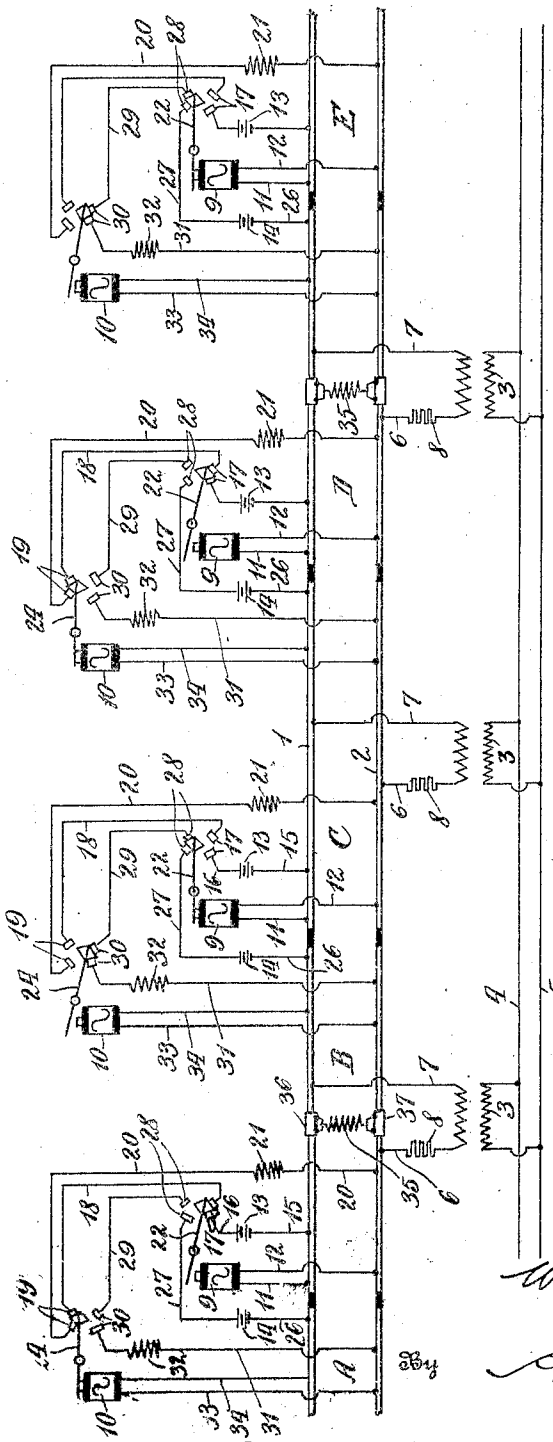
W. W. MACFARLANE.

TRACK CIRCUIT SYSTEM.

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1,383,319. Patented July 5, 1921.



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TRACK-CIRCUIT SYSTEM.

1,383,319. Specification of Letters Patent. Patented July 5, 1921.

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To all whom it may concern:

Be it known that I, WILLIAM W. MACFARLANE, a citizen of the United States, and a resident of Elkins Park, in the county of Montgomery and State of Pennsylvania, have invented certain new and useful Improvements in Track-Circuit Systems, of which the following is a specification.

This invention relates to a system of track circuits particularly adapted for use in connection with a system of train control such as is disclosed in application Ser. No. 95305 filed May 4, 1916, and renewed as Serial No. 211,669, Jan 12, 1918; again renewed as Serial No. 247,867, Aug. 1, 1918; and again renewed as Serial No. 280,194, Mar. 1, 1919, of which this application is a division.

The principal object of the invention is to provide a system of track circuits by means of which the movement of a train along a track in either direction can be continuously and automatically controlled without the use of ramp rails or stationary contacts other than the track rails.

With this, and other objects in view, the invention consists principally in the provision of means controlled by the presence of a train in a block section for supplying current to the rails of the section to control the passage of a train therethrough.

