(No Model.)

2 Sheets—Sheet 1.

W. DAVES.

ELECTRIC SIGNALING CIRCUIT.

No. 501,183. Patented July 11, 1893.

Fig. 1,

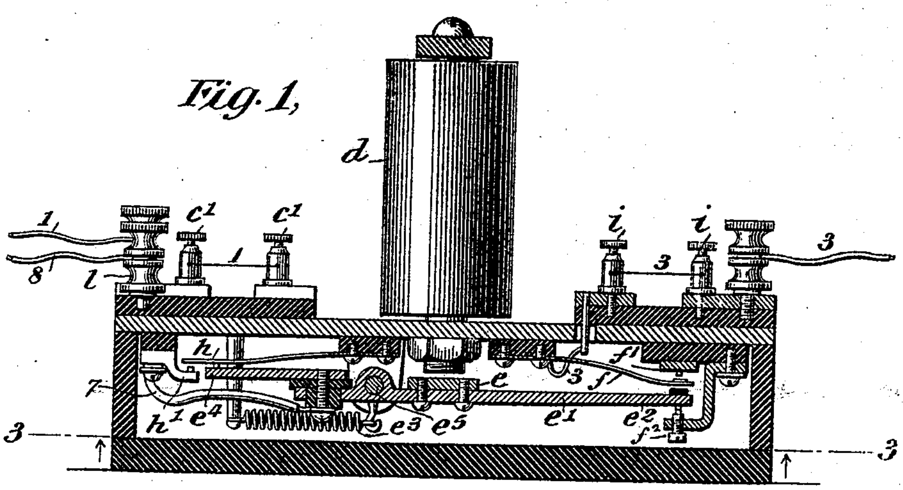


Fig. 2,

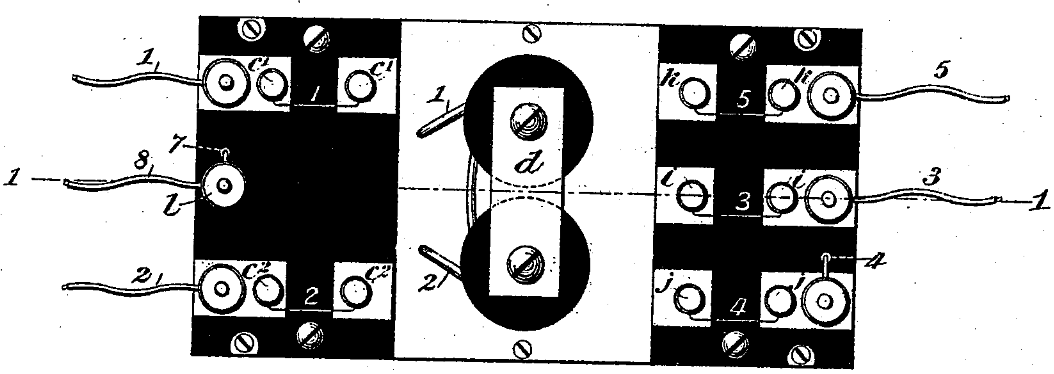
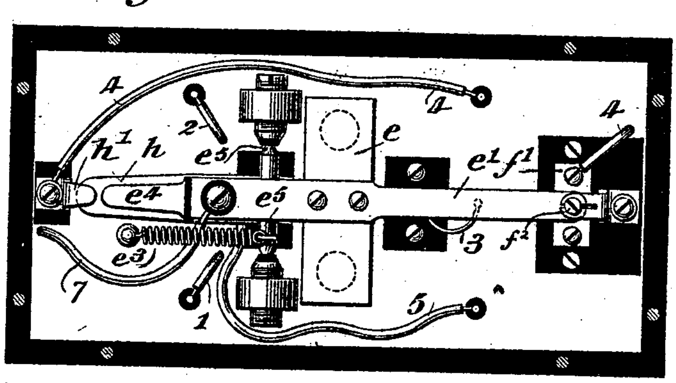


Fig. 3,



Witnesses

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(No Model.)

