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SIDING PROTECTION FOR SIGNALING SYSTEMS.

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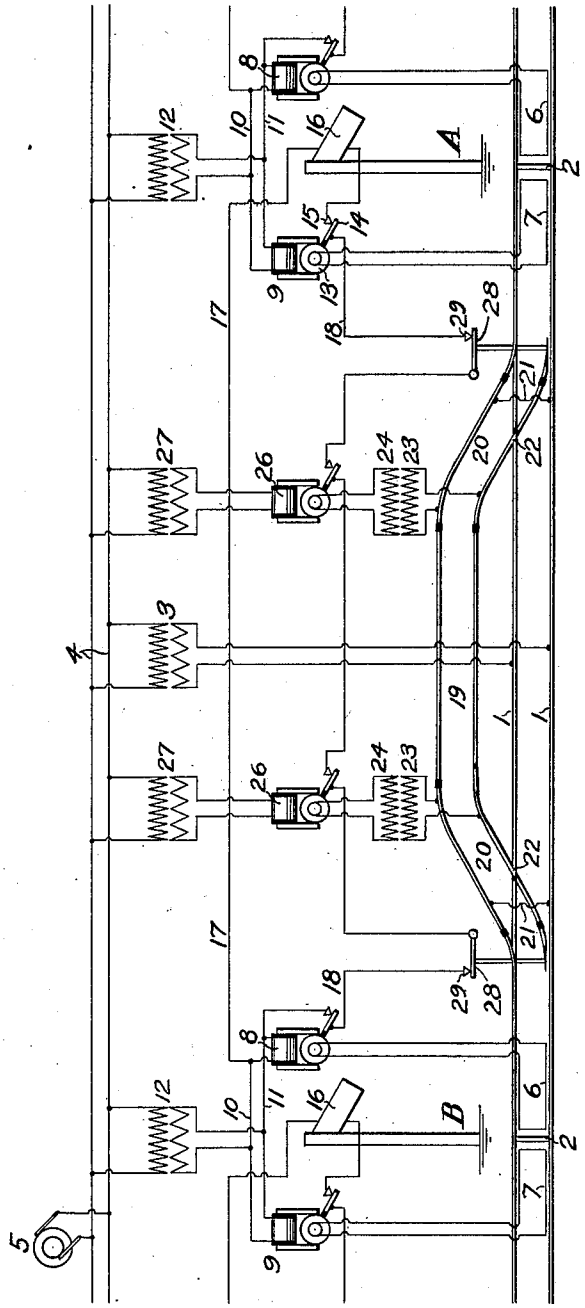

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SIDING PROTECTION FOR SIGNALING SYSTEMS.

1,097,241. Specification of Letters Patent. **Patented May 19, 1914.**

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To all whom it may concern:

Be it known that we, WILLIAM H. LANE and CLARENCE W. COLEMAN, citizens of the United States, residing at Westfield, in the county of Union and State of New Jersey, have invented a certain new and useful Improvement in Siding Protection for Signaling Systems, of which the following is a specification, reference being had therein to the accompanying drawings, forming part thereof.

Our invention relates to electric signal systems for railways, particularly to those of an automatic or semi-automatic character in which the signals are controlled by the trains, through their action on track circuits or otherwise. In signal systems of this character it is necessary, according to the accepted standards of safety, that the clearing of the signals shall depend not only upon the clear condition of the track, that is, the absence of rolling stock therefrom, but also upon the normal condition and operation of the track and the electric apparatus, so that the breakage of a rail or the breakage or failure of any portion of the electric apparatus shall be a "safe failure", *i. e.*, shall prevent the clearing of the signals.

Where a siding or spur connects with the main line it is necessary in the signal system to guard against two conditions: first, to prevent the clearing of the signals when the siding switch is open, for reasons which will be apparent, and, second, to prevent the clearing of the signals when the siding is occupied at a point so near to the main line as to cause danger of "side-wiping" or interference between the train on the siding and the train on the main line.

The object of the present invention is to produce a signal system for use in connection with a line provided with a siding, in which the required protection for the siding is provided for, and in which the apparatus is so arranged that a failure in the siding apparatus, or in the side track itself, is a safe failure to the same extent as a corresponding failure in the main line.

We will now describe the embodiment of our invention illustrated in the accompanying drawing, and will thereafter point out the invention in claims.

The drawing is a diagram of a part of a signal system embodying the invention, showing a siding and one complete block of the main line and portions of two adjacent blocks.

The two signal stations illustrated are designated as A and B, and as the apparatus at the several stations is in all respects similar, the corresponding portions of the apparatus are designated by similar reference numbers. In the following description the reference numbers are followed, where necessary, by the letters A or B to indicate the station at which the part mentioned is located.

The invention is illustrated as embodied in a signal system of the type in which the track circuits are energized by alternating currents and the signals are controlled by relays energized by inductive coils located within and close to the rails. The track rails 1 are continuously conductive so that in an electric railway they may serve as conductors for traction current, and they are divided into blocks by heavy cross-bonds 2 of negligible impedance. At or near the center of each block the track circuit is energized by a transformer 3 of which the secondary terminals are connected respectively to the two rails. The transformer is energized by connection with transmission wires 4 fed by a suitable generator 5. The track circuit has thus two branches, the current passing from one terminal of the transformer, in opposite directions, through one rail to the ends of the block, through the cross-bonds to the other rail, and back to the other terminal of the transformer.

