

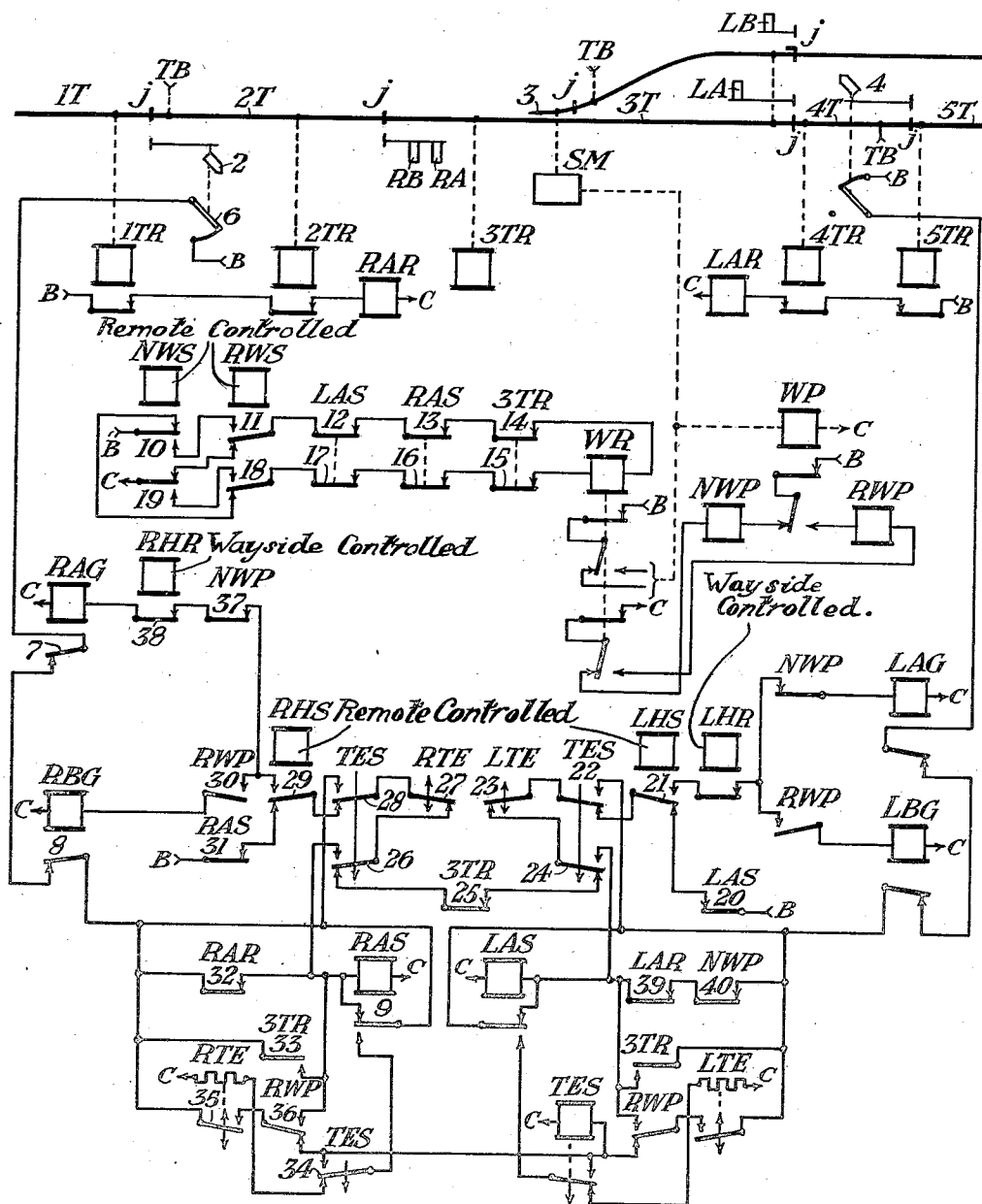
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RAILWAY TRAFFIC CONTROLLING APPARATUS

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RAILWAY TRAFFIC CONTROLLING  
APPARATUS

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My invention relates to railway traffic controlling apparatus, and more particularly to approach locking apparatus for use in interlocking systems for railroads, for locking a track switch against operation under certain conditions when a signal governing the movement of traffic over the switch is manually put to stop. The purpose of such locking is to prevent the operation of the switch when a train is approaching at such speed that it cannot be readily stopped without over-running the signal.

