

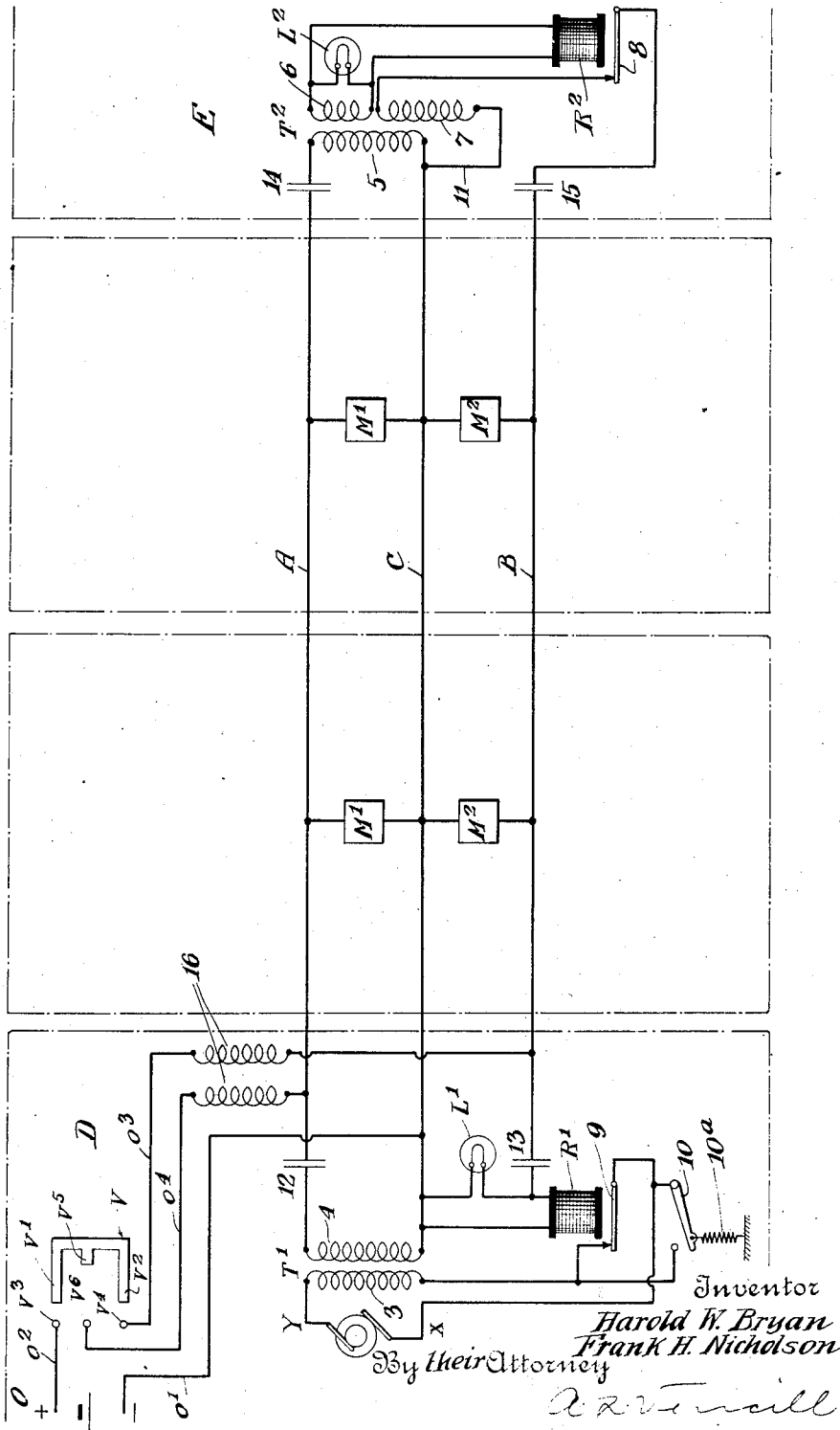
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CONTROL SYSTEM

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CONTROL SYSTEM

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This invention relates to control systems, and, although it has been primarily designed for employment in connection with brake-control means on trains, its utility is by no means to be limited to such function as it is susceptible of use in other fields.

