No. 875,313. PATENTED DEC. 31, 1907.

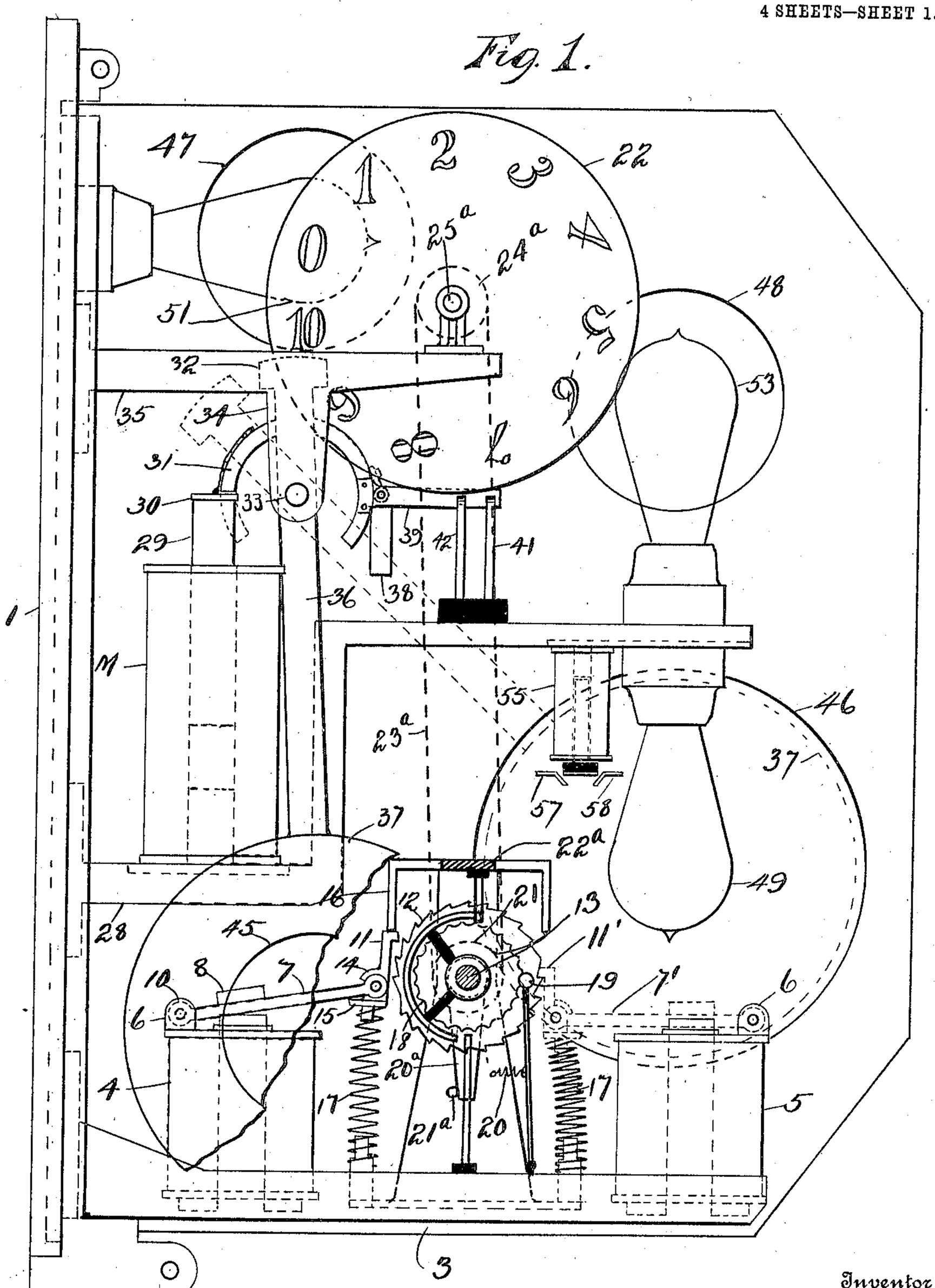
A. BEVAN.

BLOCK SIGNAL APPARATUS.

APPLICATION FILED APR. 18, 1907.

4 SHEETS—SHEET 1.

Fig. 1.



