No. 832,140. PATENTED OCT. 2, 1906.

W. MACOMBER.

RAILWAY SWITCHING APPARATUS.

APPLICATION FILED FEB. 20, 1905.

2 SHEETS—SHEET 1.

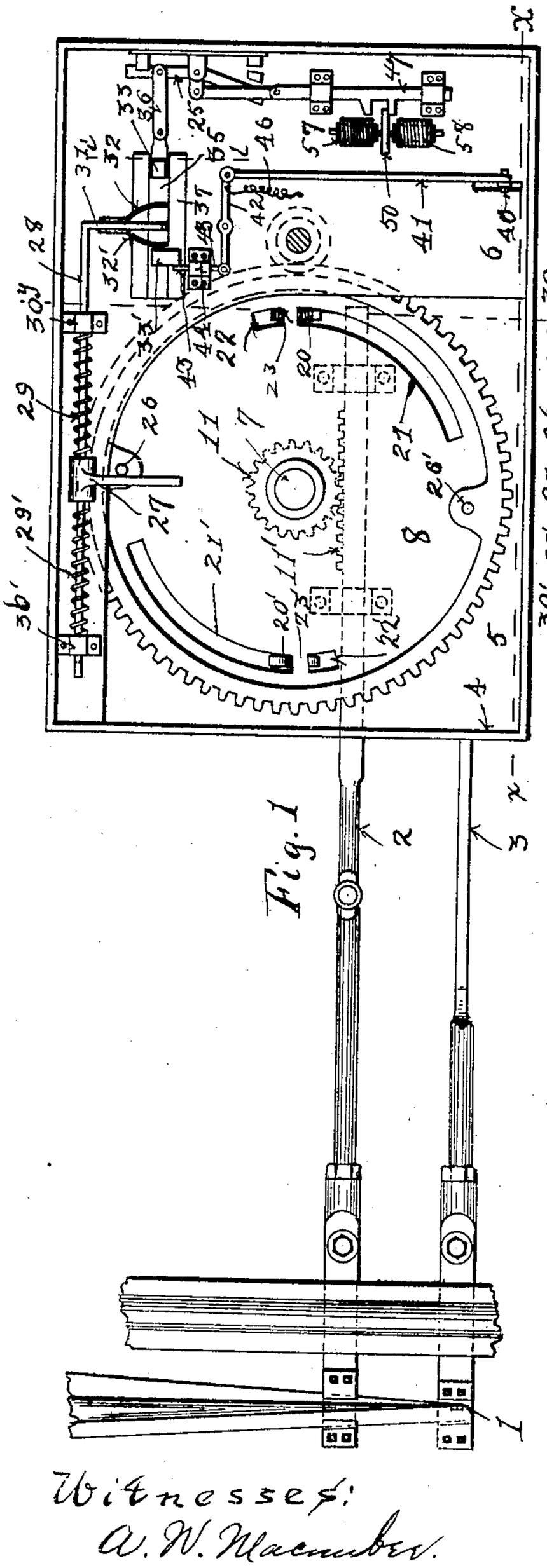

Fig. 1

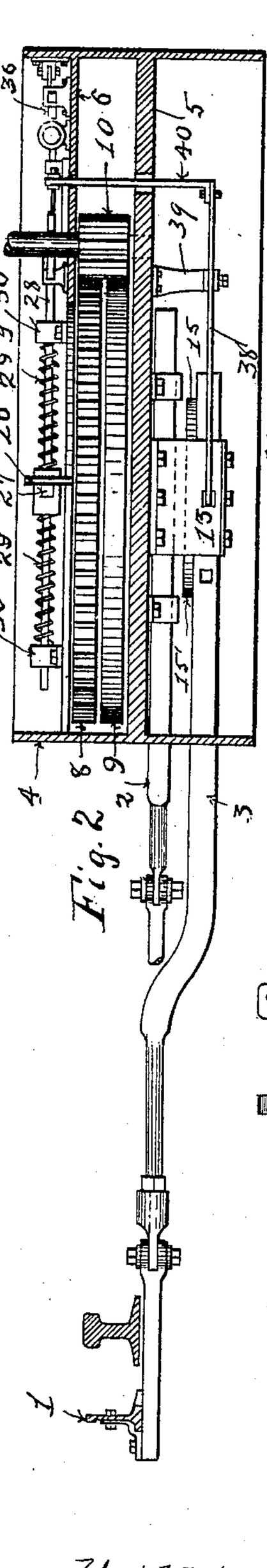

Fig. 2

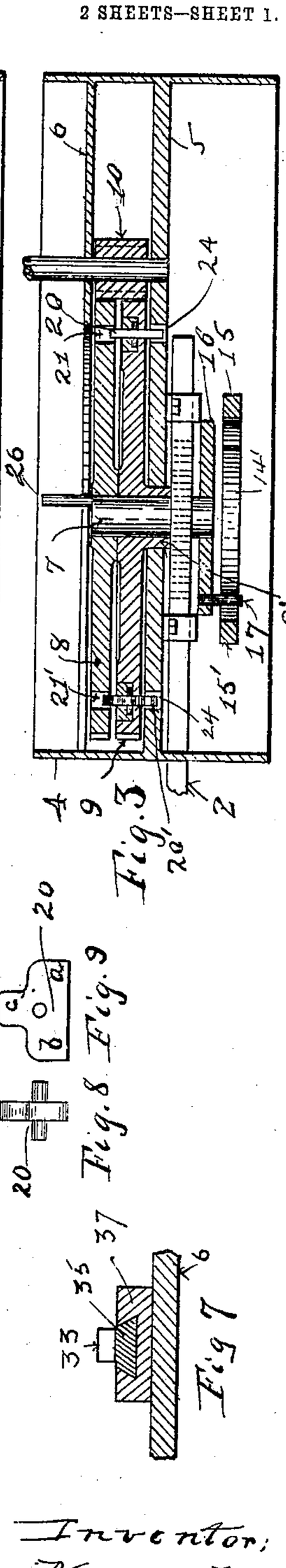

Fig. 3

Fig. 8 Fig. 9

Fig. 7

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2 SHEETS—SHEET 2.

