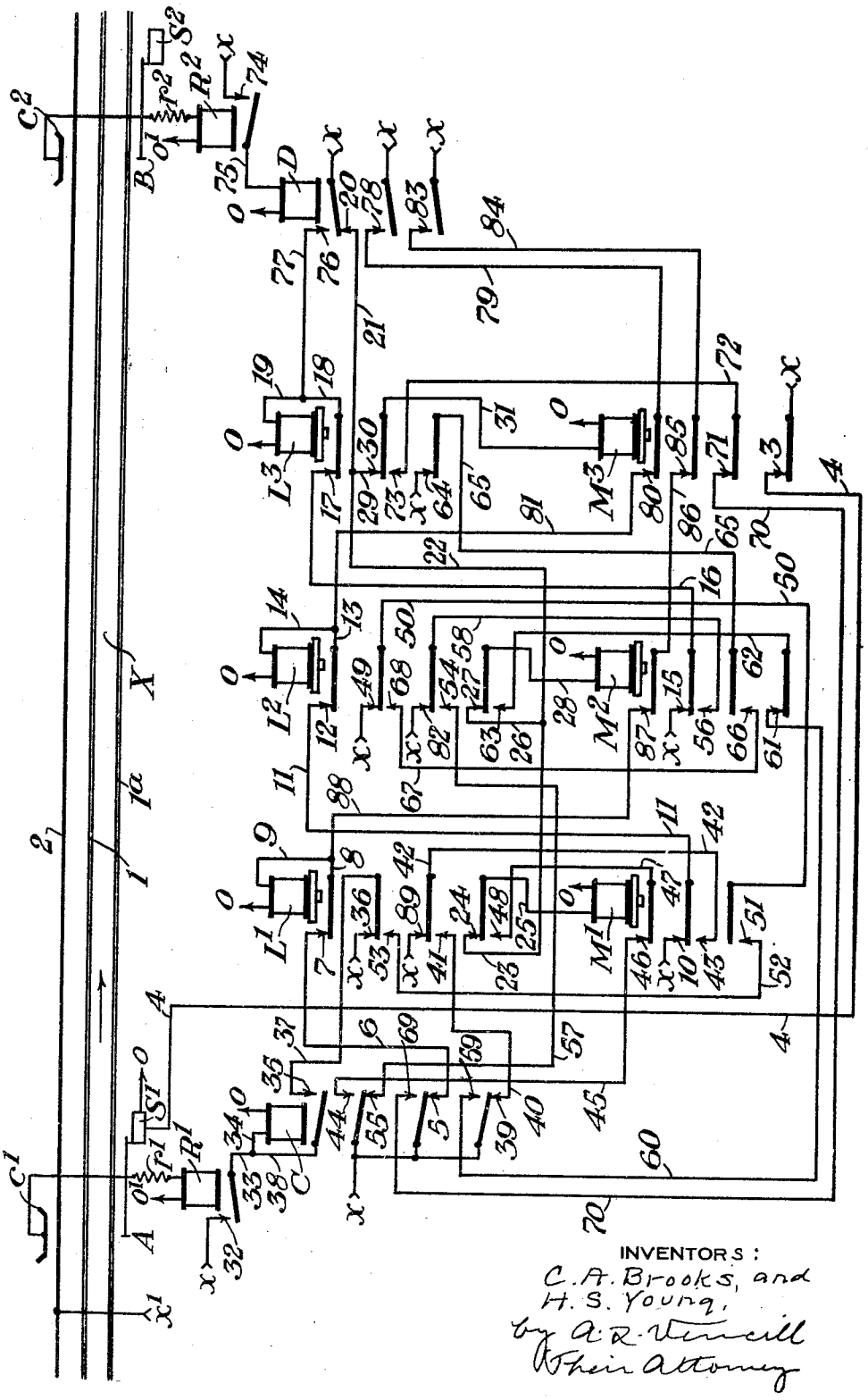
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RAILWAY TRAFFIC GOVERNING APPARATUS

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RAILWAY TRAFFIC GOVERNING APPARATUS

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Our invention relates to railway traffic governing apparatus, and particularly to apparatus for counting the number of cars entering and leaving a given stretch of track.

One of the features of our invention is the provision, in apparatus of the class described, of means operated by the cars as they enter or depart from the stretch of track for indicating when the maximum permissible number of cars occupy the stretch.

We will describe one form of railway traffic governing apparatus embodying our invention, and will then point out the novel features thereof in claims.

