No. 711,037. Patented Oct. 14, 1902.

W. M. CHAPMAN.

RAILWAY BLOCK SIGNALING SYSTEM.

(Application filed June 29, 1901.)

(No Model.) 4 Sheets—Sheet 1.

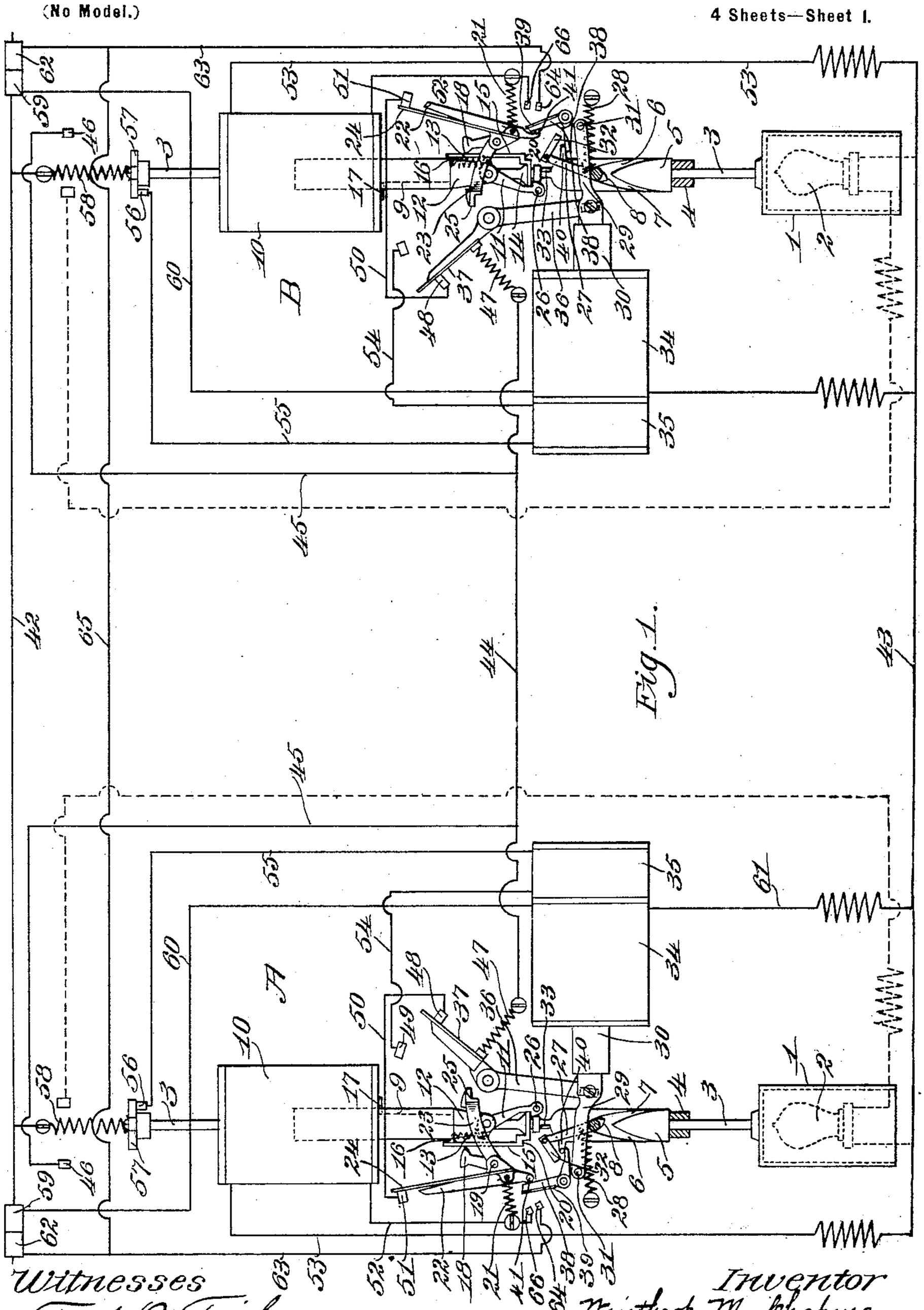

Fig. 1.

Witnesses
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(No Model.) 4 Sheets—Sheet 2.

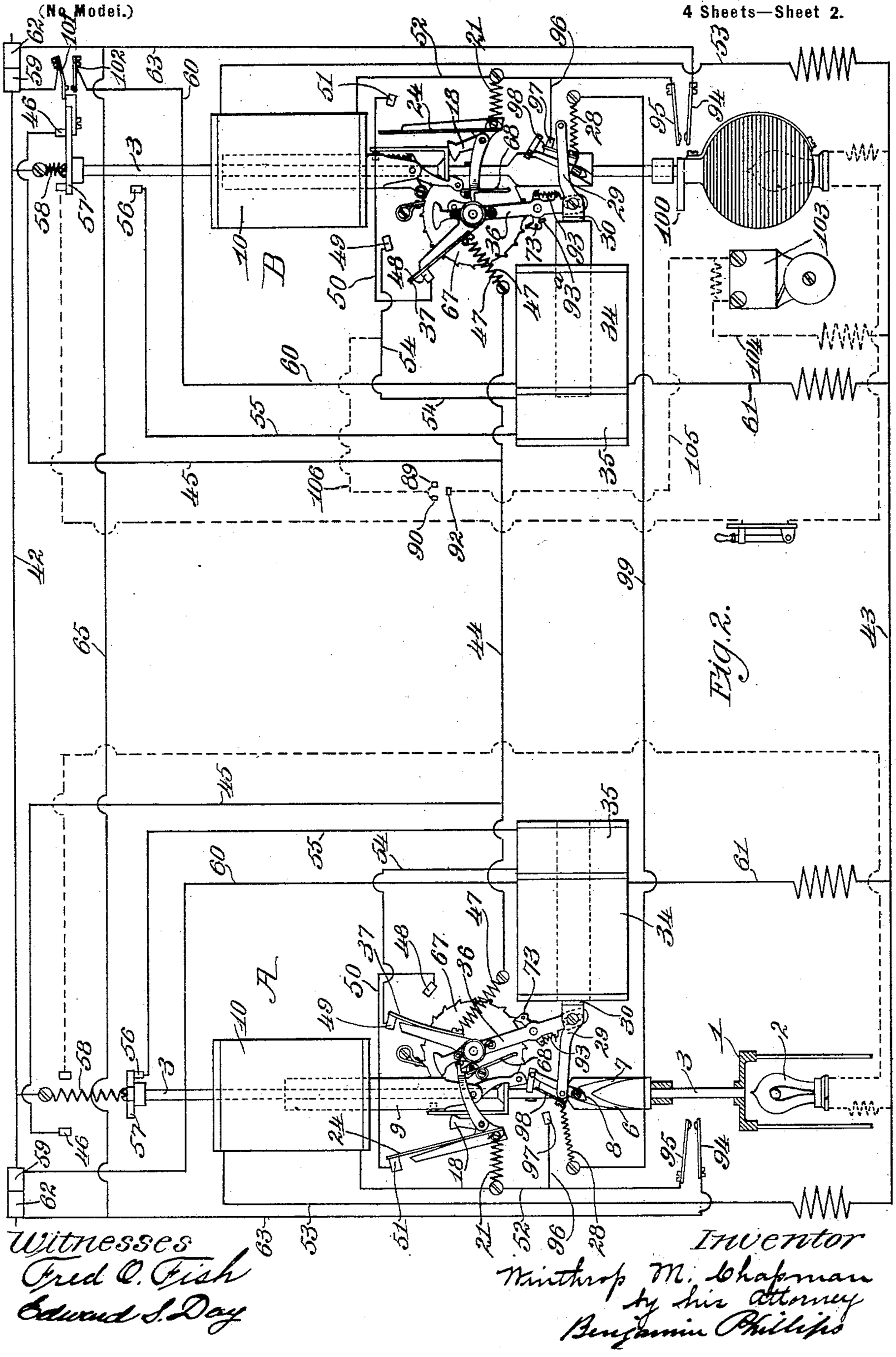

Fig. 2.

Witnesses
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(No Model.) 4 Sheets—Sheet 3.

