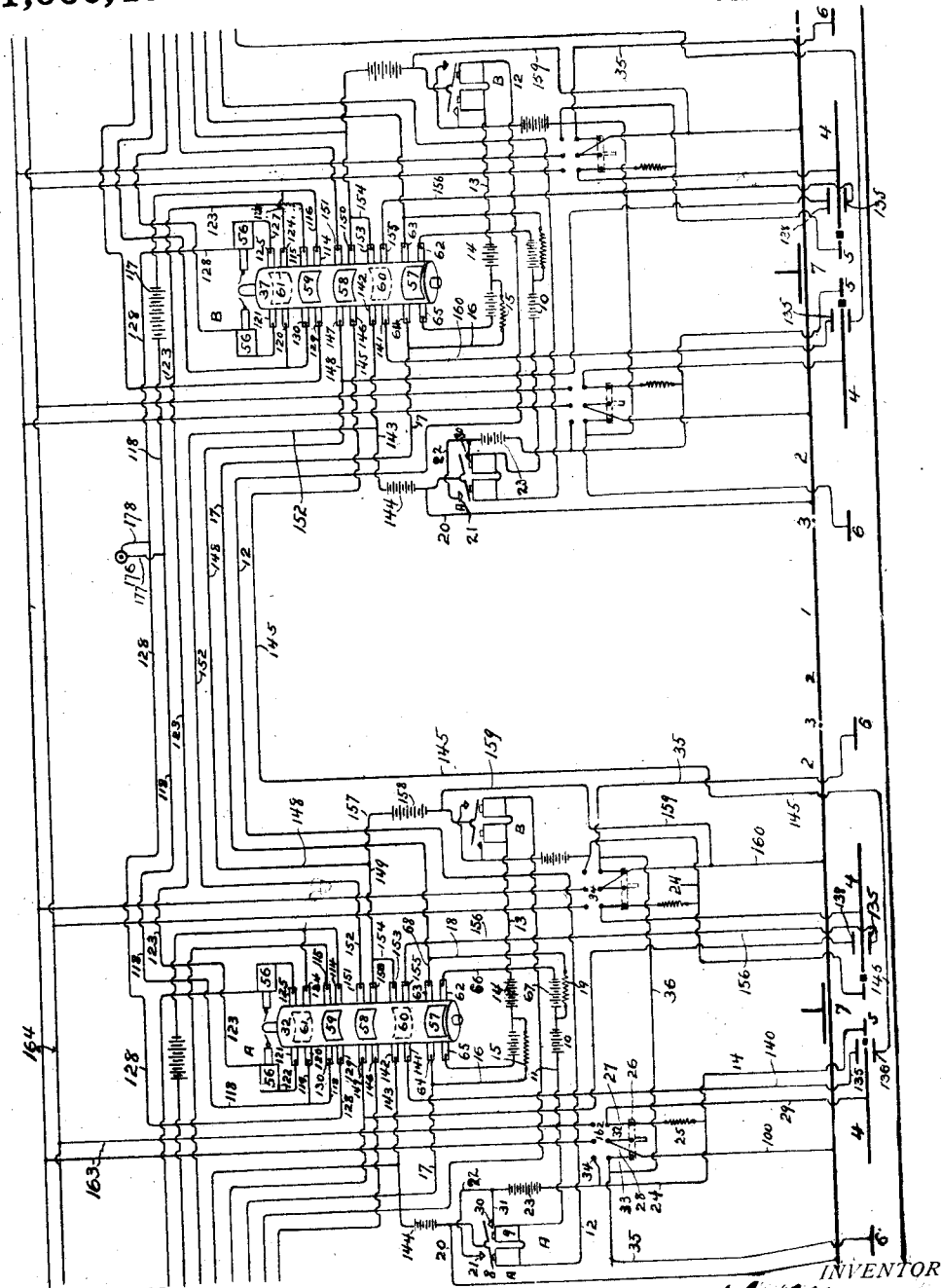


1,060,408.

A. J. ALLARD.
ELECTRICAL BLOCK SIGNALING SYSTEM.
APPLICATION FILED FEB. 15, 1911. RENEWED FEB. 3, 1913.

Patented Apr. 29, 1913.

