No. 876,684. PATENTED JAN. 14, 1908.

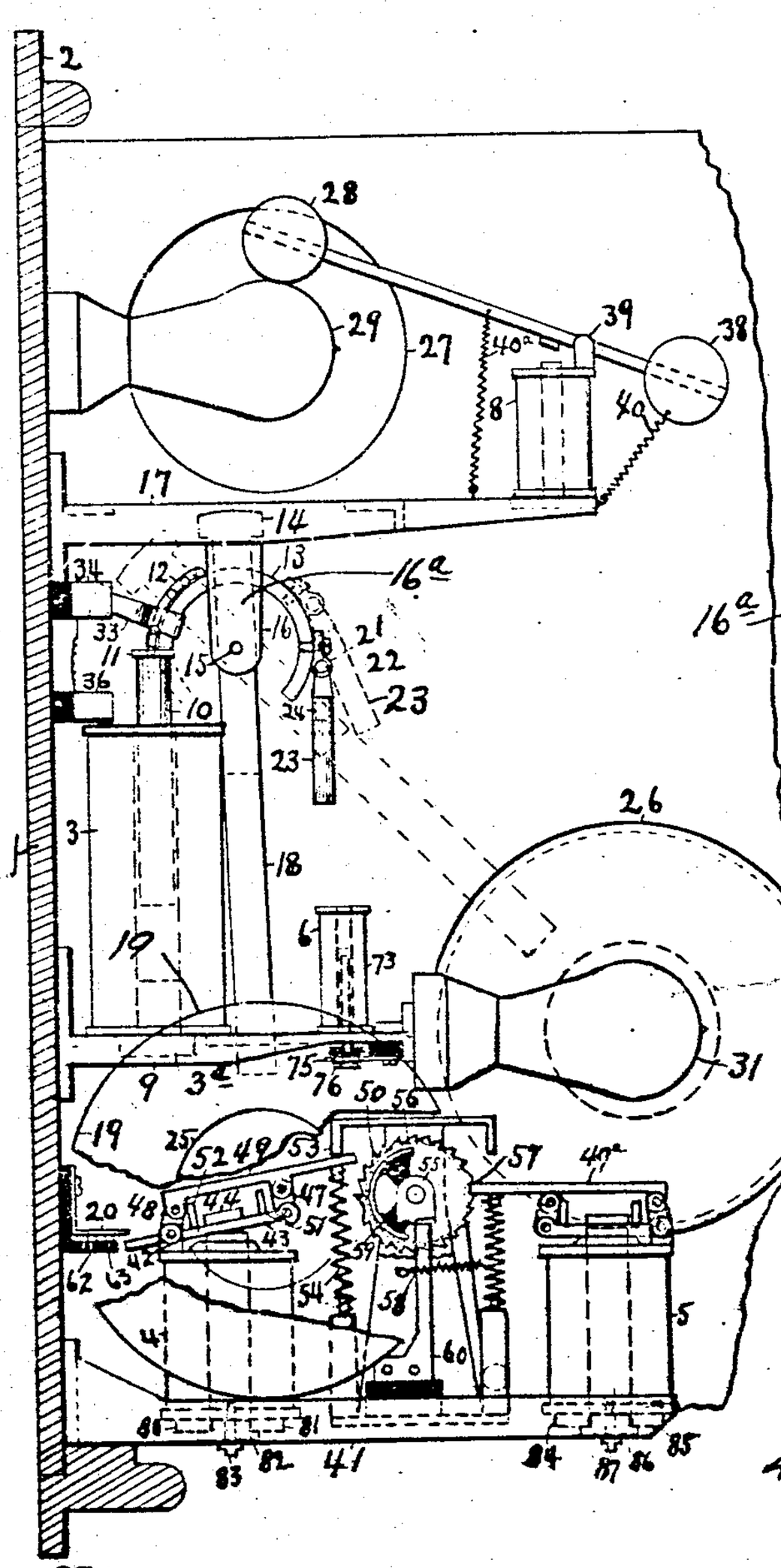
A. BEVAN.

BLOCK SIGNAL APPARATUS.

APPLICATION FILED MAR. 8, 1907.

4 SHEETS—SHEET 1.

Fig. 1.

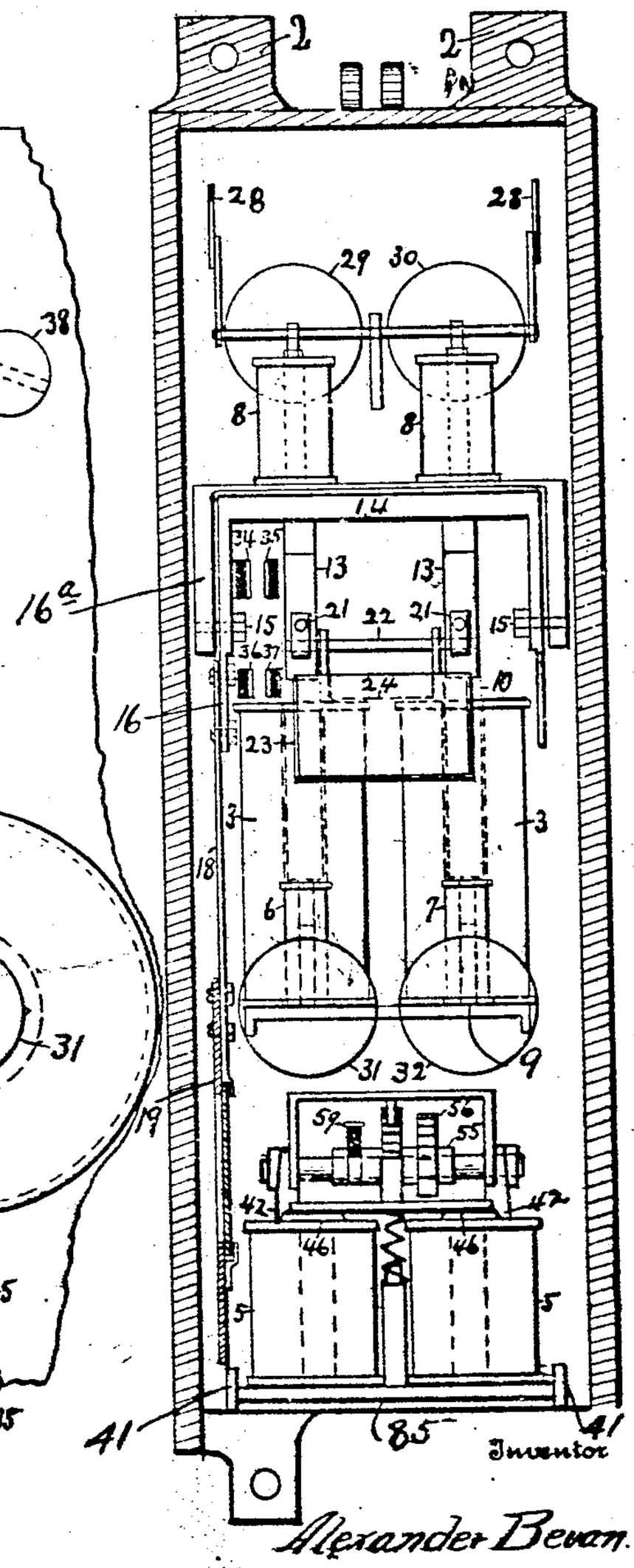


Witnesses

E. J. Ogden

A. L. Shakespeare

Fig. 2.