The accompanying drawing is a diagrammatic view showing one form of railway traffic governing apparatus embodying our invention.

Referring to the drawing, a railway track X over which traffic proceeds in the direction indicated by the arrow, is shown as comprising rails 1 and 1^a, and is provided with signals S^1 and S^2 controlling the entrance and exit respectively of a stretch A—B of the track X which is of sufficient length to accommodate a predetermined number of cars; in the present instance, three cars. The signal S^1 is controlled in a manner presently to be described so as to indicate "clear" when there is sufficient room in the stretch for one or more cars, but to otherwise display a "stop" indication. Electric current is supplied to the cars operating over the track X from a conductor 2, such as a trolley wire or third rail which derives its energy from a suitable source of energy having two terminals x^1 and o^1 one of which, x^1, is connected directly with the conductor 2. Signal S^2 may be controlled in any suitable manner, and may, for example, be under the control of traffic conditions in advance of this signal or may be controlled manually by an operator. A contactor c^1 is associated with the conductor 2 adjacent the entrance of the stretch for engagement by a vehicle carried current collecting device (not shown), such as a trolley wheel or shoe, and is connected, through a resistance r^1, with one terminal of a first control relay R^1, the other terminal of which is connected with terminal o^1 of the source of electric energy. A contactor c^2 is also located adjacent the exit end of the stretch and is connected through a resistance r^2 with one terminal of a second control relay R^2, the other terminal of which is connected with terminal o^1 of the source. When the current collecting device engages either contactor c^1 or c^2, it electrically connects such contactor with the conductor 2, so that the associated relay R^1 or R^2 becomes energized.

The apparatus also embodies an arrival relay C controlled by the relay R^1, and a departure relay D controlled by the relay R^2. The relays C and D, in turn, control a plurality of slow-releasing neutral stick relays L^1, L^2 and L^3 corresponding in number with the number of cars that the stretch A—B will hold, and which I will term the first car main relay, the second car main relay and the third car main relay, respectively. Associated with the relays L^1, L^2 and L^3 are three slow-releasing auxiliary neutral stick relays M^1, M^2 and M^3, which I will term the first car auxiliary relay, the second car auxiliary relay, and the third car auxiliary relay, respectively.

When the stretch A—B is unoccupied, the several parts of the apparatus occupy their normal positions shown in the drawing. When in this condition, the signal S^1 is caused to display a "clear" indication by electric current which traverses a circuit from a terminal x of a low voltage source of electric energy, through front contact 3 of the third car auxiliary relay M^3, wire 4 and operating mechanism of signal S^1 to terminal o of such low voltage source. The first car main relay L^1 is energized by electric current which traverses a stick circuit from terminal x, through back contact 5 of the arrival relay C, wire 6, front contact 7 of first car main relay L^1, wires 8 and 9, and winding of this relay to terminal o. The relay L^2 is energized over a stick circuit which passes from terminal x, through front contact 10 of relay M^1, wire 11, front contact 12 of relay L^2, wires 13 and 14, and winding of this relay to terminal o. The relay L^3 is also energized over a stick circuit which may be traced from terminal x, through front

contact 15 of auxiliary relay M^2, wire 16, front contact 17 of relay L^3, wires 18 and 19, and winding of this relay to terminal *o*.

The first car auxiliary relay M^1 is energized by current which flows from terminal *x*, through back contact 20 of departure relay D, wires 21, 22 and 23, front contact 24 of first car main relay L^1, wire 25, and winding of auxiliary relay M^1 to terminal *o*. The second car auxiliary relay M^2 is energized by electric current which traverses a circuit from terminal *x*, through back contact 20 of departure relay D, wires 21, 22 and 26, front contact 27 of relay L^2, wire 28 and winding of relay M^2 to terminal *o*. The auxiliary relay M^3 is energized over a circuit passing from terminal *x*, through back contact 20 of departure relay D, wires 21 and 29, front contact 30 of relay L^3, wire 31 and winding of relay M^3 to terminal *o*.