3 SHEETS—SHEET 1.



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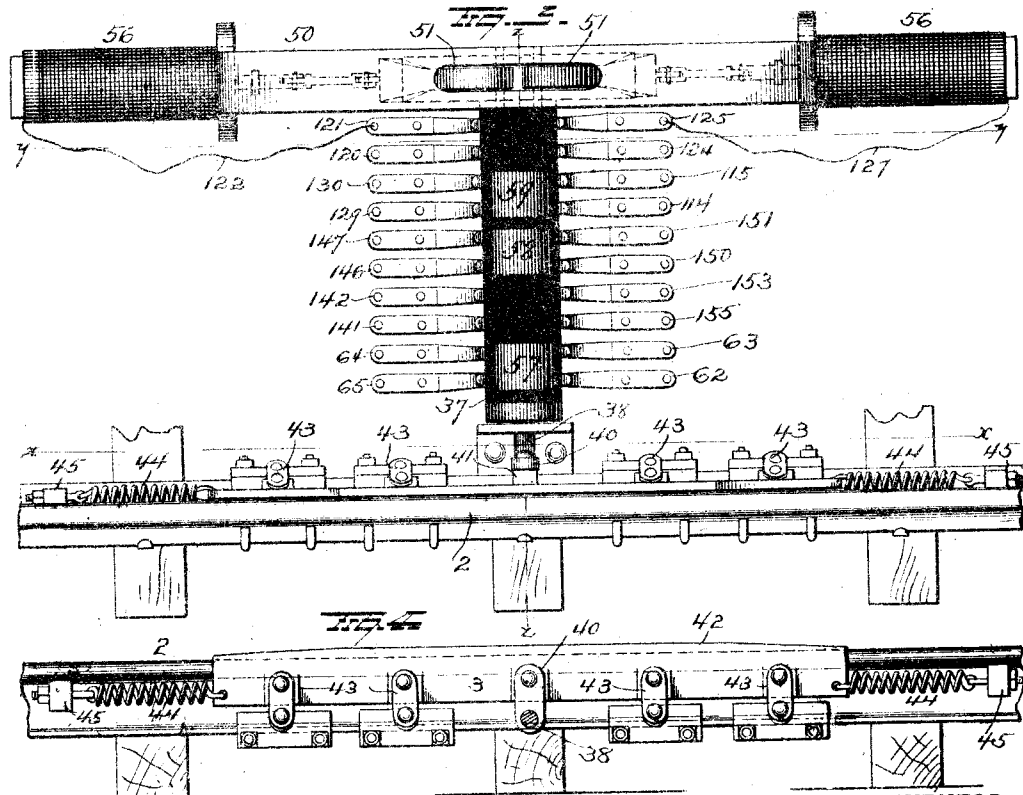
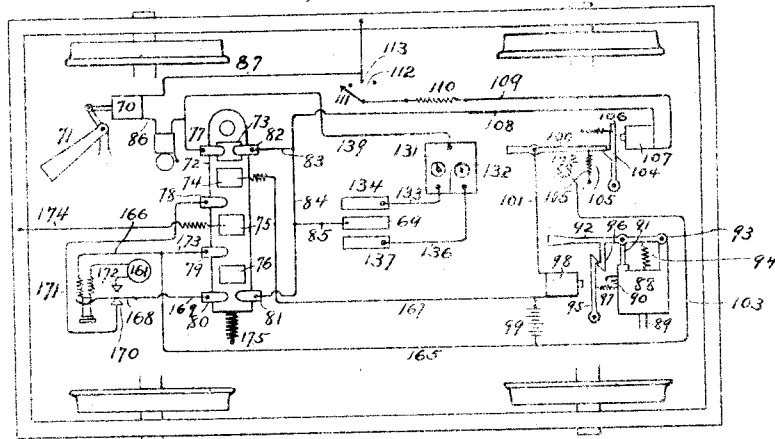
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3 SHEETS—SHEET 2.

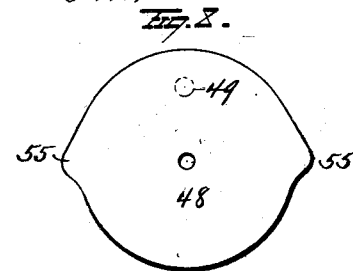
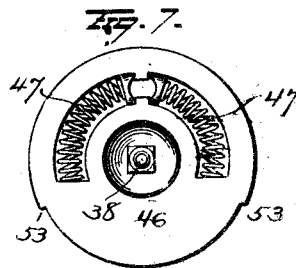
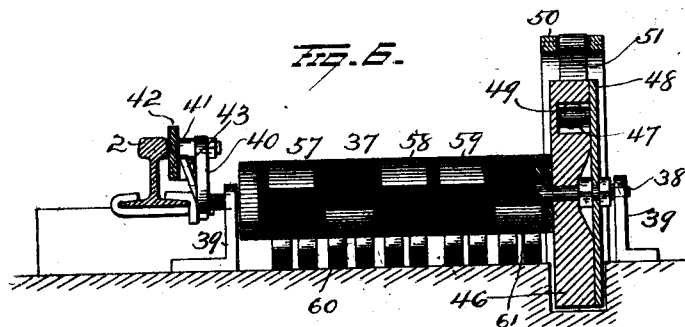
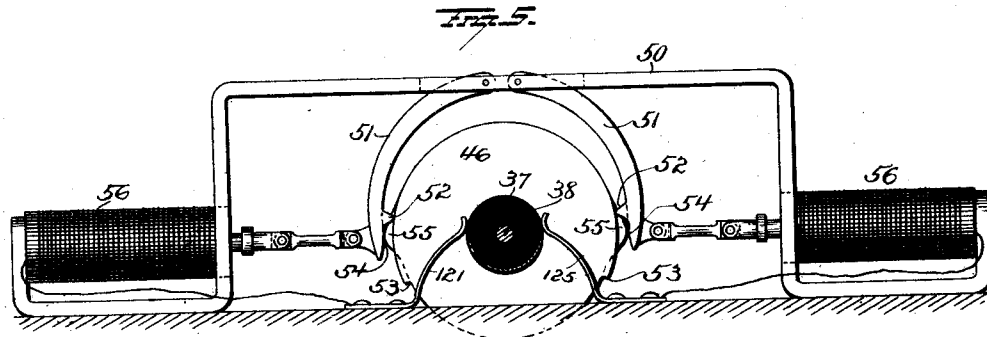
Fig. 2.



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1,060,408. 3 SHEETS—SHEET 3.



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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 D. R. CREECY, JR., OF RICHMOND, VIRGINIA.

ELECTRICAL BLOCK-SIGNALING SYSTEM.

1,060,408.

Specification of Letters Patent.

Patented Apr. 29, 1913.

Application filed February 15, 1911, Serial No. 608,776. Renewed February 3, 1913. Serial No. 746,040.

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 Electrical Block-Signaling Systems; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as it appertains to make and use the same.

This invention relates to improvements in electrical block signaling and train controlling systems and particularly to such in which the signals appear in the locomotive and the brake controlling mechanism in the cab is actuated automatically to operate the brakes and stop the train.

One object of my present invention is to provide a block system which shall be continuous or in which the blocks overlap, and to so construct and arrange the system that signals on trains will be accurately operated to protect the trains both in advance and in rear thereof, and to automatically stop trains if the signals be ignored.

A further object is to so construct and arrange the system that the engineer of a train shall be advised of the presence of another train either ahead or in rear of his train and to inform him of the direction in which such other train is running.

A further object is to provide a continuous blocking system which shall be operated automatically when set by a train entering or leaving the end of a block, to effectually protect trains from both rear-end and head-on collisions.