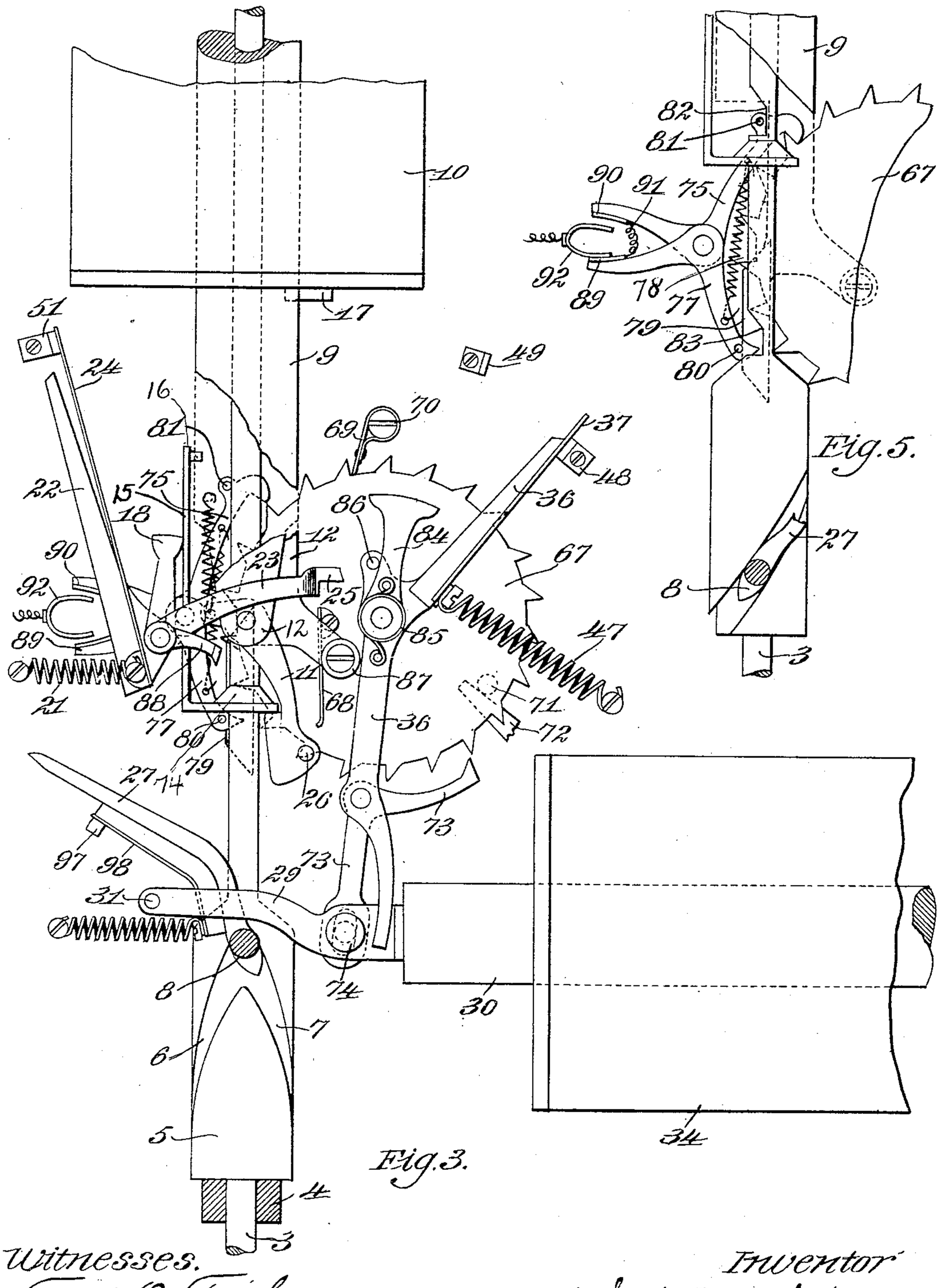

Fig. 5.

Fig. 3.

Witnesses.
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RAILWAY BLOCK SIGNALING SYSTEM.

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(No Model.) 4 Sheets—Sheet 4.

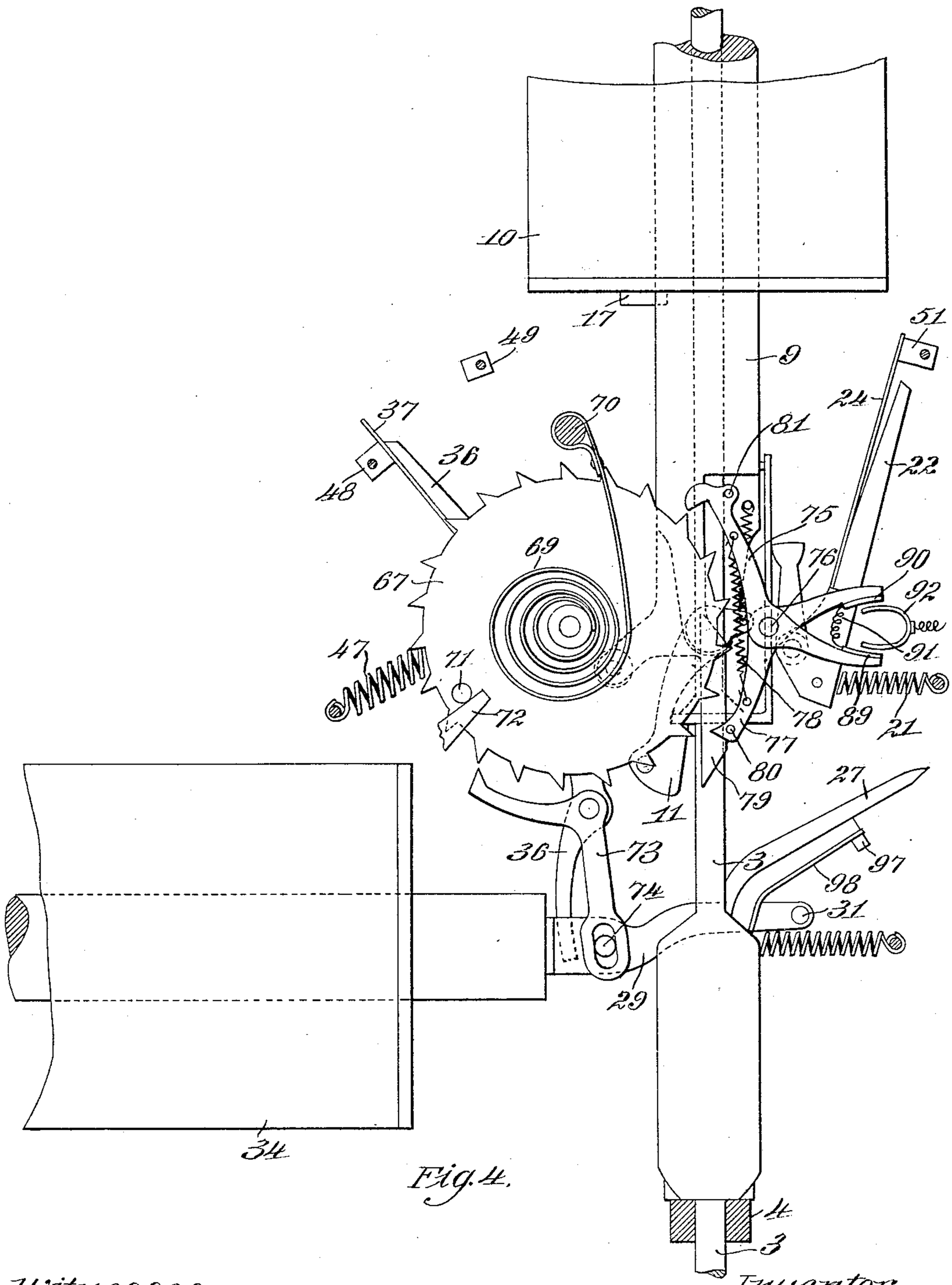

Fig. 4.

Witnesses
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UNITED STATES PATENT OFFICE.

WINTHROP M. CHAPMAN, OF NEWTON, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO WILLIAM PESTELL, OF LYNN, MASSACHUSETTS.

RAILWAY BLOCK-SIGNALING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 711,037, dated October 14, 1902.

Application filed June 29, 1901. Serial No. 66,599. (No model.)

To all whom it may concern:

Be it known that I, WINTHROP M. CHAPMAN, a citizen of the United States, residing at Newton, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Railway Block-Signaling Systems; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to railway block-signaling systems.

The object of my invention is to provide an improved railway block-signaling system, and more particularly an electrical block-signaling system in which the signals will be properly actuated to indicate the presence or absence of cars on the track sections or blocks under the various conditions met with in actual practice, in which the proper actuation of the signaling apparatus connected with a track section or block will be indicated to a car entering the block, and in which a comparatively small number of operating parts, line-wires, and connections are required.

