

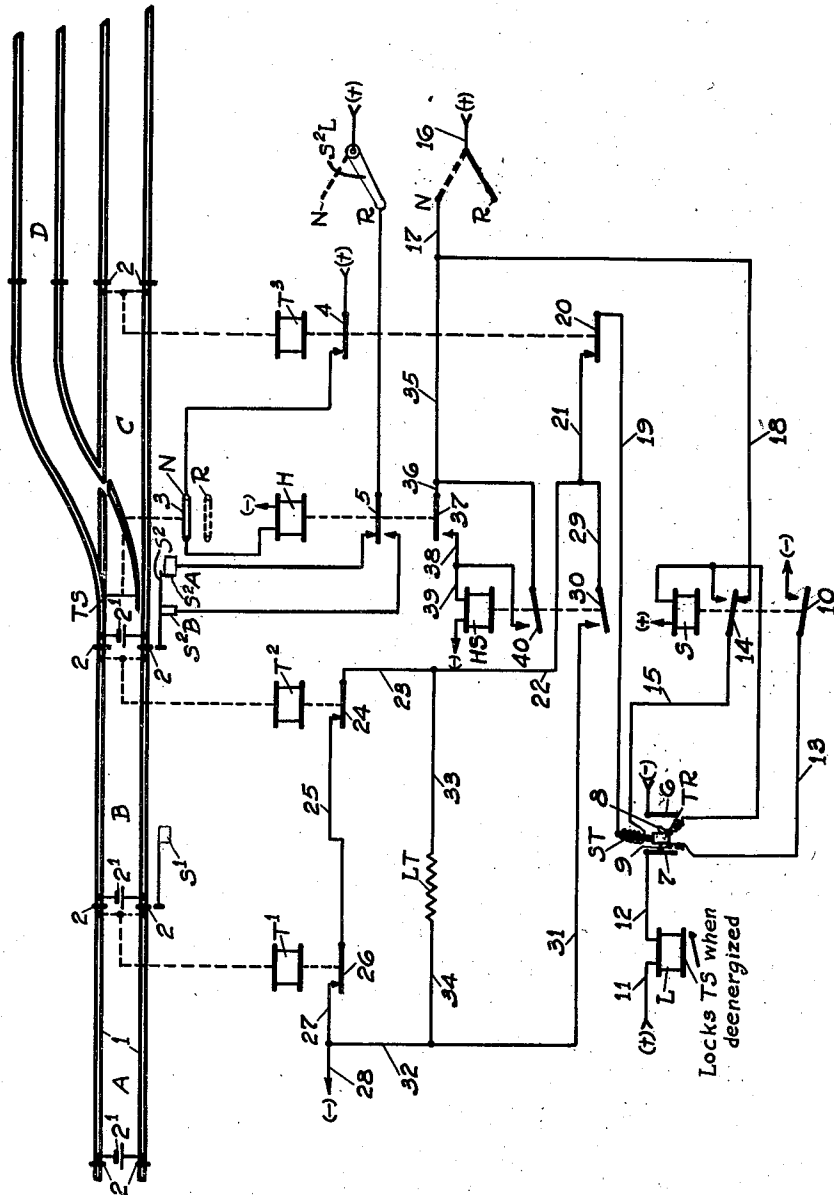
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INTERLOCKING SYSTEM FOR RAILROADS

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INTERLOCKING SYSTEM FOR RAILROADS

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This invention relates in general to interlocking systems for railways, and has more particular reference to a system of this character wherein a single device is protected against misuse by means of two time-measuring devices measuring, respectively, different lengths of time, so as to give time locking of different durations.

In interlocking systems, it may occur that a signal, after being put to clear, may then be changed to stop preparatory to moving a track switch or the like. Obviously, if an approaching train is proceeding fast enough, or is near enough to the switch, at the time the signal is put to stop, the switch may be thrown under the train or the train proceeding at a fast rate may be forced to take a diverging route at too great a speed for safety, in any event making for a dangerous condition.

To prevent such a contingency, it is desirable to provide means requiring a given lapse of time after a signal is put to stop, before the control of a track switch or the like is given to the operator.

With the above and other objects in view, it is proposed, in accordance with this invention, to provide timing means to measure different lengths of time during which control of a track switch, for example, is withheld from an operator subsequent to his placing a signal at stop, with the different times automatically made effective depending upon signal aspects, or the like.

Further objects, purposes and characteristic features of the present invention will appear as the description progresses, reference being made to the accompanying drawing showing, solely by way of example, and in no manner whatsoever in a limiting sense, one form which the invention can assume.

