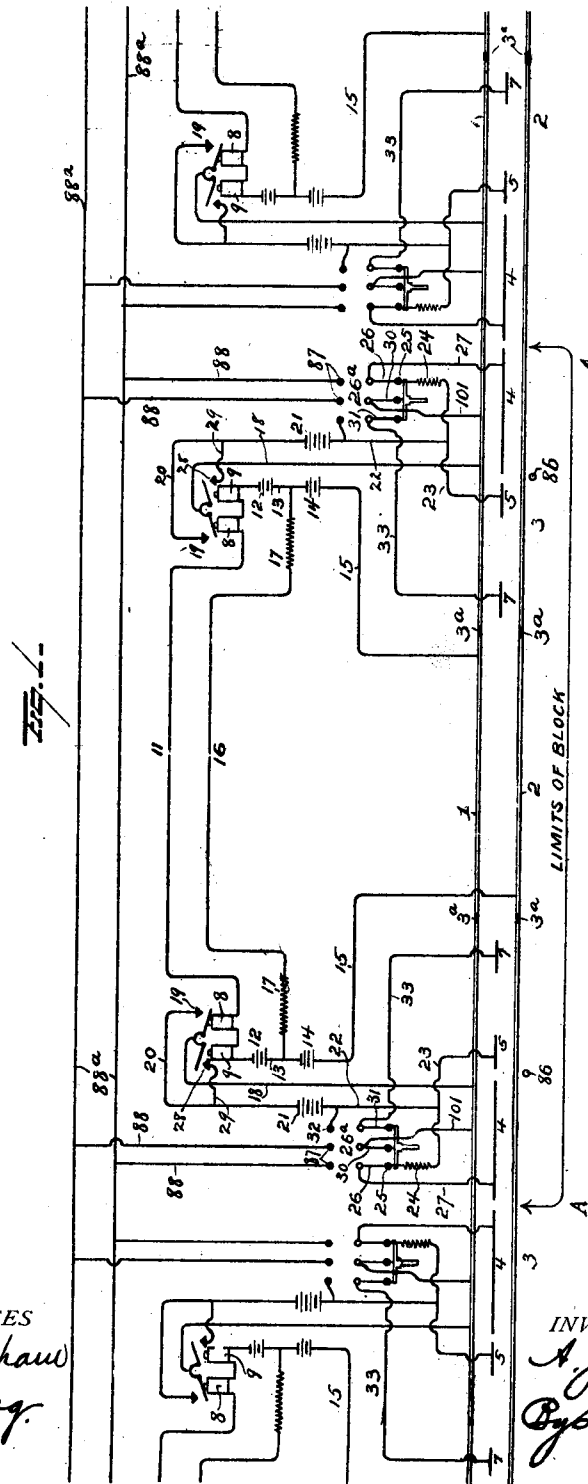


A. J. ALLARD.
ELECTRIC TRAIN SIGNALING AND CONTROLLING MEANS.
APPLICATION FILED OCT. 4, 1910. RENEWED JAN. 28, 1913.

1,060,398.

Patented Apr. 29, 1913.

2 SHEETS—SHEET 1.



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2 SHEETS-SHEET 2.

Fig. 2.

