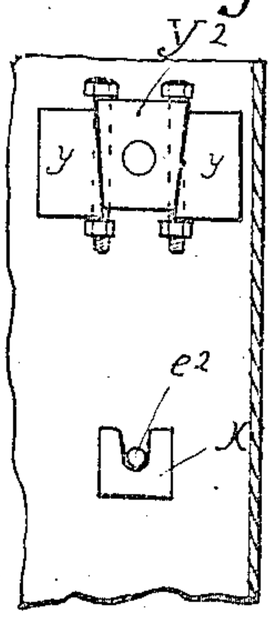


Fig. 8.



WITNESSES:

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3 SHEETS—SHEET 2.

Fig. 2.

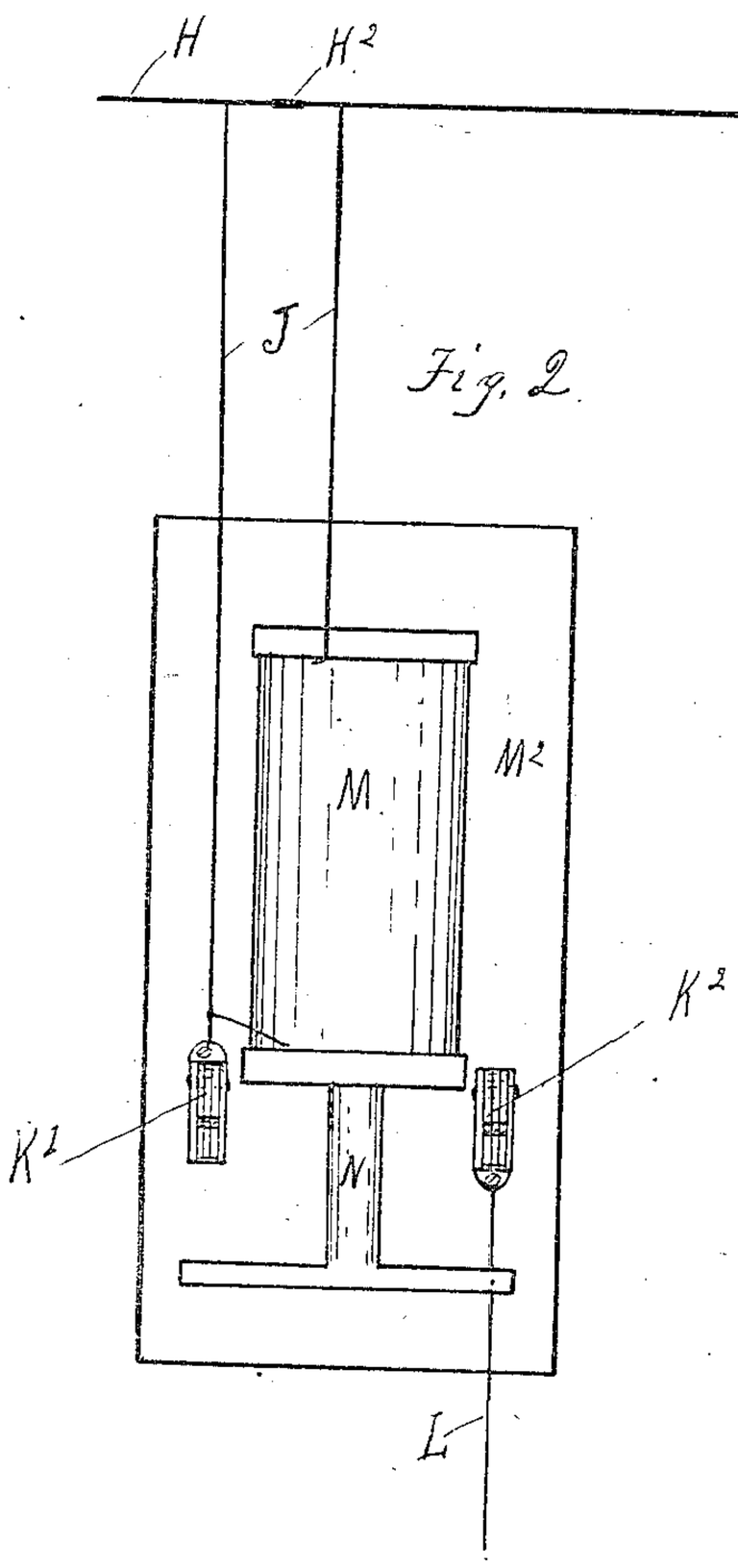


Fig. 9.