Other objects of my invention are to simplify and improve the signaling apparatus of railway block-signaling systems and to improve the construction, mode of operation, and arrangement of the various parts and connections of such systems.

With these objects in view my invention consists in the devices, combinations, and arrangement hereinafter described and claimed, the advantages of which will be obvious to those skilled in the art from the following description.

My invention is intended, primarily, as an improvement on the signaling system disclosed in the pending application of myself and William Pestell, Serial No. 59,273, filed May 8, 1901; but many features of my invention are not limited to use in such a system, but may be embodied in other systems without departing from the spirit thereof; also, the various features of my invention are not limited, except as defined in the claims, to any particular form of apparatus or to any particular arrangement of circuits.

One feature of my invention contemplates providing a single magnet for setting each signal and for restoring it to normal condition and providing means for energizing a magnet to set a signal when a car enters the block with which the signal is associated and for energizing said magnet to restore the signal when a car leaves the block. By using the same magnet to set and restore the signal I am enabled to dispense with a separate restoring-magnet and produce a simple and compact apparatus.

On railways where it is desirable to allow one or more cars to enter a block from the same direction before the first car to enter the block leaves the block it is necessary to provide means for returning the signal to normal position only when the last car leaves the block, and a feature of my invention contemplates providing a controller actuated when cars enter and leave the block to prevent the return of the signal until the last car leaves the block, the magnet for setting the signal constituting a part of the means for actuating the controller. By utilizing the magnet which sets the signal as a part of the means for actuating the controller a multiplicity of magnets, operating parts, and circuit connections are avoided and a simple and efficient apparatus is produced.

These features of invention are preferably embodied in a signaling system in which a signal apparatus is provided at each end of a track section or block, both of which apparatus are actuated to set the signals when a car enters an empty block and to restore the signals to normal condition when the last car leaves the block, and certain features of my invention consist in the devices and arrangements whereby the signals are so operated.

The features of invention above referred to are embodied in their preferred form in the systems shown in the drawings accompanying this application, which systems also embody other features of invention, as will hereinafter appear.

Referring to said drawings, Figure 1 is a view illustrating diagrammatically the circuit connections for a track section or block of a signaling system embodying my invention and also somewhat diagrammatically

the signaling apparatus at each end of the track section or block, the system being arranged to allow but a single car to be upon the block at one time. Fig. 2 is a view similar to Fig. 1 of the circuit connections and apparatus of a signaling system arranged to allow a plurality of cars to be on the block at the same time, the apparatus being shown in the position which it assumes at the moment a car enters the block from the left, the signal at the distant end of the block having been set and the signal at the entering end being in normal position. Fig. 3 is a view of a preferred form of signaling apparatus for use in the system shown in Fig. 2, certain of the parts being broken away to more clearly show the construction. Fig. 4 is a view of the parts shown in Fig. 3 looking in the opposite direction; and Fig. 5 is a detail view of a portion of the apparatus shown in Figs. 3 and 4, the parts being in the position which they assume after the target has been operated to display its white side.

Referring to Fig. 1, A indicates a signaling apparatus at one end of a track section or block, and B a similar apparatus at the other end of the track section or block. As shown, the signal of each apparatus consists of a target 1, the opposite faces of which are of different colors, preferably white and red. The normal position of the target is such that neither side is visible from an approaching car, and in order to display either side the target is rotated in one direction or the other. As a convenient means for rendering the target visible at night and adapting the apparatus for night as well as day signaling the target is hollow and is provided at its lower end with an opening through which a support for a suitable lamp 2 extends. The faces of the target 1 or a portion thereof are formed of transparent material, and one or both edges of the target are of opaque material, so that when the target is in normal position the lamp will be screened from view, but will be visible through one side or the other of the target when the target is turned into a position to display either side. As shown in the drawings, the lamp 2 is an electric lamp and the circuit of the lamp is closed only when the signal is set, as will be described. The target 1 is secured to the lower end of an actuating-rod 3, which is arranged to slide vertically and rotate in a fixed bearing 4. Above the bearing 4 the rod 3 is provided with an enlarged cylindrical portion 5, in which are formed right and left spiral grooves 6 and 7, which intersect at their upper ends. A block 8, pivotally mounted upon a fixed portion of the frame, normally engages the slots at their intersections and is arranged to cause the rod to rotate in one direction or the other, according to which groove is engaged when the rod 3 is raised. The upper end of the rod 3 extends axially through the armature-core 9 of the solenoid-magnet 10 and is free to reciprocate and rotate therein. For raising the rod 3 to set the signal a hooked pawl or latch 11 is pivotally mounted between ears 12, projecting downwardly from the lower end of the armature 9, the lower end of the pawl being pressed toward the rod 3 by means of a coiled spring 13, connecting the heel of the pawl with the armature 9. A shoulder 14 is formed on the rod 3 above the cylindrical portion 5, and surrounding the rod below this shoulder is a horizontal portion of a plate 15, the upper end of the vertical portion of which is provided with a pin 16, engaging a longitudinal groove in the armature 9. When the parts are in normal position, as shown in Fig. 1, the hook of pawl 11 extends beneath the horizontal portion of plate 15 in position to raise the plate 15 and rod 3 when the armature 9 is drawn upward by the magnet 10. During the upward movement of armature 9 and rod 3 the rod is rotated by the engagement of groove 6 or 7 with block 8, the rod resting by means of the shoulder 14 upon the horizontal portion of plate 15. By providing the plate 15 a firmer support for the rod 3 is secured than would be the case if the pawl 11 engaged the shoulder 14 directly; also, the pawl is relieved from frictional engagement with the shoulder 14 during the rotation of the rod. After the rod 3 has been raised by the upward movement of armature 9 it is locked in position by means to be hereinafter described, the armature 9 returning to its lowest position independently of the rod when the magnet 10 is deënergized. The armature 9 has a movement of reciprocation only. The armature is cylindrical, and as a convenient means for preventing any rotary movement thereof a pin or projection 17 is secured to or formed integral with the hub of the spool of magnet 10 and enters a longitudinal slot or groove in the armature. After the rod 3 has been raised to set the signal it is locked in position by means of a latch 18, pivoted at 19 in position to swing beneath a shoulder 20, formed on the plate 15. When the rod 3 is in its lowest position, the latch 18 is pressed against the plate 15 by means of a coiled spring 21, and when the rod is raised to set the signal the spring forces the latch beneath the shoulder 20 of plate 15 and locks the rod in its raised position. Rigidly connected with the latch 18, so as to move therewith, are two arms 22 and 23. The arm 22 extends in a substantially vertical direction and has secured thereto a contact-plate 24, the function of which will be hereinafter described. The arm 23 extends in a substantially horizontal direction and is provided at its outer end with a lateral offset 25. The lower end of pawl 11 is provided with a laterally-projecting pin 26, which is arranged to engage the offset 25 of the arm 23, when the armature 9 is again attracted by the magnet 10 after the signal has been set and locked in position. On the first movement of armature 9 to set the signal the pin 26 passes inside of the offset 25, so that the arm is not engaged by the pin and the latch 18 is

allowed to swing beneath the shoulder 20. When the signal is set, however, the cylindrical portion 5 of the rod 3 is in a position to be engaged by the pawl 11 and to guide the pawl, so as to cause the pin 26 to engage the offset 25 of the arm 23 at the next actuation of the armature. In order to allow the pin 26 to pass the arm 23 in its downward movement after the signal has been set, the upper surface of the offset is inclined, as shown, said surface acting to swing the pawl laterally when engaged by the pin 26 during the downward movement of the armature to allow the pin to pass off the end of the offset. The magnet 10 thus acts to set the signal if energized when the signal is in normal position and to restore the signal if energized when the signal is set.

