

Feb. 13, 1940.

A. BROWN

2,189,879

RAILWAY SIGNAL CONTROL SYSTEM

Filed Sept. 9, 1936

2 Sheets-Sheet 1

FIG. 1.

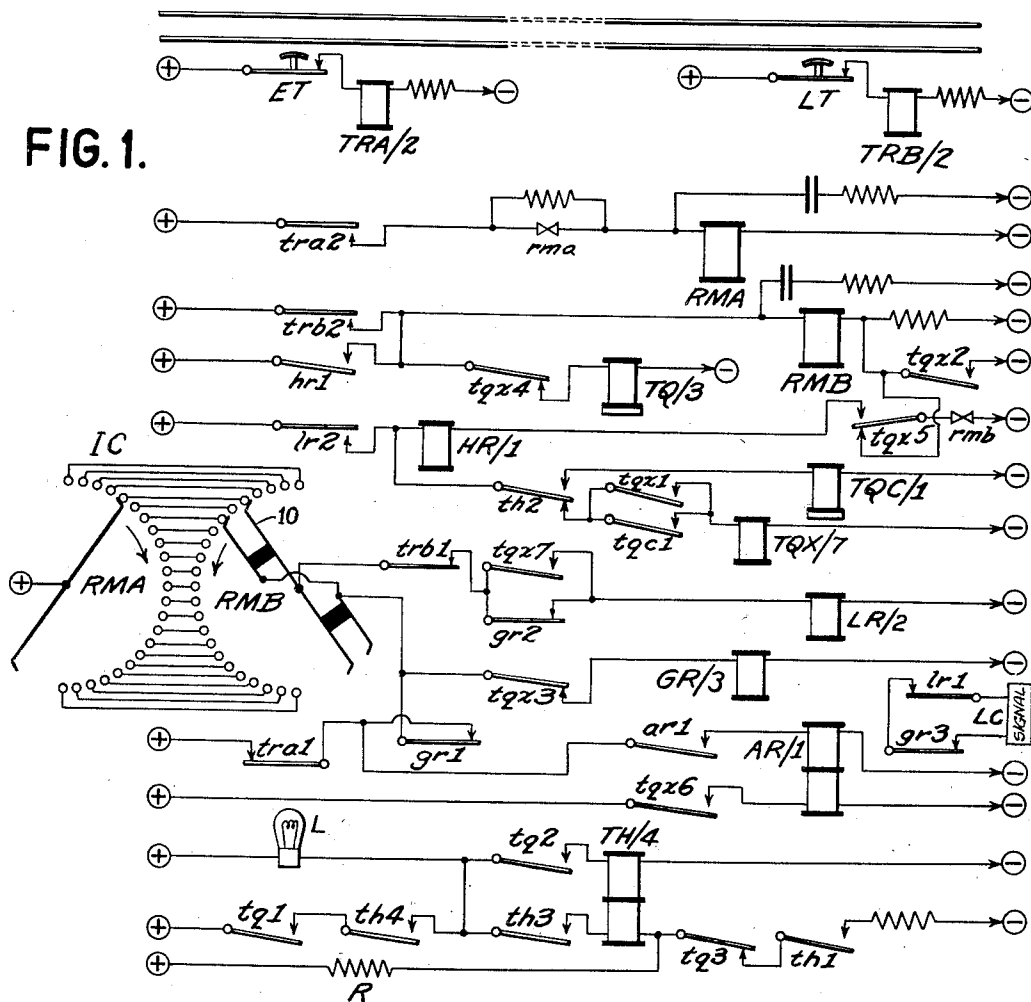
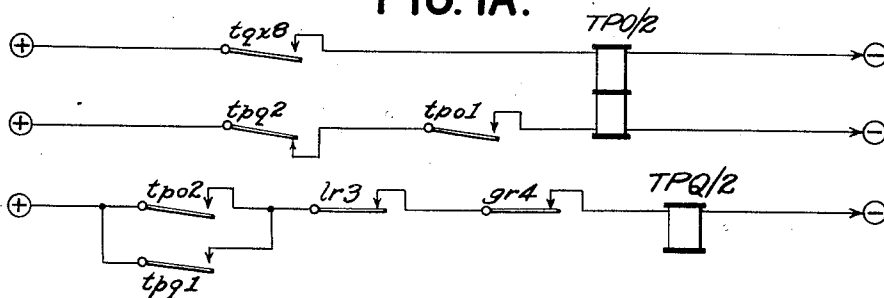


FIG. 1A.



