F. D. SHINDEL.

AUTOMATIC TRAIN CONTROLLING SYSTEM.

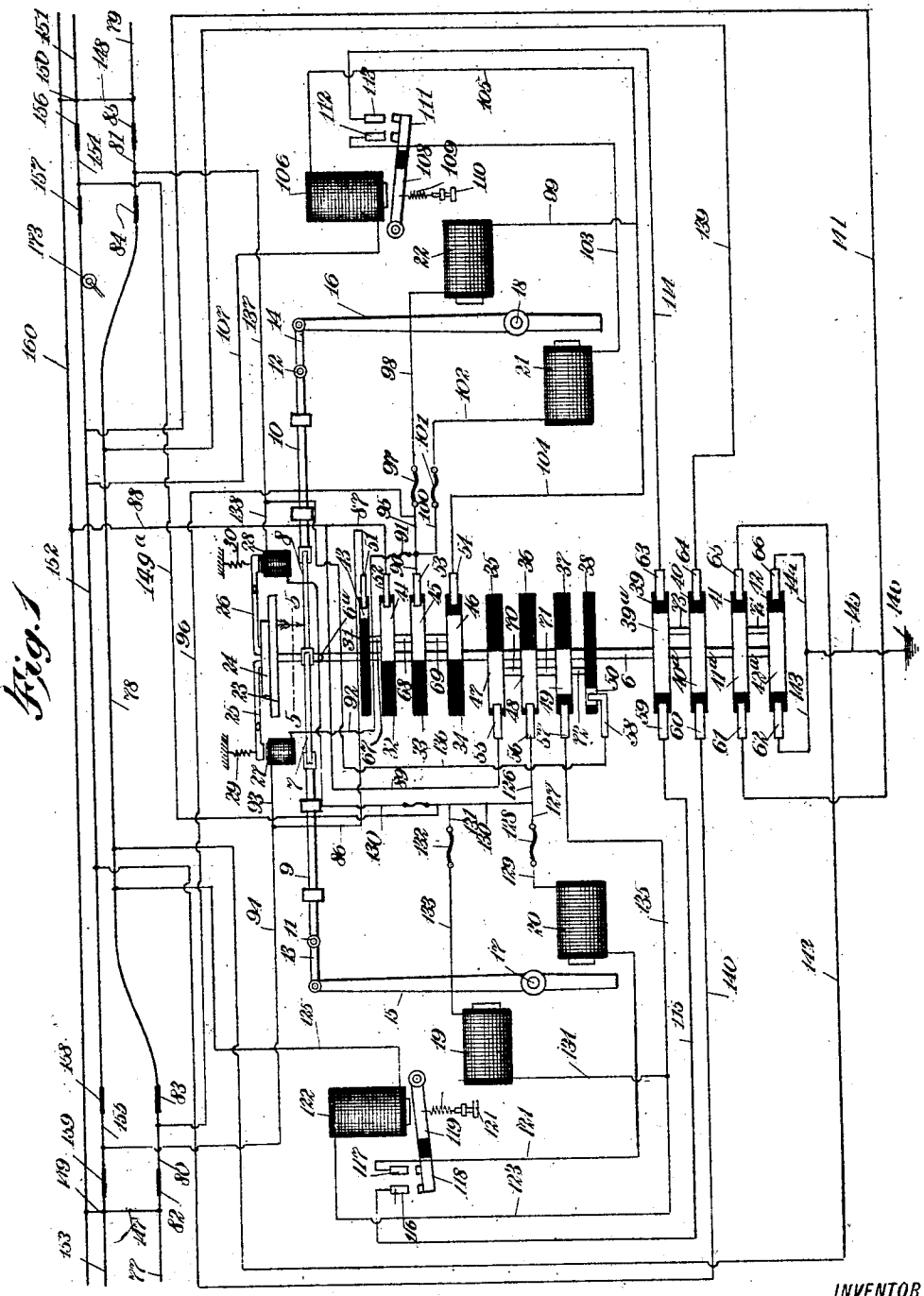
APPLICATION FILED FEB. 16, 1911.

1,037,673.

Patented Sept. 3, 1912.

4 SHEETS—SHEET 1.

Fig. 1



WITNESSES

F. D. Smith

Walton Harrison

INVENTOR

Frank Dilley Shindel

BY Munn & Co.

ATTORNEYS

F. D. SHINDEL.

AUTOMATIC TRAIN CONTROLLING SYSTEM.

