(No Model.)

J. P. BUCHANAN.

CIRCUIT CONTROLLING DEVICE.

No. 497,489. Patented May 16, 1893.

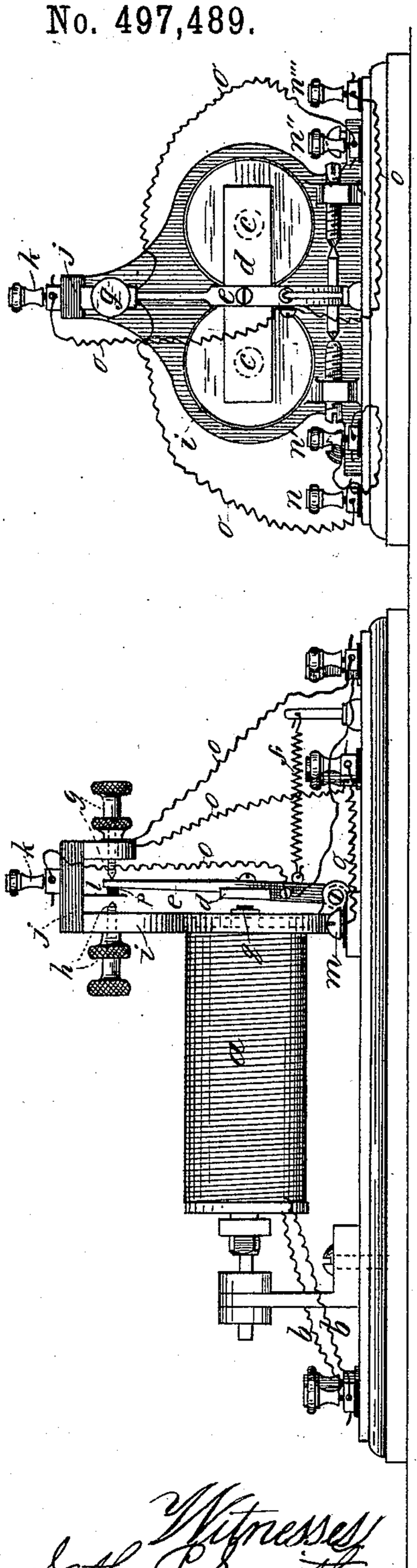

Fig. 2.

