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L. DICKEY.

ELECTRICALLY OPERATED BLOCK SIGNAL SYSTEM FOR RAILROADS.

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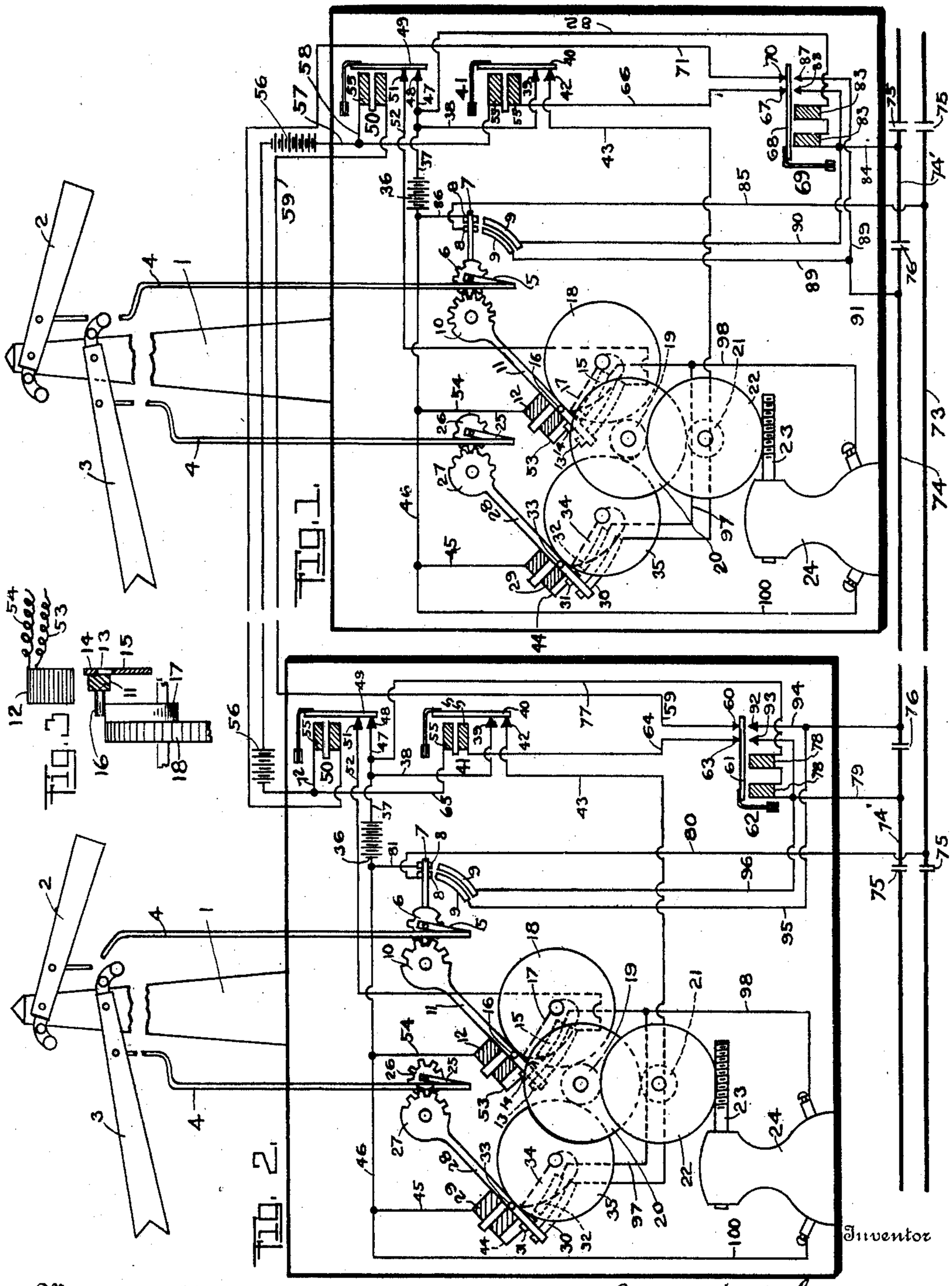

Witnesses
J. M. Fowler Jr.
Edgar M. Kitchin

Inventor
Lester Dickey,
By Mason, Fenwick & Lawrence
Attorneys.

