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RAILWAY SIGNALING SYSTEM

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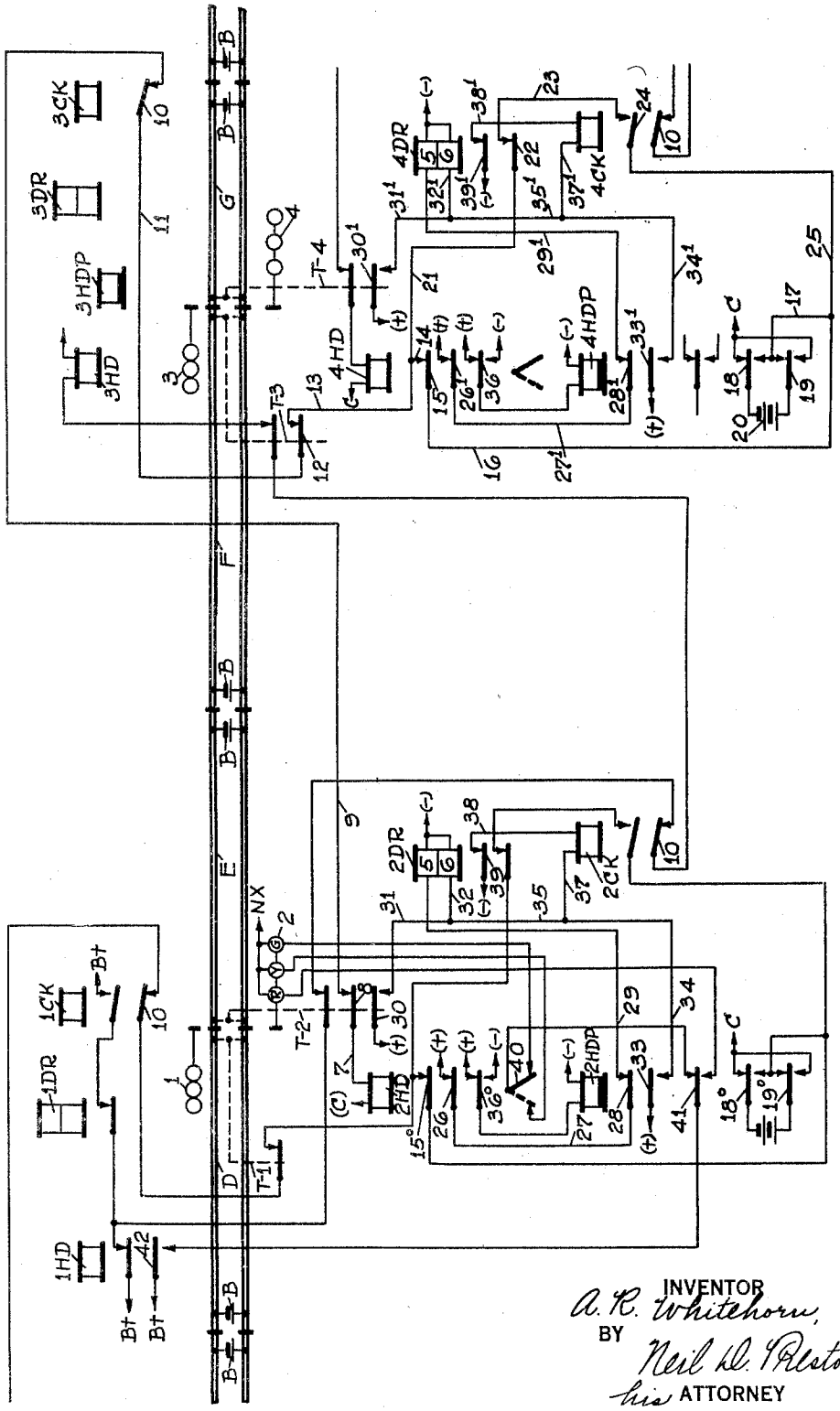

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RAILWAY SIGNALING SYSTEM

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This invention relates to block signaling systems for single track railroads, and more particularly to such a system of the type commonly known as an absolute-permissive-block system.

In one type of such an absolute-permissive-block system, a normally energized directional relay is employed for permitting following train movements when energized; and the object of the present invention is to provide means for checking the operation of this directional relay.

Other specific objects and advantages of the invention will be in part apparent, and in part pointed out, as the description progresses.

The accompanying drawing illustrates, in a simplified and diagrammatic manner, part of a complete A. P. B. system embodying the invention.

