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CONTINUOUS INDUCTIVE TRAIN CONTROL SYSTEM

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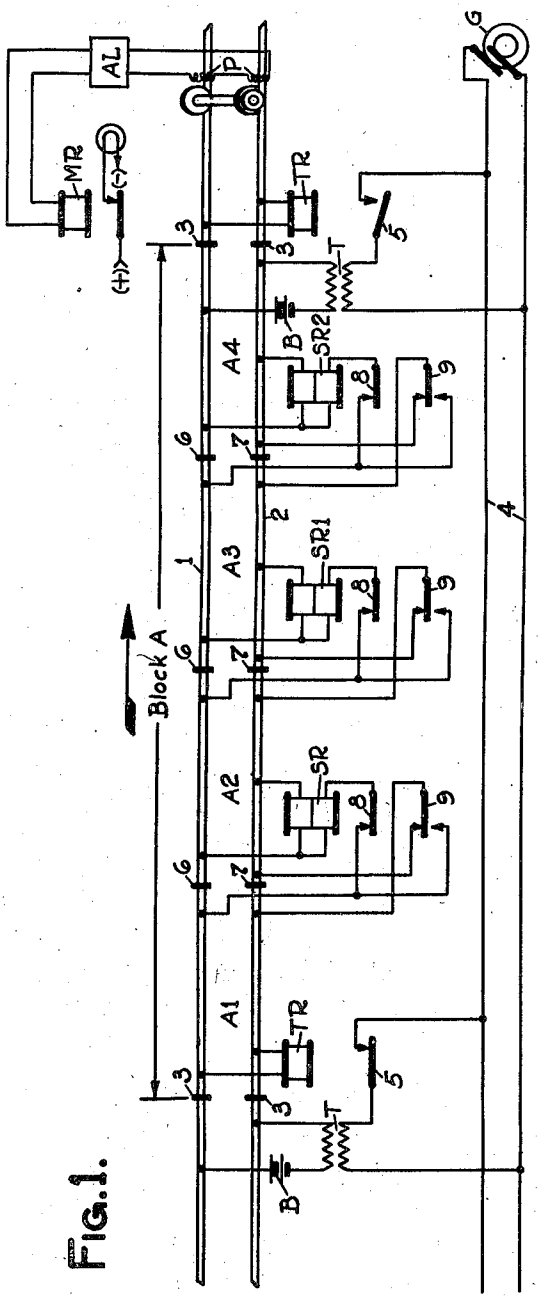


FIG. 1.

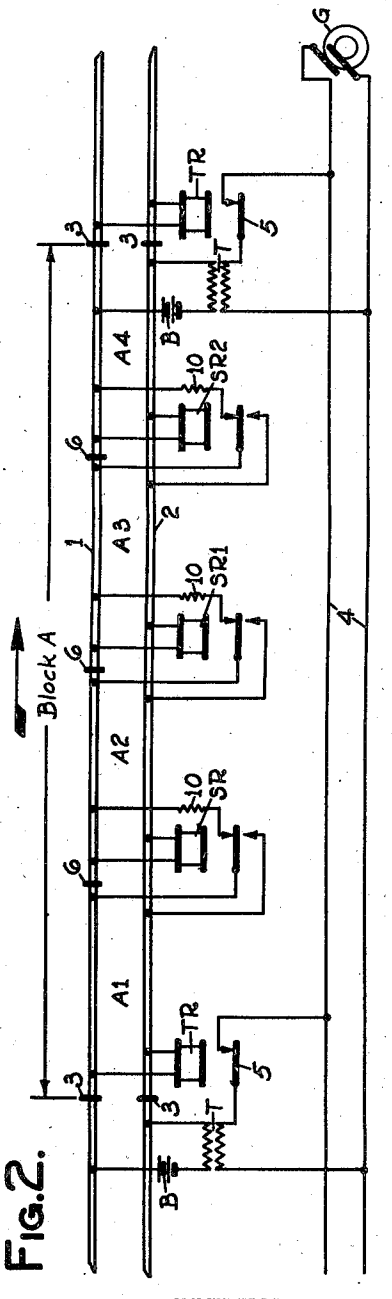


FIG. 2.

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CONTINUOUS INDUCTIVE TRAIN CONTROL SYSTEM

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11 Claims. (Cl. 246—57)

This invention relates to automatic train control and cab signal systems for railroads, and more particularly to such systems of the continuous inductive control type.

In the well-known continuous inductive control type of cab signal or train control system, with either coded or steady rail current, the presence of a train in a block is intended to shunt the rail current from a following train in the same block and cause the desired stop indication to be displayed on the following train. Under some conditions, more particularly where a relatively high inter-rail potential is employed for long blocks, and under exceptional unfavorable shunting conditions, there may be a substantial rail current for a following train in an occupied block which will tend to give an improper indication.

