

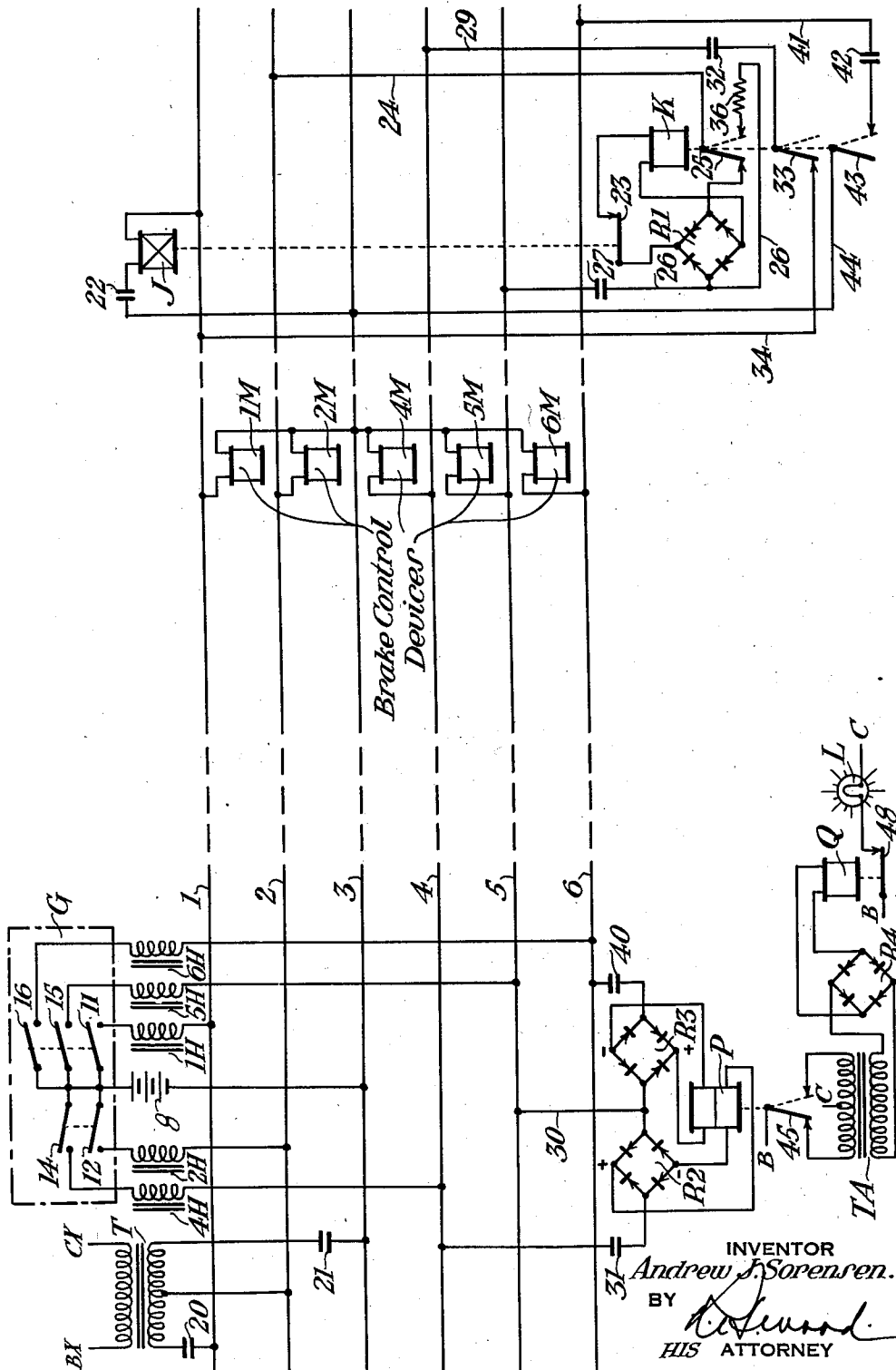
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ELECTRIC SIGNALING SYSTEM

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ELECTRIC SIGNALING SYSTEM

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My invention relates to electric signaling systems and particularly to signaling systems for continuously checking the integrity of electrical control circuits.