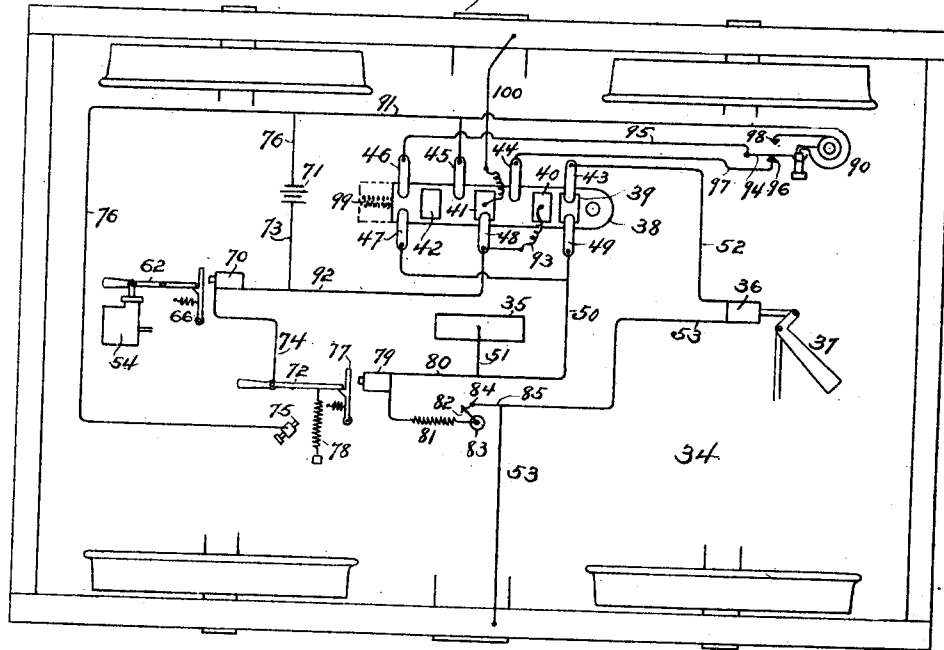


Fig. 3.

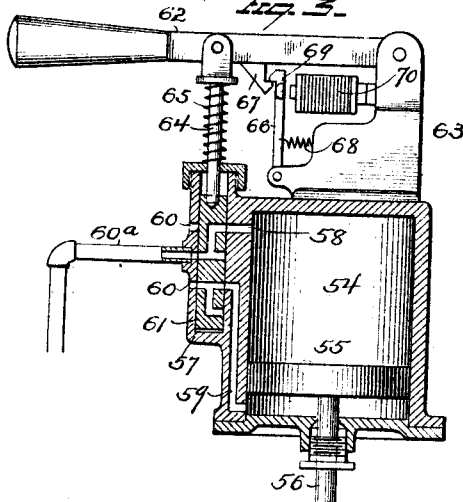
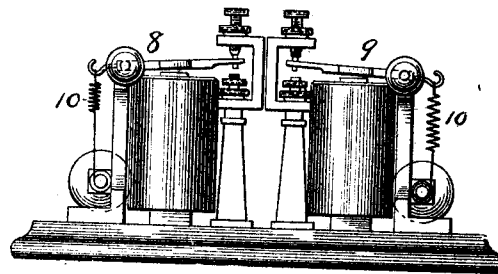


Fig. 4.



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UNITED STATES PATENT OFFICE.

ANDREW J. ALLARD, OF RICHMOND, VIRGINIA, ASSIGNOR OF ONE-THIRD TO T. F. GREEN AND ONE-THIRD TO DAVID R. CREECY, JR., OF RICHMOND, VIRGINIA.

ELECTRIC TRAIN SIGNALING AND CONTROLLING MEANS.

1,060,398.

Specification of Letters Patent.

Patented Apr. 29, 1913.

Application filed October 4, 1910, Serial No. 585,295. Renewed January 28, 1913. Serial No. 744,780.

To all whom it may concern:

Be it known that I, ANDREW J. ALLARD, of Richmond, in the county of Henrico and State of Virginia, have invented certain new and useful Improvements in Electric Train Signaling and Controlling Means; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in block signaling and train controlling systems, and more particularly to such in which the signals appear in the cab of the locomotive and the brake controlling mechanism in the cab is actuated automatically to stop the train under certain conditions.

One object of my invention is to so construct a system of circuits and devices that they will be operated automatically, under varying conditions, to effectually prevent both head-on and rear-end collisions.

A further object is to so construct and arrange the system that the trainman will be given signals upon approach to the entrance of a block, indicating dangerous conditions in such block, and to provide means whereby the trainman can report to a despatcher's station and receive orders.

A further object is to construct and arrange the system in such manner that if a train is in a block and another train is about to enter the block from either end, a danger signal will appear in the cab of the locomotive thus about to enter the block, and so that if the engineer disregards such danger signal and proceeds, his train will be stopped before he enters the block if his train is running beyond a predetermined rate of speed.

A further object is to so construct the system that an engineer on a train about to enter a block can cause the automatic stopping of a train running in the opposite direction and approaching the exit of the block.

