A. J. WURTS.

RAILWAY SIGNALING SYSTEM.

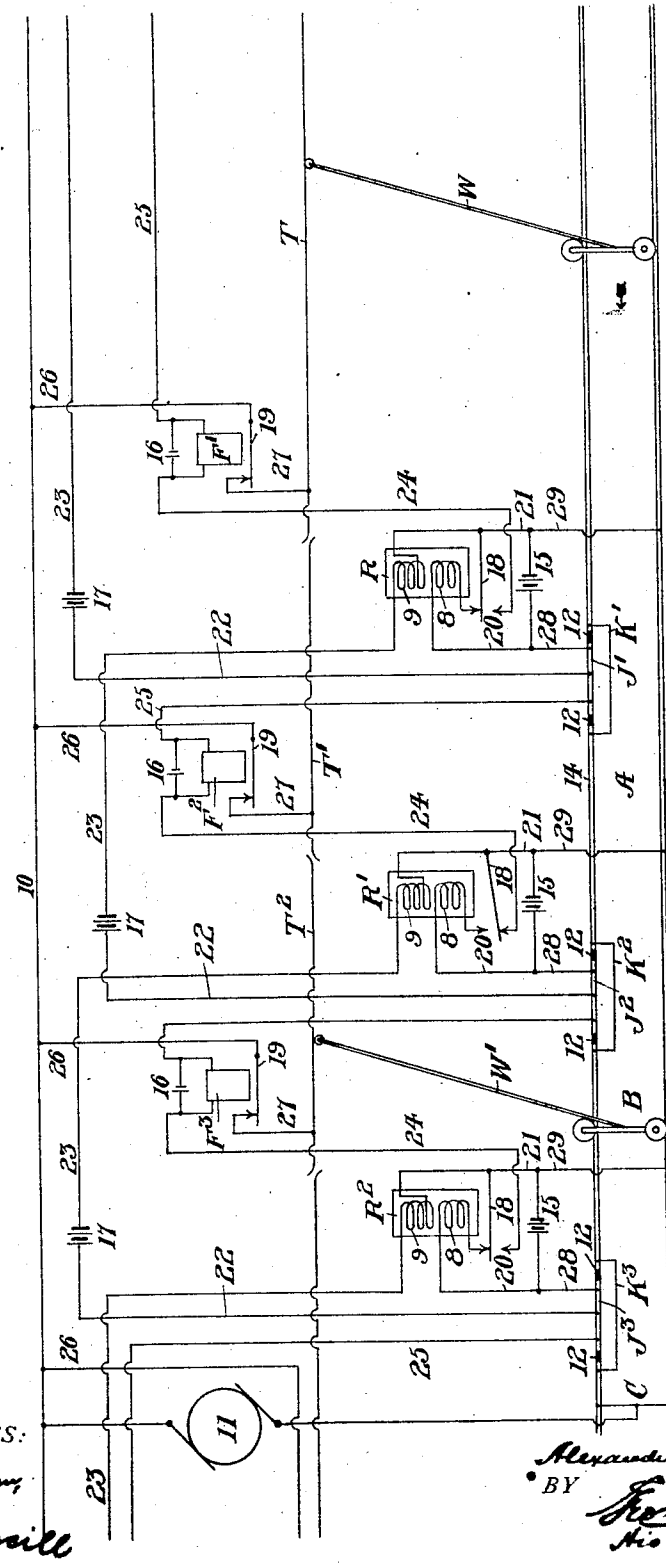
APPLICATION FILED JAN. 9, 1911.

1,046,703.

Patented Dec. 10, 1912.

