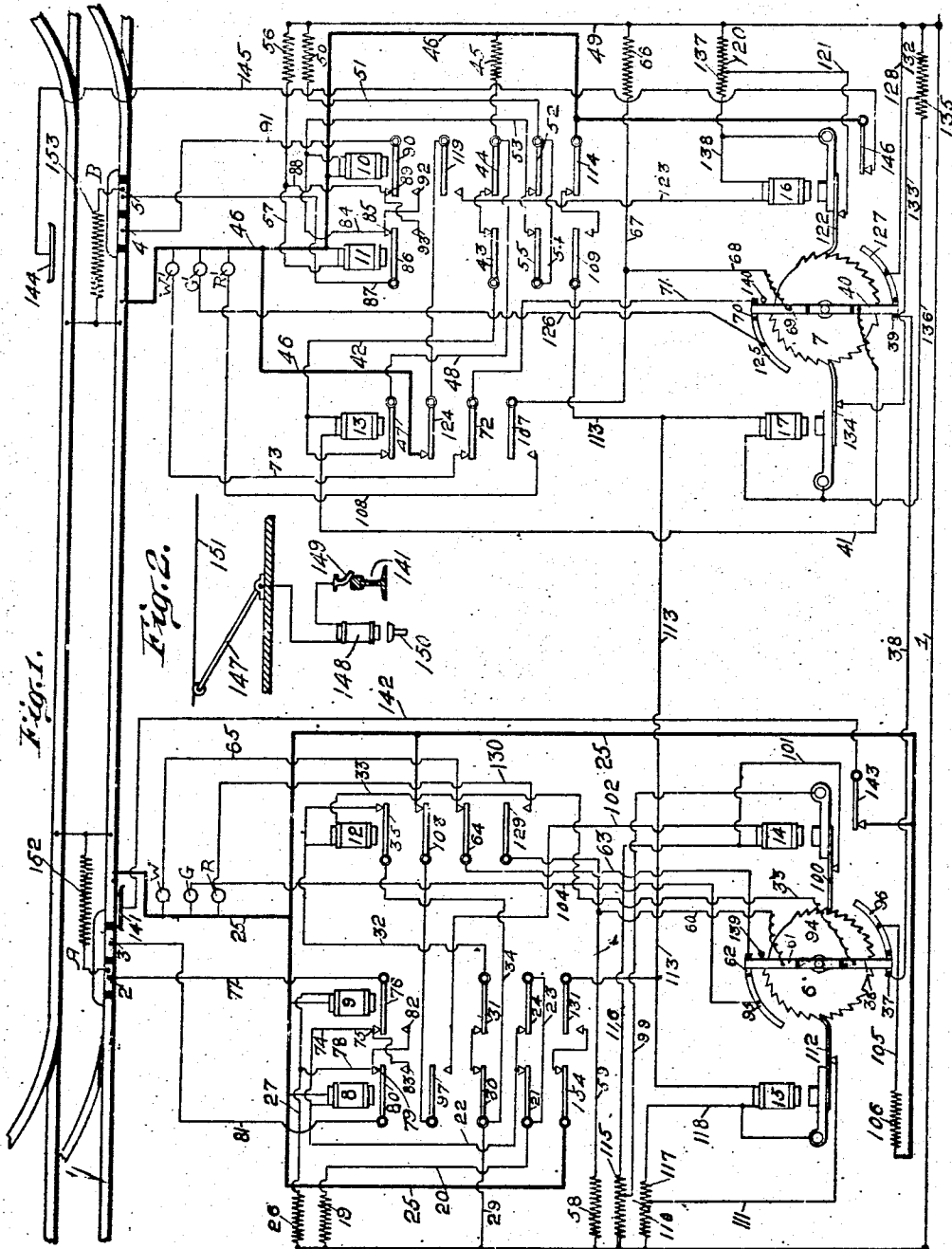


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ELECTRIC BLOCK SIGNALING SYSTEM.
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ELECTRIC BLOCK-SIGNALING SYSTEM.

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To all whom it may concern:

Be it known that we, WILLIAM F. MESCHENMOSER and CYRUS H. KINSMAN, both citizens of the United States, and residents, respectively, of the city of Hoboken, county of Hudson, and State of New Jersey, and of the city of Plainfield, county of Union, and State of New Jersey, have invented certain new and useful Improvements in Electric Block-Signaling Systems, of which the following is a specification.

This invention relates to electric block signaling systems for railways. The complete organization of its combined features is more particularly applicable to a block system for single track electric roads. The various features and circuits included in the invention are, however, adapted for use in various relations and are not restricted in their application to the particular organization shown in the drawings nor to the specific use thereof.

In the accompanying drawings forming part of this specification, and illustrating the preferred arrangement of the invention, Figure 1 is a diagrammatic view of a complete block system for single track electric roads. Fig. 2 is a diagrammatic view of part of the car stopping circuit employed in the system.

In the system shown in the drawings, the block comprises a portion of the track between the two turn-outs. Signaling means are located at each end of the block which normally show safety indication in the preferred arrangement, as shown in the drawings. When a car enters a block, it sets the signaling means at the opposite end of the block to danger and sets the signaling means at the entering end of the block to caution. When a car passes out of the block, it restores the signals to normal safety indication. If, however, one or more cars follow the first car into the block so that all occupy it simultaneously, only the first car in will set the signals and only the last out will restore them to normal.

An arrangement is also provided for stopping a car when it enters a block against the danger signal or, in other words, if a car running in the opposite direction has previously entered the block at the opposite end.