A feature of my invention is the provision of novel and improved apparatus to continuously check the continuity of the control wires or conductors of control circuits, and to also continuously check the conductors to detect short circuit conditions between the control wires without interference with the operation of the apparatus governed over these control wires.

Other features and advantages of my invention will be apparent from the following description taken in connection with the accompanying drawing.

In the drawing the single figure is a diagram showing the signaling means of this invention employed with an electropneumatic brake control system for railway trains.

Although the system provided by this invention is peculiarly adapted for employment with electropneumatic brake control systems for railway trains, the system is not limited to use in this situation but is capable of application in other fields.

Referring to the drawing, the control wires 1, 2, 3, 4, 5 and 6 are the brake control wires of an electropneumatic brake control system. Each of these wires extends the full length of the train. In the drawing the left-hand full line portions represent the portions of the control wires on the car at the forward end of the train, from which point the train brakes are controlled. The right-hand full line portions of the control wires represent the portions of the control wires on the car at the rear of the train, while the intermediate full line portions represent the portions of the control wires on an intermediate car of the train. The dotted lines represent the portions of the control wires on other cars of the train.

The control wire 3 is a common return wire for each of five different control circuits, the other side of which is formed by a particular one of the other wires 1, 2, 4, 5 and 6.

These control circuits may be employed to govern the vehicle brakes in any desired manner. Each car is provided with magnet valve devices 1M, 2M, 4M, 5M and 6M having windings which are connected between the common wire 3 and the control wires 1, 2, 4, 5 and 6, respectively. Although only the magnet valve devices on the intermediate car of the train are shown it should be understood that a similar series of valve de-

vices is located on each of the other cars of the train.

In one system of brake control the valve device 1M controls release of air from the brake cylinder, while the valve device 2M controls the supply of air from a reservoir to the brake cylinder to apply the brakes. The valve devices 4M, 5M and 6M are employed in connection with speed responsive apparatus to govern the pressure developed in the brake cylinder in accordance with the speed of the train.

The circuits of the various valve devices are governed by contacts of a control device designated as a whole by the reference character G. This device has five contacts 11, 12, 14, 15 and 16 which govern the circuits of the magnet valve devices 1M, 2M, 4M, 5M and 6M, respectively. Thus when contact 11 is closed the battery 8 is connected across the wires 1 and 3 through the choke or reactor 1H so that energy is supplied to the magnet valve device 1M, as well as to the corresponding magnet valves, not shown, on the other cars of the train.

In similar manner, when the contacts 12, 14, 15 and 16 are closed circuits are established to supply energy from the battery 8 through the reactors 2H, 4H, 5H and 6H to the magnet valve devices 2M, 4M, 5M and 6M.

The apparatus thus far described, except for the reactors or choke coils, is that required for an electropneumatic train brake system now in use. With such a system it is desired to continuously check the integrity of the control wires both as to continuity and as to crosses or short circuits between wires, so that the operator may be assured at all times that the brake equipment will function as intended.

The signaling apparatus provided by this invention employs transformers T and TA, relays J, K, P and Q, and a signal lamp L. The apparatus also includes condensers and rectifiers as described below. The relays J and K are located on the last car of the train while the relays P and Q are located on the first car of the train.

The primary winding of the transformer T is supplied with alternating current of any convenient frequency from any suitable source the terminals of which are designated BX and CX. One end terminal of the transformer secondary winding is connected through a condenser 20 to wire 1, while the other end terminal of the transformer secondary winding is connected through condenser 21 to control wire 3. The center tap of the transformer secondary winding is connected directly to the control wire 2. The

condensers 20 and 21 serve to prevent direct current from the battery 8 from flowing through the secondary winding of transformer T, while the reactors or chokes 1H and 2H prevent the alternating current supplied to the control wires from flowing through battery 8. The impedance of the windings of the magnet valve devices is high enough to substantially prevent flow of alternating current through these windings.

As a result of the supply of alternating current to the transformer T energy is supplied from the entire transformer secondary to the control wires 1 and 3 and this energy feeds to the relay J through the condenser 22 and causes contact 23 of the relay to be picked up. The relay J is of a type which responds to alternating current.

