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1,782,052

TRAIN COUNTING APPARATUS

Filed Jan. 16, 1930

2 Sheets-Sheet 1

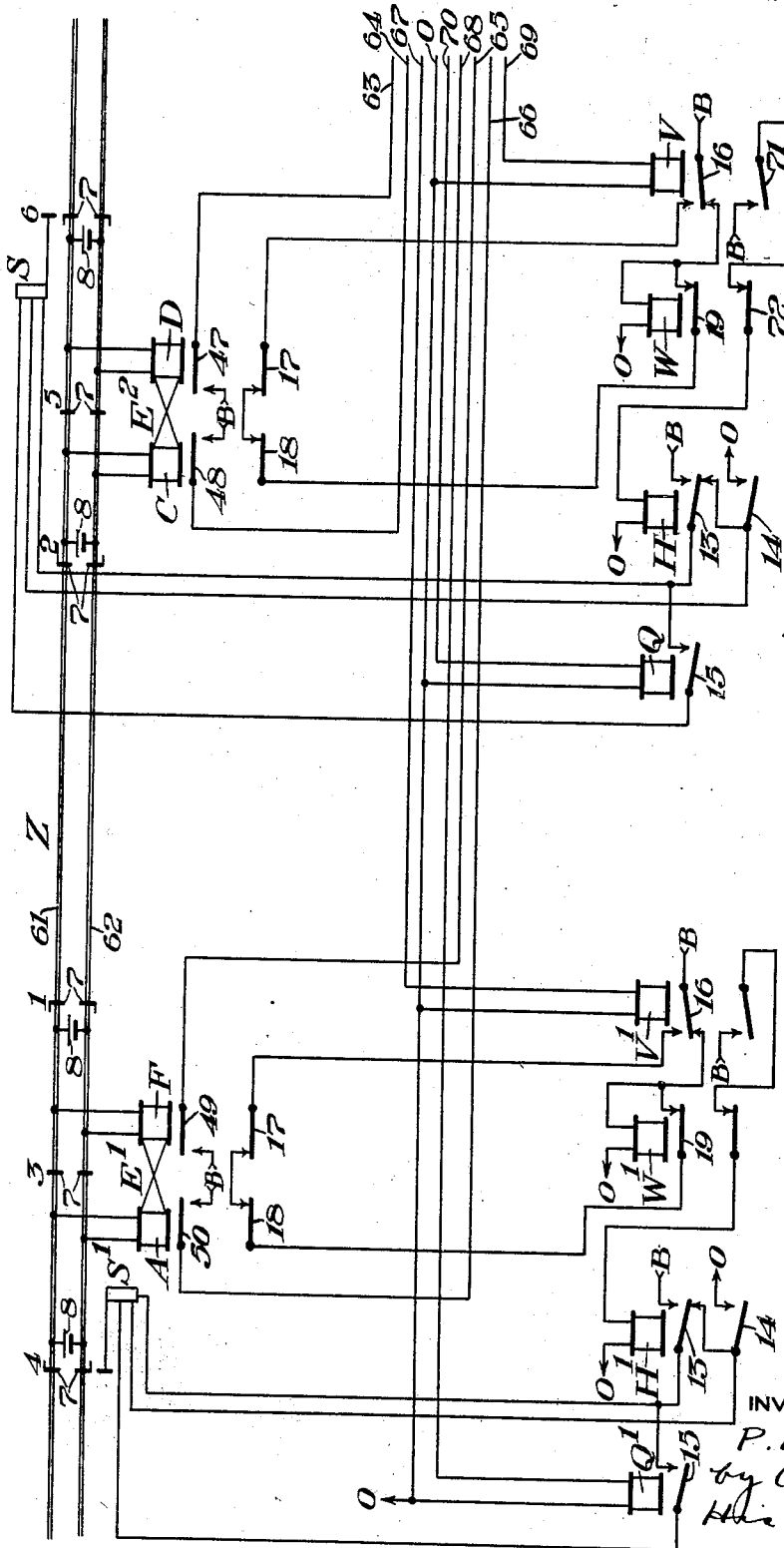


Fig. 1a

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Nov. 18, 1930.