It is proposed in accordance with this invention to divide the block lengths, extending between the feed points for the train control or cab signalling rail current, into a plurality of shorter sections, and to provide means for opening the rail circuit in said sections behind a train in the block, so that the rail current is definitely cut off behind that train and the rails are shunted.

Various characteristic features, functions, and advantages of the invention will be in part apparent and in part explained as the description progresses.

In the accompanying drawing, Fig. 1 illustrates in a simplified and diagrammatic manner one specific embodiment of the invention; and Fig. 2 illustrates a modified organization.

In the application and use of the invention, it is contemplated that the usual track rails 1 and 2 will be bonded in the usual way, and also divided by insulated joints 3 into block lengths, one complete block A with the ends of two adjacent blocks being illustrated. The block length under consideration refers to that portion or section of track between the points at which rail current for cab signalling or train control is supplied to the track rails. Such a block may refer to the braking distance for maximum running speed, or only to a portion of such braking distance, according to the way in which the system of cab signalling or train control is organized.

It is also contemplated that each of these blocks will be provided with the usual track relay TR supplied with track circuit current from a suitable source at the other end of the block. In the particular arrangement shown, it is assumed that the track relay TR is of the usual direct current type, and is energized from a track battery B in series with the secondary of a transformer T, by which the usual rail current is supplied. This rail current for train control and cab signal purposes is preferably of a distinctive frequency, such as 100 cycles, and as shown, this current is supplied to the primary of the transformer T of each block from a suitable transmission line 4 energized from a generator G, each primary circuit including a front contact 5 of the track relay TR of the block next in advance in the usual way. It should be understood that this organization shown is merely illustrative or typical of various arrangements of steady or coded rail current systems with which the invention may be used.

It is contemplated that the locomotive or other leading vehicle of each train will be equipped with continuous inductive control cab signal or train control equipment of any one of the well-known types, with pick-up coils P, an amplifier and filter organization AL, and a primary or master relay MR, the particular type of such vehicle equipment forming no part of the present invention, and being illustrated in a simplified form merely to indicate the nature of the invention.

In accordance with this invention, each block length is divided into a plurality of sub-blocks or sections, four of which have been illustrated and designated A1, A2, etc. In the arrangement of Fig. 1, insulated joints 6 and 7 are included in both track rails to define the limits of these sections. At the entering end of each section (traffic being from left to right as indicated by the arrow), with the exception of the first section A1, the upper winding of a double-wound sectionalizing relay SR, SR1, etc. is connected across the track rails. Front contacts 8 and 9 of each sectionalizing relay SR establishes bridge or by-pass circuit connections around the adjacent insulated joints 6 and 7, the other lower winding of said relay being included in one of these by-pass connections, this winding being preferably of low resistance.

Under normal clear conditions, all of the sectionalizing relays SR, SR1, etc. of each block are energized, and their front contacts 8 and 9 close the by-pass or bridging circuits around the intermediate insulated joints 6 and 7, so that in effect the track rails are continuous throughout the length of the block, and the train control current and track circuit current may flow down these track rails from the feed end to the other end of the block.

When a train enters the first section A1 of a block, the track relay TR is deenergized, but current from the track rails through the wheels and axles of this train, passes through the lower

holding windings of the several sectionalizing relays SR, SR1, etc., thereby maintaining the front contacts of these relays closed in spite of the reduction of the inter-rail potential effected by the shunting action of the wheels and axles of the train in the section A1. The de-energization of the track relay TR opens its front contact 5 and cuts off the supply of rail current to the block in the rear, thereby providing the desired restricted indication for following trains in that block.

When the train in question enters the next section A2, current is shunted from both windings of the relay SR of that section, and this relay opens its front contacts 8 and 9 to interrupt the bridging or by-pass circuit connections around the insulated joints 6 and 7 at that point, thereby cutting off the supply of rail current to the first section A1 and also shunting the track thereof. In the same way, when the train enters section A3, the relay SR1 is de-energized to cut off current from the section A2; and the same operation is repeated as the train advances through the several sections.

Thus, a train at any point in the block interrupts or cuts off the supply of rail current to all sections in its rear, so that no rail current tending to give an improper indication can reach any following train in the same block. If the following train, however, should advance into the same section with the train ahead, such improper indication might be received; but in such a case the following train is so close to the train ahead that the engineer of the following train would unquestionably see the danger; and in any event, the distance for the train to accelerate after receiving an improper indication is so short that an excessive or disastrous speed cannot be attained, even though the engineer should fail to see the train ahead.