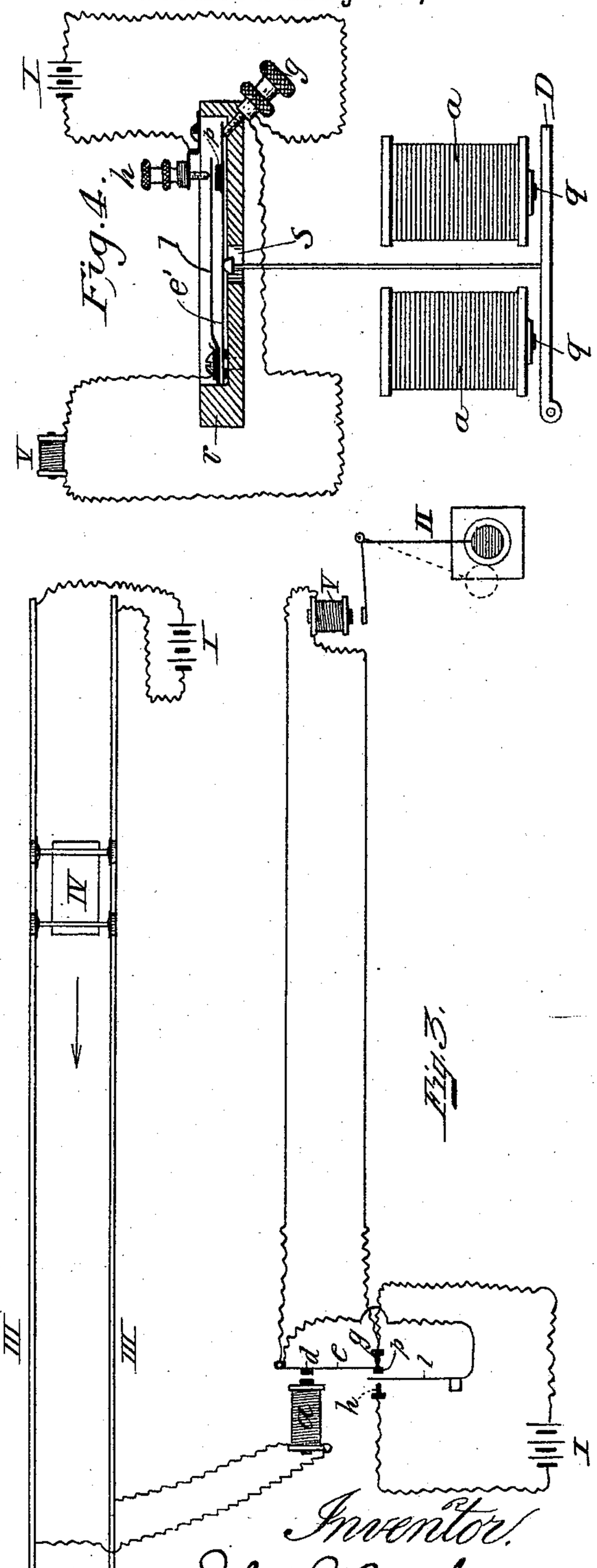

Fig. 4.

Fig. 7.

Fig. 3.

Witnesses
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CIRCUIT-CONTROLLING DEVICE.

SPECIFICATION forming part of Letters Patent No. 497,489, dated May 16, 1893.

Application filed October 15, 1891. Renewed October 22, 1892. Serial No. 449,706. (No model.)

To all whom it may concern:

Be it known that I, JOHN P. BUCHANAN, of Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Improvement in Relay-Circuit-Controlling Devices, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention relates to circuits and to means for controlling the current therein. The object of the said controlling means is to provide a path for the current through a translating device, included in a circuit, and to exclude the current from said translating device at the proper time with a greater degree of certainty than has heretofore been attained. This controlling device I term a relay. It comprises two or more pairs of contact points connected with a circuit, any pair of which will act, when in one position, to exclude the current from the translating device, and when all the pairs of contacts are in their other position a path through the translating device will be provided.

I have shown and shall describe my relay in its preferred form, but it is obvious that many changes may be made therein without departing from its broad spirit. As long as the pairs of contacts are so arranged that when all are in one position a path for the current is provided through the circuit and, when either pair is in the reverse position, current is excluded from the circuit it is obvious that there is no departure from the true spirit of my invention. In the specific form shown and hereinafter described I employ only two pairs of contacts and put one pair in the main circuit and the other pair in a shunt circuit. It is also obvious that my relay is capable of a very extended application. It is especially useful, however, in signaling circuits which include a signal operating device and I have shown it arranged in connection with such a circuit. When thus employed it enables me, as hereinafter set forth, to substitute a danger signal for a safety signal when the relay becomes disabled either from too fine an adjustment of the armature bar, closing point, and back stop, or when the points become fused by lightning.

It is a well-known fact that in many relays now in use for signaling purposes upon railroads, there is constant danger that the points may become fused by lightning, in which case the relay current remains closed and a clear or safety signal is shown continuously until the difficulty is discovered and the instrument repaired. My invention, in the form shown in the drawings, overcomes this danger by causing the movement of the armature which would normally break the relay circuit, to also shunt the relay current through a circuit of low resistance not including the signal, so that in case the contact points become fused, electrically welded or stuck together and will not separate, the shunting of the relay current will nevertheless practically cut the signal out from the relay circuit, and cause the same signals to be exhibited as if the contact points were working normally. This shunting of the circuit in place of the normal breaking of the circuit will continue until the instrument is repaired. Thus my device causes the signal to perform its proper functions under conditions which, when my invention is not employed, often render the signal worse than useless.

I accomplish the above results in the manner hereinafter described, and shown in the accompanying drawings, referring to which—

Figure 1 is a side elevation of an instrument known as a Morse relay with my new safety shunting device applied thereto. Fig. 2 is a front elevation of the same. Fig. 3 is a diagram showing the circuits used in operating an electric signal upon a railroad, with my shunting device applied thereto. Fig. 4 is another variety of my device designed to apply my invention to a Westinghouse relay.