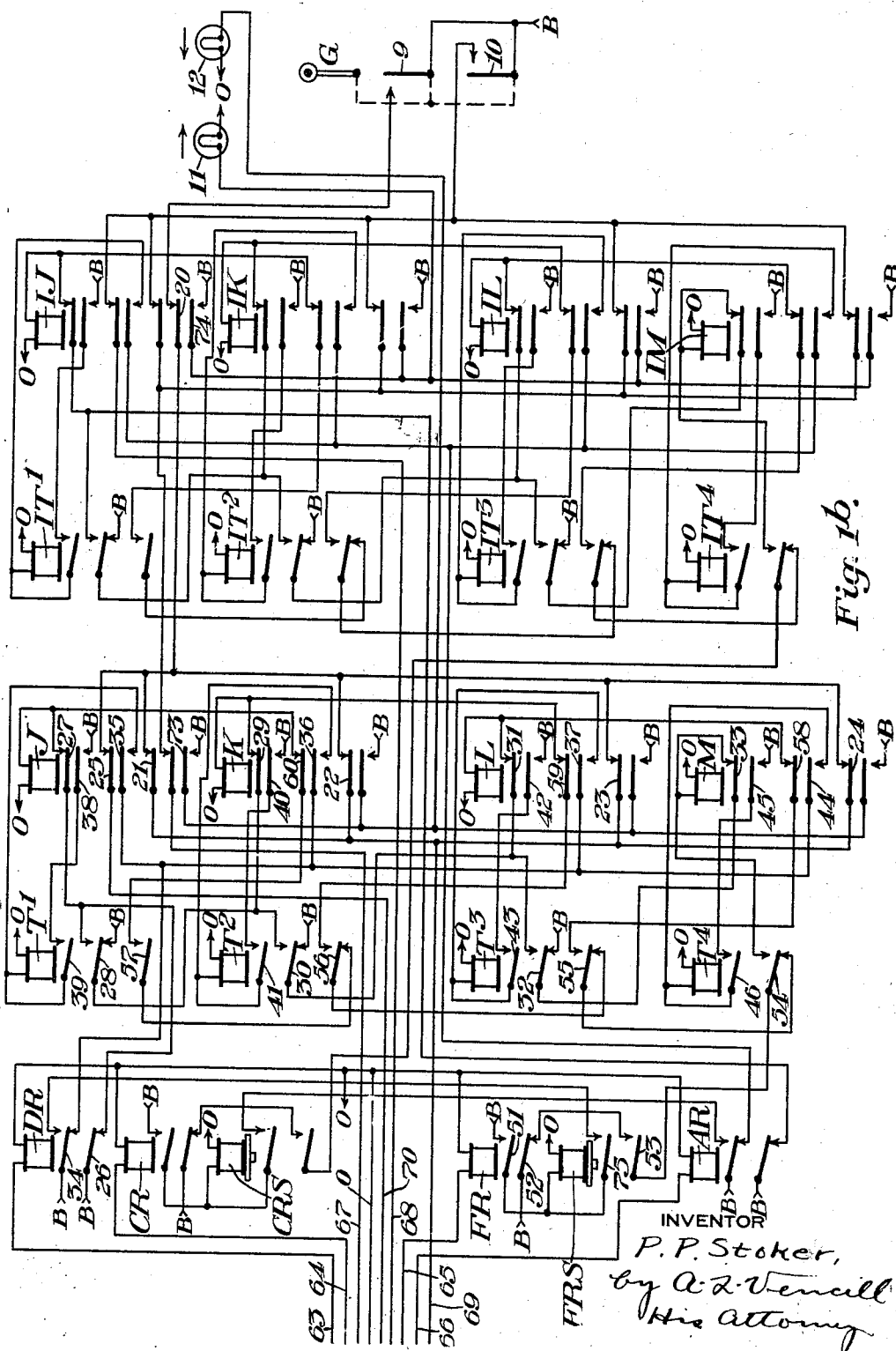
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

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TRAIN-COUNTING APPARATUS

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My invention relates to train counting apparatus, and has for an object the provision of novel and improved means for counting the passage of trains into and out of a stretch of single track, whereby a certain number of trains moving in one direction may be allowed to enter such stretch, but no trains moving in the other direction will be allowed to enter the stretch until all of the first-mentioned trains have passed out of the stretch.

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

In the accompanying drawings, Figs. 1^a and 1^b, when placed end to end, with Fig. 1^a on the left, constitute a diagrammatic view showing one form of apparatus embodying my invention.