The track coils 6 and 7 are located within and close to the rails of a short portion of each end of the block and are connected with the armature coils of track relays 8 and 9. These relays are of the polarized alternating-current type. Each relay (see relay 9^A) has a field magnet constantly energized through feed wires 10 and 11, by a transformer 12 of which the primary winding is connected with transmission wires 4. The armature 13 is pivoted and is provided with a coil connected with a track coil and carries a contact finger 14 coöperating with a fixed contact 15. As the current from the

track coil is derived, indirectly, from generator 5, it agrees in frequency with that in the field magnet of the relay, and normally the phase relation of the currents is such that the armature tends to rotate to raise the contact finger into engagement with the fixed contact. Upon the interruption of the current in the armature coil, the contact finger will fall and open the circuit controlled by it.

The signals 16 have a bias to danger position, but are normally held clear by electrically-controlled apparatus, which is not shown, as it may be of any suitable or ordinary character. Line wires 17 and 18 connect the stations and constitute signal-controlling line circuits. The line circuits pass through the contacts of the relays 8 and 9 and are normally held closed thereat.

A siding is illustrated, terminating at each end in a switch connecting it with the main line in block A—B. The main portion 19 of the siding is not operatively connected with the signal system, but at each end of the siding is an insulated section 20 forming a branch track circuit. The upper rails of sections 20 are connected by bonds 21 with the lower rail of the main track, while the lower rails of the sections 20 are connected by the frogs 22 with the upper rail of the main track. The primary winding 23 of a transformer is connected across the rails of each section 20, and the secondary windings 24 of these siding transformers are connected with the armature coils of siding relays 26. These relays are similar to the track relays above described and their field magnets are energized by transformers 27 connected with the transmission wires 4. The contact fingers and their fixed contacts of the siding relays 26 are connected with line wire 18 and are thus interposed in the line circuit.

In the normal condition of the apparatus a part of the current from the transformer 3 is diverted through the siding sections 20 and the siding transformers, so that the siding relays are normally energized and their contact fingers keep the line circuit closed. To open the line circuit when either siding switch is opened, two circuit breakers 28 cooperating with fixed contacts 29 are interposed in the line circuit. These circuit breakers are mechanically connected with the switches, so as to move to open-circuit position when the switches are opened.

The normal condition of the apparatus is shown in the drawing. Current from transformer 12^B flows through feed wire 10^B and line wire 17 to station A and signal 16^A. This line circuit returns through the fixed contact and contact finger of relay 9^A, thence by line wire 18 through the circuit breakers 28 and the fixed contacts and contact fingers of the siding relays 26, through the fixed contact and contact finger of relay 8^B, and back by feed wire 11^B to transformer 12^B. The signal at A is thus normally held clear. If a train enters block A—B at A, it short-circuits the eastern end of the track circuit, thereby deënergizing track coil 7^A and relay 9^A, and as the line circuit through signal 16^A is thus broken by the action of the contact finger of the relay, the signal goes to danger position behind the train. When the train reaches the western branch of the track circuit, track coil 6^B and relay 8^B are similarly deënergized, so that the line circuit is kept open until the train leaves the block. When the train enters the block in advance of B signal 16^B is similarly set at danger position, while line circuit A—B is reëstablished automatically and signal 16^A is again cleared. If either siding switch be opened, the line circuit is thereby opened by one of the circuit breakers 28 and the signal at A is thereby set at danger position to prevent the admission of a train at A. With the siding switches closed, if a train on the siding moves into either of the sections 20, so as to be in dangerous proximity to the main line, the corresponding siding transformer is thereby deënergized and the siding relay 26 opens the line circuit and signal 16^A goes to danger position. Finally, if a rail of either section 20, or either of the cross-bonds 21, becomes broken, the corresponding siding relay is deënergized and opens the line circuit so as to set the signal at danger. Any failure in either of the siding track circuits is thus, owing to the use of the siding relays, a safe failure, and results in setting the signal at A to danger position.

The operation of the siding relays alone is sufficient to open the line circuit whenever the sections 20 are occupied, so that the track circuits comprising these sections may be quite independent from the main-line track circuits, but by connecting them with the latter and energizing them from a common source we not only simplify the apparatus, but also gain the additional element of safety residing in the fact that a short-circuit of either siding track circuit will operate also as a short circuit of the corresponding branch of the main track circuit, so that the line circuit will be interrupted by one of the line relays as well as by the siding relay. Also, the relay controlled by either siding branch of the track circuit may be deënergized by a railway car on the main track, either between the supply transformers 3 and the siding switch or near the siding switch between it and the end of the block.