With these and other objects in view, the invention consists in certain novel features of construction and combinations of parts and circuits 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 rolling equipment. Fig. 3 is a plan view of the track instrument embodying circuit shifting devices arranged at the intersection of two blocks and adapted to be operated by

the wheels of a locomotive through the medium of a track bar or shoe. Fig. 4 is a view on the line $x-x$ of Fig. 3, showing the track shoe or bar. Fig. 5 is a section on the line $y-y$ of Fig. 3. Fig. 6 is a section on the line $z-z$ of Fig. 3, and Figs. 7, 8 and 9 are detail views of parts of the circuit shifting devices.

In Fig. 1 of the drawing, one complete block and the adjacent ends of two other blocks are shown, the adjacent ends of the blocks being arranged to overlap, so that the blocking of trains will be continuous.

1—1 represent the rails of a railroad track and at points several hundred feet distant in opposite directions from abutting block terminals, the inner rail section 2 is insulated (as shown at 3) from the major portions of the inner rail of the track between blocks.

Near 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 forward end of the long contact rail 4 but electrically separated therefrom, and beyond the contact rail 5, a distance about eighteen hundred feet (more or less) another short contact rail 6 is located,—the contact rails 6 for two adjacent block terminals being located approximately in line with the ends of the insulated track rail sections 2.

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 connected with said armatures will be so adjusted that the armature of relay 8 will be actuated upon the passage of a low voltage current through its coils and so that the armature of relay 9 will be actuated only when a current of higher voltage passes through its coils. 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 juncture of two blocks, so far as the track is concerned, is indicated at 7, (Fig.

1) and at this position, certain track mechanism for shifting electrical circuits, as hereinafter explained, is located.

In Fig. 1 of the drawings, the relays at A indicate one end of a block and the relays at B indicate the other end of the same block, so that, upon inspection of Fig. 1, it will be seen that the adjacent ends of the blocks (so far as the circuits between the block terminals are concerned) overlap and thus the blocks of the system are tied together electrically. Attention may also be called to the fact that no portion of one track rail will be included in the electrical circuits, and that only the section 2 of the other track rail which overlaps the block terminals, will be utilized as an electrical conductor.

The coils of the relays 8-9 are connected in series and the relays at one end of a block are connected in series with the relays at the other end of the same block in a normally closed circuit to which sufficient current is supplied to normally energize the low resistance relays 8. This circuit may be traced on the full block shown in Fig. 1 as follows: From a battery 10, by a conductor 11 to and through the coils of the relays 8-9 at A; then by a conductor 12 to and through the coils of the relays 8-9 at B; then by a conductor 13 to one terminal of a battery 14; from the other terminal of this battery to a resistance 15; from said resistance, by a conductor 16 to a conductor 17; then by said conductor 17 to a conductor 18 at the A end of the block; then by said conductor 18 to a resistance 19 and from said resistance, back to the battery 10. The current in this circuit will not be sufficient to energize the high voltage relays 9 in a manner to move the armatures of said relays, but it is sufficient to energize the low voltage relays 8 in a manner to move their armatures and maintain normally open, partial local circuits which include the contact rails 4 and 5.

At each end of each block, the armature levers of the relays are connected, by a conductor 20 with an insulated track rail section 2. The contact 21 of the relay 8 is connected, by a conductor 22 with one terminal of a battery 23, and the other terminal of this battery is connected by a conductor 24 with a short contact rail 6. One end of a resistance 25 is connected with the conductor 24 and the other end of this resistance is connected with a contact 26, with which the switch arm 27 of a switch 28 cooperates. This switch arm is connected, by a conductor 29 with a long conductor rail 1. The contact 30 for the armature lever of each relay 9 is connected, by a conductor 31 with the conductor 22.

The switch 28 comprises three mechanically connected arms 27, 32 and 33 and suitable contacts for said arms. One of said contacts (34) is electrically connected with the

conductor 24 and the switch arm 33 is connected, by a conductor 35 with a short contact rail 6. The conductors 35 at the adjacent or overlapping ends of two blocks are connected by a conductor 36.

It will be understood that the circuits and devices at each end of each block are the same, and the cooperation of the circuits and devices between the blocks will be hereinafter made apparent.

The local partial circuits which include the batteries 23, the contacts of the high resistance relays, and the contact rails 4-5 are for the purpose of supplying current to actuate devices on a rolling equipment when (under certain conditions) the latter bridges one or the other of said contact rails and the track rail section 2, but the said local circuits can not be closed (even when the circuits and devices of the locomotive are included therein) until current of sufficient voltage passes through the coils of the relay magnets to cause the high voltage relays to actuate their armatures and close said local circuits at the relays, and such complete closing of the said local circuits is brought about by the mechanical operation, by a locomotive, of circuit shifting or switch devices located near the track rail section 2 and actuated by the wheels of the locomotive. These circuit shifting or switch devices serve other purposes than to effect the closing of the partial local circuit or rather placing said circuits in condition to be closed through the devices on the locomotive when the latter bridges a contact rail and track rail section 2, but for convenience, the said mechanical circuit shifting or switching mechanism will now be described in its entirety, and afterward, other circuits and appliances which cooperate therewith will be explained.