Referring to the drawings, the reference characters 61 and 62 designate the track rails of a single track over which traffic moves in both directions. These rails are divided by insulated joints 7 to form a stretch 1—2, which stretch I will hereinafter refer to as stretch Z. The purpose of the present invention is to provide means for counting the passage of trains through the stretch Z.

Located at the left-hand end of the stretch Z are two short insulated track sections 1—3 and 3—4. Each of these sections is provided with a track circuit comprising a track battery 8 and the operating winding of a track relay A or F, the two track relays being interlocked in the usual manner to constitute an interlocking relay E¹. Located at the right-hand end of the stretch Z are two short insulated sections of track 2—5 and 5—6, likewise provided with track circuits comprising track relays C and D which are interlocked to constitute an interlocking relay E² of the usual and well known type. Each track relay A and D may be termed an "operating" relay, whereas, each of the other track relays F and C may be termed a "restoring" relay.

Located at the point 6 is a signal S for governing traffic moving toward the left in the stretch Z, and located at the point 4 is another signal S¹ for governing traffic moving toward the right into the stretch Z.

The operating track relay D is provided with an operating repeater relay DR, and the operating track relay A is provided with an operating repeater relay AR. The restoring track relay C is provided with a restoring repeater relay CR, while the restoring relay F is provided with a restoring repeater relay FR. Associated with the repeater relay CR is a slow-releasing relay CRS, and associated with the repeater relay FR is a slow-releasing relay FRS.

Associated with the signal S is a series of counting relays J, K, L and M, and associated with the signal S¹ is another series of counting relays IJ, IK, IL and IM. The first group of counting relays is provided with a group of transfer relays T¹, T², T³ and T⁴; while the second group of counting relays is provided with another group of transfer relays IT¹, IT², IT³ and IT⁴.

The signals are controlled in part by a manually operable lever G, having a normal or intermediate position in which both of the associated contacts 9 and 10 are open, but which lever may be moved to a left-hand position wherein contact 9 is closed, and to a right-hand position wherein contact 10 is closed. Associated with this lever G are two indicating lamps 11 and 12, the functions of which will appear hereinafter.

Signal S is provided with a normally de-energized caution relay H, and a normally de-energized proceed relay Q. Relay H is controlled by a normally de-energized main relay V, and by a normally energized stick relay W, the relay V being controlled in part by the manually operable lever G as will hereinafter be explained. Relay W is normally energized by a circuit which passes from terminal B of a suitable source of current, through the back point of contact 16 of relay V, and the winding of relay W to terminal O of the same source of current. Signal S¹ is provided with caution and proceed relays H¹ and Q¹ respectively, and relay H¹ is controlled by relays V¹ and W¹, which correspond in all respects to the relays V and W associated with signal S.

Each of the counting relays J, K, L and M, as well as IJ, IK, IL and IM, is normally

energized, but all of the transfer relays and all of the repeater relays are normally de-energized.

The circuits for the various relays will be traced in connection with the description of the operation of the apparatus.

I will first assume that the operator desires to permit a train moving toward the left to enter the stretch Z. To do this, he will move lever G to the left, thereby closing a circuit for relay V, which circuit passes from terminal B, through contact 9 of lever G, contact 20 of counting relay IJ, contacts 21, 22, 23 and 24 of counting relays J, K, L and M, respectively, all of which contacts are connected in multiple, thence through wire 69 and the winding of relay V, to a common wire O which is connected to terminal O of the same source of current. When relay V becomes energized, it will open the circuit previously traced for relay W, but will close a stick circuit for the latter relay, which stick circuit passes from terminal B, through the front point of contact 16 of relay V, front contacts 17 and 18 of track relays D and C, respectively, front contact 19 of relay W, and the winding of relay W to terminal O. Relay W is sufficiently slow-releasing in character to prevent it from releasing during the transit of contact 16 from its back to its front point. Relay H will become energized in response to the closing of relay V, by virtue of a circuit which includes front contact 71 of relay V and front contact 72 of relay W. The closing of relay H will close a caution circuit for signal S, which circuit is from terminal B through a front point of contact 13 of relay H, operating mechanism of signal S, and front contact 14 of relay H to terminal O. Relay Q will also become energized by virtue of a circuit which passes from terminal B, through contact 9 of lever G, contact 20 of counting relay IJ, contact 25 of counting relay J, wire 70, and the winding of relay Q to common wire O. The closing of relay Q will close a proceed circuit for signal S, which circuit passes from terminal B, through the front point of contact 13 of relay H, front contact 15 of relay Q, the operating mechanism of signal S and front contact 14 of relay H to terminal O. It follows that signal S will give a proceed indication and so the train moving toward the left will be permitted to enter stretch Z.