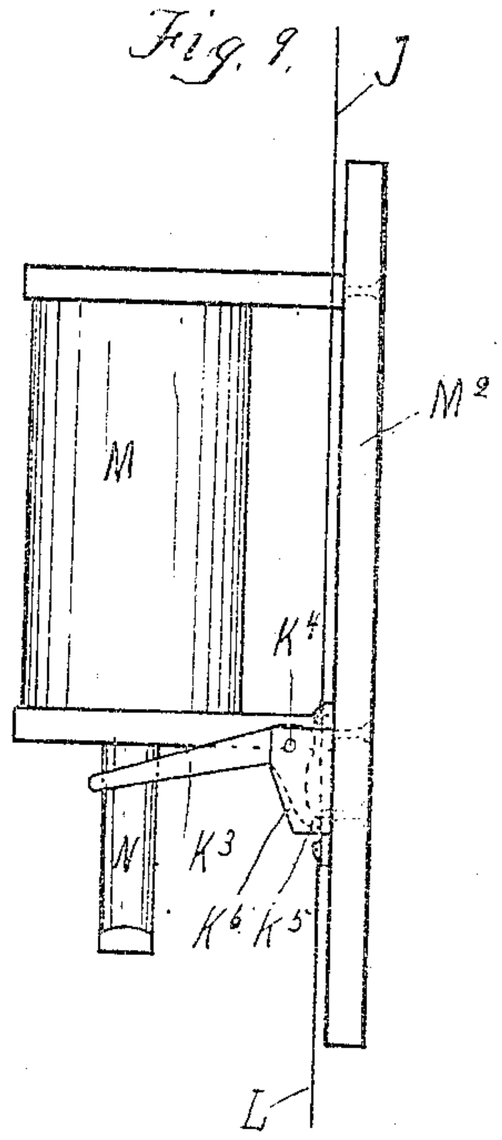
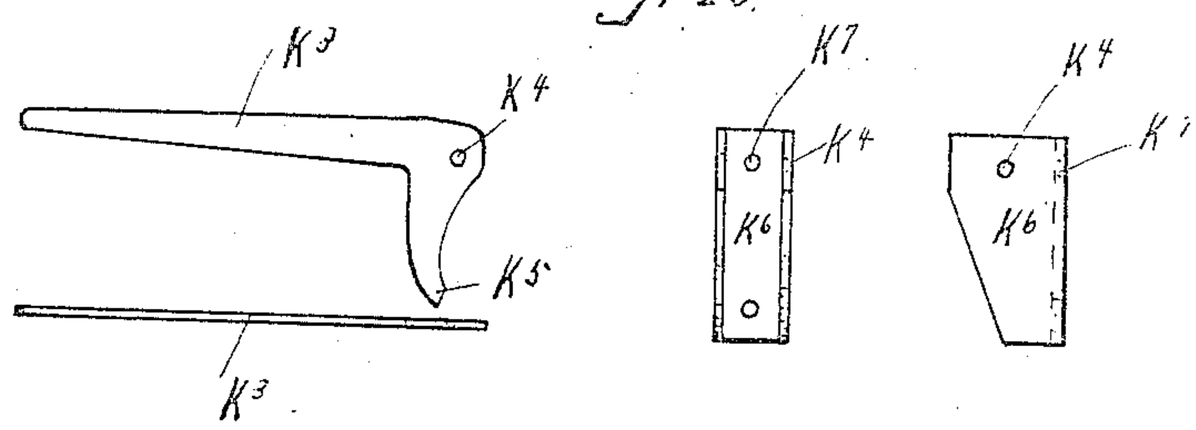


Fig. 10.



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3 SHEETS—SHEET 3

Fig. 5.