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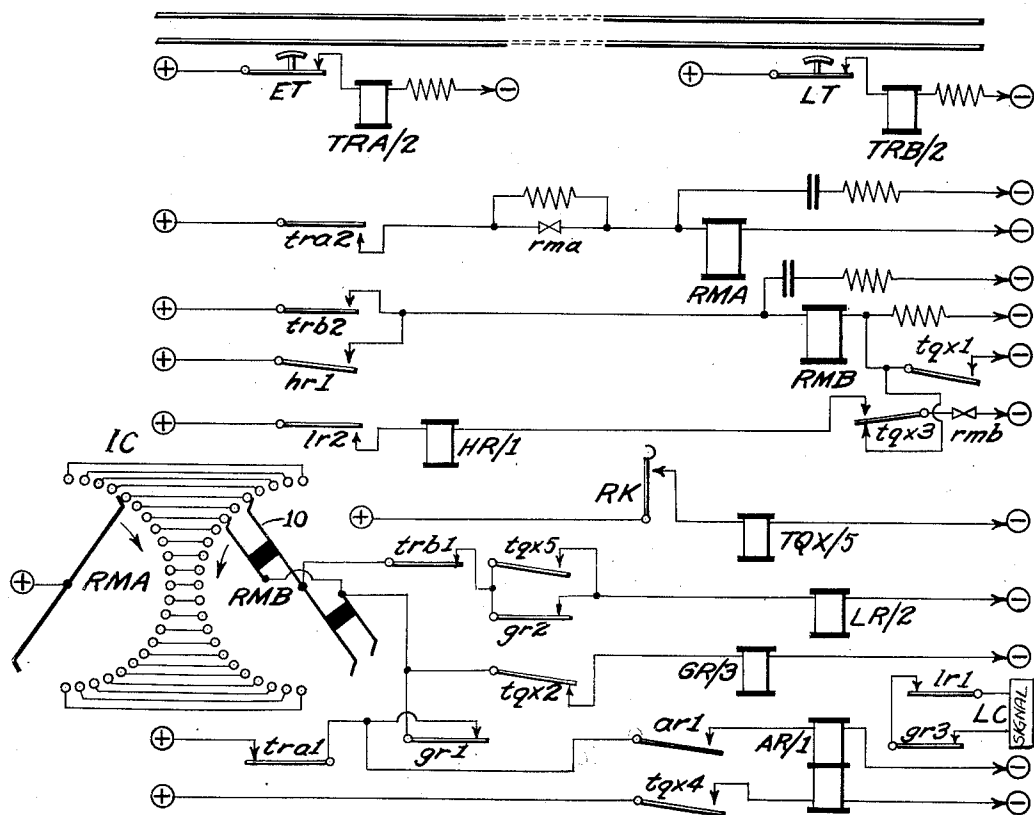
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FIG. 2.



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RAILWAY SIGNAL CONTROL SYSTEM

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9 Claims. (Cl. 246—77)

This invention relates to railway or like signal control systems of the kind in which the signal for a particular section of track is automatically set to danger on a train entering that section, the number of wheels on the train is automatically counted as the train enters a section and also as the train leaves the section and the signal is only permitted to indicate that the track is clear if the same number of wheels has been automatically counted out of the section as was automatically counted into the section.

In such a system it may sometimes happen that due to some error in the working of the apparatus, the counting apparatus has not returned to its original position when a train has left the section and therefore that the signal is left at danger. Means have previously been proposed for manually restoring the counting apparatus to normal position and for thus restoring the signal to clear. It is obvious that such restoration must not be permitted until it has been ascertained that the track section is in fact clear and it is therefore necessary that a man should be sent to examine the track section before this manual restoration takes place. There is some danger that restoration to normal may take place before proper examination of the track sections.

The present invention allows of the counting apparatus to be restored to normal without this danger. The counting apparatus may be restored to normal position whilst leaving the signal at danger. With the signal in this position the driver of a train is permitted, after waiting a specified time, to proceed at caution. Means may be provided to display a special signal in these circumstances to inform a driver that he may proceed at caution.

The restoration of the counting apparatus to normal position may be done manually or automatically. If a train then passes through the track section at caution and the counting apparatus functions correctly to count in and out the same number of wheels the signal may be restored to clear, but provision may be made that two trains must pass through the track section at caution and be counted in and out correctly before the signal is restored to clear.

The nature of the invention will be clear from the following description taken in conjunction with the accompanying drawings which show the circuits of an arrangement for counting the wheels of a train into and out of a single track section.

Fig. 1 shows the circuits for an automatic restoration;

Fig. 1A shows additional circuits for use with the circuits of Fig. 1 in a modification of the structure; and

Fig. 2 the circuits for a manual restoration of the counting apparatus to normal position.