In addition, on the supply of energy to the transformer T energy is supplied from the mid-tap of the transformer secondary winding over line wire 2, branch wire 24, left-hand contact 25 of relay K, rectifier R1, contact 23 of relay J, winding of relay K, branch wire 26, condenser 27, control wire 5, branch wire 30, rectifier R2, lower winding of relay P, condenser 31, control wire 4, condenser 32, left-hand contact 33 of relay K, branch wire 34, control wire 1, and condenser 20 to an end terminal of the secondary winding of transformer T.

As a result of the supply of energy to the winding of relay K the contacts of this relay are shifted from their left-hand position as shown to their right-hand position. As a result contact 25 interrupts the circuit of the relay winding and energy is no longer supplied to the relay. This relay is of a type the contacts of which are biased by a spring or other appropriate means to their left-hand position so that after movement of the contacts to their right-hand position, and resultant interruption of the supply of energy to the relay, the contacts are returned to their left-hand position so that energy is again supplied to the relay winding and the relay contacts are again moved to their right-hand positions. This cycle is repeated continuously, while the device is constructed in such manner that the rate of operation of the contacts is relatively slow, on the order of one or two cycles a second.

When the contacts of relay K are in their right-hand position contact 25 interrupts the circuit traced above for supplying energy from transformer T to the lower winding of relay P, while a circuit is established to supply energy from the transformer T to the upper winding of relay P. This circuit is traced from the mid-tap of the transformer secondary winding over control wire 2, branch wire 24, right-hand contact 25 of relay K, resistance 35, branch wire 26, condenser 27, control wire 5, branch wire 30, rectifier R3, upper winding of relay P, condenser 40, control wire 6, branch wire 41, condenser 42, right-hand contact 43 of relay K, branch wire 44, control wire 3, and condenser 21 to the end terminal of the secondary winding of transformer T.

The various parts of the apparatus are arranged so that when energy is supplied to the upper winding of relay P the contact 45 of this relay is shifted to one position, and so that when energy is supplied to the lower winding of the relay the contact 45 is shifted to its other position. This relay is also constructed in such manner that its contact when moved to either position will remain in that position until energy effective to move the contact to its other position is supplied to the relay.

The contact 45 controls the supply of energy from a source of direct current to the two portions of the primary winding of the transformer TA so that as long as this contact is moved between its two positions energy is induced in the secondary winding of the transformer and is supplied therefrom through the rectifier R4 to the relay Q. The contact 48 of relay Q is picked up, therefore, and establishes the circuit of the lamp L so that this lamp is lighted to indicate to the operator that all of the control wires are intact and that there are no crosses between them.

Continuity of control wire 2 is checked since this wire is included in both circuits for supplying energy from the transformer T to the relay P, as well as in the circuit for supplying energy to the relay K. If for any reason this wire is broken the relay P will cease to operate and contact 48 of relay Q will release and interrupt the circuit of the lamp L.

As previously traced in detail the circuit for supplying energy to the lower winding of relay P includes in series therewith control wires 5, 4 and 1 so that if either of these wires is broken the upper winding of relay P will not be energized and the contacts of this relay will remain in the position to which they are moved by energization of the lower winding of the relay. Similarly the circuit for supplying energy to the upper winding of relay P includes in series therewith control wires 5, 6 and 3 so that if either of these wires is broken the contact of relay P will not be moved between its two positions and relay Q will be released and lamp L will not be lighted. It is obvious, therefore, that continuity of each of the control wires is continuously checked.

This system also operates to continuously check each control wire with respect to crosses with each of the other control wires.

If control wire 2 is crossed with wire 1 the portion of the secondary winding of transformer T from which energy is supplied to the lower winding of relay P will be short circuited and energy will not be supplied to this winding of the relay. Similarly, if wires 2 and 3 are crossed the portion of the transformer secondary winding from which energy is supplied to the upper winding of relay P will be short circuited and energy will not be supplied to this winding.

If a cross exists between wire 2 and wire 4 energy will not be supplied to the lower winding of relay P nor will energy be supplied to the relay K. Instead the terminals of the left-hand portion of the secondary winding of transformer T will be connected together over the circuit which is traced from the mid-tap of the transformer winding over control wire 2 through the cross which is assumed to exist with wire 4, branch wire 29, left-hand contact 33 of relay K, branch wire 34, control wire 1, and condenser 20 to the other terminal of the transformer winding. Accordingly energy will not be supplied to the windings of relays K and P and relay Q will be released, while the contacts of relay K will remain in their left-hand position and maintain the circuit traced above.