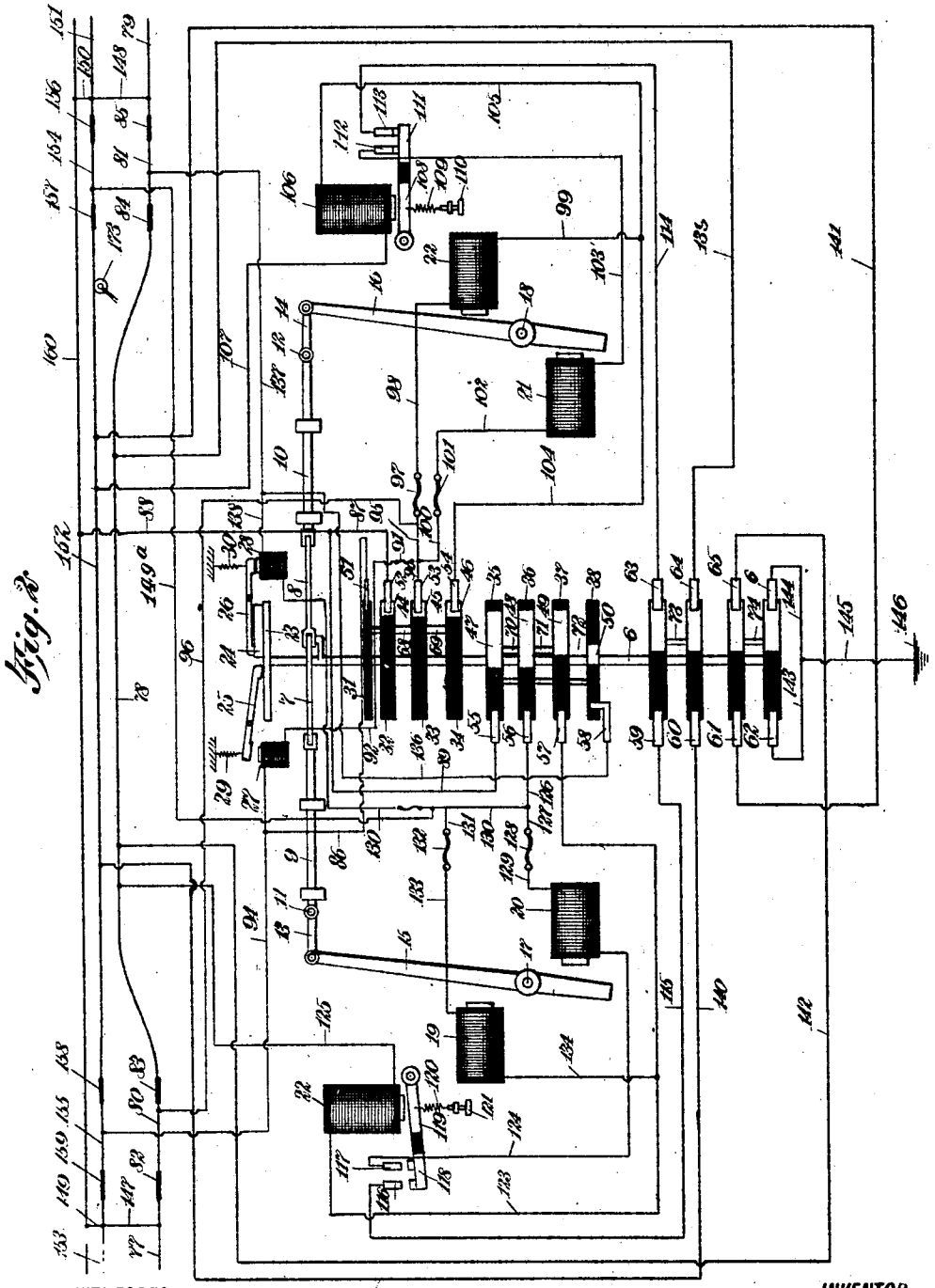
APPLICATION FILED FEB. 16, 1911.

1,037,673.

Patented Sept. 3, 1912.

4 SHEETS—SHEET 2.

Fig. 2.



WITNESSES

F. D. Shindel

Walton Harrison

INVENTOR

Frank Dilley Shindel

BY Munn & Co.

ATTORNEYS

F. D. SHINDEL.

AUTOMATIC TRAIN CONTROLLING SYSTEM.

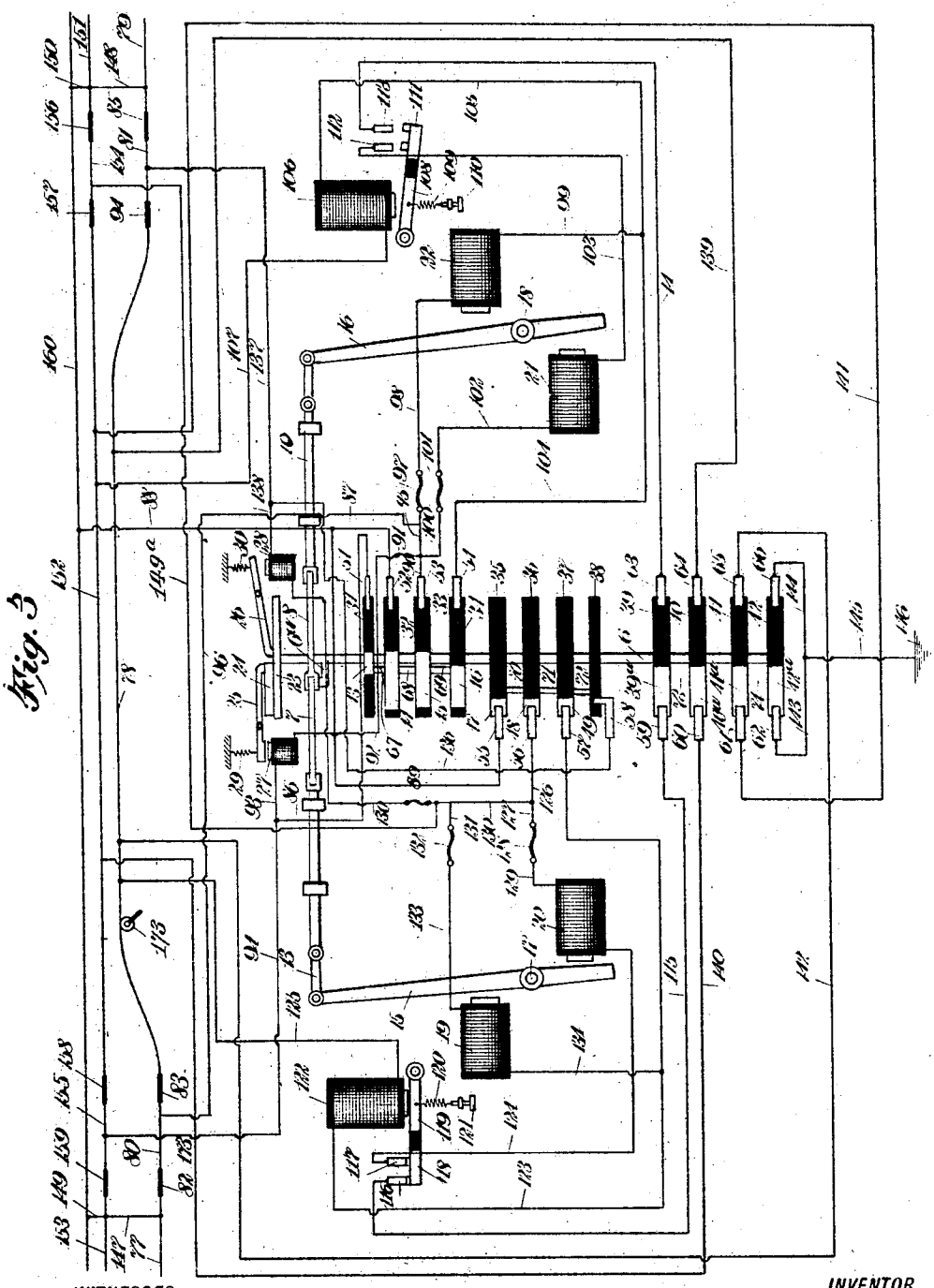
APPLICATION FILED FEB. 16, 1911.