6 SHEETS—SHEET 1.

FIG. 1



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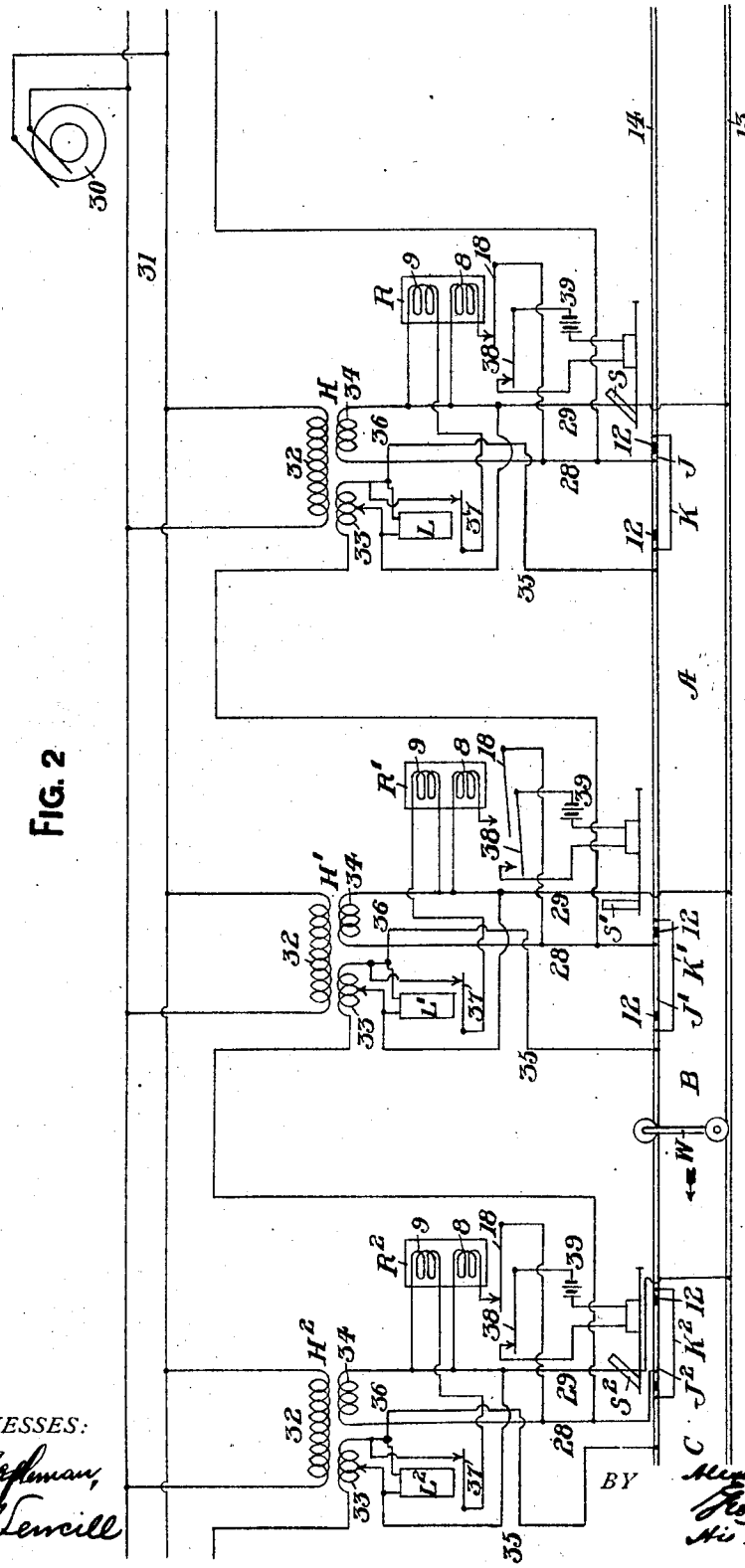

FIG. 2

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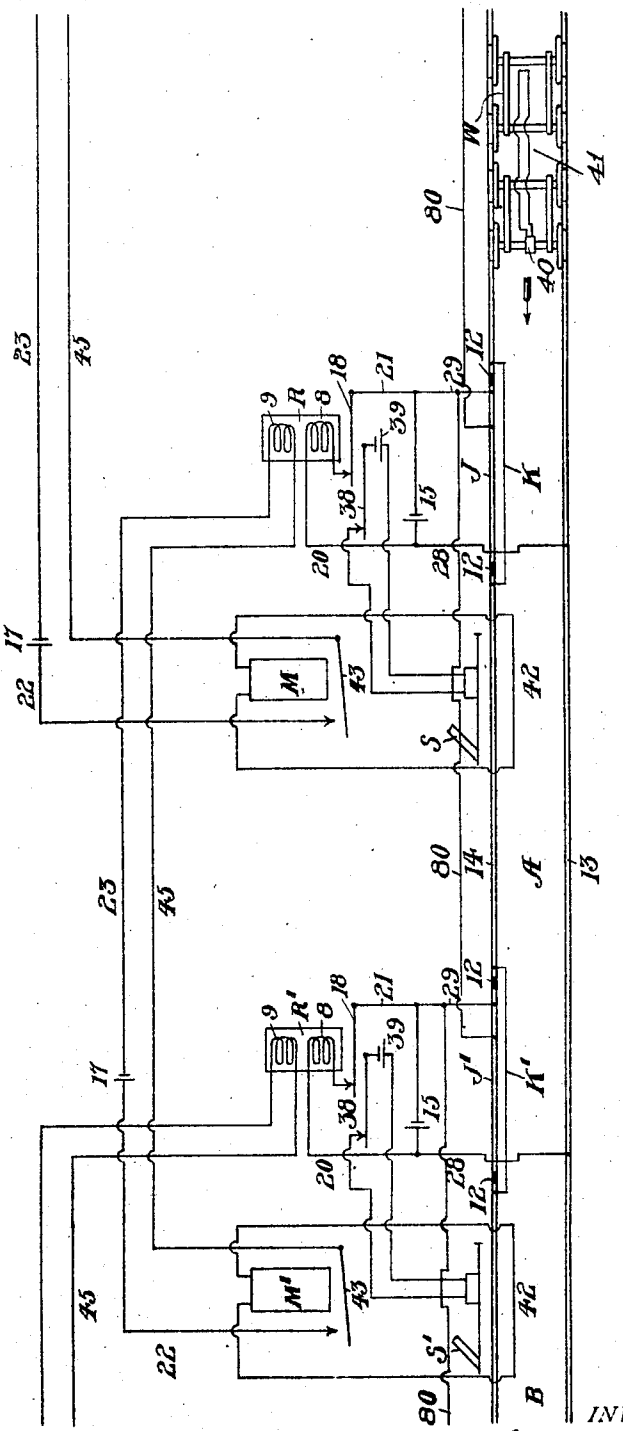
6 SHEETS—SHEET 3.