In the system shown in Fig. 1 both signals are set when a car enters the block from either direction, the target at the distant end of the block being moved to display the red side and the target at the entering end of the block then being moved to display the white side. The side of the target displayed depends upon which groove 6 or 7 is engaged by the block 8 when the rod 3 is raised. Means are accordingly provided for moving the blocks 8 into a position to engage the proper groove prior to the raising of the rods 3. As shown in the drawings, an arm 27 is rigidly connected with each block 8 and is acted upon by a coiled spring 28 to normally hold the block 8 in a position to engage the groove 7, which causes the target to be rotated in a direction to display the red side when the rod 3 is raised. For swinging the rod 27 against the tension of spring 28 into a position to cause the block 8 to engage the groove 6 an arm 29 is provided, secured to or forming a part of an armature 30 and which is provided at its outer end with a laterally-projecting pin 31, arranged to engage the arm 27 when the armature 30 is moved a sufficient distance. The magnet which attracts the armature 30 is deenergized before the magnet 10 is energized to raise the rod 3, and consequently means are provided for locking the block 8 in the position to which it is moved by the armature. These means consist of a spring-plate 32, secured to the upper end of arm 27 and projecting laterally therefrom, and a lateral projection 33 on the rod 3, which when the rod 3 is in its lowest position is adapted to be engaged by the plate 32 when the arm 27 is swung into a position to cause the block 8 to engage the groove 6. The arm 27 is thus held by the projection 33 during the upward movement of rod 3 until the block 8 engages groove 6, and during the continued upward movement of the rod the block is retained in the groove. When block 8 engages groove 6, it is allowed to move slightly to swing the arm 27 to a position in which the plate 32 will not be engaged by the projection 33 upon the return of the signal to normal position. When, therefore, the signal is restored to normal condition, the arm 27 will be swung back to its original position. The armature 30 is acted upon by two magnets 34 and 35, an initial movement being imparted to the armature by the magnet 34 and the movement being completed by the magnet 35. In order to move the arm 27 sufficiently to cause the plate 32 to be engaged by the projection 33, the armature 30 must be moved by the magnet 35 as well as by the magnet 34 for a purpose which will hereinafter appear.

In addition to the parts above described each signaling apparatus is provided with a lever 36, the lower end of which is connected to armature 30 or to the arm 29 by a pin-and-slot connection and the upper arm of which is provided with a contact-plate 37. A bell-crank lever 38 is also provided, to one arm of which is secured a contact-plate 39. The bell-crank 38 is mounted upon its pivot with sufficient friction to remain in the position to which it is moved. The bell-crank lever 38 is actuated in one direction by a projection 40 from the cylindrical portion 5 of the rod 3, which engages one arm of the bell-crank, and in the other direction by a pin 41 at the lower end of arm 22, the construction being such that the bell-crank is actuated in one direction when the latch 18 swings beneath the shoulder 20 to lock the rod 3 in raised position and is actuated in the other direction when the rod 3 returns to its lowest position. The function of the parts above referred to will appear hereinafter.

The circuits for the magnets 10, 34, and 35 and the means for closing these circuits to properly actuate the signals when a car enters or leaves the block will now be described.

42 represents a feed-wire—as, for instance, the trolley-wire of an electric railroad—and 43 the return-circuit, preferably the rail.

44 is a single line-wire through which current is transmitted to the magnets 10 of both signals to set the signals. In each apparatus the line-wire 44 is connected by means of a wire 45 to a contact 46 and by means of the retracting-spring 47 for the lever 36 to a contact-plate 37. On each side of the contact-plate 37 are located contact-plates 48 and 49, the contact-plate 48 being connected by means of wire 50 to a contact-plate 51, arranged to be engaged by the contact-plate 24. The contact-plate 24 is connected by means of the retracting-spring 21 for the latch 18 and arms 22 and 23 to wire 52, which connects with one terminal of magnet 10. The other terminal of magnet 10 is connected by means of wire 53 to return 43. The contact-plate 49 is connected by means of a wire 54 to one terminal of magnet 35, the other terminal of which is connected by wire 55 to a contact-plate 56. To the upper end of rod 3 is secured a contact-plate 57, which is in electrical connection through the counterbalancing-spring 58 for the rod 3 with the trolley-wire 42. When the rod 3 is in its lowest position, the contact-plate 57 is in engagement with contact-plate 56.

The plate 57 is provided with an arm, which when the rod 3 is raised and rotated to display the red side of target 1 engages contact-plate 46. At each end of the block is located a circuit-closer 59, arranged to be actuated by the trolley of a car passing onto the block. This circuit-closer is connected by means of a wire 60 to one terminal of magnet 34, the other terminal of which is connected to return 43 by means of the wire 61.

By means of the circuits and contacts so far described the magnets 10 of both signals can be energized when a car enters the block from either direction and the magnets 34 and 35 of the apparatus at the entering end of the block can be energized to cause the target at that end of the block to be moved to display the white side. In the operation of the system the signal-actuating magnet of the apparatus at the distant end of the block is first energized to move the target to a position to display the red side and the signal-actuating magnet of the apparatus at the entering end of the block cannot be energized until the signal at the distant end of the block has been set and locked in position; also, the magnet 35 of the apparatus at the entering end of the block cannot be energized to cause the block 8 to be locked in a position to engage the groove 6 unless the signal-actuating magnet of the apparatus at the distant end of the block is also energized. The operation of the system when a car enters the block from the left as viewed in Fig. 1 may be described as follows: As a car enters the block the circuit-closer 59 is actuated and a current is transmitted from the trolley-wire 42, through wire 60, magnet 34, and wire 61, to return 63. The magnet 34 of apparatus A being thus energized, the armature 30 is attracted and a sufficient movement imparted thereto to bring the contact-plate 37 in engagement with contact-plate 49. This movement of armature 30 is not, however, sufficient to move the arm 27 so as to cause the plate 32 to engage the projection 33. By the engagement of contact-plate 37 with contact 49 a circuit is closed through the magnet 35 of apparatus A and magnet 10 of apparatus B, as follows: trolley-wire 42, spring 58, contact-plate 57, contact 56, wire 55, magnet 35, wire 54, contact 49, contact-plate 37, spring 47 of apparatus A, line-wire 44, spring 47, contact-plate 37, contact 48, wire 50, contact 51, contact-plate 24, spring 21, wire 52, magnet 10, wire 53 of apparatus B, and return 43. Magnet 35 of apparatus A being included in the same circuit with magnet 10 of apparatus B will not be energized unless the magnet 10 of apparatus B is also energized, and thus the armature 30 will not be moved sufficiently to cause the plate 32 to engage the projection 33 unless the signal-actuating magnet of apparatus B is energized to set its signal. When the magnet 10 of apparatus B is energized, it draws up armature 9 and moves the target 1 into the position to display the red side by the mechanism hereinbefore described. After the signal has been set it is locked in position by the latch 18, which swings beneath the shoulder 20 of plate 15. The arm 22 moves with the latch 18 and separates the contact-plate 24 from the contact 51. The circuit through magnet 35 of apparatus A and magnet 10 of apparatus B is thus broken, and armature 30 of apparatus A and armature 9 of apparatus B return to normal position. When the rod 3 of apparatus B reached its highest position, the arm of contact-plate 57 at the upper end of rod 3 engaged contact-plate 46, and when armature 30 of apparatus A returned to its normal position contact-plate 37 was moved away from contact 49 and brought into engagement with contact 48. A circuit including magnet 10 of apparatus A was thus closed, as follows: trolley-wire 42, spring 58, contact-plate 57, contact 46, wire 45 of apparatus B, line-wire 44, to magnet 10 of apparatus A, through the connections above described for apparatus B, and to return 43 through wire 53. Magnet 10 of apparatus A being thus energized, its armature 9 is attracted, and the block 8 being locked in position to engage groove 6 of rod 3 the target 1 of apparatus A is moved to display the white side. When the signal of apparatus A is set, it is locked in position by the latch 18 and the circuit of magnet 10 broken by the separation of contact-plates 24 and 51.

In the operation of the system as so far described it will be seen that the signal at the distant end of the block is set first and that the signal at the entering end is set only after the signal at the distant end has been locked in position. The signal at the entering end thus affords an indication that the system is in order and that the signal at the distant end has been set to prevent the entrance of a car onto the block from the opposite direction.