When a train leaves the last section A4 at the exit end of a block, the track battery B energizes the upper winding of the last sectionalizing relay SR2, which closes its front contacts 8 and 9 and establishes the by-pass circuits to supply the current to the next relay SR1 in the rear, which in turn picks up and supplies current to the next relay SR, and so on, until the track relay TR is energized.

From the foregoing it can be seen that this invention provides a special type of control for the rail current in occupied blocks in such a way that the rail current is definitely and positively cut off behind the train by insulated joints, and cannot cause an improper indication to be displayed on a following train in the same block.

In the modification illustrated in Fig. 2, the track rail 1 is divided by insulated joints into the blocks or sections, while the other rail 2 is continuous throughout the length of the block. The sectionalizing relays SR have only one winding connected across the track rails; but the by-pass connections around the joint, established through the front contact of such sectionalizing relay, includes a suitable resistance or impedance 10 of such value to prevent a train from entering the block from shunting out the sectionalizing relays ahead of it.

The invention has been illustrated as applied to a simple two indication system of cab signalling or train control; but the same principles and functions can be employed with systems giving three or more indications, either by steady rail currents distinctive in frequency, phase relation or the like, or by rail currents of the same frequency interrupted at different rates or in accordance with some code pattern. It should be understood, therefore, that the particular embodiment shown and described is merely illustrative; and that various adaptations, modifications, and additions may be made in this specific embodiment without departing from the invention.

What I claim is:—

1. In a system of continuous inductive control for railroads, the combination with a portion of track constituting a block, of means for supplying rail current to one end of said block, and means responsive to the presence of a train at intermediate points in said block for interrupting the rail circuit and the flow of rail current in the rear of such train.

2. In a system of the character described, a section of track supplied at one end with rail current and divided by insulated joints into a plurality of sections, means responsive to the presence of a train in each section for interrupting electrical connections bridging the joints at the ends of that section, whereby the presence of a train in an intermediate section of said block cuts off the rail current to sections in the rear.

3. In a system of cab signal for train control of the continuous inductive control type, a portion of track constituting a block and supplied with rail current at one end, said block being divided into a plurality of sections by insulated joints, relays connected across the track rails at each section and acting when energized to establish conductive paths around said joints at the entering end of that section, said relays being shunted by a train in the corresponding section to open said conducting paths and thereby cut off the supply of current to the sections in the rear.

4. In a system of the character described, a block supplied with rail current at the exit end and divided into a plurality of sections by insulated joints, electro-responsive means associated with each section acting when energized to establish bridging circuit connections around said joints, said means being successively de-energized as a train travelling through the block enters said sections.

5. In a system of the continuous inductive train control type, blocks each divided into a plurality of sections by insulated joints, a relay having the winding connected across the track rails at the entering end of each section, and bridging circuit connections around each of said joints at the entering end of each section controlled by a front contact of the corresponding relay.

6. In a system of continuous inductive control comprising, in combination with a block divided into a plurality of sections by insulated joints, a double-wound relay associated with each section and having one winding connected across the track rails at the entering end of that section, circuit connections around the joints at the entering end of each section including front contacts of the relay of that section, the other winding of said relay being included in one of said circuit connections.

7. In a system of continuous inductive control for railroads, the combination with a portion of track constituting a block, of means for supplying rail current to one end only of said block, and means responsive to the presence of a train at intermediate points in said block for interrupting the rail circuit and the flow of rail current in the rear of such train.

8. In a system of cab signal for train control of the continuous inductive control type, a portion of track constituting a block and supplied

throughout its length with rail current at one end, said block being divided into a plurality of sections by insulated joints, relays connected across the track rails at each section and acting when energized to establish conductive paths around said joints at the entering end of that section, said relays being shunted by a train in the corresponding section to open said conducting paths and thereby cut off the supply of current to the sections in the rear.

9. In a system of the character described, a block supplied throughout its length with rail current at the exit end and divided into a plurality of sections by insulated joints, electro-responsive means associated with each section acting when energized to establish bridging circuit connections around said joints, said means being successively de-energized as a train travelling through the block enters said sections.

10. In a system of the continuous inductive train control type, blocks each divided into a plurality of sections by insulated joints, a relay having the winding connected across the track rails at the entering end of each section, and bridging circuit connections around each of said joints at the entering end of each section controlled by a front contact of the corresponding relay to constitute a continuous conductive circuit through all of the blocks.

11. In a system of the continuous inductive train control type, blocks each divided into a plurality of sections by insulated joints, a relay having the winding connected across the track rails at the entering end of each section, and bridging circuit connections around each of said joints one at the entering end of each of said sections controlled by a front contact of the corresponding relay to constitute a continuous conductive circuit through all of the blocks, said bridging circuits having sufficient resistance to prevent a relay being deenergized by shunting due to a train in the section next in the rear.

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