Again, if a car enters a block and then backs out, it restores the signals to normal safety indication. A peculiar arrangement of the track magnets is employed for initiating the signal setting and restoring operations and these magnets are operated by the car wheels passing over insulated track sections. This arrangement avoids the difficulties that have heretofore been encountered where it has been attempted to control the signal operations from the supply conductor and its traveling contact.

The invention will best be understood by a detailed description of the various circuits and their operation as shown in the drawings.

The block extends from station A to station B.

1 is the feed wire for the system and the return rail is through one or both of the track rails. One of the track rails at each end of the block is divided into short insulated sections 2, 3, 4 and 5.

6 and 7 are two controllers in the form of step-by-step mechanisms, one for each end of the block, and each preferably located at one end of the block. The signals are arranged to indicate safety, caution and danger.

W, G and R indicate electric lamps at one end of the block giving respectively white, green and red light when energized and together constituting signaling means at that end of the block. W¹, G¹ and R¹ are similar signal lamps at the opposite end of the block.

8 and 9 are respectively track restoring and track setting magnets at one end of the block and 10 and 11 are similar magnets at the opposite end of the block. These track magnets are operable by passing cars to produce the signal indications.

12 and 13 are line circuit magnets one for each end of the block and each operable from the opposite end of the block to control certain signal indications.

14 and 15 are respectively setting and restoring magnets for the step-by-step mechanism 6, magnet 14 being operable from its end of the block and magnet 15 being operable from the opposite end of the block. 16 and 17 are similar setting and restoring

magnets for the step-by-step mechanism 7. These mechanisms operate to make and break certain of the circuits.

In the normal condition of the system, the following circuits are closed;—

Circuit 1—Circuit for setting track magnet 8.—From feed wire 1, wire 18, through resistance 19, wire 20, armature 21 to wire 22, also through wire 23, armature 24 to wire 22, magnet 8 to common return wire 25 connected with a rail of the block. This circuit energizes setting magnet 8 and holds up its several armatures.

Circuit 2—Circuit for restoring track magnet 9.—From feed wire 1, through wire 18, resistance 26, wire 27, magnet 9 to common return wire 25. This energizes magnet 9 and holds up its several armatures.

Circuit 3—Line circuit.—From feed wire 1, through wire 18, wire 29, armatures 30, 31, wire 32, magnet 12 to wire 33, also from wire 29, through multiple branch wire 34, armature 35, and through magnet 12 to wire 33 to contact finger 36, contact 37, wire 38, contact 39, contact finger 40, wire 41, magnet 13, wire 42, armatures 43 and 44, resistance 45 to common return wire 46 which is connected with a rail of the block, also from magnet 13 through multiple branch including armature 47, wire 48, resistance 45, to wire 46. This circuit normally energizes line circuit magnets 12 and 13 so that they hold up their several armatures.

Circuit 4—Circuit for setting track magnet 10.—From feed wire 1, through wire 49, resistance 50, wire 51, armature 52, wire 53, also from multiple branch 54 and armature 55 to wire 53, thence through magnet 10 to common return wire 46. This energizes track magnet 10 and holds up its several armatures.

Circuit 5—Circuit for setting track magnet 11.—From feed wire 1, through wire 49, resistance 56, wire 57, magnet 11 to common return wire 46. This energizes magnet 11 and holds up its several armatures.

Circuit 6—Safety signal circuit at station A.—From feed wire 1, through wire 18, resistance 58, wire 59, wire 60, finger 61, contact 62, wire 63, armature 64, wire 65, white lamp W to common return wire 25. This normally energizes white lamp W to give a normal safety indication at station A.

Circuit 7—Safety signal circuit at station B.—From feed wire 1, through wire 49, resistance 66, wire 67, wire 68, finger 69, contact 70, wire 71, armature 72, wire 73, white lamp W¹ to common return wire 46. This energizes white lamp W¹ to give a normal safety indication at station B.

Each of the track magnets is provided with a shunt circuit which is open at an insulated track section, such as 2, whereby when a car reaches such insulated track section, it closes the shunt around the track

magnet and thereby deenergizes it so that it drops its several armatures. The shunt circuit of each setting and restoring magnet is controlled, however, by the other magnet of the pair. The shunt circuit for setting track magnet 8 extends from wire 22 through wire 74, contact 75, armature 76, and wire 77 to insulated track section 2. This shunt circuit is controlled by restoring track magnet 9 at armature 76. The shunt circuit for restoring track magnet 9 extends from wire 27 through wire 78, contact 79, armature 80, wire 81, to insulated track section 3. This circuit is controlled by magnet 8 at armature 80. Front contact 79 of armature 80 is connected with back contact 82 of armature 76 and front contact 75 of armature 76 is connected with back contact 83 of armature 80. In the operation of these track magnets 8 and 9, when a car enters the block at A, it first passes on to track section 2 and thereby closes through its wheels and axles the break in the shunt circuit of magnet 8. This deenergizes magnet 8 which thereby drops all its armatures and armature 80 makes connection with contact 83. Armature 80 thus breaks the shunt circuit of magnet 9, heretofore traced, so that when the car wheels reach insulated section 3, magnet 9 will not be deenergized. When armature 80 makes connection with contact 83, it also switches in a new shunt circuit around magnet 8, this circuit being from wire 74, through contact 75, contact 83, armature 80, wire 81 to insulated track section 3. Hence, when the car reaches track section 3, it closes this latter shunt through its wheels and axles so as to continue to shunt magnet 8 and keep it deenergized until the last wheels have passed off of section 3. If the car were running in the opposite direction, viz.,—out of the block at station A, it would first enter on track section 3 and close the shunt circuit of magnet 9 through wire 78, armature 80 and wire 81. This would deenergize magnet 9 and cause it to drop its several armatures so that armature 76 would make connection with contact 82 thereby breaking the shunt of magnet 8 and making a new shunt around magnet 9 through wire 78, contact 82, armature 76, and wire 77, which latter shunt would be closed by the car passing on to insulated track section 2 so as to keep magnet 9 deenergized until the last wheels have passed beyond section 2. It will thus be seen that when a car travels into the block at station A, the setting magnet 8 only is deenergized and when a car travels out of the block at station A, restoring magnet 9 only is deenergized. At station B, restoring magnets 10 and 11 are similarly arranged and connected. The shunt circuit for magnet 10 is through wire 84, contact 85, armature 86, and wire 87 to track section 5. The shunt circuit for re-