In order to energize both magnets 10 to restore the signals to normal position when a car leaves the block in either direction, the following circuits and connections are provided: At each end of the track-section or block a circuit-closer 62 is provided, which is arranged to be actuated by the trolley of a car leaving the block. Each of these circuit-closers is connected, by means of a wire 63, to a contact-plate 64, and the wires 63 are connected by wire 65. Adjacent to each contact-plate 64 is a contact-plate 66, which is connected to the wire 52, which leads to one terminal of magnet 10. These contact-plates are bridged by the contact-plates 39, carried by the bell-crank levers 38, when the signals are set, the bell-cranks 38 being swung into a position to cause the plates 39 to bridge the contacts by the engagement therewith of pins 41 during the movement of latches 18 into a position to lock the signals. The magnets 10 are thus connected in circuit with the circuit-closers 62 and will be energized whenever a car leaves the block in either direction. Thus when the car which entered the block from

the left leaves the block a circuit is closed through the magnet 10 of apparatus B, as follows: wire 63 of apparatus B, contact 64 of apparatus B, plate 39, contact 66, wire 52, magnet 10, and wire 53. There is also a circuit closed through magnet 10 of apparatus A, as follows: wire 63 of apparatus B, wire 65, wire 63 of apparatus A, contact 64, plate 39, contact 66, wire 52, magnet 10, and wire 53. Both magnets 10 being energized, the armatures 9 will be again attracted and the pins 26 of pawls 11, which are guided by the enlarged portions 5 of rods 3, will engage the offsets 25 of arms 23 and swing the latches 18 into position to disengage the shoulders 20 of plates 15 and allow the signals to return to normal position. The movement of latches 18 from beneath the shoulders 20 of plates 15 brings the contact-plates 24 into engagement with contacts 51, and the engagement of the lower arms of bell-cranks 38 by the projections 40 on rods 3 during the downward movement of the rods separates the contact-plates 39 from the contacts 64 and 66. All parts of the apparatus are thus restored to their normal position. It will be noted that during the operation of setting the signals contacts 24 and 51 are separated before contact-plate 39 is brought into engagement with contacts 64 and 66. This is important, as otherwise the magnet 10 of apparatus B would be energized to restore its signal when the signal of apparatus A was set. Thus, supposing the signal of apparatus B to be set and the contact-plate 39 in engagement with contacts 64 and 66, if when the signal of apparatus A was set the plate 39 of apparatus A came in engagement with contacts 64 and 66 before contact 24 left contact 51 magnet 10 of apparatus B would be again energized through the following circuit: wire 58 of apparatus B, contacts 57 and 46, wire 45, line-wire 44, spring 47 of apparatus A, contacts 37 and 49, wire 50, contacts 51 and 24, spring 21, wire 52, contacts 66, 39, and 64, wire 63, wire 65, wire 63 of apparatus B, contacts 64, 39, and 66, wire 52, magnet 10, and wire 53. By separating contacts 24 and 51 before the engagement of contact-plate 39 with contacts 64 and 66 the closing of this circuit is prevented. It will also be noted that the contacts 64 and 66 remain bridged by the contact-plate 39 until the rod 3 has nearly reached its lowest position, and thereby the magnet 10 is kept energized a sufficient length of time to cause the actuation of the locking-latch. When the signals are set, it will be seen that the circuits by which both magnets are energized when a car enters the block are broken at the contacts 51 and 24. As an additional safeguard in order to avoid any possibility of the signals being improperly actuated when a second car enters the block either intentionally or accidentally these circuits are also broken when the signals are set by the separation of contacts 57 and 56.

It will be seen that when a car enters the block from either end the magnet 34 is energized and through the movement of armature 30 the contacts 37 and 48 are separated, thereby breaking the circuit by which the magnet 10 of the apparatus at that end of the block is energized when a car enters the other end of the block. This arrangement prevents the energization of either magnet 10 in case two cars enter the block simultaneously from opposite directions. The failure of the signaling apparatus to act will prevent both cars from proceeding, and both cars will be required to back off the block. When the magnets 34 are deënergized, the signaling apparatus are restored to normal condition and will be properly actuated when a car enters the block from either direction, the movement imparted to armatures 30 by the magnets 34 being insufficient to lock the blocks 8 in position to engage the grooves 6, as has been described. The advantage of actuating the means for determining the position to which the signals are moved by means of a magnet separate from the magnet 34 will now be obvious, for if these means were actuated by the magnet 34 they would be locked in position to cause both targets to display the white side in case two cars entered the block simultaneously from opposite directions and the signals would be improperly actuated when one of the cars again entered the block from either direction. Since the circuit-closer 59 is operated by the trolley of a passing car, the magnet 34 is only momentarily energized, and the arrangement shown in the drawings, in which the magnet 35 of one apparatus is arranged in the circuit of the magnet 10 of the other apparatus, has the further advantage of maintaining the circuit through the magnet 10 of one apparatus closed after the magnet 34 of the other apparatus is deënergized.

One terminal of the lamp 2 is connected to return 43, and the other terminal is connected to a contact-plate arranged to be engaged by the plate 57 at the upper end of rod 3 when the rod 3 is in its raised position and the target 1 set to display either the white or the red side. By this arrangement the circuit through the lamp is only completed when the signal is set.

In the system illustrated in Fig. 2 means are provided for properly actuating the signals in case one or more cars enter the block from the same direction before the first car to enter the block leaves the block. In this system many of the parts of the apparatus and many of the circuit connections illustrated in Fig. 1 are employed, as will be obvious from an inspection of the drawings. These parts and circuit connections are designated by the same numerals of reference as in Fig. 1 and need not be again specifically described. To cause the signals to be restored to normal position only when the last car leaves the block, each signaling apparatus is provided with a controller, one of

which is utilized to control the restoration of the signals when the cars pass through the block in one direction and the other of which is utilized to control the restoration of the signals when the cars pass through the block in the other direction. These controllers are actuated without the use of magnets additional to those illustrated in the system shown in Fig. 1. The system illustrated in Fig. 2 is also provided with means whereby the signal at the distant end of the block, which shows red, cannot be restored to normal condition until the signal at the entering end of the block, which shows white, has been restored. This feature is of value, as thereby any possibility of the white signal remaining set after the red signal has been restored is avoided. If means were not provided for insuring the return of the white signal as well as the red and if for any reason the white signal should remain set after the red signal was restored to normal condition, a car coming from one direction would be allowed to enter the block by the presence of the white signal and a car coming from the other direction, not being prohibited from entering the block by the presence of a red signal, might enter the block in spite of the fact that the apparatus at that end was not operated to show the white signal. For insuring the return of the white signal the magnet 10 of the apparatus which displays the white signal is connected in circuit with the circuit-closers 62, which are actuated by cars leaving the block, and suitable connections are provided by which the magnet 10 of the apparatus which shows the red signal is energized when the white signal is restored to normal condition. By this arrangement the red signal cannot be returned until after the white signal, and the return of the red signal serves as an indication that the white signal has also been returned. These and other features will be more fully understood from the following detailed description.

The preferred form of apparatus is illustrated on an enlarged scale in Figs. 3, 4, and 5, and this apparatus will be first described. Referring to these figures, 67 designates a ratchet-wheel rotatably mounted concentric with the pivot of lever 36. Mounted upon the face of this ratchet-wheel is a plate 68, which when the ratchet-wheel is in the position shown in Fig. 3 and the rod 3 is in its highest position forms a guide for the pin 26 of pawl 11 to cause the pin to engage the offset 25 of arm 23 when the armature 9 is raised by the magnet 10. The enlarged portion 5 of rod 3 in the construction shown in Figs. 3 and 4 extends slightly above the lower end of guide-plate 68 when the rod 3 is in its highest position, but does not extend to a sufficient height to form a guide for the pawl 11 to cause the pin 26 to engage the offset 25 of lever 23 independently of the guide-plate 68. If then the magnet 10 is energized after the signal has been set, the offset 25 will be engaged by pin 26 and the latch 18 operated to allow the rod 3 to drop if the ratchet-wheel 67 is in the position illustrated in Fig. 3. If, however, the ratchet-wheel has been advanced one or more steps, the guide-plate 68 will not be in a position to be engaged by the pin 26, and the pin will not engage the offset 25 during the upward movement of armature 9. The ratchet-wheel 67 is actuated when cars enter and leave the block so as to be in the position illustrated in Fig. 3 when the last car leaves the block. For so actuating the ratchet-wheel 67 the magnets 10 and 34 are employed. The ratchet-wheel is forced in one direction by means of a coiled spring 69, one end of which is attached to the hub of the wheel and the other end to a fixed pin 70. The ratchet-wheel is held in normal position by means of a pin 71, which contacts with a fixed abutment 72. For advancing the ratchet-wheel a pawl 73 is provided, pivoted to the lever 36 and provided with a downwardly-extending arm having a pin-and-slot connection with the arm 29, which is secured to or formed integral with the armature 30 of magnet 34. The lower end of lever 36 in the construction shown in Fig. 3 is not connected to the arm 29, but extends downwardly at one side of the arm to the rear of the pin 74, which connects the pawl 73 with the arm 29.