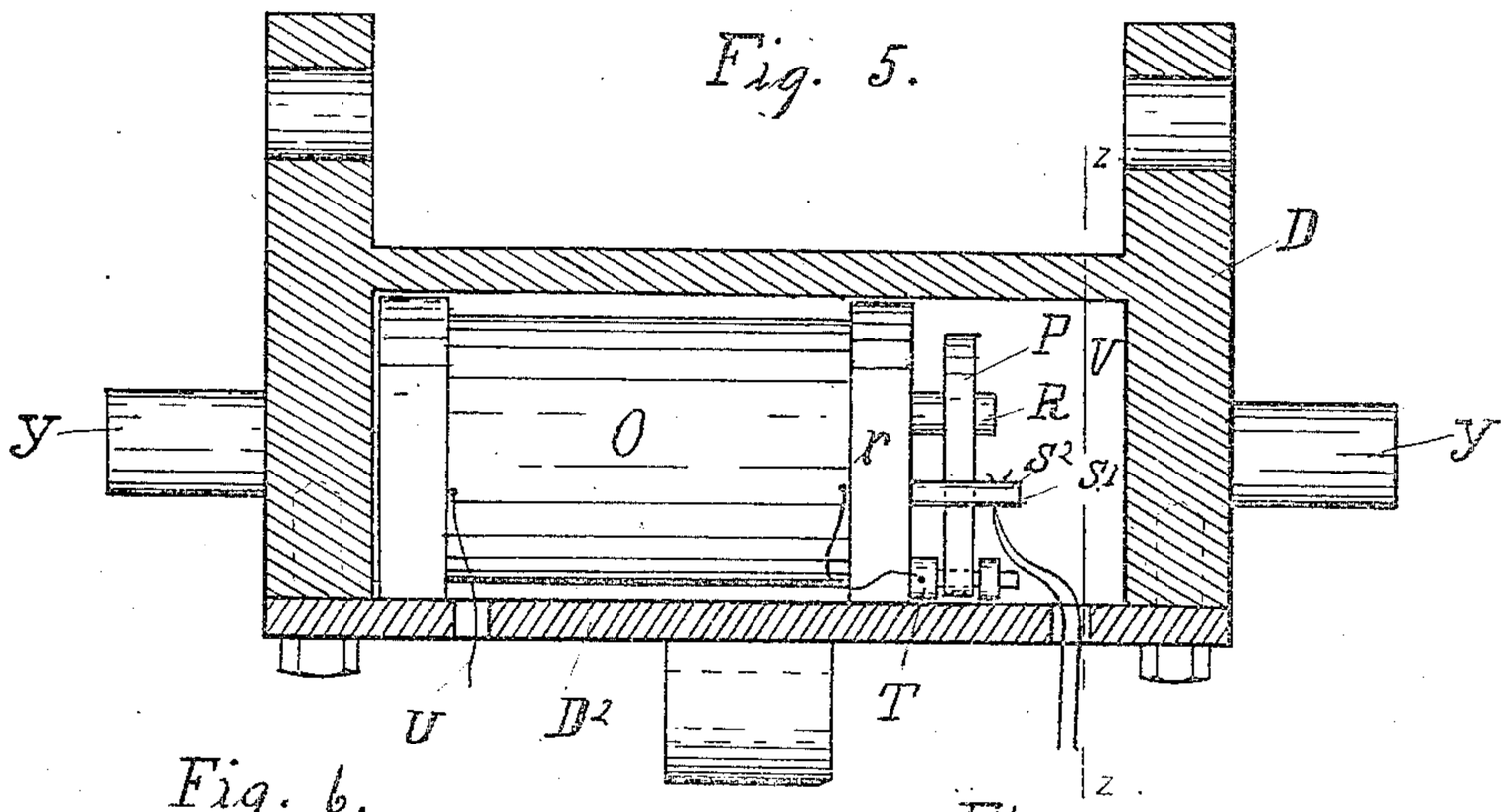


Fig. 6.