storing magnet 11 is through wire 88, contact 89, armature 90, wire 91 to insulated track section 4. When magnet 10 is shunted by a car entering the block at B, armature 90 makes connection with contact 92 which is connected with contact 85 of armature 86, so that when a car reaches track section 4, it continues to deenergize magnet 10 through shunt circuit from contact 85 to contact 92, armature 90 and wire 91. When a car runs out of the block station B and enters on track section 4, it closes the shunt around restoring magnet 11 through wire 88, armature 90 and wire 91. This deenergizes magnet 11 and causes its armature to make connection with contact 93, which is connected with contact 89 of armature 90, so that the shunt circuit around magnet 11 is continued from contact 89 through contact 93, armature 86 and wire 87. Hence, when this car passes on to track section 5 it keeps magnet 11 shunted until the last car wheels have passed beyond section 5.

The controller or step-by-step mechanism 6 includes a toothed wheel 94, one-half of whose teeth face in one direction and the other half in the other direction. This wheel 94 carries an arm provided with insulated contact fingers 61 and 36. Finger 61 moves over segmental contacts 62 and 95 insulated from each other. Finger 36 moves over segmental contacts 37 and 96 insulated from each other. When magnet 14 is energized, its armature engages with the teeth on one side of the wheel to move it to the left. When magnet 15 is energized, its armature engages with the teeth on the opposite side of the wheel to move it in the opposite direction. The controller or step-by-step mechanism 7 is similarly constructed and arranged. The details of these mechanisms may be variously modified.

The system will be best understood by a description of the operation of the circuits in connection with a passing car, which will be now set forth. Assuming that the system is in normal condition with the signals showing safety at both ends of the block, when a car enters the block at A, it first passes on to track section 2 thereby shunting setting magnet 8 and it continues to shunt this magnet until it has passed beyond track section 3 and without operating restoring magnet 9. This shunting of magnet 8 drops its several armatures including armature 97. This closes the circuit through controller setting magnet 14 as follows;—from feed wire 1, through wire 18, resistance 98, wire 99, armature 100, wire 101, magnet 14, wire 102, armature 97, armature 103, to common return wire 25. Armature 100 is thereby lifted to turn wheel 94 one step so as to move finger 61 off of contact 62 and on to contact 95, and so as to move finger 36 off of contact 37 on to contact 96. When finger 61 moved

off of contact 62, it broke the normally closed circuit through white safety lamp W, heretofore traced. When it moved on to contact 95, it closed at that point the circuit through the green caution lamp G as follows;—from feed wire 1, through wire 18, resistance 58, wire 59, wire 60, finger 61, contact 95, wire 104 through green lamp G to common return wire 25. This changes the signal indication from safety to caution. When finger 36 made connection with contact 96, it connected circuit wire 33 through wire 105, resistance 106 to common return wire 25, thereby continuing to keep magnet 12 energized. When finger 36 moved off of contact 37, and thereby broke the normally closed line setting circuit through magnet 13, heretofore traced, it deenergized magnet 13 causing it to drop its several armatures. When armature 72 dropped, it broke at that point the normally closed signal circuit through the white safety lamp W¹, heretofore traced. When armature 107 of magnet 13 dropped, it closed at that point the normally open circuit through the red danger lamp R¹ as follows;—from feed wire 1, through wire 49, resistance 66, wire 67, armature 107, wire 108, lamp R¹ to common return wire 46. This changes the signal indication at station B from safety to danger so as to warn a car from entering the block at B. When the car reaches the exit end of the block at B and passes on to track section 4, it closes the shunt around restoring magnet 11 and continues to shunt this magnet when it is on track section 5 and without operating setting magnet 10, as heretofore described. When restoring magnet 11 is thus deenergized, it drops its several armatures. When its armature 109 drops, it closes at that point the circuit through controller restoring magnet 15 as follows;—from feed wire 1, through wire 18, resistance 110, wire 111, armature 112, magnet 15, wire 113, armature 109, armature 114 to common return wire 46. This energizes magnet 15 which lifts its armature to step back the wheel 94 to its normal position, thereby closing at finger 61 the normal circuit through the white safety lamp W and also at finger 37 closing the normal circuit through magnet 13.

It is to be noted that magnet 15 is energized as soon as the car passes on to insulated section 4 but that magnet 13 is not energized until the car passes beyond insulated section 5 which permits restoring magnet 11 to become reenergized and close the break at armature 43 in the line circuit of magnet 13. When magnet 13 is thus again energized, it lifts up its armatures thereby breaking at armature 107 the circuit through the red lamp R¹ and thereby closing at armature 72 the normally closed circuit through white lamp W¹. Thus, the signals and circuits are

restored to their normal condition. If a second car following the first enters the block at A, it will know that that block is occupied by a car running in the same direction because of the caution indication of the lamp G. This following car will not alter the signal indication at either end of the block. It will do no more than energize magnet 14 thereby stepping around one more step the fingers 61 and 36. This movement of the fingers does not change the circuits because the fingers continue to move around on the contacts 95 and 96 and they move around one step on these contacts for each car following the first into the block. When the first of these several cars occupying the block passes over the insulated track sections 4 and 5, it closes the circuit through magnet 15 and thereby moves the fingers 61 and 36 back one step toward normal position. But it does not change the condition of the signals. The signals remain in the condition to which they were set by the first car entering the block until the last car passes on to track sections 4 and 5 and causes magnet 15 to move the fingers back the last step into their normal position whereupon the signals at both ends of the block are restored to normal condition.