If a cross exists between control wires 2 and 5 the circuit for supplying energy to relay K will be short circuited and the contacts of this relay will remain in their left-hand position. Under these conditions energy flows through the cross between control wires 2 and 5 instead of from control wire 2 through branch wire 24, left-hand contact 25 of relay K, rectifier R1,

winding of relay K, and branch wire 26 to control wire 5.

As the contacts of relay K remain in their left-hand position contact 43 does not establish the circuit for supplying energy to the upper winding of relay P and contact 45 of this relay, therefore, remains in the position to which it is moved by the lower winding. Accordingly, energy is not supplied through the transformer TA to the relay Q and this relay interrupts the circuit of the lamp L.

If a cross exists between control wires 2 and 6 energy will not be supplied to the upper winding of relay P during the periods in which contact 43 of relay K is in its right-hand position. Instead the right-hand portion of the transformer T will be short circuited at these times over the circuit which is traced from the mid-tap of the transformer through control wire 2, through the assumed cross to control wire 6, branch wire 41, condenser 42, right-hand contact 43 of relay K, branch wire 44, control wire 3, and condenser 21 to the right-hand end terminal of the transformer secondary winding. As energy is not supplied to the upper winding of relay P the relay Q is released and lamp L is extinguished as explained above.

If a cross exists between control wires 1 and 3 the relay J will be short circuited and its contact 23 will be released to prevent the supply of energy to relay K. Accordingly the contacts of relay K will remain in their left-hand position and contact 43 will not establish the circuit for supplying energy to the upper winding of relay P, and the lamp L will not be lighted.

If a cross exists between the control wires 1 and 4 energy will be continuously supplied to the lower winding of relay P and the contact 45 of this relay will remain in one position so that energy will not be supplied through transformer TA to the relay Q and lamp L will not be lighted.

Under these conditions energy will be supplied to the winding of relay K and to the lower winding of relay P over the circuit which is traced from the center terminal of the secondary winding of the transformer T through control wire 2, branch wire 24, left-hand contact 25 of relay K, rectifier R1, contact 23 of relay J, winding of relay K, branch wire 26, condenser 27, control wire 5, branch wire 30, rectifier R2, lower winding of relay P, condenser 31, control wire 4, through the assumed cross to control wire 1, and through condenser 20 to an end terminal of the secondary winding of transformer T.

The energy supplied to the lower winding of relay P moves the contact 45 to one position, while the energy supplied to relay K moves the contacts of this relay from their left-hand to their right-hand positions. On this movement of the contacts of relay K its contact 25 interrupts the circuit traced above for supplying energy to the relays K and P and establishes another circuit to supply energy to the lower winding of relay P. This circuit is traced from the mid-terminal of the secondary winding of transformer T over control wire 2, branch wire 24, right-hand contact 25 of relay K, resistance 36, branch wire 26, condenser 27, control wire 5, branch wire 30, rectifier R2, lower winding of relay P, condenser 31, control wire 4, through the assumed cross to control wire 1, and through condenser 20 to an end terminal of the secondary winding of transformer T.

At this time energy is also supplied to the

upper winding of relay P over the circuit which is traced from the mid-terminal of the secondary winding of transformer T over control wire 2, branch wire 24, right-hand contact 25 of relay K, resistance 36, branch wire 26, condenser 27, control wire 5, branch wire 30, rectifier R3, upper winding of relay P, condenser 40, control wire 6, branch wire 41, condenser 42, right-hand contact 43 of relay K, branch wire 44, control wire 3, and condenser 21 to an end terminal of the secondary winding of transformer T.

As energy is supplied to both windings of relay P through the resistance 36 the forces exerted by these windings offset each other, and the contact 45 of relay P remains in the position to which it was moved as a result of energization of the upper winding only of relay P.

On movement of the contacts of relay K to their right-hand position contact 25 interrupts the supply of energy to the winding of relay K so that the contacts of this relay are returned to their left-hand position by the biasing means and energy is again supplied to the relay K and to the lower winding of relay P over the circuit traced above, while contact 43 of relay K interrupts the supply of energy to the upper winding of relay P. Accordingly, the contacts of relay K are again shifted to their right-hand positions and the cycle described above is repeated continuously and the contact 45 of relay P will remain in one position so that energy is not supplied through the transformer TA to the relay Q and its contact 43 is released and interrupts the circuit of the lamp L.