Centrally between the ends of each insulated track rail section 2, and opposite the point 6 which marks the juncture of two blocks of rails, a drum or cylinder 37 of insulating material is located at right angles to said rail section 2. This drum or cylinder is mounted to turn on a shaft 38 having bearings near its ends in standards 39. The shaft 38 is provided at one end with a crank arm 40 which is pivotally connected with a pin 41 on an elongated bar or shoe 42 disposed alongside the head of the rail section 2. The bar or shoe 42 is supported by means of a series of pivoted links 43 so that said bar shoe can have an up and down movement in the arc of a circle and thus transmit motion, through the crank arm 40 to the shaft 38. The track bar or shoe 42 is maintained normally in its upper position with its upper edge slightly above the tread of the rail and returned to such position by the action of springs 44. These springs are attached, respectively, to the ends of the bar or shoe and connected adjustably to lugs 45

fixed to track rail 2. The drum or cylinder 37 is provided with a fixed head 46 having slots or recesses in which coiled springs 47 are housed. The shaft 38 passes freely through the head 46 and to said shaft adjacent to the outer face of the fixed head, a disk 48 is secured so as to move with said shaft. The disk 48 covers the springs 47 and the slots containing them, and is provided with a fixed pin 49 which projects into the head 46 and is disposed between the opposing ends of the two springs 47—47. Thus it will be seen that when the shaft 38 is turned, motion will be imparted, through the disk 48, pin 49 and one or the other of the springs 47, to turn the head 46 also, but as the head will be locked in the position to which it may be thus moved (by means presently explained), the spring 47 will act to return the disk 48 to its normal position after the wheels of the train shall have passed the track bar or shoe 42.

A frame 50 extends over the head 46 and pivotally mounted in said frame, are two curved latch arms 51 which partially embrace the head 47 and constructed near their free ends with lugs 52 to engage shoulders 53 on the periphery of the head 46. The latch arms are also provided near their free ends with shoulders 54 to be engaged by cams or projections 55 on the periphery of disk 48 for moving said latch arms out of engagement with the head 46 to release the latter. The frame 50 also supports two solenoids 56, the movable cores of which are connected with the latch arms 51 for moving the latter to release the head 46 and the drum or cylinder 37 to which it is fixed, as hereinafter explained.

The insulated drum or cylinder 37 has secured thereto a plurality of contact plates, 57—58—59 and 60—61, the latter two plates being located on the diametrically opposite face of the drum from the plates 57—58—59 and out of line therewith as illustrated in Fig. 1.

At respective sides of the drum 37 and in position to be engaged by the contact plate 57, are two pairs of contact arms 62—63 and 64—65. Contact finger 62 at the A-end of the block is connected, by a conductor 66 with one terminal of a battery 67 and the other terminal of this battery is connected with the resistance 19. The contact finger 63 at the A-end of the block, is connected by a conductor 68 with the conductor 17 at the juncture of the latter with the conductor 18. The conductor 17 which extends to the B-end of the block, is there connected in circuit with the battery 14—resistance 15 and relays 8—9.

Assume now that a train is entering the block shown complete in Fig. 1 of the drawing and is traveling from left to right. The wheels of the locomotive will depress the

track bar or shoe 42 and thus cause the drum 37 and its head 46 as well as the disk 48 to be turned to the right. The drum will be retained in this position by engagement of one of the latch arms with the head 46, but after the wheels shall have left the track-bar or shoe 42, one of the springs 44 (which springs are much stronger than the springs 47 in the head 46) will move the track bar or shoe to its normal position and cause the shaft 38 to be turned and bring the disk 48 to its normal position. When the drum 37 has been turned as just described, the contact plate 57 will electrically connect the contact fingers 62 and 63, thus short-circuiting the resistance 19, and including the battery 67 at the A-end of the block in series with the battery 10. A circuit will now be established from battery 10 through the coils of relays 8—9 at the A-end of the block; then by conductor 12 to the B-end of the block; through coils of relays at B; then by conductor 13 to battery 14; from the latter through resistance 15 to conductor 16; then to conductor 17 and by the latter to the conductor 68 at the A-end of the block; then to contact arm 63, through plate 57 to contact arm 62, then by conductor 66 to battery 67 and from the latter to battery 10.

By reason of the exclusion of the resistance 19 from and the inclusion of the battery 67 in the circuit of the relays 8—9 at the two ends of the block, current of sufficient voltage will be supplied to this circuit to cause the armature of the high voltage relays to be actuated and close the local partial circuits hereinbefore described. Local partial circuits are now closed at both ends of a block,—the contact rails 4—5 at the A-end of the block being included in one local circuit and the contact rails 4—5 at the B-end of the block being included in the other local circuit.

Should a second train, traveling from right to left, approach the distant B-end of the block, the local circuit at this end of the block will be closed through signaling devices on the locomotive and the engineer thus notified that another train is in the block. Should another train approach the block at the A-end thereof, the local circuit at this end of the block will be closed through signaling devices on the locomotive and the engineer will thus be notified of the presence of another train in the block. The signaling devices on the locomotives will be included in the local circuits at the ends of blocks by the bridging of the signal circuit on the locomotive, from track rail 2 to long contact rail 4, a contact shoe 69 being carried by the locomotive for this purpose. Should the engineer on either train approaching the block while another train is in the block, disregard the signal, his train

will be stopped (if running at or beyond a predetermined rate of speed) when the contact shoe 69 reaches a short contact rail 5. The local circuit at the end of the block will then exclude the resistance 25 and therefore sufficient voltage will be supplied to operate devices on the locomotive for controlling the application of the brakes.

In order that the operation of the signaling and brake controlling devices on the locomotive and the manner in which they are controlled and actuated by the local partial circuits at the ends of the blocks, shall be more readily understood,—said devices and the circuits on the locomotive in which they are included will now be explained, with special reference to Fig. 2 of the drawing.

Each locomotive is provided with a contact shoe 69 to engage the contact rails 4, 5 and 6, and in the cab of the locomotive, a solenoid 70 is located, the core of this solenoid being connected with a semaphore 71 also located in the cab. A switch 72 is also located in the cab and comprises a longitudinally movable bar provided with a plurality of contact plates 73, 74, 75 and 76 and a plurality of contact fingers 77, 78, 79, 80, 81 and 82 cooperate with said contact plates. The switch arms 77 and 82 are normally connected by the contact plates 73 and the switch arm 82 is connected by conductors 83—84—85 with the contact shoe 69. The switch arm 77 is connected by a conductor 86 with one terminal of the coil of solenoid 70 and the other terminal of said coil is connected, by means of a conductor 87 with the truck frame.