Referring now to Fig. 1 the contacts of the treadles at the entrance to and exit from the track section denoted by ET and LT respectively, are normally closed, and normally maintain relays TRA and TRB respectively, in operated condition. The indications /1, /2, etc., following the reference to the relays throughout the drawings, indicate the number of contacts controlled by these relays. The circuit LC maintains the signals at clear when closed. This circuit includes normally closed contacts *lr1* and *gr3* of the relays LR and GR respectively. The guard relay GR is normally energized in a circuit including back contacts *trq3*, its own front contacts *gr1* and front contacts *tr1*. The line LR relay is maintained energized over front contacts *gr2*, front contacts *trb1*, and contacts of the switch IC for the impulses when in normal position.

The switch IC is schematically shown as two completely independent rotary switches RMA and RMB, each of the well known non-homing step-by-step type, having corresponding contacts connected together. It will be understood that in actual construction IC may be a single combined incounging and outcounting switch of any well known type, having two separate actuating magnets and two independent sets of wipers so arranged as to be electrically equivalent to two step-by-step switches multiplied as shown. Since, however, the construction of such a combined switch is not readily adaptable to simple schematic representations, this switch has been shown in the conventional manner and will be described as if its incounging and outcounting portions were separate switches structurally independent of each other. For convenience in description, the relative position of the wipers shown in the drawings (in which the wiper of RMA and the main wiper 10 of RMB rest on contacts which are connected together) is referred to as the "normal" position of the switch. The switch wipers are illustrated as being provided with two wiper arms, so that upon reaching the extreme lower contacts by one arm, the other arm will reach the upper contact and thus continue to operate. Regardless of the rotary position of the respective wipers of switch portions RMA and RMB, the normal position exists

so long as the two wipers above mentioned rest on the contacts which are connected together.

The normal operation of the system will now be described assuming that a train enters and leaves the section at a substantially constant predetermined rate of speed.

Each wheel entering the track section opens contacts ET and de-energises relay TRA. This relay breaks the circuit of relay GR at *tra1* on its first de-energisation and so causes interruption of the circuit LC by opening *gr3*, to set the signal for the track section at danger. De-energization of relay GR permits its contacts *gr1* to open thus maintaining relay GR de-energized, and also opens circuit LC at *gr3*. Contacts *tra2* also close the circuit of the magnet RMA which steps the incounting portion of the switch IC forward one step for each operation. This operation continues, the switch portion RMA stepping forward one step for each wheel entering the section until all the entering wheels have been counted in. The switch portion RMA will then be in advance of the switch portion RMB by a number of contacts dependent upon the number of wheels of the train.

As the train leaves the track section each wheel successively opens contacts LT and de-energizes relay TRB. Deenergization of this relay closes, at contacts *trb2*, the circuit of magnet RMB which steps the outcounting portion RMB of the switch IC forward one step for each operation. As the outcounting portion RMB of this switch reaches a point two steps behind normal, the relay GR is energized over a circuit from positive supply through switch portion RMA, lower arm of switch portion RMB, and contact *txq2* and immediately closes a locking circuit for itself over its front contacts *gr1* and front contacts *tra1*. This energization of relay GR also closes contact *gr2* and *gr3*. When the switch portion RMB again reaches normal position the relay LR is energized over contacts *gr2* and contacts *trb1*. The signal is restored to clear by circuit LC.

Should there be any failure in the operation of the switch so that it fails to take the same number of steps for both the incounting and outcounting impulses after a train has left the track section, switch portion RMB will not reach normal position and relay LR will remain de-energized leaving circuit LC open at *lr1* and the signal will remain at danger.

In order that the switch IC may be restored to normal leaving the signal at danger further circuits are provided.

De-energization of the outcounting relay TRB closes contacts *trb2* completing a circuit over said contacts and contacts *txq4* for relay TQ. This relay is slow to release and designed to remain energized during the outcounting impulses as a train passes from the section at an ordinary speed. Relay TQ closes at contacts *tq2* the circuit of a high resistance winding of a thermal relay TH in series with a lamp L. As the circuit through the lamp is completed relay TH is energized over a circuit starting from positive supply through the filament of lamp L, contact *tq2* and the high resistance winding of relay TH. If this circuit remained complete the current would heat filament of lamp L causing its resistance to rise to such a value that the current would be insufficient to hold TH operated. Before such heating occurs a short circuit path is established around the lamp by closing of contact *th4* from positive battery through contact *tq1* which was closed upon operation of relay TQ. At changeover