If a cross exists between control wires 1 and 5 energy will not be supplied to either winding of relay P and the contact 45 of this relay will remain in its last operated position. Under this condition energy from the transformer T is supplied from the mid-terminal of the transformer secondary winding through control wire 2, branch wire 24, thence through contact 25 of relay K to control wire 5 through rectifier R1 and winding of relay K, if the contact 25 is in its left-hand position, or through the resistor 36, if the contact 25 is in its right-hand position, and from control wire 5 through the assumed cross to control wire 1, and through condenser 20 to an end terminal of the transformer secondary winding. As energy is not supplied to either winding of relay P the contact 45 of this relay remains in one position and energy is not supplied to relay Q and lamp L is not lighted.

If a cross exists between control wires 1 and 6 the upper winding of relay P will be continuously energized over the circuit which is traced from the mid-terminal of the secondary winding of transformer T over control wire 2, branch wire 24, contact 25 of relay K, thence to branch wire 26 through the rectifier R1 and winding of relay K or through the resistance 36, depending on the position of the contact 25, through condenser 27 to control wire 5, branch wire 30, rectifier R3, upper winding of relay P, condenser 40, control wire 6, through the assumed cross to control wire 1, and condenser 20 to an end terminal of the secondary winding of transformer T.

During the periods in which the contacts of relay K are in their left-hand positions energy is also supplied to the lower winding of relay P over the circuit which is traced from the mid-terminal of the transformer through control wire 2, branch wire 24, right-hand contact 25 of relay K, rectifier R1, winding of relay K, branch wire 26, condenser 27, control wire 5, branch wire 30,

rectifier R2, lower winding of relay P, condenser 31, control wire 4, branch wire 29, condenser 32, right-hand contact 33 of relay K, branch wire 34, control wire 1, and condenser 20 to the end terminal of the secondary winding of transformer T. At these times the upper and lower windings of relay P are energized over circuits which include the winding of relay K so that the force exerted by the windings of the relay offset each other and the contact of the relay remains in the position to which it is moved as a result of energization of the upper winding of the relay and relay Q is released and lamp L is not lighted.

If a cross exists between control wires 3 and 6 the upper winding of relay P is supplied with energy in both positions of the contacts of relay K. Under this condition energy is supplied to the upper winding of relay P over the circuit which is traced from the center terminal of the secondary winding of transformer T over control wire 2, branch wire 24, contact 25 of relay K, thence to branch wire 26 through the rectifier R1 and winding of relay K or through the resistance 36 depending on the position of the contact 25, through the condenser 27, control wire 5, branch wire 30, rectifier R3, upper winding of relay P, condenser 40, control wire 6, through the assumed cross to control wire 3, and condenser 21 to an end terminal of the secondary winding of transformer T.

During the periods in which the contacts of relay K are in their left-hand positions energy is also supplied to the lower winding of relay P over the circuit traced above, but as both windings of relay P are energized the contact 45 remains in the position to which it is moved by energization of the relay upper winding and relay Q is released and lamp L is not lighted.

If a cross exists between control wires 3 and 5 energy will not be supplied to either winding of relay P. Under these conditions energy from the transformer T is supplied over the circuit which is traced from the mid-terminal of the secondary winding of transformer T through control wire 2, branch wire 24, contact 25 of relay K, thence to branch wire 26 through rectifier R1 and winding of relay K or through resistance 36 depending on the position of the contact 25 of relay K, through condenser 27 to control wire 5, thence through the assumed cross to control wire 3, and condenser 21 to an end terminal of the secondary winding of transformer T. As energy is not supplied to either winding of the relay P the contact of this relay remains in one position and relay Q is released and lamp L is not lighted.

