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AUTOMATIC CUT-OUT FOR ELECTRIC CIRCUITS.

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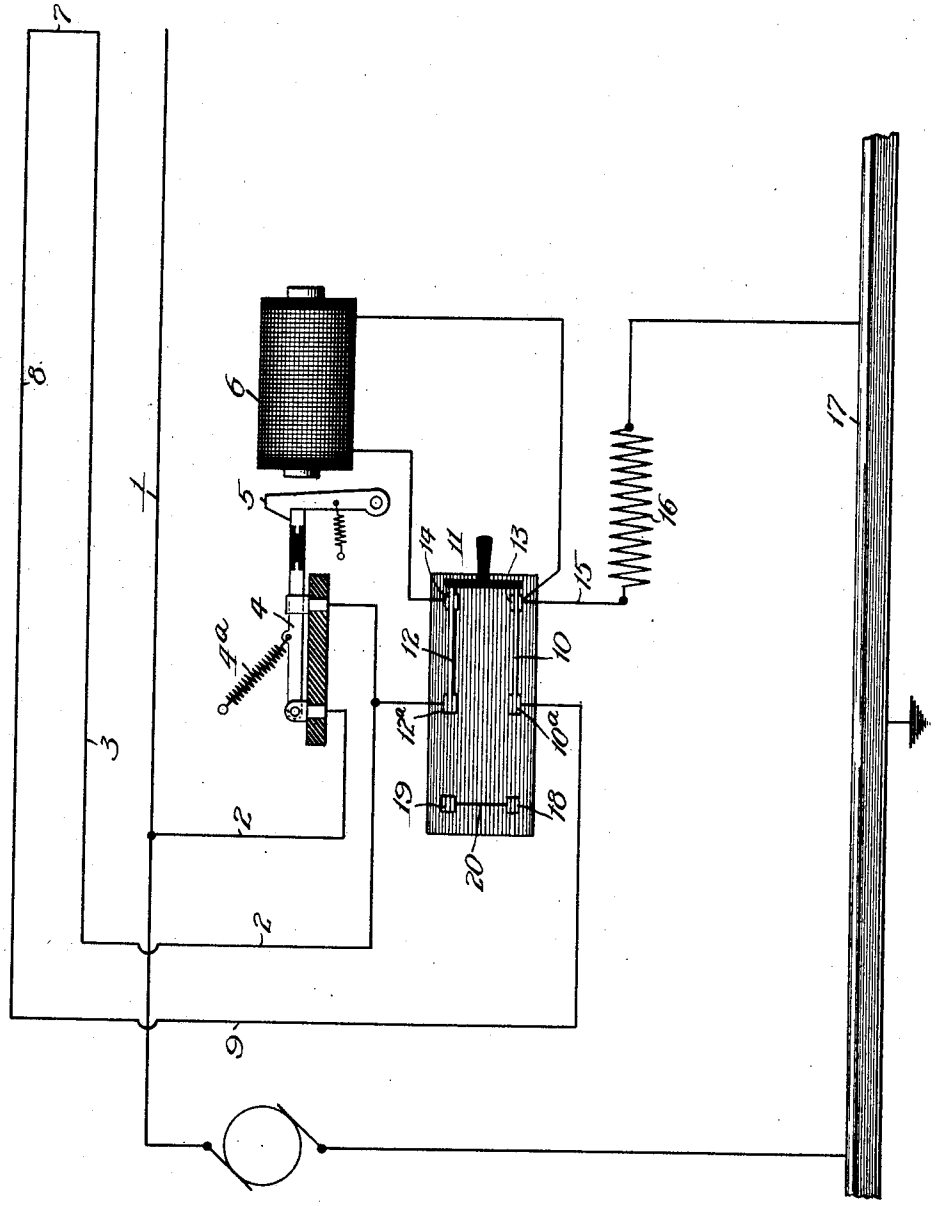

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UNITED STATES PATENT OFFICE.

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AUTOMATIC CUT-OUT FOR ELECTRIC CIRCUITS.

1,002,544. Specification of Letters Patent. **Patented Sept. 5, 1911.**

Application filed July 25, 1910. Serial No. 573,723.

To all whom it may concern:

Be it known that I, EUGENE S. SEARS, citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Automatic Cut-Outs for Electric Circuits, of which the following is a full, clear, concise, and exact description.

My invention relates to an automatic cut-out for electric circuits. It may, for example, be advantageously employed to cut off the supply of current to an overhead trolley wire in case such wire breaks, thereby preventing the occurrence of a fallen live-wire.

My invention is also designed to provide means whereby, after the operation of the protective cut-out device, the several sections of the broken trolley wire may temporarily be supplied with current until the ends of the broken wire shall have been reunited.