With the parts in the positions above described, we will assume that a first car enters the stretch A—B and carries its trolley wheel or other current collecting device into engagement with the contactor c^1. This will connect the contactor c^1 with the conductor 2, and current will flow thence through resistor r^1, and winding of control relay R^1 to terminal o^1 of the first source, thereby momentarily energizing relay R^1 and causing it to close its front contact 32. The closing of this contact completes a circuit from terminal *x*, through front contact 32 of relay R^1, wires 33 and 34, and winding of approach relay C to terminal *o* of source, thereby energizing the approach relay C and causing it to close its front contacts. This establishes a stick circuit for relay C from terminal *x*, through a front contact 36 of relay L^1, wire 37, front contact 35 of approach relay C, wires 38 and 34, and winding of approach relay C to terminal *o*. This stick circuit maintains the approach relay C energized after the control relay R^1 becomes deenergized upon the movement of the current collecting device out of engagement with the contactor c^1. The energization of the approach relay C also opens its back contact 5, thereby opening the stick circuit for the first car main relay L^1 previously traced through this contact and causing the deenergization of this relay, the stick circuit of relay C maintaining the contact 5 open until the slow-releasing relay L^1 has had time to open its front contact 7. As soon, however, as the contact 7 opens, another break is provided in the stick circuit for the first car main relay L^1 and, simultaneously with the opening of the contact 7, the front contact 36 of this relay also opens. The opening of contact 36 breaks the stick circuit previously traced through this contact for approach relay C thereby causing the relay C again to become deenergized and close its back contact 5, but the stick circuit through this contact will not be reestablished for the reason that the front contact 7 of slow-releasing relay L^1 is now open.

The deenergization of the first car slow-releasing main relay L^1 also causes the front contact 24 of this relay to open and causes the deenergization of slow-releasing auxiliary relay M^1 which causes the front contact 10 of this relay also to open and interrupt the stick circuit previously traced therethrough for the second main relay L^2. The deenergization of the first car auxiliary relay M^1, however, establishes a second stick circuit for the second car main relay L^2 before it has had time to open its contact 12. Current in this second stick circuit flows from terminal *x*, through back contact 39 of approach relay C, wire 40, a back contact 41 of relay L^1, wire 42, back contact 43 of relay M^1, wire 11, front contact 12 of relay L^2, wires 13 and 14, and winding of relay L^2 to terminal *o*. The slow-releasing relay L^2 consequently remains energized.

If the first car stops with its current collecting device in engagement with the contactor C^1, the front contact 24 of slow-releasing relay L^1 opens at the expiration of a predetermined interval of time, and opens the circuit through this contact which maintains relay M^1 energized. Under such conditions, the stick circuits for the second car main relay L^2 would not be established through the back contact 43 of the auxiliary relay M^1 by reason of the fact that the back contact 39 of approach relay C is open due to the energization of this relay. If this happens, it causes the deenergization of the second main relay L^2 and such succeeding relays as are dependent upon the operation of relay L^1. In order, therefore, to insure against such a possibility we provide a stick circuit for relay M^1 from terminal *x*, through a front contact 44 of arrival relay C, wire 45, front contact 46 of relay M^1, wire 47, back contact 48 of relay L^1, wire 25, and winding of relay M^1 to terminal *o*. This stick circuit is established immediately upon the closing of back contact 48 and before the slow-releasing relay M^1 has had time to open its front contact 10, and maintains the second main relay L^2 energized by its stick circuit previously traced through front contact 10 of relay M^1, notwithstanding the abnormal condition above described.

When a second car now enters the stretch A—B and carries its current collecting device into engagement with the contactor c^1, it will energize the control relay R^1 and arrival relay C in the manner previously described. The energization of the arrival relay C again causes the front contact 35 thereof to close and immediately establish a stick circuit for this relay from terminal *x* of the source, through front contact 49 of the second car main relay L^2, wire 50, back contact 51 of

relay M^1, wire 52, a back contact 53 of relay L^1, wire 37, front contact 35 of arrival relay C, wires 38 and 34, and winding of relay C to terminal *o*. The energization of arrival relay C also opens back contact 39 thereof and interrupts the stick circuit for the slow-releasing relay L^2, previously traced through this contact, thereby causing front contacts 49 and 27 of this relay to open and a back contact 54 thereof to close at the expiration of a predetermined time interval. The opening of front contact 49 of relay L^2 interrupts the stick circuit previously traced through this contact which maintains the arrival relay C energized after the current collecting device moves out of engagement with the contactor c^1 and permits this relay to close a back contact 55 thereof. Also, the opening of front contact 27 of relay L^2 interrupts the circuit previously traced through this contact which maintains the auxiliary relay M^2 normally energized and permits this relay to open its front contact 15 and to close a back contact 56 thereof. The opening of front contact 15 interrupts the stick circuit for relay L^3 previously traced through this contact but a second stick circuit is, however, immediately established for the relay L^3 from the terminal *x* through back contact 55 of arrival relay C, wire 57, back contact 54 of relay L^2, wire 58, back contact 56 of relay M^2, wire 16, front contact 17 of relay L^3, wires 18 and 19, and winding of relay L^3 to terminal *o*. The slow-releasing third car main relay L^3 consequently remains energized.