If a cross exists between control wires 3 and 4 energy will be supplied to the lower winding of relay P in both positions of the contacts of relay K. This energy is supplied over the circuit which is traced from the mid-terminal of the secondary winding of transformer T through control wire 2, branch wire 24, contact 25 of relay K, thence to branch wire 26 through rectifier R1 and winding of relay K or through resistance 36 depending upon the position of contact 25, through condenser 27, control wire 5, branch wire 30, rectifier R2, lower winding of relay P, condenser 31, branch wire 4, and thence through the assumed cross to control wire 3, and through condenser 21 to an end terminal of the secondary winding of the transformer T.

Energy is supplied to the upper winding of relay P during the periods in which the contacts of relay K are in their right-hand positions, but as the lower winding of the relay is also energized at

these times the contact 45 of the relay remains in one position and relay Q is released and lamp L is not lighted.

If a cross exists between control wires 4 and 5 energy will not be supplied to the lower winding of relay P. Under these conditions energy from the transformer T is supplied over the circuit which is traced from the midterminal of the transformer secondary winding over control wire 2, branch wire 24, left-hand contact 25 of relay K, rectifier R1, winding of relay K, branch wire 26, condenser 27 to control wire 5, and through the assumed cross to control wire 4, branch wire 29, condenser 32, left-hand contact 33 of relay K, branch wire 34, control wire 1 and condenser 20 to an end terminal of the transformer secondary winding. This circuit is interrupted on movement of the contacts of relay K to their right-hand positions, while at these times energy is supplied to the upper winding of relay P. As energy is supplied to the upper winding of relay P but not to the lower winding of the relay, the contact 45 of the relay remains in one position and energy is not supplied to relay Q and lamp L is not lighted.

If a cross exists between control wires 4 and 6 energy will be supplied to the lower winding of relay P in both positions of the contacts of the relay K. When the contacts of relay K are in their left-hand positions energy is supplied to the lower winding of relay P over the circuit which is traced from the mid-terminal of secondary winding of transformer T over control wire 2, branch wire 24, left-hand contact 25 of relay K, rectifier R1, winding of relay K, branch wire 26, condenser 27, control wire 5, branch wire 30, rectifier R2, lower winding of relay P, condenser 31, control wire 4, branch wire 29, condenser 32, left-hand contact 33 of relay K, branch wire 34, control wire 1 and condenser 20 to an end terminal of the secondary winding of transformer T.

On movement of the contacts of relay K to their right-hand positions the circuit traced above for supplying energy to the lower winding of relay P is interrupted and another circuit is established for supplying energy to this winding. This circuit is traced from the center terminal of the secondary winding of the transformer T over control wire 2, branch wire 24, right-hand contact 25 of relay K, resistance 36, branch wire 26, condenser 27, control wire 5, branch wire 30, rectifier R2, lower winding of relay P, condenser 31, control wire 4, through the assumed cross to control wire 6, branch wire 41, condenser 42, right-hand contact 43 of relay K, branch wire 44, control wire 3, and condenser 21 to an end terminal of the transformer secondary winding.

When the contacts of relay K are in their right-hand positions energy is also supplied to the upper winding of relay P over the normal circuit for this winding. However, as the lower winding of relay P is also energized the contact 45 of the relay remains in the position to which it is moved by energization of the lower winding of the relay and relay Q is released, while lamp L is not lighted.

If a cross exists between control wires 5 and 6 energy will not be supplied to the upper winding of relay P. Under this condition energy from the transformer T is supplied over the circuit which is traced from the mid-terminal of the transformer secondary winding over control wire 2, branch wire 24, right-hand contact 25 of relay K, resistance 36, branch wire 26, condenser 27, control wire 5, through the assumed cross to con-

trol wire 6, branch wire 41, condenser 42, right-hand contact 43 of relay K, branch wire 44, control wire 3, and condenser 21 to an end terminal of the transformer secondary winding.

At this time energy is supplied to the lower winding of relay P during the periods in which the contacts of relay K occupy their left-hand positions. Accordingly, the contact of relay P remains in the position to which it is moved by energization of the lower winding of the relay and relay Q is released and lamp L is not lighted.

From the foregoing it will be seen that the system provided by this invention operates to continuously check the integrity of each of the six control wires. If there is a break in any one of these wires, or if there is a cross between any two of these wires the lamp L will not be lighted and the operator will know that a defect exists and he can take steps to correct it.

In addition, it will be seen that the system provided by this invention does not interfere with the normal use of the control wires to control the brake equipment, and that the checking means may be applied to existing apparatus without changing that apparatus except to add the equipment required by this checking means.