UNITED STATES PATENT OFFICE.

LESTER DICKEY, OF PERRY, IOWA, ASSIGNOR TO ELZA S. STOTTS, OF PERRY, IOWA.

ELECTRICALLY-OPERATED BLOCK-SIGNAL SYSTEM FOR RAILROADS.

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To all whom it may concern:

Be it known that I, LESTER DICKEY, a citizen of the United States, residing at Perry, in the county of Dallas and State of Iowa, have invented certain new and useful Improvements in Electrically-Operated Block-Signal Systems for Railroads, of which the following is a specification.

This invention relates to improvements in block-signal systems, and more particularly to such as are electrically controlled and operated.

One of the objects in view is the indication of the presence of a train within a block, such indication also disclosing the direction of travel of the train.

Another object is the provision of automatically-operating mechanism for indicating at the terminals of the block the presence and direction of travel of the train within the block, such mechanism being capable of automatically restoring normal conditions as the train passes beyond the block.

With these and other objects in view the invention comprises certain novel constructions, combinations, and arrangements of parts, as will be hereinafter fully described and claimed.

In the accompanying drawings, Figure 1 is a diagrammatic view of a block-signal system embodying the features of the present invention arranged at one of the terminals of the block. Fig. 2 is a similar view of a similar mechanism arranged at the opposite terminal of the block. Fig. 3 is a detail view of one of the restoring cams and gears and surrounding parts.

Each of the mechanisms seen in Figs. 1 and 2 are duplicates, and the circuits thereof are duplicated. Hence it is believed that an understanding of the present improved structure may be had better by the use of the same reference-numerals indicating corresponding parts in Figs. 1 and 2, and such reference characters will be employed.

At each terminal of the block is arranged the usual tower 1, pivotally supporting any ordinary form of semaphore signal devices 2 and 3. Each of the signal devices 2 and 3 is preferably provided with a weighted end beyond its pivot, so that the longer portion projecting beyond the pivot will normally be lifted to a horizontal position when the respective signal device is free for independent movement. Pivotally engaging each of the devices 2 and 3 is an operating-rod 4, designed to be drawn downwardly by mechanism hereinafter fully described for indicating a clear track and adapted to be released by said mechanism to be described for permitting the weighted end of the signal to lift the remaining portion thereof to a horizontal position when the train is in the block.

The lower end of the rod 4, connected with the signal 2 at each terminal of the block, pivotally engages a crank-arm 5, the said arm being fixed to a suitable pivotally-mounted segmental rack 6. The rack 6 may assume the form of a pinion, if desired. A contact-arm 7 projects radially from the rack in position for closing contact between a pair of contact-blocks 8 8 when the respective signal 2 is in position for indicating a clear track. Spaced from the contact-blocks 8 8 in the path of movement of the arm 7 are suitable contact-blocks 9 9, adapted to be engaged by said arm 7 when the respective signal 2 is elevated to a horizontal position or to a position indicating the presence of a train within the block. The rack 6 meshes with a correspondingly pivotally-mounted rack 10, and said rack 10 carries a radially-projecting arm 11. The arm 11 extends past any ordinary electromagnet 12 and when the respective signal 2 is in its lowered position closes contact between contact-blocks 13 and 14, and when said signal device 2 is in its raised position said arm 11 closes contact between block 13 and a contact-block 15, arranged in line with the block 14 in the path of movement of the arm 11. A roller-stud 16 projects laterally from each of the arms 11 in the path of movement of a cam 17, carried by the face of gear-wheel 18. The gear-wheel 18 is rotatably mounted on any suitable support and meshes with a pinion 19, fixed to and carried by the gear-wheel 20, the gear-wheel 20 being rotatably mounted in any suitable support and meshes in turn with pinion 21, fixed to and carried by the worm-gear 22, said worm-gear meshing with the worm-thread of the driving-shaft 23, carried by the armature of the electric motor 24.