FIG. 3



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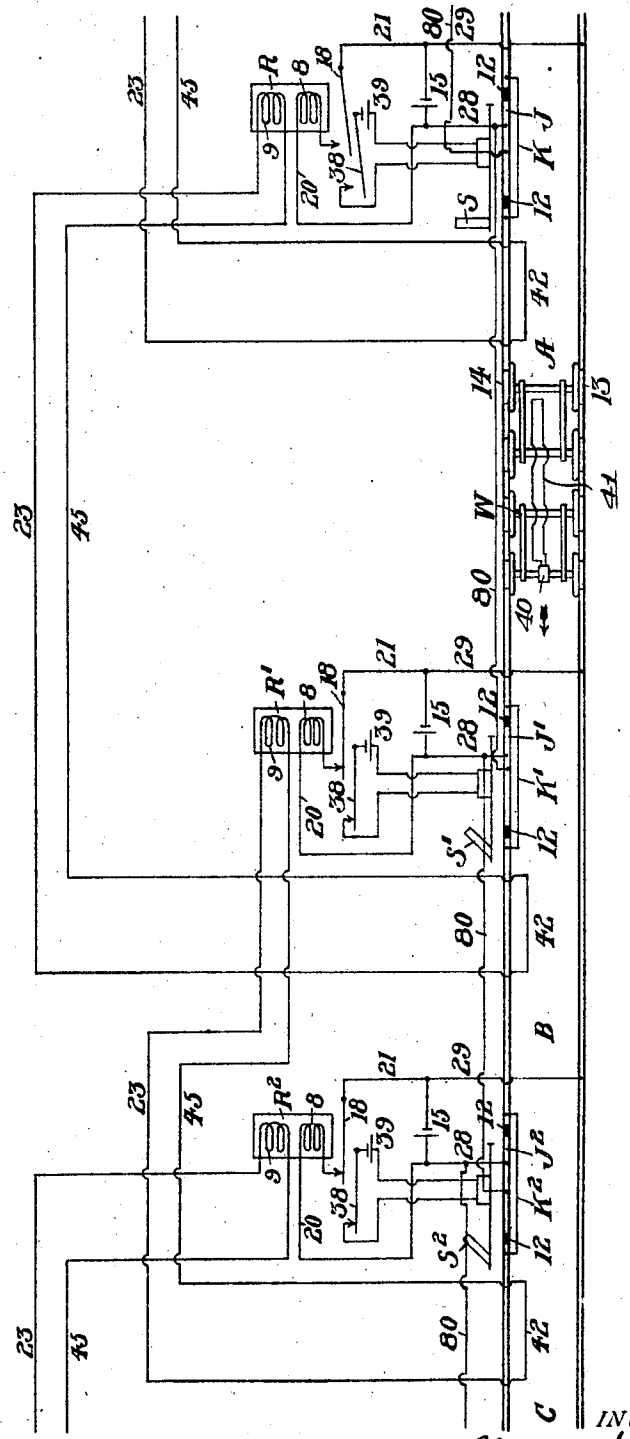

