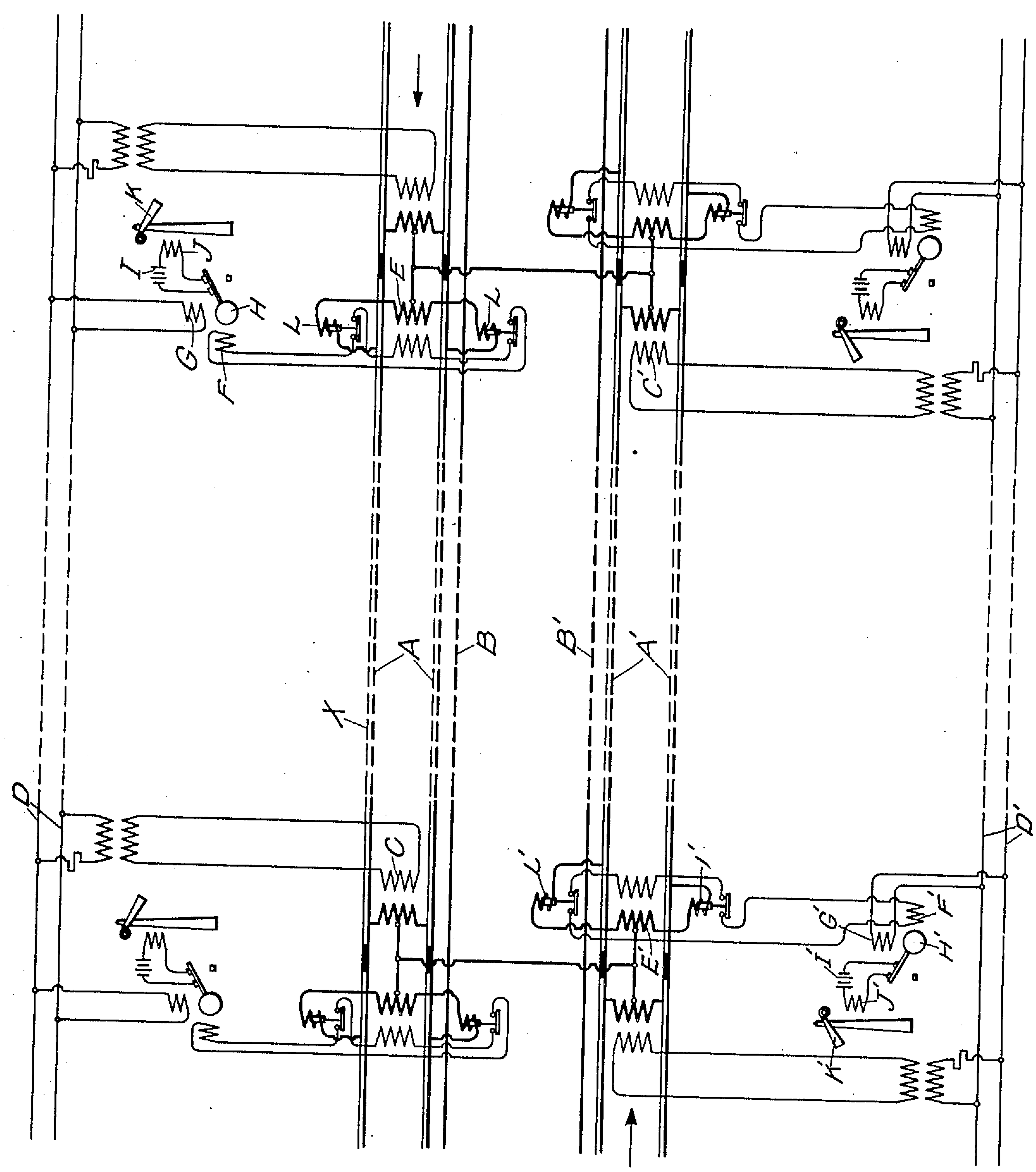
No. 869,365.

PATENTED OCT. 29, 1907.

L. A. HAWKINS.

BLOCK SIGNAL SYSTEM.

APPLICATION FILED MAR. 28, 1906.



Witnesses:
Murray D Badgley
Helen Oxford

Inventor
Laurence A. Hawkins
By Albert G. Davis
Att'y.

UNITED STATES PATENT OFFICE.

LAURENCE A. HAWKINS, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

BLOCK-SIGNAL SYSTEM.

No. 869,365. **Specification of Letters Patent.** **Patented Oct. 29, 1907.**

Application filed March 28, 1906. Serial No. 308,433.

To all whom it may concern:

Be it known that I, LAURENCE A. HAWKINS, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Block-Signal Systems, of which the following is a specification.