Corresponding letters or characters in the several figures of the drawings designate like parts, referring to which—

a is the coil of an electro magnet; *b b* the wires connected with the same.

c is the magnet; *d* the armature; *e* the armature bar; *f* a retraction spring attached to the same.

g is the back stop, regulated by a screw and set-screw. *h* is the closing point, also regulated by a screw and set-screw.

i is a metallic frame which supports one end of the electro magnet, and the device for

connecting, breaking or shunting the rela current.

j is a non-conducting substance. *k* is a connecting screw fastened thereto.

l is a movable metallic medium. It may be a flexible spring or a rigid bar pivoted at one end. It is so arranged that one end oscillates between the end of the armature bar *e* and the closing point *h*, and is electrically connected with the connecting screw *k*.

m is a point of connection on the frame *i*.

n, *n'*, *n''*, and *n'''* are connecting screws; *o* electric wires.

p is a non-fusible and non-conducting substance attached to the end of the armature bar, and separating said bar from the spring or lever *l*.

q is a small piece of insulating material inserted in the end of the magnet *c* and protruding a short distance from the end thereof.

r is a wooden frame, shown only in Fig. 4, and *s* is a hole or opening in the middle of the same.

e' is a flexible spring, and is actuated by an armature by means of a connecting rod. It is used only when applying my device to a relay in which the magnets are arranged vertically as shown in Fig. 4.

By reason of the free mechanical contact of the armature bar and the conducting medium *l* and of the other features of construction described it will be seen that the armature bar and the conducting medium *l* may move conjointly to break the electrical contact of the armature bar and point *g* and at the same time electrically connect the conducting medium *l* and the point *h*. It is also obvious that the armature bar is capable of independently moving to make and break electrical contact with point *g* without necessarily making or breaking the contact between *l* and *h*.

I is an electric battery, II a signal, III railroad tracks, IV a truck or wheels running thereon, and V an electro magnet which directly operates the signal. The signal II may be of any usual construction.

To a part of my invention it is essential that the signaling instrument should be operated to give a warning signal when no current is flowing through it.

For the present I confine my description to Figs. 1 and 2. In the old style of relays it will be remembered there was nothing between the back stop, represented in Fig. 1 by *g*, and the closing point *h*, but the end of the armature bar *e;* and the circuit was closed by the contact of the armature bar *e* and the closing point *h* caused by the electro magnet *c* attracting the armature *d*. When the electro magnet was demagnetized the armature bar was drawn from the closing point by the retraction spring *f*, and the connection was broken. The device constructed as thus explained is open to two dangers: first, in too fine an adjustment of the back stop and closing point whereby the armature bar is pressed against the closing point and held in that position; second, by reason of the armature bar and closing point becoming fused by lightning. In either event the relay current remains constant and unbroken, and as this is the current or circuit by which the signal is operated, a safety signal is constantly shown. These are great dangers and are met and corrected by my invention. By using my device, in the event of the points being screwed together, the current is switched or shunted, and returns to battery on a short circuit without going through the line to the signal, and a danger signal is shown until the instrument is properly adjusted; and in the event of the points being fused by lightning the relay circuit is so controlled that the signal continues to exercise its proper functions.

When my device is used as shown in the drawings, and the signal is in proper working order, the relay is in the main signaling circuit which would be through the instrument in the following manner: With electro magnets magnetized, starting from the positive pole of the battery to the connecting screw *n'*, thence by wire to the screw *m*, thence through the frame *i* to the closing point *h*, thence along the movable metallic medium *l* to the connecting screw *k*, thence by wire to the armature bar, thence by wire to the connecting screw *n'''*, thence by wire to the signal; returning by wire to the connecting screw *n''*, thence by wire to the back stop *g*, thence by wire to the connecting screw *n*, and thence by wire back to battery, and the signal is set at safety so long as the current so flows. The contact point *h* and the contacting point on the metallic medium *l* constitute the contact points in this main signaling circuit.

In case the points are screwed together by too fine an adjustment of the screws *g* and *h* the device operates the same, whether the electro magnet *c* be magnetized or demagnetized, and the current taking the shortest course, and the one which offers the least resistance, back to battery will flow as follows: from the positive pole of battery to connecting screw *n'*, thence by wire to *m*, through frame *i* to closing point *h*, through movable metallic medium *l* to connecting screw *k*, thence by wire to the armature bar *e*, up the armature bar to back stop *g*, thence by wire to the connecting screw *n*, thence by wire back to battery. It will be thus seen that in the particular construction shown in the drawings the armature bar *e* constitutes the shunt around the signal operating device, and that the point *g* and its contacting point on the armature constitute the contact points of this shunt or branch circuit. Thus the current in taking the shortest course back to battery is shunted from the signal and a danger signal is shown and remains in view until the instrument is properly adjusted.

In case the points are fused by lightning the movable metallic medium *l* becomes permanently attached to the closing point *h*.