When this train enters section 5—6, it will open track relay D, thereby opening at contact 17 the stick circuit for relay W, so that the latter relay will become de-energized and will open at contact 72 the circuit for the caution relay H. This will result in causing signal S to return to the stop position. The opening of relay D will also close the circuit for the repeater relay DR, which circuit passes from terminal B, through back contact 47 of relay D, wire 63 and winding of

relay DR to common wire O. The energization of relay DR will open the normally closed stick circuit for counting relay J, which circuit passes from terminal B, through back contact 26 of relay DR, front contact 27 of relay J, and the winding of relay J to terminal O. It follows that relay J will become de-energized. When the train passes from section 5—6 into section 2—5, it will have no effect on the contacts associated with relay C, because of the interlocking characteristic of the two track relays C and D. The back contact 47 of relay D will open, however, thereby again de-energizing the operating repeater relay DR, and this will result in closing a pick-up circuit for transfer relay T¹, which circuit passes from terminal B, through back contact 34 of relay DR, back contact 35 of relay J, and the winding of relay T¹ to terminal O. The closing of relay T¹ will close a stick circuit for this relay, which circuit passes from terminal B, through back contact 38 of relay J, front contact 39 of relay T¹, and the winding of relay T¹ to terminal O. With the first train in stretch Z, then, counting relay J will be de-energized and transfer relay T¹ will be energized. Inasmuch as the circuit for the proceed relay Q includes a front contact 25 of counting relay J, it follows that relay Q has become de-energized and will remain de-energized until relay J again becomes energized. The circuit for the main relay V has not been affected, however, because this circuit includes, in multiple, front contacts of the several counting relays J, K, L and M.

I will now assume that the operator desires to allow second train moving toward the left to enter the stretch Z, while this stretch is still occupied by the first train. To do this, he will restore lever G to its middle position, thereby de-energizing relay V, with the result that the stick relay W will again become energized. The operator will then move the lever G to its left-hand position, thereby energizing relay V, with the result that relay H will become energized, and this will cause signal S to assume the caution position. Signal S cannot be caused to give the proceed indication, because the proceed relay Q cannot be energized. When the second train enters section 5—6, the opening of track relay D will close the circuit for the operating repeater relay DR as before, and the closing of relay DR will open a stick circuit for relay K, which circuit is from terminal B, through the back contact 26 of relay DR, front point of contact 28 of transfer relay T¹, front contact 29 of relay K, and the winding of relay K to terminal O. It follows that relay K will become de-energized. When repeater relay DR again opens in response to the closing of track relay D, transfer relay T² will become energized, the circuit being from terminal B, through the back point of contact 34 of relay DR, back

contact 36 of relay K, and the winding of relay T² to terminal O. Relay T² will then remain energized by a circuit which passes from terminal B, through back contact 40 of relay K, front contact 41 of relay T², and the winding of relay T² to terminal O. Relay T² being energized, counting relay L is placed under the control of repeater relay DR, the circuit being from terminal B, through back contact 26 of relay DR, front point of contact 28 of relay T¹, front point of contact 30 of relay T², front contact 31 of relay L, and the winding of relay L to terminal O.

Assuming now that the operator desires to admit a third train to the stretch Z, he will first restore lever G to its middle position and will then again move it to its left-hand position, thereby energizing relays V and W, as before. When the third train enters section 5—6, relay DR will become energized and will open the stick circuit just traced for relay L, with the result that the latter relay will become opened. When relay DR again becomes de-energized, transfer relay T³ will be energized by virtue of a circuit which passes from terminal B, through back contact 34 of relay DR, back contact 37 of relay L, and the winding of relay T³ to terminal O. This will place relay M under the control of relay DR, the circuit being from terminal B, through the back point of contact 26 of relay DR, front contact 28 of relay T¹, front contact 30 of relay T², front contact 32 of relay T³, front contact 33 of relay M, and the winding of relay M to terminal O.

If now a fourth train moving toward the left is permitted to enter stretch Z, the opening of relay DR will open the circuit just traced for relay M, so that the latter relay will become de-energized. Then when relay DR again closes, transfer relay T⁴ will become energized by a circuit which passes from terminal B, through back contact 34 of relay DR, back contact 44 of relay M, and the winding of relay T⁴ to terminal O.