Another feature of the invention is the provision of means for controlling the supply of the train controlling current to the train occupied block by the traffic condition of the block section next in advance regardless of the direction of travel of the train.

The track circuit system disclosed is particularly adapted for use on a single track railway. In addition to the ordinary normally closed track circuit in each block section, other normally open circuits are employed that are adapted to furnish to the rails of the block train controlling current of a different character than that supplied by the normally closed circuit. Either alternating or direct current may be used in both the normally open and the normally closed circuits provided the current in the different circuits be made to distinguish by some characteristic of phase, frequency, voltage or the like. Preferably, however, alternating current is employed for the normally closed circuit and direct current for the normally open train controlling circuits.

Other features of the invention will be referred to as the specification proceeds.

In the drawing there is represented a general diagrammatic view of a track circuit system embodying the invention.

In the track circuit system illustrated the track rails 1 and 2 are divided into suitable block sections A, B, C, D and E which are insulated from each other in the usual manner. In the form shown, each block has normally impressed thereon an alternating current supplied by the transformer 3 connected across the line conductors 4 and 5. The supply conductors 6 and 7 connect the secondary of the transformer to the rails at points near the middle of each block section. A non-inductive resistance 8 is preferably interposed in the conductor 6 to prevent an excessive flow of current from the transformer when a train is bridging the rails near the points of connection of the supply conductors 6 and 7 therewith.

Each block section is provided with two alternating current track relays 9 and 10 connected to the rails at the ends of the block through the conductors 11—12 and 33—34 respectively and adapted to be normally energized by current from the transformer 3 when the block is not occupied by a train, in a manner well-known in the signaling art. These track relays are preferably of the type which will respond only to a given frequency which, of course, will be that characteristic of the current supplied by the transformer 3, and will therefore be immune to direct current or to alternating current of a different frequency from that in connection with which they are designed to operate. If found desirable, some form of condenser might be provided in the connection between each alternating current relay and the track to prevent direct current from interfering with these relays.

The track rails of each block have also connected thereto at opposite ends of the block, the sources of direct current 13 and 14 which supply current for controlling suitable train governing devices preferably mounted on the locomotive of the train and

arranged to be supplied with current from the rails. The current sources 13 and 14 are preferably designed to furnish a current of comparatively low voltage and relatively large volume.

The source 13 is connected to the track rail 1 through the conductor 15 and to the track rail 2 through the conductor 16, contacts 17, conductor 18, contacts 19, and conductor 20 including resistance 21 to rail 2. The contacts 17 are adapted to be bridged by the circuit closer 22 which is adapted to be held out of engagement with the contacts when the track relay 9 is energized. When the relay 9 is deënergized, as by the short-circuiting effect of a train in the block, the circuit closer 22 is moved by the action of gravity into engagement with the contacts 17. Normally the circuit including the source 13 is open at the contacts 17 and is closed at this point coincidently with the entrance of a train into the block and upon the consequent deënergization of the track relay 9.

The contacts 19 in the circuit through the source 13 are normally bridged by a circuit closer 24 controlled by the track relay 10 of the adjacent end of the adjoining block. The action of gravity will move the circuit closer 24 out of bridging engagement with the contacts 19 upon deënergization of relay 10 caused by the presence of a train in the corresponding block. Thus, under normal conditions,—that is, when no train is in either of two adjacent blocks,—the circuit through the source 13 of one block is open at the contacts 17 and closed at the contacts 19.

At the other end of each block the source of current 14 is connected through the conductor 26 to the track rail 1 and through the conductor 27, contacts 28, conductor 29, contacts 30, and conductor 31 including the resistance 32 to the track rail 2. The contacts 28 are adapted to be bridged by the circuit closer 22 when the relay 9 of the adjacent end of the adjoining block is energized, while the contacts 30 are adapted to be bridged by the circuit closer 24 when the track relay 10 is deënergized.