One feature of my invention relates to means, in case a trolley wire should break, for automatically opening the feed-tap which supplies current from the main-feed to said trolley wire, such means not being responsive, however, to the cessation of current flow in the main-feed.

As is well known, the trolley wire of an electric railway is divided into insulated sections fed at intervals by feed-taps from the main feed. Ordinarily the two trolley wires of a double track are fed in parallel from the same feed tap. By the arrangement of my invention, such two trolley wires are normally fed in series from the same feed-tap, but, in case of a break in either of the trolley wires, the apparatus is so arranged that such wires can then be connected in parallel to the feed-tap.

One feature of my invention consists, therefore, in the provision of switching apparatus whereby the two trolley wires of a double track may be either connected in series or in parallel, as desired.

Another feature of my invention consists in the provision of an automatic cut-out in the feed-tap and an electromagnet for controlling the operation of said cut-out, the circuit of said electromagnet being normally short-circuited, but being actively introduced into the circuit by the breakage of the trolley wire.

Another feature of my invention consists in an arrangement wherein the corresponding ends of two trolley wires of a double track are permanently connected together and means whereby the two opposite ends of the same wires may be temporarily connected together, combined with a feed tap leading to one of said trolley wires.

These and other features of my invention may be more readily understood by reference to the accompanying drawings in which is shown a diagram of circuits and apparatus embodying my invention as applied to an electric railway system.

Referring to the drawings, the main feed 1 is connected by a feed tap 2 to one end of the trolley wire 3. In the circuit of the feed tap 2 is a single-pole, single-throw knife switch 4 which is normally held in closed position by the pivoted latch 5. A spring 4^a is provided to open the switch 4 when the latch 5 is released from engagement therewith. The latch 5 constitutes the armature of an electromagnet 6 and is released from locking engagement with the switch upon the energization of said electromagnet. As before stated, one end of the trolley wire 3 is connected to the feed-tap 2. The opposite end of such trolley wire is connected by a conductor 7 to the corresponding end of the other trolley wire 8 of the double track road. The opposite end of the trolley wire 8 is connected by a conductor 9 to one of the knife blades 10 of a double-pole, double-throw switch 11. The knife blades 10 and 12 of said double-throw switch are pivoted between pairs of contact plates 10^a and 12^a, respectively, and, in the normal operation of the system, are closed between the pairs of contact plates 13, 14, respectively. The terminals of the windings of the electromagnet 6 are connected to the plates 13 and 14, respectively. Leading from the plates 13 is a conductor 15 which includes a resistance 16. The conductor 15 is grounded in any suitable manner, the drawings indicating said conductor as being grounded through the rail 17. The double-pole, double-throw switch 11, in addition to the contact plates 13 and 14, is provided with contact plates 18 and 19 for

engagement with the blades 10 and 12 when the switch is thrown in the position reverse to that shown in the drawings. The plates 18 and 19 are preferably electrically connected by a bus bar 20.

In the normal operation of the system, current to the trolley wires is supplied from the main feed 1, through the feed-tap 2, which includes the normally closed switch 4, the two trolley wires being connected in series to said feed tap. The end of the trolley wire 8 is connected through the conductor 9, knife blade 10, conductor 15, and resistance 16, to ground. The windings of the electromagnet 6 are in a shunt circuit which extends from the feed tap 2 and includes the switch blade 12, contact plate 14, the windings of the electromagnet 6 and the contact plates 13. The resistance of this circuit being extremely large, as compared with the resistance of the trolley wire circuit with which it is in shunt, it is obvious that the electromagnet is normally practically short-circuited. However, in case of a break in any portion of the main circuit which is in parallel with the coils of the electromagnet 6, as, for example, in case of a broken trolley wire 3 or 8, such short-circuit of said electromagnet is thereby opened and current flows from the feed-tap 2, through the knife blade 12, contact plate 14, the windings of the electromagnet 6, contact plate 13, conductor 15, to ground. This causes an energization of the electromagnet 6 which thereupon attracts its armature 5 and releases the switch 4. Upon the withdrawal of the latch 5, the switch 4 is automatically thrown into its open position, thereby cutting off the supply of current to the trolley wires, and, hence, when the wire falls to the street, it is dead and the danger usually incident to the fall of a live wire is entirely absent.