1,037,673.

Patented Sept. 3, 1912.

4 SHEETS—SHEET 3.

Fig. 3



WITNESSES

F. D. Shindel

Walter Harrison

INVENTOR

Frank Dilley Shindel

BY Munn & Co.

ATTORNEYS

F. D. SHINDEL.

AUTOMATIC TRAIN CONTROLLING SYSTEM.

APPLICATION FILED FEB. 16, 1911.

1,037,673.

Patented Sept. 3, 1912.

4 SHEETS—SHEET 4.

Fig. 4

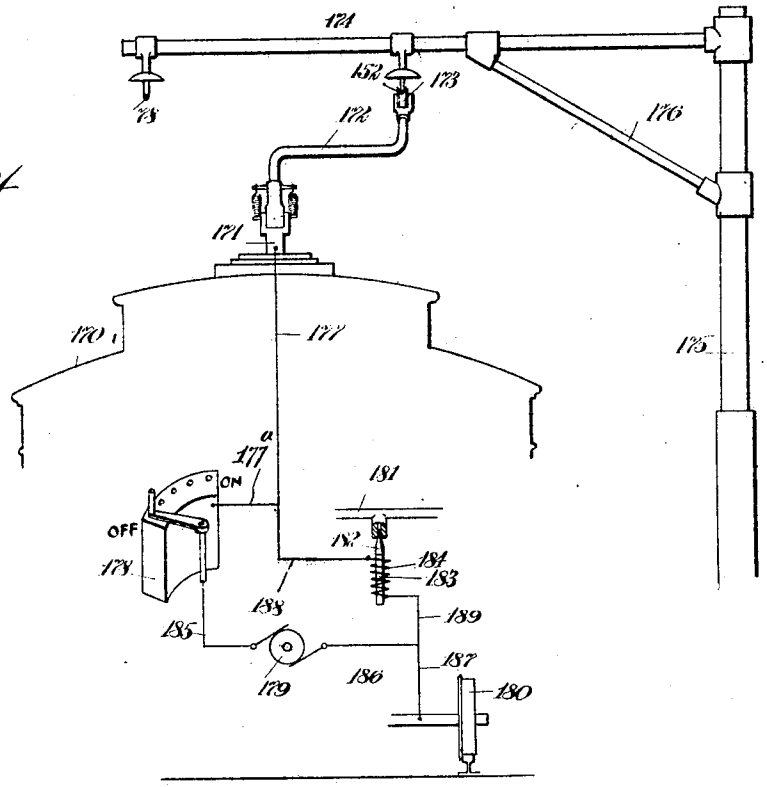
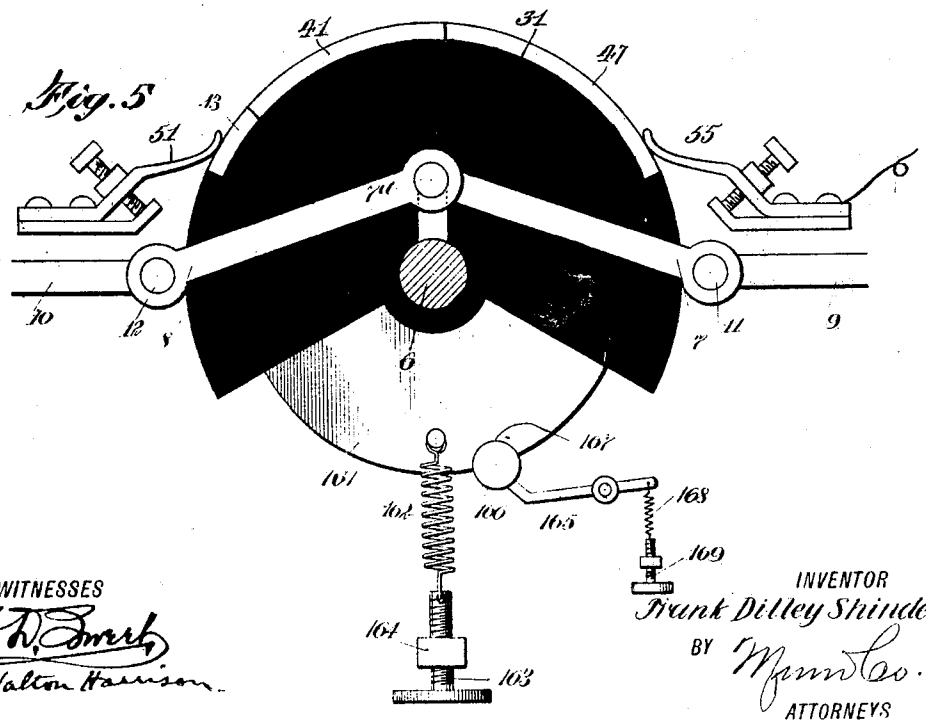


Fig. 5



WITNESSES

F. D. Smith

Walton Harrison

INVENTOR

Frank Dilley Shindel

BY Munn & Co.

ATTORNEYS

UNITED STATES PATENT OFFICE.

FRANK DILLEY SHINDEL, OF HUNTINGDON, PENNSYLVANIA.

AUTOMATIC TRAIN-CONTROLLING SYSTEM.

1,037,673. Specification of Letters Patent. **Patented Sept. 3, 1912.**

Application filed February 16, 1911. Serial No. 608,949.

To all whom it may concern:

Be it known that I, FRANK DILLEY SHINDEL, a citizen of the United States, and a resident of Huntingdon, in the county of Huntingdon and State of Pennsylvania, have invented a new and Improved Automatic Train-Controlling System, of which the following is a full, clear, and exact description.

My invention relates to automatic car controlling systems, and embodies more particularly an electrically operated system of this general type, so arranged as to automatically stop any car attempting to enter a block already occupied by another car.

My invention comprehends a system for general use upon railways, but specially adapted for single-track roads, upon which different cars travel in the same or in opposite directions.