It will be noted that when magnet 14 was energized, it broke its circuit, heretofore traced, at controller 100. The magnet is kept energized, however, through a branch path, from resistance 98 through resistance 115, wire 116, through magnet 14 and as before. Resistance 115 is introduced into this path so as to choke off part of the current after the magnet has lifted its armature, less current being required to hold the armature up than to initially lift it. In the same way, when magnet 15 has been energized to lift its armature 112 and thereby break its circuit, heretofore traced, through armature 112, it is kept energized through another path which includes resistance 117, wire 118 to magnet 15.

When a car passes through the block from B to A, it operates the circuits and signals corresponding to those above described with reference to a car traveling from A to B, the circuits and devices at station B having the same arrangement as the corresponding operation as those at station A. When a car enters the block at B, it shunts the track setting magnet 10 when it reaches the insulated section 5 thereby dropping the armature of magnet 10. When armature 119 drops, it energizes magnet 16 through the following circuit;—from feed wire 1, through wire 49, resistance 120, wire 121, armature 122, magnet 16, wire 123, armature 119, armature 124 to common return wire 46. This moves the controller mechanism 7 to the left one step thereby breaking the circuit through the lamp W¹ at finger 69, and

closing the circuit through green lamp G¹ as follows;—from wire 68, through finger 69, contact 125, wire 126, lamp G¹ to common return wire 46. At the same time, finger 40 is moved from contact 39 on to contact 127 so as to keep magnet 13 energized through the following circuit;—from feed wire 1, through wire 128, finger 40, wire 41, and as heretofore traced through magnet 13. When finger 40 broke connection with contact 39, it broke at this point the circuit through magnet 12 which is normally included in the line circuit with magnet 13 as heretofore described. Magnet 12 is thus deenergized and its armatures drop. When armature 64 drops, it breaks at that point the normal circuit through lamp W. When armature 129 drops, it closes at that point the circuit through danger lamp R as follows;—from resistance 58, through wire 59, armature 129, wire 130, lamp R to common return wire 25. Thus caution indication is set behind the advancing car and danger indication set at the farther end of the block.

When the car passes out of the block at A, it shunts restoring magnet 9 when it reaches track section 3 and causes it to drop its armatures. When armature 131 drops, it closes at that point the circuit through magnet 17 as follows;—from feed wire 1, through resistance 132, wire 133, armature 134, magnet 17, wire 113, armature 131, armature 154, to common return wire 25. Magnet 17 lifts its armature so as to move the controller mechanism 7 back one step to its initial position, thereby deenergizing caution lamp G¹ and energizing safety lamp W¹ at station B. Finger 40 again makes contact with contact 39 and closes the normal line circuit at that point through magnet 12 which lifts its armatures so that armature 129 breaks the circuit through the danger lamp R and armature 64 closes the normal circuit through safety lamp W. If two or more cars running from B to A occupy the block simultaneously, the first car into the block sets the signals and only the last car out of the block restores the signals to normal condition. This is accomplished in a way corresponding to that heretofore described with reference to several cars simultaneously occupying the block and running from A to B. Resistance 135 and wire 136 are connected in the same way with magnet 17 and for the same purpose as resistance 117 and wire 118 are connected with magnet 15. Resistance 137 and wire 138 are connected in the same way with magnet 16 and for the same purpose as resistance 115 and wire 116 are connected with magnet 14.

139 and 140 are stops to limit the movement of the mechanisms 6 and 7 to the right.

The circuits are arranged so as to prevent derangement of the system in case current

in the feed wire is interrupted by accident or otherwise and then again established. An occurrence of this character has no effect upon the signals whether a train is in the block or not. In this connection, it is to be noted that the track magnets and the line magnets have a predetermined sequence of operation. Magnet 12 when once deenergized must be reenergized through the circuit which includes armatures 30 and 31 controlled respectively by magnets 8 and 9. Hence, magnets 8 and 9 must be energized before magnet 12 can be reenergized. Magnet 12 is therefore controlled by magnets 8 and 9. Again, when magnet 8 has once been deenergized, it must be reenergized through the circuit which includes armature 24 controlled by magnet 9. Hence, magnet 9 must be energized before magnet 8 can be reenergized, this latter magnet being controlled, therefore, by magnet 9. Hence, when these three magnets have once been deenergized, they must be reenergized in the sequence of magnets 9, 8 and 12. In the same way and for the same reason when magnets 10, 11 and 13 have been deenergized, they must be reenergized in the sequence of magnets 11, 10 and 13, magnets 10 and 11 controlling magnet 13, and magnet 11 controlling magnet 10.