FIG. 4

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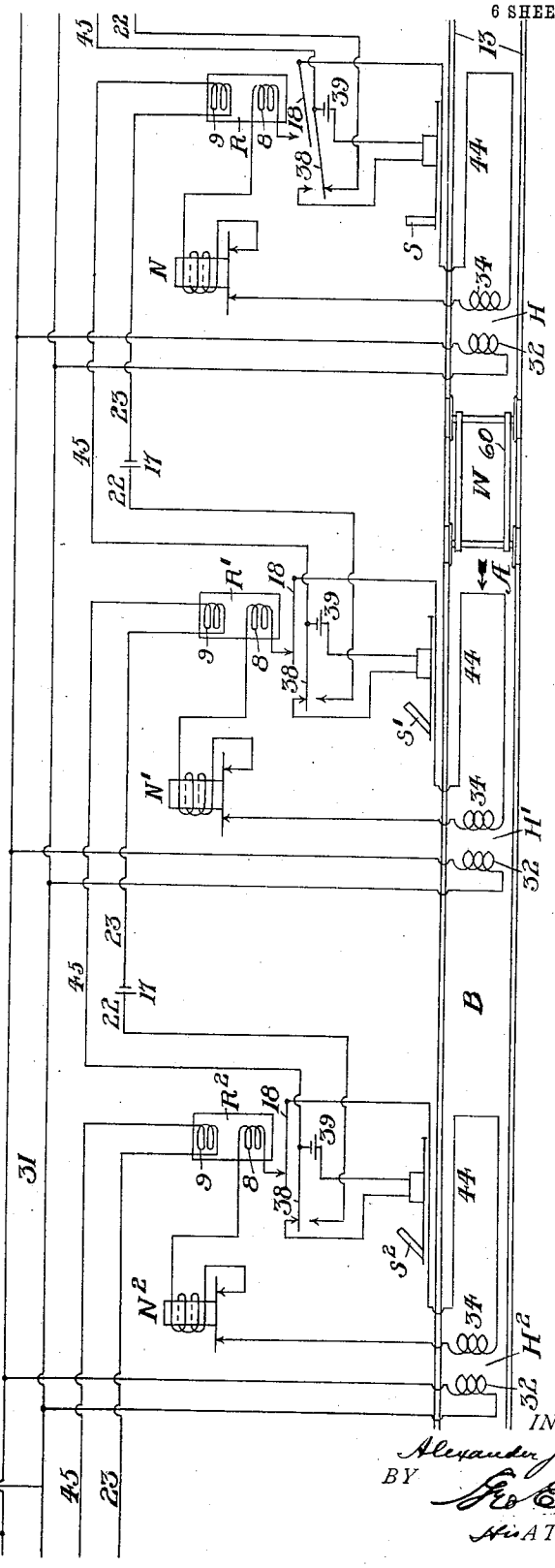
APPLICATION FILED JAN. 9, 1911.

1,046,703.

Patented Dec. 10, 1912.

6 SHEETS—SHEET 5.

FIG. 5



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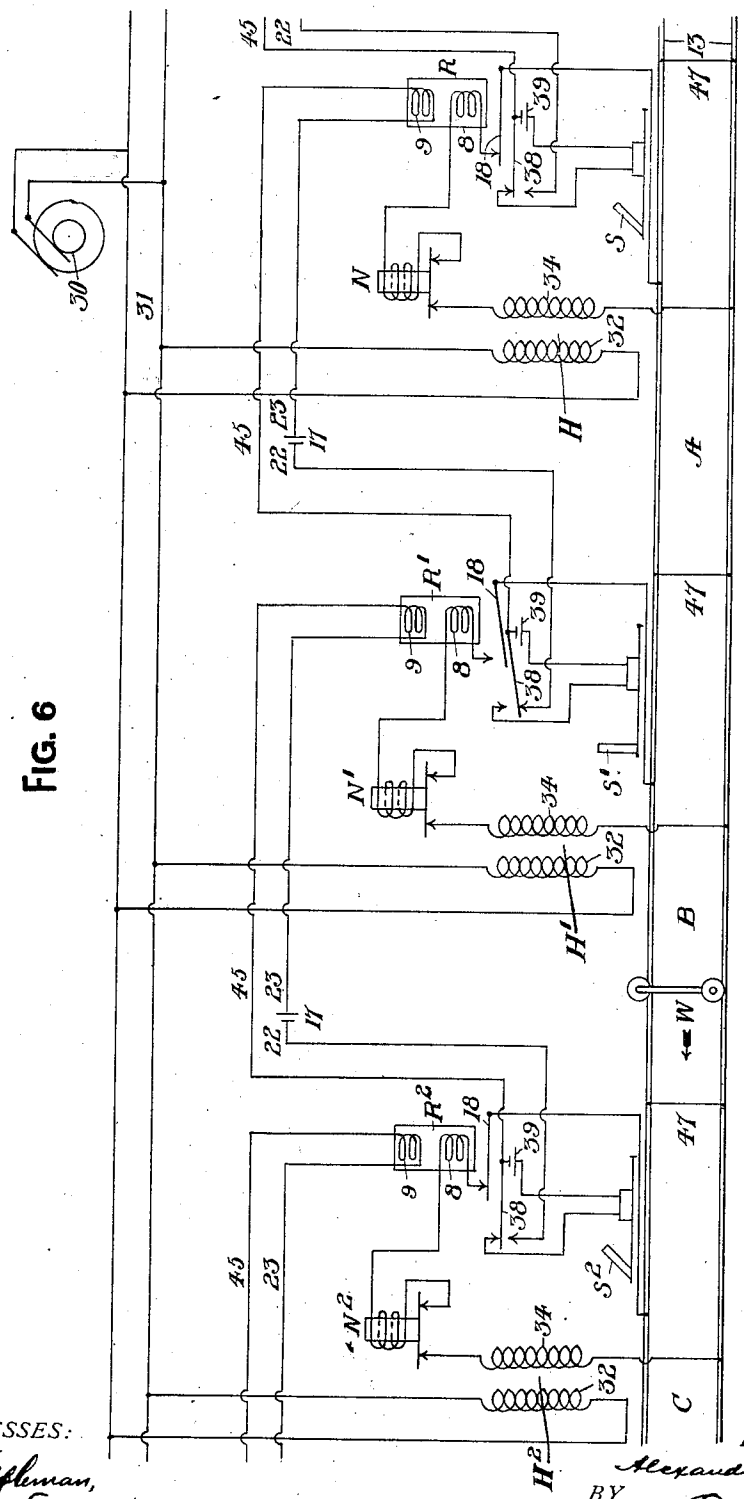
6 SHEETS—SHEET 6.