One object of my invention is the provision of a time measuring device of a relatively simple type for each group of signals, each such device being arranged to delay the release of the approach locking for either a long or a short time interval, depending upon whether the signal put to stop is one for governing high speed or slow speed traffic.

Another object of my invention resides in the provision of an improved arrangement of circuits for so controlling each time measuring device, that its operation can be initiated only when it is in its normal inactive condition.

Other objects, purposes and features of my invention will appear as the description progresses.

I shall describe one form of apparatus embodying my invention, and shall then point out the novel features thereof in claims.

Referring to the accompanying drawing, the track plan at the top is a conventional single line diagram representing a stretch of single track railway in which the track rails are divided by insulated joints *j* to form a plurality of successive track sections 1T to 5T, inclusive, each of which is provided at one end with a track relay bearing the designation TR with a corresponding numerical prefix. It is to be understood that each track relay TR is normally energized by a track battery TB at the opposite end of the corresponding track section, and is released when such section is occupied by a train. Section 3T includes a track switch 3 leading to one end of a siding track, and four signals, as shown, are provided to govern the movement of traffic over switch 3. Signals RA and LA are high speed signals governing traffic movements over the main track when switch 3 is normal, while RB and LB are slow speed signals which govern movements into and out of the siding, respectively, when switch 3 is reversed. The distant signals 2 and 4 are located at suitable distances in the rear of the high speed signals RA and LA, and in accordance with the usual practice each distant signal is controlled by means, not shown,

so as to indicate proceed only when the high speed signal in advance indicates proceed or caution and the intervening track circuit is unoccupied. The signals may be of the color light type controlled by relays G of the ordinary type, or they may be of the well-known searchlight type, in which case the relays G will comprise the operating mechanism of the signals, such for example, as the one disclosed in the E. J. Blake Reissue Patent No. 14,940 of Aug. 31, 1920.

The signal relays G are identified in the drawing by prefixes corresponding to the designation of the signals they control and are controlled over a signal network of interconnected circuits as will hereinafter be explained.

For simplicity, the usual circuits for reversing the polarity of the current supplied to the relays G to cause the signals to indicate caution when the next signal in advance indicates stop have been omitted from the drawing, since these are not essential to an understanding of my invention.

As indicated conventionally in the drawing, the track switch 3 is controlled by a power operated switch mechanism SM having the usual polarized indication relay WP, as shown for example, in the Zabel Patents 1,293,290 and 1,413,820, which is controlled by a polarized switch control relay WR as illustrated in the Willard Patent No. 1,380,452. Relays WR and WP jointly control two indication repeating relays NWP and RWP. When relay WR is energized in its normal or reverse direction, switch 3 will be operated to the corresponding position and relay NWP or RWP is energized only when switch 3 is locked in the respective normal or reverse position corresponding to the position of relay WR.

The approach locking of the track switch is effected through the medium of two stick relays RAS and LAS, one for each direction, each of which is energized only when the signals for the corresponding direction are at stop, and each when deenergized prevents the closing of the circuit for the switch control relay WR and the circuits for the mechanism G for the opposing signals. A time measuring device which, as shown, comprises a time element relay RTE or LTE and is associated with each approach locking stick relay and these relays jointly control a slow release stick relay TES. The relays RTE and LTE are preferably of the thermal type such as is disclosed in a Patent No. 2,114,895, to H. E. Ashworth, granted April 19, 1938, having a bimetallic strip, or heat responsive member actuated by the energization of a coil of resistance wire and

provided with one contact closed only when the relay is in its normal cooled condition and another contact which closes when the relay has been energized for a measured time interval.

Relays of this type, while relatively inexpensive in comparison with time element relays of the well-known motor type are inherently limited in the number of contacts that are available, and a feature of my invention resides in the use of each of the two contacts mentioned for a dual purpose. Thus as hereinafter will be explained in detail, the normally open contact of each relay RTE and LTE provides a circuit for picking up the corresponding relay RAS or LAS at the end of a relatively short time interval when a slow speed signal is put to stop, and also provides a circuit for energizing a stick relay TES when a high speed signal is put to stop and a longer time interval is required. The normally closed contact of each thermal relay provides a circuit for picking up the associated relay RAS or LAS at the end of a cycle of operation during which the thermal relay is first heated to pick up relay TES and is then deenergized so as to cause it to close its normal contact at the end of a predetermined cooling period, this cycle comprising the longer time element mentioned. The normal contact is also included in a checking circuit over back contacts of relay TES which functions to prevent the initiation of either time interval except when the thermal relay is in its normal cooled condition.