2 Sheets—Sheet 2

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ELECTRIC SIGNALING CIRCUIT.

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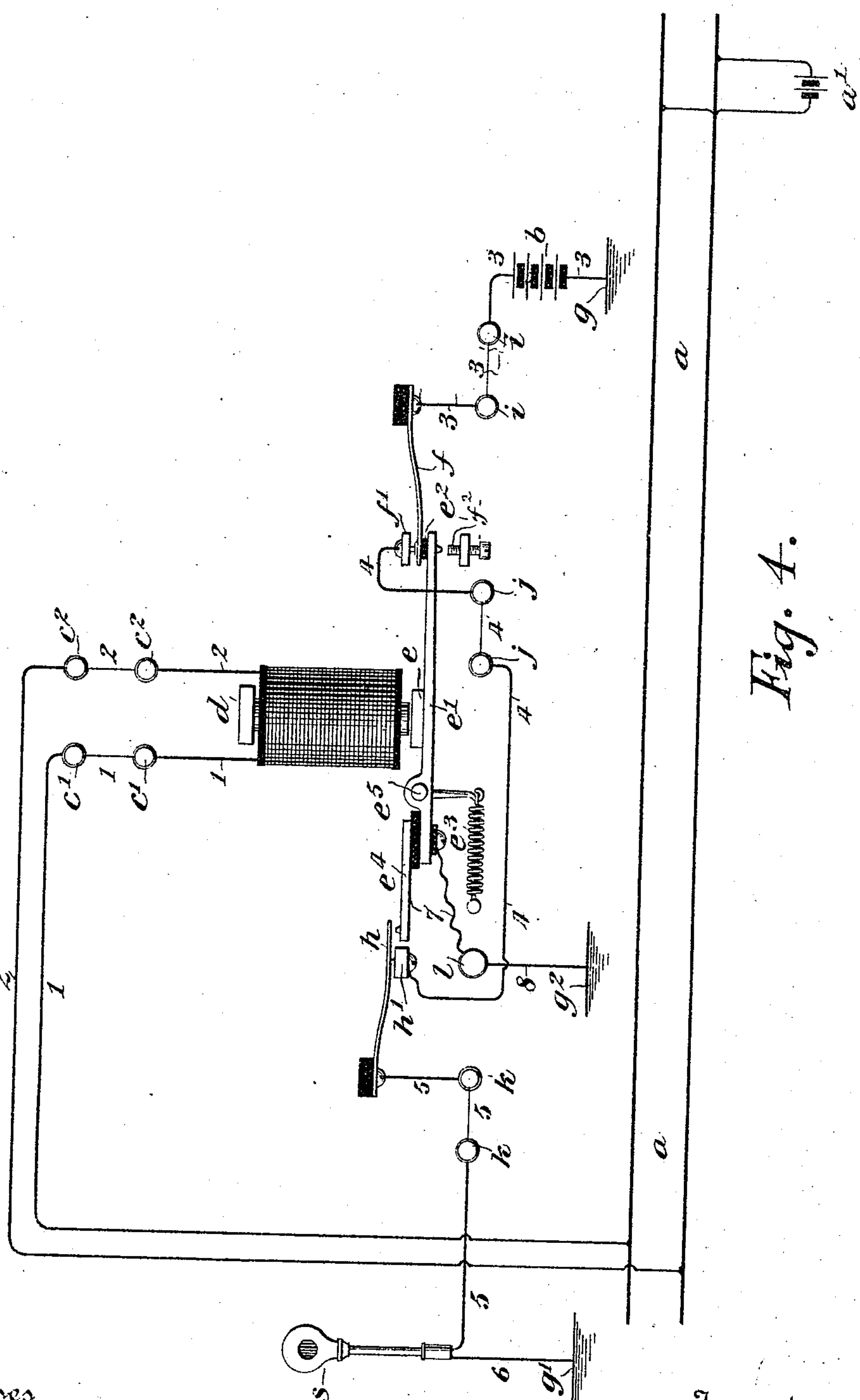

Fig. 4.