FIG. 6



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RAILWAY SIGNALING SYSTEM.

1,046,703. Specification of Letters Patent. Patented Dec. 10, 1912.

Application filed January 9, 1911. Serial No. 601,519.

To all whom it may concern.

Be it known that I, ALEXANDER JAY WURTS, a citizen of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Railway Signaling Systems, of which the following is a specification.

My invention relates to automatic signaling systems for railways, and more particularly to that class of systems in which the railway is divided into block sections, and in which a relay device is provided for each block section for governing traffic through such block section.

I will describe several arrangements of signaling systems embodying my invention, and then point out the novel features thereof in claims.

In the accompanying drawings, Figure 1 is a diagrammatic view showing a railway signaling system embodying my invention, one of the lines of the rails of the track-way being divided into block sections and having a short insulated preliminary section for each block section. Figs. 2, 3 and 4 are diagrammatic views showing modifications of the signaling system shown in Fig. 1. Figs. 5 and 6 are diagrammatic views showing railway signaling systems in which both of the lines of rails are electrically and mechanically continuous.

Similar reference characters refer to similar parts throughout the several views.

One feature of my invention is a traffic-controlling relay device for each block section, which relay device comprises two windings—a "holding" winding and a "resetting" winding. The holding winding is provided with a circuit which preferably includes an armature contact of the relay. I provide means for opening the circuit of the holding winding when a train or car enters the block section, thereby opening the relay armatures and placing the signal or other traffic-governing device controlled thereby in the danger position. The relay remains deënergized until the train or car leaves the block section, when a circuit including the resetting winding is energized, thereby closing the armature and again energizing the holding winding, and also placing the signal or other traffic-governing device in the clear or proceed position.

In each of the views, A, B and C designate block sections of a railway, over which traffic is governed by relays R, R^1 and R^2. Each of these relays comprises two windings, a holding winding 8 and a resetting winding 9. The direction of traffic is indicated by an arrow in each of the views.

Referring now to Fig. 1, one of the lines of rails 13 is continuous, the other line 14 being divided by insulations 12 to form the block sections A, B and C, and also to form short insulated preliminary sections J^1, J^2 and J^3 for each block section. The line of rails 14 may be made electrically continuous by means of conductors K^1, K^2 and K^3 connected around the short insulated sections as shown. The holding winding 8 for relay R is normally supplied with current from a battery 15 through a circuit as follows: from battery 15 through wire 20, winding 8, armature 18, wire 21 to battery 15. The terminals of battery 15 are however connected with the preliminary insulated section J^1 and rail 13 by wires 28 and 29 respectively, so that when the wheels and axles of a car or train enter preliminary section J^1 the battery 15 is short circuited from winding 8 and the relay R is deënergized and armature 18 opened. The holding winding 8 of relay R will then remain deenergized until armature 18 is closed by the energizing of resetting winding 9. This resetting winding is included in a normally open circuit as follows: from short insulated section J^2 through wire 22, battery 17, wire 23, resetting winding 9, wire 29 to rail 13. When therefore the car or train reaches section J^2 its wheels and axles will complete this last mentioned circuit and the resetting winding 9 of relay R will be energized, thus closing armature 18 and thereby again energizing the holding winding 8. The operation of relays R^1 and R^2 is similar to that just described for relay R.