Witnesses

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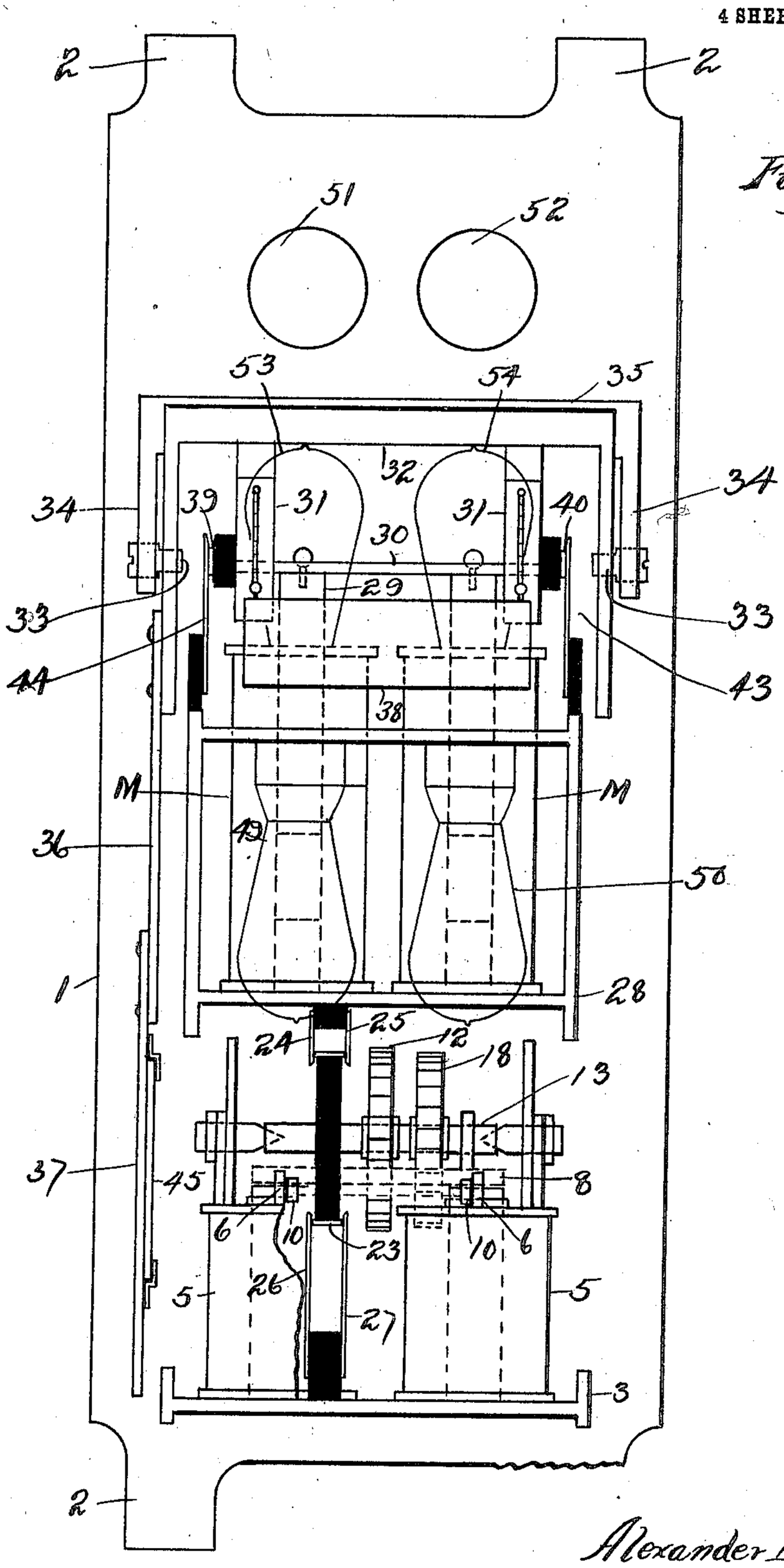
4 SHEETS—SHEET 2.

Fig. 2.



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4 SHEETS—SHEET 3.

Fig 3

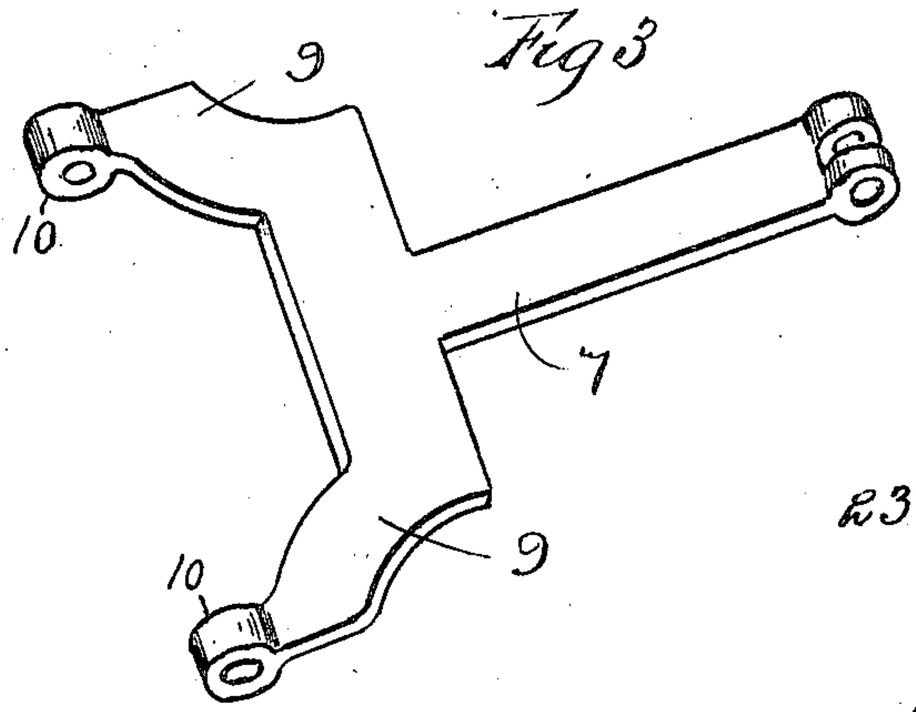


Fig 4.

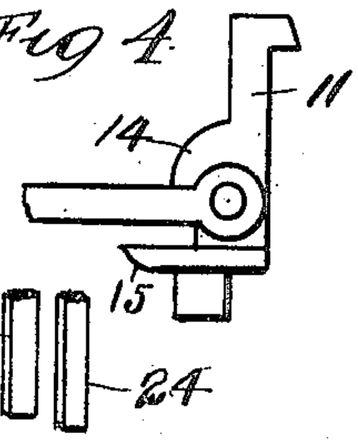
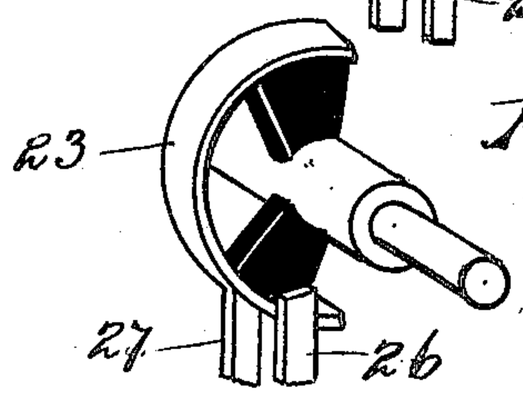


Fig. 5.