Supposing now while the block is clear, the current in the feed wire is interrupted as at the power station or through a break in the wire. This interruption of current deenergizes all the track magnets and the two line magnets so that they all drop their armatures. When the current is again established, these magnets are again energized and pick up their various armatures. This occurrence does not affect magnet 14 because the dropping of armature 97 to close the circuit of magnet 14 would be simultaneous with the dropping of armature 103 to break this same circuit, and armature 97 again picks up to break this circuit before armature 103 picks up to close it. Furthermore, the dropping of armature 131 to close the circuit of magnet 15 would be simultaneous with the dropping of armature 154 to break this same circuit, and armature 131 again picks up to break this circuit before armature 154 picks up to close it. In the same way a make and break in the feed wire would not affect magnets 16 and 17. Magnet 16 would not be affected because armatures 124 and 119 would drop simultaneously when the feed wire broke, and when it was again made, magnet 10 would break at armature 119 the circuit of magnet 16 before magnet 13 could close this circuit at armature 124. Magnet 17 would not be affected because armatures 109 and 114 would drop simultaneously when the feed wire broke, and when it was again made, magnet 11 would break at armature 109 the circuit of magnet 17 before magnet 10 could lift armature 114 to close this circuit. Magnets 15 and 17 both have their negative sides connected to the common return wire 46 so that both magnets are thus protected against being energized through this return path from the false operation under discussion by the arrangement of armatures 109 and 114. Magnets 15 and 17 also have both of their negative sides connected to common return wire 25 through armatures 131 and 132, and since the former must open before the latter can close in the condition under discussion, both magnets are prevented from operation through this return path. If the circuit of the feed wire was interrupted and then reestablished while a train was occupying the block, the result would be the same.

The system has provisions for automatically stopping the car when it enters the block at a time when the block is dangerous as, for example, when it is occupied by a car running in the opposite direction or when the signal system is deranged and the controller setting magnets 14 and 16 refuse to work. These provisions will now be described.

141 is a contact rail located alongside of the track near one end of the block and connected through wire 142 and armature 143 with the common return wire 25. Armature 143 is operated by the magnet 14. 144 is another similar contact rail located at the opposite end of the block and connected by wire 145 and armature 146 with common return wire 46. A car running on the track has its trolley 147 connected through a stopping magnet 148 with the contact shoe 149. Magnet 148 controls the brake mechanism of the car as by means of a valve 150. The contact rails 141 and 144 are located on opposite sides of the track and the contact shoe 149 is carried on one side of the car so that the shoe makes connection with a contact rail only as a car enters the block. As the car leaves the block, its shoe and the contact rail at that end are on opposite sides of the track and could not make contact. The contact rail 141 is so located with respect to the insulated sections 2 and 3 that the car enters on section 2 before the shoe makes connection with rail 141, and so that the shoe leaves rail 141 before the rear wheels have passed off of section 3. The contact rail 144 is similarly located with respect to the insulated sections 5 and 4. Suppose now a car has entered the block from station B. As the car entered the block, it broke at controller 7 the line circuit through magnet 12 thereby deenergizing it and dropping its armatures. When armature 103 dropped, it made a break in the circuit of magnet 14 for station A. If now a second car enters the block from station A, its contact shoe 118 makes connection with rail 141 and closes the following circuit

through stopping magnet 148;—from trolley wire 151, through trolley 147, magnet 148, shoe 149, contact rail 141, wire 142, armature 143 and common return wire 25. Magnet 148 is thus energized to stop the car, armature 143 remaining down because the circuit of magnet 14 was broken at armature 103. In the same way, this second car would be stopped if, for any other reason, magnet 14 failed to become energized as, for example, by an interruption of the current in the feed wire or in the circuit of this magnet. In the same way, a car entering the block at B would be automatically stopped if a car had previously entered the block from A or if magnet 16 was not properly operated by a car entering at B. If the block is clear and a car runs into the block or a second car follows the first car into the block, both entering at the same end, neither car operates its stopping magnet, as 148, because each car energizes the controller setting magnet at that end of the block, as 14, and opens the stopping circuit before its shoe, as 149, reaches the stop rail, as 141, and holds it open till said shoe has passed beyond the said stop rail.

Provision is also made in this system to prevent a shock being received by a trackman or other person who might connect insulated rail sections 2 or 5 with the return rail on the same or opposite side of the track at a time when the common return wire happened to be broken between the track magnets and the rail. This is done by providing leakage paths 152 and 153 from these insulated track sections to the return track rails so that such leakage paths would constitute a shunt around the body of the person. For example, suppose the common return wire 25 should be broken between the track rail and magnets 8 and 9. These magnets would be deenergized and current would flow from the feed wire through wire 18, resistance 26, wire 78, contact 82, armature 76, wire 77, rail section 2 and leakage path to return rail. If it were not for this leakage path, the main portion of this current would flow from section 2 through the person's body to the return rail. In the same way, if the common return rail 46 at station B should be broken between the rail and the track magnets, then current would flow from wire 49, through resistance 56, wire 88, contact 93, armature 86, wire 87, rail section 5, through leakage path to return rail and thus pass around the body of a person who might at this time be connecting rail section 5 with the return rail. There would be no danger under the conditions described if the person's body should connect the rail section 3 with the return rail because at this time the circuit between wire 18 and rail section 3 would be broken at armatures 21 and 24. The same thing would be true with

reference to rail section 4 for corresponding reasons. The leakage paths described have, of course, a high resistance and such as would in no way interfere with the proper working of the system or add materially to its cost of operation. But the resistance would be considerably less than the body of a human being. The leakage paths 152 and 153 may be provided by utilizing artificial resistances or they may be provided by utilizing the track bed itself.

What is claimed and what is desired to be secured by United States Letters Patent is:—

1. In a block signaling system the combination of a setting track magnet and a restoring track magnet, both normally energized; a shunt track circuit for each magnet, said shunt circuits being connected with insulated track sections at opposite ends of the block for operation by passing cars, said insulated track sections being excluded from the energizing circuits for said magnets; and a signal circuit controlled by said magnets.

2. In a block signaling system the combination of a setting track magnet and a restoring track magnet located at opposite ends of a block and normally energized; a shunt track circuit for each magnet, said shunt circuits being connected with insulated track sections at opposite ends of the block for operation by passing cars; and signaling means operating to change the signal indication thereof when said shunt circuits are operated.