In the drawing:—

The single figure of drawing is a wholly diagrammatic view showing one form of this invention.

Referring now to the drawing, there is here shown a stretch of track 1, divided into signalling blocks A, B and C, by the usual insulating joints 2, and having a diverging route D, controlled by a track switch TS. The blocks A, B and C are provided with usual track relays T¹, T² and T³ respectively and track batteries 2¹.

At the entrance to block B, east bound traffic being considered, is a distant signal S¹, having a single blade which can assume clear, caution or stop positions, and, while shown as of the

semaphore type, it can equally well be of any other usual or desired type of signal.

At the entrance to block C, from which block the diverging route D branches out, is positioned a home signal S², having an upper signal blade S²A, and a lower signal blade S²B, the upper blade controlling traffic over the main line and the lower blade controlling traffic over the diverging route.

The signal S² is controlled by a signal lever S²L, which can be placed by an operator either in normal or reverse positions, N and R, respectively. These signals S² and S¹ are of the semi-automatic type, or other switch type, and are jointly controlled by traffic in an automatic manner, and by the signal lever controlled by an operator.

A relay H, is employed, which has an energizing circuit passing through a contactor 3 of track switch TS, which contactor is closed when the track switch is in normal position, and a contact finger 4 and front point of track relay T³ of the lock or detector track section C, whereby it is apparent that when the signal lever S²L is put at reverse, the upper blade S²A is placed at proceed, if relay H be energized, the signal control circuit for the upper blade passing through contact finger 5 and front point of relay H. On the other hand, if relay H be down, due to the track switch being in reverse position, or due to occupancy of the track section C, the lower signal blade S²B is put at its least restrictive position, which is caution, through a control circuit including contact finger 5 and back point of relay H. With the signal lever placed at normal, both of the arms of the signal S² go to stop.

The distant signal S¹, and the home signal S² are interlocked in any usual manner, (it being deemed unnecessary for the purpose of this invention to describe or show it,) so that S¹ moves to proceed when S²A moves to proceed or caution, S¹ goes to caution when S²B moves to caution and S¹ goes to caution when S²A and S²B go to stop. S¹ of course automatically goes to stop upon occupancy of block B.

A lock relay L, is employed, which is arranged to lock up the track switch TS, when the relay is de-energized, (or if desired, when energized) so that the switch cannot be moved. It is thus necessary, in order for the operator to move the track switch, that the lock relay L first be energized.

Employed in this system is a timing means comprising a thermal relay TR, having a fixed

front contact 6 and a fixed back contact 7, with corresponding movable front and back contacts 8 and 9 suitably mounted to operate, on heating of a heating winding ST, to give a short time of operation, with the heating winding ST at times connected in series with a resistance LT, to thereby give a long time of operation of the thermal relay TR.

In order to energize the lock relay L, it is necessary to have the thermal relay make up its back contacts, and also have relay S picked up, so as to make up its contact finger 10 and front point, whereby to energize relay L through a circuit including one terminal of a source of energy, wire 11, relay L, wire 12, back contact fingers 7 and 9, wire 13 and contact finger 10 and front point of relay S.

The relay S is a stick relay, having a pick-up circuit passing through front contacts 6 and 8 of relay TR, etc., as is obvious from the drawing. When relay S is once picked up it sticks up through a circuit including its contact finger 14 and front point, wire 15, winding ST, etc., as will be obvious from the description to follow.

From the above, it appears that before an operator receives control of the track switch TS, relay L must be energized, and this in turn requires that thermal relay TR be energized to its right hand position, to thereby pick up relay S, and then must return to its left hand position to make up its back contacts whereby to energize L. This is very similar to the operation in the application of J. E. Willing 463,903 filed June 26, 1930.

The time required for the relay TR to operate, depends on the heating effect of the winding ST and this in turn depends on whether or not the resistance LT is placed in series therewith, it being clear that with this resistance in series with the heating winding ST, a longer time is required to operate the thermal relay, with a given employed voltage, than if the resistance LT were cut out, or shunted around.

The energizing circuits for the winding ST are three in number, and include a portion common to the three, connected to three multiple branches, and can be traced from one terminal of a source of energy, wire 16, the lower arm of lever S²L in the normal, (N) position, wires 17 and 18, contact finger 14 and back point of relay S, wire 15, winding ST, wire 19, contact finger 20 and front point of relay T³, wire 21, and then through one of the three multiple paths to include wires 22 and 23, contact finger 24 and front point of relay T², wire 25, contact finger 26 and front point of relay T¹, and wires 27 and 28 to thus constitute an upper branch; through a lower branch to include wire 29, contact finger 30 and front point of a stick relay HS, and wires 31, 32 and 28; and through a middle branch to include wires 22 and 33, resistance LT, and wires 34, 32 and 28, this middle branch including the resistance LT determining the long time of operation of relay TR.

