(No Model.) 3 Sheets—Sheet 1.

T. A. B. PUTNAM.

AUTOMATIC SHUNT RELAY OR CIRCUIT CLOSER.

No. 289,137. Patented Nov. 27, 1883.

Fig. 1.

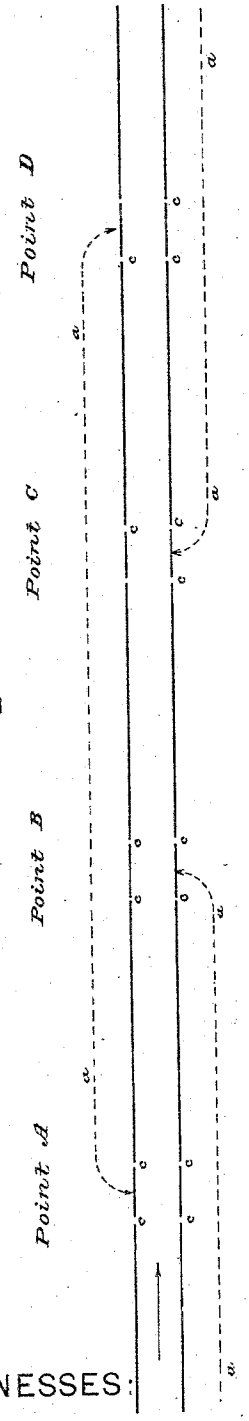


Fig. 2.

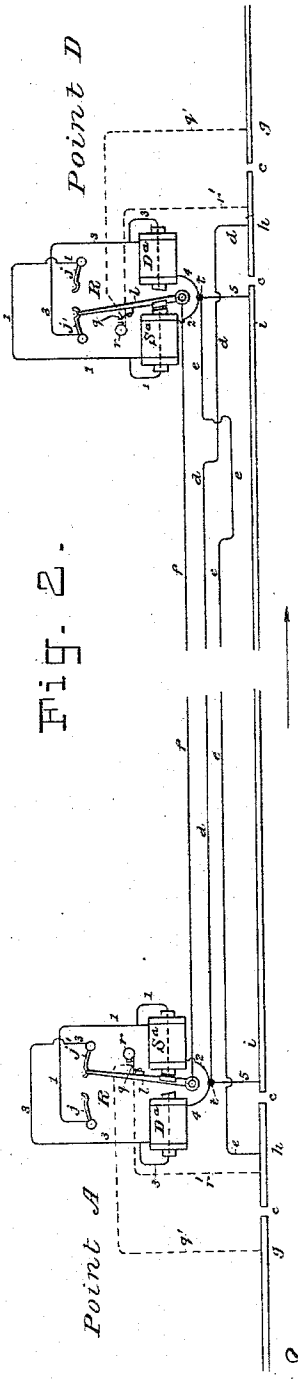


Fig. 6.

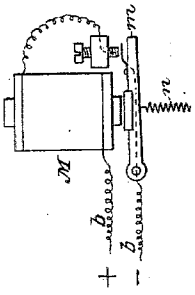
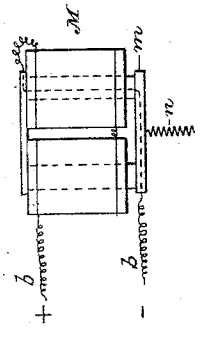


Fig. 7.



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(No Model.) 3 Sheets—Sheet 2.

T. A. B. PUTNAM.

AUTOMATIC SHUNT RELAY OR CIRCUIT CLOSER.

No. 289,137. Patented Nov. 27, 1883.

Fig. 3.