3. In a block signaling system the combination of a setting track magnet and a restoring track magnet located at opposite ends of a block; a shunt track circuit for each magnet, said shunt circuits being connected with insulated track sections at opposite ends of the block for operation by passing cars, said insulated track sections being excluded from the energizing circuits for said magnets; and signaling means located at the entering end of the block operating to change the signal indication thereof when said shunt circuits are operated.

4. In a block signaling system the combination of a setting track magnet and a restoring track magnet located at opposite ends of a block and normally energized; a shunt track circuit for each magnet, said shunt circuits being connected with insulated track sections at opposite ends of the block for operation by passing cars; and signals located at opposite ends of the block operating to change the signal indication thereof when said shunt circuits are operated.

5. In a block signaling system the combination of a setting track magnet and a restoring track magnet located at opposite ends of a block and normally energized; a shunt track circuit for each magnet, said shunt circuits being connected with insulated track sections at opposite ends of the

block for operation by passing cars; and signals located at opposite ends of the block and arranged to be set to indicate "block occupied" by the operation of the setting track magnet and to be restored to normal by the operation of the restoring track magnet.

6. In a block signaling system the combination of a setting track magnet and a restoring track magnet located at opposite ends of a block and normally energized; a shunt track circuit for each magnet, said shunt circuits being connected with insulated track sections at opposite ends of the block for operation by passing cars; signals located at opposite ends of the block and arranged to be set to indicate "block occupied" by the operation of the setting track magnet and to be restored to normal by the operation of the restoring track magnet; and an intervening circuit controller controlled by said magnets and itself controlling said signals.

7. In a block signaling system the combination of a setting track magnet and a restoring track magnet located at opposite ends of a block and normally energized; a shunt track circuit for each magnet, said shunt circuits being connected with insulated track sections at opposite ends of the block for operation by passing cars; and signaling means at opposite ends of the block arranged to indicate safety, caution and danger, said signaling means being normally at safety and arranged to be set by the operation of the setting track magnet to indicate caution at the entering end of the block and danger at the exit end of the block, and to be restored to normal by the operation of the restoring track magnet.

8. In a block signaling system the combination of a setting track magnet and a restoring track magnet located at opposite ends of a block and normally energized; a shunt track circuit for each magnet, said shunt circuits being connected with insulated track sections at opposite ends of the block for operation by passing cars; signaling means at opposite ends of the block arranged to indicate safety, caution and danger, said signaling means being normally at safety and arranged to be set by the operation of the setting track magnet to indicate caution at the entering end of the block and danger at the exit end of the block, and to be restored to normal by the operation of the restoring track magnet; and an intervening step-by-step mechanism controlled by said magnets and itself controlling said signals.

9. In a block signaling system, the combination of two pairs of setting and restoring track magnets, one pair at each end of the block, said magnets being normally energized; a shunt track circuit for each magnet,

the shunt circuits for said pairs of magnets being connected with insulated track sections at opposite ends of the block for operation by passing cars, said insulated track sections being excluded from the energizing circuits for said magnets; and signals at opposite ends of the block controlled by said magnets.

10. In a block signaling system, the combination of two pairs of setting and restoring track magnets, one pair at each end of the block, said magnets being normally energized; a shunt track circuit for each magnet, the shunt circuits for said pairs of magnets being connected with insulated track sections at opposite ends of the block for operation by passing cars; and signals at opposite ends of the block arranged to be set to indicate "block occupied" by the operation of a setting track magnet and to be restored to normal by the operation of its corresponding restoring track magnet.

11. In a block signaling system, the combination of two pairs of setting and restoring track magnets, one pair at each end of the block, said magnets being normally energized; a shunt track circuit for each magnet, the shunt circuits for said pairs of magnets being connected with insulated track sections at opposite ends of the block for operation by passing cars; signals at opposite ends of the block arranged to be set to indicate "block occupied" by the operation of a setting track magnet and to be restored to normal by the operation of its corresponding restoring track magnet; and an intervening step-by-step mechanism for each end of the block each of which is controlled by a setting track magnet and a restoring track magnet at opposite ends of the block and each operating to set signals at opposite ends of the block.

12. In a block signaling system, the combination of two pairs of setting and restoring track magnets, one pair at each end of the block, said magnets being normally energized; a shunt track circuit for each magnet, the shunt circuits for said pairs of magnets being connected with insulated track sections at opposite ends of the block for operation by passing cars; the shunt track circuit for each of said restoring track magnets being controlled by its adjacent setting track magnet; and signals at opposite ends of the block controlled by said magnets.

13. In a block signaling system, the combination of two pairs of setting and restoring track magnets, one pair at each end of the block, said magnets being normally energized; a shunt track circuit for each magnet, the shunt circuits for said pairs of magnets being connected with insulated track sections at opposite ends of the block for operation by passing cars, the shunt track circuit for each of said restoring track magnets

being controlled by its adjacent setting track magnet; and signals at opposite ends of the block arranged to be set to indicate "block occupied" by the operation of a setting track magnet and to be restored to normal by the operation of its corresponding restoring track magnet.

14. In a block signaling system, the combination of two pairs of setting and restoring track magnets, one pair at each end of the block, said magnets being normally energized; a shunt track circuit for each magnet, the shunt circuits for said pairs of magnets being connected with insulated track sections at opposite ends of the block for operation by passing cars, the shunt track circuit for each of said restoring track magnets being controlled by its adjacent setting track magnet; signals at opposite ends of the block arranged to be set to indicate "block occupied" by the operation of a setting track magnet and to be restored to normal by the operation of its corresponding restoring track magnet; and an intervening step-by-step mechanism for each end of the block each of which is controlled by a setting track magnet and a restoring track magnet at opposite ends of the block and each operating to set signals at opposite ends of the block.