With these and other objects in view, the invention consists in certain novel features of construction and combinations of parts as hereinafter set forth and pointed out in the claims.

In the accompanying drawings, Figure 1

is a diagrammatical view showing the system of circuits and devices along the railroad; Fig. 2 is a diagrammatical view showing the circuits and devices on the car or locomotive; Fig. 3 is a detail view of the brake controlling device, and Fig. 4 is a detail view of one pair of relays.

In Fig. 1 of the drawing, one complete block and the adjacent ends of two other blocks are represented, the limits of the complete block being indicated by A—A.

1—2 represent the rails of a road and at points several hundred feet distant in opposite directions from the block terminals, each rail is divided by insulating material as indicated at 3^a, the remaining portions of the rails having their sections suitably connected to form electrical conductors. Thus portions 3 of the rails extending several hundred feet in both directions from the juncture of two blocks, are insulated from the main portions of the rails of the blocks. At each end of each block, a contact rail 4, about one-thousand feet (more or less) in length, is located and preferably situated between the track rails. A shorter contact rail 5 having a length of two-hundred feet (more or less) is located near the inner end of the long contact rail 4 and electrically separated therefrom, and in advance of this short rail, a distance about eighteen hundred feet (more or less), another short contact rail 7 is located, said last-mentioned short contact rail terminating near the points 3^a where the track rails are electrically separated. At each end of each block, two relays 8—9 are located, and in order that the armatures of these relays shall respond to currents of different voltages under different conditions as hereinafter explained, the springs 10 connected with said armatures will be so adjusted that the armature of the relay 8 will be actuated upon the passage of a low voltage current through its coil, and so that the armature of the relay 9 will be actuated only when a current of higher voltage passes through its coil. For convenience, the relay 8 will be hereinafter referred to as a low voltage relay and the relay 9 will be designated as a high voltage relay.

The coils of the relays are included in series with each other and a line wire 11

connects one terminal of the relay magnets at one end of the block with one terminal of the relay magnets at the other end of the block. The other terminal of each pair of relay magnets is connected with a battery 12 and the latter is connected by a conductor 13 with one terminal of a battery 14. The other terminal of each battery 14 is connected by means of a conductor 15 with one of the track rails—the conductor 15 at one end of the block being connected with the track rail 1 and the conductor 15 at the other end of the block being connected with the track rail 2. A line wire 16 (including resistance at 17 at respective ends of the block) is connected at respective ends of the block with the conductors 13 between the batteries 12 and 14. It will thus be seen that the relay magnets at both ends of a block are included in series in a constantly closed circuit comprising the lines 11—16, resistances 17 and batteries 12, but by reason of the resistances 17, the voltage of the current in this circuit is such that the low voltage relay magnets 8 only will be sufficiently energized to actuate their armatures, and hence the local circuits (hereinafter described) controlled by the relays 8 will be held open, as shown in Fig. 1 of the drawing.

At each end of the block, the armature levers of the relays are connected, by means of a conductor 18, with a track rail section, 3. The contact 19 of the relay 8 is connected by a conductor 20 with one terminal of a battery 21 and the other terminal of this battery is connected by a conductor 22 with a conductor 23. One end of the conductor 23 is connected with a short contact rail 5 and the other end is connected with one terminal of a resistance 24, the other terminal of said resistance being connected with a switch contact 25 with which the arm 26 of a switch 26^a coöperates. This switch arm is connected by means of a conductor 27 with a long contact rail 4. The contact 28 for the armature lever of each relay 9, is connected, by a conductor 29 with the conductor 20.

The switch 26^a comprises three mechanically connected arms 26, 30 and 31, and suitable contacts for said arms. One of these contacts (32) is electrically connected with the conductor 22 and the switch arm 31 which is adapted to coöperate with this contact, is connected, by means of a conductor 33, with the short contact rail 7.

It will, of course, be understood that the construction and arrangement of circuits and devices at both ends of the block will be the same as above described, and their coöperation will, hereinafter, be made apparent.