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By

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4 SHEETS—SHEET 2.

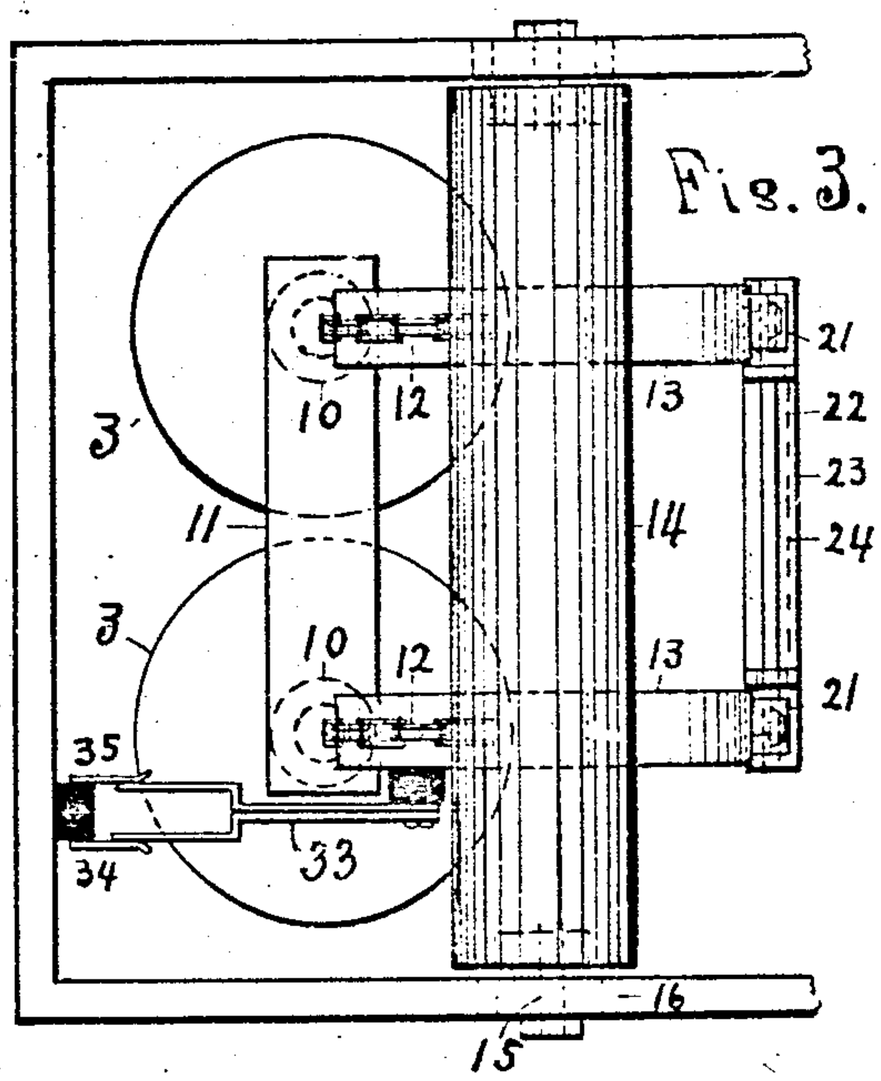

Fig. 3.

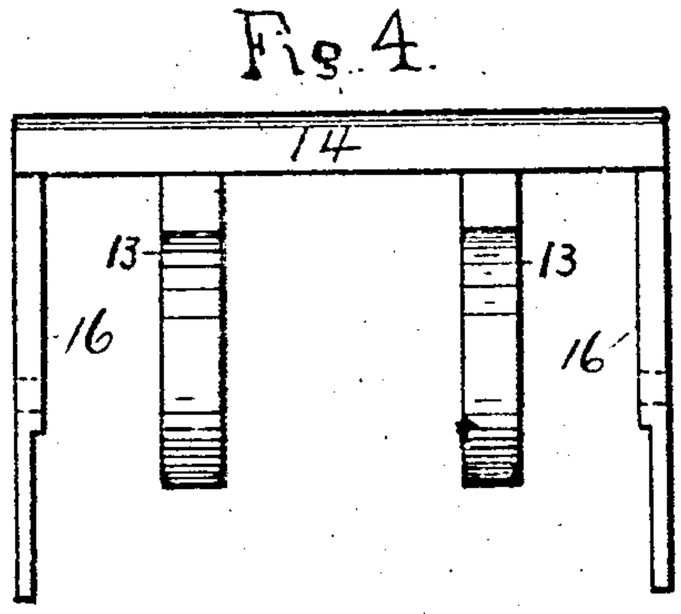

Fig. 4.