15. In a block signaling system, the combination of two pairs of setting and restoring track magnets, one pair at each end of the block, said magnets being normally energized; a shunt track circuit for each magnet, the shunt circuits for said pairs of magnets being connected with insulated track sections at opposite ends of the block for operation by passing cars, the shunt track circuit for each of said setting track magnets being controlled by its adjacent restoring track magnet; and signals at opposite ends of the block controlled by said magnets.

16. In a block signaling system, the combination of two pairs of setting and restoring track magnets, one pair at each end of the block, said magnets being normally energized, a shunt track circuit for each magnet, the shunt circuits for said pairs of magnets being connected with insulated track sections at opposite ends of the block for operation by passing cars, the shunt track circuit for each of said setting track magnets being controlled by its adjacent restoring track magnet; and signals at opposite ends of the block arranged to be set to indicate "block occupied" by the operation of a setting track magnet and to be restored to normal by the operation of its corresponding restoring track magnet.

17. In a block signaling system, the combination of two pairs of setting and restoring track magnets, one pair at each end of the block, said magnets being normally energized; a shunt track circuit for each mag-

net, the shunt circuits for said pairs of magnets being connected with insulated track sections at opposite ends of the block for operation by passing cars, the shunt track circuit for each of said setting track magnets being controlled by its adjacent restoring track magnet; signals at opposite ends of the block arranged to be set to indicate "block occupied" by the operation of a setting track magnet and to be restored to normal by the operation of its corresponding restoring track magnet; and an intervening step-by-step mechanism at each end of the block each of which is controlled by a setting track magnet and a restoring track magnet at opposite ends of the block and each operating to set signals at opposite ends of the block.

18. In a block signaling system, the combination of two pairs of setting and restoring track magnets, one pair at each end of the block, said magnets being normally energized; a shunt track circuit for each magnet, the shunt circuits for said pairs of magnets being connected with insulated track sections at opposite ends of the block for operation by passing cars, the shunt track circuit for each of said restoring track magnets being controlled by its adjacent setting track magnet and the shunt track circuit for each of said setting track magnets being controlled by its adjacent restoring track magnet; and signals at opposite ends of the block controlled by said magnets.

19. In a block signaling system, the combination of two pairs of setting and restoring track magnets, one pair at each end of the block, said magnets being normally energized; a shunt track circuit for each magnet, the shunt circuits for said pairs of magnets being connected with insulated track sections at opposite ends of the block for operation by passing cars, the shunt track circuit for each of said restoring track magnets being controlled by its adjacent setting track magnet and the shunt circuit for each of said setting track magnets being controlled by its adjacent restoring track magnet; and signals at opposite ends of the block arranged to be set to indicate "block occupied" by the operation of a setting track magnet and to be restored to normal by the operation of its corresponding restoring track magnet.

20. In a block signaling system, the combination of two pairs of setting and restoring track magnets, one pair at each end of the block, said magnets being normally energized; a shunt track circuit for each magnet, the shunt circuits for said pairs of magnets being connected with insulated track sections at opposite ends of the block for operation by passing cars, the shunt track circuit for each of said restoring track magnets being controlled by its adjacent setting track magnet and the shunt track circuit for each

of said setting track magnets being controlled by its adjacent restoring track magnet; signals at opposite ends of the block arranged to be set to indicate "block occupied" by the operation of a setting track magnet and to be restored to normal by the operation of its corresponding restoring track magnet; and an intervening step-by-step mechanism for each end of the block each of which is controlled by a setting track magnet and a restoring track magnet at opposite ends of the block and each operating to set signals at opposite ends of the block.

21. In a signaling system for railways the combination of two track magnets; and a shunt circuit for each magnet operated by a car, each magnet controlling the shunt circuit of the other magnet, whereby only one of the two magnets is operated by a car moving in one direction.

22. In a signaling system for railways, the combination of two track magnets; and a shunt circuit for each magnet operable by a car, said shunt circuits being connected with separate insulated track sections, and each magnet controlling the shunt circuit of the other magnet, whereby only one of the two magnets is operated by a car moving in one direction.

23. In a block signaling system for railways, the combination of signaling means at opposite ends of the block adapted to indicate safety, caution and danger; a line circuit including two magnets, one for each end of the block and each controlling the safety and danger indications of the signaling means at its end of the block; a step-by-step mechanism for each end of the block, each such mechanism controlling the safety and caution indications at its end of the block and also the line circuit magnet for the other end of the block; and means operable by passing cars for operating said step-by-step mechanism.

24. In a block signaling system for railways, the combination of signaling means at opposite ends of the block adapted to indicate safety, caution and danger; a line circuit including two magnets, one for each end of the block and each controlling the safety and danger indications of the signaling means at its end of the block; a step-by-step mechanism for each end of the block, each such mechanism controlling the safety and caution indications at its end of the block and also the line circuit magnet for the other end of the block; and means operable by passing cars for operating said step-by-step mechanisms, each step-by-step mechanism being operable to change the signals by only the first of several cars to simultaneously occupy the block and which enter the block, at the same end, and being operable to restore said signals by only the last of said cars to leave the block.

25. In a block signaling system for railways, the combination of signaling means at opposite ends of the block; a line circuit including two magnets, one for each end of the block and each operable by an entering car at the opposite end of the block to change the signal indication at said magnet's end of the block; a step-by-step mechanism for each end of the block controlling the line circuit magnet for the opposite end of the block; and means operable by cars moving into the entering end of the block for operating the step-by-step mechanism for that end of the block.