When a car or locomotive 34 (illustrated diagrammatically in Fig. 2) bridges the track rails 1—2 during its travel through

the block, the normally open circuit including the batteries 14 and conductors 16 will be closed and the line 16 and resistance 17 will be short-circuited. A circuit will thus be established including both batteries 12 and 14 at each end of the block, and current of sufficient voltage will flow through this circuit to cause the relays 9 to actuate their armatures and close them onto their contacts 28, thus connecting the batteries 21 in open circuits including track rails 3 and contact rails 4 and 5 at both ends of a block, so that when the circuits and devices on the locomotive become disposed between a track rail 3 and one or the other contact rails 4 or 5, the batteries 21 will supply current for actuating the apparatus on the locomotive. Each locomotive is provided with a contact shoe 35 to engage the contact rails 4, 5 and 7, and in the cab of the locomotive, a solenoid 36 is located, the core of this solenoid being connected with a semaphore 37 also located in the cab. A switch 38 is also located in the cab and comprises a longitudinally movable bar provided with a plurality of contact plates 39, 40, 41 and 42, and a plurality of contact arms 43, 44, 45, 46, 47, 48 and 49. The switch arms 43, 49 are normally connected by the contact plate 39, and the arm 49 is connected by conductors 50—51 with the contact shoe 35. The switch arm 43 is connected by a conductor 52 with one terminal of the coil of solenoid 36, the other terminal of said coil being connected, by means of a conductor 53 with the truck frame.

When a train occupies a block and the relays have operated as above explained to connect the local batteries 21 with the track rails 3 and contact rails, and another train attempts to enter the block from either direction, the contact shoe 35 on the latter train will ride over the long contact rail 4 and thus close the circuit of the battery 21 at one end of the block, through the resistance 24, contact shoe and truck frame and the circuit on the locomotive which includes the semaphore solenoid 36. The semaphore will be thus actuated and moved to "danger" position, indicating to the engineer that another train occupies the block. Should the engineer disregard such warning, his train will be automatically stopped, by means of appliances and in the manner which will now be explained: A cylinder 54 is located on the locomotive and provided with a piston 55, the rod 56 of which is connected with the air-brake valve mechanism (not shown) for operating the same. The cylinder 54 is provided with a valve chamber 57 which communicates with the respective ends of the cylinder by means of ducts 58—59, and said valve casing is also provided with exhaust ports 60. An air supply pipe 60^a

communicates with the valve chamber between the exhaust ports. A reciprocating valve 61 is located within the valve chamber 57 and provided with suitable ducts for connecting respective ends of the cylinder with the air supply pipe and an exhaust port, alternately so as to cause reciprocation of the piston 55 for operating the valve controlling mechanism of the air brakes. A hand lever 62 is pivoted at one end to a suitable support 63 and this lever is connected, by means of a rod 64 with the valve 61,—said lever being movable in one direction by a spring 65. The valve 61 is maintained normally in the position shown in Fig. 3, by means of a latch 66 pivoted at one end to a fixed support and adapted at its other end to engage a lug or hook 67 on the lever 62, such engagement being normally maintained by means of a spring 68. The latch lever 66 is provided with an armature 69 for an electro-magnet 70, and this magnet is controlled by devices presently explained, to actuate the latch lever and release the hand lever 62. When the hand lever shall have been thus released, the spring 65 will be free to shift the valves 61 and thus admit air behind the piston 55 to operate the valve mechanism of the brakes.

The brake controlling devices above described will be located in such position under the locomotive that it will be necessary for the engineer to leave his cab before he can reach them for resetting, such resetting being accomplished by operating the hand lever 62 until its latch devices 66—67 become engaged.

The coil of the magnet 70 is included in a normally open local circuit with a battery 71 and a switch 72,—this circuit being traced on Fig. 2 as follows: The battery 71 is connected by a conductor 73 with one terminal of the coil of magnet 70 and the other terminal of said coil is connected, by a conductor 74, with the switch lever 72. This switch lever is intended to cooperate with a fixed contact 75 and the latter is connected, by a conductor 76, with the battery 71. This circuit is maintained normally open by the engagement of a pivoted latch 77 with the switch lever 72 as shown in Fig. 2, and when said switch lever has been released by the operation of the latch lever, it will be thrown, by the action of a spring 78, and be permitted to cooperate with the contact 75 to close said local circuit. The switch devices above described for controlling the local circuit of magnet 70, will also be located under the locomotive, so as to necessitate the engineer leaving the cab to reset them. It is apparent that the engineer cannot reset the brake controlling devices shown in Fig. 3, until he has first reset the switch 72 to open the local circuit including the magnet 70 because the latter would not per-