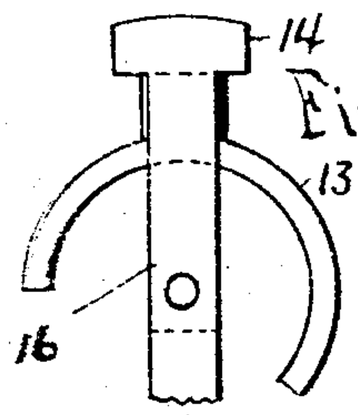

Fig. 5

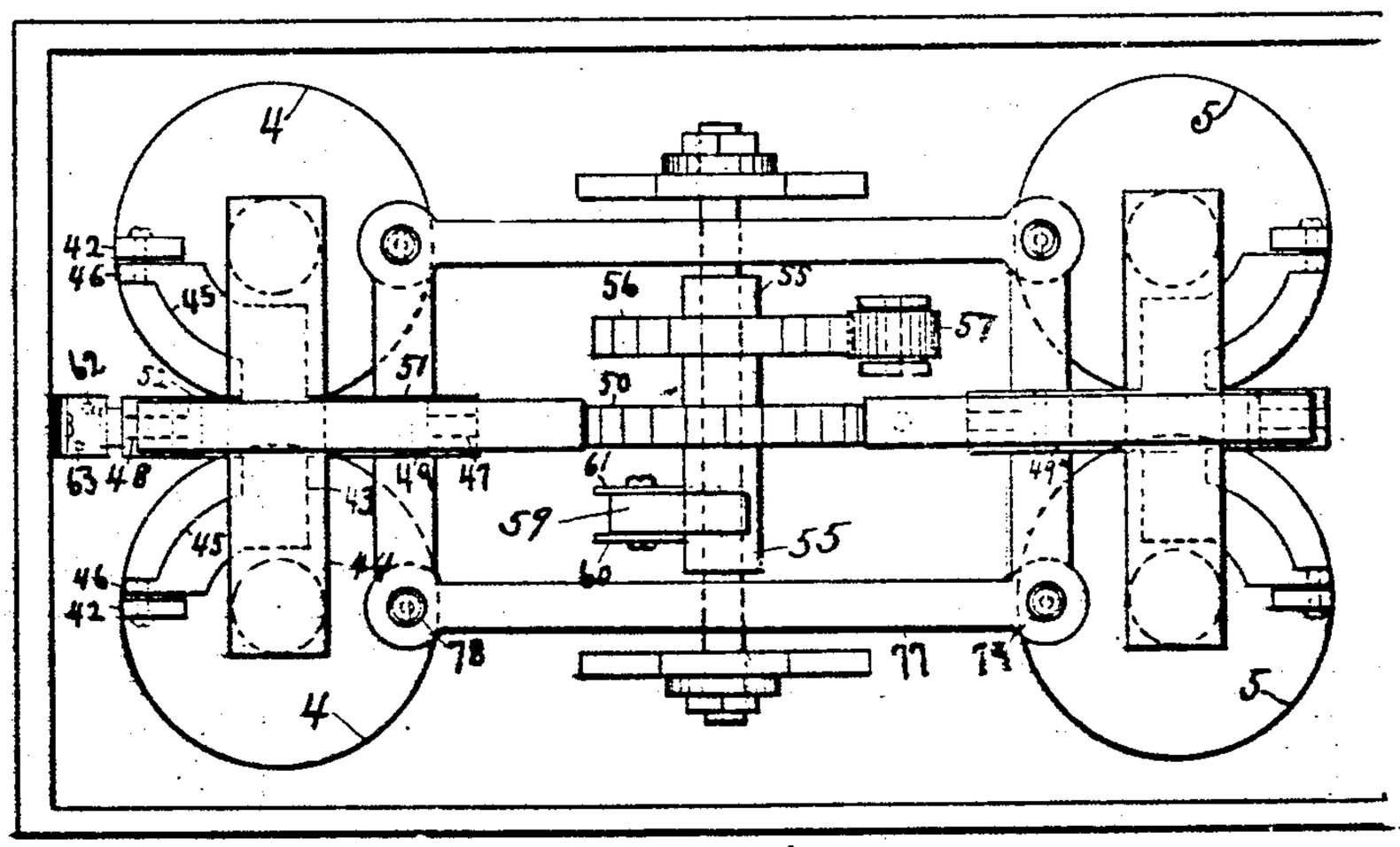

Fig. 6.

Witnesses
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4 SHEETS—SHEET 3.

Fig. 11.

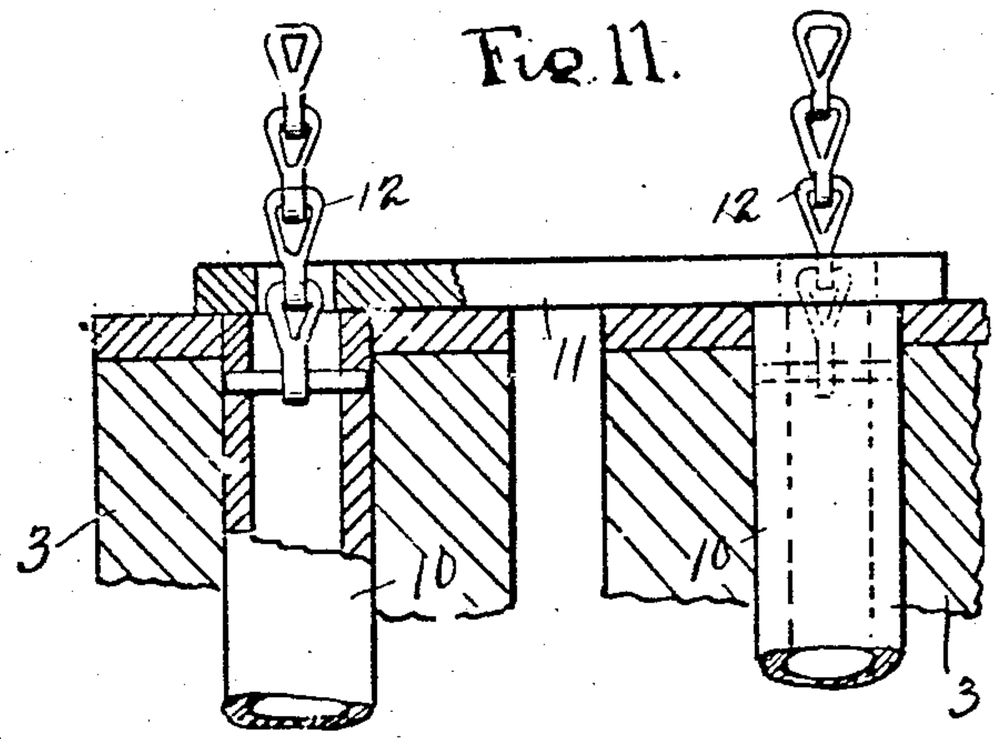


Fig. 10.

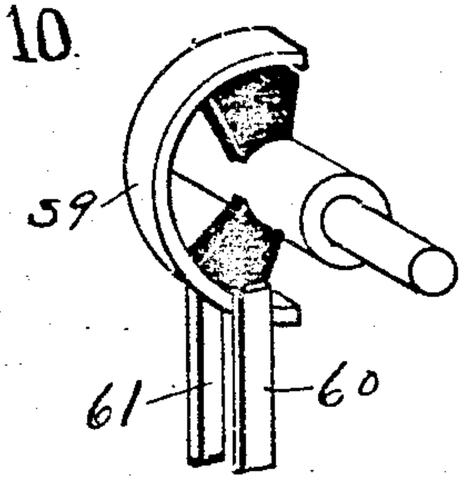
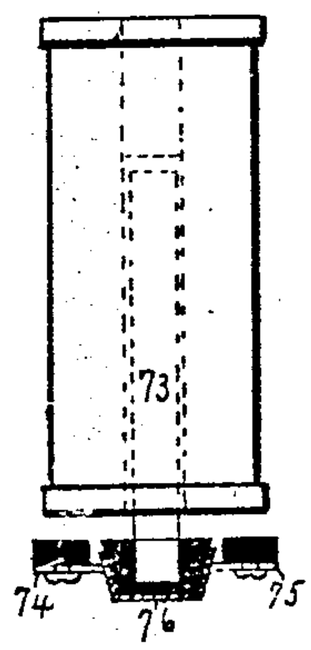


Fig. 8.



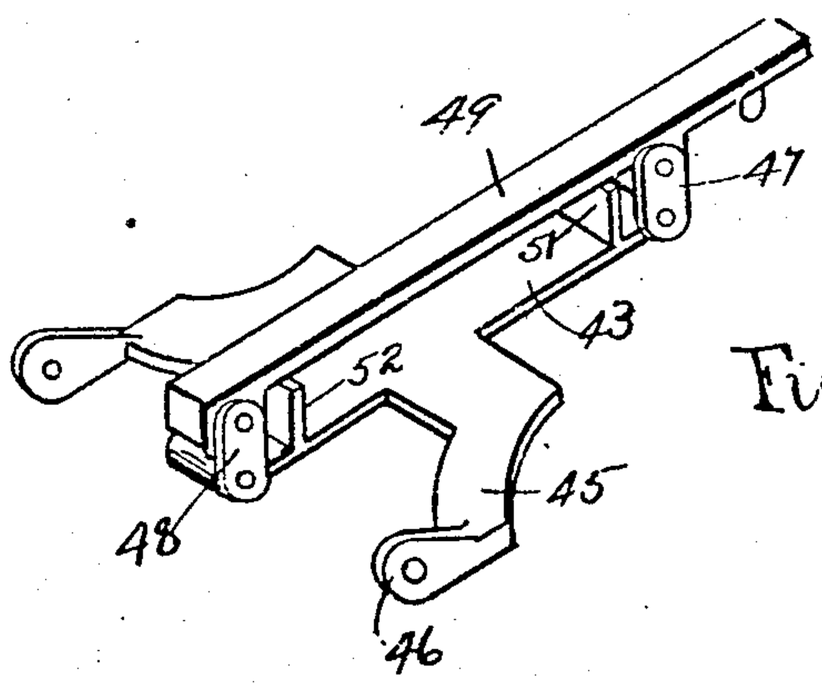


Fig. 9.