26. In a block signaling system for railways, the combination of signaling means at opposite ends of the block; a line circuit including two magnets, one for each end of the block and each operable by an entering car at the opposite end of the block to change the signal indication at said magnet's end of the block; a step-by-step mechanism for each end of the block controlling the line circuit magnet for the opposite end of the block and also the signaling means at its end of the block; and means operable by cars moving into the entering end of the block for operating the step-by-step mechanism for that end of the block.

27. In a block signaling system for railways, the combination of signaling means at opposite ends of the block; a line circuit including two magnets, one for each end of the block and each operable by an entering car at the opposite end of the block to change the signal indication at said magnet's end of the block; a step-by-step mechanism for each end of the block controlling the line circuit magnet for the opposite end of the block; means operable by cars moving into the entering end of the block for operating the step-by-step mechanism for that end of the block; and means operable by cars moving out of the exit end of the block for restoring said step-by-step mechanism at the entering end of the block.

28. In a block signaling system for railways, the combination of signaling means at opposite ends of the block; a line circuit including two magnets, one for each end of the block and each operable by an entering car at the opposite end of the block to change the signal indication at said magnet's end of the block; a step-by-step mechanism for each end of the block controlling the line circuit magnet for the opposite end of the block and also the signaling means at its end of the block; means operable by cars moving into the entering end of the block for operating the step-by-step mechanism for that end of the block; and means operable by cars moving out of the exit end of the block for restoring said step-by-step mechanism at the entering end of the block.

29. In a block signaling system for railways, the combination of signaling means at opposite ends of the block; a line circuit including two magnets, one for each end of the block and each operable by an entering car at the opposite end of the block to change the signal indication at said magnet's end of the block; a step-by-step mechanism for each end of the block controlling the line circuit magnet for the opposite end of the block and also the signaling means at its end of the block; means operable by cars moving into the entering end of the block for operating the step-by-step mechanism for that end of the block; and means operable by cars moving out of the exit end of the block for restoring said step-by-step mechanism at the entering end of the block.

ways, the combination of signaling means at opposite ends of the block; a line circuit including two magnets, one for each end of the block and each operable by an entering car at the opposite end of the block to change the signal indication at said magnet's end of the block; a step-by-step mechanism for each end of the block controlling the line circuit magnet for the opposite end of the block; means operable by cars moving into the entering end of the block for operating the step-by-step mechanism for that end of the block; and means operable by cars moving out of the exit end of the block for restoring said step-by-step mechanism at the entering end of the block, each step-by-step mechanism being operable to change the signals by only the first of several cars to simultaneously occupy the block and which enter the block at the same end, and being operable to restore said signals by only the last of said cars to leave the block.

30. In a block signaling system for railways, the combination of signaling means at opposite ends of the block; a line circuit including two magnets, one for each end of the block and each operable by an entering car at the opposite end of the block to change the signal indication at said magnet's end of the block; a step-by-step mechanism for each end of the block controlling the line circuit magnet for the opposite end of the block and also the signaling means at its end of the block; means operable by cars moving into the entering end of the block for operating the step-by-step mechanism for that end of the block; and means operable by cars moving out of the exit end of the block for restoring said step-by-step mechanism at the entering end of the block, each step-by-step mechanism being operable to change the signals by only the first of several cars to simultaneously occupy the block and which enter the block at the same end, and being operable to restore said signals by only the last of said cars to leave the block.

31. In a block signaling system for railways, the combination of signaling means at opposite ends of the block; a line circuit including two magnets, one for each end of the block and each operable by an entering car at the opposite end of the block to change the signal indication at said magnet's end of the block; a step-by-step mechanism for each end of the block controlling the line circuit magnet for the opposite end of the block; and means operable by cars moving into the entering end of the block for operating the step-by-step mechanism for that end of the block, said means including a track magnet having a normally open track shunt circuit arranged to be closed by said car.

32. In a block signaling system for railways, the combination of signaling means at opposite ends of the block; a line circuit including two magnets, one for each end of the block and each operable by an entering car at the opposite end of the block to change the signal indication at said magnet's end of the block; a step-by-step mechanism for each end of the block controlling the line circuit magnet for the opposite end of the block; means operable by cars moving into the entering end of the block for operating the step-by-step mechanism for that end of the block; and means operable by cars moving out of the exit end of the block for restoring said step-by-step mechanism at the entering end of the block, each of said means including a track magnet having a normally open track shunt circuit arranged to be closed by said car.

33. In a block signaling system for railways, the combination of signaling means at opposite ends of the block; a line circuit including two magnets, one for each end of the block and each operable by an entering car at the opposite end of the block to change the signal indication at said magnet's end of the block; a step-by-step mechanism for each end of the block controlling the line circuit magnet for the opposite end of the block; and a pair of setting and restoring track magnets at each end of the block, each magnet having a normally open shunt circuit arranged to be closed by a passing car, and the shunt circuit of each magnet of a pair being controlled by the other magnet of said pair.

34. In a signaling system for electric railways, the combination of a track magnet and circuit therefor; a shunt circuit for said magnet including an insulated rail section and the return conductor and adapted to be closed by a passing car to operate said magnet; and a leakage path connecting said insulated rail section and the return conductor.

35. In a block signaling system, the combination of signaling means for each end of the block; a controller at each end of the block each operable to set the signals at both ends of the block; a restoring magnet for each controller, each of said restoring magnets being operable by a car leaving the block at either end, whereby a car may leave the block at either end and restore the signals at both ends to normal; and track circuits for actuating said controllers.

In testimony whereof, we have signed our names to this specification, in the presence of two subscribing witnesses.

WILLIAM F. MESCHENMOSER,
CYRUS H. KINSMAN.

Witnesses:

BEATRICE MIRVIS,
IDA G. GILMORE.