As in the case of the first car, if the second car stops with its current collecting device in engagement with the contactor c^1, the front contact 27 of slow-releasing relay L^2 opens at the expiration of a predetermined time interval and interrupts the circuit through this contact which maintains relay M^2 energized. Under such conditions, the second stick circuit for the third car main relay L^3 is not established through the back contact 56 of the second auxiliary relay M^2 by reason of the fact that the back contact 55 of the arrival relay C is open due to the energization of this relay. If this happens, it causes the deenergization of the third car main relay L^3 and the relay M^3 controlled thereby. In order, therefore, to insure also against this possibility, we provide a stick circuit for relay M^2 from terminal *x* through front contact 59 of arrival relay C, wire 60, front contact 61 of relay M^2, wire 62, back contact 63 of relay L^2, wire 28, and winding of relay M^2 to terminal *o*. This circuit is closed immediately upon the opening of front contact 27 and the closing of back contact 63 and before the slow-releasing relay M^2 has had time to open its front contact 61, and maintains relay L^3 energized by its stick circuit previously traced through front contact 15 of relay M^2 notwithstanding the abnormal conditions above described.

If a third car now enters the stretch A—B and carries its current collecting device into engagement with the contactor c^1, it will energize the control relay R^1 and the arrival relay C. The energization of the relay C again causes the front contact 35 thereof to close and immediately establish a stick circuit for this relay from terminal *x*, through a front contact 64 of relay L^3, wire 65, back contact 66 of relay M^2, wire 67, back contact 68 of relay L^2, wire 50, back contact 51 of relay M^1, wire 52, back contact 53 of relay L^1, wire 37, front contact 35 of arrival relay C, wires 38 and 34, and winding of relay C to terminal *o*. The energization of arrival relay C also opens back contact 55 thereof, and interrupts the stick circuit for relay L^3, previously traced through this contact, thereby causing front contacts 64 and 30 of relay L^3 to open at the expiration of a predetermined time interval. The opening of front contact 64 of relay L^3 interrupts the stick circuit previously traced through this contact which maintains the arrival relay C energized after the current collecting device moves out of engagement with the contactor c^1. Also, the opening of front contact 30 of relay L^3 interrupts the circuit previously traced through this contact which maintains the auxiliary relay M^3 normally energized and permits this relay to open its front contact 3. The opening of the front contact 3 interrupts the signal circuit previously traced through this contact, thereby causing the signal S^1 to display a "stop" indication signifying to succeeding cars that the stretch A—B is occupied to the limit of its capacity.

Also, as in the case of the first and second cars, if the third car stops with its current collecting device in engagement with the contactor c^1, the front contact 30 of slow-releasing relay L^3 will open at the expiration of a predetermined time interval and interrupt the circuit through this contact which maintains the third car auxiliary relay M^3 energized, resulting in a "stop" indication of the signal S^1 notwithstanding the fact that the stretch A—B is not yet filled. In order, therefore, to avoid the display of such a false indication, we provide a stick circuit for the auxiliary relay M^3 from the terminal *x*, through front contact 69 of arrival relay C, wire 70, front contact 71 of relay M^3, wire 72, back contact 73 of relay L^3, wire 31, and winding of relay M^3 to terminal *o*. This circuit is also established immediately upon the closing of back contact 73 and before the slow-releasing relay M^3 has had time to open its front contact 71, and maintains the front contact 3 closed and the signal circuit therethrough intact. As soon, however, as the car moves entirely into the section A—B and carries its current collecting device out of

engagement with the contactor c^1, the arrival relay becomes deenergized and opens its front contact 69, thereby interrupting the stick circuit for the third auxiliary relay M^3 previously traced through this contact and permitting the front contact 3 to open. This breaks the signal circuit as above described and causes the signal S^1 to display a "stop" indication.