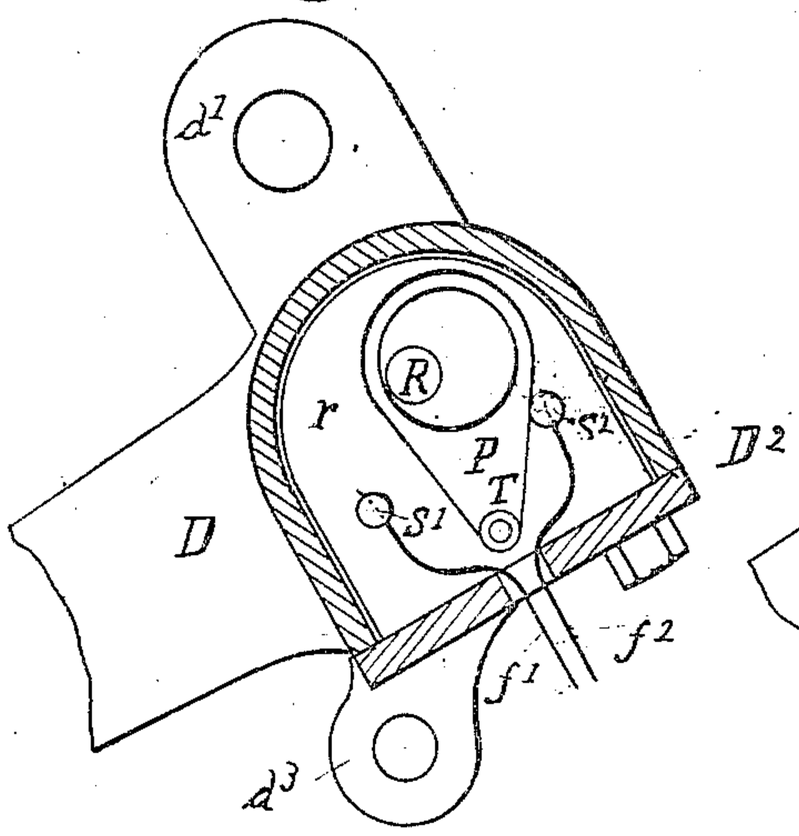
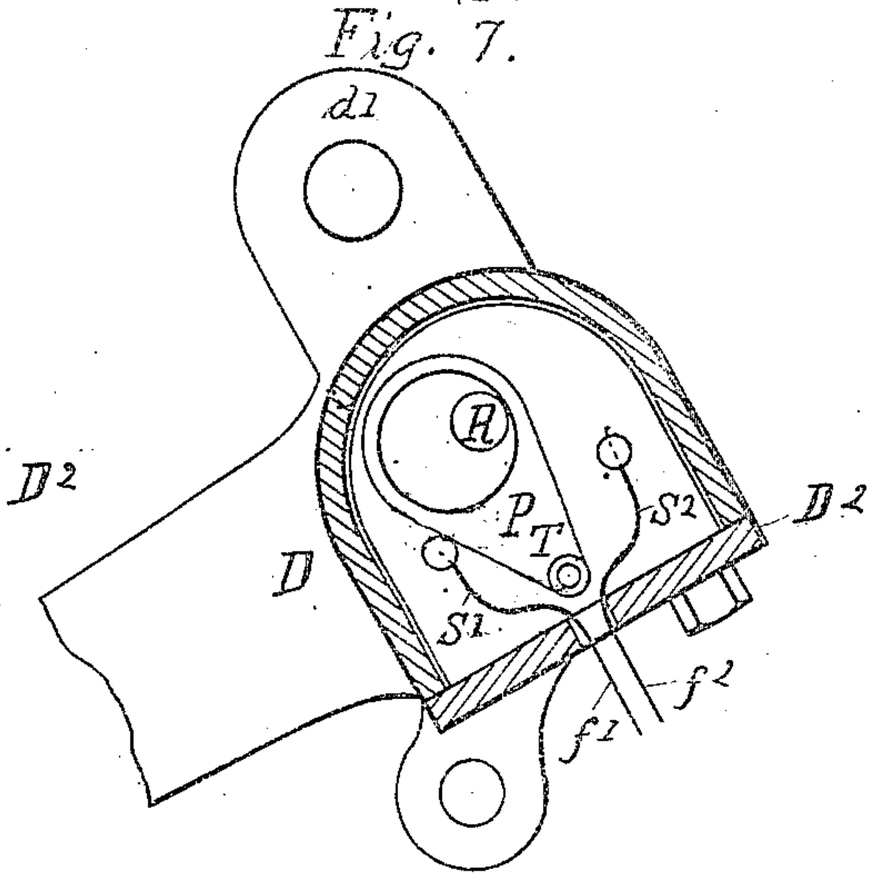


Fig. 7.