My invention relates to block signal systems for electrically-operated roads employing the rails as return conductor for the power-current. It has been proposed heretofore to provide such roads with alternating-current signal systems, since by the use of alternating-currents the signal system may be so arranged as not to be interfered with by direct power-current or by alternating power-current of different frequency. The general arrangement that has been proposed heretofore comprises means for supplying alternating-current to the rails of a block and an inductive winding connected to the signal end of the block. This inductive winding may be the primary of a transformer, the secondary of which supplies the track relay, or it may be a reactance coil shunting the track relay; the winding in either case being formed of a conductor large enough to carry the power-current, and having sufficient reactance so as not to act as a short-circuit for the high frequency alternating signal-current. Adjacent blocks are connected so as to form a path for the power-current. This connection is preferably formed between equipotential points with respect to the signal current,—that is, from the central point of the inductive winding, before mentioned. With this connection the power-current in the two portions of the inductive winding on opposite sides of the connection is in opposition, so that the signal-current and power-current pass through the same conductors without interference. This connection and the results obtained thereby are fully explained in Patents Nos. 645,907 and 647,741, issued to Bedell, March 20, 1900, and April 17, 1900, respectively and need not be further discussed here.

A signal system as briefly outlined above has been found to be satisfactory as far as single tracks are concerned. It sometimes happens, however, in the case of roads having parallel tracks that it is desired to cross-bond the two tracks so as to improve the conductivity of the system for the power-current. The addition of such cross-connections between the ends of parallel blocks introduces certain difficulties which it is the object of the present invention to remove. These difficulties arise from the fact that since the two parallel blocks are electrically connected in parallel, a rail on one block may be broken without causing the signal for that block to go to danger, since the parallel block serves as a shunt around the broken rail. This is obviously a source of danger.

My invention consists in inserting between a cross-connection and a rail of a block, signal-controlling means whereby the signal may be caused to go to danger when the controlling means is deënergized. Since the signal controlling means is inserted between the cross-connection and the rail it will always be deënergized when that rail is broken, whether current is flowing through the cross-connection to the other rail or not. Consequently, a broken rail will always be protected and the signal set automatically at danger.

My invention will best be understood by reference to the accompanying drawing, which shows diagrammatically a block signal system for electrically-operated roads arranged in accordance with my invention.

In the drawing A and A′ represent the rails of two parallel blocks of a double-track road.

B and B′ represent the supply conductors for the power-current.

The block A is supplied with alternating-current by means of a transformer C, the primary of which is connected directly or through a step-down transformer to the alternating-current supply-conductors D. A transformer E has its primary connected to the opposite end of the block, and its secondary supplies a coil F of the track relay. This relay is shown as of the polyphase induction type, the other primary coil G being supplied directly or through a transformer from the alternating-current line-wires D. Such a relay is wholly unaffected by an unbalanced fluctuating power-current in the primary of the transformer E. The short-circuited secondary member H of the relay carries a contact adapted to close a circuit through the source of current I and the operating mechanism J of a signal K. This operating mechanism is illustrated diagrammatically, as it forms no part of my present invention.

L L represent relays which may be of the ordinary solenoid type inserted between the primary transformer winding E and the rails of the block.

A connection is made from the central points of the secondary of transformer C and of the primary of transformer E to corresponding points on adjacent blocks. Through these connections the power-current is transmitted, normally passing in opposite directions and in substantially equal amounts through two parts of the transformer winding on each side of the connection. Furthermore, cross-connections between the two tracks are made as shown in the drawing, so as to bond the two tracks together, thereby improving the general conductivity of the system. Without these cross-connections, it is obvious that a break in one rail of the block A, as, for instance, at X, would prevent the flow of current in any portion of the block, and would consequently put the signal K at danger, since the relay coil F would be deënergized. With the cross-connections, however, this is no longer true. For instance, with a break at X current may flow from the central point of the secondary of transformer C through the cross-connection to the opposite track, through the two portions of the primary of transformer E′ in opposite directions, through the two rails A′ in parallel, through the two portions of the secondary of transformer C′ in opposite directions, through the cross-connection to the central point of the primary of transformer E, through the lower half of the primary winding, and through the lower rail A to the lower terminal of the secondary of transformer C. Since this current flows in opposite directions through the windings of transformers E′ and C′, these windings are practically non-inductive, and so offer practically no impedance to this current, which, passing through one-half of the primary winding of transformer E, induces an electromotive force in the secondary winding, which energizes relay F and may hold the relay in position to keep the signal K at clear. In order to prevent such a contingency, the relays L L are employed. One of these relays is inserted between the cross-connection from the opposite track and each of the rails of the block A. These relays are normally held in the position shown by the alternating signal-current. They may be of the simple solenoid type, since the only effect of the power-current is to hold the relay contacts more firmly closed. The only requisite in the design of these relays is that their windings shall be of large enough cross-section to carry the power-current, and at the same time that the relays shall be sensitive enough to be held closed by the alternating signal-current. Since both relays L L are energized only when current is flowing through both rails, it is evident that if either rail breaks, one of the relays will be deënergized, since in that case neither signal-current nor power-current can pass through it. Thus, for instance, if a break occurs at X the upper relay L will be deënergized, thereby breaking the circuit of the relay winding F so as to cause the relay to open the signal-operating circuit and put the signal at danger. The contacts of both relays L are in series with the winding F so that if either relay is deënergized, the signal will go to danger.