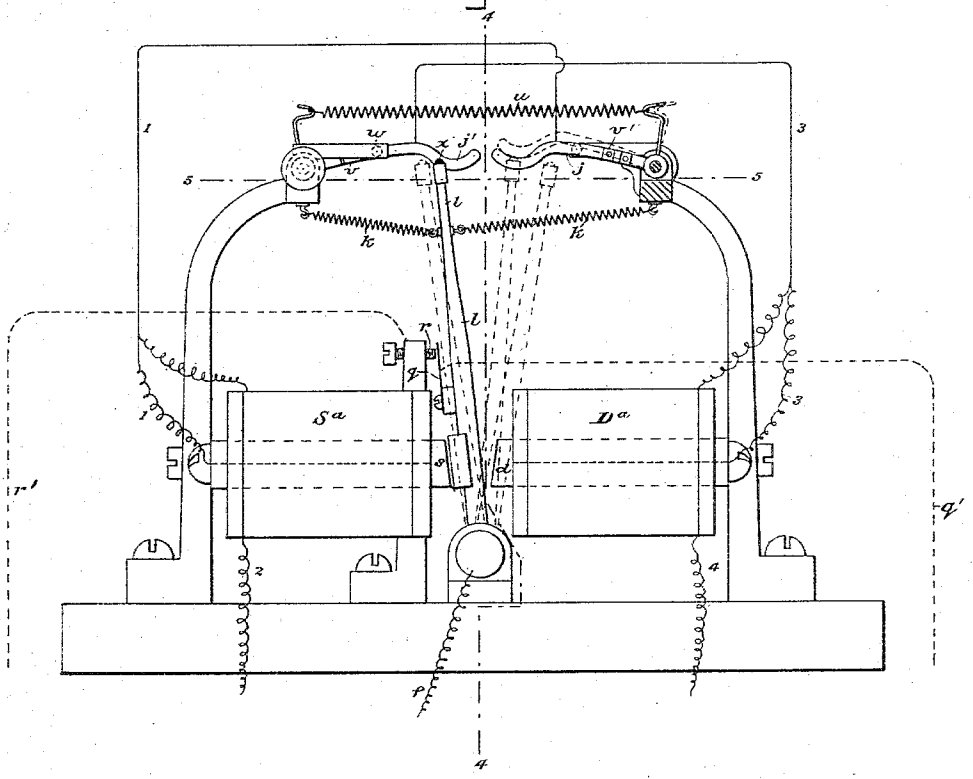


Fig. 6.

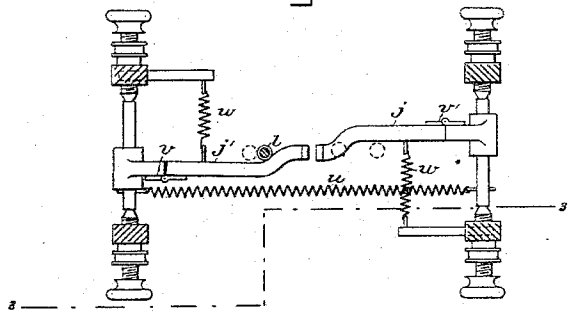


Fig. 9.



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Fig. 4.

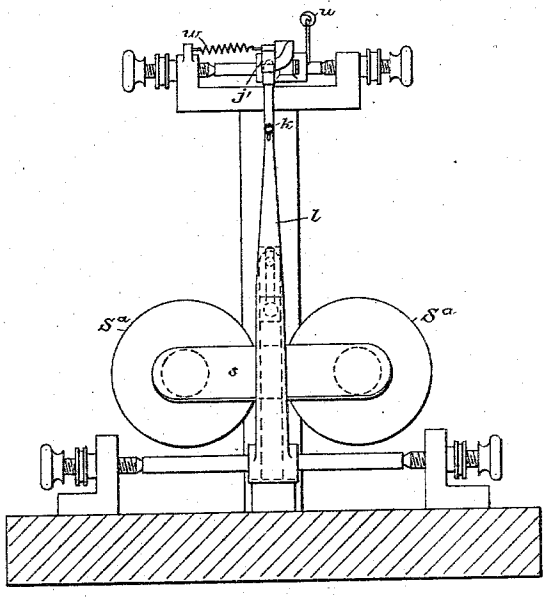
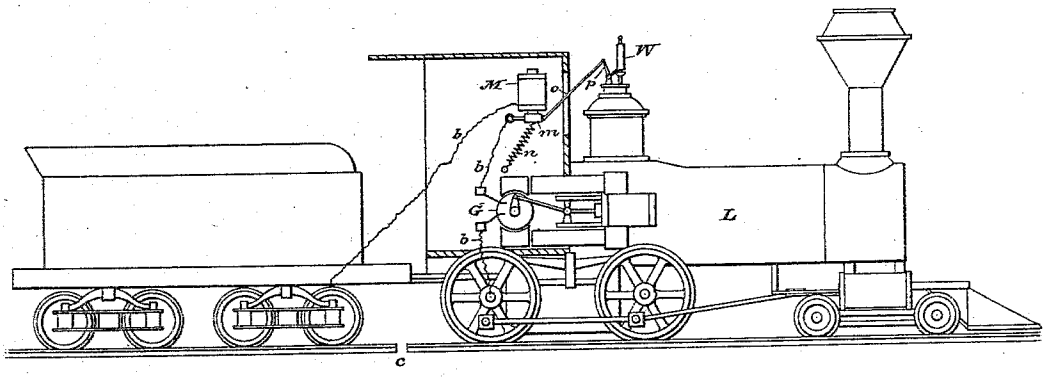