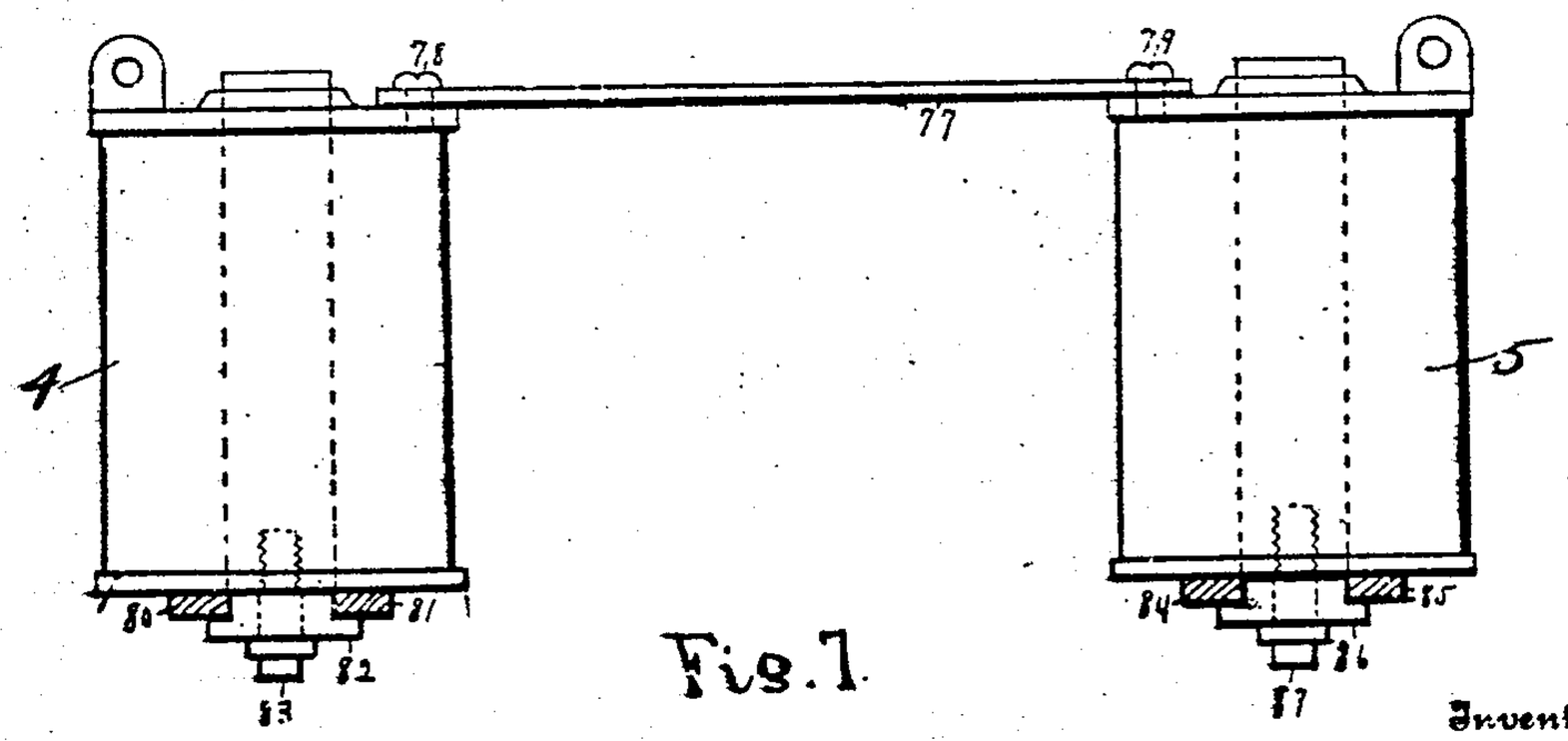


Fig. 7.

Witnesses

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4 SHEETS—SHEET 4.

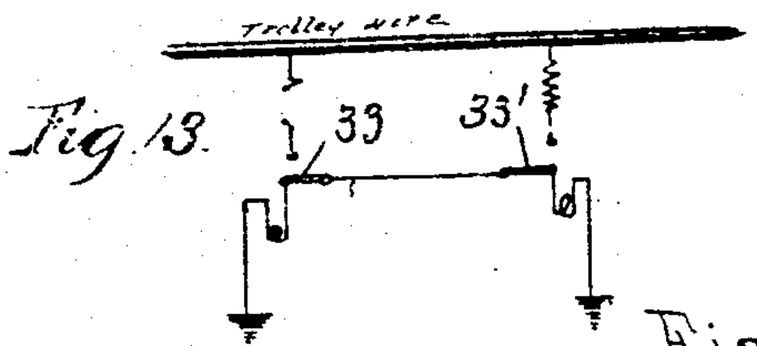


Fig. 13.

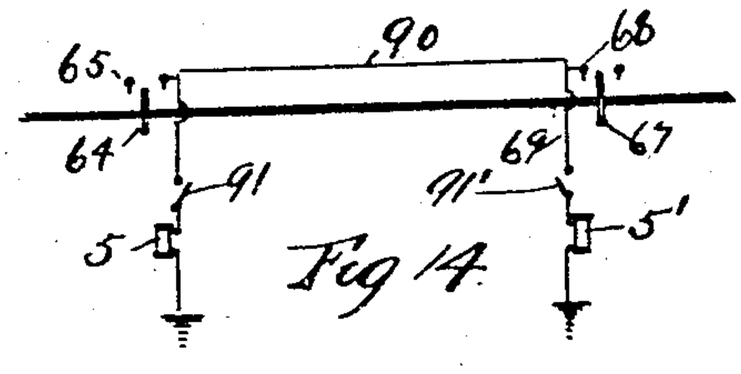
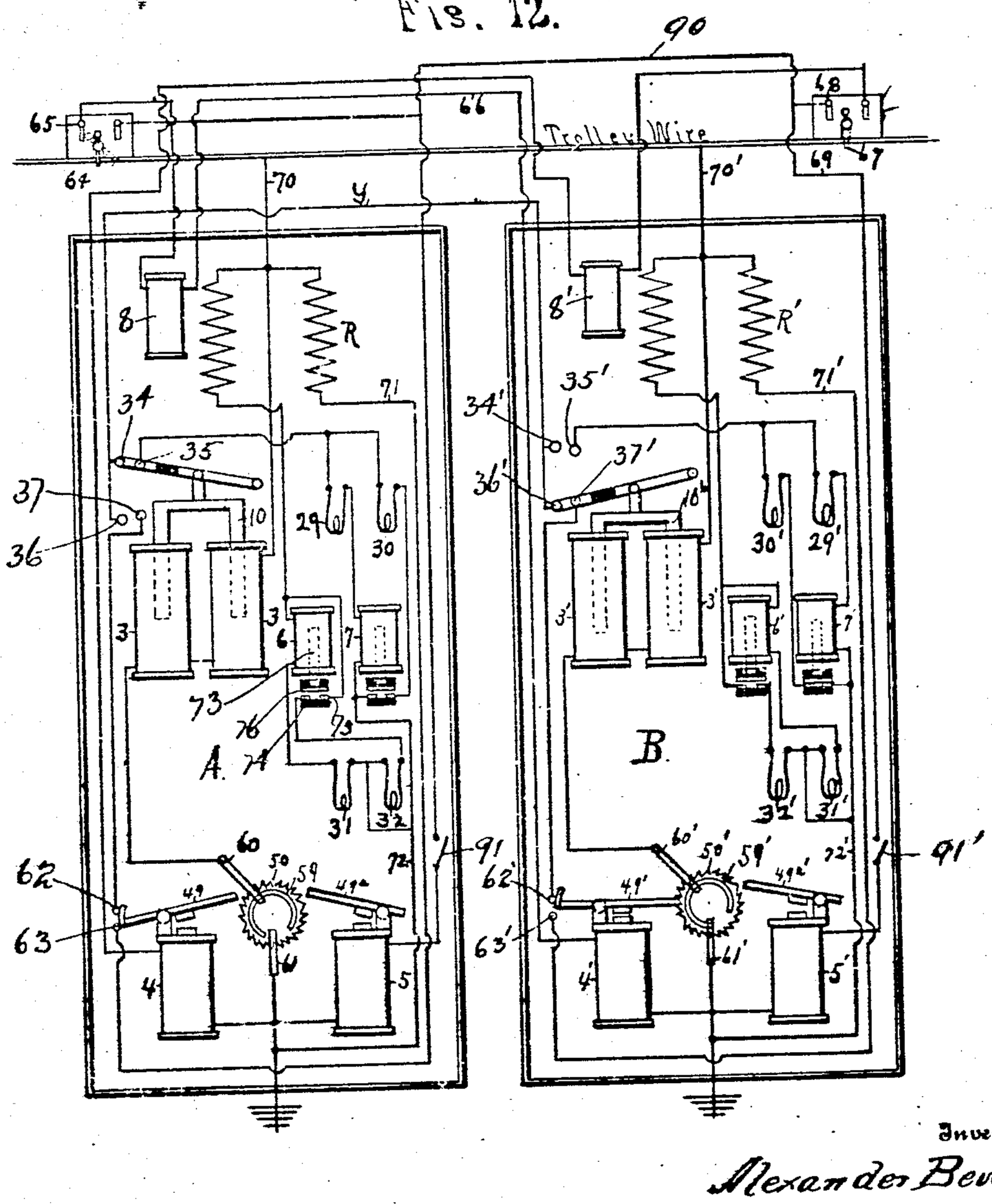