mit the operation of the latch lever 66 as long as the magnet 70 remains energized. The latch 77 is maintained normally in engagement with the switch lever 72 by means of a suitable spring and the operation of said latch is controlled by an electro-magnet 79. One terminal of the coil of this magnet is connected, by a conductor 80, with the conductor 51, the latter being connected with the contact shoe 35 as before explained. The other terminal of the coil of magnet 79 is connected with one end of a stationary resistance 81, the other end of said resistance being connected with the movable arm 82 of a speedometer 83 of any preferred construction and suitably connected with the car axles or wheels. The arm 82 of the speedometer also forms a switch arm adapted to cooperate with a contact 84, the latter being connected, by means of a conductor 85, with the conductor 53. The speedometer will be so set that the circuit including the magnet 79 will be closed at 82—84 when the train is running beyond a predetermined rate of speed,—preferably, five miles per hour or more. The speed of the train when it reaches the long contact rail and while it is passing over such rail would (in most instances) be such that the circuit controlled by the speedometer would be closed, but the voltage of the current supplied by the batteries 21 would be so cut down by the resistance 24 and 81, that the magnet 79 would not be sufficiently energized to operate the trip 77, and hence the circuit of the magnet 70 which controls the brake mechanism, would be kept open.

As before explained, the semaphore 37 in the cab will be moved to "danger" or "stop" position, when the shoe 35 is in engagement with the long contact rail 4 at the entrance of a block, if another train is in the block. At the forward end of this long contact rail, a post 86 will be located alongside the railroad to indicate to the engineer, the end of the long contact rail, and therefore, the necessity for slackening the speed of the train or stopping it if the semaphore 37 still remains at "danger." Should the engineer disregard the warning of his semaphore and permit the train to continue at a rate of five miles per hour (more or less, according to the setting of the speedometer) and the shoe 35 should reach the short contact rail 5, the air brakes on the train would be at once applied, by reason of the automatic manipulation and operation of circuits and devices, as follows: When the shoe 35 leaves the long contact rail 4 and engages the short contact rail 5, those portions of the circuit at the ends of the block, which include the resistances 24 will be opened and the circuits of the batteries 21 will be closed through the conductors 23, short contact rails 5 and the cab circuits, thus placing the

full voltage supplied by the batteries 21 in the short contact rails and cab circuits. The circuit of the magnet 79 being now closed at the speedometer, and the resistances 24 having been cut out, sufficient current will be supplied by the batteries 21 to so energize the magnet 79 as to cause it to actuate the trip 77 and release the switch lever 72. This switch lever will then be promptly moved by the spring 78, into engagement with the contact 75 and close the local circuit including the magnet 70 and battery 71. The magnet 70 will then move the trip 66 and release the lever 62, whereupon the action of the spring 65 will shift the valve 61 and permit a movement of the piston 55 to operate the valve mechanism of the air brakes and the consequent application of the latter, thus automatically stopping the train. Before the train can proceed, the engineer must alight from his cab and manually reset, first the switch lever 72 and then the lever 62 as previously explained.

If, while the contact shoe 35 of the train entering the block is on the long contact rail 4, the engineer has reason to believe that the train in the block (and running in the reverse direction), is closely approaching the end of the block, he will, by means of my improvements, be enabled to stop such approaching train before it reaches the train about to enter the block. This can be accomplished by the engineer of the train at the entrance end of the block, throwing the switch 26^a so as to connect the switch arm 31 with the contact 32. The battery 21 at one end of the block will now be connected with the short contact rail 7 about 2000 feet (more or less) in advance of the train about to enter the block with its contact shoe 35 on the long contact rail 4. Now when the approaching train reaches the short rail 7 and its shoe 35 makes contact therewith, a circuit will be established through the devices on such approaching train and the brakes will be automatically applied in the same manner as hereinbefore explained.