The arm 4 of each of the signal devices of the opposite ends of the block pivotally engages at its lower end a crank-arm 25, fixed to a segmental pinion 26, suitably rotatably

mounted and meshing with a similar rack 27, similarly mounted. The rack 27 carries a radially-projecting arm 28, extending past electromagnet 29 and normally closing contact between contact-blocks 30 and 31 when the signal 3, to which the respective rod 4 is connected, is in its lowered position or in position for indicating a clear track. Said arm 28 is adapted to be swung when the respective signal 3 is raised to a danger position out of contact with the block 31 to a position for closing contact between the block 30 and a contact-block 32, arranged in line with the block 31 in the path of movement of the arm 28. Each arm 28 carries a roller-stud 33, adapted to be engaged by the cam 34, fixed to and projecting from the face of the gear-wheel 35, said gear-wheel meshing with the gear-wheel 19 on the opposite side thereof from the gear-wheel 18.

A local battery or other suitable source of electrical energy 36 is provided for each set of mechanism at the respective end of the block, and each of said batteries has circuits closed through the respective electromagnets 12 and 29, as follows: first, of magnet 29, through conductor 37, to conductor 38, to contact-point 39, to armature 40 of relay 41, to contact-point 42, to conductor 43, to contact-plate 30, to arm 28, to contact-plate 31, to conductor 44, through winding of the magnet 29, to conductor 45, to conductor 46, and through conductor 46 to the opposite pole of the battery 36. The other normally closed circuit of the battery 36 is as follows: through conductor 37, to conductor 47, to contact-point 48, to armature 49 of relay 50, to contact-point 51, to conductor 52, through contact-plate 13, to arm 11, to contact-plate 14, to conductor 53, through winding of magnet 12, to conductors 54 and 46, to the opposite pole of the battery 36.

Each of the arms 11 and 28 is of course of magnetic material, and therefore it will be observed that when the signals 2 and 3 have been positioned in their lowered position the closed circuits energizing the magnets 12 and 29 will maintain the arms 11 and 28 in their raised condition against the pressure of the weighted ends of the signals 2 and 3.

The relays 41 and 50 are of any ordinary type and simply consist of electromagnets 55 55, acting upon the respective armatures 40 and 49, which armatures are of course spring-acted for being thrown away from the magnets when released. A battery or other suitable source of electrical energy 56 is preferbly provided at each end of the block for normally supplying current to the magnets 55 for normally retaining the armatures 40 and 49 in position for closing contact between the contact-points 39 and 42, 48 and 51, respectively.

One of the circuits of the batteries 56 is as follows: from positive pole of one battery 56 to negative pole of the other battery 56, through the second battery 56, to conductor 57, to conductor 58, through the windings of magnet 55 of relay 50, to conductor 59, to contact-point 60, to armature 61 of relay 62, to contact-point 63, to conductor 64, to winding 55 of relay 41, to conductor 65, to negative pole of the first battery 56. The other circuit of the batteries 56 is as follows: from positive pole of one battery 56 to the negative pole of the other battery 56, through the second battery 56, to conductor 57, through winding 55 of the relay 41, to conductor 66, to contact-point 67, to armature 68 of relay 69, to contact-point 70, to conductor 71, to winding 55 of relay 50, to conductor 72, and through conductor 65 to the negative pole of the starting-battery.

73 and 74 indicate the rails of a railway which are insulated, as at 75, at the terminals of the block from the contiguous rails. The rail 74, for purposes hereinafter specified, is provided with an insulation 76 near each end of the block and which leaves a section 74′ of the rail not normally in electrical contact with the remaining or main portion of the rail 74.

Each of the relays 62 and 69 is provided with a normally open circuit designed to be closed by the moving of a train into the block. The circuit of relay 62 is as follows: beginning with battery 36, through conductor 37, to conductor 77, through windings 78 of relay 62, to conductor 79, to section of rail 74′, across the wheels and axles of the train to rail 73, to conductor 80, to contact-block 8, to arm 7, to second contact-block 8, to conductor 81, to conductor 46, and to battery 36. The circuit of relay 69 is as follows: from battery 36, through conductor 37, to conductor 82, through windings 83 83 of relay 69, to conductor 84, to rail-section 74′, across the wheels and axles of the train to rail 73, to conductor 85, to contact-plate 8, to arm 7, to second contact-plate 8, to conductor 86, to conductor 46, to battery 36.