The armature bar, however, is left free to act, first, because the armature *d* cannot fuse, stick or adhere to the magnet *c* on account of the insulation *q;* and second, the armature bar *e* cannot fuse, stick or adhere to the movable metallic medium *l* owing to the non-fusible rest or insulation *p*.

With points fused or stuck together as above set forth and with the magnet *c* magnetized, the current would flow as follows: from the positive pole of the battery to connecting screw *n'*, thence by wire to *m*, through the frame *i* to the point *h*, through the movable metallic medium *l*, to the connecting screw *k*, thence by wire to the armature bar *e*, thence by wire to the connecting screw *n'''*, thence by wire to the signal, returning by wire to the connecting screw *n''*, thence by wire to the back stop *g*, thence by wire to the connecting screw *n*, thence by wire back to battery; and the current, having passed to the signal, sets the same at safety.

With the points fused, electrically welded or stuck together as above set forth, and the magnet *c* demagnetized, the armature bar *e* is held against the back stop *g* and the current flows as follows: from the positive pole of the battery to the connecting screw *n'*, thence by wire to *m*, through the frame *i* to the closing point *h*, through the movable metallic medium *l*, to the connecting screw *k*, thence by wire to the armature bar *e*, up the armature bar to the back stop *g*, thence by wire to the connecting screw *n*, and thence by wire back to battery. This course of the relay circuit is precisely the same as when the points are screwed together; the current returns on a short circuit to battery. The current does not pass over the line to the signal, and the signal shows at danger.

To sum up briefly: If the points are screwed together, instead of showing a safety signal as in the old device, the current is shunted from the signal line and a danger disk is shown. If the points are fused, electrically welded or stuck together, the signal continues to operate, showing a safety disk when the magnet *c* is magnetized and a danger disk when the magnet *c* is demagnetized.

Fig 4 represents a different variety of my device designed to apply the same to an ordinary Westinghouse relay. In this form the bar *e'*, which is really a secondary armature bar, is attached to the movable metallic medium *l*, by a screw or otherwise, and the bar *e'* is actuated by a connecting rod attached to the real armature and operating through the opening *s*. In this variety, when the points are closed the current flows as follows: from the battery by wire to the closing point *h*, thence through the spring *l*, thence by wire to the signal; thence by wire to the back stop *g*, thence by wire back to battery. If the points were fused or screwed together the course would be, from battery, by wire, to the closing point *h*, along the spring *l* to the bar *e'*, along the bar *e'* to the back stop *g*, thence by wire back to battery, and the current is shunted and signal set at danger.

For the purpose of brevity I have shown my device constructed for application to but two forms of relay, but do not confine myself to these two forms alone. The principles herein described may be employed in a variety of ways and may be applied to any variety of relay now in use. I have already employed said principles in no less than six different forms.

Fig. 3 represents the whole device applied to and in operation upon a railroad. The car wheels IV are represented as having passed the point where the wires from the battery I are connected with the rails. The wheels and axle electrically connect the rails and make a short circuit back to battery. The current is cut off from the coil *a*, and the electro magnet within is demagnetized; this breaks the main signaling circuit, demagnetizes the electro magnet V, and the signal is set at danger as represented in Fig. 3. In case the points are fused or screwed together the current may be traced upon Fig. 3 as previously described.

The object in carrying the wire from the signal to the back stop and thence back to battery is obvious. The result might be accomplished by returning the wire from the signal directly back to battery, and making the connection from said wire to the back stop by means of a tap wire. With the latter arrangement, however, in the event of the tap wire breaking, the relay circuit would be complete, and the signal would appear at safety. The shunting device would thereby become inoperative. By running the wire from the signal to the back stop, thence back to battery, making the back stop a portion of the return circuit, this danger is overcome; for, in the event of the wire breaking in any portion of the relay circuit a danger signal will be shown.

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

1. An electric circuit including a translating device in combination with a primary circuit controller operating to energize and de-energize the translating device, a secondary circuit controller in a shunt around the translating device but not in circuit with the translating device and provided with means for moving it independently of the primary circuit controller, and electrically controlled means for normally operating said circuit controllers in reverse, substantially as set forth.

2. The combination with a main electric signaling circuit having contact points therein, said main electric signaling circuit normally operating by the making or breaking of contact between said main contact points, said main signaling circuit including a signaling device, of a shunt circuit of relatively low resistance excluding the signaling device, said shunt circuit also having contact points, and of an electro magnet controlling said main contact points and also controlling in reverse

said shunt contact points, said shunt contact points being capable of movement under the control of the electro magnet independently of said main contact points, all so combined that the action of said electro magnet which, by tending to open one of said sets of contact points, affects the signaling device in one direction, by the same movement tends to affect the signaling device in the same direction by closing the other of said sets of contact points, whereby the control of said electro magnet over the signaling device is rendered more certain, substantially as set forth.