When the circuit shifting mechanism at one end of a block has been shifted mechanically by the passing of a train as before described, and the shoe 69 on the locomotive of another train engages a long contact rail 4 at one end of the block, the local circuit at that end of the block (including the resistance 25) will be closed through the circuit above described, including the shoe 69, truck frame, contacts 73—77—82 of switch 72 and the coil of solenoid 70, and thus the semaphore 71 will be moved to "danger" position, indicating to the engineer that another train occupies the block. Should the engineer disregard such warning and permit the contact shoe 69 to reach the short contact rail 5, his train will be stopped by means of appliances and in the manner which will now be explained.

A cylinder 88 is located on the locomotive and provided with a suitable piston, the rod 89 of which is connected with the air-brake valve mechanism (not shown) for operating the same. The cylinder 88 is provided with suitable valve for controlling the supply of air from a pipe 90 to operate the piston in the cylinder 88. The steam of said valve is

indicated at 91, Fig. 2, and is connected with a hand lever 92 which is pivotally supported at 93 and movable in one direction by a spring 94. The valve is maintained normally in the position shown in Fig. 2, by means of a latch 95 pivoted at one end to a fixed support and adapted at its other end to engage a hook 96 on the lever 92, such engagement being normally maintained by means of a spring 97. The latch 95 is provided with a suitable armature for an electro-magnet 98, and this magnet is controlled by devices presently explained, to actuate the latch 95 and release the hand lever 92. When the hand lever shall have been thus released, the spring 94 will be free to shift the air supply valve of the cylinder 88 and thus admit air behind the piston in said cylinder to operate the mechanism of the brakes.

The coil of magnet 98 is included in a normally open local circuit with a battery 99 and a switch 100,—this circuit being traced as follows: The battery 99 is connected with one terminal of magnet 98 and the other terminal of this magnet is connected, by a conductor 101 with the switch lever 100. This switch lever is intended to cooperate with a fixed contact 102 and the latter is connected, by a conductor 103 with the battery 99. This circuit is maintained normally open by the engagement of a pivoted latch 104 with the switch lever 100 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 105, and be permitted to cooperate with the contact 102 to close said local circuit.

The latch 104 is maintained normally in engagement with the switch lever 100 by means of a spring 106 and the operation of said latch is controlled by an electro-magnet 107. One terminal of the coil of this magnet is connected, by a conductor 108 with the conductor 84, the latter being connected, by means of the conductor 85, with the shoe 69. The other terminal of the coil of magnet 107 is connected by a conductor 109, with one end of a resistance 110, the other end of said resistance being connected with the movable arm 111 of a speedometer 112 of any preferred construction and suitably connected with the car axles or wheels. The arm 111 of the speedometer also forms a switch-arm adapted to cooperate with a contact 113, the latter being connected, with the conductor 87 and the truck frame. The speedometer will be so set that the circuit including the magnet 107 will be closed at 111—113 when a 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 4 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 from the local block circuit of battery 23 would be so cut down by the resistances 25 and 110, that the magnet 107 would not be sufficiently energized to operate the trip 106, and hence the circuit of magnet 98 which controls the brake mechanism, would be kept open.

As before explained, the semaphore 71 in the cab will be moved to "danger" or "stop" position, when the shoe 69 is in engagement with the long contact rail 4 at the entrance of a block if another train is in the block. Should the engineer ignore the semaphore signal and permit his train to continue at a rate of five miles an hour (or more, according to the setting of the speedometer) and the shoe 69 should reach the short contact rail 5, the air brakes on the train would be at once applied, by reason of the cutting out of the resistance 25 and the consequent of supply of sufficient voltage from battery 23 to operate magnet 107 to release the switch arm 100 and close the local cab circuit which includes the magnet 98,—the latter in turn, operating the latch 95 to release lever 92 to control the operation of the brake controlling devices.

Should a train, for any reason, remain near the juncture of two blocks after having operated the mechanical circuit shifting devices, the engineer can, by throwing the switch 28, cause a train which might approach in either direction, to be stopped by the automatic application of the brakes, before such approaching train could reach the standing train. This result would be accomplished, by the engagement of the shoe 69 on the approaching train, with either of the short contact rails 6, because a current of sufficient voltage from the battery 23 would be supplied to cause the operation of the brake controlling devices in the cab,—the partial circuit of said battery, between track rail 2 and contact rail 6 being traced as follows: From contact rail 6, by conductor 35 to switch arm 33, to switch contact 34, to battery 23, then to relay contact 30, and then from the armature lever of relay 9, by way of conductor 20 to track rail 2. As the switch arm 33 of both switches 28 located adjacent to each other at the intersection of two blocks, are connected by the conductor 36, a train standing at the intersection of two blocks, between the two short rails 6, 6, will be protected from trains approaching from both directions.

I have hereinbefore assumed that a train has entered the block (shown complete in Fig. 1) from the left or A-end thereof, and that it has caused the operation of the mechanical circuit shifting devices. Should it be necessary for the train to back and re-

enter the block to the left, it would be desirable that the train shall be protected from a train which might enter said rear block. When the drum 37 of the switch shifting devices was turned when the train (traveling from left to right) passed over the bar or shoe 42, said drum was locked in such position by the engagement of one of the latch arms 51 with a shoulder 53 on head 46. Now when the train runs backwardly over the bar or shoe 42 the shaft 38 with which said bar or shoe is connected, will first be turned,—causing the disk 48 to be also turned and a cam 55 of said disk to engage the latch arm and move it to release the head 46 of drum 37. One of the springs 47 in head 46 will now cause the drum to assume its normal position with all of the contact plates thereon out of electrical contact with the contact fingers, but the further depression of the track bar or shoe 42 by the wheels of the train will cause a partial rotation of the drum and its head in the opposite direction, and the same will be locked in such position by the engagement of the other latch arm 51 with a shoulder 53 of head 46. When the drum 37 has been thus shifted, the contact plate 57 will electrically connect fingers 64—65 and short-circuit the resistance 15 at the B-end of the block located to the left of the full block shown in Fig. 1. The effect of this will be to include the contact rails 4—5 at the A-end of the block to the left or in rear of the full block shown in Fig. 1, in local block circuits which will operate the mechanism in the cab of a train which might reach the A-end of the rear block while a train is in the same block near the B-end thereof.