The traffic-governing relays R, R^1 and R^2 may be employed in any suitable manner for the control of traffic through the respective block sections. For example, as shown in Fig. 1, they may be employed in an electric railway to cut off the propulsion current from a car or train which attempts to enter a block section in the rear of a block section occupied by another car or train. In this view, 11 designates a source of propulsion current connected with the rails of the track-way and with a feeder main 10. T, T^1 and T^2

designate sections of a trolley wire or third rail which are connected with the feeder main 10 through armatures 19 controlled by feeder relays F^1, F^2 and F^3 respectively. Thus the circuit for the propulsion current to a car or train W^1 is as follows: from source 11 through feeder main 10, wire 26, armature 19, wire 27, trolley or third rail section T^2, car or train W^1, track rails 13 and 14 to source 11. The feeder relays F^2 and F^3 are normally energized by batteries 16, and the armatures therefore held closed, but these batteries 16 may be short circuited to deënergize the relays and open the armatures under the following conditions: Assume a car or train W^1 in block section B as shown, and the armature 18 of relay R^1 therefore open. If now a second car or train W enters preliminary section J^1, a circuit will be closed through battery 16 (for feeder relay F^2) as follows: from battery 16 through wire 25, wheels and axles of car or train W, rail 13, wires 29 and 21, armature 18 of relay R^1, back contact of armature 18, wire 24 to battery 16. The feeder relay F^2 will therefore become deënergized, and its armature 19 will open, cutting off propulsion current from car or train W. The latter will therefore be brought to a standstill and will be held so until car or train W^1 has reached preliminary section J^3, when the armature 18 of relay R^1 will be closed and the above described circuit for battery 16 therefore opened.

It will be evident from the foregoing that the propulsion current is automatically cut off from a car or train when such car or train attempts to enter a block section preceding a block section which is already occupied by a car or train. A feature of this system is that a car or train while passing along the railway never cuts off the propulsion current from the block section preceding the one which it occupies, except when a second car or train attempts to enter this preceding block section. I thus avoid all operations of the circuit controllers which control the supply of propulsion current to the block sections except in cases of emergency, and I therefore avoid mechanical wear of these circuit controllers, and deterioration of their contacts due to arcing.

Referring now to Fig. 2, I have here shown a modification of the system shown in Fig. 1. In this modification I provide auxiliary relays L, L^1 and L^2 for each block section by means of which the resetting circuit for each of the traffic-controlling relays is held open while the corresponding block section is occupied by a car or train. It is therefore necessary that a car or train shall have passed entirely out of a block section before the resetting circuit of the corresponding traffic-controlling relay can be closed. In this view I show the windings 8 and 9 of the relays as being energized by alternating current from two secondary windings 34 and 33 of transformers H, H^1 and H^2, whose primary windings 32 are connected with mains 31 to which alternating current is supplied from a source 30. An armature 37 of each auxiliary relay is included in the resetting circuit of the corresponding traffic-controlling relay. The windings of these auxiliary relays may be supplied with current from any suitable source, as for example from the secondary windings 33 of the transformers, but the winding of each auxiliary relay is also connected with the rails of the corresponding block section by wires 35 and 29 whereby the source of current will be short-circuited and the armature 37 therefore open while the rails of the block section are occupied by a car or train. Or, if desirable, the auxiliary relays may be so proportioned that as a car or train approaches the exit end of a block section, the resistance or reactance, or both, of the rails becomes so high as to allow sufficient current to pass through the relay to close the armature 37. The operation of this system is in other respects similar to that of the system shown in Fig. 1. In this system I have however shown the traffic-controlling relays R, R^1 and R^2 as being employed to control railway signals S, S^1 and S^2 which govern traffic through the block sections A, B and C respectively. For this purpose each of the traffic-controlling relays is provided with an additional armature 38 which controls the signal circuit in the usual manner, current for the signal being supplied by any suitable source, such as by a battery 39.

Referring now to Fig. 3, I here show a system similar to that shown in Fig. 1, but with a modification of the means for closing the resetting circuit as a train leaves a block section. A feature of this modified form is that a train must be intact as it passes out of a block section in order to close the circuit of the resetting winding of the relay for such block section. To accomplish this purpose I provide on each train a generator 40, preferably of high frequency alternating current, connected with a circuit 41 which extends the entire length of the train. The current in this circuit acts inductively to induce current in conductors 42 located in the trackway, and to the terminals of which conductors are connected the windings of auxiliary relays M and M^1. The circuit for the resetting winding 9 of relay R is controlled by an armature 43 of relay M^1, and includes a battery 17. The operation of this system is as follows: When the train W reaches preliminary section J, it opens the armatures of relay R as before. Upon reaching preliminary section J^1 it similarly