The main object and feature of the invention is the provision of means for testing or indicating the integrity of one or more circuits that control normally deenergized translating means without, however, energizing said translating means when testing the circuit or circuits.

In the accompanying drawing the invention is disclosed in a concrete and preferred form by means of a diagrammatic view of the circuits here involved.

In the exemplification shown in the drawing, there are two circuits which here have one path in common, said path being conveniently indicated by conductor C, reference characters A and B indicating line wires which in conjunction with common path C and other devices to be presently described constitute two line circuits. These line circuits may be conceived as extending from a control station D to a remote station E, and in the present instance said control station is one of a plurality of cars, such as the cab of the engine, and said remote station is another one of a plurality of cars, such as the caboose of a train. Any number of intervening cars may, of course, be present, and it will be seen that the line circuits extend from car to car. M' indicates a translating device, here a traffic-controlling device such as a brake-control magnet, connected across conductors A and C. M² indicates a similar translating device connected across conductors B and C. M' and M² are of the type of brake-control means that are normally deenergized, and which when energized apply the brakes. Any suitable means may be provided to energize M' and M². In the present instance is shown a source of direct current O having one lead o' connected to path C and the other lead o² connected through wires o³ and o⁴ to either one or both of line conductors B and A. The arrangement is here such that when the engineer's brake valve V is in the position shown in the drawing, that is in release, running or holding position, the contacts are open and no current is supplied to the line wires, but that when valve V is moved to bring contacts v', v² and v⁵ into engagement with contacts v³, v⁴ and v⁶, current is supplied to both M' and M² to thereby energize them and give a service application of the brakes. When valve V is moved into

an intermediate or lap position in which contacts v' and v² are in engagement with contacts v³ and v⁴ but in which contacts v⁵ and v⁶ are out of engagement, M² only is energized whereby the brake application already made is maintained.

It will be understood that with such construction it is desirable to provide means for testing the integrity of the line conductors so that the engineer may be assured at all times that the brakes will function if operated. Also, on long freight trains, it is desirable that the crew in the caboose be kept informed as to the dependability of the brakes.

Accordingly, the following means, or their equivalent, are provided to test the integrity of the line circuit:

Suitable means are provided to supply to the line conductors a current of a character different from that of source O. As here shown X and Y represent two terminals of a circuit connected to a source of alternating current, and by preference these means are located in the control station. Interposed between this circuit and the one composed of conductors A and C is a transformer T', the primary 3 of which is in circuit X—Y and the secondary 4 of which is connected between conductors A and C. At the remote station is a transformer T² which is here constructed and connected as follows: primary 5 of the transformer extends between A and C, and secondary 6 is included in a circuit that controls relay R². A second secondary 7 is also in an inductive relation to primary 5, but in addition said secondary 7 is connected in series with primary 5 by reason of conductor 11, and also is connected to a front contact of circuit breaker 8 controlled by relay R². Circuit breaker 8 is connected to line conductor B, which latter in turn is connected at the control station to conductor C. Windings 5, 6 and 7 are so related to each other that, when the line conductors are intact, the flow of current in circuit A, C, will energize primary 5 which latter in turn will energize both secondaries 6 and 7 with the result that R² will be energized and will pick up 8 to thereby close the circuit between B and C, and this latter circuit will then receive current from secondary 7. If current, however, flows through primary 5 and secondary 7 in series the influence of these two windings will be opposite to each other and substantially equal so that secondary 6 will receive practically no current and consequently relay R² will become deenergized and circuit breaker 8 will drop thereby opening circuit B—C.

Any suitable indication means may be employed

to denote the flow of current in the line circuits. At the remote station it is convenient to include a lamp L^2 in multiple between secondary 6 and relay R^2 . At the control station it is convenient to include a lamp L' between conductors B and C. Also, if desired, the indicating means may include a relay R' included between conductors B and C, and this relay can then control a circuit breaker 9 in circuit X—Y.

Suitable blocking or filtering means, such as are well-known in the art, may be inserted in the various leads to segregate the direct and alternating currents. For instance, conductors A and B may be provided with condensers 12, 13, 14 and 15 to prevent the direct current from flowing through the transformers, and choke coils 16 may be inserted in the leads to the source of direct current. So also magnets M' and M^2 can be protected from the alternating current by having a high impedance, and this high impedance prevents an undue drain of alternating current from the checking circuit.