3. The combination with an electric signaling circuit and its signaling device, said signaling circuit operating to give a danger signal when no current is flowing through its signaling device, and said signaling circuit having contact points in its main circuit, and normally operating to give a danger signal by the breaking of contact between said main contact points, and said signaling circuit having a normally open parallel branch or shunt circuit of less resistance excluding said signaling device, said parallel branch or shunt circuit also having contact points, of an electro magnet controlling said main contact points, and also controlling in reverse said shunt contact points, said shunt contact points being capable of movement under the control of the electro magnet independently of said main contact points, whereby said electro magnet normally both breaks said main signaling circuit, and by the same movement shunts the current from the signaling device, and whereby any interference with the breaking of said main contacts will not affect the making of the shunt contacts, substantially as set forth.

4. An electric signaling circuit, including a signal operating device in combination with a relay comprising a spring and its contact point in series in the said signaling circuit, an oscillating armature bar and its contact point in a shunt around the said signal operating device, said spring and armature bar bearing loosely upon each other at their free ends through the intervention of an insulating and non-fusible substance, and both having a natural bent in one direction which maintains the spring and its contact open and the armature bar and its contact closed, the said contacts being arranged opposite each other with the spring and armature bar between them, an electro magnet normally energized and acting upon the armature bar and spring against their natural bent whereby the signaling circuit is normally closed through the signal operating device and the shunt is open and when the electro magnet is de-energized current is excluded from the signal operating device by both the break in the signaling circuit and the completion of the shunt circuit and whereby the shunt is completed if the break should fail, substantially as set forth.

5. In an electric circuit including a translating device, a series of movable contacts each bearing loosely upon another, other contacts for said movable contacts connected with the circuit, all of said movable contacts having a natural bent in the same direction and so arranged in relation to the other contacts that when any one is controlled by its natural bent it excludes current from the translating device, and when all are moved contrary to their natural bent a free path through the translating device is provided, substantially as set forth.

6. In an electric signaling circuit including a signal operating device, a series of movable arms each bearing loosely upon another through the medium of an insulating and non-fusible substance, contacts for said movable arms connected with the circuit, said movable arms having a natural bent in one direction and so arranged in relation to their contacts that when any one is controlled by its natural bent it excludes current from the said signal operating device and when all are moved contrary to their natural bent a free path through the signal operating device is provided, substantially as set forth.

7. The combination of a main signaling circuit including a signal operating device and a movable arm in series therewith and adapted to make and break the circuit, of a shunt circuit around the said signal operating device and including a movable arm adapted to make and break the shunt circuit, the movable arm in the shunt circuit bearing loosely upon the movable arm in the main circuit through the medium of an insulating and non-fusible substance, whereby the movement of the arm in the shunt circuit to break the shunt circuit will operate upon the arm in the main circuit to complete the main circuit and whereby the shunt circuit may be completed whatever may be the condition of the main circuit, substantially as set forth.

8. In a signaling circuit including a signal operating device, two contact points located opposite each other and near together, two movable contact arms adapted to vibrate with their free ends between the contact points, one connected in series in the circuit and the other connected in shunt around the signal operating device and bearing loosely with its free end upon the free end of the arm in series, through the medium of an insulating and non-fusible substance, and an electro-magnet adapted to operate the arm in shunt to make or break the shunt circuit, whereby the arm in series may be moved to close on its contact point when the shunt circuit is broken and the arm in shunt may make its circuit whatever may be the position of the arm in series, substantially as set forth.

9. The combination, in electric relays, of a movable metallic medium *l*, actuated by an armature, a non-fusible rest *p*, insulation *q*, insulation *j*, closing point, back stop and connections, substantially as shown and for the purposes set forth.

10. In electric relays the combination of a movable metallic medium *l*, flexible spring *e'*, actuated indirectly by an armature, a non-fusible rest *p*, closing point *h*, back stop *g*, and connections used as part of the return circuit, all for the purposes and in the manner set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 13th day of October, A. D. 1891.

JOHN P. BUCHANAN.

Witnesses:
GILBERT O. BURNHAM,
SETH P. SMITH.