opens the armatures of relay R^1, and the primary circuit 41 comes into inductive relation with conductor 42, inducing a current therein which energizes relay M^1, thus closing the resetting circuit for relay R. It is evident that if the train W should separate into two or more parts in block A, the primary circuit 41 on the train would be broken and no current would be induced in conductor 42. Hence the resetting circuit for relay R could not be closed, and the armatures 18 and 38 of the relay would remain open. The relays R and R^1 may be employed for controlling any suitable traffic-governing devices, such for example as railway signals S and S^1 in the usual manner. In this system I also provide means for placing the signal for each block section in danger position in case a car or train enters the block from the opposite end. This means comprises an additional wire 80 extending from each preliminary section J, J^1 to the wire 29 of the preceding block section. A car or train entering the preliminary section J^1 in the direction opposite to that indicated by the arrow will short-circuit battery 15 for relay R as follows: from battery 15 through wires 29, and 80, wheels and axles of car, rail 13, wire 28 to battery 15; the signal S controlled by relay R will therefore be placed in danger position.

In Fig. 4 I have shown a system similar to that of Fig. 3, except that I have omitted the relays M and M^1 controlling the resetting circuits, and have shown the resetting windings of the relays as being energized directly by current induced in the conductors 42 by the primary circuit 41 on the train W. As in Fig. 3, an additional wire 80 serves as a means for placing at danger the signal governing traffic through a block section when a car or train enters such block section from the direction opposite to the direction of traffic.

In Figs. 5 and 6 I have shown embodiments of my invention in which each line of rails may be both electrically and mechanically continuous. As in the preceding views, traffic-controlling relays are located at intervals along the trackway, each relay having a holding winding 8 and a resetting winding 9. In these systems however, the armatures of each relay are opened by increasing the current in the circuit of the holding winding as a car or train enters the block section, instead of by short-circuiting the holding winding as before. The resetting circuit for each relay is closed as here shown by the opening of an armature of the relay for the next succeeding block section.

Referring now particularly to Fig. 5, I have here shown a means for increasing the current in the holding winding circuit by the inductive action of a closed secondary circuit carried by a car or train, on a primary circuit included in the holding winding circuit. In this view, the circuit of the holding winding 8 for each relay includes a circuit controller N, N^1 or N^2, back contacts controlled by the circuit controller, armature contact 18, and a pair of conductors 44 extending parallel with the track rails which conductors form the above mentioned primary circuit. Alternating current is supplied to this holding winding circuit by a secondary winding 34 of a transformer H, the primary 32 of which is connected with mains 31 which are in turn connected with a source of alternating current 30. The adjustment of the parts of this holding winding circuit is such that under normal conditions the current flowing in the circuit is not sufficient to cause the circuit controller N to open its back contacts. 60 designates a closed secondary circuit carried by the car or train W, for which circuit the steel structure of the car or train may conveniently be employed. This secondary circuit is adapted to act inductively on the conductors 44 to increase the current in the holding winding circuit to such a value that the circuit controller N is caused to momentarily open its back contacts. During this momentary opening the circuit of the holding winding 8 is opened and armature 18 drops, so that when the contacts of circuit controller N again close, the holding winding circuit remains open at armature contact 18. The opening of the contacts of circuit controller N is of course only momentary, and this controller and the relay R are so adjusted that armature contact 18 opens before the contacts of controller N close. An armature 38 of each relay may be employed to control any suitable type of traffic-governing device, such for example as railway signals S, S^1 and S^2 in the usual manner. The opening of the armature 38 is also employed to close a circuit including the resetting winding of the relay for the preceding block section, which circuit is as follows: from battery 17 through wire 23, resetting winding 9, wire 45, armature 38, wire 22 to battery 17.

Referring now particularly to Fig. 6, I have here shown a means for increasing the current in the holding winding circuit by cutting out resistance or impedance or both from this circuit as a car or train enters the block section. The holding winding circuit in this system includes portions of the track rails 13, bonds 47 being placed across the rails at the proper points to complete the circuit. These bonds 47 are so located that under normal conditions the resistance or impedance or both of the circuit are such as to prevent the flow of sufficient current to open the contacts of circuit controller N. When however the portion of this circuit comprising the track rails is short-circuited by the wheels and axles of a car or train.

the current increases to an amount sufficient to open the contacts of circuit controller N and to thereby open the armatures of the traffic-controlling relay R. In other respects this system is similar to that shown in Fig. 5, hence no further explanation is necessary.

Having thus described my invention, what I claim is:

1. In a railway signaling system, a plurality of block sections, a traffic-controlling relay for each block section, each relay comprising a holding winding and a resetting winding, means for opening the circuit of the holding winding of each relay when a train enters the block section controlled by said relay, and means independent of the said means for energizing the resetting winding of the said relay when the train leaves the block section controlled by the relay.