Fig 14.

Fig. 12.



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UNITED STATES PATENT OFFICE.

ALEXANDER BEVAN, OF PROVIDENCE, RHODE ISLAND.

BLOCK-SIGNAL APPARATUS.

No. 876,684. Specification of Letters Patent. Patented Jan. 14, 1908.

Application filed March 8, 1907. Serial No. 361,211.

To all whom it may concern:

Be it known that I, ALEXANDER BEVAN, a citizen of the United States, residing at the city of 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.

My invention relates to railway block-signaling systems, in which the signals are automatically operated by a passing car to indicate the presence or absence of a car or cars on the block, as well as the direction in which any car on the block may be moving. The system is particularly adapted for use on single track trolley roads to warn cars from entering the same block from an opposite direction, but may also serve to "space" cars or trains on double track roads.

As installed on single track roads, a 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 the block operates the mechanism to display a danger signal at the farther end of the block, and also a cautionary or permissive signal at the entering end; the permissive signal being absolutely dependent for its appearance on the proper operation of the danger signal at the opposite end.

The improvements herein claimed relate particularly to the manner of constructing and operating the danger signal, the cautionary or permissive signal, and the counting mechanism; and have for their object certainty and efficiency of operation and comparative freedom from the dangers incident to lightning or high voltage static discharges, thus reducing the possibility of failure to properly operate, to a minimum.

In my present construction the target is moved to, and held at the danger position by power; in other words the electric circuit of the target magnets is normally open, being closed by the first car to enter a block, and opened again by the last car to leave the block, hence the magnets are using current, and are thus exposed to damage from lightning or static discharges only while the block is occupied. With this arrangement the danger indication of the target is positive evidence that the system is in working order, and that a passing car, (and not gravity), has operated it.

Owing to the wide variations of the voltage or electric pressure on the trolley line it has been found very difficult in practice to secure positive action of the target when the voltage is very low and still avoid such violent action as to injure the bearings and derange the movable parts when the voltage is high. To meet this difficulty the moving parts are made as light as is consistent with the required strength, and then efficiently counterbalanced to secure their proper action.

Another feature of practical advantage is the loose connection of the armature held in place across the tops of the cores of the target magnets. Arranged thus, the armature increases the magnetic strength or pull of the cores, and yet allows each core the necessary latitude of movement within its own solenoid to prevent binding, or friction, which binding would be almost certain to result if the cores were rigidly fastened to the armature; since this latter arrangement would require that the cores and the tubes of their solenoids be true and parallel, or else that the tubes of the solenoids be considerably larger than their cores, which would result in a marked loss of magnetic pull.

A further practical advantage is secured by using steel tubes as cores for the reason that they are lighter, and reach the point of magnetic saturation earlier than rods of the same size, so that while they exert a sufficient pull to operate the target when the voltage is low, the magnetic pull is not increased in proportion to the increased current through the magnet when the voltage is high, and hence the action is not so violent.

The purpose of my improvements in the method of operating the cautionary signal is to afford the motorman of each entering car a positive and easily recognizable indication that the signal mechanism has effectively operated. This may be accomplished by introducing an auxiliary magnet into the circuit of the signal-setting magnet, or into the circuit of the permissive lamp to impart motion to a disk or other visible object as evidence that the system has operated. I also claim an improved method of controlling the circuits of the cautionary or permissive signal by the action of the target as will be fully explained in my description of the operation of the system.

Another special feature is the method of constructing the rotatable parts of the counting mechanism, and the means for closing

and opening the target circuit, the details of which will be particularly described in connection with the drawings and wiring diagram illustrating the same.

An improvement is claimed also in the method of securing the operating magnets so that the magnets may be held rigidly in proper adjustment to the counting device, and may also be readily replaced in case of damage to the coils from lightning or other accidental cause.

The accompanying drawings will illustrate the construction and arrangement of parts as described.

Figure 1—is a side elevation of the signal with one side of the casing removed, and a portion of the opposite side broken away. Fig. 2—is a front elevation of the same with the case in section. Fig. 3—is a top view of the target magnets enlarged and the parts they operate. Fig. 4—is a front elevation of the target bearing frame. Fig. 5—is an end view of the same. Fig. 6—is a top view of the operating magnets and counting device. Fig. 7—is a side elevation of the operating magnets, showing the method of fastening the same in position. Fig. 8—is a rear view of the reserve lamp magnet showing the terminals and tapering contact. Fig. 9—is a perspective view of the pivoted arm with the swinging pawl mounted thereon. Fig. 10—is a detail showing the insulated semicircular contact 59 which makes and breaks the circuit to the target magnets, also showing the contact fingers engaged by said contact. Fig. 11—is an enlarged detail showing the construction and arrangement of the target magnets and their tubular cores, also their armature and the flexible means by which the cores are connected to the circular arms. Fig. 12—is a diagrammatical view showing the wiring of the system. Fig. 13—shows a simplified wiring diagram illustrating the cautionary lamp connections and the manner of inserting the resistance into the circuit by the operating of the switch finger 33. Fig. 14—shows a simplified wiring diagram of the operating magnet circuits as connected by wire 90.