As herein disclosed, the signals are manually controlled by means of a pair of signal control relays LHS and RHS and the track switch similarly by a pair of switch control relays NWS and RWS. The control relays LHS, RHS, NWS and RWS may be operated in a well-known manner either directly by levers or by means of a communication system of a suitable type.

I shall now describe the operation of my apparatus in connection with an assumed train movement from left to right. With the apparatus as shown, relay RAS is energized over a stick circuit which may be traced from one terminal B of a suitable source of current over a contact 6 which is closed when the distant signal 2 indicates stop or caution, thence over contacts 7 and 8 of relays RAG and RBG which are closed when the corresponding signals indicate stop, and over front contact 9 and the winding of relay RAS to the other terminal C of the source. Relay LAS is similarly controlled by the signals LA and LB at stop and by the distant signal 4 at stop or caution.

If now the reverse switch control relay RWS is manually energized and the normal switch control relay NWS released, the reverse energizing circuit for relay WR becomes closed from terminal B, back contact 10 of relay NWS, front contacts 11, 12, 13 and 14 of relays RWS, LAS, RAS and 3TR, the winding of relay WR and thence over front contacts 15 to 18 and back contact 19 to terminal C. The track switch 3 will reverse in response to the energization of relay WR over the circuit just traced; relay NWP will release and relay RWP will become energized. If relay RHS is then picked up by manual control, signal relay RBG will become energized over a circuit which may be traced from terminal B at front contact 20 of relay LAS, back contacts 21, 22, 23 and 24 of relays LHS, TES, LTE and TES, front contact 25 of track relay 3TR, back contacts 26, 27 and 28 of relays TES, RTE and TES, front contacts 29 and 30 of relays RHS and RWP, relay RBG

to terminal C. Signal RB will therefore clear to permit a train approaching from the left to move over switch 3 reversed into the siding and upon clearing will open the circuit for relay RAS at contact 8. Relay RAS upon releasing locks the track switch by opening contacts 12 and 17. Relay RAS also opens a contact 31 in the circuit for the opposing signal relay LBG, which circuit is similar to the signal circuit traced above, whereby the approach locking is rendered effective to prevent the reversal of traffic direction in case the relay LHS is energized manually and relay RHS released while relay RAS is deenergized.

The approach locking may now be released in the usual manner if signal RBG is manually put to stop before the approaching train enters the approach zone comprising sections 1T and 2T, that is, while the approach relay RAR is energized over front contacts of the corresponding track relays 1TR and 2TR. In this case, the front contact 32 of relay RAR will complete a pick-up circuit for relay RAS, when contact 8 closes, as will be apparent from the drawing.

The locking will also be released automatically if the train passes signal RB at clear and enters section 3T. When the track relay 3TR releases its front contact 25 opens the circuit for relay RBG, and its back contact 33 prepares a pick-up circuit for relay RAS which is completed at contact 8 when mechanism RBG releases, as will be apparent from the drawing.

In this case the usual detector locking, as exemplified by contacts 14 and 15 of relay 3TR in the circuit for relay WR, will be effective to maintain switch 3 locked as long as section 3T is occupied.

If the operator puts signal RB to stop when a train occupies the approach zone, the reenergization of relay RAS to unlock the switch will be delayed for a time sufficient either to enable the train to be stopped before passing signal RB if it is at some distance from the signal or is moving slowly, or to enter section 3T and thus render the detector locking effective before relay RAS picks up, if the train is unable to stop.

Since signal RB is a slow speed signal, the train will be governed accordingly and will pass signal 2 at caution and will reduce its speed if necessary in order to be able to pass signal RB at slow speed, and it follows that the time interval may be relatively short. The front contact 32 of relay RAR is now open, and when back contact 8 closes, a circuit is completed from terminal B at contact 6 over contacts 7 and 8, back contacts 9 and 34 of relays RAS and TES, the winding of relay RTE to terminal C. Relay RTE is now in its normal cooled condition, because signal relay RBG was released by opening a circuit which includes the normal contact 27 of relay RTE. Relay RWP is now energized because switch 3 is reversed, and after relay RTE has been energized for a measured time interval, it becomes heated sufficiently to close its contact 35 to complete a branch of the pick-up circuit for relay RAS over front contact 36 of relay RWP. Relay RAS upon becoming energized completes its stick circuit and by opening back contact 9 deenergizes relay RTE, which then returns to its normal cooled condition.

It will be noted that signal RB can not be cleared again until sufficient time has elapsed to permit relay RTE to return to its normal cooled condition so as to close contact 27 in the signal circuit. It follows that the operator is prevented

from shortening the time delay by again clearing the signal and then putting it to stop when relay RTE is partly heated.