All four of the counting relays J, K, L and M will now be open, so that the circuit for relay V will be open at all four contacts 21, 22, 23 and 24 of these relays, with the result that signal S cannot again be moved to the caution position, and so it follows that no further trains moving toward the left can be permitted to enter stretch Z.

I will now assume that the first of the trains referred to above, passes out of the stretch Z. When this train enters section 3—1, it will open track relay F, and this will close a circuit for the restoring repeater relay FR, which circuit includes back contact 49 of relay F and wire 65. The closing of repeater relay FR will close at front contact 51, a circuit for the slow-releasing relay FRS, which circuit will be obvious from the drawing. Then when the train passes out of section 3—1, relay F will become energized, thereby releasing

repeater relay FR. Before relay FRS releases, however, a circuit for relay M will become closed, which circuit passes from terminal B, through back contact 52 of relay FR, front contact 53 of relay FRS, front point of contact 54 of relay T⁴, and the winding of relay M to terminal O. Relay M will then be held closed by the stick circuit traced hereinbefore, which circuit includes back contact 26 of repeater relay DR. The closing of relay M will open the stick circuit for relay T⁴ at contact 45, so that relay T⁴ will also open. Owing to the interlocking characteristics of relay E¹, the de-energization of relay A when the train enters sections 3—4 will have no effect on the rest of the apparatus.

If now the second train passes out of stretch Z, relays FR and FRS will be operated as before, whereupon, relay L will become energized by virtue of a circuit which passes from terminal B, through back contact 52 of relay FR, front contact 53 of relay FRS, back contact 54 of relay T⁴, front contact 55 of relay T³, front contact 58 of relay M and winding of relay L to terminal O. Relay L will then be held closed by virtue of the stick circuit which was traced hereinbefore. The opening of relay L will open the stick circuit for relay T³ at contact 42, and the normal stick circuit for relay M will then be closed through front contact 33 of relay M and back contact 32 of relay T³. When the third train passes out of the stretch Z, relay K will become energized by virtue of a circuit which will be obvious from the foregoing without detailed explanation. The closing of relay K will open the stick circuit for relay T² at contact 40, and the normal stick circuit for relay L will then be closed through back contact 30 of relay T². Similarly, when the fourth train passes out of the stretch Z, relay J will become energized and relay T¹ will open. The parts of the apparatus will then be restored to the conditions in which they are shown in the drawing.

When the operator desires to allow a train moving toward the right to enter stretch Z, he will swing the lever G to the right-hand position, thereby closing a circuit for relay V¹, which includes lever contact 10, front contacts in multiple of relays IJ, IK, IL and IM, a front contact of relay J, and wire 67. Relay Q¹ will also become energized by virtue of a circuit which includes a front contact of relay IJ, and wire 68. When the train enters section 4—3 it will open the relay A, and this will close at back contact 50 the circuit for repeater relay AR, and successive operations of track relay A by successive trains moving toward the right will actuate relay AR in the same way that relay DR was actuated by successive trains moving toward the left. Relay AR will control the counting relays IJ, etc., and the transfer relays IT¹,

etc., in the same way that the corresponding relays were controlled by relay DR. It follows that it is unnecessary to explain in detail the operation of the apparatus during the passage of trains moving toward the right.

While the stretch Z is occupied by a train moving toward the right, counting relay IJ will, of course, be open, and, consequently, the circuits for relays V and Q will be opened at front contact 20 of this relay. It follows that under this condition it will be impossible for the operator to cause signal S to assume either the caution or the proceed position, and so it will be impossible for him to admit a train moving toward the left into stretch Z. For a similar reason it is impossible to allow a train moving toward the right to enter stretch Z while this stretch is occupied by one or more trains moving toward the left.

When counting relay J is open, indication lamp 12 will be lighted by virtue of a circuit which includes back contact 73 of this relay, and this lamp will indicate to the operator that the stretch Z is occupied by one or more trains moving toward the left. Multiple circuits are provided for lamp 12 which include back contacts of the remaining counting relays K, L and M, to insure that this lamp will be lighted whenever any one of the counting relays is open. Similarly, when counting relay IJ is open, lamp 11 will be lighted by virtue of a circuit which includes back contact 74 of this relay, thereby indicating to the operator that stretch Z is occupied by one or more trains moving toward the right. This lamp is provided with multiple circuits corresponding to those for lamp 12.