Among the many purposes of my invention are the following: I. To provide a number of successive blocks, and to locate in each block a controller, hereinafter designated as a block controller, and suitable circuits whereby said controller is electrically operated by aid of a car entering the block, and when so operated serving to cut off the power of any other car attempting, for the time being, to enter the same block from either end thereof. II. To provide for locking said controller, after its actuation by a car moving into the block, so as to prevent the subsequent disturbance of the controller by any other car while the block is occupied. III. To provide for rendering the controller certain and positive in its action. IV. To provide electric mechanism to be carried by a car and under control of the motorman for enabling him, when his car enters a block otherwise vacant, to assist the controller in making its initial movement for the protection of the block. V. To provide a special construction of controller and a new arrangement of electric circuits associated with said controller, for furthering the above-mentioned objects.

While my invention may be practised in various ways, and by means of numerous electrical arrangements and mechanical devices, I prefer, for the sake of conciseness, to describe and illustrate merely one preferred form of apparatus, this being sufficient to render clear the principles involved.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a diagram showing the wiring and apparatus of one block of a single track railroad as equipped in accordance with my invention, this view showing the controller in its normal position of inactivity, and various other parts in corresponding positions; Fig. 2 is a diagram somewhat similar to Fig. 1, and indicating the condition of the controller and various other devices as they appear when the block is occupied by a car moving in from the right; Fig. 3 is a diagram indicating the condition of the controller and various parts as they appear when the block is occupied by a car moving into it from the left; Fig. 4 is a detail, partly in elevation and partly diagrammatic, showing the mechanism carried by a car and under control of the motorman; and Fig. 5 is a section on the line 5—5 of Fig. 1, looking in the direction of the arrow, and showing details of the controller.

I will first describe the block controller and various other mechanical parts:

A rocking shaft 6 is disposed horizontally, and provided with a crank 6^a extending upwardly from it. This crank carries a crank pin 7^a, to which two pitmen 7, 8, are respectively connected. Two rods 9, 10 are by aid of knuckle joints 11, 12 connected with the two pitmen. The rods 9, 10 are by aid of joints 11, 12 connected with shorter rods 13, 14, the latter being journaled to two levers 15, 16. These levers are supported upon stationary bearings 17, 18, upon which they are adapted to rock. The levers 15, 16 are made of soft iron, and serve as armatures for the adjacent magnets 19, 20, 21, 22, as hereinafter described.

Mounted rigidly upon one end of the shaft 6 is a disk 23, to which is firmly secured a plate 24, having generally the form of a sector and hereinafter designated as a "locking plate." Adjacent to the locking plate are two pawls 25, 26, made of soft iron or other magnetic material, and pivotally mounted. These pawls are adapted to rock, and serve as armatures for two releasing magnets 27, 28, which are disposed upon opposite sides of the disk 23. Two tensile springs 29, 30, are provided for retracting these armatures. By aid of these springs the armatures, at their inner ends,

are normally pressed against the locking plate 24, so that whenever the shaft 6 is rocked in either of two directions from its normal position, it is locked in a new position by one or the other of the two armatures. This is because the particular armature affected, by slipping off the locking plate 24, lodges directly against the disk 23 and thus acts as a pawl and temporarily prevents the return of the locking plate to its normal position.

Mounted rigidly upon the shaft 6 are a number of sector plates 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, made of insulating material. These sector plates are severally provided with metallic sectors, 43, 44, 45, 46, 47, 48, 49, 50, 39^a, 40^a, 41^a, 42^a. Spring contact fingers, adapted to be engaged and disengaged by these sectors respectively, as the latter are moved by the rocking of the shaft 6, are provided and are herein designated as 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, and 66. Connecting pins 67, 68, 69 establish electrical intercommunication between the sectors 43, 44, 45, 46 and practically connect them together. Similarly, connecting pins 70, 71, 72 connect up all four of the sectors 47, 48, 49, 50; a connecting pin 73 connects the sector 39^a with the sector 40^a, and another connecting pin 74 extends from the sector 41^a to the sector 42^a.

At 77, 78, 79 are three sections of the line wire, representing practically three blocks or parts thereof, and arranged to supply current to cars moving from left to right according to Figs. 1, 2, and 3.

At 80, 81 are two short sections for the purpose of supplying current momentarily, as hereinafter described, for the protection of a car occupying the block.

A number of insulators 82, 83, 84, and 85 are used for separating and insulating from each other the various sections of line wire just mentioned.

Connected with the contact springs 51, 52 are wires 86, 87, and connected with the wire 87 are two wires 88, 89. The wire 89 leads to the contact spring 55. Connected with the contact spring 53 is a wire 90, which communicates with a fuse 91, and from the latter a wire 92 extends to the releasing magnet 27. From the latter a wire 93 extends to the wire 86, and both these wires are connected with a wire 94, by aid whereof the releasing magnet 27 may be energized. Connected with the wire 90 and fuse 91 is a wire 95. Connected with the latter is a wire 96 which leads to the short section 80 of the line wire. Connected with the wires 95, 96 is a fuse 97, and from the same a wire 98 leads to the magnet 22. A wire 99 is also connected with this magnet. Connected with the wires 90, 95 and the fuse 91 is a wire 100, which leads to a fuse 101, the latter being connected by a wire 102 with the magnet 21. A wire 103 is also connected with this magnet. A wire 104 is connected to the contact spring 54, and also with the wire 99 and a wire 105, the latter leading to a relay magnet 106. A wire 107 is also connected with this magnet, and is used in energizing it, as hereinafter explained.

The magnet 106 has a movable armature 108 which is retracted by aid of a spring 109, the tension of this spring being adjustable by aid of an adjusting screw 110. The armature 108 carries an insulated contact member 111, which is adapted to engage and disengage two stationary contact members 112, 113. The magnet 106 and its contact mechanism constitutes a relay. The contact member 112 is connected with the wire 103. A wire 114 leads from the contact member 113 to the contact finger 63.

Connected with the contact finger 59 is a wire 115 which leads to a stationary contact member 116. The latter, with another stationary contact member 117, is adapted to be engaged and disengaged by an insulated contact member 118 carried by and forming a part of a movable armature 119. A spring 120 retracts this armature, the tension of the spring being controllable by an adjusting screw 121. Adjacent to the armature 119 is a magnet 122 for actuating it. Two wires 123, 125 are connected to the magnet 122 for energizing it, as hereinafter explained. A wire 124 leads from the stationary contact member 117 to the magnet 20.