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UNITED STATES PATENT OFFICE.

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ELECTRIC SIGNALING-CIRCUIT.

SPECIFICATION forming part of Letters Patent No. 501,183, dated July 11, 1893.

Application filed May 2, 1892. Serial No. 431,461. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM DAVES, a citizen of the United States, and a resident of Jersey City, county of Hudson, State of New Jersey, have invented certain new and useful Improvements in Electric Signaling-Circuits, of which the following is a specification, reference being had to the accompanying drawings, forming part hereof.

This invention relates to electric signaling circuits, and it has for its objects certainty of operation of the make-and-break devices, and immunity from derangement of any part of said circuits by abnormally heavy currents of electricity, or by strokes of lightning.

The invention consists in an improved construction and arrangement of the make-and-break contacts and conducting wires, so as to insure the proper operation in preventing the flow of electric current to the electric signaling apparatus notwithstanding the derangement or adhesion of some of the parts, by means of multiple contacts arranged in series in the signaling circuit.

My invention also includes the combination with said multiple contacts in series of means for shunting the electric current so long as the actuating armature moves, even if all other contacts are non-operative.

Another part of my invention consists in providing additional safeguards by means of protecting spider wires interposed in the circuits and in such construction as to make practically impossible the substitution of heavier wires in place of such spider wires.

In the accompanying drawings Figure 1 is a sectional elevation taken on line 1—1, Fig. 2, showing my improvements applied to a relay for electric signaling circuits. Fig. 2 is a top plan view and Fig. 3 is an underneath plan view of the same. Fig. 4 is a diagrammatic view showing my improvements applied to an electric railway signaling system.

My invention will be more clearly explained by reference to Fig. 4, which is an illustrative diagram of one form of a complete system, although it must be noted that the relative positions of the parts are slightly changed in Fig. 4 to more clearly show the circuits. In this figure, a represents a section of railway track, the rails of which form two continuous conductors throughout the length of the section shown.

a' is a track battery, the two terminals of which are connected respectively to the two rails of the track. Two conductors 1, 2, extend from the two rails, one from each rail, and form the terminals of the coil of the relay electro-magnet d. Interposed in these conductors between the binding posts c', c', and c^2, c^2 respectively (of special construction to be hereinafter described) are short sections of very small wires of high resistance, such as are denominated spider wires, which act as lightning arresters, as will be hereinafter described. The track battery circuit is thus normally closed through the relay electro magnet d and the electro magnet d is normally energized and attracts and holds up its armature e. The operation of the train upon this track circuit is the well known operation of shunting the track battery current through the wheels and axles of the cars, thus demagnetizing the relay electro-magnet d when a train is upon any portion of the section a, and thereby causing the release of the armature e, so that the entrance of a train upon the section causes the armature to be operated in one direction by its electro-magnet, while the moving off from the section of the train causes the armature to be operated by its electro-magnet in the opposite direction.

The armature e controls the contacts of the make-and-break devices which I will now describe. The armature e is pivoted so as to oscillate as it moves toward and from the poles of the relay magnet, d. It is normally held away from the magnet by gravity and by the retractile spring e^3, but in the condition of the circuits described as their normal condition,—*i. e.* when the electro-magnet d is energized—the armature e is held in upper position close to the poles of the electro-magnet d. The armature e has two arms or projections which operate upon movable contacts to make and break the signaling circuit. The signaling circuit receives its electric current from a battery b, or other source of electricity. One terminal of the battery b is connected to earth at g, and the other terminal of said battery is connected by conductor 3, through the movable or spring contact f, the fixed contact

f', the conductor 4, the fixed contact h', the movable contact h and the conductor 5 to some suitable electrically operating apparatus in the signaling instrument s, and then through the conductor 6 is connected again to earth, at g'. The circuit is thus complete from the battery through the contacts of the relay and through the signaling apparatus, and back again through the earth as a common conductor, to the battery. It is obvious that any suitable return conductor, such as a metallic wire, could be used instead of the earth.