From the above it appears that relay TR, upon the signal lever S²L being placed at normal, will operate to its front position, in a relatively short time, if either of the two above mentioned upper and lower branches be intact, since thereby the resistance LT is shunted out of the circuit including the heating winding ST. On the other hand, if both the upper and lower branch be broken, then a relatively long time is required for the relay TR to operate since in such circumstances the heating winding ST is in a cir-

cuit to include in series therewith the added resistance LT.

When relay TR is energized to the right, relay S picks up, and then sticks up through a circuit including its contact finger 14 and front point, wire 15, winding of ST, wire 19 etc., as described just above for the circuits for ST, the picking up of relay S cutting energy off of the winding ST, by inserting S in series therewith, to a sufficient extent to allow the relay to cool down and return to its initial, and shown, position.

It appears from the above that the lower branch of the energizing circuit for the winding ST depends on the stick relay HS, this relay having a pick-up circuit including one terminal of a source of energy, wire 16, the lower arm of lever S²L at N, wires 17, 35 and 36, contact finger 37 and back point of relay H, wires 38 and 39 and the relay winding HS, and when picked up, this relay sticks up through its contact finger 40 and front point, through a circuit which is obvious from the drawing, to thereby provide for follow-up train movements in a manner which need not be desired in this application since it is not necessary for a complete understanding of the present invention.

It is thus seen that the relay TR operates relatively quickly if neither of the track sections A or B is occupied, to thereby close the upper shunt path, and also if the relay HS is up to thereby close the lower shunt path, and furthermore, on moving the signal lever to normal, relay HS picks up unless the switch TS is in normal position, or unless the track circuit C is occupied.

With the system as above described, a route is now set up for through traffic along the main track because the signal lever S²L is in a reverse position clearing the signal S²A which allows the signal S¹ to automatically clear. The relay S is deenergized, as shown, and therefore the lock relay L is deenergized so that the operation of the track switch TS is prevented. The operation of the track switch TS is not permitted until signal lever S²L is moved to normal and the signal S² is at stop, which conditions are explained more explicitly hereinafter.

Let us assume now that an east bound train has accepted the signal S¹ at proceed, and then the operator decides to change the position of the track switch which first requires the operator to move the signal blade S²A to stop by moving the signal lever to normal. Under these conditions the approaching train, which has passed signal S¹ at proceed, and hence is proceeding at a fast speed, will be faced by a stop signal on reaching, or first sighting, signal S², and if the operator were permitted to move the track switch TS immediately after putting the signal to stop, either the train would run into the switch when it is open, or might be derailed by taking the diverging route at too high a speed. In the interest of safety, under such conditions, it is necessary that sufficient time be given for the approaching train to pass over the track switch, or at least to occupy the lock or detector track section C, before the operator is given control, so far as the lock relay L, is concerned, of the track switch and this necessary time is covered by the time enforced by the long time element LT.

Thus, when the operator puts the signal lever S²L to normal, with the track switch TS at normal, relay H is up and relay HC cannot pick up, whereby the lower shunt path around the resistance element LT is open at contact finger 30, and the upper shunt path is open at either contact

finger 24 or 26, due to the approaching train occupying blocks A or B, whereby the lock relay L cannot receive energy until after the long operating cycle of the thermal relay TR has been completed.

After the lock relay L is energized, as above described, the track switch TS can be operated to its opposite position as desired, which assumes of course that the train approaching the signal S² stopped in advance thereof. It is of course apparent that if the train did not stop in advance of the signal S² that the track relay T³ would be deenergized before the long time period expired and thereby open the energizing circuit of the thermal relay TR at front contact 20. As the relay S also receives its energy through front contact 20 of relay T³, there is positive assurance that the track switch is locked by the deenergization of the relay L when a train is upon the detector track section C. But assuming the train has stopped in advance of the signal S², the track switch can be operated as desired, after which the signal lever S²L can be again moved to its reverse position to clear either the upper or the lower arm of the signal S². This allows the train to proceed over the track switch TS either over the main track or the diverging track depending upon the final position of the track switch TS, which passage of the train deenergizes the track relay T³ opening front contact 20 thereby insuring that the track switch TS is locked during such passage of the train. Also this locking of the track switch by the opening of front contact 20 of the track relay T³, causes the deenergization of the relay L which condition is maintained until the signal lever S²L is again returned to its normal position.