It will be apparent that, when the insulated blocks on both sides of any given block are unoccupied by a train, the contacts of the train control circuits of the given block which are under the control of the relays in the adjacent blocks will be closed. Consequently, a train which may be present in the given block will have current supplied to its controlling device by the closed control circuit at the end of the block which it is approaching, since the contacts of the control circuits that are governed by the train-occupied block are also closed because of the deënergization of the track relays 9 and 10.

Specifically, the circuit over which current is supplied to the left-hand end of block B and thence to the train controlling device on the locomotive of the train traveling through that block, is as follows: battery 13, conductor 16, contacts 17, bridged by the circuit closer 22, conductor 18, contacts 19 bridged by circuit closer 24, conductor 20 including resistance 21, track rail 2, contact member 37 in engagement with rail 2, coil 35, contact member 36, track rail 1 and conductor 15 back to battery 13.

The current supplied by the circuit at the rear of the train will have no effect on the coil 35 of the controlling device carried by the locomotive because of the shunting effect of the wheels and axles of the train which are between the contact members 36 and 37 and the source at the rear. It will be clear, therefore, that a train entering the block to the rear will in no way affect the progress of the train in the block ahead but will itself be stopped because of its inability to take current from the circuit at the forward end of the block since this circuit will of course be open at the break controlled by the train in the block ahead. Consequently, when two trains are proceeding along the track in the same direction the forward train will not have its progress restricted by the presence of the train in the rear, while, on the other hand, the train to the rear cannot advance into the block immediately to the rear of the one occupied by the forward train. There must always be, then, in the track circuit system disclosed, an intervening clear block between two trains traveling in the same direction so that a following train can by no possibility approach near enough to the train in advance to cause a rear-end collision therewith.

In the case where two trains are approaching each other on a single track, since the train in an occupied block opens a break in the train control circuit of the block ahead, it will be clear that the approaching train will be stopped as soon as it enters the block ahead of the first train. It will be clear also that, since the second train opens the train control circuit in the adjacent end of the block ahead of it, that the first train will also be stopped as soon as it enters the block ahead of the second train.

To make this clear let us assume that trains in blocks B and D are approaching each other. The presence of a train in block B will deënergize relay 10 and open the circuit through battery 13 of block C so that, when the train in block D reaches block C, the controlling device on this train will not receive current from battery 13 and the train will accordingly be stopped. On the other hand, the entrance of a train into block

C, even though the train is immediately stopped, has the effect of deënergizing relay 9 at the left-hand end of the block. The effect of this is to open the controlling circuit at the right-hand end of block B and thus bring the train in that block to a stop. This is brought about as follows: Current is normally supplied to the rails at the right-hand end of block B from battery 14 by way of conductor 27, contacts 28, when bridged by circuit closer 22, conductor 29, contacts 30 bridged by circuit closer 24 because of the deënergized condition of relay 10, conductor 31 including resistance 32, track rail 2, contact member 37, coil 35, contact member 36, rail 1 and conductor 26 back to battery 14. It will be seen, the pressure of the train in block C will break this circuit by deënergizing relay 9 and permitting the circuit closer 22 to move out of engagement with contacts 28. This interruption of the supply of current from battery 14 to block B will automatically bring the train in block B to a stop.

Therefore, not only will a train approaching from the rear be stopped when it reaches the block immediately to the rear of the train-occupied block, but also both of the approaching trains will be stopped immediately upon entrance of either train into the block immediately ahead of the other train. The result of this is that no train can approach nearer than a block to another train regardless of whether the other train is running toward or away from the first train or is not moving at all. Also, of two trains running in the same direction, the following train will be prevented from approaching within dangerous proximity to the train ahead, while the train in advance, which is constantly tending to withdraw from what might become a dangerous position, will have no restriction whatever placed upon its movement by the approach of the train following. It will accordingly be obvious that each train, as it travels, creates and carries with it a protective zone that extends through the block immediately to the rear and the block immediately ahead of the train-occupied block, and thereby serves to prevent the approach of two trains to a position within a block-length of each other.