I shall next assume that with switch 3 normal, as shown, the operator energizes relay RHS to clear the high speed signal RA. In this case a signal circuit is closed from terminal B over front contact 29 of relay RHS which is similar to that already traced except that it includes front contact 37 of relay NWP, front contact 38 of a line relay RHR, the winding of relay RAG, to terminal C, so that the high speed signal RA will be cleared.

Relay RHR, it will be understood is controlled in the usual manner by traffic conditions on the main line at the right of section 3T, and signal RA, upon clearing, will cause the distant signal 2 to indicate proceed.

If now signal RA is put to stop manually while section 1T or 2T is occupied, the release of the track relay 2TR or of the signal relay RAG will put signal 2 to stop and a circuit will be completed as already traced from terminal B at contact 6 over back contacts 7, 8, 9 and 34, relay RTE to terminal C. Since switch 3 is normal, relay RWP is now deenergized, and relay RTE after being energized for the relatively short time interval comprising its heating period completes a circuit from terminal B at contact 6 over contacts 7 and 8 and its front contact 35, back contact 36 of relay RWP, relay TES to terminal C. Relay TES picks up, closing a stick circuit over back contact 9 of relay RAS and its own front contact 34 and opens the circuit for relay RTE at its back contact 34. Relay RTE now returns to its normal cooled condition after a measured time interval and then closes contact 27 as before, but this contact is now included in a circuit extending from terminal B at contact 6 over back contacts 7 and 8, front contact 28 of relay TES, contact 27 of relay RTE, front contact 26 of relay TES, relay RAS to terminal C, so that relay RAS picks up. Relay TES is a slow release relay and remains picked up after back contact 9 opens until relay RAS completes its stick circuit at front contact 9 and then releases, whereupon the apparatus is again in the condition shown in the drawing.

It will be observed that signal RA likewise cannot be put to stop to initiate the long time element unless relay RTE is in its normal cooled condition, because the circuit for the signal relay RAG which is opened to put signal RA to stop also includes the normal contact 27 of relay RTE.

Considering now the circuits for the opposite direction involving relay LAS, it will be noted that contact 39 of the approach relay LAR is in series with a contact 40 of the normal indication relay NWP so that relay LAR is rendered effective to govern the release of the locking only when the main line signal LA is put to stop, and the short time element is effective when signal LB is put to stop even though the siding is not occupied. The circuits otherwise are similar to those hereinbefore described, and it is believed therefore, that the operation of the thermal relay LTE in connection with relays LAS and TES will be readily understood from the drawing without further detailed description.

Although I have herein shown and described only one form of apparatus embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In combination with a stretch of railway track, two opposing manually controlled signals for governing train movements in opposite directions over the stretch, a locking relay for each signal, a normally deenergized stick relay, a normally deenergized time element relay for each signal each having an energizing circuit including back contacts of the associated locking relay and of the stick relay, an energizing circuit for each signal including contacts closed only when the associated time element relay and the stick relay are in their normal deenergized condition and the locking relay for the other signal is energized, means effective when either signal is manually put to stop to complete the circuit for the corresponding time element relay, means for energizing the stick relay when either time element relay has been energized for a measured time interval, thereby deenergizing such time element relay, means maintaining the stick relay energized independently of such time element until the associated locking relay becomes energized, means for energizing each locking relay when the associated time element relay has been deenergized for a measured time interval after said stick relay becomes energized, and means for maintaining such locking relay energized until the corresponding signal is again cleared.

2. In combination, a plurality of locking relays, a normally deenergized time element relay for each locking relay, a stick relay, manually controlled means for each locking relay operable only when the corresponding time element relay is in its normal condition to deenergize such locking relay, means effective when each manually controlled means is restored to normal to energize the corresponding time element relay but only if said stick relay is deenergized, means for energizing said stick relay when any time element relay has been energized for a predetermined time interval, thereby deenergizing such time element relay, means for maintaining the stick relay energized independently of such time element relay until the associated locking relay becomes energized, means for energizing each locking relay when the associated time element relay has been deenergized for a predetermined time interval after said stick relay becomes energized, and a stick circuit for maintaining such locking relay energized until the corresponding manually controlled means is again operated.