Connected with the contact finger 56 is a wire 126, and a wire 127 leads from the latter to a fuse 128. A wire 129 connects this fuse to the magnet 20. A wire 130 is connected to both wires 126, 127, and to the releasing magnet 28. A fuse 132 is connected with the wire 131 and from this fuse a wire 133 leads to the magnet 19. A wire 134 is connected with this magnet and with a wire 135, which leads to the contact finger 57.

A wire 136 leads from the contact finger 58 to a wire 137, the latter leading to the short section 81 of the line. A wire 138, which communicates with 137, leads to the releasing magnet 28. A wire 139 leads from the contact finger 64 to the line wire section 78. Similarly a wire 140 leads from the contact spring 60 to a section 152. A wire 141 leads from the contact finger 61 to the wire section 152. From the contact finger 65 a wire 142 leads to the line section 78. Wires 143, 144, are connected with contact fingers 62, 66 and with each other, and also with a ground wire 145, which is earthed at 146. Connected with the line wire sections 77, 79, are wires 147, 148, and connected to the latter are wires 149, 150.

At 151, 152 and 153 are line sections

(practically blocks or parts thereof) used for supplying current to cars traveling from right to left according to Figs. 1, 2 and 3. Intermediate these line sections are shorter sections 154, 155. Insulators 156, 157, 158, 159 are used for separating, insulating and aligning all of the sections just mentioned. Each of these insulators is preferably about twelve or fifteen inches long.

At 160 is a feed wire, which extends continuously for an indefinite distance along the line, and which supplies all of the current used by cars passing in both directions. The wires 149, 150 are connected directly with the feed wire. By aid of the wires 147, 149 the feed wire 160 is always directly in communication with the sections 153, 77, and by aid of the wires 148, 150, the sections 151, 79 are similarly in communication at all times, with the feed wire.

Mounted rigidly upon the underside of the shaft 6 (see Fig. 5) and serving as a counterweight for the various sector plates and sectors is a heavy block 161 of metal, having generally a sector-like form. A spring 162 is secured to this block, for the purpose of pulling it downward and thus increasing its effectiveness. The main purpose of this counterweight and spring is to restore the shaft 6, and parts carried by it, to normal position, provided the shaft be otherwise free. No matter what else may happen, if the shaft 6 be otherwise free, the tendency of the counterweight and spring is to bring the shaft 6 to its normal position, to wit, that in which the controller is inactive or idle. By aid of an adjusting screw 163, which extends through a stationary post 164, the tension of the spring may be regulated at will, and its sensitiveness thereby governed within due limits.

At 165 is a pawl, which is provided with an end portion 166 having generally a cylindrical form. The counterweight is provided with a semi-cylindrical slot 167 into which the cylindrical end portion of the pawl is adapted to fit. This steadies the shaft 6, and accurately defines the normal position thereof so that the shaft is not easily disturbed by any accidental cause. The pawl 165 is provided with a spring 168, and an adjusting screw 169 is employed for adjusting at will the tension of the spring and consequent pressure of the pawl.

At 170 (see Fig. 4) is a car, which may be the motor car of a train. Mounted upon it is a trolley fork 171, and journaled upon the latter is a trolley pole 172. This trolley pole is bent sidewise, that is, in a direction crossing the general direction of the length of the car, and carries a trolley wheel 173, which successively engages the several sections of the line employed for cars traveling in one direction.

The line sections of two kinds, for cars traveling in two directions, are all supported by cross arms, one of which is shown at 174 in Fig. 4. Each cross arm is supported upon a post 175, by aid of a brace 176.

In each car 170 is a wire 177 which leads from the trolley pole downwardly, and is connected with a wire 177^a, which leads to a car controller 178. This controller is as usual adapted for handling different quantities of current at the will of the motorman, and is provided with the customary legends "On" and "Off".

At 179 is the car motor, and at 180 is a car wheel which, by virtue of its engagement with the track, is grounded.

A train pipe is shown at 181, for applying air brakes and stopping the car. The train pipe is provided with a sluggish valve (preferably a needle valve) 182, for slowly venting the train pipe and thus setting the brakes. The valve is provided with a needle or plunger, which is mounted upon a movable core 183 and controllable by movements of the latter. The lower end of this core is of soft iron, and serves as an armature for a solenoid 184. A wire 185 leads from the controller 178 to the motor 179. A wire 186 leads from the motor to a wire 187, which is grounded by aid of the car wheel 180 as above stated. A wire 188 is connected with the wires 177, 177^a and with the solenoid 184. A wire 189 is connected with the solenoid and with the two wires 186, 187. The solenoid is normally energized, and hence the valve is normally closed, so that the train pipe is closed and the brakes normally stand released or unset. The solenoid 184 is preferably of about 250 ohms resistance.

The solenoid 184 has a high resistance, about 250 ohms, and is in parallel with the car motor whenever the car controller is in the condition commonly designated as "On," so that current is passing through the car motor, the resistance of which is negligible by comparison. The parts are so proportioned and arranged that whenever the current supplied to the car is cut off from the trolley wire which the trolley wheel happens to engage for the time being the sluggish valve opens and begins to slowly vent the train pipe.

In the block controller the magnets 19, 20, 21, 22 are each of high resistance, say 1000 ohms; and the magnets 106 and 122 are each of low resistance, say five ohms. Each releasing magnet 27, 28 is of high resistance, preferably about 1,000 ohms.

While the armature lever 16 is controllable by the two magnets 22 and 21, these magnets do not begin to act at the same time. At the moment the magnet 22 begins to draw, the magnet 21 is idle, but when the contact finger 54 is engaged by the sector

46, the magnet 106 is fully energized and closes its contact and the magnet 21 is energized. The consequence is that the armature first receives an easy pull and immediately afterward a harder pull in the same direction. The easy pull takes place when the controller shaft is in its normal position, the crank extending directly upward and capable of exerting great leverage when pulled horizontally in consequence of the action of the magnet 22. The harder pull takes place after the crank is displaced a little from its normal position, and its leverage upon the shaft 6 is correspondingly lessened. The magnet 21 continues to pull upon the armature lever 16 after the magnet 22 is short circuited. The motion of the shaft 6, in rocking in one direction from its normal position, is thus rendered positive and certain. Similarly, to rock the shaft 6 in the opposite direction from its normal position, the magnet 19 first exerts its power, and as the shaft is turned and the finger 57 is engaged by the sector 49 so that the magnet 122 attracts its armature 119, the magnet 30 is energized.