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UNITED STATES PATENT OFFICE.

CHARLES WM. SQUIRES, OF BEVERLY, MASSACHUSETTS.

SWITCH-OPERATING MECHANISM FOR RAILWAYS.

936,381. Specification of Letters Patent. Patented Oct. 12, 1909.

Application filed August 15, 1908. Serial No. 448,747.

To all whom it may concern:

Be it known that I, CHARLES W. SQUIRES, a citizen of the United States, residing at Beverly, in the county of Essex and State of Massachusetts, have invented new and useful Improvements in Switch-Operating Mechanisms for Railways, of which the following is a specification.

My invention relates to electrically-operated switch throwing mechanisms for electric railways in which the switch tongue in the track is operated by a person on the car by the same means usually employed in running the car, and the object of my invention is to provide a system of electrical operation which shall be more practical and certain in its results, the same being devised by me as a different principle of operation rather than an improvement on former systems, and in no way connected with former U. S. patents issued to me, viz., 642,932, February 6, 1900; 647,637, April 17, 1900; 719,055, Jan. 27, 1903, and 792,174, June 13, 1905.

The details of the invention will be hereinafter explained, and that which I regard as new will be set forth in the claims.

In the accompanying drawings, Figure 1 is a cross sectional view of a switch bed and tongue with the switch operating device in connection. H, is a section of trolley wire supporting the insulated section of rail with the trolley wheel, W, in contact. J, and L, represent the electrical circuits leading from the trolley wire to the switch operating solenoid magnet. Fig. 2 is an enlarged front view of the circuit controller with modification of trolley insulation. Fig. 3, is a bottom plan view of the end of the insulated rail. Fig. 4 is a sectional view on line *a*, *a*, of Fig. 1. Fig. 5, is a transverse sectional view of the angle lever D, shown in Fig. 1, on line *c*, *c*. Fig. 6, is a cross sectional view of angle lever D, on lines *z*, *z*, Fig. 5. Fig. 7, is a view of the same section with a reversed position of part P. Fig. 8, is a section of the box or casing. Fig. 9, is a side view of the controller. Fig. 10, is a detailed view of a controller contact plate and a bracket for supporting the same.

In Fig. 1, the switch box or casing C, is supplied with lugs, (not shown), to support the switch-operating magnet F, and the angle lever D, the angle lever D, being adapted to have an oscillating motion. The switch-throwing magnet F, is a double solenoid magnet having a movable core, *g*, attached by means of a connecting rod, G^2, to the long arm, d^1, of angle lever D. Angle lever D, is provided with another shorter arm, *d*, which is connected with the adjacent switch tongue, B, by means of connecting rod G^1. The switch operating solenoid magnet F, comprising two magnet coils, f^1, and f^2, is adapted to propel its core up or down accordingly as its coils are energized alternately by the passage of the current, thereby transmitting motion through the angle lever D, and rod G^1, to the switch tongue B. The body of the angle lever D, is hollow for a purpose hereinafter described, the opening being fitted with a cover D^2, which is held in place by cap screws. Said cover D^2, is provided with a lug, d^2, which is adapted to engage with a rod *e*, carrying spring E, which is used to counterbalance the weight of the magnet core *g*. The rod, e^2, shown as supporting said spring may rest in seats cast on the casing C, or may be dropped down from the boxes which support the angle lever D, and the upper ends threaded and used for bolts to secure said boxes to lugs on the casing, detachable boxes being desirable that they may be replaced when worn out. See Fig. 8.