In all the drawings like characters refer to corresponding parts, but as duplicate apparatus is shown in Fig. 12, the characters referring to the duplicate parts are designated by the prime mark.

Referring to the drawings, 1 designates 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 secured in position on a pole or other suitable location for the proper display of the signals.

At 3—3 is a pair of electro-magnets, technically known as the plunger type, supported on a bracket 9, and magnetically connected at their lower ends by the usual "back-iron" 3ª. The plungers or cores 10 of these magnets are in the form of tubes connected at their upper ends by link chains 12, or other flexible means, to the circular arms 13, as shown, which arms form integral parts of the counterbalancing frame 14. Said frame is pivoted on an axis 15, to swing freely between the hangers 16ª, attached to the bracket 17. Resting by gravity across the tops of the cores, 10, is an armature 11 having holes near its ends through which the chains 12 pass to the cores, thus avoiding any tendency of the cores, as they move up and down in their solenoids, to bind or lock, as would be the case if they were rigidly attached to their armature. Fastened to one arm 16 of the frame 14 is the thin bar 18 which carries the target 19; the upper cross bar of the frame 14 thus acting as a counterpoise of the target 19.

Horizontally opposite the armature 11, are the links 21 fastened to the circular arms 13, through which links passes a rod 22. On said rod is hung a swinging weight 23, which serves to balance the cores and their armature. Weight 23 is provided with a cavity 24, to contain shot or other suitable material for producing a more perfect adjustment of the balance. The dotted lines show the position of the weight 23 when the target has been moved to the danger position. In this position of the weight it will be noted that the vertical line through its center of gravity has moved farther from the axis of rotation 15 and hence said weight is exerting a stronger downward pull to counterbalance the increasing pull of the cores as they are drawn within their solenoids, and will also exert a stronger pull to start the target downward when the circuit of the solenoids is broken.

Attached to the frame 14 and adapted to rotate therewith, but electrically insulated therefrom, is the spring forked finger 33, which serves to bridge alternately the terminals 34—35 and 36—37, see Figs. 3 and 1, terminals 34 and 36 being permanently electrically connected in the manner shown in Figs. 1 and 12. These terminals form a part of the electric circuit of the cautionary signals, as will be made clear by reference to the wiring diagram Fig. 12.

In the center of the target 19, which is colored red, is a disk of red glass 25, or other suitable transparent material, the whole arranged to show, when moved to the danger position, through the aperture 26, 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 27 is a second aperture in the case over a portion of which the disk 28 may be made to vibrate by the joint action of magnets 8—8 and the springs 40—40ª. Weight 38 is a

counterpoise of disk or screen 28 about the axis 39, and springs 40—40ª are adapted to give a vibratory motion to the screen after the magnets have produced a downward movement. Opposite each of the two apertures, 26 and 27 is a pair of lamps 29—30 and 31—32, so that when lighted their light is visible through their respective apertures. The rear lamp of each pair, *i. e.*, 30 and 32 is a reserve lamp arranged to be automatically lighted by means of magnets 6 or 7 when for any cause either of the regular lamps 29 or 31 fails to light.

Secured to bracket 41 are two pairs of magnets 4—4 and 5—5, and the counting device which they operate. These magnets are controlled through properly arranged circuits by the passing cars. Pivoted to an ear 42 on the head of each magnet is a cross-shaped frame 43, best shown in Fig. 9, which is adapted to carry the armature 44. Integral with, and extending backward from each end of the "cross" of said frame (see Fig. 9) is a curved arm 45 terminating in a lug 46, which lug is pivoted to ear 42. Attached to the frame 43 by means of links 47 and 48, is the pawl 49 whose function is to engage and rotate the ratchet wheel 50. Stop lugs 51 and 52 limit the longitudinal motion of the pawl, and prevent the ratchet wheel from moving more than one notch with each magnetic impulse, while stop 53 limits its upward motion, which movement is produced by the compression spring 54 after the pawl has been drawn down by the action of magnets 4—4. Magnets 5—5 are a duplicate of magnets 4—4, said latter pair acting through a corresponding pawl 49ª to produce a reverse motion upon the counting mechanism.

Cast on the same hub 55, with the ratchet wheel 50, is the detent wheel 56 against which the roller 57 is held by tension of spring 58, the object of which is to hold the ratchet wheel in position when not being acted upon by either of the pawls 49 or 49ª. The teeth of this ratchet wheel are cut in opposite directions on its two halves, and suitable stops (not shown) are provided to prevent the wheel from being moved more than half a revolution in either direction. Carried by the hub 55, but insulated therefrom, is the circular ring 59, which bridges the terminals 60 and 61 to complete the target magnet circuit when the first car enters the block and continues the connection between said terminals until the last car leaves the block, when the same is broken. The cross-shaped frame 43 is provided with a rearwardly extending finger which is adapted to engage the flat spring 20 to raise the same and break the contact between terminals 62 and 63 when the magnets 4—4 ar energized. The said terminals 62 and 63, bridged by said spring 20, may be introduced into the electric circuit of the cautionary signal, which circuit may then be temporarily interrupted to operate the screen 28, when magnets 8—8 are placed in said circuit, each time the magnet 4—4 is operated by an entering car; but the preferred form is that illustrated in Fig. 12 where magnets 8 and 8′ are placed in circuit with their respective setting magnets 4 and 4′, whereby the screen 28 is operated each time the circuit is closed through the setting magnet.

By reference to the wiring diagram Fig. 12 it may be seen that the resistance coil R′ of signal B is in series with lamps 29 and 30 of signal A; while resistance coil R of signal A is in series with lamps 29′ and 30′ of signal B; in other words, the resistances in series with the cautionary lamps are in the opposite signals from their respective lamps. With this arrangement the yoke wire *y* is never in shunt with the trolley wire without considerable resistance in series, which precludes the possibility of injurious heating at the contact points.

The contact for closing the circuit of the reserve lamp in case the regular lamp fails to light is made to taper toward the bottom, either in a circular form as an inverted truncated cone, or a square pyramid, so that when it drops by gravity between the terminals of the reserve lamp circuit it will be sure to close the circuit even if the terminals should be slightly out of adjustment, and will make a better electric contact from the slight tendency to wedge. This construction will be readily understood by a reference to Fig. 8, in which 76 represents the taper contact above mentioned, and 74 and 75 terminals in the reserve lamp circuit.

In Figs. 6 and 7 is illustrated the means of locating and securing the operating magnets in proper relation to the counting mechanism. Fig. 6 shows a rectangular frame 77 screwed to the tops or heads of the magnets, and Fig. 7 shows in detail the means of fastening the two sets of magnets to the bracket 41 at their lower ends through their respective cross bars. At 80, 81, 84 and 85 are the said cross bars which are integral with the sides of the bracket 41, and 82 and 86 are the ends of two T-shaped back-irons joining the cores of the magnets 4, 4 and fastened to the same by bolts 83 and 87. To replace either of these magnets therefore it is only necessary to remove the screws from one end of frame 77 and the bolts from the back-iron 82 or 86.