I claim:—

1. An electric traffic-controlling system comprising: track rails divided into insulated sections, means for supplying current having a certain characteristic to the rails intermediate the ends of each section, a circuit controller at each end of each section electrically connected to the rails and controlled by current from said current supplying means, and means for supplying current having a different characteristic to both ends of a train-occupied section to control the passage of a train therethrough when the circuit controllers at the adjacent ends of the adjoining sections are energized.

2. An electric traffic-controlling system comprising: track rails divided into insulated sections, means for supplying current having a certain characteristic to the rails of each section, a circuit controller at each end of each section electrically connected to the rails and controlled by current from said current supplying means, and means for supplying current having a different characteristic to the rails at the exit end of a train-occupied section to control the passage of a train therethrough when the circuit controller at the entrance end of the next adjoining section is energized and regardless of the direction of travel.

3. An electric traffic-controlling system comprising: track rails divided into insulated sections, means for supplying alternating current to the rails of each section, a circuit controller for each section electrically connected to the rails thereof and controlled by current from said alternating current supplying means, and means for supplying direct current to the rails at the exit end of a train-occupied section to control a train therein when the circuit controller at the entrance end of the next adjoining section is energized.

4. An electric traffic-controlling system comprising: track rails divided into insulated sections, means for supplying alternating current to the rails of each section, a relay for each section controlled by current from said alternating current supplying source, and means controlled by each relay for supplying direct current to the rails of the next adjoining section.

5. An electric traffic-controlling system comprising: track rails divided into insulated sections, means for supplying alternating current to the rails of each section, a relay at the entrance end of each section controlled by current from said alternating current supplying means, and means controlled by each relay for supplying direct current to the rails at the exit end of the next adjoining section.

6. An electric traffic-controlling system comprising: track rails divided into insulated sections, means for supplying alternating current to the rails of each section, a relay at each end of each section electrically connected to the rails and controlled by current from said alternating current supplying means, and means controlled by said relays for supplying direct current to the rails of the adjoining sections.

7. An electric traffic-controlling system comprising: track rails divided into insulated sections, means for supplying alternating current to the rails of each section, a relay at each end of each section electrically connected to the rails and controlled by cur-

rent from said current supplying means, means controlled by one of said relays for supplying direct current to the rails at the adjacent end of the adjoining section, and means controlled by the other relay for supplying direct current to the rails at the adjacent end of the other adjoining section.

8. An electric traffic-controlling system comprising: track rails divided into insulated sections, means for supplying alternating current to the rails of each section, a circuit controller at the entrance end of each section electrically connected to the rails thereof and controlled by current from said alternating current supplying means, and means for supplying direct current to the rails at the exit end of a train-occupied section to control the passage of a train therethrough when the circuit controller at the entrance end of the next adjoining section is energized.

9. An electric traffic-controlling system comprising: track rails divided into insulated sections, means for supplying alternating current to the rails intermediate the ends of each section, a relay at each end of each section electrically connected to the rails and controlled by current from said current supplying means, and means for supplying direct current to both ends of a train-occupied section to control the passage of a train therethrough when the relays at the adjacent ends of the adjoining sections are energized.

10. An electric traffic-controlling system comprising: track rails divided into insulated sections, means for supplying alternating current to the rails of each section, a relay at each end of each section electrically connected to the rails and controlled by current from said alternating current supplying means, and means for supplying direct current to the rails at the exit end of a train-occupied section to control the passage of a train therethrough when the relay at the entrance end of the next adjoining section is energized and regardless of the direction of travel.

11. A system of train control comprising: a track divided into insulated blocks, means for continuously supplying current of a certain characteristic to the rails of each block, a track relay for each block normally energized by said current, and means controlled jointly by the relay in a given block and the relay in the block next in advance for supplying current of a different characteristic to the rails of the given block to control the passage of a train therethrough.

Signed at New York, in the county of New York and State of New York, this 18th day of September, 1917.

WILLIAM W. MACFARLANE.