2. In a railway signaling system, a block section, a traffic-controlling relay for the block section comprising a holding winding and a resetting winding, a circuit for the holding winding including an armature contact of the relay and a source of current, means for short-circuiting the said holding winding when a car or train enters the block section controlled by the relay, a circuit for the resetting winding including a source of current, and means for closing the last-mentioned circuit when the car or train leaves the block section controlled by the relay.

3. In a railway signaling system, a block section, a traffic-controlling relay for the block section, comprising a holding winding and a resetting winding, a circuit for the holding winding including an armature contact of the relay and a source of current, means for short-circuiting the source of current when a car or train enters the block section controlled by the relay whereby the holding winding is deënergized and the armature opened, a circuit for the resetting winding including a source of current, and means for closing the last mentioned circuit as the car or train leaves the block section whereby the armature is closed and the holding winding again energized.

4. In a railway signal system, a block section, a short insulated section at each end of the block section, a relay for the block section comprising a holding winding and a resetting winding, a circuit for the holding winding including an armature contact of the relay and a source of current, conductors connecting the terminals of the said source of current with the opposite rails of one of the short sections whereby the said source will be short-circuited from the holding winding by the wheels and axles of a car or train in the said short section, a circuit for the resetting winding including a source of current, and means for closing the last mentioned circuit when the car or train passes over the other short section, whereby the armature will be closed and the holding winding again energized.

5. In a railway signaling system, a block section, a short section at each end of the block section formed by insulations in one of the lines of rails of the block section, a relay for the block section comprising a holding winding and a resetting winding, a circuit for the holding winding including a source of current and an armature contact of the relay, conductors connecting the terminals of the said source of current with respectively the insulated rail of one of the said short sections and with the uninsulated rail whereby the said source will be short-circuited by the wheels and axles of a car in the said short section, and a circuit for the resetting winding including a source of current, one side of the said circuit being connected with the insulated rail of the other short section and the other side with the uninsulated rail whereby the said resetting circuit may be closed by the wheels and axles of a car on the said other short section.

6. In a railway signaling system, a plurality of block sections formed by insulations in one of the lines of rails, a short preliminary section for each block section formed also by insulations in the said line of rails, a conductor around each preliminary section and connecting the insulated line of rails of one block section with the insulated line of rails of each adjacent block section whereby the said line of rails is made electrically continuous; a relay for each block section comprising a holding winding and a resetting winding, a circuit for the holding winding of each relay, including an armature contact of the relay and a source of current, conductors connecting the terminals of the said source of current with respectively the opposite rails of the short preliminary section for the corresponding block section whereby the said source will be short-circuited from the holding winding by the wheels and axles of a car or train in the preliminary section, a circuit for the resetting winding including a source of current, and means for closing the said resetting circuit when the car or train enters the preliminary section for the next succeeding block section, whereby the armature of the said relay will be closed and the holding winding again energized.

7. In a railway signaling system, a block section, a traffic-controlling relay for the block section, comprising a holding winding and a resetting winding, a circuit for the holding winding including an armature contact of the relay and a source of current, means for short-circuiting the source of current when a car or train enters the block

section whereby the relay is deënergized and its armature opened, a circuit for the resetting winding including a source of current, and means for closing the resetting circuit as the car or train leaves the block section whereby the armature is closed and the holding winding again energized, and a traffic-governing device controlled by the relay.

8. In a railway signaling system, a block section, a traffic-controlling relay for the block section comprising a holding winding and a resetting winding, a circuit for the holding winding including an armature contact of the relay and a source of current, means for short-circuiting the source of current when a car or train enters the block section whereby the relay is deënergized and its armature opened, a circuit for the resetting winding including a source of current, means for closing said resetting circuit as the car or train leaves the block section whereby the armature is closed and the holding winding again energized, a circuit controller the contacts of which are included in the circuit of the resetting winding, and means for holding open said contacts while a car or train is on the rails of the block section.

9. In a railway signaling system, a block section, a traffic-controlling relay for the block section comprising a holding winding and a resetting winding, a circuit for the holding winding including an armature contact of the relay and a source of current, means for short-circuiting the source of current when a car or train enters the block section controlled by the relay whereby the relay is deënergized and its armature opened, a circuit for the resetting winding including a source of current, and means for closing said resetting circuit as the car or train leaves the block section whereby the relay armature is closed and the holding winding again energized; a circuit controller comprising a winding and a contact, the said contact being included in the resetting circuit, a source of current for the winding of the circuit controller, and means for connecting said last-mentioned source of current also with the rails of the block section whereby the said source of current will be short-circuited from the circuit controller winding while the block section is occupied by a car or train.

In testimony whereof I affix my signature in presence of two witnesses.

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