This drawing shows the relays and the control circuits for two pairs of opposite intermediate signals 1—2 and 3—4 between two passing sidings. This will serve to show the principles and mode of operation of the invention which can be applied to staggered intermediate signals and extended to provide a complete block signaling system for any number of passing sidings.

The stretch of signal track shown in the drawing is divided into track circuit sections D, E, F and G, in the usual way, there being two such track circuit sections between successive signals governing traffic in the same direction. Each of these track circuit sections has a track relay and source of current, which are shown diagrammatically, the symbol B indicating the track battery and the dotted lines T—1, T—2, etc., with associated contacts, indicating the track relay.

Associated with each signal, are a line or signal relay HD, a slow-acting repeater relay HDP, a directional relay DR, and a check relay CK, these relays being given the number of the corresponding signal. The line relay HD is of the neutral-polar type, having neutral contacts and a polar contact, shown conventionally. The relay HDP is a neutral relay, provided with copper washers, or some other well-known expedient, to make it slow-releasing. The directional relay DR, in the particular form shown, has two windings 5 and 6, so arranged and proportioned that the winding 5, conveniently termed a pick-up winding, is capable when energized of attracting the armature of this relay from its retracted position, while the winding 6, conveniently termed the holding winding, is only able to hold up the armature of the relay in its attracted position, but cannot pick up this armature from its retracted position. This directional relay DR is of the neutral type, and is preferably constructed so as to be quick-acting. The check relay CK is of the usual neutral type.

In the absolute-permissive-block system, as shown and described in detail, for example, in the patent to S. N. Wight, No. 1,294,736, dated February 18, 1929, when a train enters the stretch of single track between the passing sidings at either end, it causes all of the opposing signals governing traffic in the opposite direction to indicate stop; and as this train progresses through the stretch of single track, and passes each intermediate signal, the signals governing following train movements in the same direction are permitted to clear, in the same way as in double-track block signaling systems. In accomplishing this control of the signals, the line circuit for energizing the relay HD, controlling each signal, is governed by the track circuits between that signal and the next signal in advance, governing traffic in the same direction, and is also controlled by the line relay HD of this signal next in advance, and the directional relay DR associated with that signal.

Thus, the line circuit of the relay 2HD may be traced from (C), indicating a connection to the common return wire (not shown) extending along the track, relay 2HD, wire 7, front contact 8 of track relay T—2 next in advance of the signal 2, wire 9, back contact 10 of the check relay 3CK associated with the next opposing signal 3, wire 11, front contact 12 of track relay T—3, wire 13, and thence over two alternative circuits in multiple, one over wire 14, front contact 15 of relay 4HD, wires 16 and 17, through the pole changing contacts 18 and 19

of the relay 4HDP and battery 20 to (C), the other multiple path being over wire 21, front contact 22 of relay 4DR, wire 23, front contact 24 of relay 4CK, and wires 25 and 17 through the pole changing contacts 18 and 19 of the relay 4HDP and battery 20 to (C). The other line or signal control relays HD for the other signal have similar energizing or control circuits.

Each directional relay DR is normally energized, but is so controlled that it remains energized for one direction of train movement, and is de-energized for the other direction of train movement. Referring to the relay 2DR, this relay has a pick-up circuit which may be traced from (+), indicating one terminal of the local battery, front contact 26 of relay 2HD, wire 27, front contact 28 of relay 2HDP, wire 29, pick-up winding 5 of relay 2DR to (−), indicating the other terminal of this local battery.

One holding circuit for the relay 2DR may be traced from (+), back contact 30 of track relay T—2, wires 31 and 32, holding winding 6 to (−). Another holding circuit relay 2DR may be traced from (+), back contact 33 of relay 2HDP wires 34, 35 and 32, holding winding 6 to (−).

The relay 2HDP is directly controlled by the relay 2HD through the front contact 36°, being energized when relay 2HD is picked up, and being de-energized and shunted, when relay 2HD drops.

The checking relay 2CK has an energizing circuit which may be traced from (+) through the back contact 33 of relay 2HDP, wires 34 and 37, relay 2CK, wire 38, front contact 39 of relay 2DR to (−).

When a west-bound train, travelling from right to left, enters the stretch of single track, it drops the relay 4HD and breaks the pick-up circuit for the relay 4DR. The relay 4HDP, being slow releasing and also shunted by the dropping of 4HD, does not close the holding circuit through its back contact 33^1 for the relay 4DR, until the armature of this relay (which is quick-acting) assumes its retracted position, so that the closing of this holding circuit and energization of the winding 6 of this relay 4DR is not effective to hold up the armature of this relay. The armature of the relay 4DR being in the retracted position and its front contact 39^1 open by the time the back contact 33^1 of relay 4HDP closes, the energizing circuit for the relay 4CK is broken.