At the control station is located a shunt around circuit breaker 9, and in this shunt is located a manually operated circuit breaker 10 biased to its open position by spring 10^a. When the system is to be started, switch 10 is closed thereby energizing transformer T' . Alternating current will now flow over line conductors A and C, and this current flow will in turn energize secondary 6 to thereby close the circuit B—C at 8, and also lighting lamp L^2 . Current induced in secondary 7 will then flow over conductors B and C and will light lamp L' and also energize relay R' thereby picking up 9, so that switch 10 may now be opened. So long as alternating current flows in the line conductors, that fact will be indicated at both stations by lamps L' and L^2 and the engineer is therefore assured as to the integrity of these line conductors. If now conductor A should break or a low resistance short-circuit be established between A and C, then transformer T^2 will no longer be energized, and as a result lamp L^2 will be extinguished, R^2 will be deenergized, circuit B—C will be ruptured, at 8, lamp L' will be extinguished, relay R' will be deenergized and circuit X—Y will be ruptured at 9 thereby deenergizing transformer T' . If conductor C should become ruptured, then current from transformer T' will flow over conductor A, through primary 5, over conductor 11, and through secondary 7. The result will be that secondary 6 will receive practically no energy and hence lamp L^2 will become extinguished and relay R^2 will become deenergized thereby dropping armature 8, and thus extinguishing lamp L' and deenergizing relay R' . In this case, therefore, transformer T' will likewise receive no current and indication of failure of integrity in the line circuits will be given at both stations. If conductor B should become ruptured or a low resistance short circuit be established between B and C, then lamp L' will become extinguished and relay R' will become deenergized. This in turn, will deenergize transformer T' , as before, and will thus deenergize transformer T^2 thereby extinguishing lamp L^2 and deenergizing relay R^2 . Again, in these circumstances, the result will be indication of failure in the line circuits at both stations and the discontinuance of the power supply.

This application is a continuation in part of application Ser. No. 512,922 filed February 2, 1931. We claim:

1. In a control system involving three conductors A, B and C extending from a control station to a remote station, the combination there-

with of a first transformer T' the secondary of which is connected with conductors A and C at the control station, a second transformer T^2 the primary of which is connected with conductors A and C at the remote station, a relay R^2 having its winding connected with a first secondary on transformer T^2 , a second secondary on said transformer T^2 connected with conductors B and C through a front contact of relay R^2 and so related to the other windings on transformer T^2 that if current flows through the primary and the second secondary in series the voltages induced thereby in the first secondary will be equal and opposite, a relay R' at said control station having its winding connected across conductors B and C, a circuit for the primary of transformer T' including a front contact of relay R' and a source of alternating current, a normally open manually operable contact included in said circuit and connected in multiple with said contact of relay R' , and indicating devices connected in multiple with said relays.

2. In a control system involving three conductors A, B and C extending from one station to another, the combination therewith of a first transformer T' located at one station and supplying current to conductors A and C, a second transformer T^2 located at the other station and receiving current from conductors A and C and provided with two secondary windings, a relay R^2 having its winding receiving energy from the first secondary winding of transformer T^2 , the second secondary winding on transformer T^2 being connected across conductors B and C through a front contact of said relay and being so related to the other windings of the second transformer that in the event of a difference of potential across conductors A and B the voltages created in the first secondary winding due to current in the primary and the second secondary winding are equal and opposite, a second relay R' at the first station having its winding receiving energy from conductors B and C, means controlled by relay R' for supplying current to the primary of said first transformer T' , and indicating devices connected in multiple with said relays.

3. In a control system involving three conductors A, B and C extending from one station to another, the combination therewith of a winding at the first station connected across conductors B and C, a circuit breaker located at the first station and controlled by said winding, means controlled by said circuit breaker for creating a difference of potential across conductors A and C, a second winding located at the second station and receiving energy from said conductors A and C, a circuit breaker at said second station controlled by said second winding, and means controlled by said second circuit breaker for creating a difference of potential across conductors B and C if and only if said second winding is energized.