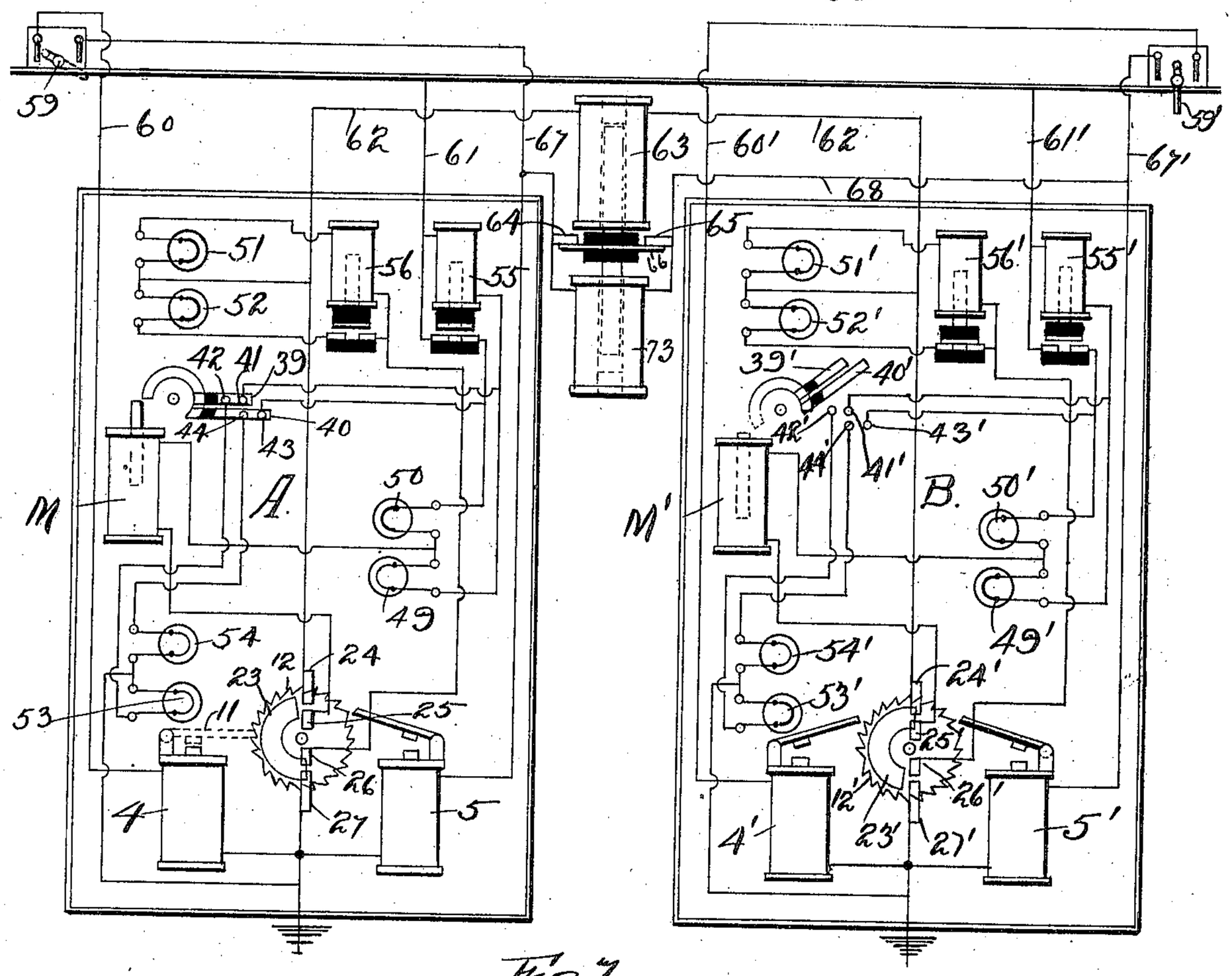


Fig. 7.