Fig. 6.



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UNITED STATES PATENT OFFICE.

THEODORE A. B. PUTNAM, OF NEW YORK, N. Y.

AUTOMATIC SHUNT-RELAY OR CIRCUIT-CLOSER.

SPECIFICATION forming part of Letters Patent No. 289,137, dated November 27, 1883.

Application filed July 19, 1883. (No model.)

To all whom it may concern:

Be it known that I, THEODORE A. B. PUTNAM, a citizen of the United States, residing in the city, county, and State of New York, have invented certain Improvements in Automatic Shunt-Relays or Circuit-Closers, of which the following is a specification.

My invention relates to a device for automatically breaking and closing electric circuits, which is adapted for general purposes, but particularly for electric safety systems employed on railways—as, for example, in block systems, electrically-controlled switches, draw-bridges, crossing-gates, &c.

One part of my invention relates to the automatically-operating shunt-relay, whereby two electro-magnets acting upon one armature-lever in common and in connection with a commutator act to shunt one magnet out of circuit and the other into circuit at each electrical impulse, at the same time breaking or closing another circuit through the movement of the armature-lever.

Another feature of my invention is the placing of the moving attracted part of the magnet—that is to say, the armature or its lever, or both—in the same circuit with the coil, whereby when the circuit is broken at any point the retraction of the armature will make another break at the magnet as well, for reasons that will be more fully set forth hereinafter.

Where the armature is in circuit, the core or cores may also be in the circuit.

In order to make the operation of my invention clear and enable it to be the more readily understood, I will describe it as applied to a block-signal system for a single-track railway, for which service it is well adapted.

In the drawings, Figure 1 is a diagram illustrating the circuit-connections for a single-track railway, the track being shown in plan, and the dotted lines denoting generally the electrical connections between the signaling-points. Fig. 2 is a diagram showing two signaling-points and their connections complete, the said points being provided with my improved shunt-relays. Fig. 3 is a side elevation of the relay, enlarged. Fig. 4 is a section of same on line 4 4 in Fig. 3. Fig. 5 is a section on line 5 5 in Fig. 3, looking upward. This view is designed to illustrate the construction of the commutator. Fig. 6 is a side elevation of a locomotive, showing the alarm apparatus in the cab, and designed to illustrate the application of my invention. Fig. 7 illustrates an electro-magnet wherein the armature and core are in the same circuit with the coil, and Fig. 8 illustrates a similar construction wherein the armature-lever only is in circuit with the coil. Fig. 9 is a detached view of the extremity of the armature-lever, enlarged.

Referring first to Fig. 1, I will briefly describe the system of electrical connection between signaling-points for a single-track railway. These points are lettered A, B, C, and D in this view, only four being shown. The points are connected together in pairs, and there are two points intervening between the points of each pair thus connected. Thus points A and D are electrically connected together, and the two points B and C intervene. The electrical connection is denoted by the dotted line *a a*. At each point is a signaling device for automatically imparting a signal or alarm to a passing engineer, if it be set at "danger;" but if it be set at "safety," it imparts no alarm. As each locomotive passes each signaling-point, it sends an electric current through the signaling device at this point and the one with which it is electrically connected.