The armature 68 of relay 69 is held under spring-pressure away from the magnets of the relay and in contact with the contact-points 67 and 70, said armature being designed to be moved when the relay is energized toward the magnets in position for closing circuit between contact-points 87 and 88. Contact-point 87 is engaged by conductor 89, extending to one of the contact-plates 9, and contact-point 88 is engaged by conductor 90, extending to the other contact-plate 9, the conductor 90 being in electrical contact with conductor 84. A branch conductor 91 leads from conductor 89 to and contacts with the rail 74. The armature 61 of relay 62 is retained under spring-pressure away from magnet 78 when said magnets are not energized, whereby contact is closed between contact-points 60 and 63, and when

said magnets are energized said armature is caused to swing away from said contact-points to a position for closing contact between contact-points 92 and 93. Contact-point 92 is engaged by conductor 94, leading to rail 74 and formed with a branch conductor 95, extending to one of the contact-plates 9. The contact-point 93 is engaged by conductor 96, which extends to the other contact-plate 9. Said conductor 96 is in electrical connection with the conductor 79.

In operation the train entering the block from a direction corresponding to the right-hand side of the drawings will first close the circuit of battery 36 through conductor 37, conductor 82, magnets 83, conductor 84, track-sections 74′, the wheels and axles of the train, track 73, conductor 85, contact-block 8, arm 7, second contact-block 8, conductor 86, and conductor 46, to battery. Thus the magnets 83 are energized and the armature 68 caused to break contact with the points 67 and 70 and to make contact with the points 87 and 88. The breaking of contact between the points 67 and 70 destroys the circuit of relay 41 at the right-hand end of the block and the circuit of relay 50 at the other end of the block. Hence the contact-points 39 and 42 of the said relay 41 and the contact-points 48 and 51 of the said relay 50 are no longer connected, and the normally closed circuit of magnet 29 of one signal mechanism is broken, and the circuit of magnet 12 of the other signal mechanism is broken. Hence the arm 28 of one signal mechanism and the arm 11 of the other signal mechanism are left free to swing downwardly. The semaphore 3 at the right-hand end of the block is therefore left free to rise to a danger-indicating position, and the signal 2 of the opposite end of the block is permitted to rise to a danger-signal position. The upward movement of the signal 2 swings the arm 7 of the signal mechanism at the left-hand end of the block for breaking contact between blocks 8 and for making contact between plates 9. Thus it is made impossible for a train entering the block from the opposite direction from that above described to effect any operation of the parts. If the circuit were closed between the rail-section 74′ at the left-hand end of the block and the rail 73 after the operation above described, no action of any of the parts would arise therefrom, as the closing of such contact would not close the circuit. As the train moves along the track and passes the insulation 76 the circuit for the magnets 83 changes and is as follows: from battery 36 to conductor 37, to conductor 82, through windings 83, to conductor 90, to contact-point 88, armature 68, contact-points 87, conductor 89, branch conductor 91, rail 74, the wheels and axles of the train, rail 73, conductor 85, contact-block 8, arm 7, second contact-block 8, conductor 86, and conductor 46 to battery 36. In order to obviate the possibility of a train entering the block from the opposite end to that above mentioned effecting operation of the signals after the entering of the block by the first train, the circuit of relay 62 is broken by the operation of the signal 2. As said signal rises to danger-indicating position the arm 7 is lowered out of contact with the blocks 8 8, and the relay 62 is thus left on open circuit. The arm 7 moves into contact with plates 9 9 and closes circuit between rail-section 74′ and rail 74, such circuit comprising conductor 79, conductor 96, contact-plates 9, and arm 7, conductor 95, and conductor 94. Thus a path is opened for the circuit above described, being maintained closed by a train moving in the block, even after such train has passed the insulating-point 76, and the relays 41 and 50, above mentioned, are retained on open circuit until the last wheel of the last car of the train has passed beyond the insulations 75. When the last car of the train has passed beyond the insulation 75 and contact between the rails 74 and 73 thus severed, the magnets 83 become demagnetized and release the armature 68, which moves back to a position for closing contact between contact-points 67 and 70. The circuits of relays 41 and 50, heretofore left open, are closed and in the instance of relay 41 current flows from battery 36 through conductor 37 to conductor 38, contact-points 39, armature 40, contact-point 42, conductor 43, contact-plate 30, arm 28, contact-plate 32, arm 28 having dropped to a position closing contact between said plates 30 and 32, conductor 97, conductor 98, to motor 24, to conductor 100, to conductor 46, to battery 36. It is to be noted that conductor 98 extends into contact with plate 15 in each signal mechanism. The corresponding circuit is closed with respect to the relay 50 from the battery 36 to conductor 37, conductor 47, contact-points 48, armature 49, contact-point 51, conductor 52, contact-plate 13, arm 11, contact-plate 15, conductor 98, motor 24, conductor 100, conductor 46, to battery 36. The operation of the motors 24 causes the gear-wheels 22 to be driven, and through the chain of gears above described produces rotation of the gears 18 and 35, which causes the cams 17 and 34 to swing about through a complete circle. Thus the roller-studs 16 and 33 are engaged by said cams, and the respective arms 11 and 28 are elevated to their normal positions, the signals 2 and 3 being thus restored to their lowered condition. As soon as the respective arms 11 and 28 have been restored to their normal positions by the cams 17 and 34 contact between plates 30 and 32 is broken, and therefore the operation of motor 24 will cease, and as the circuits of the magnets 12 and 29 have been re-