The above-described construction is such that a movement of armature 30 when attracted by magnet 34 first swings the pawl 73 into a position to engage the teeth of ratchet-wheel 67 and then by the engagement of pin 74 with the lower end of lever 36 swings the lever in a direction to advance the ratchet-wheel. When the rod 3 is in its raised position with the white side of the target displayed, the ratchet-wheel 67 is held in the position to which it is moved by the pawl 73 by means of a detent 75, pivoted at 76 upon a stationary part of the frame. Also pivoted at 76 is a detent 77, which with the detent 75 constitutes an escapement for allowing the ratchet-wheel 67 to be returned step by step under the influence of the spring 69. The coiled spring 78 is secured at its opposite ends to the detents and presses them in a direction to engage the teeth of ratchet-wheel 67. A plate 79, (best shown in Fig. 4,) provided with an incline at each end, is formed integral with or secured to one of the ears 12, which project downwardly from the armature-core, and when the armature-core is in its lowest position engages a pin 80, projecting from the detent 77, and holds the detent out of contact with the teeth of the ratchet-wheel 67. When the armature 9 is raised, the plate 79 disengages the pin 80 and allows the detent 77 to move into the path of the teeth of the ratchet-wheel and thereafter the plate 79, engages a pin 81, projecting from detent 75, and forces the detent out of engagement with the teeth of the ratchet-wheel, thereby allowing the ratchet-wheel to move under the in-

fluence of spring 69 until one of its teeth is engaged by the detent 77. As the armature 9 returns to its original position the detent 75 is allowed to move into the path of the teeth of the ratchet-wheel 67, and the detent 77 is disengaged therefrom. The arrangement of the detents 75 and 77 with relation to the teeth of ratchet-wheel 67 is such that an actuation of the detents, as above described, allows the ratchet-wheel to move backward the distance of one tooth. The detents 75 and 77 are held from movement into the path of the teeth of ratchet-wheel 67 at all times, except when the rod 3 is in its raised position and turned to display the white signal. The means shown in the drawings for holding the pawls 75 out of the path of the teeth of the ratchet-wheel 67 consists of the pin 81, which projects into a position to engage the rod 3. For allowing the pawl to move into the path of movement of the teeth of the ratchet-wheel when the rod 3 is in its raised position and turned to display the white side of the target the rod 3 is provided with a notch 82, which is brought opposite the pin 81 when the rod is raised to display the white side of the target, as is clearly shown in Fig. 5. When the armature 9 is down, the detent 77 is held out of the path of movement of the teeth of ratchet-wheel 67 by the engagement of pin 80 with the plate 79. As a means for preventing the engagement of detent 77 with the teeth of the ratchet-wheel when the armature 9 is raised the pin 80 of detent 77 is extended into a position to engage the rod 3, and thereby hold the detent 77 out of the path of movement of the teeth of the ratchet-wheel. To allow the detent 77 to move into the path of movement of the teeth of the ratchet-wheel when the rod 3 has been raised to display the white side of the target and thereafter the armature 9 is raised, the rod 3 is provided with a notch 83, which comes opposite the pin 80 of detent 77. The detent 75 has secured thereto or formed integral therewith an arm, upon which is mounted a contact-plate 89, and the detent 77 is provided with a similar arm, upon which is mounted a contact-plate 90, electrically connected to contact-plate 89 by a coiled wire 91. Between the contact-plates is located a contact-plate 92, with which the contact-plates 89 and 90 engage when the detents 75 and 77 are in a position to engage the teeth of ratchet-wheel 67. The function of these contacts will appear hereinafter. When the signals are set, the magnet 10 is energized to cause the ratchet-wheel 67 to rotate in a direction to allow the signal to be restored or returned to normal condition whenever a car leaves the block, and the magnet 34 is energized to cause the ratchet-wheel 67 to be moved in a direction to prevent the return of the signal whenever a car enters the block. In case a car enters the block at the same instant that another car leaves the block the magnets 10 and 34 are energized simultaneously, as will hereinafter appear, and in order to insure the proper actuation of the ratchet-wheel 67 under such circumstances it is necessary that the return of the armature 9 of magnet 10 be delayed until after the armature 30 has completed at least a portion of its return movement. For causing the armatures 9 and 30 to be so returned, and thereby the ratchet-wheel 67 to be returned to the position which it occupied before the magnets 10 and 34 were energized, an arm 84 is pivotally mounted concentrically with the ratchet-wheel 67 and pivot of lever 36 and connected to the lever 36 by means of a spring 85, coiled about the hub of the arm and having one end secured to the arm and the other end to the lever. The lever 36 is provided with an upwardly-extended arm, from which projects a pin 86, against which the arm 84 is pressed by the spring 85. One of the ears 12, which projects downwardly from the armature-core 9, is provided with a lateral extension, from which projects a pin, upon which is mounted a roller 87, beneath which the arm 84 passes when the armature 9 approaches its highest position if the arm has been actuated by a movement of lever 36 due to the attraction of armature 30 by magnet 34. The spring connection between the arm 84 and lever 36 permits the arm to yield if engaged by the roll 87 during the upward movement of armature 9, and the pin 86, engaging the arm, positively swings the arm from beneath the roll during the return movement of armature 30. By the engagement of arm 84 with roll 87 the return movement of armature 9 will be delayed until the armature 30 has completed a portion of its return movement. This movement of armature 30 retracts the pawl 73, so as to allow the ratchet-wheel 67 to be turned backward a sufficient distance to cause the detent 75 to engage the tooth with which it was last in engagement, when the armature 9 is returned to its lowest position.

In the construction shown in Figs. 3 and 4 the block 8 is locked in position by means of a latch formed by a projection 88 from the hub of latch 18, which extends into the position to engage the upper end of arm 27. Also the pawl 11 is pivotally supported by but one of the ears 12, projecting downward from the armature 9, the other ear being cut away to allow the pin 81 of detent 75 to engage rod 3. Otherwise the construction of the various parts illustrated in Figs. 3 and 4 and not specifically referred to above is the same as that of the parts designated by corresponding numerals of reference in Fig. 1.

The signal apparatus illustrated in Fig. 2 is the same as that illustrated in Figs. 3 and 4, above described, except that the means for locking the blocks 8 in position to engage the groove 6 is the same as that illustrated in Fig. 1. Also the lever 36 has a pin-and-slot connection with the arm 29, and the pawl 73 is pivotally mounted on the lever and pressed toward the ratchet-wheel 67 by means of a

coiled spring 93, one end of which is connected to the heel of the pawl and the other end to the lever. A fixed guide 93ª engages a pin projecting laterally from the pawl when the lever 36 is in normal position and holds the pawl out of the path of movement of the teeth of ratchet-wheel 67, as shown at apparatus B. To avoid confusing the drawings, certain of the parts illustrated in Figs. 3 and 4 have been omitted from Fig. 2. From an inspection of Fig. 2 it will be seen that the circuits for energizing magnets 34 and 35 and the circuits for energizing magnets 10 to set the signals are the same as the circuits illustrated in Fig. 1, hereinbefore described. For energizing the magnets 10 after the signals have been set the following circuits are provided: The wires 63, leading from the circuit-closers 62 at each end of the block, and the wire 65, connecting the wires 63, are the same as in the system illustrated in Fig. 1. Each wire 63 leads to a spring contact-plate 94. Adjacent the contact-plate 94 is a contact-plate 95, which is connected to the wire 52, leading to one terminal of magnet 10. The wire 52 is connected, by means of a wire 96, to a contact-plate 97, which is engaged by a contact-plate 98, carried by the arm 27, when the block is in a position to engage groove 7. The contact-plates 98 of apparatus A and B are connected, through the retracting-springs 28 of the arms 27, to a line-wire 99. When the contacts 94 and 95 are closed, it will be seen that the magnets 10 are thrown into circuit with the circuit-closers 62. For closing the contacts 94 and 95 an arm 100, projecting from the rod 3 or the upper portion of the target, is provided, which when the rod 3 is raised and turned to a position to display the white side of the target engages contact 94 and forces it against contact 95. When the rod 3 is raised and turned to a position to display the red side of the target, the arm 100 is swung in the opposite direction and does not engage contact 94, as shown at apparatus B.