When the various parts shown in Fig. 1 are in normal condition as indicated, that is to say when no car is present—each of the line sections is in metallic communication with the feed wire 160, and is therefore ready to supply current as soon as occasion requires. The conection from the feed wire 160 to the short sections 154 is made up of wires 88 and 89, contact finger 55, sector 47, connecting pin 70, sector 48, contact finger 56, wires 126, 130 and 149[a]. The connection from the feed wire 160 to the long section 152 is made up of the following parts: wire 88, contact finger 52, sector 44, connection pin 68, sector 45, contact finger 53, wires 90, 95, fuse 97, wire 98, magnet 22, wires 99, 105, magnet 106 and wire 107. The short section 155 is connected with the feed wire by aid of the following parts: wire 88, contact finger 52, sector 44, connecting pin 68, sector 45, contact finger 53, wire 90, fuse 91, wire 92, releasing magnet 27, and wires 93, 94 to section 155. Whenever the controller is normal, the sector 43 is in engagement with the contact finger 51, and hence is in metallic communication, through the wires 86 and 94, with the section 155. The short section 80 is in communication with the feed wire 160, through the following parts: wire 88, contact finger 52, sector 44, connection pin 68, sector 45, contact finger 53, wires 90, 95 and 96. The long section 78 is in communication with the feed wire by aid of the following parts: wires 88, 89, contact finger 55, sector 47, connecting pin 70, sector 48, contact finger 56, wires 126, 130, fuse 132, wire 133, magnet 19, wires 134, 123, magnet 122 and wire 125. Communication from the feed wire 160 to the short section 81 is made up of the following parts: wires 88, 89, contact finger 55, sector 47, connecting pin 70, sector 48, contact finger 56, wires 126 and 130, releasing magnet 28, and wires 138 and 137. When the controller is in normal condition, the contact sector 50 is in metallic communication with the section 81 by aid of the contact finger 58, and wires 136 and 137.

The operation of my system is as follows: I will suppose that the block controller is in its normal condition, as indicated in Fig. 1, and that a motor car, moving from right to left according to this figure, is approaching. As above explained, there are practically two trolley wires for cars traveling in opposite directions. The approaching car carries a trolley wheel 173, as above described, and this trolley wheel is adapted to engage, in successive order, the following parts: alive section 151 of right turnout, insulator 156, short section 154, insulator 157, long section 152, insulator 158, short section 155, insulator 159, and alive section 153 of left turnout. So long as the trolley wheel 173 engages the alive section 151 of right turnout, the car is supplied with current by aid of the following circuit: feed wire 160, wire 150, section 151, trolley wheel 173, trolley pole 172 (see Fig. 4), to wire 177, whence the current divides, nearly all of it passing through wire 177[a], car controller 178, wire 185, car motor 179, and wire 186 to wire 187, while a negligible portion passes through the wire 188, solenoid 184 and wire 189 to wire 187. From the wire 187 the current passes through the car wheel 180 to ground, thence to power house and from there to feed wire 160. This circuit keeps the car in motion by aid of the car motor 179, and further, by maintaining the high-resistance solenoid 184 energized, as above described, keeps the valve of the train-pipe closed and prevents the brakes from setting. As the car continues to move to the left according to Fig. 1, the trolley wheel engages the insulator 156, thereby momentarily interrupting the current. This momentarily deënergizes the solenoid 184, and thus opens the brake-valve. The insulator 156, of course, breaks the current for an instant only, and consequently the solenoid 184 is deënergized, but the insulator is quickly passed and the solenoid is again energized, the brake-valve being closed before the car stops. The trolley wheel next engages the short section 154, and completes the following circuit: feed wire 160, wire 88, wire 89, contact finger 55, sector 47, connecting pin 70, sector 48, contact finger 56, wires 126, 130, 149[a], short section 154, trolley wheel 173, thence through the car, the rest of the circuit being the same as above traced with reference to Fig. 4. The trolley wheel 173

next passes the insulator 157 and engages the long section 152, thus completing the following circuit: feed wire 160, wire 88, contact finger 52, sector 44, connecting pin 68, sector 45, contact finger 53, wire 90, wire 95, fuse 97, wire 98, magnet 22, wires 99, 105, magnet 106, wire 107, section 152, trolley wheel 173, mechanism shown in Fig. 4 to ground, thence to power house and back to feed wire 160. This circuit contains high resistance, due mainly to the magnet 22, the resistance of which is about 1,000 ohms. Because of this fact, the current following the circuit just traced is greatly curtailed. The car motor tends to slow down. The solenoid 184 having a high resistance (about 250 ohms) and being in series with the magnet 22 which has a resistance of about 1,000 ohms, the current passing through this magnet and solenoid is not sufficient to energize either so as to bring it into action. The brake valve is consequently now open, and slightly vents the train pipe. If the motorman does nothing, the car will stop. The motorman, however, notices a slackening of the speed of the car and hears the hiss of the air now beginning to escape from the train pipe, and is thus apprised that his car is entering the block now under consideration. He thereupon grasps the handle of the controller carried by his car, and turns on the current through the car controller, so that the handle of the car controller is brought adjacent to the legend "On." The resistance of the car motor being only a few ohms, more current is sent through the magnet 22, which now actuates the armature lever 16 as above described, so that the shaft 6 is turned slightly, an additional circuit being thereby completed, as follows: feed wire 160, wires 88, 87, contact finger 52, sector 44, connecting pin 68, sector 45, connecting pin 69, sector 46, contact finger 54 (now engaged by sector 46), wires 104, 105, magnet 106, wire 107, section 152, trolley wheel 173, car mechanism shown in Fig. 4 to ground, thence to feed wire 160.