Fig. 6

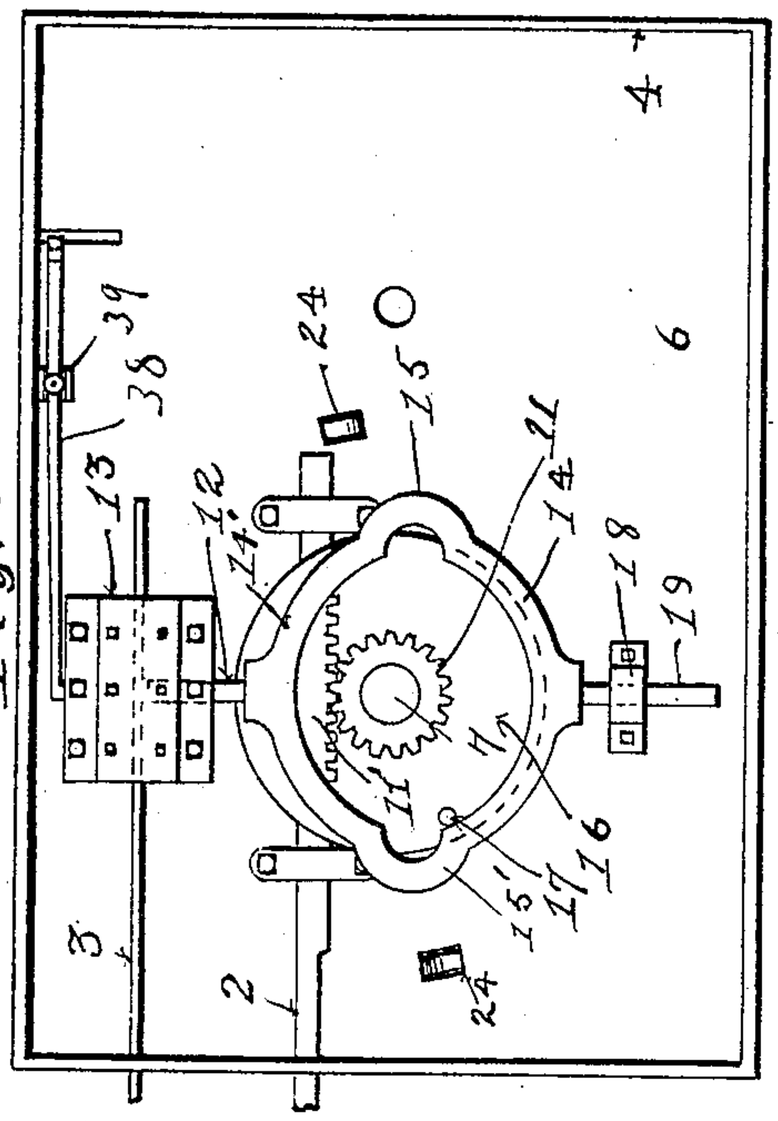


Fig. 10

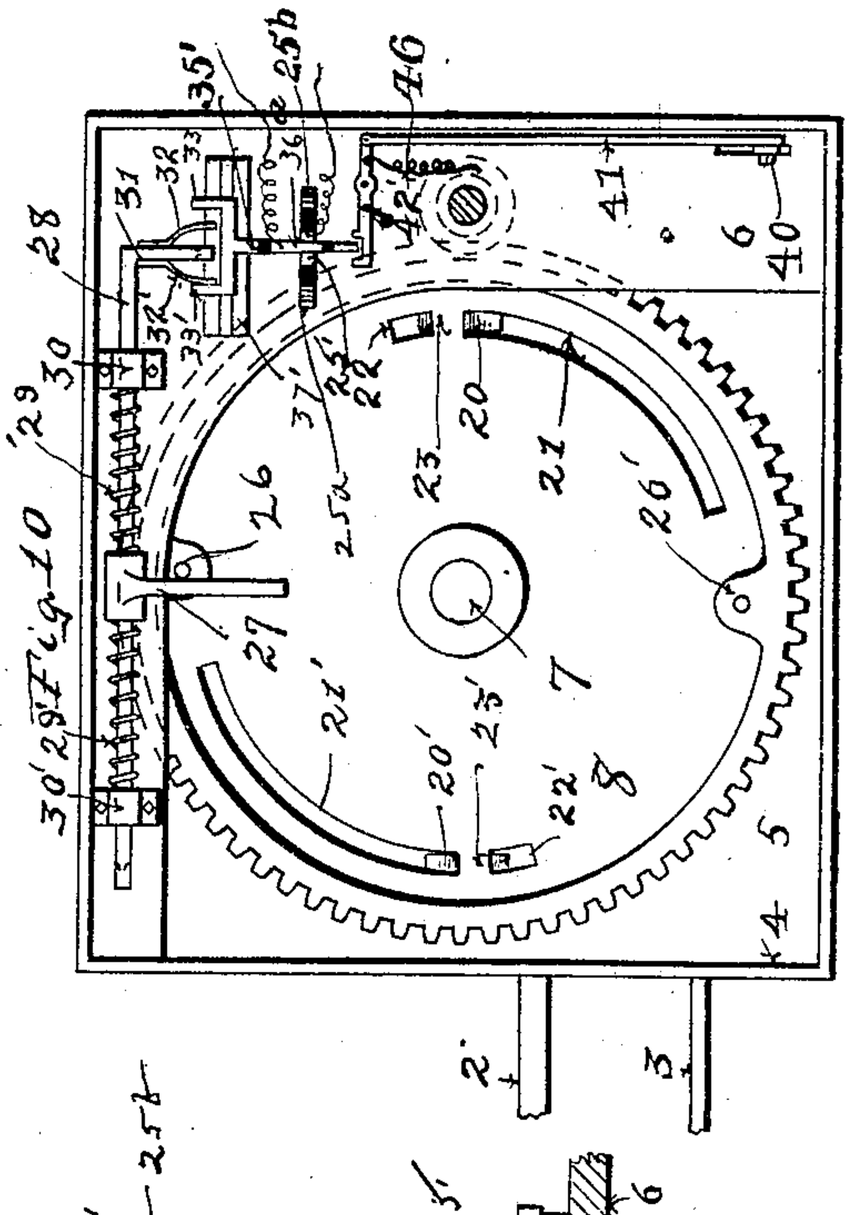