Consequently, for a west-bound train, the dropping of the relay 4HD, and the opening of its front contact 15 de-energizes the relay 2HD for the signal 2, the front contact 22 of relay 4DR and front contact 24 of relay 4CK both being opened. In the same way, when relay 2HD is de-energized, the directional relay 2DR drops, and the relay HD (not shown) for the signal in the rear of signal 2, governing traffic in the same direction, is likewise de-energized.

In this way, when a west-bound train enters the stretch of track, all of the opposing signals, such as 2 and 4, are caused to indicate stop.

The controlling circuits for these signals, which as shown are color-light signals, are illustrated for the signal 2. The circuits for lighting the green lamp G (proceed indication), yellow lamp Y (approach or caution indication), and the red lamp R (stop indication) may be readily traced through the polar contact 40 of the relay 2HD, front and back contacts 41 of the relay 2HDP, and back contact 42 of relay 1HD associated with the adjacent opposing signal, this contact 42 acting to light the lamps of signal 2 upon the approach of a train.

When an east-bound train enters a stretch of single track, the opposing signals such as 1 and 3 are caused to indicate stop in the same way as for a west-bound train movement. When this east-bound train passes the signal 2, the circuit for energizing the holding winding 6 of the relay 2DR is established through the back contact 30 of the track relay T—2 before the relay 2HD opens its front contact 26 and breaks the pick-up circuit for this relay 2DR. When the relay 2HDP drops and closes its back contact 33, the armature of the relay 2DR is held in the attracted position by the holding circuit through the back contact 30 of the track relay T—2, so that this relay 2DR is held up so long as the relay 2HDP remains de-energized, that is, until the east-bound train in question passes the signal 4. Also, when the track relay T—2 closes its back contact 30 and while the relay 2HDP closes its back contact 33, the relay 2DR being picked up, relay 2CK is energized, thereby establishing a shunt for the front contact 15° of relay 2HD controlling the circuit for the relay HD of the signal next in the rear of signal 2. This permits this signal in the rear to indicate caution, the polarity of the energizing current for its relay HD being reversed at the pole changing contacts 18° and 19° of relay 2HDP.

When the east-bound train in question passes the signal 4, the directional relay 2DR is maintained energized, and the check relay 4CK is picked up, permitting the signal 2 to indicate caution, the signal (not shown) in the rear thereof now being permitted to indicate clear.

Considering now the checking means for the directional relays DR, more specifically forming the subject matter of this invention, it will be noted that a back contact 10 of each check relay CK is included in the energizing circuit for the line relay of the next opposing signal. For example, if the relay 2CK is energized, the relay 3HD for the opposing signal 3 is de-energized. Consequently, if

the directional relay 2DR for the signal 2 should fail to drop for a west-bound train, the relay 2CK would be picked up in this case and hold at stop the opposing signal 3. If, therefore, a west-bound train should fail to drop the directional relay 2DR, thereby permitting a signal in the rear of signal 2, governing traffic in the same direction, to clear, then the signal 3 could not clear, affording the proper signal protection for the two opposing trains.

From the foregoing it can be seen how the provision of checking relay CK and its associated circuits provides a check upon the operation of the normally energized directional relay DR, so that failure of this directional relay to drop when it should, making possible the improper clearing of an opposing signal, sets up stop and caution signals for the train, which should have caused dropping of this directional relay, so as to afford the proper signaling protection.

The energizing circuit for each check relay CK is checked, because if this relay CK should fail to pick up, when it should, the signal in the rear cannot be cleared for following movements. For example, if the relay 4CK fails to pick up for an east-bound train passing the signal 4, the relay 2HD is maintained de-energized, front contact 24 of relay 4CK being open, and breaking the shunt around the front contact 15 of the relay 4HD controlling the energizing circuit for relay 2HD.

Having shown and described one specific embodiment of my invention which may be modified without departing from the invention, what I claim is:—

1. In a railway signaling system of the type described, the combination with a normally energized directional relay governed in accordance with the direction of train movements, of checking means responsive to the presence of a train irrespective of its direction of movement if said relay is energized.

2. In a block signaling system for single track railroads, signals at intervals governing traffic in opposite directions over a stretch of single track, a directional relay associated with each signal and automatically operated by a train travelling in the direction of traffic governed by that signal, and a check relay governed by each directional relay and responsive to the presence of a train adjacent its associated signal for controlling the line circuit of the opposing signal governing traffic in the opposite direction.