In Fig. 1, the trolley wire H, supports a strip of channel iron I, which is held in place on the lower side of the trolley wire H, with its flanges extending downward by blocks, *i*, *i*, clamped to the trolley wire, and is suitably insulated therefrom. The ends of this section of channel iron, or insulated rail as I shall call it, are curved upward above the wire that they may be readily engaged by the trolley wheel of a passing car. The trolley wire H, is provided with an electric circuit conductor J, connecting it with the otherwise insulated rail I, said circuit conductor J, comprising in its circuit the coils of circuit closing magnet M. The trolley wheel W, is shown in contact with the insulated rail I, and all current taken therefrom must first pass through the coils of the circuit closing magnet M, in its passage from the trolley wire H. The core N, of the solenoid magnet M, is shown in contact with terminals K^1, and K^2, as it is assumed, the trolley wheel W, is taking current from the insulated rail I, consequently lifting core N, and allowing the current to flow from terminal K^1, to K^2, thence through conductor L, to the switch throwing solenoid magnet F.

In Fig. 2, the construction is the same as

in Fig. 1, with the exception of the insulated section of trolley wire I, which takes the place of the insulated rail, I, in Fig. 1, the same being insulated from the rest by ordinary cut-outs, H^2. The controller magnet M, and circuit terminals, K^1 and K^2, are mounted on the slate, M^2, the contacts being adapted to be engaged by armature N, when said armature is energized, as shown in Fig. 1.

In Figs. 1 and 2, K^1, and K^2, refer to the electric circuit terminals as terminals, their component parts being designated in Figs. 9 and 10, as K^3, contact plate, and K^6, bracket for supporting the same, each terminal consisting of a bracket containing three plates.

In Fig. 3, is shown the slot *j*, in the end of the insulated rail I, that the ends of said rail may be bent upward to their proper position without coming in contact with the trolley wire H.

In Fig. 4, the sectional view on lines *a*, *a*, Fig. 1, shows the shape of the insulated rail and method of clamping it to the trolley wire.

In Fig. 5, the angle lever D, has two journals, Y, Y, which are adapted to fit in boxes supported by lugs *y*, *y*, cast on the casing C, Fig. 1, Fig. 8.

Fig. 6, illustrates the position armature plate P would occupy after the reversing of angle lever D, with the current still flowing through the circuit, the core R, still attracting plate P, and preventing the same from dropping down onto contact stud S^1.

Fig. 7, illustrates angle lever D, in same position as Fig. 6, but with the current suspended, and plate P, dropped down onto contact stud S^1. In this position the next flow of current would result in again reversing the position of the angle lever.

In Fig. 8 the casing C is supplied with the lugs *y*, *y*, which serve to support the journal boxes Y^2. The casing is further supplied with lugs *x*, which support a cross bar e^2, which acts for an abutment for spring E, as shown in Fig. 1.

In Fig. 9, the contact plates K^3 are shown loosely pivoted to brackets, K^6, which are fastened to the slate M^2, that they may have a yielding resistance to armature N, when same engages therewith.

In Fig. 10, the contact plate which is of sheet metal is provided with a pivot hole, K^4, and also a point of abutment, K^5, to provide for a limited motion as said abutment engages the bracket K^6. The bracket K^6, is provided with screw holes, K^7, for fastening to the slate, and is also provided with pivot holes K^4, for pivoting the contact plates, K^3. These contact plates are made of sheet iron preferably, that they may be attracted by the armature N, during engagement. They are also designed to be used in multiple that they may give more contact surface.