Assume now that the train running from left to right and which entered the A-end of the completed block shown in Fig. 1 of the drawing, did not back over the track bar or shoe 42, but proceeded to the distant B-end of the block. When the train passes over the track bar or shoe 42 at the B-end of the block the drum 37 at this end of the block will be turned to the right and the contact plate 59 on said drum will electrically connect contact fingers 114—115. The finger 114 is connected by a conductor 116 with one terminal of a battery 117 and the other terminal of this battery is connected by a line conductor 118 and a conductor 119 with a contact finger 120 to cooperate with the contact plate 61 on the drum 37 at the A-end of the block. The finger 120 is electrically connected, by the plate 61, with a contact finger 121 and the latter is connected by a conductor 122 with one terminal of the coil of the left hand solenoid 56 at the A-end of the block. The other terminal of this solenoid coil is connected, by a line conductor 123 with the contact finger 115 at the B-end of the block.

When the train passed the circuit shifting mechanism at the A-end of the block and caused the partial right-hand rotation of the drum 37 as before explained; the fingers 120—121 were electrically connected by the contact plate 61. When the train (running from left to right) leaves the B-end of the block and causes the partial right-hand rotation of the drum 37 there located, the contact plate 59 on this drum will electrically connect the contact fingers 114—115 and the electric circuit which includes these contacts, the battery 117, line conductors 118—123 contacts 120—61 and 121 at the other end of the block, and the left hand solenoid 56 at this end of the block, will be closed. In this manner, the said left hand solenoid at the A-end of the block will be energized and caused to withdraw the latch 51 from the head 46 of drum 37, thus releasing said drum and permitting it to assume its normal position with all the circuits which it controlled, open.

It will be understood that trains running from right to left, will cause partial rotation of the drums 37 in the reverse or left-hand direction and they will be locked when thus turned, by the right-hand latches 51. When the drum 37 at B is thus turned to the left, the contact plate 61 will connect contact fingers 124—125. The contact finger 124 is connected by a conductor 126 with the conductor 116 and the finger 125 is connected by a conductor 127 with one terminal of the right-hand solenoid 56 at B. The other terminal of this solenoid is connected, by a line conductor 128, with a contact finger 129 to cooperate with contact plate 59 on drum 37 at A. The plate 59 connects finger 129 with a contact finger 130, and the latter has connected therewith, the conductor 118. When a train traveling from right to left passes the B-end of the complete block shown in Fig. 1 and the drum 37 there located will be shifted as above described, and when the train passes the A-end of the same block, the drum there located will be turned to the left and the right-hand solenoid 56 at B will be energized to operate its latch and release the drum, permitting the same to assume its normal position. The circuit which causes the energizing of the right hand solenoid at B when the train is traveling from right to left on the completed block shown in Fig. 1, will be traced as follows:—from battery 117, by conductor 116, to conductor 126, through contacts 124—61—125 and conductor 127 to right hand solenoid 56 at B, then by conductor 128 to contact finger 129 at A, then by contact plate 59 on drum 37 at A to finger 130, and then by line conductor 118 to battery 117.

My improvements also contemplate means whereby the engineer of a train, upon approach to a block terminal, will be given

a signal in the cab regarding the presence and direction of travel of another train in the block ahead. Such signals will be received in the cab on annunciators 131—132 (Fig. 2) of any preferred form of construction. One terminal of the annunciator 131 is connected by a conductor 133 with a contact shoe 134 located under the locomotive and adapted to engage contact rails 135 located near but spaced laterally from the forward ends of the long contact rails 4. One terminal of the annunciator 132 is connected by a conductor 136 with a contact shoe 137 adapted to engage contact rails 138 spaced laterally from the opposite side of the long contact rails 4. The other terminals of the two annunciators 131—132 are connected together and connected by a conductor 139 with conductor 86, the latter being connected with the semaphore solenoid core 70 and said coil being connected by conductor 87 with the truck frame.

Referring now to the A-end of the completed block shown in Fig. 1 of the drawing the contact rail 135 is connected by a conductor 140 with a contact finger 141, and the latter is electrically connected (when the drum 37 at A is turned to the right) by contact plate 60 with a contact finger 142. A conductor 143 connects finger 142 with one terminal of a battery 144, and the other terminal of this battery is connected by conductor 20 to the track rail section 2 at the A-end of the block. The contact rail 138 at the A-end of the block is connected, by a line conductor 145 with a contact finger 146 at the B-end of the block, and the latter is electrically connected (when the drum 37 at B is turned to the left) by contact plate 58 with a contact finger 147. A line conductor 148 connects the finger 147 at B with a conductor 149 at A and the latter is connected with a contact finger 150 at the A-end of the block. The finger 150 is connected by contact plate 58 (when the drum 37 at A is turned to the right) with a contact finger 151 and the latter is connected, by a line conductor 152, with conductor 143 at the B-end of the block. At the intersection of each two blocks, the contact finger 153 which cooperates with contact plate 60 on drum 37, is connected by conductor 154 with conductor 149, and the other contact finger 155 which cooperates with contact plate 60 is connected by a conductor 156 with contact rail 135 near the exit end of a block. At the intersection of each two blocks, the conductor 149 is connected by a conductor 157 with a battery 158, and the latter is connected by a conductor 159 with conductor 160, the latter being connected with the track rail section 2.