The signaling instrument s may be of any usual construction. To a part of my invention it is essential that this signaling instrument should be operated to give a warning signal when no current is flowing through it. The movable or spring contact f is interposed between the fixed contact f' and the insulated stud e^2 at the end of the arm e' of the armature. The spring contact f tends to move downward, pressing against the stud e^2 and thus exerting a pressure whereby it tends to move away from the fixed contact f'; but it is brought against the fixed contact f' by the upward movement of the armature e when the armature is attracted toward the poles of the relay magnet d. The fixed contact f' thus forms a stop to the upward movement of the armature. A suitable adjustable stop f^2 is provided underneath the contact f' to limit the downward movement of the armature. The movable or spring contact h tends to move toward the fixed contact h', and is in contact with and presses against said fixed contact h' when it is permitted so to do by the upward movement of the armature e toward the poles of the relay magnet d, and the consequent downward movement of the insulated arm e^4 of such armature (see Fig. 4); but when the armature is in lower position, as shown in Fig. 1, the insulated arm or projection e^4 of such armature holds the spring contact h away from the fixed contact h'.

In the normal condition of the circuits, as shown in Fig. 4, when there is no train upon the section a and the relay magnet d is energized and the armature e is held in upper position, the spring contact h is independent of the armature—is not in contact with any part of the armature or its arms—but presses by its own resilience against the fixed contact h'. Under these conditions the passage of a stroke of lightning or other heavy current through the coils of the electro-magnet d, causing a vibration of the armature e, and the formation of an arc, and consequent fusing together of the contacts f f' (but not of the contact f and stud e^4 by reason of the infusible nature of such stud), or causing the armature to be pulled violently upward, would have no effect whatever upon the contacts h h'; whereas the demagnetization of the electro-magnet d, at any time and by any means,—whether by the proper shunting action of a train or by some abnormal cause—withdraws the force that holds up the armature e, and thereupon the weight of the armature and the force of the retractile spring e^3 together act to pull the armature downward and thus, through the arm e^4, to lift the spring contact h away from the fixed contact h' and to break the signaling circuit at that point. The action just described will occur and will cause proper breaking of the circuit notwithstanding non-operativeness of the contacts f and f'. I also provide, however, for the proper operation of the relay, even if the contacts h, h', are also non-operative. As above stated the arm e^4 of the armature is insulated from the remainder of the armature. A wire 7 is connected to this insulated arm and through the binding post l and wire 8 to the earth or other return conductor from the signal s to the battery b. The effect of this connection is to close a short-circuit between the contacts h h' and the battery b,—such short circuit excluding the signal s—the moment the arm e^4 comes against the spring contact h, thus effectually preventing the flow of an appreciable amount of electric current to the signal s. If now the contacts h and h' adhere together and are not separated by the downward movement of the armature, this short-circuit will be practically as effective in checking the flow of electric current to the signal s as if the contacts had been separated. It is also to be noted that the portion of the armature in proximity to the electro-magnet d,—*i. e.*, the armature proper e and the arm e'—forms no part of the electric circuits—so that there is no possibility of the passage of electricity from the electro-magnet to the armature.

Additional safeguards are provided by means of spider wires interposed at various places in the circuits. The conductor 3 from the battery to the spring contact f has a spider wire between the binding posts i i. The conductor 4 from the fixed contact f' to the fixed contact h' has a spider wire between the binding posts j j. The conductor 5 between the spring contact h and the signal s has a spider wire between the binding posts k k. The spider wires in the circuit of the electro-magnet d between the binding posts c' c' and c^2, c^2 have been already referred to. All the binding posts just referred to, i i, j j, k k, c' c', c^2 c^2, are of special construction, being provided with orifices so small as to receive only the spider wires, so that in the event of the breakage of the spider wires, they cannot be replaced by wires of larger cross section. It will therefore always be necessary in repairing the circuits, to use spider wires between these binding-posts, and the circuits will always, when operative, contain the protecting spider wires. Thus carelessness of workmen in repairing the instrument is effectually guarded against.