contact *th2* relay TQC is energized over a circuit from positive supply, contact *lr2* and upper contact *th2*. When the train has left the section, treadle LT is no longer periodically operated and relay TRB remains energized. The circuit of relay TQ is consequently opened at *trb2* for a period long enough so that slow release relay TQ releases. Release of TQ opens the circuit through high resistance winding of relay TH at *tq2* and removes the short circuit from lamp L at *tq1*. Simultaneously a circuit is established through the low resistance winding of relay TH from positive supply through filament of lamp L, contact *th3*, low resistance winding of relay TH, back contact of *tq3* and contact *th1*. The low resistance winding and the lamp are shunted by a resistance R but sufficient current flows in the winding to maintain it operated. After an interval the resistance of the lamp increases due to heating of the filament to a sufficient extent to so reduce the current through the winding of relay TH as to cause the relay TH to release its armature. If the number of outcounting impulses corresponded with the number of incoming impulses switch IC will be in its normal position and relay LR will again be energized. This will open contact *lr2* and release of contact *th2* will have no further effect. Slow release relay TQC will release after an interval whether or not LR is operated and the circuit will be restored to normal unoperated condition.

If, however, at the conclusion of the outcounting impulses, relay LR remains de-energized, i. e., either some error has occurred in the counting operations, or there is still a train, or a portion of a train within the track section, there is before release of TQC a circuit established over contacts *lr2*, back contact *th2*, front contacts *tqcl* and winding relay TQX becomes energized.

Relay HR is energized over a circuit from positive supply over contact *lr2*, winding of relay HR, front contact of *txq5*. Magnet RMB is energized over a circuit traced from positive supply over *hr1*, winding of magnet RMB and contact *txq2*. The opening of contacts *txq4*, however, prevents the re-energization of relay TQ. The magnet RMB is energized to cause the outcounting portion of the switch to take one step. The interrupter or pulsing contacts *rmb* break the circuit of HR which de-energizes and breaks the circuit of RMB. The interrupter contacts again close repeating the cycle of operation outlined above.

This outcounting stepping of the switch continues by the interaction of magnet RMB and relay HR until the switch reaches the normal position.

At *txq3* the circuit by which the relay GR is normally energized when the switch portion RMB is two steps behind the normal position is broken and the relay GR is thus prevented from re-energizing. A circuit is closed over switch portion RMA, switch portion RMB, contact *trb1*, contact *txq1* and winding for the relay LR when the switch portion RMB reaches the normal position. When LR becomes energized the circuit for HR is broken at *lr2* and the circuit for magnet RMB is broken at *hr1*, the relay TQX de-energizes and all relays save GR return to normal position. As GR remains de-energized, the circuit LC remains open and the signal remains at danger.

If it is desired that a special signal should be given to indicate to the driver of a train that he may proceed at caution, despite the track signal being at danger, the relay TQX is caused at its

contacts *txx6* to close a circuit for relay AR to give such a signal. Relay AR then closes a locking circuit for itself over its own contacts *arl* and the normally closed contacts *tral* of the

5 incounting relay TRA.

If, after restoration of the switch IC to normal, without restoration of the signal to clear as described above, a train subsequently passes through the section and causes the same number of incounting and outcounting impulses, the signal will be returned to clear by the operation described below. The wheels passing over incounting treadle ET operate to step switch portion RMA ahead as fully described above. Similarly the outcounting treadle LT subsequently operates to advance switch portion RMB toward normal. Relay TQX will be deenergized by opening of its circuit at back contact *th2* when relay TH operates to move contact *th2* to its front contact. Deenergization of TQX permits the closing of back contact *txx3* preparing a circuit for GR from lower member of switch portion RMB through contact *txx3* and winding of relay GR. When switch portion RMB advances to a point two steps behind switch portion RMA the circuit of relay GR is completed and relay GR is energized. Relay GR then closes a locking circuit by closing its front contact *gr1*, and likewise closes contact *gr2*, as fully described above. When switch portion RMB then reaches normal position relay LR is energized from positive supply over switch portion RMA, switch blade 10 of switch portion RMB, contact *trb1*, contact *gr2* and winding of relay LR. The circuit of LC is completed at *lr1* and *gr3* and the signal restored to clear.

Thus the system provides a means for restoring the signal to clear, upon the passing through the section of a second train proceeding at caution and operating the switch correctly.

In another modification, the signal is not restored to clear until two trains have passed through the section at caution and have been counted in and out correctly. For this purpose the additional circuits shown in Fig. 1A are provided. A back contact of relay TPQ is included in the locking circuit of the guard relay GR, and a back contact of relay TPO is included in the circuit LC.