The operation is as follows: A locomotive passing in the direction of the arrow first reaches point A. If the signaling device here be set at "danger," some suitable alarm will be sounded on the locomotive. I will assume that no such signal is received, the device here being set at "safety," and that at D being also at "safety." In passing A the locomotive sends a current, which sets the devices at both A and D to "danger," and if afterward another locomotive coming in the other direction passes D, it will receive the danger-signal and must stop. This second locomotive has previously set the device at C to "danger," and when the first locomotive reaches C it will receive the danger-signal, and it must also stop. Assuming that the distance between signaling-points is one mile, the approach of each locomotive is heralded always from one to three miles in advance, and each locomotive has at least half a mile to stop in. In this way the probability

of a collision is greatly lessened. The points B and C, D, and E, &c., may advantageously be brought closer to each other than indicated in the diagram, or even arranged in immediate juxtaposition.

The manner in which the electric current is transmitted and the signal is received will be best understood by reference to Fig. 6, where L is a locomotive, G is an electric-current generator thereon, M is an alarm electro-magnet, and *b b* is an incomplete electric circuit, commencing at the wheels of the locomotive, traversing the generator G, the coils of the magnet M extending thence to the tender and terminating at the wheels of the latter. The tender-wheels are insulated from the locomotive-wheels, as described in my Patent No. 258,600, dated May 30, 1882. When running over an uninterrupted track, this incomplete circuit is completed through the rails, the current from the generator traverses it, and the magnet M is excited and retains its armature *m* adhering to its poles. Thus we have a normally-closed circuit; but when a break in the rails is crossed, as denoted at *c* in Figs. 1 and 6, if the rails on opposite sides thereof are not bridged by an electric conductor, the circuit *b b* is broken, and the armature *m*, being no longer held by the magnet, is drawn down by the retracting-spring *n*. In descending it pulls on a rod, *o*, and so tilts the whistle-lever *p*, which sounds the whistle W. This constitutes the danger-alarm. The whistle will continue to sound until the engineer pushes up the armature against the poles of the magnet, to which it will be again attracted if the circuit has meanwhile been closed. As the duration of the interruption in the circuit in passing over an insulation on the track is extremely brief, and as in many cases the armature of magnet M might not be drawn by its spring beyond the attractive influence of the magnet before it would be brought back by the re-establishment of the attraction, I employ the construction before referred to as the second part of my invention—that is to say, I place the moving part or part attracted of said magnet in the same circuit with the coil, whereby at the instant the circuit is broken at the rail and the retracting-spring moves the armature from the poles the circuit is broken at the magnet also, so that upon the reuniting of the circuit through the rail the circuit will not be completed, and there will be no tendency to draw the armature back to the poles of the magnet, and thus cut short the alarm or entirely fail to give it.

In Figs. 7 and 8 I have shown more in detail this construction and arrangement of the magnet, Fig. 7 showing the preferred form wherein the armature and coil are in the circuit, and Fig. 8 showing the armature-lever or a contact-piece thereon in the circuit. The magnet illustrated in Fig. 7 is the magnet M, enlarged and detached; but I employ the same magnet in my shunt-relay, which will be hereinafter described. Where it is desired that the core and armature shall not come into actual contact, I prefer to employ the construction shown in Fig. 8. In this the wire from the coil leads to the contact-screw, which screw comes in contact with the armature-lever, or, better, a metal spring-contact thereon, when the armature is attracted. To this spring-contact the circuit-wire is electrically connected. After the alarm is sounded on the locomotive, the circuit will not be re-established until the engineer replaces the armature, so as to close the circuit at magnet M, as before stated.