Just before the contact sector engages the contact finger 54, the several contact fingers 63, 64, 65, 66 are engaged by the respective sectors associated with them. It will be noted in this connection that when air begins to escape and the motorman turns the car controller to the "on" position, he, for the moment, diminishes the power of the solenoid 183. An instant later, however, owing to the increase in the motor current due to the "on" position, the magnet 22 receives more current than before and thus becomes stronger so as to actuate the revoluble shaft 6 of the block controller, as above described. The operator, by turning on the current through the car motor as above described will cause the controller shaft to rotate until the contact finger 54 makes contact with the sector 46 which short circuits the magnet 22, resulting in a heavy current passing through the magnet 106. This energizes the relay magnet, causing it to attract its armature 108 so that the contact member 111 engages the contact members 112, 113. Another circuit is thus completed, as follows: feed wire 160, wire 88, contact finger 52, sector 44, connecting pin 68, sector 45, contact finger 53, wires 90, 100, fuse 101, wire 102, magnet 21, wire 103, contact members 112, 111, 113, wire 114, contact finger 63, sector 39^a (now engaging same), connector pin 73, sector 40^a, contact finger 64, wire 139, line section 78, wire 142, contact finger 65, sector 41^a, connecting pin 74, sector 42^a, contact finger 66, wires 144, 145 to ground at 146, thence to power house and back to feed wire 160. The circuit just traced performs two functions, to wit, it grounds the line section 78 through a low resistance, and also energizes the magnet 21. This magnet being thus energized, the shaft 6 is turned quickly and positively into one of its extreme positions. The block controller and parts associated with it now appear as indicated in Fig. 2. As the line section 78 is now grounded, as stated, through a circuit of low resistance, and is one of the sections necessary to be used by any car approaching from the left turnout, according to Fig. 1, no such car can now enter the block, as it can get no current from the grounded section 78. Hence there can be but one car in the block at a time, and for purposes of clearness I will suppose, as before, that the car now occupying the block is the one above described as moving in from the right, and is still moving to the left, its trolley wheel engaging the long section 152. If, now, a second car traveling in the same direction as the one already in the block should attempt to enter, it is unable to do so, as the section 154 is now dead, owing to the fact that the sector 48 is now disengaged from its contact finger 56.

As the car already in the block continues its travel toward the left, its trolley wheel 173 passes the insulator 158 and engages the short section 155. This breaks the circuit through the magnet 106, and completes the following circuit: feed wire 160, wires 88, 87, contact finger 52, sector 44, connecting pin 68, sector 45, contact finger 53, wire 90, fuse 91, wire 92, magnet 27, wire 94, short section 155, trolley wheel 173, car connections indicated in Fig. 4 to ground, thence to power house and back to feed wire 160. When the trolley wheel passed under the insulator 158, just before reaching the section 155, the circuit including the brake valve solenoid 184 was opened, and when the trolley wheel engages the section 155 the solenoid is in series with the releasing magnet 27. Neither the solenoid nor the releasing

magnet can get sufficient current, however, to bring it into action. Hence, the brake valve opens the train pipe. The operator upon the car now turns the handle of the car controller to the "on" position, so that the resistance within the car is reduced to a few ohms, the releasing magnet 27 is strongly energized. It attracts its armature, which thereupon releases the locking plate 24 and thus allows the shaft of the block controller to resume its normal position. This being done, the section 155 is rendered alive by virtue of the following connections: feed wire 160, wire 88, contact finger 52, sector 44, connecting pin 67, sector 43, contact finger 51, wires 86, 94 to section 155. The energizing of the magnet 27 causes it to attract the adjacent portion of its armature pawl 25, and this releases the locking plate 24. The shaft 6 is now free, and under influence of the counterweight 161 and spring 162 (see Fig. 5) is instantly restored to its normal position, all other movable parts being similarly restored, as indicated in Fig. 1. The trolley wheel 173 next passes the insulator 159 and engages the section 153, which is the alive part of the turnout at the left, where a car can remain, while waiting upon another car, and is enabled to receive current for purposes of lighting and heating.

For a car traveling in the opposite direction, that is from left to right, according to Figs. 1, 2 and 3, the various operations are quite analogous to those above set forth, the current being supplied now by aid of sections 77, 80, 78, 81 and 79, acting successively. When the trolley wheel 173 of the car in question engages the short section 80, a circuit is completed as follows: feed wire 160, wires 88, 87, contact finger 52, sector 44, connecting pin 68, sector 45, contact finger 53, wires 90, 95, 96 to short section 80, thence to trolley wheel 173, through car connections (see Fig. 4) to ground, thence to power house and back to feed wire 160. The short section 80 thus supplies current to the car through a circuit of low resistance. The trolley wheel 173 next passes the insulator 83 and engages the long section 78, thus completing several circuits, having their analogues in those above associated with the car first described, while its trolley was in engagement with the long section 152. One circuit thus completed by the engagement of the trolley wheel with the long section 78 is as follows: feed wire 160, wires 88, 89, contact finger 55, sector 47, connecting pin 70, sector 48, contact finger 56, wires 126, 130, 131, fuse 132, wire 133, magnet 19, wires 134, 123, magnet 122, wire 125 to long section 78, trolley wheel 173 (now engaging this section), car connections shown in Fig. 4 to ground, thence to power house and back to feed wire 160. This energizes magnet 19, which starts the armature lever 15 into motion, and so begins to turn the controller shaft 6 to the left according to Fig. 3. When the sector 49 engages the contact finger 57, the sudden rush of current through the motor circuit of the car when the controller is "On" causes the magnet 122 to attract its armature 119 and close the following circuit: feed wire 160, wires 88, 89, contact finger 55, sector 47, connection pin 70, sector 48, contact finger 56, wires 126, 127, fuse 128, wire 129, magnet 20, wire 124, contact members 117, 118, 116, wire 115, contact finger 59, sector 39^a, connecting pin 73, sector 40^a, contact finger 60, wire 140, long section 152, wire 141, contact finger 61, sector 41^a (now engaging contact finger 61), connecting pin 74, sector 42^a, contact finger 62, wires 143, 145 to ground at 146, thence to power house and back to feed wire 160. This circuit performs two functions, to wit, it energizes the magnet 20, which thereupon pulls hard upon the armature lever and thus moves the shaft 6 quickly and positively into its extreme position to the left, as indicated in Fig. 3; it also effectively grounds the long section 152 through a path of low resistance. The grounding of the section 152 prevents the entrance of any car into the block from the opposite direction, that is entering at the right and moving toward the left according to Fig. 3, as any car attempting to do this would be dependent upon the section 152 for its current supply. The completion of the movement of the controller shaft 6, by bringing the sector 49 into engagement with the contact finger 57, cuts out (*i. e.* short circuits) the magnet 19 and consequently throws its resistance out of the circuit through the car motor, which now becomes traceable as follows: feed wire 160, wires 88, 89, contact finger 55, sector 47, connecting pin 70, sector 48, connecting pin 71, sector 49, contact finger 57, wire 123, relay magnet 122, wire 125, long section 78, trolley wheel 173, car connections shown in Fig. 4 to ground, thence to power house and back to feed wire 160. The armature pawl 26, under control of the spring 30, moves partly into the path of travel of the locking plate 24, as indicated in Fig. 3, and thus locks the controller so as to prevent the shaft 6 from turning to its normal position. Neither can a second car enter the block by aid of the short section 80, as this section is now dead owing to the disconnection of the sector 45 from its contact finger 53. Everything now remains as indicated in Fig. 3 until the car in the block reaches such a position that its trolley wheel 173 engages the short section 81. This completes the following circuit: feed wire 160, wires 88, 89, contact finger 55, sector 47, connecting pin 70, sector 48, contact finger 56, wires 126, 130, releasing magnet 28, wire 137, short sec-