Assume now that the track switch is set for the diverging route, and the signal arm S²B is at caution, then the signal S¹ is at caution, and an approaching train, on passing this signal S¹, is warned that the next signal may be at stop and hence will be proceeding at a relatively low speed and be prepared to stop at the next signal. Under such conditions, if the operator move the signal lever from reverse to normal, the signal blade S²B goes to stop, and, if the signal S² is visible within braking distance from the entrance of the block C, at the slow speed at which the train is proceeding the approaching train can stop before reaching the track switch. If, however, the engineer be not alert, or if signal S² be positioned so that it becomes visible to the approaching train only after the train has approached closer to the entrance to block C than the safe braking distance, it is clear that sufficient time should be given the approaching train to occupy the section C, and lock up the track switch, before the operator is given control of the track switch. Otherwise the switch might be thrown under the approaching train.

Under the conditions assumed, on moving the signal lever S²L to normal, relay HS is picked up through its pick-up circuit since contact finger 37 is down due to the track switch, under the assumed conditions, being at reverse, to thus de-energize relay H. With relay HS picked up, it closes the lower shunt path including contact finger 30 and front point of relay HS, whereby to shunt out the resistance element LT. Accordingly, lock relay L receives energy after the time required for the relay TR to complete its short time cycle to thereby give control of the track switch to the operator, the short time interval after the signal lever has been moved. This short time is chosen to be sufficient to al-

low the oncoming train, at its reduced speed, either to stop before reaching the switch or to occupy the lock section C and thus keep the switch locked up.

If an approaching train has not reached the section A, the upper shunt path is intact, and hence only the short-time interval is operative, as clearly, under these conditions, no danger exists.

After the short time interval required for the operation of the thermal relay TR, when the resistance LT is shunted, expires, the relays S and L are energized thereby unlocking the track switch TS, as previously explained, provided of course that the train does not occupy the track section C. This allows the operation of the track switch TS to a new position, after which the signal S² can be cleared to allow the passage of the train which both locks the track switch TS during such passage and also conditions the locking, as previously described, so that it will be maintained until the signals are again put to stop by the movement of the signal lever S²L to its normal position.

The above rather specific description of one form of system embodying the present invention, is given solely by way of illustration, and is not intended, in any manner whatsoever, in a limiting sense. Obviously, this invention can assume many different physical forms, and is susceptible of numerous modifications, and all such forms and modifications are intended to be included by this invention, as come within the scope of the appended claims.

Having described our invention, we now claim:—

1. In a railway interlocking system, in combination, a main line track having a turn out, a home signal, a track switch governing the turn out, manual control means for the signal, and thermally operated means for withholding control of the switch for various predetermined times after the home signal has been put to stop by said manual control means and traffic controlled means for selecting the various predetermined times.

2. In a control system, in combination, a main line track having a turn out, a home signal and a track switch governing the turn out, manual control means for the signal and switch, a distant signal, and a thermal relay operating, dependent upon whether or not an approaching train has accepted the distant signal, for withholding control of the switch for various predetermined times after the home signal has been put to stop.

3. In a railway interlocking system, in combination, a main line track having a turn out, a home signal and a track switch governing the turn out, manual control means for the signal and switch, a distant signal, and a thermally operated relay operating, dependent upon whether an approaching train has accepted the distant signal at clear or at a restrictive indication, for withholding control of the switch for various predetermined times after the home signal has been put to stop.

4. In a control system, in combination, a main line track having a turn out, a home signal, a track switch governing the turn out, manual control means for the signal, a distant signal, and a thermally operated means for withholding control of the switch for various predetermined times after the main signal has been put to stop, a relatively long or a relatively short time being

imposed, depending on whether an approaching train had, or had not, accepted the distant signal at the time the main signal was put to stop.

5 In a control system, in combination, a main line track having a turn out, a home signal, a track switch governing the turn out, manual control means for the signal, a distant signal, a thermal relay including a resistance for withholding control of the switch for various predetermined times after the main signal has been put to stop, and means controlling the insertion of the resistance in series with the relay so that a long or a short time is imposed, depending on whether an approaching train had, or had not accepted the distant signal at the time the main signal was put to stop and also according to whether or not an approaching train has accepted the approach signal at clear, or at a restrictive indication.