Although the invention has been illustrated and described in connection with a control system in which direct current is employed for control purposes and alternating current is employed for checking purposes, it should be understood that the invention is not limited to this arrangement and that alternating current may be employed for control purposes and direct current for checking purposes.

Although I have herein illustrated and described one form of signaling system provided by my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In a control system having six control wires each extending between two stations and employing energy of a first character for control purposes, in combination, a source of energy of a second character at one of said stations, a first means energized from said source over a first supply circuit which includes in series therewith the second, fifth, fourth and first control wires, a second means energized from said source over a second supply circuit which includes in series therewith the second, fifth, sixth and third control wires, a device energized in series with one of said supply circuits and effective when energized to interrupt said supply circuit and to establish the other supply circuit, a relay energized from said source over a circuit including in series therewith the first and third control wires and governing the supply of energy to said device, and indication means responsive to alternate energization of said first and second means.

2. In checking means for use with a control system having six control wires each extending between a first and a second station and employing energy of a first character for control purposes, in combination, a source of energy of a second character at said first station, a first means energized from said source over a first supply circuit which includes in series therewith the second, fifth, fourth and first control wires, a second means energized from said source over a second supply circuit which includes in series

therewith the second, fifth, sixth and third control wires, a device energized in series with one of said supply circuits and effective when energized to interrupt said supply circuit and to establish the other supply circuit, a relay at said second station connected across said first and third control wires to receive energy from said source and governing the supply of energy to said device, and indication means responsive to alternate energization of said first and second means.

3. In checking means for use with a control system having six control wires extending between a first and a second station and employing energy of a first character for control purposes, in combination, a source of energy of a second character at said first station, a first means energized from said source of alternating current over a first supply circuit which includes in series therewith a plurality of said control wires, a second means energized from said source of alternating current over a second supply circuit which includes in series therewith all of the others of said control wires, a device energized in series with one of said supply circuits and effective when energized to interrupt said supply circuit and to establish the other supply circuit, and indication means responsive to alternate energization of said first and second means.

4. In checking means for use with a control system having six control wires extending between a first and a second station and employing energy of a first character for control purposes, a source of energy of a second character at said first station, a stick polar relay having a first winding effective when energized to move the relay contacts to one position and a second winding effective when energized to move the relay contacts to their other position, said relay being constructed so that when both windings of the relay are energized or deenergized its contacts remain in the position which they already occupied, a first supply circuit including in series therewith a plurality of said control wires for supplying energy from said source to the first winding of said relay, a second supply circuit including in series therewith all of the others of said control wires for supplying energy from said source to the second winding of said relay, a device energized in series with one of said supply circuits and effective when energized to interrupt said supply circuit and to establish the other supply circuit, and indication means responsive to movement of a contact of said relay between its two positions.

5. In checking means for use with a control system employing six control wires extending between a first and a second station, a source of alternating current, a transformer at said first station having a primary winding energized from said source of alternating current, said transformer having a secondary winding having a mid-terminal connected to the second control wire and having its end terminals connected to the first and third control wires, a relay at said first station having a first winding connected across the fourth and fifth control wires and a second winding connected across the fifth and sixth control wires, a control device located at the second station and having contacts biased to a first position and movable therefrom to a second position on energization of the device winding, means effective when the contacts of said device occupy their first position to connect the

winding of the device across the second and fifth control wires and to establish connection between the fourth and first control wires, means effective when the contacts of said device occupy their second position to establish connection between the second and fifth control wires and to establish connection between the sixth and third control wires, means at said second station connected across the first and third control wires and controlling the circuit of said control device winding, and indication means responsive to movement of the relay contacts between their two positions.

6. In checking means for use with a control system having a plurality of control wires extending between a first and a second station and employing energy of a first character for control

purposes, in combination, a source of energy of a second character, an electroresponsive device having a first winding energized by current supplied from said source over a first supply circuit including in series therewith some of said control wires and having a second winding energized by current supplied from said source over a second supply circuit including in series therewith the others of said control wires, means energized by current supplied over one of said supply circuits and effective when energized to interrupt said supply circuit and to establish the other of said supply circuits, and indication means responsive to alternate energization of the windings of said electroresponsive device.

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