Obviously, the contacts of the relays L may be included in any other circuit, which, when opened, will put the signal at danger. Furthermore, these relays may be of any desired construction, instead of the simple solenoid type shown. Consequently, I do not desire to limit myself to the particular construction and arrangement of parts here shown, but aim in the appended claims to cover all modifications which are within the scope of my invention.

What I claim as new, and desire to secure by Letters Patent of the United States, is,—

1. In a signal system for electrically-operated roads having parallel tracks and employing the rails as return conductor for the power-current, means for supplying alternating-current to the rails of a block, an inductive winding connected across the rails at one end of the block, a cross-connection between said block and a parallel block adapted to form a path for the power-current, and signal controlling means inserted between said cross-connection and a rail of the block.

2. In a signal system for electrically-operated roads having parallel tracks and employing the rails as return conductor for the power-current, means for supplying alternating-current to the rails of a block, an inductive winding connected across the rails at one end of the block, a cross-connection between said block and a parallel block adapted to form a path for the power-current, a winding inserted between said connection and a rail of the block, a signal for the block, and means for causing the signal to indicate danger upon a failure of current in the last-mentioned winding.

3. In a signal system for electrically-operated roads having parallel tracks and employing the rails as return conductor for the power-current, means for supplying alternating-current to the rails of a block, an inductive winding connected across the rails at one end of the block, a cross-connection between said block and a parallel block adapted to form a path for the power-current, a winding inserted between said connection and a rail of the block, a signal for the block, and controlling means for the signal controlled by the current in the last-mentioned winding.

4. In a signal system for electrically-operated roads having parallel tracks and employing the rails as return conductor for the power-current, means for supplying alternating-current to the rails of a block, an inductive winding connected across the rails at one end of the block, a cross-connection between said block and a parallel block adapted to form a path for the power-current, a relay winding inserted between said connection and a rail of the block, a signal for the block, and connections whereby said signal is caused to indicate danger when said relay is deënergized.

5. In a signal system for electrically-operated roads employing the rails as return conductor for the power-current, means for supplying alternating-current to the rails of a block, an inductive winding connected across the rails at one end of the block, a connection from the central point of said winding to an adjacent block adapted to afford a path for the power-current and signal-controlling means in series with said winding on each side of said connection.

6. In a signal system for electrically-operated roads employing the rails as return conductor for the power-current, means for supplying alternating-current to the rails of a block, a transformer having its primary connected across the rails at one end of the block, a connection from the central point of said primary to adjacent blocks adapted to afford a path for the power-current, a signal-controlling relay supplied from the secondary of said transformer, and signal-controlling means in series with the primary on each side of said connection.

7. In a signal system for electrically-operated roads employing the rails as return conductor for the power-current, means for supplying alternating-current to the rails of a block, an inductive winding connected across the rails at one end of the block, a connection from the central point of said winding to adjacent blocks adapted to afford a path for the power-current, two windings in series with the first on opposite sides of said connection, a signal, and means for causing the signal to indicate danger upon a failure of current in either of said two windings.

8. In a signal system for electrically-operated roads employing the rails as return conductor for the power-current, means for supplying alternating-current to the rails of a block, an inductive winding connected across the rails at one end of the block, a connection from the central point of said winding to adjacent blocks adapted to afford a path for the power-current, two windings in series with said inductive winding on opposite sides of said connection, a signal, and controlling means for said signal controlled by the current in each of said two windings.

9. In a signal system for electrically-operated roads employing the rails as return conductor for the power-current, means for supplying alternating-current to the rails of a block, an inductive winding connected across the rails at one end of the block, a connection from the central point of said winding to adjacent blocks adapted to afford a path for the power-current, two relays in series with said winding on opposite sides of said connection, a signal, and connections whereby said signal is caused to indicate danger when either of said relays is deënergized.

10. In a signal system for electrically-operated roads employing the rails as return conductor for the power-current, means for supplying alternating-current to the rails of a block, an inductive winding connected across the

rails at one end of the block, a connection from the central point of said winding to adjacent blocks adapted to afford a path for the power-current, two relays in series with said winding on opposite sides of said connection, a signal, a circuit passing through the contacts of both relays, and means in said circuit for causing said signal to indicate danger when said circuit is broken.

11. In a signal system for electrically-operated roads having parallel tracks, a connection from an end of a block to the parallel track adapted to form a path for the power-current, a relay winding inserted between said connection and a rail of the block, a signal for the block, and connections whereby said signal is caused to indicate danger when said relay is deënergized.

12. In a signal system for electrically-operated roads having parallel tracks, a connection between an end of a block and the parallel track adapted to form a path for the power-current, independent windings inserted between said connection and the rails of the block, independent relay contacts controlled by the current in said windings respectively, a signal for the block, and operative connections between both relay contacts and the signal.

In witness whereof, I have hereunto set my hand this 26th day of March, 1906.

LAURENCE A. HAWKINS.

Witnesses:
BENJAMIN B. HULL,
HELEN ORFORD.