By reference now to the wiring diagram Fig. 12. The operation of the system will be readily understood. A car entering from the left moves the pendant 64 to close the circuit from the trolley wire through terminal 65 magnet 8 and wire 66 to magnet 4′—4′. Pawl 49′ is drawn downward, moving ratchet wheel 50′ one notch, and causing ring 59′ to

bridge terminals 60′ and 1′, thus closing the circuit of the target magnet 3′—3′ through wire 70′, drawing the cores 10′ downward and moving the target 19 to the danger position as shown by the dotted lines in Fig. 1. The finger 33 is thus caused to bridge terminals 36′ and 37′ closing the circuit of the cautionary lamp 29 through resistance R′, wire 71′, terminals 63′—62′ (normally closed) terminals 37′ and 36′, wire *y*, terminals 34 and 35, lamp 29, magnet 7 and wire 72 to the ground. On leaving the block the car moves pendant 67 to energize the magnet 5—5 through terminal 68 and wire 69, moving the ratchet wheel 50′ back one notch, ratchet 50 being locked against further rotation in that direction opening the circuit of the target magnet and restoring the system to normal or deënergized condition, and so effectually protects the mechanism from lightning discharges.

When more than one car enters the block each following car energizes the magnet 4′—4′ to move the ratchet wheel one step farther in the same direction, maintaining the circuits already established, and on leaving the block each car energizes the magnet 5′—5′ to return the ratchet wheel one notch; so that only the last car can reopen the target circuit through ring 59′ and thus restore the signals to normal.

The circuit of lamp 31 is normally closed through magnet 6, lifting the core 73 and maintaining a break in the circuit of the reserve lamp 32 at terminals 74 and 75 so long as lamp 31 is lighted. Should lamp 31 burn out or fail to light core 73 would drop, causing contact 76 to bridge terminals 74 and 75 lighting the reserve lamp 32. The same conditions apply to lamp 29 and magnet 7, except that the circuit of lamp 29 is normally open, being closed only while the block is occupied.

Another feature of my invention is the introduction of a fourth wire into the wiring system as represented at 90 in Fig. 12 which wire directly connects the wiring circuits of the clearing magnets so that the circuit of both clearing magnets 5 and 5′ may be closed from either end of the block by an outgoing car, the object being to enable the car, which has entered a block and set the signals, to back back and clear the same. Still another feature in connection with this fourth wire is the introduction of a switch 91—91′ in the circuit of each clearing magent, whereby either magnet may be cut out of circuit by turning the switch, the purpose of this action being to enable a car which has inadvertently entered an occupied block and set the farther signal, to open the circuit of the near signal, so that said car may back out of the block and clear the said farther signal without affecting the near signal.

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

1. In an electric signal, a signal circuit normally open, a pair of insulated terminals in said circuit, an oscillatory shaft, an insulated circuit controller and ratchet wheel mounted thereon, a pair of magnets on either side of said shaft, an armature frame mounted on and pivoted to each pair of magnets, a reciprocating pawl supported on said armature frame, means for securing all of the magnets at both ends whereby said magnets and their pawls are firmly held in exact operative relation to the ratchet wheel, and means whereby the said circuit controller may be operated to control the signal circuit to actuate the signal.

2. In an electric signal, a target, a target magnet circuit normally open, a pair of insulated terminals in said circuit, an oscillatory shaft, an insulated circuit controller and a ratchet wheel mounted thereon, a pair of magnets on either side of said shaft, an armature frame pivoted to each pair of magnets, a reciprocating pawl mounted on said armature frame, means for securing all of the magnets at both ends whereby said magnets and their pawls are firmly held in exact operative relation to the ratchet wheel, and means whereby the said circuit controller may be operated to control said target magnet circuit to actuate the target.

3. In an electric signal, a target, a target magnet circuit normally open, a pair of insulated terminals in said circuit, an oscillatory shaft, an insulated circuit controller and a ratchet wheel mounted thereon, a pair of magnets on either side of said shaft, a T-shaped back-iron for closing the magnetic circuit between each pair of magnet-cores and also to serve as a means for securing said magnets to their supports, an armature frame pivoted to each pair of magnets, a reciprocating pawl mounted on said armature frame, means for securing all of the magnets at both ends whereby said magnets and their pawls are firmly held in exact operative relation to the ratchet wheel, and means whereby the said circuit controller may be operated to control the target magnet circuit to actuate the target.

4. In a signal, the combination of a counterbalanced target normally held by gravity to the safety position, a plunger magnet, a tubular core in said magnet for moving said target, a counterbalance therefor, and means for energizing said magnet to carry the target to the danger position.

5. In a signal, the combination of a counterbalanced target normally held by gravity to the safety position, a plunger magnet, a tubular core in said magnet for moving said target, a weight, means whereby said weight is given a variable leverage to counterbalance said core, and means for energizing said

magnets to carry the target to the danger position.

6. In a signal, the combination of a counterbalanced target normally held by gravity to the safety position, a rotatable arm, a plunger magnet, a core in said magnet having a flexible connection to said arm, a weight, means whereby said weight is adapted to increase its leverage substantially in proportion to the increasing magnetic pull of the core.

7. In a signal, the combination of a counterbalanced target normally held by gravity to the safety position, a rotatable arm, a plunger magnet, a tubular core in said magnet having a flexible connection to said arm, a weight, means whereby said weight is adapted to increase its leverage substantially in proportion to the pull of the magnet to counterbalance said core.

8. In a signal, the combination of an oscillating frame, a counterbalanced target mounted thereon, rotatable arms also mounted on said frame, a pair of plunger magnets, a core in each of said magnets, a flexible connection from said core to said arms, an armature loosely held in position on said cores, a weight, means whereby said weight is given a variable leverage to counterbalance said cores, and means for energizing said magnets to raise the target.

9. In a signal, the combination of an oscillating frame, a counterbalanced target mounted on said frame held by gravity in the safety position, rotatable arms also mounted on said frame, a pair of plunger magnets, a tubular core in each of said magnets, a flexible connection from said core to said arms, an armature loosely held in position on said cores, a weight, means whereby said weight is given a variable leverage to counterbalance said cores, and means for energizing said magnets to raise the target to the danger position.

10. In a signal, the combination of an oscillating frame, a counterbalanced target mounted thereon, rotatable arms also mounted on said frame, a lamp circuit closer mounted to be operated by the movement of said frame, said closer being adapted to close the contact at two points simultaneously plunger magnets, cores in said magnets having a flexible connection to said arms, a counterbalance weight for said cores and means for energizing said magnets to raise the target.

11. In a signal, the combination of an oscillating frame, a counterbalanced target carried by said frame, circular arms also carried by said frame, a lamp circuit closer mounted to be operated by the movement of said frame, said closer having a spring forked end whereby the contact may be broken at two points simultaneously, plunger magnets tubular cores in said magnet having a flexible connection to said arms, a counterbalance weight for said cores, and means for energizing said magnets to raise the target.

12. In a device of the character described, the combination of a target, an electro-magnet adapted to actuate said target, an indicator lamp, means for automatically setting the target to the danger position and lighting said lamp when the first car enters the block, a screen, and means for moving said screen to indicate that the mechanism has operated.

13. In a device of the character described, the combination of a target, an electro-magnet adapted to actuate said target, an indicator lamp, means for automatically setting the target to the danger position and lighting said lamp when the first car enters the block, and means for screening the lamp momentarily as each car enters the block.

14. In a device of the character described, the combination of a target normally held by gravity in its inoperative position, an electro-magnet adapted to move said target to its danger position, an indicator lamp, means for automatically setting the target to the danger position and lighting said lamp when the first car enters the block, and means for screening said lamp momentarily as each car enters the block.