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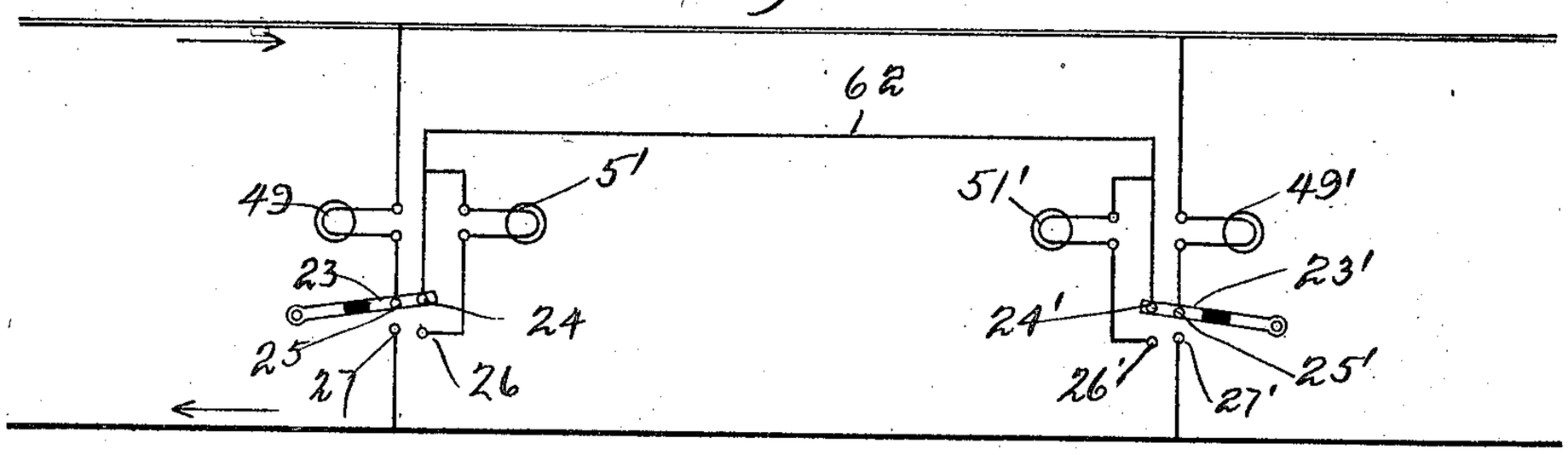
4 SHEETS—SHEET 4.