Angle lever D, is provided with a chamber V, in which is secured magnet Q, which consists of an ordinary electro-magnet wound with the same size wire as is the switch throwing magnet F, in Fig. 1, and having a soft iron core one end of which R, projects beyond the head, being offset upward from the center to allow the compact arrangement of the parts. Magnet head *r*, supports on its face stud T, to which is loosely pivoted an armature plate P, having an aperture in its upper part through which extends the core end of magnet O, the core end being adapted to attract and hold plate P, in its proper position while there is any current flowing through the coils of magnet O. Magnet head *r*, also supports two other studs S^1, and S^2, adapted to engage with plate P, alternately, as said plate is shifted from side to side. The position of plate P, is determined by the position of the angle lever D, while no current is flowing through the coils of magnet O, as the center of gravity is changed with the shifting of said angle lever. The electrical arrangement of the parts is as follows: Studs S^1, and S^2, (see Fig. 6) constitute the terminals of coils f^1, and f^2, of the switch throwing magnet F, Fig. 5. Pivot stud T, is connected with one end of the coil of magnet O, the other end U, of said coil being connected with the ground or return wire. Armature plate P, is adapted to transmit the current from terminal stud S^1, or S^2, as the case may be, to pivot stud T, from which it flows through the coils of magnet O, to the ground or return wire. The circuit through magnet O, always remains unbroken during the flow of current through its conductors, the armature plate P, being always in contact with either stud S^1, or S^2, and remaining so during the flow of current notwithstanding the reversing of the position of the angle lever D.

The armature plate P, may consist of a number of thin iron plates which may be separated by thin brass washers, in this case each plate acts independently making a separate contact and is more effective in transmitting the current if a larger amperage is used.

This electrical device which I have just described I shall call the electro-mechanical circuit changer, as by the mechanical shifting of armature P, and the holding of the same in position by magnetic force until the current is suspended, electric current is made to pass through coils f^1, and f^2, of the switch-throwing solenoid magnet F, alternately. The electro-mechanical circuit changer constitutes the essential feature of this invention.

Fig. 6, is a sectional view of angle lever D, on lines *z*, *z*, Fig. 5, and illustrates the

position which armature P must occupy in Fig. 1, under the stated conditions.

Fig. 7, is the same sectional view as Fig. 6, and illustrates the position assumed by armature plate P, immediately as the current is suspended through the coils of its magnet.

Fig. 8, shows the lugs y, y, cast on casing C, to support journal boxes Y^2 for carrying journals Y, Y. The lower lug x, supports rod e^2, Fig. 1.

As the current passes through the circuit changer after leaving the switch-operating magnet F, there is little resistance offered at this part of the circuit, and therefore practically no danger of short circuiting, or like trouble. The conductors leading from the switch-operating magnet to the circuit changer being loose and flexible to allow of the movement of the angle lever D.

Counterbalance spring E, between angle lever D, and rod e^2, is used to counterbalance the weight of the core or plunger when the same is intermediate of its extreme positions. When the core is at its upward extreme, the spring exerts a tension to hold it there. When the core is at its lower extreme, its own weight acts to hold it there, as the spring in this position is on center and is neutral. Thus is afforded a tension to hold the switch tongue firmly at either extreme during the passage of a car over the switch to provide against the possibility of displacement during the passage of a car, for there is no energy in the track solenoid while the car passes over the switch.

To operate the switch: As the car approaches, if it is desired to shift the position of the switch tongue, the trolley wheel should pass over the insulated rail with the power on. This will cause a flow of current through magnet M, lifting core N, and connecting terminals K^1, and K^2, affording an unbroken circuit through conductor L, thence through one of the coils of magnet F, thence to and through the coils of electromagnet O, to the ground or return wire. The electrical connections at studs S^1, and S^2, are such that armature plate P, will, by gravitative force, complete the circuit for the reverse position of the switch. If the position of the switch is found to be correct, the trolley wheel must pass over the insulated rail while no current is being applied to the motors; the ordinary current from the lights, heaters, etc., being insufficient to lift core N. In this case the circuit L, will remain open and the switch will not be moved.

The method of insulation for the trolley wire here shown and described is to be used when it is desired not to cut the trolley wire; otherwise, two ordinary "cutouts" may be inserted in the trolley wire at proper distances from the switch. This last method has its advantage in not loading the trolley wire, also that the switch may be reversed at will by application of power while the trolley wheel is between the cutouts.

The essential feature of my invention consists in using a combination of mechanical and magnetic forces to operate the electro-mechanical circuit changing device, which is contained within the body of the angle lever D. The reversing of the angle lever would result at once in the reversing of the position of the armature P, were it not that said armature is held fast in its position so long as there is any flow of current through its magnet, after which it falls by gravitative force to a reversed position connecting with the opposite stud. At another application of current, the switch parts will again be reversed, and so on at each successive application of current. I have placed this electro-mechanical circuit changing device within the body of the angle lever that it may be sure of operation in conjunction therewith; also for the purpose of making the device as compact as possible. It is not departing from the scope of the invention to place it in a separate casing or to arrange the parts different from what I have shown.