The operation of the apparatus and circuit connections of the system illustrated in Fig. 2 and so far described is as follows: The apparatus at both ends of the block being in normal condition, when a car enters the block from the left both signals will be set in the manner above described in connection with Fig. 1. By the energizing of magnets 34 and 35 of apparatus A the ratchet-wheel 67 of apparatus A is moved forward a distance somewhat greater than the distance between two teeth and thereafter returned to normal position, when the magnets are deënergized, as the detent 75 is held out of the path of movement of the teeth of the ratchet-wheel at this time by the engagement of pin 81 with the rod 3. If now the car leaves the block before another car enters the block from the left, the actuation of circuit-closer 62 will cause a current to be transmitted from trolley-wire 42 to return 43, through wire 63 at the distant end of the block, wire 65, wire 63 at the entering end of the block, contacts 94 and 95 of apparatus A, which are now closed by the engagement therewith of projection 100, since the target of apparatus A has been actuated to display its white side, wire 52, magnet 10, and wire 53. Magnet 10 of apparatus S is thus energized and its armature 9 is raised. The ratchet-wheel 67 being in normal position, the plate 68 on the ratchet-wheel will engage the pin 26 of pawl 11 during the upward movement of the armature and will guide the pin 26 into contact with the offset 25 of arm 23, and thereby cause the locking-latch 18 to be swung into a position to allow the signal to return to normal position. When the rod 3 reaches its lowest position, the arm 27 will be swung in a direction to cause contact-plate 98 to engage contact-plate 97, and thereby close a circuit through the magnet 10 of apparatus B, as follows: spring 58 of apparatus B, contact-plates 57 and 46, wire 45, line-wire 44, spring 47 of apparatus A, contact-plates 37 and 48, wire 50, contact-plates 51 and 24, which are now in engagement, since the signal of apparatus A has been returned to its normal position, spring 21, wires 52 and 96, contact-plates 97 and 98, spring 28, line-wire 99, spring 28 of apparatus B, contacts 98 and 97, wires 96 and 52, magnet 10 of apparatus B, and wire 53. This circuit remains closed until the locking-latch of apparatus B has been actuated to allow the signal to return to normal position, when it is broken by the separation of contact-plates 57 and 46 during the downward movement of rod 3. When the signals are set by the entrance of the first car onto the block from the left, the target of apparatus A displays its white side and the target of apparatus B displays its red side. The notches 82 and 83 in rod 3 of apparatus A are therefore opposite the pins 81 and 80 and detent 75 is in a position to engage the teeth of the ratchet-wheel 67, detent 77 being held out of a position to engage the teeth of the ratchet-wheel by the engagement of pin 80 by plate 79. If a car enters the block before the first car leaves the block, the magnet 34 of apparatus A will be energized and the ratchet-wheel 67 advanced the distance between two teeth and held in its advanced position by the engagement of detent 75 with a tooth of the ratchet-wheel. In such case when the first car leaves the block the movement of armature 9 of apparatus A, due to the energizing of magnet 10, will simply actuate the detents 75 and 77 to return the ratchet-wheel to normal position without causing the release of the signal, as the guide-plate 68 will not be in a position to engage and guide the pin 26 during the upward movement of the armature. The ratchet-wheel 67 is advanced a step each time a car enters the block after the signals have been set and is returned a step toward its normal position each time a car leaves the block until but a single car remains on the block. When the last car leaves

the block, the ratchet-wheel is in its normal position, and the movement of armature 9 acts to restore the signal to normal condition. Neither of the magnets 34 or 35 of apparatus B are energized when cars enter and leave the block from the left, and therefore the ratchet-wheel 67 of apparatus B remains in its normal position and the pin 28 of apparatus B is guided into engagement with the offset 25 of arm 23 to release the signal when the magnet 10 of apparatus B is energized by the return of the signal of apparatus A to normal position, as has been described. Even if the magnet 34 of apparatus B is energized by the accidental entrance of a car onto the block from the right after the signal of apparatus B has been set the ratchet-wheel 67 of apparatus B will be at once returned to normal position, since the detent 75 is held out of engagement with the teeth of ratchet-wheel 67 by the contact of pin 81 with rod 3. As a means for preventing the energizing of magnet 34 of apparatus B by the accidental entrance of a car onto the block from the right contacts 101 and 102 may be provided in the wire 60, which are separated by means of an insulated block on an arm of contact-plate 57, which engages contact 101, when the rod 3 is raised and turned into a position to display the red side of the target.

In the system illustrated in Fig. 2 if two cars enter the block at the same time from opposite directions when both signals are in normal condition magnets 34 will be energized, but the magnets 10 will not be energized, the operation being the same as in the system illustrated in Fig. 1 and hereinbefore described. In such case the blocks 8 will not be locked in position to engage groove 6, since the movement imparted to the armatures 30 by magnets 34 is not sufficient to produce this result, as has been described in connection with Fig. 1, and the ratchet-wheels 67 will not be held in their advanced position, since the detents 75 are held out of the path of movement of the teeth of ratchet-wheel 67, as has been described.

It is desirable that means be provided whereby the proper actuation of the ratchet-wheel 67 may be indicated to a car entering the block after the signals have been set. In Fig. 2 I have shown diagrammatically an auxiliary signal connected with apparatus B for making such an indication, it being understood that each apparatus will be provided with such a signal. The auxiliary signal, as shown in Fig. 2, consists of a vibratory bell 103, one terminal of which is connected, by means of a wire 104, to the return 43 and the other terminal of which is connected, by means of a wire 105, to contact-plate 92. The contact-plates 89 and 90 are connected, by means of a wire 106, to wire 54. The lever 36, to which the pawl 73 is pivoted, is provided with the contact-plate 37, which is normally in engagement with contact 48 and which is brought into engagement with contact 49 at each actuation of the lever 36, the construction being the same as that already described in connection with Fig. 1. Each time the lever 36 is actuated to cause the pawl 73 to advance the ratchet-wheel 67 the contact-plate 37 is brought into engagement with the contact 49, and thereby a circuit closed through the bell 103 if either contact 90 or 89 is in engagement with contact 92. Starting with the line-wire 44, which is in connection with the trolley-wire 42, the signals are set through wire 45, contact 46, plate 57 of the apparatus which has been actuated to display the red side of the target, and spring 58. The circuit of bell 103 consists of spring 47, contact-plate 37, contact 49, wire 54, wire 106, contact 89 or 90, contact 92, wire 105, bell 103, and wire 104. This circuit will not, however, be closed by the engagement of contact-plate 37 with the contact 49 if both contacts 89 and 90 are out of engagement with contact 92. This will only occur in case both detents 75 and 77 are out of the path of movement of the teeth of the ratchet-wheel 67, in which case the ratchet-wheel will not be retained in the position to which it is advanced by pawl 73. It will thus be seen that the auxiliary signal 103 will be actuated only in case the ratchet-wheel 67 is advanced by the pawl 73 and retained in its advanced position. The circuits, connections, and apparatus illustrated in Fig. 2 and not specifically described are the same in arrangement, construction, and mode of operation as the corresponding circuits, apparatus, and connections illustrated in Fig. 1 and will be readily understood without further description.

Having thus indicated the nature and scope of my invention and having described the best means at present known to me for carrying out the several features thereof, I claim as new and desire to secure by Letters Patent—

1. A railway block-signal system, having, in combination, a signal, a locking device therefor, a magnet acting to set the signal and to actuate the locking device to release the signal, and means for energizing the magnet to set the signal when a car enters a block and for energizing the magnet to actuate the locking device to release the signal when a car leaves the block, substantially as described.

2. A railway block-signal system, having, in combination, a signal, a locking device therefor, a magnet, an armature therefor, mechanism connecting with the armature constructed and arranged to set the signal when the armature is attracted by said magnet and to actuate the locking device to release the signal upon a subsequent attraction of the armature, substantially as described.

3. A railway block-signal system, having, in combination, a signal, a reciprocating rod connected with the signal, a locking device for the rod, a magnet, an armature therefor, mechanism connected with the armature for moving the rod to a position to be engaged

by the locking device when the armature is attracted by the magnet and for actuating the locking device to release the rod upon a subsequent attraction of the armature, substantially as described.

4. A railway block-signal system, having, in combination, a signal at each end of a track-section or block, a magnet acting to set each signal and restore it to normal condition, means for energizing one of said magnets to set one of the signals when a car enters the block, means for energizing the other magnet to set the other signal when the first signal is set and means for energizing the magnets to restore the signals when a car leaves the block, substantially as described.