Fig 9



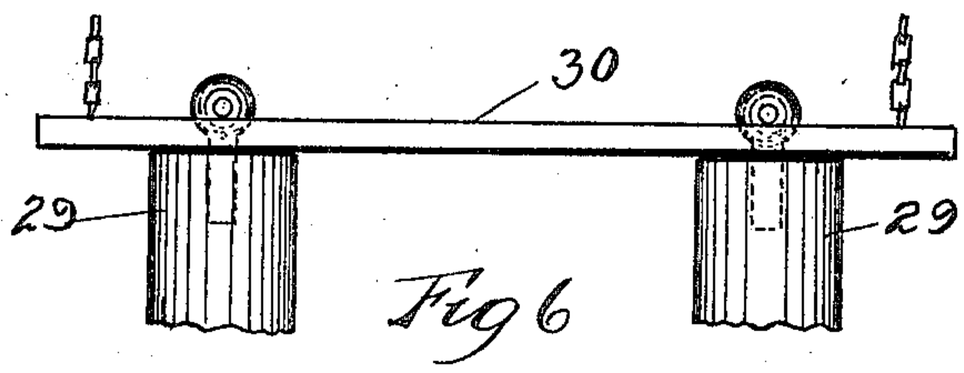


Fig 6

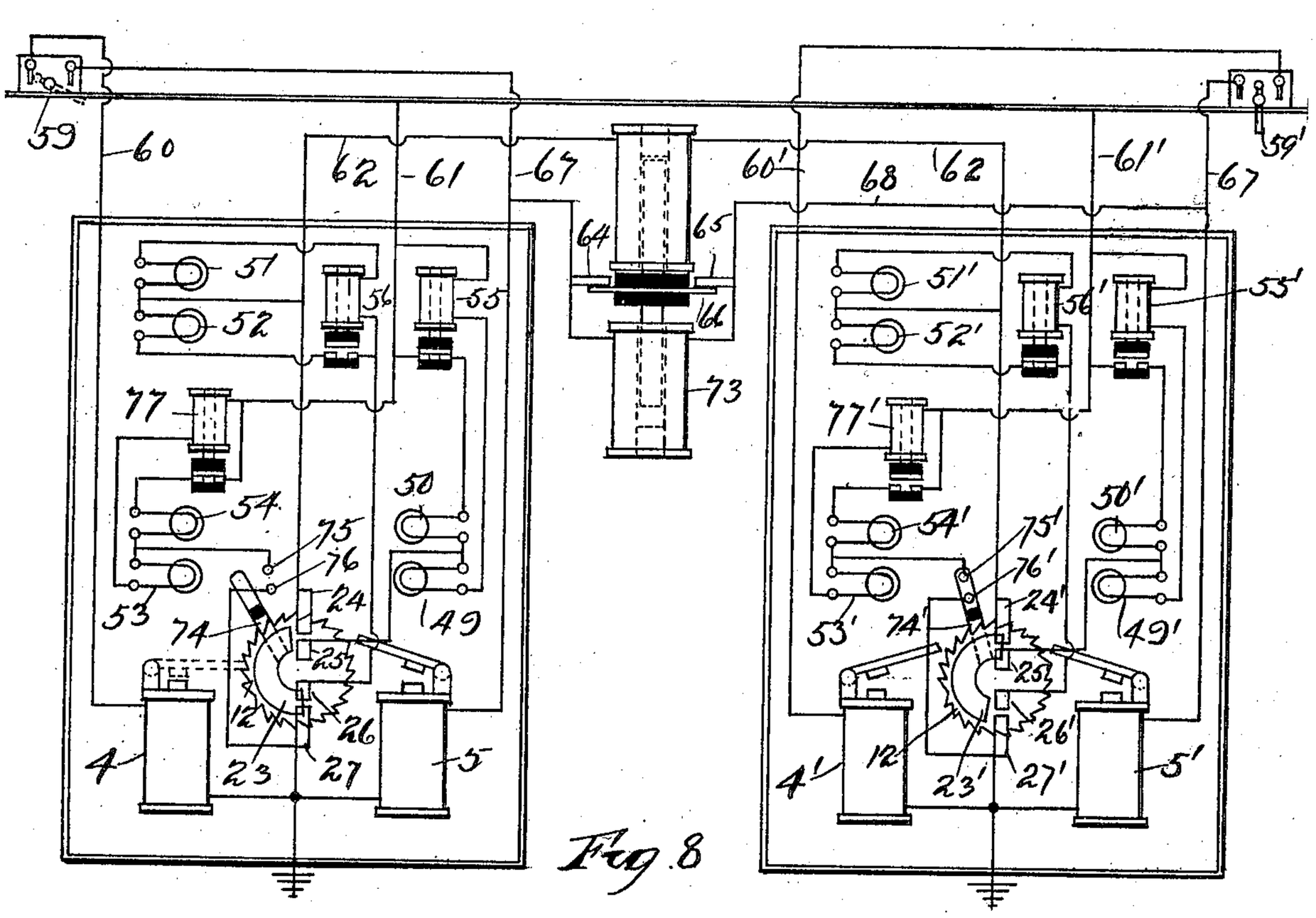


Fig. 8

Witnesses

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UNITED STATES PATENT OFFICE.

ALEXANDER BEVAN, OF PROVIDENCE, RHODE ISLAND.

BLOCK-SIGNAL APPARATUS.

No. 875,313. Specification of Letters Patent. Patented Dec. 31, 1907.

Application filed April 18, 1907. Serial No. 368,877.

To all whom it may concern:

Be it known that I, ALEXANDER BEVAN, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Block-Signal Apparatus, of which the following is a specification, reference being had therein to the accompanying drawing.

The present invention relates to a railway block signaling system in which the signals are automatically operated by the passing cars to indicate the presence or absence of a car or cars in the block, as well as the direction in which any car in the block may be moving. The system is equally well adapted for use on single track trolley roads to warn cars from entering the same block from opposite directions, and on double track roads to warn cars not to enter an occupied block ahead.

A complete set of signaling apparatus consists of two signals and two circuit closers, one of each located at each end of a block, so arranged that any car on entering a block operates the mechanism to display a danger signal at the farther end of the block, and a safety signal at the entering end. These two signals are mutually dependent, so that under normal conditions neither can appear without the other; and under no conditions possible can the safety signal appear without the simultaneous display of the danger signal.

The improvements herein claimed have particular reference to a simplified arrangement of the signal mechanism whereby the system may be operated with or without a movable target, and also to the method of operating and controlling the electric circuits of the system; the special object of which is to prevent the derangement of the system by irregular movements of the cars, such as entering and leaving a block from the same end.

With my present construction the system readily permits of two methods of signaling, either one of which may be converted into the other without change of the essential arrangements; first, by simply lighting and extinguishing the signal lamps, and second, by introducing magnetically operated targets whose individual circuits are automatically controlled by the lamp circuit.

The object of the above-mentioned arrangements is to provide a signaling system which is adapted to meet not only the varying requirements of different railway systems, but also the varying conditions in different parts of the same system. The first method is especially suited to spacing cars or trains on double track roads, while the second is particularly adapted to blocking cars or trains on single track roads. In both of these methods means have been provided for automatically clearing one or both signals from either end of the block as operating conditions may require. This is accomplished by introducing into the main signal circuit a magnetically operated circuit closer whose function is to maintain a closed electric connection between the clearing magnet circuits while the signal circuit is closed, so that both these magnets will operate in multiple from either end of the block whenever the signal circuit is closed, but will operate independently when the signal circuit is open. This is effected preferably by the use of two plunger magnets arranged to act oppositely on the same core, but may also be successfully accomplished by retarding the motion of the core by a plunger moving in a closely fitting cylinder, or other well known means of checking or retarding motion.

Distinctly novel features are claimed. 1. In a device to indicate the number of cars in a block. 2. In a clear signal to be displayed at each end while the block is clear. 3. In grounding the home signal when the first car enters the block, to prevent the possibility of a false safety signal. 4. In the method of combining and controlling the various lamp and target circuits. 5. In the means for operating both the clearing magnets either in multiple or separately.

The purpose and advantage of the above-mentioned features will be made clear in connection with the detailed description of the operation of the system, making reference to the accompanying drawings.

In all of these drawings like characters refer to corresponding parts.

Figure 1— is a side elevation of the signal including the target. Fig. 2— is a front elevation of the same. Fig. 3— is a detail perspective view of the armature frame. Fig. 4— is a detail of the pawl showing the same pivoted in the end of said frame. Fig. 5— is the insulated contact segment and its spring terminals. Fig. 6— is a detail of the target armature and core connection. Fig. 7— is a wiring diagram of the complete system. Fig. 8— is a wiring diagram omitting

the targets. Fig. 9— is a simple wiring diagram showing the main signal connections only.

Referring to the drawings, at 1 is shown the base to which is secured the signal operating mechanism. This base is provided at both ends with lugs 2—2 by means of which the same may be supported in position on a pole or other suitable location for the proper display of the signals.

Secured to the lower bracket 3 are two duplicate pairs of magnets 4—4 and 5—5, together with the counting device and circuit controller which said magnets operate. The magnets 4—4 are energized through properly arranged circuits by cars entering the block, and 5—5 by cars leaving the block. Pivoted to an ear 6 on the head of each magnet is a cross-shaped frame 7 carrying the armature 8. Integral with, and extending backward from each end of the "cross bar" of said frame (see Fig. 3) is a curved arm 9 terminating in a lug 10, which lug is pivoted to ear 6. At the other end of the frame 7 is pivoted the pawl 11, whose function is to engage and rotate the ratchet wheel 12 mounted on shaft 13, the same being drawn downward by the magnet, and returned by the spring 17. Stop lug 14 on the pawl limits the backward motion of the same, and thus prevents the ratchet wheel from moving more than one notch with each operation of the magnet, while stop lug 15 is arranged to engage the under side of the frame 7 to limit the forward motion of the pawl, the upward stroke of the same being limited by the downwardly extending arm 16.