It will be observed that in the present invention we do not rely upon the short-circuiting of the main-line track circuit through a car or train on the siding to control the signals; but we so arrange the apparatus that the siding branch of the track

circuit has an independent control over the signals, so that the clearing of the signals depends upon the normal condition of the siding circuit, or portion of the track circuit embodied in the siding, as well as upon the normal condition of the track circuit in the main line. The arrangement is such, in fact, that the track circuit in the siding may be quite independent from the circuit in the main line. We prefer, however, to arrange it as a branch of the main track circuit, both for the convenience of energizing the circuits from a common source and for the additional element of safety resulting from the short-circuiting of the main track circuit by the siding circuit and vice versa.

The invention is illustrated, for convenience, in connection with a simple signal system comprising only home signals, but it will be obvious that it may be embodied in other usual systems.

Various other modifications may be made in the embodiment of our invention hereinbefore described and illustrated in the accompanying drawing, within the nature of the invention and the scope of the following claims.

We claim:

1. A signal system comprising, in combination with a main line and a siding, a signal on the main line, a main signal-controlling circuit controlled by trains on the main line, signal-controlling apparatus energized thereby, a branch circuit controlled by trains on the siding, and signal-controlling apparatus energized thereby, the main-circuit signal-controlling apparatus and the branch-circuit signal-controlling apparatus being arranged to control the signal independently of each other.

2. A signal system comprising, in combination with a main line and a siding, a signal on the main line, a main signal-controlling circuit controlled by trains on the main line, signal-controlling apparatus energized thereby, a branch circuit controlled by trains on the siding, and signal-controlling apparatus energized thereby, the signal being arranged to be cleared by the simultaneous energization of the main-circuit signal-controlling apparatus and the branch-circuit signal-controlling apparatus.

3. A signal system comprising a signal-controlling track circuit including a main track, a signal, a siding, a signal-controlling track circuit including the siding rails, and signal-controlling relays controlled by said track circuits and arranged to clear the signal by the simultaneous energization of both relays.

4. A signal system comprising a main track, a signal-controlling track circuit including the main track rails, a signal, a siding, a signal-controlling track circuit including the siding rails, and separate signal-controlling apparatus for each track circuit, each apparatus being energized by its respective track circuit and constructed and arranged to prevent the clearing of the signal independently of the other apparatus when its track circuit is broken.

5. A signal system comprising a main track, a signal-controlling track circuit including the main track rails, a signal, a siding, a signal-controlling track circuit including the siding rails, a line circuit in control of the signal, and a separate relay for each track circuit, each relay being energized by its respective track circuit and constructed and arranged to open the line circuit independently of the other relay when its track circuit is either broken or short-circuited by a railway vehicle.

6. A signal system comprising a main track, a signal-controlling track circuit including the main track rails, a signal, a siding, a signal-controlling track circuit including the siding rails and including a portion of the main track circuit, common means for energizing the two track circuits, and separate signal-controlling apparatus for each track circuit, each apparatus being energized by its respective track circuit and constructed and arranged to prevent the clearing of the signal independently of the other apparatus when its track circuit is broken.

7. A signal system comprising a main track, a signal-controlling track circuit including the rails of the main track, a signal, a siding, a signal-controlling track circuit including the rails of the siding and including a portion of the main track circuit, common means for energizing the two track circuits, and separate signal-controlling apparatus for each track circuit, each apparatus being energized by its respective track circuit and constructed and arranged to prevent the clearing of the signal independently of the other apparatus when its track circuit is broken.

8. A signal system comprising, in combination with a main line and a siding, a signal on the main line, signal controlling apparatus, a main signal-controlling circuit arranged to energize the signal-controlling apparatus, a track circuit controlled by trains on the main line, a branch of the track circuit controlled by trains on the siding, and two electro-translative devices, one under the control of the main track circuit and the other under the control of the branch and each electro-translative device being arranged to open the main signal-controlling circuit when its circuit is de-energized.

9. A signal system comprising a main track, a signal-controlling track circuit including the rails thereof, means for energizing said track circuit with a periodic cur-

rent, a siding with its rails connected with respective rails of the main track to constitute a branch track circuit energized by the main track circuit, and a separate signal-controlling relay energized by each of said track circuits, the relays controlling the signal independently to prevent clearing of the signal when either track circuit is broken or short-circuited.

10. An electric signal system for railways comprising a signal block or section of the railway, a second track connecting therewith by a railway switch, a signal located at the entrance end of said block, a line circuit in control of the signal, a track circuit coextensive with and including the rails of the said block, a branch track circuit including the rails of the second track, two relays at or near opposite ends of the said block electrically related to the track rails and each arranged when deënergized to open the line circuit, and a third relay electrically related to the second track and also arranged when deënergized to open the line circuit.

11. An electric signaling system for railways comprising a signaling block or section of a railway track, a second track connecting therewith by a railway switch, a signal, a line circuit in control of the signal, two relays connected to the track rails at or near opposite ends of the said block or section arranged in control of the line circuit, means for transmitting electrical energy to said relays through the rails of said block or section, a third relay also in control of the line circuit, and means for transmitting electrical energy to the third relay through the rails of the said second track.

In testimony whereof we have affixed our signatures in presence of two witnesses.

WILLIAM H. LANE.
CLARENCE W. COLEMAN.

Witnesses:
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WM. M. TOWNLEY.