tion 81, trolley wheel 173, car connections shown in Fig. 4 to ground, thence to power house and back to feed wire 160. This circuit, when the controller of the car is "On", energizes the releasing magnet 28, which attracts the adjacent portion of its armature pawl 26 and releases the controller shaft. The latter thereupon resumes its normal position as indicated in Fig. 1. This done, the sector 81 is rendered alive by aid of the following connections: feed wire 160, wires 88, 89, contact finger 55, sector 47, connecting pin 70, sector 48, connecting pin 71, sector 49, connecting pin 72, sector 50, finger 58, wires 136, 137 to section 81.

As may be readily seen from the foregoing description, any car moving into the block from either direction takes possession of the block and no other car can enter, either by backing or otherwise: that when a car moves into a block it locks the block controller; and that when it leaves the block it unlocks the block controller.

I do not limit myself to the precise details herein shown, nor to this particular arrangement of the circuits, nor to the use of my invention upon a single track road, as various changes may be made without departing from the spirit of my invention.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. The combination of a movable car, a train pipe carried thereby, a valve of small capacity connected with the train pipe and adapted to open automatically for the purpose of slowly venting said train pipe, an electro-magnet connected with said valve and adapted when fully energized, to maintain said valve closed, a block controller disposed adjacent to the path of travel of said car and provided with contact mechanism, said contact mechanism being controllable by movements of said block controller and being normally open, mechanism including an electro-magnet for actuating said controller so as to close said contact mechanism, a circuit connected with said electro-magnets and energized by a current too weak to render active said electro-magnets, a car controller connected with said circuit and controllable from said car for diminishing the resistance of said circuit so as to render the said second named electro-magnet active, and connections from said contact mechanism of said block controller around said controller-actuating electro-magnet for supplying current directly from said block controller to the electro-magnet carried by the car, so as to fully energize the same when the said controller is actuated by the said second named electro-magnet.

2. The combination of a movable car, a train pipe carried thereby, a valve of small capacity connected with said train pipe and adapted to open automatically for the purpose of slowly venting said train pipe, an electro-magnet connected with said valve and adapted, when fully energized, to maintain said valve closed, a block controller disposed adjacent to the path of travel of said car and provided with contact mechanism, said contact mechanism being controllable by movements of said block controller and being normally open, mechanism including an electro-magnet for actuating said controller so as to close said contact mechanism, a circuit connected with said electro-magnets, means controllable from said car for increasing the flow of current through said circuit, in order to energize the second-named electro-magnet, and connections from said contact mechanism around said controller actuating magnet for still further increasing the flow of current through said circuit, so as to fully energize the first named electro-magnet.

3. The combination of a source of current having a ground return, a conductor section for supplying current to a car traveling in one direction, a conductor section for supplying current to a car traveling in the opposite direction, a controller provided with circuit controlling contacts, a connection between said first mentioned conductor section and the ground, said connection including one of said contacts and being normally open thereat, electrically operated mechanism for turning said block controller into such position as to close said connection, a connection from said source of current through another of said circuit controlling contacts and through said electrically operated mechanism to said second mentioned conductor section, and a movable car provided with an electrically operated motor and connections for establishing temporary communication from said second mentioned conductor section through said motor to the ground whereby said electrically operated mechanism is energized.

4. The combination of a source of current having a ground return, a conductor section for supplying current to a car traveling in one direction, a conductor section for supplying current to a car traveling in the opposite direction, a controller provided with circuit controlling contacts, a connection between said first mentioned conductor section and the ground, said connection including one of said contacts and being normally open thereat, electrically operated mechanism for turning said block controller into such position as to close said connection, a connection from said source of current through another of said circuit controlling contacts and through said electrically operated mechanism to said second mentioned conductor section, a movable car

provided with an electrically operated motor, connections for establishing temporary communication from said second mentioned conductor section through said motor to the ground whereby said electrically operated mechanism is energized, and electrically operated locking mechanism, controllable partly by the condition of said block controller and partly by movements of said car for locking and unlocking said block controller.

5. The combination of a source of current having a ground return, a conductor section for supplying current to a car traveling in one direction, a conductor section for supplying current to a car traveling in the opposite direction, a controller provided with circuit controlling contacts, a connection between said first mentioned conductor section and the ground, said connection including one of said contacts and being normally open thereat, electrically operated mechanism for turning said block controller into such position as to close said connection, a connection from said source of current through another of said circuit controlling contacts and through said electrically operated mechanism to said second mentioned conductor section, a movable car provided with an electrically operated motor, connections for establishing temporary communication from said second mentioned conductor section through said motor to the ground whereby said electrically operated mechanism is energized, a magnet included in said connections, a valve controllable by said magnet, and a train pipe mounted upon said car and operated by said valve.

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

FRANK DILLEY SHINDEL.

Witnesses:
R. W. JACOBS,
META A. SHINDEL.