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M. R. HANNA.

ALTERNATING CURRENT BLOCK SIGNAL SYSTEM.

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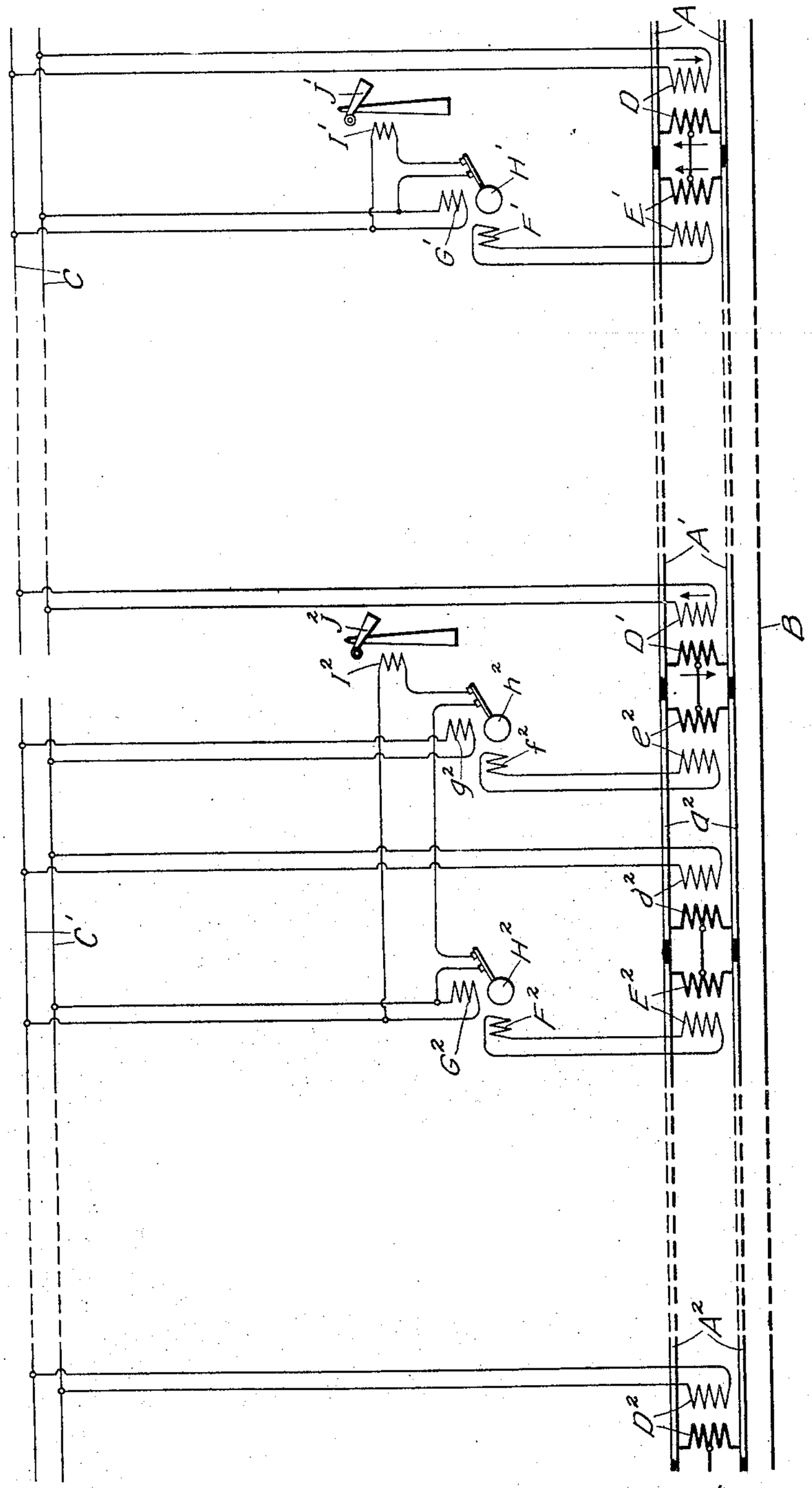

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UNITED STATES PATENT OFFICE.

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ALTERNATING-CURRENT BLOCK-SIGNAL SYSTEM.

No. 835,419. Specification of Letters Patent. Patented Nov. 6, 1906.

Application filed April 26, 1906. Serial No. 313,809.

To all whom it may concern:

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

My invention relates to alternating-current signal systems, such as have been proposed for use on electrically-operated roads. On roads where the rails are used as return-conductor for the power-current it is necessary to connect adjacent blocks by a conductor adapted to carry the power-current. This connection may be made by leaving one rail continuous and sectioning the other or by sectioning both rails and connecting equipotential points of adjacent track-circuits to each other by the method described in Patents No. 645,907 and No. 647,741, issued to Bedell March 20, 1900, and April 17, 1900. With either connection the failure of a single insulating-joint will close a circuit from the supply-transformer of one block to the other block, so as to energize the track-relay. Because of this there is danger of obtaining a clear indication from a signal while a train is in the block, the relay being energized from the preceding block through the defective insulating-joint; but this can ordinarily be readily avoided by connecting the supply-transformers of alternate blocks reversely, so that in case an insulating-joint fails the current supplied to the relay will be of a phase opposite to normal, so that by employing a relay of a type responsive to a reversal of phase this leakage-current acts only to hold the relay in its open-circuit position. Similar connections have been employed with batteries and polarized relays in direct-current signal systems. This arrangement removes all danger from leakage-current as long as all the blocks are supplied with signal-current from the same source. It frequently happens, however, that it is desirable to section the supply-conductors for the track-transformers and connect them to different stations, which may sometimes operate in parallel and sometimes not. When the two stations are not operating in parallel, it is evident that the relative phases of the voltages on the supply-conductors are indeterminate, and consequently the arrangement outlined above by itself would not insure against trouble from leakage-currents between two adjacent blocks supplied from different stations. The object of my invention is to take care of this contingency, and to that end I insert between the two adjacent blocks supplied from different stations a short track-section with its supply-transformer connected to the same conductors as the supply-transformer of one of the two adjacent blocks and connect it oppositely with respect to that transformer, and I provide a relay for the short track-section and interlock it with the relay of the adjacent block supplied from the same conductors, so that the two relays jointly control the signal for that block. In this manner, as will appear from the following explanation, all danger from leakage-currents is avoided.