Magnets 5—5 are duplicates of 4—4 just described, the two pairs acting in a reverse manner upon the ratchet wheel 12. The pawl 11 on frame 7 is shown in its up or normal position, while pawl 11′ on frame 7′ is shown in dotted lines representing its position when the armature is drawn down by the magnets 5—5.

Mounted on the same shaft 13 with the ratchet wheel 12 is the detent wheel 18, against which the roller 19 is held by the tension of spring 20, the purpose of which is to hold the ratchet wheel in position when not acted upon by either of the pawls 11 or 11′. The teeth of this ratchet wheel are cut in opposite directions on its two halves, and an arm 20^a is provided to strike against the stop pin 21^a and prevent the wheel from being moved past the normal in one direction, and also to strike against the edge of frame 22^a above to limit its movement in the opposite direction.

One important feature of my invention is that means have been provided for indicating the number of cars that are in the block. This indicating means may be constructed in any desired or convenient form, and actuated in any desired or convenient manner without departing from the spirit and scope of my invention. The device illustrated is a simple and convenient means for accomplishing this object, which consists of a disk 22 containing a plurality of numbers, the same being adapted to be rotated with a step by step motion to bring the numbers before the light 51. This disk is rotatably mounted on the shaft 25^a and is actuated from the shaft 13 through the sprocket 21, belt 23^a and sprocket 24^a, said shaft being actuated through the closing of the electric circuits by the cars passing both into and out of the block. Carried also by this shaft 13, but insulated therefrom is the contact segment 23, the upper part of which normally bridges the terminals 24 and 25, but is rotated to leave terminals 24 and 25 and bridge terminals 26 and 27 by the first car to enter the block (see Figs. 5 and 7.)

Supported on the bracket 28 is a pair of plunger magnets M M magnetically connected at their lower ends of a back-iron. To permit a slight independent motion the plungers or cores 29 of these magnets are hung at their upper ends by a ball and socket joint from the armature 30, see Fig. 6, which in turn is flexibly connected to the curved arms 31 of the frame 32. Said frame is supported on an axis 33 to rotate freely between the hangers 34, attached to the bracket 35. Fastened to one leg of the frame 32 is the arm 36 carrying the red target 37, the main cross-bar of frame 32 thus acting as a counterpoise of the target 37. The weight 38 hung from said arms 31 is made to counterbalance the cores and their armature. Attached to the frame 32, and rotatable therewith, but insulated therefrom, are the metal fingers 39 and 40 which are caused to bridge terminals 41 and 42, and 43 and 44 when the target falls to the safety position, said terminals being in the circuit of the clear track, or "no signal" lamps mentioned in the next paragraph.

In the center of the target 37, which is colored red, is a disk of red glass 45, or other suitable transparent material, the whole arranged to show, when moved to the danger position, through the aperture 46 in the casing. During the day danger is thus indicated by the display of a red target, and at night by a light shining through the red center. At 47 is a green glass window through which a lamp is visible when lighted to indicate safety, while at 47 is a window of yellow glass through which a lamp is visible when lighted to indicate a clear signal or "no signal", the color distinguishing it from other nearby lights.

Opposite each of the three apertures 46, 47, 48 is a pair of lamps 49—50, and 51—52 and 53—54, so that when lighted their light is visible through their respective apertures. The rear lamp of each pair, *i. e.*, 50, 52 and

54 is a reserve lamp arranged to be automatically lighted by means of the magnets 55 and 56, when for any reason either of the regular lamps 49, 51 or 53 fails to light. The terminals 57 and 58, forming a part of the reserve lamp circuit in each case, are declined toward each other to make a surer and better electrical contact when the bridge drops to close these lamp circuits.

It should be noted that as shown in Fig. 7, the reserve lamps in both the danger signal and the clear signal circuits are controlled by the same magnet 55, and the clear signal circuit is opened and closed by the movement of the target, while in the arrangement shown in Fig. 8 the clear signal is on an individual circuit, controlled by the movement of the contact bar 74 which is arranged to move in time with the ratchet wheel to make and break the clear signal circuit at the terminals 75—76. These two arrangements may be so combined that the clear signal will never show in either box while either the safety or the danger signal is displayed, but will show in both boxes at all other times.

Referring now to wiring diagram Fig. 7, the operation is as follows: A car entering from the left moves the contact pendant 59 to close the circuit from the trolley wire through wire 60 to magnets 4—4. Pawl 11 is thus drawn downward moving ratchet wheel 12 one notch, causing the contact segment 23 to leave terminals 24 and 25, and bridge terminals 26 and 27, thus grounding the signal circuit in the home signal A. This operation establishes the signal circuit through wire 61′ in signal B, lamp magnet 55′, danger lamp 49′, target magnet M′, terminals 25′ 24′, yoke wire 62, magnet 63, safety lamp 51, magnet 56 and terminals 26—27, to ground. Magnet M′ is thus energized to raise the target to the danger position in front of lamp 49′, and at the same time the core of magnet 63 is raised to connect terminals 64 and 65 by bridge 66. The wires 67 and 67′ being thus joined by wire 68, when the car moves contact pendant 59′ to the right on leaving the block, both the clearing magnets 5—5 and 5′—5′ will be energized, and ratchet wheel 12 will be returned to its normal position; but as ratchet wheel 12′ is already in its normal position, no motion is produced as a stop is provided to prevent rotation to the right beyond the normal.