20 6. In an interlocking system for railways, a main line track and a turn-out track, a governing home signal and track switch, a control circuit for the track switch, means for closing the control circuit including a thermal relay having an energizing circuit including a manual lever for the home signal in normal position, a distant wayside signal, a resistance, and means for inserting the resistance into the relay energizing circuit, depending on whether or not a train had accepted the distant signal at the time the home signal was manually put to stop.

7. In an interlocking system for railways, a main line track and a turn-out track, a governing home signal and track switch, a control circuit for the track switch, means for closing the control circuit including a thermal relay controlled by a manual lever for the home signal in normal position, a distant wayside signal, a resistance element, and means automatically inserting the resistance element into the control for the thermal relay, depending on whether or not a train had accepted the distant signal at the time the main signal was manually put to stop, and also depending on whether the approaching train had accepted the distant signal at clear or at a restrictive indication.

8. In an interlocking system for railways, a main line track and a turn-out track, a governing home signal and track switch, a control circuit for the track switch, means for closing the control circuit for the switch machine including a thermal time element energized by a manual lever for the home signal in normal position, a distant wayside signal, a resistance element, and means automatically inserting the resistance element into the control circuit for the thermal relay depending on whether or not a train had accepted the distant signal at the time the home signal was manually put to stop, and also depending on whether the approaching train had accepted the distant signal at clear or at a restrictive indication, the resistance element being inserted into the relay control circuit on condition that the distant signal had been accepted at clear, whereby to allow time for the train to pass the switch before control of the switch is given to the operator.

9. In a railway interlocking system, in combination, a main line track having a turn out, a home signal, a track switch governing the turn out, control means for the signal, a distant signal, subject to control by said home signal to forewarn of said home signal being in a restrictive condition, and thermally operated means for withholding control of the switch for various pre-

determined times after the home signal has been put to stop by said control means and traffic controlled means for selecting the said various predetermined times.

10. In a railway interlocking system, in combination, a main line track having a turn out, a home signal and a track switch governing the turn out, control means for the signal and switch, a distant signal, and a thermally operated relay operating, dependent upon whether an approaching train has accepted the distant signal at clear or at a restrictive indication, for withholding control of the switch for various predetermined times after the home signal has been put to stop.

11. In a control system, in combination, a main line track having a turn out, a home signal, a track switch governing the turn out, means for controlling the signal, and a thermally operated means for withholding control of the switch for various predetermined times after the signal has gone to stop, a relatively long or a relatively short time being imposed depending upon the position of an approaching train with respect to the track switch at the time the signal reached its stop position.

12. In combination, a controlled circuit, a control contact, an electro-thermal device, a resistor, an operating circuit for energizing said electro-thermal device closed when said control contact is closed to cause said device to be actuated, means for closing said controlled circuit when said electro-thermal device is actuated, and means for selectively including said resistor in said operating circuit for said electro-thermal device, whereby said circuit is at times closed a predetermined time after said control contact is closed and is at other times closed a different predetermined time after said control contact is closed.

13. In combination, a device to be controlled, a thermal relay for controlling said device, a control circuit for said thermal relay having two separate branches of different resistances, means for automatically selecting which branch can be energized, and means for energizing the selected branch, whereby said device is controlled after either of two different predetermined times following the energization of said control circuit.

14. In combination; a device to be controlled; a thermal relay including an operating winding, a bi-metallic element and contacts for controlling said device; a source of energy; a control contact; a circuit for said operating winding of said thermal relay including said control contact, said source of energy and either of two branches having different resistances; and means for automatically selecting in accordance with the condition of said device which branch is to be energized upon the closure of said control contact; whereby said device is controlled after either of two different predetermined times following the closure of said control contact depending upon which branch of the circuit for said operating winding is closed.

15. In combination; a track switch; means for locking said track switch; a thermal relay for releasing said locking means, said thermal relay including an operating winding, a bi-metallic element and contacts; a source of energy; a control contact; a circuit for said operating winding of said thermal relay including said control contact, said source of energy and either of two branches having different resistances; and means dependent upon the position of said track switch

for selecting which branch is to be effective upon the closure of said control contact; whereby said device is controlled after either of two different predetermined times following the closure of said control contact dependent upon the position of said track switch.

16. In combination, a device to be controlled, a thermal relay having a contact which is closed after said thermal relay has been heated, a control circuit for said device governed by said contact, a heating circuit for said thermal relay having two branches of different resistance, means for selecting which of said branches of said heat-

ing circuit can be closed, and means for energizing the selected branch of said heating circuit, whereby heat is supplied to operate said thermal relay at either of two different rates depending upon which branch of said heating circuit is selected, and whereby said control circuit for said device can be closed only after said heating circuit has been closed a time measured by said thermal relay.

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