It will be seen that the working of the electro-mechanical circuit changer is not dependent upon the source of current, or the manner of utilizing the current from the trolley wire, so long as means are provided to cause the current to flow through its coils at will; for instance, were it desirous to dispense with the circuit closing device M, the circuit conductors leading through the switch operating magnet F, would be as follows: from the trolley wire H, to switch operating magnet F, thence to and through the electro-mechanical circuit changing magnet O, and back to the insulated section I, from which the current would be taken by the trolley wheel W, the circuit remaining closed at all times except the instant the armature P, reversed, which would be while no current was flowing.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In combination a switch tongue, a magnet for shifting the tongue, intermediate mechanism in which is comprised an electro-mechanical gravity-acting circuit changing device, and suitable conductors.

2. In combination a switch tongue, two magnet coils adapted to move said tongue to either position alternately, a gravity-acting circuit-changing device for determining which of the two said coils shall be energized, mechanical connection between said circuit changing device and the switch

throwing mechanism causing them to cooperate with each other, and suitable circuit conductors, substantially as described.

3. In combination an insulated section of trolley, a switch tongue, a two circuit magnet for shifting the tongue, a gravity-acting circuit changing device adapted to change the circuit alternately, in conjunction with the movements of the switch throwing mechanism, a circuit conductor extending from a feed wire to insulated section of trolley and comprising in its circuit a circuit closing device, and a circuit conductor extending from said circuit closing device to and through the coils of said switch operating magnet and said circuit changing device, to a return wire, substantially as set forth.

4. In combination an insulated section of track, (I), a switch tongue, (B), a two circuit magnet, (F), for shifting the tongue, an electro-mechanical circuit-changing device, (O), for closing the circuits alternately in conjunction with the movement of the switch-throwing mechanism, a circuit conductor, (J), extending from a feed wire to insulated rail and comprising in its circuit a circuit closing device, (M), and a circuit conductor, (L), extending from said circuit closing device to and through the coils of said switch operating magnet, (F), and said circuit changing device, (O), to a return wire, (U), substantially as set forth.

5. In combination an insulated section of track, a switch tongue, a magnet for shifting the tongue, and intermediate mechanism between switch tongue and magnet in which is comprised an angle lever, a counterbalance spring, and an electro-mechanical circuit changing device, all substantially as described.

6. In combination a switch tongue, a vertically disposed magnet for shifting the tongue, intermediate connections in which are comprised an angle lever, and a spring adapted to insure a tension for the extreme positions of said angle lever, and suitable circuit conductors.

7. In combination a primary circuit conductor extending from a feed wire to an otherwise insulated section of trolley wire, and comprising in its circuit a magnet coil for operating an electric circuit switch, a second circuit conductor extending from a feed wire through said electric circuit switch to and through the coils of a track switch solenoid and a circuit changing device to a return wire, and gravitative means controlled by said track solenoid for operating said circuit changing device, substantially as described.

8. In combination a gravity acting switch member to close the circuits alternately in accordance with the position of the switch throwing mechanism, and magnetic means to retain said switch member in its position during a flow of current through the track solenoid.

9. In combination an electro-mechanical circuit changing device in which is comprised the terminals of two electric circuits, (S^1, and S^2, Fig. 6;) a pivoted member (P, Fig. 6), adapted to operate by gravitative force to close said electric circuits alternately; mechanical means adapted to cause the gravity acting member to assume a reverse position accordingly as the position of the switch moving mechanism is reversed; and an electro magnet (O, Fig. 5), adapted to sustain said gravity acting member in its position during the passage of current through its coils.

10. The combination with the switch moving mechanism of a controller consisting of a solenoid magnet and its armature, a pair of electric circuit terminals consisting of pivoted metal plates adapted to have a yielding resistance when engaged and electrically connected by said armature, and suitable circuit conductors.

CHARLES WM. SQUIRES.

Witnesses:

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