Should the circuit embracing the line conductors 11—16 become impaired, as by a breaking or grounding of one or the other of these conductors, the low voltage relays 8 would at once become deenergized so that their armatures would be released and be permitted to engage the contacts 19 of the local circuits. Under such conditions, a train entering a block from either end would (upon reaching a long contact rail 4) receive a "danger" or "stop" signal, because such local circuit would be closed through the semaphore circuit on the train. When such a condition exists, it is desirable (in order to avoid holding the train an indefinite length of time) that the engineer shall be enabled to report to a despatcher's office and receive orders. For this reason, a telephone 90 is

provided in the cab, and the arms 26—30 of the switch 26^a are adapted (when thrown from the position shown in Fig. 1) to engage contacts 87, with which conductors 88 leading to telephone line wires, are connected. In the cab, one terminal of the battery 71 is connected with a telephone terminal by means of conductors 76—91, and the other terminal of said battery is connected with switch arm 48, by means of conductors 78—92, and the switch arm 48 is electrically connected with switch contact 40 by a conductor 93. The switch arm 94 of the telephone is connected by conductor 95 with arm 46 of the switch 38, and the contact point 96 for the telephone switch arm 94, is connected, by a conductor 97 with the arm 44 of switch 38. The contact point 98 is connected in the talking circuit of the telephone and the conductor 91 is connected with the arm 45 of switch 38. The contact 41 of the switch 38 is connected by a conductor 100, with the truck frame. The switch 38 is maintained in its normal position by means of a spring 99.

When the engineer desires to communicate with the despatcher's office, he will first throw the switch 26^a to connect the telephone line wires (through the medium of conductors 27 and 101) with a track rail 3 and a conductor rail 4 and he will then move the switch bar 38 longitudinally. The result of this will be to include the battery 71 in circuit with the telephone line and in circuit with a rheotome bell (not shown) at the despatcher's office. As soon as the engineer removes the telephone receiver from its hook, the calling battery 71 will be cut out and the talking circuit of the telephone will be closed. The engineer can now receive orders from the despatcher and if such orders be for him to proceed, the engineer will first restore the switches 26^a and 38 and then proceed with his train at a rate less than five miles an hour (more or less according to the setting of the speedometer 82) until he has passed the short conductor rail 5. Should the engineer, from neglect, fail to restore the switch 26^a, his air brakes will be applied and his train stopped (if running at a rate of more than five miles an hour) when the short conductor rail 7 is reached, because under such conditions, this short rail 7 will be connected in circuit with the battery 21 and current will therefore be supplied to operate the brake controlling mechanism, it being kept in mind that the several arms of the switch 26^a are mechanically connected so as to move together and that the switch arm 31 serves to connect the battery 21 with the short contact rail 7.

It will of course be understood that if a train approaches a block while another train is in the block and running in the same direction, the semaphore of the entering train 13

will move to "danger" and that when the forward train leaves the block, the semaphore on the following train will move to safety and thus notify the engineer that the block is clear.

Having fully described my invention what I claim as new and desire to secure by Letters-Patent, is:—

1. In a block system of electric train signaling and control, the combination of high and low voltage relays at respective ends of a block of railway, partial local circuits including the contacts of said relays, a closed electric circuit of relatively high resistance including the magnets of said relays in series for normally retaining said partial local circuits open, signaling devices on the rolling equipment, circuit connections for including said signaling devices in said partial local circuits, and means cooperating with the rolling equipment occupying a block, for increasing the voltage in the relays to cause the high voltage relays to close said local partial circuits.

2. In a block system of electric train signaling and control, the combination with the track rails and insulated rail sections near the ends of a block, of a pair of high and low voltage relays at respective ends of a block, a closed circuit including said pairs of relays in series, a resistance included in said circuit, electrical connections between said closed circuit and the track rails in the block for short-circuiting said resistance when a train occupies the block, contact rails near the ends of the block, partial local circuits including said contact rails and the relay contacts, and signaling means on the rolling equipment and adapted to cooperate with said contact rails and insulated track sections to complete said local circuits for actuating the signaling means on the rolling equipment entering a block when the block is occupied by a train.