When more than one car enters the block each follower energizes magnet 4—4 to move the ratchet wheel one step farther in the same direction, maintaining the bridge between terminals 26 and 27 until a predetermined number has entered, when the stop arm 20ª engages the stop bar 22ª (see Fig. 1) preventing further rotation in that direction. Each car on leaving the block energizes magnet 5—5 as previously explained to return the ratchet wheel 12 one notch, so that only the last car can re-open the signal circuit and restore normal conditions. It will now be apparent that if several cars enter from the same end of the block the signals will be cleared when all the cars have passed out, whether from the same end or not. If, however, a car should enter by mistake, or otherwise after the signal circuit has already been established by a car entering from the opposite end, both signals would be grounded, thus breaking the signal circuit. Under these conditions magnet 63 would be deënergized and the common core would drop to its lowest position in magnet 73, thus opening the electric path between terminals 64 and 65, but leaving a path through the high resistance magnet 73. Now if the car, which has wrongly entered, say from the right, backs out, magnet 5′—5′ will be energized to reëstablish the signal circuit just opened through terminals 25′ and 24′, while the very high resistance in magnet 73 prevents sufficient current flowing through to operate magnet 5—5, but allows the flow of sufficient current to prevent the common core from being drawn upward by magnet 63. As soon, however, as the contact is broken at pendant 59′ magnet 73 is deënergized and the common core will be drawn up by magnet 63 to again bridge terminals 64 and 65, thus leaving the system in exactly the same condition as it was before the second car entered from the wrong end.

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

1. In a block signaling system, the combination of a signal box, a register for indicating the number of cars in the block rotatably mounted in said box, a step by step magnetically actuated counting device also mounted in said box, and mechanical means connecting said counting device with said register, whereby the latter is rotated by the former as each car enters or leaves the block.

2. In a block signaling system, the combination of a signal box, a register for indicating the number of cars in the block rotatably mounted in said box, a step by step magnetically actuated counting device also mounted in said box, and a flexible driving connection between said counting device and said register, whereby the latter is rotated by the former as each car enters or leaves the block.

3. In a block signaling system, a signal box at each end of the block, a clear signal normally displayed in each box, a rotatable disk with numerals thereon in each box, means for displaying said safety signal in either box and said danger signal in the opposite box simultaneously by a car entering the block, means for displaying the proper numeral on

said disk to indicate the number of cars that have entered the block, means for removing the clear signals while the other signals are displayed, and means for restoring the normal conditions when the last car leaves the block.

4. In a block signaling system, a signal box at each end of the block, a clear signal normally displayed in each box, a safety signal and a danger signal in each box, the safety signal in either box and the danger signal in the opposite box being adapted to be operated in series circuit, means for operating said safety signal in either box and said danger signal in the opposite box simultaneously by a passing car, and means for removing the clear signals while the other signals are displayed.

5. In a block signaling system, a signal box at each end of the block, a clear signal normally displayed in each box, a safety signal and a danger signal in each box, the safety signal in either box and the danger signal in the opposite box being adapted to be operated in series circuit, means for displaying said safety signal in either box and said danger signal in the opposite box simultaneously by a car entering the block, means for removing the clear signals while the other signals are displayed, and means for restoring the normal conditions when the car leaves the block.

6. In a block signaling system, a signal box at each end of the block containing a safety signal lamp, a danger signal indicating target and a clear signal lamp normally lighted in each box, means for lighting the safety signal lamp by a car entering the block, and simultaneously setting the danger signal target at the distant end of the block, means for extinguishing the clear signal lamp when the target in that box swings to its danger position, and means for extinguishing the safety light at the home box and relighting the clear light at the distant box when the target swings from its danger indicating position.

7. In a block signaling system, a signal box at each end of the block containing a safety signal lamp, a danger signal lamp and a red target and a clear signal lamp normally lighted in each box, means for lighting the safety signal lamp by a car entering the block and simultaneously setting the danger signal target at the opposite end of the block, means whereby the swinging of the target in each box to and from its danger position controls the extinguishing and lighting of the clear signal lamp in its individual box.

8. In a block signaling system, a signal box at each end of the block containing a safety signal lamp, a danger signal lamp, a red target and a clear signal lamp normally lighted, means operated by an entering car to light the danger lamp in the distant box and a saftey lamp in the home box, and also throw the distant target to the danger position, and means whereby the movement of said target to the danger position extinguishes the clear signal in that box.

9. In a block signaling system, a signal box at each end of the block containing a safety signal lamp, a danger signal lamp, a red target and a clear signal lamp normally lighted, means operated by an entering car to light the danger lamp in the distant box and a safety lamp in the home box, and also throw the distant target to the danger position, means whereby the movement of said target to the danger position extinguishes the clear signal in that box, and means whereby the return of said target causes said clear signal lamp to be relighted.

10. In a block signaling system, a safety signal lamp and a danger signal lamp on the same circuit, a clear signal lamp on a separate circuit, means for controlling the first-mentioned circuit by the movement of the cars, and means for controlling the second circuit by the first.

11. In a block signaling system, a safety signal in one box and a danger signal in the opposite box on the same circuit, a clear signal and a target magnet in each box on separate circuits, means for controlling the first mentioned circuit by the cars, and means for controlling the other two circuits by the first.

12. In a block signaling system, a safety signal lamp, a danger signal lamp and a target magnet in the same circuit, a clear signal lamp on a separate circuit, means for controlling the first mentioned circuit by the movement of the cars, and means for controlling the second circuit by the first.