Let it be assumed that a train has entered the completed block shown in Fig. 1, and that it is running from left to right, having

entered at the A-end of the block. When this train passed the track bar or shoe 42, it caused a partial rotation of the drum 37 at A, to the right and has caused the contact plate 60 to electrically connect contact fingers 141—142. If, while the train is in the block, a second or following train arrives at the A-end of the same block, so that the shoe 134 on said second train contacts with the contact rail 135, a circuit will be established through the annunciator 131 on said second or following train and operate said annunciator to indicate to the engineer that another train running in the same direction occupies the block and thus a rear-end collision will be avoided. The circuit just mentioned will be traced as follows: from battery 144 by conductor 143 to finger 142, then by contact plate 60 on drum 37 at A, to finger 141, then by conductor 140 to contact rail 135, then to shoe 134, then by conductor 133 to annunciator 131, from this annunciator, by conductor 139, to conductor 86, then through the solenoid 70 of semaphore 71, and then by conductor 87 to the truck frame,—from the latter to track section 2, and then, by way of conductor 20 back to battery 144.

Let it be now assumed that a train running from left to right, has arrived at the A-end of the block with the contact shoe 137 on the contact rail 138, and that a second train, running in the opposite direction, has passed the other or B-end of the same block and now occupies the block. When the said second train passed the track shoe or bar 42 at B the drum at B was shifted to the left in a manner to cause the contact plate 58 to connect the fingers 146—147. With the second train occupying the block and traveling from right to left and the first train (traveling from left to right) arrives at the A-end of the block, the shoe 137 on said first train, making contact with contact rail 138, will establish a circuit through the annunciator 132 on the train arriving at the A-end of the block and denote to the engineer that a second train is in the block and running in a direction opposite to the direction of travel of said first train which has just arrived at the A-end of the block. The circuit which thus actuates the annunciator 132 and prevents the possibility of a head-on collision will be traced as follows: from battery 158 (at the left hand end of the complete block shown in figure) by conductors 159—160 to track rail 2; then through the cab circuits including the annunciator 132, to the shoe 137, then by conductor 145 to contact finger 146 at the opposite end of the block, then through contact plate 58 to finger 147, then by conductor 148 to conductor 157 at the A-end of the block, and finally by said conductor 157 to battery 158.

Should the constantly closed circuits be-

tween blocks and including the relays 8—9 become impaired, as by the grounding, crossing or breaking of a line wire, the low-voltage relays would at once release their armatures and, the local partial circuits hereinbefore described for supplying current to the semaphore and brake-controlling devices in the cab, would be closed at 21. 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 161 is provided in the cab, and the arms 27—32 of the switch 28 are adapted (when thrown from the position shown in Fig. 1) to engage contacts 162, with which conductors 163 leading to telephone line wires 164 are connected. In the cab, one terminal of the battery 99 is connected with a telephone terminal by means of conductors 165—166, and the other terminal of said battery is connected with contact plate 74 by means of conductors 167. The switch arm 168 of the telephone is connected by conductor 169 with arm 80 of the switch 72, and the contact point 170 for the telephone switch arm 168 is connected, by a conductor 171 with the arm 78 of switch 72. The contact point 172 is connected in the talking circuit of the telephone and the conductor 166 is connected by conductor 173 with the arm 79 of switch 72. The contact 75 of the switch 72 is connected by a conductor 174, with the truck frame. The switch 72 is maintained in its normal position by means of a spring 175.

When the engineer desires to communicate with the despatcher's office, he will first throw the switch 28 to connect the telephone line wires (through the medium of conductors 29 160) with a track rail 2 and a conductor rail 4 and he will then move the switch bar 72 longitudinally. The result of this will be to include the battery 99 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 99 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 28 and 72 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 112) until he has passed the short conductor rail 5. Should the engineer, from neglect, fail to restore the switch 28 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 6 is reached, because under such conditions, this short rail 6 will

be connected in the partial local circuits as before explained.

In order to permit trains to pass each, suitable sidings may be provided, and in order to release the drum 37 of the circuit shifting mechanism and permit the same to return to normal position when a train is to enter a siding, the circuit of releasing solenoid 56 may be energized from the battery 117 by means of a suitably located circuit closer 176 which may be connected, for example, by conductors 177-178 with the conductors 118 and 128, as illustrated diagrammatically in Fig. 1.

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

1. In an electrical block system, the combination with high and low voltage relays at both ends of a block of railway, a closed electric circuit of relatively high resistance including the magnets of both pairs of relays in series to maintain the low voltage relay contacts normally open and permit the contacts of the high voltage relays to remain open, and signaling means on the rolling equipment, of means operable mechanically by the rolling equipment entering a block for causing an increase of voltage in the circuit including the magnets of the relays to close the contacts of the high-voltage relays, partial local circuits including the relay contacts, and means for including said partial local circuits in circuit with the signaling means on the rolling equipment when the latter enters a block after said mechanical means have been operated.

2. In an electrical block system, the combination of high and low voltage relays at both ends of a block, electrical resistance, a closed electric circuit including said resistance and the magnets of both pairs of relays to maintain the contact of the low voltage relays open and permit the contacts of the high voltage relays to remain open, mechanical circuit shifting means operable by the rolling equipment for excluding said resistance to increase the voltage of the circuit and cause the high voltage relays to close their contacts, local partial circuits including the relay contacts, signal controlling means on the rolling equipment, and means for closing said local partial circuits through the signal controlling means on a rolling equipment entering a block, after said mechanical circuit shifting means have been operated.

3. In an electrical block system, the combination of high and low voltage relays at both ends of a block, a closed electric circuit of relatively high resistance including the magnets of both pairs of relays to maintain the contacts of the low voltage relays open and permit the contacts of the high voltage

relays to remain open, mechanical circuit-shifting means operable by the rolling equipment for causing an increase of voltage in said circuit, means for locking said circuit-shifting means, local partial circuits including the contacts of the relays, signal controlling means on each rolling equipment, means for closing a partial local circuit through the signal controlling means on one rolling equipment after the mechanical circuit shifting means have been operated by a preceding rolling equipment, and means controlled by the last-mentioned rolling equipment for unlocking the said mechanical circuit shifting means.