The operation of the circuits and devices along the track may now be understood. In Fig. 2 point A is shown at the left and point D at the right, the intervening points being omitted. At each of these points is installed my improved relay R, and between the two points extend three wires, *d*, *e*, and *f*. At each point the track has two breaks or insulations, *c c*, with an insulated rail, *h*, between them, and rails *g* and *i* on either side. Two magnets, D*a* and S*a*, are opposed to each other, with an armature-lever, *l*, playing between them. The free end of this lever has considerable movement, and normally makes contact with one or other of two conducting spring-levers, *j j'*; but when its armature is in contact with the cores of either magnet it makes contact with neither of these commutator-levers, as denoted by dotted lines in Fig. 3. Two opposite springs, *k k*, tend to draw the armature-lever to an intermediate position. When the lever is attracted toward the magnet S*a*, a contact-spring, *q*, which is attached to but insulated from the lever, is brought in contact with a stop or button, *r*. This spring and button are connected by wires *q'* and *r'* (shown in dotted lines) with the rails *g* and *h*, respectively, so that when *q* touches *r* the insulation *c* between rails *g* and *h* is bridged, and a locomotive crossing this insulation receives no alarm. This is the "safety" position, and the magnet S*a*, the excitation of which produces this result, is called the "safety-magnet," while the magnet D*a*, which draws the lever to the opposite side and separates *q* from *r*, to give the danger-alarm, is called the "danger-magnet." One terminal of the magnet S*a* is connected by a wire, 1, to its core *s*, and thence to the lever *j*, and the other terminal connects by wire 2 to a binding-post or connection, *t*. One terminal of magnet D*a* is likewise connected by wire 3 to its core *d* and to spring *j'*, and its other terminal by wire 4 to *t*. From *t* two other wires lead, wire 5 extending to rail *i*, and wire *d* extending to the distant signaling-point, and there connected to rail *h*. The other wire, *e*, extends from the rail *h* at the adjacent point to the connection *t* at the distant point. The third line-wire, *f*, extends from the lever *l* at one point to the lever *l* at the other.

The operation is as follows, assuming that both relays at starting are set to "safety," as shown: A locomotive traveling in the direction of the arrow on reaching point A first bridges rails *g h* and receives no alarm. On bridging

rails *h i* it sends a current through rail *h*, wire *e*, to point D, wire 4, magnet D*a*, wire 3, spring *j'*, lever *l*, wire *f*, back to point A, lever *l* there, spring *j'*, wire 3, magnet D*a*, wire 4, and wire 5, to rail *i*. This causes the magnets D*a* D*a* at both points to draw the levers *l l* over into contact with them, thereby separating both springs *q q* from their buttons *r r* and setting both relays to "danger." Each lever *l*, in flying over, lifts the lever *j'* and passes under it, and when its armature touches the poles of the magnet the current is short-circuited through the cores of that magnet, so that the armature is held thereto, if by that time the current be still flowing over the line from the locomotive. As soon as the current ceases to flow, the armature-lever is released, and is drawn by one of the springs *k* toward the middle until it rests against the spring *j*, whereby the magnet D*a* is shunted out and the magnet S*a* is shunted into circuit. The parts remain in this condition until the locomotive reaches point D and bridges rails *i* and *h*, whereupon the current passes through both magnets S*a* S*a*, and the levers *l l* are both drawn back to "safety," so that when the locomotive bridges rails *h* and *g* it does not receive its own danger-signal. It will be observed that a locomotive can receive the danger-alarm only when entering a "block" or signaling-division, as from points A to D, but cannot receive it when leaving a block.

The distinguishing feature of my relay R is that at each electric impulse only one of the two magnets is in circuit, and at the termination of the impulse that magnet is automatically switched out of circuit and the other magnet is switched in. The advantage of this relay is that it necessitates the use of only three line-wires between signaling-points, whereas with the usual devices six wires would be necessary. The particular arrangement of commutator-levers *j j'*, in connection with the lever *l*, is not material, as many different constructions of commutators may be used.