Fig. 11

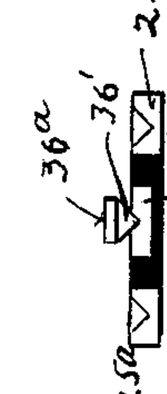


Fig. 12

Fig. 4

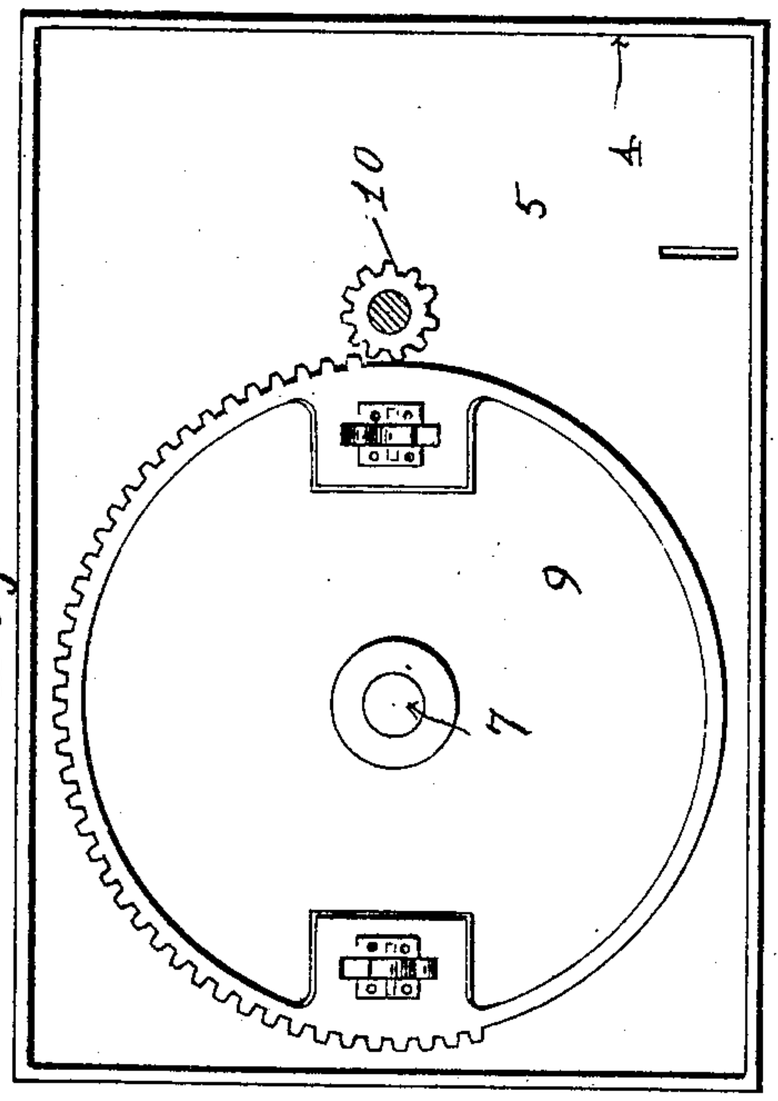
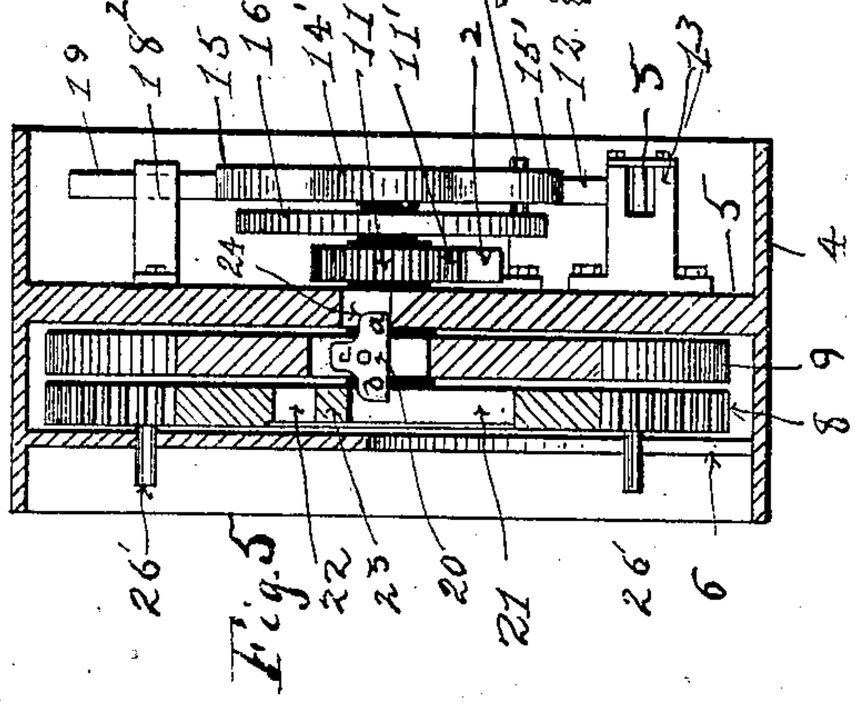