Referring now to the assumption that stretch Z is occupied by a train moving toward the left, I will assume that this train enters the restoring section 3—1 at the same time that a second train moving toward the left enters the operating section 5—6. The effect of the first train would be to close relay J, and the effect of the second train would be to open relay Q, but obviously neither of these operations should be allowed to occur. For this reason I have provided a stick circuit for relay FRS, which circuit passes from terminal B, through the front point of contact 34 of relay DR, front contact 75 of relay FRS, and the winding of relay FRS to terminal O. It follows that relay FRS will remain energized as long as relay DR remains energized. In other words, the control of relay FRS is transferred from relay FR to relay DR, and so relay K, which is opened due to the closing of relay DR, will again become closed after relay DR closes, the circuit for relay K then being from terminal B, through back contact 52 of relay FR, front contact 53 of relays FRS, back contact 54 of relay T⁴, back contact 55 of relay T³, front contact 56 of

relay T², front contact 59 of relay L, and the winding of relay K to terminal O. It follows that after the first train has passed out of stretch Z and the second train has entered this stretch, relay J will be open and relay K will be closed, so that the counting relays will be in the condition corresponding to but one train in the stretch. Relay CRS is provided with a stick circuit controlled by the relay AR for the same purpose.

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, a stretch of railway track, a signal governing traffic into said stretch, a plurality of normally energized counting relays, means for successively de-energizing said relays in one order as successive trains enter said stretch, means for successively re-energizing said relays in the reverse order as successive trains leave the stretch, a main relay and a proceed relay for said signal, a circuit for said main relay including front contacts of all of said counting relays in multiple, a circuit for said proceed relay including a front contact of only the first of said counting relays, a caution indication circuit for said signal controlled by said main relay, and a proceed indication circuit for said signal controlled by both said main and said proceed relays.

2. In combination, a stretch of railway track, signals at the ends of said stretch for governing traffic into the stretch, a plurality of normally energized counting relays associated with each signal, means operating as successive trains enter said stretch from one end to successively de-energize the associated counting relays in one order, means operating as said trains successively leave the stretch at the other end to successively re-energize in the other order the relays which were de-energized as the same trains entered the stretch, means for preventing each signal from indicating proceed unless all of the associated counting relays are energized, and for causing the signal to indicate caution when any number less than all of the associated counting relays are energized, and means for preventing either signal from indicating caution or proceed when the first counting relay associated with the other signal is de-energized.

3. In combination, a stretch of railway track, two short insulated sections at each end of said stretch, the sections remote from the stretch being operating sections and the sections adjacent the stretch being restoring sections, signals at the ends of said stretch

for governing traffic into the stretch, a plurality of normally energized counting relays associated with each signal, means responsive to the passage of successive trains over each operating section to successively de-energize the associated counting relays in one order, means responsive to the passage of such trains over the restoring section at the other end of the stretch to successively re-energize in the other order the relays which were de-energized as the same trains entered the stretch, means for preventing operation of said counting relays due to the passage of trains over said restoring sections while entering the stretch, means for preventing each signal from indicating proceed unless all of the associated counting relays are energized and for causing the signal to indicate caution when any number less than all of the associated counting relays are energized, and means for preventing either signal from indicating caution or proceed when the first counting relay associated with the other signal is de-energized.

4. In combination, a stretch of railway track, two short insulated sections at each end of said stretch, track circuits including track relays for said sections, the relays for the sections remote from said stretch being operating relays and the relays for the sections adjacent said stretch being restoring relays, an operating repeater relay for each operating track relay and a restoring repeater relay for each restoring track relay, the track relays at each end of the stretch being interlocked so that a train entering the stretch will actuate only the operating repeater relay and a train leaving the stretch will actuate only the restoring repeater relay, signals at the ends of said stretch for governing traffic into the stretch, a plurality of normally energized counting relays associated with each signal, means responsive to successive actuations of each operating repeater relay to successively de-energize the associated counting relays in one order, means responsive to successive actuations of each restoring repeater relay to successively re-energize the associated counting relays in the other order, means for preventing each signal from indicating proceed unless all of the associated counting relays are energized and for causing the signal to indicate caution when any number less than all of the associated counting relays are energized, and means for preventing either signal from indicating caution or proceed when the first counting relay associated with the other signal is de-energized.

In testimony whereof I affix my signature.
PAUL P. STOKER.