In order to obviate a tie-up of the railway system until a broken trolley wire shall have been repaired I have provided the double-pole, double-throw switch 11 hereinbefore described. By reversing the throw of said switch and bringing the blades into engagement with the contact plates 18 and 19, the trolley wires 3 and 8 which were formerly connected in series, are now connected in parallel up to the point of breakage of the wires. This is due to the fact that one end of the trolley wire 3 is connected to the feed tap 2, and, upon throwing the switch 11 to its reversed position, the trolley wire 8 is likewise connected, through the blade 12, bus bar 20, blade 10, and conductor 9, to the feed-tap 2. The reversal of the switch 11 opens the circuit of the electromagnet 6 and renders it possible to close the cut-out switch 4. Such reversal of the switch 11 is designed merely to furnish a supply of current to the system for temporary operation of the car during the time intervening between the breakage of a wire and the repair thereof. It will be understood, of course, that before the switch is thrown to its reverse position, the broken ends of the trolley wire are tied up so as not to be a menace when current is again supplied to the wires. After the trolley wire has been repaired, the switch 11 is again thrown to its normal position shown in the drawings.

The end of the trolley wire 8 is normally grounded through the conductor 9, switch blade 10, and conductor 15. The resistance 16 of the conductor 15 is made sufficiently high to prevent any considerable current flow, and hence the loss of current by reason of such grounding of the trolley wire 8 is negligible.

Since the opening of the switch 4 is dependent upon the energization of the electromagnet 6, it is obvious that a temporary cessation of current flow, as frequently happens in electric railway systems, has no effect whatever upon the apparatus.

It is obvious that the details of apparatus and circuit arrangement may be modified within the scope of the appended claims without departing from the invention. For instance, though I have shown the trolley wire 8 connected to the trolley wire 3 so as to constitute a return wire to the apparatus, such arrangement is not essential, but is merely employed to lessen the amount of extra wiring that would otherwise be required. It is obvious that the use of a bus bar 20 is not essential, since the feed tap 2 may otherwise be connected to the contact plates 18.

The protective apparatus illustrated above may be inclosed in a suitable box and mounted upon a trolley pole at the side of the street, the conductor 15 leading directly to ground.

What I claim is:

1. The combination with a main feed, of the two trolley wires of a double track electric railway, said wires being connected in series, a conductor connecting said trolley wires to ground, a feed tap for supplying current from said main feed to said trolley wires, a switch in said feed tap normally locked in closed position, an electromagnet arranged when energized to release said switch, said electromagnet having its coils in shunt of said trolley wires and normally short-circuited thereby, and a switching mechanism arranged to open the circuit of said electromagnet and to connect the trolley wires in parallel.

2. The combination with a main feed, of the two trolley wires of a double track electric railway, a conductor connecting said trolley wire to ground, a feed tap normally supplying current to said trolley wires in series, a switch in said feed tap normally locked in closed position, a double-pole, double-throw switch having its blades elec-

trically connected to corresponding ends of said trolley wires, an electromagnet arranged when energized to release said first mentioned switch, said electromagnet having the opposite ends of its coils connected to the pair of contact plates with which the blades of said double-pole switch are normally in closed relation, and a conductor connecting the other pair of contact plates of said double-pole switch.

3. The combination with a main feed, of a trolley wire, a feed tap for supplying current from said main feed to said trolley wire, a switch in said feed tap normally locked in closed position, a double-pole, double-throw switch having one of its blades electrically connected to said feed tap, a return conductor from said trolley wire to the other blade of said double-pole switch, an electromagnet arranged when energized to release said first named switch, said electromagnet having the opposite ends of its coils connected to one of the pairs of contact plates of said double-pole switch, means for electrically connecting the other pair of contact plates of said double-pole switch, and a grounded conductor extending from the contact plates to which said return conductor from the trolley wire is normally connected.

4. The combination with a main feed, of the two trolley wires of a double track electric railway, said wires being connected in series, a conductor connecting said trolley wires to ground, a feed tap for supplying current from said main feed to said trolley wires, an electromagnet having its coils in shunt of said trolley wires and normally short-circuited thereby, means in said feed tap, responsive to the energization of said electromagnet, for opening the circuit of said feed tap, and switching mechanism arranged to open the circuit of said electromagnet and to connect the trolley wires in parallel.

5. The combination with a main feed, of the two trolley wires of a double track electric railway, a feed tap connecting the end of one of said trolley wires with said main feed, a conductor connecting the opposite end of said latter trolley wire to the corresponding end of said other trolley wire, whereby said trolley wires are normally fed in series from said main feed, a double-pole, double-throw switch having its blades electrically connected to the corresponding ends of said trolley wires, an electromagnet having the opposite ends of its coils connected to the pair of contact plates with which the blades of said double-pole switch are normally in closed relation, a conductor connecting the other pair of contact plates of said switch, a conductor extending to ground from one of the said contact plates of said double-pole switch, said conductor being normally in series with said trolley wires, a resistance included in said grounded conductor, a normally closed switch in said feed tap, and a latch for holding said switch in its closed position, said latch constituting the armature of said electromagnet.

In witness whereof, I, hereunto subscribe my name this 17th day of May, A. D., 1910.

EUGENE S. SEARS.

Witnesses:
ALFRED H. MOORE,
MCCLELLAND YOUNG.