3. In a block signaling system of the type described for single track railroads, signals at intervals governing traffic in opposite directions through a stretch of single track; a line circuit for each signal controlled by the line circuit of the signal next in advance governing traffic in the same direction; a normally energized directional relay associated with each signal and acting to control the indications of the signal in the rear for train movements in one direction; and a checking relay for each signal, responsive to the presence of the train adjacent to that signal, and energized if the directional relay for that signal is energized, for controlling the line circuit for the next opposing signal.

4. In a signaling system of the type described, a line relay, a line circuit including a front contact of said line relay, a normally energized directional relay controlled by said line relay, a normally de-energized check relay controlled by said directional relay, and the shunt for said contact of the line relay including in series front contacts of said directional relay and said check relay.

5. In a signaling system of the type described, two signals at different points along the stretch of single track for governing traffic in opposite directions, a normally energized directional relay for each signal, means for de-energizing said relay for train movements in a direction opposite to the direction of traffic governed by the corresponding signal, said means maintaining said directional relay energized for train movements in the same direction of traffic governed by the corresponding signal, and checking means for preventing the clearing of either signal if the directional relay associated with the opposing signal fails to drop for an opposing train movement.

6. In a signaling system of the type described, a normally energized directional relay, a holding circuit for said relay, and a normally de-energized check relay controlled by a front contact of said directional relay and responsive to the energization of its holding circuit.

7. In a signaling system of the type described, a directional relay having two windings, a pick-up circuit including one winding, a holding circuit including the other winding, a check relay having an energizing circuit including a front contact of said directional relay, and a signaling circuit including in series front contacts of said directional relay and said check relay.

8. In a signaling system of the type described for single track railroads, signals at intervals governing traffic in opposite directions over a stretch of single track, a normally energized directional relay associated with each signal and controlling the signal next in the rear governing traffic in the same direction, and a normally de-energized check relay associated with each signal controlling the next signal in the rear governing traffic in the same direction, and also the next opposing signal governing traffic in the opposite direction.

9. In a signaling system of the type de-

scribed for a single track railroad, a signal, a normally energized directional relay associated with said signal and automatically de-energized by a train traveling in a direction opposite to traffic governed by said signal, said directional relay being maintained energized by a train moving in the same direction of traffic governed by said signal, and checking means rendered effective when said directional relay is not de-energized by such opposing train movement.

10. A signaling system for single track railroads, of the absolute-permissive-block type, characterized by a normally energized directional relay associated with each intermediate signal, and normally de-energized checking means governed by each directional relay.

11. In a signaling system of the type described for governing train movements on single track railroads, a signal governing traffic in one direction, a normally energized directional relay maintained energized by a train traveling in the direction of traffic governed by said signal and automatically de-energized by a train traveling in the opposite direction, a second signal located at a distance from said first mentioned signal and governing traffic in the opposite direction, and checking means associated with said directional relay and rendered effective if said relay is not properly de-energized by such opposing train for holding said second signal at stop.

12. A signaling system for controlling the indications of signals located at intervals in a stretch of single track and governing traffic in opposite directions, a normally energized directional relay associated with each signal and automatically maintained energized or de-energized by the presence of a train in advance of that signal dependent upon the direction of movement of that train, a normally de-energized check relay for each directional relay and governed by the corresponding directional relay, and a circuit for governing the indications of each signal including in series front contacts of the directional relay and the check relay associated with the signal next in advance which governs traffic in the same direction.

13. In a signaling system of the type described, signals at intervals governing traffic in opposite directions through a stretch of single track, said stretch of track being divided into track sections each having a track relay, a line circuit for controlling the indications of each signal governed by a plurality of track circuits in advance thereof, a normally energized directional relay for each signal automatically de-energized whenever the line circuit for that signal is opened prior to the dropping of the track relay of the track section next in advance of that signal, a check relay associated with each directional relay and having an energizing circuit including a front contact of its associated directional relay, said check relay when energized acting to break the line circuit for the next opposing signal, whereby if the directional relay associated with a signal should fail to drop upon the approach of an opposing train, the opposing signal governing the advance of such train cannot clear.

14. In a signaling system of the type described, two signals located at intervals along a stretch of single track and governing traffic in opposite directions, a normally energized directional relay and a normally de-energized check relay associated with one of said signals, said check relay having an energizing circuit including a front contact of said directional relay, and a line circuit for controlling the indications of the other signal including a back contact of said check relay.

In testimony whereof I affix my signature.

ARTHUR R. WHITEHORN.