4. Circuit means including: a first and a second circuit, said two circuits composed of a path common to both circuits and of two conductors, a transformer between the two circuits the primary of which is in the first circuit and the secondary of which is in the second circuit, said primary and secondary being not only in an inductive relation but also connected in series with their windings opposed to each other, means to supply current to the first circuit to energize the primary of the transformer, a third circuit, a secondary in said third circuit which is in such inductive relation to the primary and first-mentioned secondary as to be energized when current is flowing

in the primary but not when current is flowing through both the primary and the first-mentioned secondary in series, a circuit breaker in the second circuit, and means energized by the current flow in the third circuit for holding said circuit breaker in its closed position as long as the secondary of the third circuit is energized.

5. In a control system involving three conductors, A, B and C extending from one station to another, the combination therewith of a winding at the first station connected across the conductors B and C, a circuit breaker controlled by said winding, means at the first station controlled by said circuit breaker for creating a difference of potential across conductors A and C, a winding at the second station and receiving energy from the conductors A and C, a circuit breaker at said second station controlled by the last mentioned winding, means controlled by the last mentioned circuit breaker for creating a difference of potential across conductors B and C if and only if a difference of potential exists across conductors A and C, the winding and circuit breaker at the said first station preventing said means at the said first station from creating a difference of potential across conductors A and C unless a difference of potential exists across conductors B and C, an indicating device at the said second station responsive to the difference of potential across conductors A and C, and an indicating device at the first station responsive to the difference of potential across conductors B and C.

6. In a control system involving three conductors, A, B and C extending from one station to another, the combination therewith of a winding at the first station connected across the conductors B and C, a circuit breaker controlled by said winding, means at the first station controlled by said circuit breaker for creating a difference of potential across conductors A and C, a winding at the second station receiving energy from the conductors A and C, a circuit breaker controlled by the winding at the second station, means at the second station controlled by said circuit breaker for creating a difference of potential across conductors B and C if and only if a difference of potential exists across conductors A and C, an indicating device at the said second station responsive to the difference of potential across conductors A and C, and an indicating device at the first station responsive to the difference of potential across conductors B and C.

7. A control system including: two circuits each extending between two stations, means located at one station to supply current to one of said circuits, means located at the other station to be energized by current flow in the first mentioned circuit and to thereby produce a current flow in the other circuit, indication means located at the first station to be energized by current flow in the second circuit, and normally energized switch means automatically operative to cut off the supply of current to said indication means upon failure in the integrity of either of said circuits.

8. Circuit means including: a first and a second circuit, said two circuits composed of a path common to both circuits and of two conductors, a third circuit, a transformer comprising a primary winding included in the first circuit, a first secondary winding included in the second circuit and a second secondary included in the third circuit, said primary winding and first

secondary winding being not only in inductive relation but also connected in series and opposed to each other, means to supply current to the first circuit to energize the primary winding of the transformer, the second secondary of the transformer being in such inductive relation to said primary winding and first secondary winding as to be energized when current is flowing in the primary winding but not when current is flowing through both the primary and the first secondary winding in series, a circuit breaker in the second circuit, a winding included in the third circuit energized by the current flow in the third circuit due to the energization of the second secondary winding for holding said circuit breaker in position closing the second circuit, said third circuit being deenergized upon the flow of current through the primary and first secondary winding to permit said circuit breaker to move to its circuit opening position.

9. In an electric brake controlling system, the combination with means included in a normally open circuit for controlling the brakes, of means operative to open and close said circuit for controlling the operation of said means, a normally closed circuit, a source of current in said normally closed circuit, means in said normally closed circuit operable automatically upon damage to either of said circuits for opening the circuit through said source of current, and means operable upon the opening of said normally closed circuit for warning of said damage.