My invention will best be understood by reference to the accompanying drawing, which shows diagrammatically an alternating-current signal system arranged in accordance with my invention.

In the drawing, A A′ A^2 represent the rails of three blocks of the system.

B represents a third rail or other supply-conductor for power-current.

C C′ represent alternating-current-supply-conductors, which may be connected to different stations.

D D′ D^2 represent transformers connected to the supply-conductors and supplying signal-current to the track-circuits of the blocks.

E′ E^2 represent transformers having their primaries connected to the track-circuits and their secondaries connected to one phase of the track-relays, which are shown as of the polyphase induction type. Thus the winding F′ of the track-relay for the block A′ is supplied from the secondary of transformer E′, while the other phase G′ is supplied directly from the conductors C.

H′ represents a short-circuited secondary member adapted when both phases of the relay are energized with currents of proper phase to close the circuit of the operating mechanism I′ of the signal J′. A relay of

this type is responsive to a reversal of phase in either winding—that is, if the phase of the current in winding F′ should be reversed the torque in the secondary member would tend to move it away from closed-circuit position, so as to put the signal at "danger."

The central point of the secondary of transformer D is connected to the central point of the transformer E′, so as to afford a path for the power-current, and the other blocks are similarly connected, this being the equipotential connection described in the Bedell patents before mentioned.

It will be observed that transformers D and D′ are oppositely connected to the supply-conductors. Consequently if the upper conductors C be assumed positive at a given instant the directions of current-flow in the several circuits will be as indicated by the arrows. As shown by the arrows, the currents in the primary of transformer E′ and in the secondary of transformer D are normally in the same direction. Now if either of the insulating-joints between blocks A and A′ should fail one-half of the secondary of transformer D would be short-circuited on one-half of the secondary of transformer E′, and with a train in block A′ the current that might flow through this short circuit might be sufficient to supply to the relay-winding F′ a current of practically normal amount; but this current will be of a phase the reverse of normal. Consequently, as has been explained heretofore, the only effect that it could have upon the relay would be to hold it all the more firmly in off position. Thus by properly connecting the supply-transformers for the blocks and by using relays of a type responsive to a phase reversal all danger from leakage-currents is avoided as long as all the blocks are supplied with current from the same source. This alternately reverse connection of the supply-transformers is the same that has been employed with batteries in direct-current systems with polarized relays and has been described at length only for the purpose of giving a clear understanding of my invention.

In the case of two adjacent blocks supplied from separate stations the arrangement described above is not sufficient for protection. For instance, if conductors C, supplying the block A′, are connected to one station and conductors C′, supplying the block A^2, are connected to another station, and the two stations are not operating in parallel, it is obvious that the relative phases of the voltages supplied to the two track-circuits A′ and A^2 by the transformers D′ and D^2 will be indeterminate. In order to avoid the danger from leakage-currents in such a case, I insert the short track-section a^2 between the blocks A′ and A^2 and supply this short section from a transformer d^2, connected to the conductors C′, from which the block A^2 is supplied. By oppositely connecting D^2 and d^2 all danger of leakage-current due to a defective insulating-joint between block A^2 and section a^2 is avoided, so that the secondary member H^2 is always in off position as long as a train is in block A^2. The contacts of relay member H^2 are connected in series with the contacts of the relay member h^2 of the short track-section, so that the signal J^2 can give a clear indication only when both relays are in closed-circuit position. Consequently, although a defective insulating-joint between the short track-section and block A′ might hold the relay member h in closed position, even with a train in the short section, this is not a source of danger, since the section may be made so short that a train will enter block A^2 before it has left block A′. Consequently relay member H^2 will open before relay member H′ has closed, so that the train will always have a danger-signal behind it.

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 an alternating-current block-signal system, transformers supplying signal-current to the track-circuits of the blocks, separate supply-conductors for the transformers of two adjacent blocks, a short track-section inserted between said two blocks, a supply-transformer for said short section connected to the same supply-conductors as the transformer of one of the two blocks and oppositely connected with respect to that transformer, two relays supplied with alternating current respectively from the short section and from the adjacent block that is supplied from the same supply-conductors, said relays being responsive to a reversal of phase of said current, and a signal controlled by said relays jointly.

2. In an alternating-current block-signal system, transformers supplying signal-current to the track-circuits of the blocks, separate supply-conductors for the transformers of two adjacent blocks, a short track-section inserted between said two blocks, a supply-transformer for said short section connected to the same supply-conductors as the transformer of one of the two blocks and oppositely connected with respect to that transformer, two polyphase relays having one phase supplied respectively from the short section and from the adjacent block supplied from the same supply-conductors, and a signal controlled by said relays jointly.

3. In an alternating-current block-signal system, a plurality of sets of signal-current-supply conductors, transformers connected to said conductors and supplying the track-circuits of the blocks, the transformers of adjacent blocks supplied from the same supply-conductors being oppositely connected, and a short rail-section interposed between two adjacent blocks supplied from different conductors.

In witness whereof I have hereunto set my hand this 25th day of April, 1906.

MAX R. HANNA.

Witnesses:
BENJAMIN B. HULL,
HELEN ORFORD.