The stretch A—B being occupied by three cars, we will now assume that the first car departs therefrom and carries its current collecting device into engagement with the second contactor c^2. This connects the conductor 2 and hence terminal x^1 with the contactor c^2, and current flows thence through resistor r^2 and winding of control relay R^2 to terminal o^1, thereby momentarily energizing this relay and causing it to close a front contact 74 thereof. The closing of this contact completes a circuit from terminal x, through front contact 74 of relay R^2, wire 75, and winding of departure relay D to terminal o, thereby energizing the departure relay D, and causing it to close its front contact 76. This establishes a circuit from terminal x, through front contact 76 of departure relay D, wires 77 and 19, and winding of relay L^3 to the terminal o of source, thereby causing the energization of this relay and the closing of its front contacts 17 and 30. The closing of front contact 17 of relay L^3 immediately reestablishes the stick circuit for this relay, previously traced, through back contact 55 of arrival relay C, back contact 54 of relay L^2, and back contact 56 of relay M^2. As soon, however, as the current collecting device of the first car moves out of engagement with the second contactor c^2, the departure relay D again becomes deenergized and closes its back contact 20, thereby reestablishing the circuit for the third auxiliary relay M^3 previously traced through this contact and front contact 30 of relay L^3. The energization of the third car auxiliary relay M^3 causes this relay to close its front contact 3 and reestablish the signal circuit previously traced through this contact, thereby causing the signal S^1 to display a "clear" indication.

If the second car now departs from the stretch A—B and carries its current collecting device into engagement with the second contactor c^2, it will again cause the energization of the departure relay D. This establishes a pick-up circuit for relay L^2 from terminal x, through front contact 78 of departure relay D, wire 79, front contact 80 of relay M^3, wires 81 and 14, and winding of relay L^2 to terminal o. The energization of relay L^2 by this pick-up causes it to close its front contact 12 which immediately reestablishes the stick circuit initially traced through back contact 39 of arrival relay C, back contact 41 of relay L^1, back contact 43 of relay M^1, and front contact 12 of relay L^2. The energization of relay L^2, as above described, also causes it to open its back contact 54 and to close its front contacts 27 and 82. This interrupts the stick circuit for relay L^3 previously traced through back contact 54 of relay L^2 but reestablishes a stick circuit for relay L^3 from terminal x, through front contact 82 of relay L^2, wire 58, back contact 56 of relay M^2, wire 16, front contact 17 of relay L^3, wires 18 and 19, and winding of relay L^3 to terminal o. As soon as the contact collecting device of the second car moves out of engagement with the contactor c^2, the departure relay D again becomes deenergized and closes its back contact 20, thereby reestablishing the pick-up circuit for relay M^2 previously traced through this contact and the front contact 27 of relay L^2. The reenergization of relay M^2 causes it to open its back contact 56 and to close its front contact 15, thereby interrupting the stick circuit for relay L^3 previously traced through the former and reestablishing the stick circuit for this relay initially traced through the latter.

If the third car now departs from the stretch A—B and carries its current collecting device into engagement with the contactor c^2, it will again cause the energization of the departure relay D. This establishes a pick-up circuit for relay L^1 from terminal x, through front contact 83 of departure relay D, wire 84, front contact 85 of relay M^3, wire 86, front contact 87 of relay M^2, wires 88 and 9, and winding of relay L^1 to terminal o. The energization of relay L^1 by this circuit causes it to close its front contact 7, thereby reestablishing the stick circuit for this relay initially traced through this contact. The energization of the relay L^1 also opens back contact 41 and closes front contacts 24 and 89. The opening of back contact 41 interrupts the stick circuit previously traced through this contact, back contacts 43 of relay M^1 and front contact 12 of relay L^2 and immediately establishes another stick circuit for this relay from terminal x, through front contact 89 of relay L^1, and the contacts 43 and 12 of relays M^1 and L^2.

As soon as the third car departs entirely from the stretch A—B and carries its current collecting device out of engagement with the second contactor c^2, the departure relay D again becomes deenergized and to open its front contact 83 and close its back contact 20. This interrupts the pick-up circuit for the first car relay L^1 above traced through the contact 83, and reestablishes the stick circuit for auxiliary relay M^1 initially traced through back contact 20 of relay D, and front contact 24 of first car relay L^1. The energization of relay M^1 causes it to open its back contact 43 and to close its front contact 10, thereby interrupting the stick cir-

cuit for second car relay L^2 previously traced through contact 43 and reestablishing the stick circuit for this relay initially traced through front contact 10. The apparatus is thus returned to its normal condition originally described.

From the foregoing, it will be apparent that the signal S^1 displays a "stop" indication when and only when the maximum permissive number of cars occupy the stretch A—B and that as soon as this number is reduced, the signal S^1 immediately indicates this fact by displaying a "clear" indication. Also it will be apparent that our invention is readily adaptable to stretches of track of greater capacity by simply increasing the number of the car relays L and M. Moreover, it will be apparent that, while we have shown and described our invention as being utilized to indicate only when the stretch is occupied by the maximum permissive number of cars, it is also adaptable with slight changes to counting systems for indicating when different numbers of cars occupy the stretch.