10. The combination with electrically controlled devices on a train adapted upon energization to effect an application of the brakes, and main train wires connected to said devices, of a source of direct current normally cut out of circuit with said train wires and devices, a switch device on the head end of the train operable to close the circuit through said source of current to effect the energization of said devices, a normally closed circuit warning system including a source of alternating current and said train wires and comprising a plurality of normally closed warning circuits and a normally closed current transmission circuit for normally inducing a current in each of said warning circuits, an electric relay switch device normally energized and maintaining said transmission circuit closed and operative upon deenergization to open said circuit to said train wires, said relay switch device being deenergized upon breakage of any of said train wires and the consequent opening of the circuit through said electrically controlled devices, and means included in each of said warning circuits to cause a warning to be given upon the opening of said transmission circuit by said relay switch device.

11. In an electric brake controlling system for trains, the combination with means included in a normally open circuit system for controlling the brakes, a switch device operative to open and close said circuit to control the operation of said means, a plurality of main train wires included in said normally open circuit, a normally closed circuit system for indicating the condition of the normally open circuit, said normally closed circuit system also including said train wires and comprising a current transmission circuit and two warning circuits inductively energized by current in said transmission circuit, warning means included in said warning circuits operative upon the deenergization of said warning circuits to cause said warning means to sound a warning, and electric relay switch devices operative upon the interruption of the current flow-

ing through said normally closed circuit for de-energizing said closed circuit system.

12. The combination with electrically controlled devices on a train adapted upon energization to effect an application of the brakes, and main train wires connected to said devices, of a source of direct current normally cut out of circuit with said train wires and devices, a switch device on the head end of the train operable to close the circuit through said source of current, train wires and devices; a normally closed circuit warning system for indicating the condition of said train wires, said warning system including a source of alternating current and said train wires and comprising a plurality of normally closed warning circuits and a normally closed current transmission circuit normally energizing the warning circuits; and means operable upon the deenergization of any of said normally closed circuits for deenergizing the other of said normally closed circuits, and means included in said warning circuits operative upon the deenergization of the warning circuits to indicate that said circuits are deenergized.

13. The combination with two sets of electrically controlled devices on a train adapted upon energization to effect an application of the brakes, of a brake application train wire connected to one set of said devices, a release train wire connected to the other set of devices, a return wire connected to both sets of devices, a brake controlling source of current normally cut out of circuit with said train wires and devices, a brake switch on the head end of the train operable to connect said source of current in circuit with said wires and both of said sets of devices to effect the energization of said devices, a normally energized warning circuit system indicating the condition of said train wires and including electrically controlled warning means at the head end of the train, electrically controlled warning means at the rear of the train, a source of current for energizing the warning circuit system, a transformer on the rear end of the train having a primary winding connected in circuit with the last mentioned source of current through said application train wire and return train wire, and having two secondary windings, one of which is connected in circuit with the electrically controlled warning, means at the head end of the train through said release train wire and said return train wire, and the other of said secondary windings being connected in circuit with the electrically controlled

warning means on the rear end of the train, both of said secondary windings and the circuits in which they are included being deenergized upon the deenergization of said primary winding by the interruption of the current through either the application train wire or the release train wire, the first mentioned secondary winding being adapted, upon the interruption in the current in said return wire to render said primary winding ineffective to maintain the second mentioned secondary winding and its circuit energized, means operative to indicate a warning upon the deenergization of the second mentioned secondary winding, an electric relay switch device operative upon the deenergization of the first mentioned secondary winding to open the circuit through the second mentioned secondary winding, means operative to indicate a warning upon the opening of the circuit through the second mentioned secondary winding, and another electric relay switch device operative upon the opening of the circuit through the second mentioned secondary winding to deenergize said primary winding.

14. The combination with electrically controlled devices on a train adapted upon energization to effect an application of the brakes, and main train wires connected to said devices, of a source of direct current normally cut out of circuit with said train wires and devices, a switch device on the head end of the train operable to close the circuit through said source of current, train wires and devices; a normally closed circuit warning system for indicating the condition of said train wires, said warning system including a source of alternating current and said train wires and comprising a plurality of normally closed warning circuits and a normally closed current transmission circuit, a transformer having a primary winding included in said current transmission circuit and two secondary windings energized by current in said primary winding, each one of said secondary windings being included in one of said warning circuits, a relay switch device operable to deenergize the warning circuit system upon the interruption of current in any of said normally closed circuits, and means included in said warning circuits operative upon the deenergization of the warning circuits to indicate that the warning circuits are deenergized.

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