established through the return of the armature 40 in one instance and the return of the arm 7 in the other the respective arms 11 and 28 will be held against dropping until the circuits of the respective magnets are again broken. A train moving into the block from an opposite direction from that described will close circuit through the magnet 78, and thus break the circuits of the corresponding relay 41 and the relay 50 of the other signal mechanism, and thus destroy the circuits of the respective magnets 29 and 12, whereby the other set of signals 2 and 3 will be elevated to the danger position. The parts remain in this condition until the train passes out of the block, when the breaking of the circuit of relay 62 restores the circuits of relays 41 and 50, and thus opens the circuits of the motors 24, which motors operate to restore the signals, as above described, and the parts are again in condition for another operation.

What I claim is—

1. In mechanism of the class described, the combination with signals at the opposite ends of the block, of electromagnets on normally closed circuits, sustaining said signals out of the danger-indicating position, a train-governed relay normally retaining said magnets on a closed circuit, and designed to break the circuit of said magnets on the entering of a train into the block, whereby said signal devices are freed for assuming the danger-indicating position, electric motors, means governed by said signal devices for closing a portion of the circuits of said electric motors when the signals assume a danger-indicating position, means completing the circuits of said motors when the circuit of said relay is broken, and means actuated by said motor for restoring said signals to their normal out-of-danger position.

2. In mechanism of the class described, the combination with a signal at each end of a block, of an electromagnet for each of said signals normally retaining the same out of a danger-indicating position, a governing-relay normally maintaining the circuit of said magnet closed, a train-closed circuit for said relay for energizing the relay upon the entering of a train into the block for breaking the circuit of said magnet whereby each of said signals is freed to assume a danger-indicating position, an electric motor for each of said signals, means governed by the signals for closing a portion of the circuit of said electric motor, the remaining portion of the circuit including the armature of said governing-relay when the relay is demagnetized, and means actuated by said motor for restoring its respective signal to an out-of-danger position.

3. In mechanism of the class described, the combination with a pair of signals at each end of a block, an electromagnet for each of said signals normally retaining the same in a safety-indicating position, a normally closed circuit for each of said electromagnets, a train-controlled governing-relay for making and breaking the circuits of one of said magnets at each end of the block, a similar relay for the other magnets, and means for preventing one of said magnets from breaking the circuit of one set of said magnets when the circuit of the other set is broken.

4. In mechanism of the class described, the combination with a pair of signals at each end of a block, of an electromagnet for each of said signals normally retaining the same out of a danger-indicating position, a normally closed circuit for each of said magnets, a pair of relays, one at each end of the block, governing the circuits of a pair of said magnets, one at each end of the block, for controlling the operation of the signal at each end of the block, a second pair of relays, one at each end of the block, for governing the other pair of magnets for controlling the other of said signals, and train-controlled governing-relays for controlling the operation of said sets of relays.

5. In mechanism of the class described, the combination with signals at the ends of the block, and the rails of the track within the block, a governing-relay at each end of the block, arranged to have its circuit closed across said rails, electrical means for governing said signals, said electrical means having their circuits controlled by said governing-relays, and signal-actuated means for breaking the normal circuit of one of said relays, when the other of the relays has its circuit closed.

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

LESTER DICKEY.

Witnesses:
E. S. STOTTS,
H. C. STOTTS.