Although we have herein shown and described only one form of railway traffic governing apparatus embodying our 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 our invention.

Having thus described our invention, what we claim is:

1. In combination, a stretch of electric railway track adapted to contain a predetermined number of cars, a conductor for supplying propulsion current to cars operating over said stretch, a series of successively dependent instrumentalities, a control relay operable by the propulsion current supplied by said conductor for controlling the operation of said instrumentalities, a contact device operable by a car upon entering said stretch for causing said relay to control one of said instrumentalities so as to render a succeeding dependent instrumentality controllable by a succeeding car, and means controlled by the last of said series of instrumentalities for indicating when said stretch contains such predetermined number of cars.

2. In combination, a stretch of railway track adapted to contain a predetermined number of cars, a first series of main relays, a second series of auxiliary relays associated with said main relays, a control relay operable by cars upon entering said stretch, a stick circuit for the first main relay of said series of main relays controlled by said control relay, stick circuits for succeeding main relays of said series of main relays controlled by the preceding auxiliary relay in said second series and by said control relay, stick circuits for each of said auxiliary relays controlled by the associated main relay, and means operable by the last auxiliary relay of said second series for indicating when said stretch contains such predetermined number of cars.

3. In combination, a stretch of electric railway track adapted to contain a predetermined number of cars, a conductor for supplying propulsion current to said cars, a series of successively dependent electro-responsive instrumentalities, a trolley contactor operable by a car upon entering said stretch for causing the energization of one of said instrumentalities by said propulsion current so as to render a succeeding dependent instrumentality operable by a succeeding car, and means operated by the last of said series of instrumentalities for indicating when said stretch contains such predetermined number of cars.

4. In combination, a stretch of single track electric railway adapted to contain a predetermined number of cars, an electric conductor associated with said railway and adapted to be traversed by a vehicle carried current collecting device, traffic governing means for controlling the entry of cars into said stretch, a contactor associated with said conductor adjacent the entrance of said stretch for engagement by said current collecting device when a car enters said stretch, a plurality of main car relays, a plurality of auxiliary car relays controlled by said main car relays for controlling said traffic governing means, an arrival relay for successively controlling said main car relays upon the entrance of cars into said block, and a control relay for controlling said arrival relay and having one terminal thereof connected with said contactor.

5. In combination, a stretch of railway track adapted to contain a predetermined number of cars, a conductor associated with said track and adapted to be traversed by a car carried current collecting device, a contactor associated with said conductor, a control relay having one terminal thereof connected with said contactor, means for indicating when said stretch is occupied by the maximum number of cars, a first main relay controlled by said control relay and adapted to be deenergized upon the entry of a first car into said stretch, a first auxiliary relay controlled through a front contact of said first main relay, a second main relay controlled through a front contact of said first auxiliary relay and adapted to be deenergized upon the entry of a second car into said stretch, a second auxiliary relay controlled through a front contact of said second main relay, a third main relay controlled through a front contact of said second auxiliary relay and adapted to be deenergized upon the entry of a third car into said stretch, a third auxiliary

relay controlled through a front contact of said third main relay for operating said indication means, and a stick circuit for each of said auxiliary relays for preventing the de-energization of succeeding main relays and the operation of said indication means in the event that a car stops with its current collecting device in engagement with said contactor.

6. In combination, a stretch of single track electric railway adapted to contain a predetermined number of cars, an electric conductor associated with said railway and adapted to be traversed by a vehicle carried current collecting device, traffic governing means for controlling the entry of cars into said stretch, a first contactor associated with said conductor adjacent the entrance of said stretch for engagement by said current collecting device when a car enters said stretch, a second contactor associated with said conductor adjacent the exit end of said stretch for engagement by said current collecting device when a car departs from said stretch, a plurality of main car relays corresponding in number with the number of cars said stretch is adapted to accommodate, a plurality of auxiliary car relays controlled by said main car relays for controlling said traffic governing means, an arrival relay for successively controlling said main car relays upon the entrance of cars into said stretch, a first control relay for controlling said arrival relay and having one terminal thereof connected with said first contactor, a departure relay for controlling said main car relays upon the exit of cars from said stretch, and a second control relay for controlling said departure relay and having one terminal thereof connected with said second contactor.

In testimony whereof we affix our signatures.

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