5. A railway block-signal system, having, in combination, a signal at each end of a track-section or block, a magnet acting to set each signal and restore it to normal condition, means for energizing one of said magnets to set one of the signals when a car enters the block, means for energizing the other magnet to set the other signal when the first signal is set, means for energizing one of said magnets to restore one of the signals when a car leaves the block, and means for energizing the other magnet to restore the other signal when the first signal is restored to normal condition, substantially as described.

6. A railway block-signal system, having, in combination, a signal at each end of a track-section or block, a magnet acting to set each signal and restore it to normal condition, means for energizing said magnets to set the signals when a car enters the block, means for energizing one of said magnets to restore one of the signals when a car leaves the block, and means for energizing the other magnet to restore the other signal when the first signal is restored to normal condition, substantially as described.

7. A railway block-signal system, having, in combination, a signal at each end of a track-section or block, a magnet acting to set each signal and restore it to normal condition, means for energizing one of said magnets to set one of the signals when a car enters the block from one direction, means for energizing the other magnet to set the other signal when a car enters the block from the opposite direction, means for energizing either of the magnets to set a signal when the other signal is set and means for energizing said magnets to restore the signals when a car leaves the block, substantially as described.

8. A railway block-signal system, having, in combination, a signal at each end of a track-section or block, a magnet acting to set each signal and restore it to normal condition, means for energizing the magnet of the signal at the distant end of the block to set said signal when a car enters the block from either direction, means for energizing the magnet of the signal at the entering end of the block when the signal at the far end is set, means for energizing the magnet of the signal at the entering end of the block to restore said signal when a car leaves the block, and means for energizing the magnet of the signal at the distant end of the block to restore said signal when the signal at the entering end is restored, substantially as described.

9. A railway block-signal system, having, in combination, a signal movable from normal to either of two positions, actuating mechanism therefor, an armature, means actuated by said armature for determining the position to which the signal is moved by its actuating mechanism, a magnet for imparting an initial movement to said armature, and an auxiliary magnet for completing the movement of said armature, substantially as described.

10. A railway block-signal system, having, in combination, a signal at each end of a track-section or block movable from normal to either of two positions, an actuating-magnet for each signal, a magnet acting to determine the position to which each signal is moved, a circuit including one signal-actuating magnet and the magnet which determines the position to which the other signal is moved, a circuit including the other signal-actuating magnet and the magnet which determines the position to which the first-mentioned signal is moved, means for closing one of said circuits and breaking the other when a car enters the block from one direction, and means for breaking said first-mentioned circuit and for closing the other when a car enters the block from the opposite direction, substantially as described.

11. A railway block-signal system, having, in combination, a signal, a controller acting to control the return of the signal to normal position, a magnet acting to set the signal and to actuate the controller to allow the return of the signal, a magnet acting to actuate the controller to prevent the return of the signal, means for energizing said first-mentioned magnet to set the signal when a car enters an empty block, and means for thereafter energizing said first-mentioned magnet to actuate the controller when a car leaves the block, and for energizing the other magnet to actuate the controller when a car enters the block, substantially as described.

12. A railway block-signal system, having, in combination, a signal, a controller acting to control the return of the signal to normal position, a magnet acting to set the signal and to return it to normal position, and also acting to actuate the controller to allow the return of the signal, a magnet acting to actuate the controller to prevent the return of the signal, means for energizing said first-mentioned magnet to set the signal when a car enters an empty block, means for thereafter energizing said last-mentioned magnet to actuate the controller when a car enters the block, and means for energizing said first-mentioned magnet to actuate the controller

when a car leaves the block and to restore the signal when the last car leaves the block, substantially as described.

13. A railway block-signal system, having, in combination, a signal at each end of a track-section or block, an actuating-magnet for each signal, means for energizing both magnets to set the signals when a car enters the block from either direction, two controllers, means for actuating one controller when cars enter the block from one direction and for actuating the other controller when cars enter the block from the other direction, said means including a magnet for actuating each controller, circuits therefor and means for closing the circuit of one magnet when a car enters the block from one direction and for closing the circuit of the other magnet when a car enters the block from the opposite direction, and means for breaking the circuit of one of said magnets when the signals are set, substantially as described.

14. A railway block-signal system, having, in combination, a signal, a controller acting to control the return of the signal to normal position, a magnet acting to set the signal and to actuate the controller to allow the return of the signal, a magnet acting to actuate the controller to prevent the return of the signal, and means for causing the controller to be actuated successively by said magnets when two cars enter and leave the block simultaneously, substantially as described.

15. A railway block-signal system, having, in combination, a signal, a longitudinally-movable and rotary signal-actuating rod provided with right and left spiral grooves, means for moving the rod longitudinally and a block movably mounted to engage either groove to cause the rod to rotate in either direction, substantially as described.

16. A railway block-signal system, having, in combination, a signal, a longitudinally-movable and rotary signal-actuating rod provided with intersecting right and left spiral grooves means for moving the rod longitudinally, a pivotally-mounted block engaging the grooves at their intersections when the rod is at one limit of its movement, and means for swinging the block on its pivot to engage either groove to cause the rod to rotate in either direction, substantially as described.

17. A railway block-signal system, having, in combination, a signal, a longitudinally-movable signal-actuating rod, a locking device therefor, a reciprocating member, and means for actuating the same, mechanism connecting with said member constructed and arranged to move the rod to a position to be engaged by the locking device when said member is reciprocated and permit an independent return of said member and to actuate the locking device to release the rod upon a subsequent reciprocation of said member, substantially as described.

18. A railway block-signal system, having, in combination, a signal, a longitudinally-movable and rotary signal-actuating rod, a solenoid, an armature-core therefor having a reciprocating movement only, mechanism connecting with said armature-core constructed and arranged to move the rod longitudinally when the armature-core is attracted by said magnet and permit an independent return of said armature-core, and means engaging the rod to cause a rotation thereof during its longitudinal movement, substantially as described.

19. A railway block-signal system, having, in combination, a signal, a solenoid, an armature-core therefor, a longitudinally-movable signal-actuating rod extending through said armature-core longitudinally, and mechanism connecting with said armature-core constructed and arranged to move the rod longitudinally when the armature-core is attracted by said magnet and permit an independent return of said armature-core, substantially as described.

20. A railway block-signal system, having, in combination, a signal, a magnet acting to set the signal and restore it to normal condition, means for energizing the magnet to set the signal when a car enters a block and for energizing the magnet to restore the signal when a car leaves the block, a controller and means for actuating the controller to prevent the restoration of the signal by said magnet until the last car leaves the block, substantially as described.

21. A railway block-signal system, having, in combination, a signal, means for setting the signal when a car enters a block and for restoring the signal when a car leaves the block, a controller acting to prevent the return of the signal until the last car leaves the block comprising a ratchet-wheel, a pawl, means for actuating the pawl to advance the ratchet-wheel when a car enters the block, a detent for retaining the ratchet-wheel in advanced position, and a signal for indicating an actuation of the ratchet-wheel controlled by said detent, substantially as described.

22. A railway block-signal system, having, in combination, a signal movable from normal to either of two positions, a magnet acting to determine the position to which the signal is moved, means for energizing said magnet when a car enters the block and means for preventing the energizing of said magnet when cars enter the block simultaneously from opposite directions, substantially as described.

23. A railway block-signal system, having, in combination, a signal movable from normal to either of two positions, means for setting the signal when a car enters the block from either direction and for restoring the signal when a car leaves the block, a magnet acting to determine the position to which the signal is moved, means for energizing said magnet when a car enters the block from one direction, and means for preventing the set-

ting of the signal and the energizing of said magnet when cars enter the block simultaneously from opposite directions, substantially as described.

24. A railway block-signal system, having, in combination, a signal, means for setting the signal when a car enters a block and for restoring the signal when a car leaves the block, a controller acting to prevent the return of the signal until the last car leaves the block comprising a ratchet-wheel, a pawl, means for actuating the pawl to advance the ratchet-wheel when a car enters the block, a detent for retaining the ratchet-wheel in advanced position, and means for holding the detent out of engagement with the ratchet-wheel until the signal is set, substantially as described.

25. A railway block-signal system, having, in combination, a signal, means for setting the signal when a car enters a block and for restoring the signal when a car leaves the block, a controller acting to prevent the return of the signal until the last car leaves the block, means for moving the controller in a direction to prevent the return of the signal when a car enters the block, means for retaining the controller in the position to which it is moved, and a signal for indicating such movement controlled by said retaining means, substantially as described.

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

WINTHROP M. CHAPMAN.

Witnesses:
ALFRED H. HILDRETH,
FRED O. FISH.