The construction and arrangement of the circuits shown in the drawings may be varied without departing from my invention. The circuit of the electro-magnet d instead of being normally closed may be normally open and may be closed only during short periods. The present invention may and will usually be applied as part of a larger system of signaling circuits. So also the operation of the signaling circuit may set a signal either to caution or danger or safety, or may give an audible or visible signal, and the said circuit may operate either directly or indirectly to give the signal, directly or indirectly upon an electrical signaling device, or indirectly upon steam or pneumatic or other signals.

Having now described my invention, what I claim is—

1. The combination with an electric signaling device operated to give a warning signal when no current is flowing through it, of a signaling circuit containing two make-and-break devices arranged in series in said circuit, said circuit also being connected to the electrical signaling device and including a suitable source of electricity, said make-and-break devices each containing a movable and a fixed contact,—in one make-and-break device the movable contact being pressed toward the fixed contact, and in the other make-and-break device the movable contact being pressed away from the fixed contact—and of the armature bar of a relay electro-magnet connected with the said contacts so as to permit the former two contacts and to compel the latter two contacts to come together when the armature is actuated in one direction by the electro-magnet, and to compel the former two contacts to separate and permit the latter two contacts to separate when the armature is actuated in the reverse direction by the electro-magnets, and an infusible connection between the armature bar and one of the latter contacts, substantially as set forth.

2. The combination with an electro-magnet, of a make-and-break device consisting of a fixed contact, and a movable contact normally pressed toward said fixed contact, one of said contacts being connected to an electrical signaling device and the other of said contacts being connected to a source of electricity, and a suitable return conductor for completing the circuit from the signaling device to the source of electricity, of the armature of said electro-magnet normally held away from said electro-magnet and having an electrically conductive projection pressed against said movable contact when the armature is in normal position, said projection of the armature being electrically connected by a short-circuiting conductor to the same terminal of the source of electricity as the return conductor, substantially as set forth.

3. The combination with an electro-magnet and its armature, of two make-and-break devices, one make-and-break device consisting of a fixed contact, a movable contact normally pressed toward the fixed contact and an electrically insulated arm connected with the armature and pressed against the movable contact to move it away from the fixed contact when the armature is moved away from its magnet; and the other make-and-break device consisting of a fixed contact, a movable contact normally pressed away from the fixed contact, and an arm connected with the armature and pressed against the movable contact to move it toward the fixed contact when the armature is moved toward its magnet; the contacts of said make-and-break devices being connected in series in a circuit including an electrical signaling device and a source of electricity, and said insulated arm having a conductive part connected in a short circuit of relatively low resistance including the source of electricity and excluding the signaling device, substantially as set forth.

4. The combination with an electro-magnet and its armature, of two make-and-break devices, one consisting of the fixed contact h', the spring contact h, and the insulated arm e^4 projecting from the armature, the other consisting of the spring contact f, the fixed contact f', the arm e' of the armature, and an insulating infusible substance interposed between the spring contact f and the arm e', the arm f being separate from the arm e but normally pressed against it; and conductors joining the contacts h, h', f, f' in series in a circuit including a signaling device and a source of electricity, and joining the insulated arm e^4 in a circuit including the source of electricity and excluding the signaling device, substantially as set forth.

5. The combination of an electrical instrument, electrically connected to a binding post, a conducting wire connected to another binding post, and a spider wire joining said two binding posts, the spider wire receiving orifices of the said binding posts being adjusted to the diameter of said spider wire and so as not to permit the insertion of heavier wire, substantially as set forth.

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