4. In an electrical block system, the combination of high and low voltage relays at both ends of a block, a closed circuit of relatively high resistance including the magnets of both pairs of relays to maintain the contacts of the low voltage relays normally open and permit the contacts of the high voltage relays to remain open, signal controlling means on the rolling equipment, circuit-shifting mechanism operable by the rolling equipment to increase the voltage in said circuit, means for locking the circuit shifting mechanism when the same has been shifted, local partial circuits including the contacts of said relays, means for closing said local partial circuits through the signal controlling means on the rolling equipment, electro-magnetic means for releasing the locking means of the circuit-shifting mechanism, and an electric circuit controlled by the mechanical circuit shifting mechanism at one end of the block to actuate the electro-magnetic releasing means of the circuit shifting mechanism at the other end of the block.

5. In an electrical block system, the combination of high and low voltage relays at both ends of a block, a closed circuit of relatively high resistance including the magnets of the relays at both ends of the block, to maintain the contacts of the low voltage relays normally open and permit the contacts of the high voltage relays to remain open, signal-controlling means on the rolling equipment, local partial circuits including the contacts of said relays, means for including said partial local circuits in series with the signal controlling means on the rolling equipment, and mechanical circuit-shifting means operable by the rolling equipment to cause the high voltage relays to complete said partial local circuits.

6. In an electrical block system, the combination of high and low voltage relays at both ends of a block, an electrical resistance, a closed electric circuit including said resistance and the magnets of both pairs of relays to maintain the contacts of the low voltage relays normally open and permit the

contacts of the high voltage relays to remain open, signal controlling means on the rolling equipment, normally open local partial circuits including the relay contacts, means for completing said local partial circuits through the signal controlling means, circuit shifting means for short-circuiting the resistance in the circuit including the relays, a yielding track bar or shoe and connections between said bar or shoe and the circuit-shifting means for actuating the latter.

7. In an electrical block system, the combination of high and low voltage relays at both ends of a block, an electrical resistance, a closed circuit including said resistance and the magnets of said relays, to maintain the contacts of the low voltage relays normally open and permit the contacts of the high voltage relays to remain open, normally open partial local circuits including the contacts of said relays, signal controlling means on the rolling equipment, means for completing said partial local circuits through said signal controlling means, drums at the intersection of the blocks, each drum provided with a contact plate, pairs of contact fingers to cooperate with the contact plates on the drums, said fingers included in circuits short-circuiting said resistance, yielding track bars or shoes at the intersection of the blocks, and connections between said track bars or shoes and said drums for turning the latter.

8. In an electrical block system, the combination of high and low voltage relays at both ends of a block, an electrical resistance, a closed circuit including said resistance and the magnets of said relays to maintain the contacts of the low voltage relays normally open and permit the contacts of the high voltage relays to remain open, normally open partial local circuits including the relay contacts, signal controlling means on the rolling equipment, means for completing said local partial circuits through said signal controlling means, drums at both ends of the block, each drum having a head, a shaft passing freely through each drum and its head, yielding means between the drum and shaft, a yielding track bar or shoe connected with each shaft for turning the same and the drum, locking means to cooperate with the head of each drum, contact devices cooperating with each drum to short circuit the resistance in the first-mentioned circuit when the drum is turned, electro-magnetic devices for releasing said locking means, and electric circuits controlled by the drum and its contacts at one end of the block for actuating the lock releasing means of the drum at the other end of the block.

9. In an electrical block system, the combination of high and low voltage relays at both ends of a block, an electrical resistance,

a closed circuit including said resistance and the magnets of said relays to maintain the contacts of the low voltage relays normally open and permit the contact of the high voltage relays to remain open, normally open local partial circuits including the relay contacts, signal means on the rolling equipment, means for completing the partial local circuits through said signal means, a drum at each end of the block, a shaft passing loosely through each drum, a head on each drum, springs in each head, a disk on each shaft, a pin projecting from each disk and entering between the springs in the adjacent head, locking means cooperating with the head of each drum when the same is turned, a depressible spring-controlled track bar or shoe at each end of the block, connections between said track bars or shoes and the shafts of the adjacent drums, the disks on said shafts having cams to move the locking means and release the drums, contact devices cooperating with each drum to short-circuit the resistance in the first-mentioned circuit when a drum is turned, electro-magnetic devices for releasing said locking means, and an electric circuit controlled by a drum and its contacts at one end of the block for actuating the electro-magnetic lock releasing means of the drum at the other end of the block.

10. In an electrical block signaling system, the combination with rolling equipment and a block of railway, of two annunciators on each rolling equipment, contact shoes included in partial circuits with said annunciators, contact rails for said shoes between the track rails at the ends of the block, circuit shifting mechanism at each end of the block, mechanical devices operable by a rolling equipment entering the block and connected with said circuit shifting mechanism for operating the latter, partial electrical circuits including said circuit shifting mechanism, one of said last-mentioned partial circuits including one of the contact rails at one end of the block and the other of said partial circuits including the other contact rail at the other end of the block.

11. In an electrical block system, the combination with a railway block and rolling equipment, of two annunciators on each rolling equipment, contact shoes on each rolling equipment and included in partial circuits with the annunciators thereon, two contact rails at each end of the block, circuit shifting mechanism at each end of the block, normally open partial electrical circuits connected respectively with the two contact rails at the entrance of each block, one of said partial circuits including the circuit shifting mechanism at one end of the block and the other partial circuit including circuit shifting mechanism at the other

end of the block, each of said partial circuits including portions of the track rail, means operable by the rolling equipment entering the block for shifting said circuit shifting mechanisms to control the last-mentioned partial electrical circuits, and means for controlling the return of said circuit shifting mechanism to normal position.

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

ANDREW J. ALLARD.

Witnesses:

E. D. REDD,
WM. P. REDD.