When TQX is energized as described above it causes the restoration of the counting switch to normal position as described and also energizes a relay TPO through contact *txx8* which closes a locking circuit for itself at *tpo1*. When the first train is counted into and out of the section correctly both LR and GR are energized, but the back contact of relay TPO included in the circuit LC prevents the signal being restored to clear. A circuit is closed for relay TPQ through *tpo2* which closes a locking circuit for itself at *tpq1* and breaks the circuit of relay GR by opening the contact in the locking circuit. Relay TPQ also opens the locking circuit for relay TPO at *tpq2*, but as relay GR has de-energized, the signal remains at danger. Relay TPQ remains energized. On a second train being counted in and out of the section correctly, the relays LR and GR are energized in normal manner at the conclusion of operations. Energization of relays GR and LR breaks the circuit of relay TPQ at *gr4* and *lr3* restoring the circuits clear.

In a further modification, shown in Fig. 2 the switch may be restored manually to normal position without restoring the signal to clear. If a train has entered and left the section and the

signal remains at danger, the signalman may actuate the key RK. This energizes relay TQX which then performs the same functions as in the automatic operation described in connection with Fig. 1 and restores the switch to normal whilst keeping open the circuit of the guard relay GR and thus maintaining the signal at danger. The signal is then restored to clear upon the subsequent correct incounting and outcounting of a second train passing through the section, and particularly described in connection with Fig. 1.

In this modification also, the restoration of the signal to clear may be delayed until after two trains have traversed the section and been counted into and out of the section correctly, by the addition of the relays TPO TPQ and the modifications to the locking circuit of GR and the circuit LC described above more particularly with reference to Fig. 1A.

What is claimed is:

1. A railway or the like signal control system comprising a signal, a section of track, means for in-counting and out-counting the wheels of a train into and out of said section, means controlled by said counting means for controlling said signal into danger if the number of wheels registered by the in-counting and out-counting differ, and into clear if the number of wheels registered by the in-counting and out-counting agree, means operative for establishing an operating circuit for said counting means without restoring said signal to clear when the signal has been left at danger by a differing in-counting and out-counting of wheels in the section, and means responsive to a subsequent agreeing in-counting and out-counting operation for restoring said signal to clear.

2. A railway or the like signal control system comprising a signal, a track section, wheel counting apparatus in said section for counting wheels into and out of said section, a signal, means controlled by said counting apparatus for controlling said signal to danger in response to displacement of said counting apparatus from normal by a disagreement of said in-counting and out-counting and into clear if said in-counting and out-counting agree, means for returning said counting apparatus to normal without restoring said signal to clear after said counting apparatus has been left out of normal by a disagreement in the in-counting and out-counting operation, and means responsive to a subsequent agreeing in-counting and out-counting operation of said counting means to restore said signal to clear.

3. A railway or the like signal control system as claimed in claim 2, in which said means for restoring said counting apparatus to normal comprises means responsive to the condition that said signal remains at danger for a predetermined time, on conclusion of said out-counting operation for restoring said counting apparatus to normal while leaving the signal at danger.

4. A railway or the like signal control system as claimed in claim 2, in which said means for restoring said counting apparatus to normal comprises relay means responsive to the condition that said signal remains at danger for a predetermined time for restoring said apparatus to normal, said responsive means including a lamp in series with a relay, said time being determined by the rise in the resistance of said lamp to a value sufficient to cause said relay to deenergize.

5. A railway or the like signal control system as claimed in claim 2, in which said means for

restoring said counting apparatus to normal comprises a relay, means for energizing said relay at the commencement of counting of wheels out of said section, a lamp, and means for connecting said lamp in series with said relay in response to the conclusion of said out-counting operation.

6. A railway or the like signal control system as claimed in claim 1, in which said in-counting and out-counting means includes contacts operated by the wheels of a train, said contacts being normally closed and being opened by the passage of a wheel of a train.

7. A railway or the like signal control system as claimed in claim 2, in which said wheel counting apparatus comprises contacts operated by the wheels of a train, said contacts being normally

closed and being opened by the passage of a wheel of a train.

8. A railway or like signal control system as claimed in claim 2, in which said means for restoring the counting apparatus to normal position is manually operable, further comprising means to prevent such restoration from placing the signal to clear position until after operation of said means responsive to subsequent correct counting.

9. A railway or like signal control system as claimed in claim 1, further comprising means for maintaining the signal at danger until two trains in succession have been counted into and out of the section correctly.

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