15. In a signaling system, a target circuit normally open, a circuit closer, an electro-magnet and ratchet wheel for operating said closer to close said target circuit, an indicator lamp, means for closing said lamp circuit and lighting said lamp when the target circuit is closed, and means for screening said lamp whenever said ratchet wheel is operated in one direction.

16. In a block signaling system, the combination of a signal located at either end of the block, a target, an electro-magnet adapted to actuate said target, an indicator lamp, means for automatically setting the target to the danger position and lighting said lamp when the first car enters the block, a screen, and an electro-magnet adapted to operate said screen whereby the same is caused to indicate that the signal at the opposite end of the block has operated.

17. A block signaling system, the combination of a signal located at either end of the block, a target, means for actuating said target, an indicator lamp, a target setting and a target clearing magnet, means for lighting said lamp when the target is set, a screen, and means for operating said screen each time the setting magnet is energized whereby the same is caused to indicate that the signal at the opposite end of the block has operated.

18. In a block signaling system, the combination of a signal located at either end of the block, a target, an electro-magnet adapted to actuate said target, an indicator lamp, a target setting and a target clearing mag-

net, means for lighting said lamp when the target at the opposite end of the block is set, a screen, and an electro-magnet in circuit with said target setting magnet whereby said screen is moved before said lamp each time the setting magnet is energized to indicate that the signal at the opposite end of the block has operated.

19. In a block signaling system the combination of a target, an electro-magnet adapted to actuate said target, an indicator lamp, means for automatically setting the target to the danger position and lighting said lamp when the first car enters the block, an oscillating screen, and means for causing said screen to vibrate before said lamp momentarily as each car enters the block.

20. In a block signaling system, a signal box at each end of a block, a danger signal in each box, a feed wire terminal in each box, a safety signal in each box, said safety signals being electrically connected on one side to each other through two normally closed switches, and on the other side permanently connected to ground, means for setting the danger signal in the distant box, and thereby disconnecting said safety signals from each other and connecting the one in the home box with the feed wire terminal in the distant box, thus closing a circuit from said feed wire terminal in the distant box through the connecting conductor and the other of said safety signals to ground at the home box when a car enters the block, and means for restoring the normal conditions when the same car leaves the block.

21. In a block signaling system, a signal box at each end of a block, a feed wire terminal in each box, an electrically operated signal in each box, said signals being electrically connected on one side to each other through two normally closed switches, and on the other side permanently connected to ground, means for disconnecting said signals from each other, and connecting either one with the feed wire terminal in the opposite box, thus completing a circuit from said feed wire terminal in the opposite box through the connecting conductor and the other of said signals to ground at the home box when the first car of a series enters the block, and means for restoring the normal conditions only when the last car of the series leaves the block.

22. In a block signaling system, a signal box at each end of a block, a danger signal in each box, a feed wire terminal in each box, a resistance coil between said terminal and the feed wire in each box, a safety signal in each box, said safety signals being connected on one side to each other through two normally closed switches, and on the other side permanently connected to ground, means for setting the danger signal in the distant box and thereby disconnecting said safety signals from each other and connecting the one in the home box with the feed wire terminal in the distant box, thus closing a circuit from said feed wire terminal in the distant box through the connecting conductor and the other of said safety signals to ground at the home box when a car enters the block, and means for restoring the normal conditions when the same car leaves the block.

23. In a block signaling system, a signal box at each end of a block, a feed wire terminal in each box, a resistance coil between each terminal and the feed wire, an electrically operated signal in each box, said signals being connected on one side to each other through two normally closed switches, and on the other side permanently connected to ground, means for disconnecting said signals from each other and connecting either one with the feed wire terminal in the opposite box, thus completing a circuit from said feed wire terminal in the opposite box through the connecting conductor and the other of said signals to ground at the home box when the first car of a series enters the block, and means for restoring the normal conditions only when the last car of the series leaves the block.

24. In a block signaling system, a signal box at each end of a block, a danger signal in each box, a feed wire terminal in each box, a safety signal lamp in each box, said signal lamps being connected on one side to each other through two normally closed switches and on the other side permanently connected to ground, means for setting the danger signal in the distant box and thereby disconnecting said signal lamps from each other and connecting the one in the home box with the feed wire terminal in the distant box, thus closing a circuit from said feed wire terminal in the distant box through the connecting conductor and the other of said safety signal lamps to ground at the home box when a car enters the block, and means for restoring the normal conditions when the same car leaves the block.

25. In a block signaling system, a signal box at each end of a block, a feed wire terminal in each box, a safety signal lamp in each box, said signal lamps being connected on one side to each other through two normally closed switches, and on the other side permanently connected to ground, means for disconnecting said signal lamps from each other and connecting either one with the feed wire terminal in the opposite box thus completing a circuit from said feed wire terminal in the opposite box through the connecting conductor and the other of said signal lamps to ground at the home box when the first car of a series enters the block, and means for restoring the normal conditions only when the last car of the series leaves the block.

26. In a block signaling system, a signal

box at each end of a block, a magnetically actuated target in each box, a feed wire terminal in each box, an electrically operated signal in each box, said signals being electrically connected on one side to each other through two normally closed switches, and on the other side permanently connected to ground, means actuated by said target for disconnecting said signals from each other and connecting either one with the feed wire terminal in the opposite box, thus closing a circuit from said feed wire terminal in the opposite box through the connecting conductor and the other of said signals to ground at the home box when a car enters the block, and means for restoring the normal conditions when the same car leaves the block.

27. In a block signaling system, a signal box at each end of a block, a magnetically actuated target in each box, a feed wire terminal in each box, an electrically operated signal in each box, said signals being electrically connected on one side to each other through two normally closed switches, and on the other side permanently connected to ground, means actuated by said target for disconnecting said signals from each other and connecting either one with the feed wire terminal in the opposite box, thus completing a circuit from said feed wire terminal in the opposite box through the connecting conductor and the other of said signals to ground at the home box when the first car of a series enters the block, and means for restoring the normal conditions only when the last car of the series leaves the block.

28. In a block signaling system, a signal box at each end of the block, a magnetically actuated target in each box, a feed wire terminal in each box, a safety signal lamp in each box, said signal lamps being connected on one side to each other through two normally closed switches, and on the other side permanently connected to ground, means actuated by said target for disconnecting said signal lamps from each other and connecting either one with the feed wire terminal in the opposite box, thus closing a circuit from said feed wire terminal in the opposite box through the connecting conductor and the other of said signal lamps to ground at the home box when a car enters the block, and means for restoring the normal conditions when the same car leaves the block.

29. In a block signaling system, a signal box at each end of a block, a magnetically actuated target in each box, a feed wire terminal in each box, a safety signal lamp in each box, said signal lamps being connected on one side to each other through two normally closed switches, and on the other side permanently connected to ground, means actuated by said target for disconnecting said signal lamps from each other and connecting either one with the feed wire terminal in the opposite box, thus completing a circuit from said feed wire terminal in the opposite box through the connecting conductor and the other of said signal lamps to ground at the home box when the first car of a series enters the block, and means for restoring the normal conditions only when the last car of the series leaves the block.

30. In a block signaling system, a signal box at each end of a block, a clearing magnet in each box, an electric circuit for each magnet, an electric switch in each circuit, an electric conductor connecting the two circuits, means including said switch whereby one of said circuits may be kept open when a car on leaving the block closes the other of said circuits to clear the signal at the opposite end of the block.

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

ALEXANDER BEVAN.

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