3. The combination with a block of railway having insulated rail sections at the end of the block and rolling equipment adapted to electrically connect the track rails, of high and low voltage relays at each end of the block, an electric circuit including the relays at both ends of the block in series, a resistance in said circuit, a circuit cooperating with the track rails and rolling equipment for short circuiting said resistance, contact rails near the ends of the block, local partial electric circuits controlled by the high voltage relays and including the insulated track rails and contact rails, signaling means on the rolling equipment, and means for including said signaling means in said local partial circuits.

4. The combination with a block of railway having insulated rail sections at the ends of the block, and rolling equipment adapted to electrically connect the track rails, of

high and low voltage relays at respective ends of the block, a closed electrical circuit including all of said relays in series, a resistance included in said closed circuit, normally open local circuits including the relay contacts, means for short circuiting the resistance in said closed circuit when a train occupies the block whereby the high resistance relays will actuate their armatures and partially close said local circuits, signaling means on the rolling equipment, and means for including said signaling means in said local circuits and simultaneously closing the latter.

5. The combination with a block of railway, and rolling equipment, of high and low voltage relays at both ends of the block, a closed electric circuit including the coils of the relays at both ends of the block, a resistance in said circuit, a normally open local electric circuit at each end of the block and including the relay contacts, means for automatically short-circuiting the resistance in the closed circuit, signaling means on the rolling equipment, and means for including said signaling means in the local circuit at one end of the block.

6. The combination with a railway block and rolling equipment, of relays at both ends of the block, electric circuits for automatically controlling the operation of said relays, long and short contact rails at each end of the block, local partial circuits including relay contacts and said contact rails, a resistance in the one of the local partial circuits at each end of the block, which includes the long contact rail, another of said local partial circuits at each end of the block including a short contact rail and shunting said resistance, signaling and brake controlling means on the rolling equipment, and a contact shoe carried by the rolling equipment and electrically connected with the signaling and controlling means, said shoe being in position to engage said contact rails.

7. The combination with a railway block, rolling equipment, and signal means and brake controlling means on the rolling equipment, of a long contact rail and a short contact rail at each end of the block, means at the ends of the block for supplying current to the long contact rails, means for supplying current of higher voltage to the short contact rails, partial circuits of relatively low and high resistance including the signal and brake controlling means respectively, means for connecting said partial circuits with the contact rails, and means for automatically controlling supply of current to said contact rails.

8. The combination with a railway block, rolling equipment, and signaling means and brake controlling means on the rolling equipment, of a long and two short contact

rails near each end of the block, a switch at each end of the block, telephone lines connected with said switch, an electrical connection between said switch and the forward short contact rail, electric generators at the ends of the block, conductors connecting the switches with the long contact rails and the generators, resistances in said conductors, partial circuits including the generators and the rear short rails, means controlled by a train in the block for controlling the circuits of said generators, telephoning means on the rolling equipment, a contact shoe on the rolling equipment, and conductors for connecting said signaling, brake-controlling and telephoning means with said contact shoe.

9. The combination with a railway block and rolling equipment, of high and low voltage relays at each end of the block, a closed low voltage circuit including the relays at both ends of the block in series, means controlled by a train for forming a circuit of greater voltage through the relay magnets, local partial circuits controlled by the high voltage relays, contact rails included in said partial local circuits, train controlling means on the rolling equipment, electrical controlling devices for said train controlling means, a contact shoe and con-

ductors connecting said contact shoe and electrical controlling devices. 30

10. The combination with a railway block and rolling equipment, of a visual signal on the rolling equipment, a partial signal circuit, electrical signal operating devices in the partial signal circuit, brake controlling means, electrical devices for controlling the latter, normally open circuits for the electrical devices of the brake controlling means, one of said circuits being of greater resistance than the signal operating devices, means at the ends of a block operative automatically to supply a low voltage current to operate the signal operating devices and a higher voltage current to operate the electrical devices of the brake controlling means, successively, and speed controlled means included in one of the normally open circuits of said controlling devices for automatically closing said circuit at one point. 40 45 50

In testimony whereof, I have signed this specification in the presence of two subscribing witnesses.

ANDREW J. ALLARD.

Witnesses:

ARTHUR L. PLEASANTS,
W. B. CLAIBORNE.