13. In a block signaling system, a safety signal lamp and a danger signal lamp and a target magnet in the same circuit, a target actuated by said magnet, a clear signal lamp on a separate circuit, means for controlling the first-mentioned circuit by the movement of the cars, and means for controlling the second circuit by the movement of said target.

14. In a block signaling system, two danger signals connected on one side to a feed wire, and on the other side to each other by a conductor, two safety signals normally connected on one side to said conductor, two ground or return terminals, magnetically actuated means operated by each entering car for disconnecting either danger signal from the other and grounding the open terminal of the corresponding safety signal, thus completing the signal circuit through said safety signal from the opposite danger signal by the first car to enter the block, and means operated by each outgoing car to restore the signal to normal only when the last car leaves the block.

15. In a block signaling system, two danger signals permanently connected on one side to a feed wire, and on the other side to

each other through two normally closed switches and a conductor, two safety signals permanently connected on one side to said conductor and on the other side to an open terminal, two ground or return terminals, means actuated by the entering car for moving one of said switches to break the connection between the danger signals and connect the open terminals of the corresponding safety signal with said ground or return terminal, thus completing a signal circuit through said safety signal from the opposite danger signal, and means operated by each outgoing car whereby the signals will be restored to normal only when the last car leaves the block.

16. In a block signaling system, two danger signals permanently connected on one side to a feed wire, and connected on the other side to each other through two normally closed switches and a conductor, two safety signals permanently connected on one side to said conductor and on the other side to an open terminal, two ground or return terminals, two oscillatory counters controlling said switches, means actuated by each entering car whereby one of said oscillating counters is operated to move its switch to break the connection between the danger signals and connect the open terminal of the corresponding safety signal with said ground or return terminal by the first car to enter a block, thus completing and maintaining a signal circuit through said safety signal from the opposite danger signal, and means operated by each outgoing car whereby the signals will be restored to normal only when the last car leaves the block.

17. In a block signaling system two signal boxes, a signal setting circuit and a signal clearing circuit in each box, a signal operating circuit including a conductor between the two boxes, and means for automatically maintaining an electric connection between the signal clearing circuits only while the signal operating circuit is closed.

18. In a block signaling system two signal boxes, a setting magnet circuit and a clearing magnet circuit in each box, a signal operating circuit including a single conductor between the two boxes, and automatic means for maintaining an electric connection between the clearing magnet circuits only while the signal operating circuit is closed.

19. In a block signaling system, two signal boxes, a setting magnet circuit and a clearing magnet circuit in each box, a signal operating circuit including a single conductor between the two boxes and electromagnetic means for maintaining an electric connection between the clearing magnet circuits only while the signal operating circuit is closed.

20. In a block signaling system, two signal boxes, a setting magnet circuit and a clearing magnet circuit in each box, a signal operating circuit including a single conductor between the two boxes and electro-magnetic means for operating the clearing magnet circuits in multiple only while the signal operating circuit is closed.

21. In a block signaling system two signal boxes, a signal setting circuit and a signal clearing circuit in each box, a signal operating circuit including a conductor between the two boxes, and means including a solenoid for automatically maintaining an electric connection between the signal clearing-circuits only while the signal operating circuit is closed.

22. In a block signaling system, two signal boxes, a setting magnet circuit and a clearing magnet circuit in each box, a signal operating circuit including a single conductor between the two boxes and electromagnetic means for operating the clearing magnets simultaneously when the signal circuit is closed, and independently when the signal circuit is open.

23. In a block signaling system two signal boxes, a setting magnet in each box, a clearing magnet in each box, a signal circuit including a low resistance magnet between the two boxes, an electric conductor including a high resistance magnet between the clearing magnet circuits, means actuated by the low resistance magnet for short-circuiting the high resistance magnet only while the signal circuit is closed.

24. In a block signaling system two signal boxes, a setting magnet in each box and a clearing magnet in each box, a signal circuit including a low resistance solenoid between the two boxes, an electric conductor including a high resistance solenoid between the clearing magnet circuits, a common core movable within the solenoids, said core carrying an insulated contact for short-circuiting the high resistance solenoid only while the signal circuit is closed.

25. In a block signaling system, two signal boxes, a setting magnet in each box and a clearing magnet in each box, a signal circuit including a low resistance solenoid between the two boxes, an electric conductor including a high resistance solenoid between the clearing magnet circuits, a common core movable within the solenoids, said core carrying an insulated contact for short-circuiting the high resistance solenoid only while the signal circuit is closed, and means for preventing said short-circuiting while either clearing magnet circuit is closed.

26. In a block signaling system, two signal boxes, a setting magnet in each box, a clearing magnet in each box, a signal circuit including a low resistance magnet between the two boxes, an electric conductor including a high resistance magnet between the clearing magnet circuits, means actuated by the low resistance magnet for short-circuiting the

high resistance magnet only while the signal circuit is closed, and means including said high resistance magnet for preventing said short-circuiting while either clearing magnet circuit is closed.

27. In a block signaling system, two signal boxes, a setting magnet and a clearing magnet in each box, a signal circuit including a low resistance magnet between the two boxes, an electric conductor including a high resistance magnet between the clearing magnet circuits, means for breaking the signal circuit through the low resistance magnet when a car enters an already occupied block against the signal, means including the high resistance magnet whereby the signal circuit just opened in one box may be closed in said box to restore the signals in both boxes to their former condition.

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

ALEXANDER BEVAN.

Witnesses:
HOWARD E. BARLOW,
E. I. OGDEN.