3. In combination with a railway signal, a locking relay, a stick relay, a time element relay having a normal contact and a reverse contact, a signal relay for clearing said signal, a circuit for said signal relay including said normal contact and a back contact of said stick relay, a circuit for energizing said time element relay closed when said signal relay is released to put the signal to stop and effective only as long as said stick relay is deenergized, means including said reverse contact for energizing said stick relay after said time element relay has been energized for a measured time interval, to thereby deenergize said time element relay, means maintaining said stick relay energized until said locking relay becomes energized, a circuit including said normal contact and a front contact of said stick relay for energizing said locking relay, and a stick circuit for maintaining said locking relay energized as long as said signal relay remains in its released position.

4. In combination, a locking relay, a time ele-

ment relay, a stick relay, a signal relay, a manually controllable contact, an energizing circuit for the time element relay including a contact of the signal relay and back contacts of the locking relay and stick relay, a pick-up circuit for the stick relay including a contact which closes when the time element relay has been energized for a measured time interval, a stick circuit for the stick relay including a back contact of the locking relay, a pick-up circuit for the locking relay including a timing contact which closes when the time element relay has been deenergized for a measured time interval after said stick relay becomes energized, a stick circuit for the locking relay including said signal relay contact, and an energizing circuit for said signal relay including said manually controllable contact, said timing contact and a back contact of the stick relay.

5. In combination with a railway track switch, a signal for governing traffic movements over the switch, a locking relay which when deenergized prevents operation of the switch, a time element relay having a reverse contact which closes when the relay has been energized for a measured time interval and a normal contact which closes when the relay has been deenergized for a measured time interval, a stick relay, an energizing circuit for the time element relay including back contacts of said locking relay and stick relay and a contact closed when the signal indicates stop, a pick-up circuit for the stick relay including said reverse contact, a stick circuit for the stick relay including a back contact of the locking relay, a pick-up circuit for the locking relay including said normal contact and front contacts of said stick relay, a stick circuit for the locking relay including said contact closed when the signal indicates stop, and a control circuit for said signal including a manually controllable contact, said normal contact, and back contacts of the stick relay.

6. In combination with a railway track switch, two signals for governing traffic movements over the switch in its normal and reverse positions respectively, a locking relay which when deenergized prevents operation of the switch, a stick relay, a time element relay having a reverse contact which closes after the relay becomes energized and a normal contact which closes when the relay returns to its normal deenergized condition, an energizing circuit for the time element relay including contacts closed when said signals indicate stop, and also including back contacts of said locking relay and stick relay, a pick-up circuit for the locking relay including said reverse contact and a contact closed when the switch is reversed, a pick-up circuit for the stick relay including said reverse contact and a contact closed when the switch is normal, a stick circuit for the stick relay including a back contact of the locking relay, a second pick-up circuit for the locking

relay including said normal contact and front contacts of said stick relay, a stick circuit for the locking relay including contacts closed when said signals indicate stop, and a control circuit for each signal each including a contact indicating the position of the track switch, a manually controllable contact, said normal contact, and back contacts of the stick relay.

7. In combination, a locking relay, a stick relay, a manually controllable relay, a time element relay having a reverse contact which closes after the relay becomes energized and a normal contact which closes when the relay returns to its normal deenergized condition, an energizing circuit for said time element relay including a contact of the manually controllable relay and back contacts of the stick relay and of the locking relay, a pick-up circuit for the stick relay including the reverse contact of the time element relay, a stick circuit for the stick relay including a back contact of the locking relay, a pick-up circuit for the locking relay including said normal contact and front contacts of said stick relay, a stick circuit for the locking relay including said contact of the manually controllable relay, and a checking circuit including said normal contact and effective when open to prevent the energization of said manually controllable relay.

8. In combination, a first and a second stick relay, a time element relay having a reverse contact which closes after the relay is energized for a measured time interval provided the relay is initially in its normal condition and a normal contact which closes when the relay returns to its normal condition, means for energizing said relay effective only if both stick relays are deenergized, means preventing the closing of said circuit to initiate the operation of the time element relay when its normal contact is open, means for selectively energizing the first or second stick relay when said reverse contact closes, to thereby deenergize the time element relay, and means effective if the first stick relay becomes energized for energizing the second stick relay when said normal contact closes.

9. In combination, a first and a second stick relay, a thermal relay comprising a heating element, a normal contact closed only when said element is in its normal cooled condition, and a reverse contact which closes when said element is heated, means for energizing said heating element effective only if both stick relays are deenergized and said normal contact is initially closed, means for selectively energizing the first or second stick relay when said reverse contact closes to thereby deenergize said heating element, and means effective if said first stick relay becomes energized for energizing said second stick relay when said normal contact closes.

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