I will now describe in detail the particular construction shown in Figs. 3, 4, and 5 of the drawings. The levers *j j'* are delicately pivoted or fulcrumed, and are pressed lightly down by the spring *u*, which connects them above. They are thus permitted to play in a vertical plane. Each lever is jointed at *v*, so that its end may play laterally, and the end is provided with a retracting-spring, *w*. Thus it will be seen that the ends of these levers have both a vertical and lateral play, and this play is resisted by springs *u* and *w*. Therefore I have called them "spring-levers," and they might as well be springs. The end of each lever is bent or curved both laterally and vertically, as shown, and their opposed ends are in the same vertical plane. This is best shown in Figs. 3 and 5. The armature-lever *l* plays in the same plane with the free ends of levers *j j'*, but to one side of the bodies of same; and on its free extremity it is provided with an insulating-tip, *x*. (Best seen in Fig. 9, which shows the end of lever *l* detached.) When the relay R is standing normally at "safety" or "danger," the metal of the lever *l* is drawn into contact with the metal of one of the commutator-levers at the point where the lateral bend in the lever begins, as shown in full lines in Figs. 3 and 5. The pull of spring *k* is not sufficient to displace the commutator-lever laterally; but when the magnet is excited the attractive force is sufficient to brush the commutator-lever out of the way as the lever *l* swings over. When the lever *l* passes the first commutator-lever—*j'*, for example—it encounters the other lever, *j*; but it moves directly under the downwardly-curved end of this lever and lifts it up, as clearly shown by dotted lines in Fig. 3. No electrical contact is made with *j* in this movement, as the insulating-tip *x* alone comes in contact with the lever *j*. The movement of the lever *l* is sufficient to free it entirely from the commutator-lever, and to keep it free until the circuit is broken by the forward movement of the locomotive, when spring *k* draws the lever *l* back against the lateral curved projections on lever *j*.

In my improved shunt-relay I employ the magnet illustrated in Figs. 7 and 8, to short-circuit the current and prevent the vibration of the armature-lever.

Having thus described my invention, I claim—

1. A double-acting relay consisting of the combination of two oppositely-acting electro-magnets, an armature-lever capable of being vibrated alternately in opposite directions by the alternate excitation of said magnets, and a commutator for shunting the circuit to one or other of said magnets, constructed substantially as described, whereby so long as the current remains flowing one magnet remains in circuit and the other is cut out, and upon the cessation of the current the circuit is shunted to the other magnet, substantially as and for the purposes set forth.

2. An automatic shunt-relay comprising two oppositely-acting electro-magnets, an armature-lever common to both magnets and capable of being vibrated by the alternate excitation of said magnets, and provided with springs which tend to draw the said lever to and hold it in an intermediate position, a commutator, constructed substantially as described, arranged to shunt one magnet into and the other one out of circuit at each electrical impulse through the contact of the armature-lever with the elements of the said commutator, and means, substantially as described, for establishing a short circuit through the armature-lever and the coil of the magnet, whereby the vibration of the said lever is avoided, substantially as set forth.

3. The combination, to form an automatic shunt-relay, of the magnets D*a* and S*a*, the armature-lever *l*, the commutator levers or springs *j j'*, arranged to operate as set forth,

the spring *q* and knob *r*, and means, substantially as described, for shunting the commutator-levers out of circuit while the armature is attracted to either magnet, substantially as set forth.

4. The combination of magnets D*a* and S*a*, armature-lever *l*, circuit-connections with said armature-lever, branch circuits, each traversing the coils of said magnets and connecting with the cores of same, and commutator-levers *j j'*, connected with the terminals of said branch circuits, substantially as shown, whereby when the armature is in contact with the core of either magnet the current is short-circuited through the armature and core of the magnet, and the other magnet and the commutator are shunted out of circuit, substantially as set forth.

5. An electro-magnet having its armature or moving part in the same circuit with its exciting-coil, and with a stop against which it rests while attracted to the magnet, whereby upon the retraction of the armature the circuit is broken at said stop and the reattraction of the armature is prevented, substantially as set forth.

6. The combination, with the vibrating armature-lever *l*, of the two levers *j j'*, provided with vertical and lateral curved tips or ends, as described, and mounted as shown, the springs *u* and *w*, and the springs for drawing the lever *l* to an intermediate position, said lever *l* being provided with an insulating-tip, *x*, substantially as and for the purposes set forth.

7. The combination, with a railway-track having the insulations *c c*, arranged at signaling-points therein, of the connecting-wires *d*, *e*, and *f*, arranged as shown, the automatic shunt-relays R R, one arranged at each signaling-point, the contacts *q r*, and the bridging-wires *q'* and *r'*, all arranged to operate substantially as set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

THEODORE A. B. PUTNAM.

Witnesses:
HENRY CONNETT,
GEO. BAINTON.