Fig. 5



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UNITED STATES PATENT OFFICE

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RAILWAY SWITCHING APPARATUS.

No. 832,140. Specification of Letters Patent. Patented Oct. 2, 1906.

Application filed February 20, 1905. Serial No. 246,539.

To all whom it may concern:

Be it known that I, WILLIAM MACOMBER, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented a new and useful Railway Switching Apparatus, of which the following is a specification.

My invention relates to railway switching apparatus, and more particularly to that class of railway switching apparatus in which the motive power is electric energy.

My invention further consists of mechanism for moving and locking the rail-switch and mechanism for making and breaking the electric circuits as required by the system in connection with which it is used.

The objects of my invention are, first, to dispense with the clumsy and short-lived clutch mechanism in common use and provide in its place a movement both simple and durable; second, to provide means whereby the load upon the motor in performing its several functions is well distributed—that is to say, so that the power required to unlock, move, and lock the rail-switch to set up the spring to throw the pole-changing switch and to set up the spring to reëstablish the circuit shall be successively employed; third, to provide means for moving the electric switch at the proper time, and, fourth, especially, to hold the electric switch against any movement whatsoever until the lock-bolt locking the rail-switch is home.

The apparatus shown in Figures 1 to 9, inclusive, show my invention adapted to my battery-indication system shown in my pending application, Serial No. 198,220.

In Figs. 10 to 12, inclusive, I have shown my invention adapted to my single-circuit system shown in my pending application, Serial No. 246,538. It will also be evident that my apparatus may be readily adapted to the Taylor dynamic indication system shown in Patents Nos. 554,097 and 605,359, reissue No. 11,983, dated February 4, 1896, and reissued May 6, 1902.

Referring to the drawings herewith, in which like characters of reference indicate corresponding parts, Fig. 1 is a plan view. Fig. 2 is a vertical section on the line *x x* of Fig. 1. Fig. 3 is a longitudinal central section of Fig. 1. Fig. 4 is a plan view of my segmental gear. Fig. 5 is a vertical section on the line *y y* of Fig. 1. Fig. 6 is an under side view in plan. Fig. 7 is a detail section on *i i* of Fig. 1 of a part of my switch mechanism. Figs. 8 and 9 are respectively end and side elevations of my locking-dogs. Fig. 10 is a plan view of my apparatus adapted to my single-circuit system above mentioned. Figs. 11 and 12 are respectively detail end and side views of my electric switch. In Figs. 3 and 5 the electric switch mechanism is omitted from the views.

1 is a switch-point. It may be either one of two points of an ordinary rail-switch or it may be a derailing-switch.

2 is a switch-rod, which is pivotally connected to the switch in the usual manner.

3 is the locking-bar, which is pivotally connected to the switch-point in the usual manner.

4 is the box or casing which contains and supports the mechanism for moving the rail-switch. This casing contains a partition or plate 5, which divides the casing into an upper and lower portion.

6 is a shelf or partial division which supports the motor (not shown) and the electric switch and mechanism connected therewith. Mounted loosely upon a vertical shaft 7 is a gear 8. Mounted directly beneath the gear 8 and rigidly splined to the shaft 7 is a segmental gear 9, which is clearly shown in Fig. 3. Upon the under side of the segmental gear 9 is a hub or extension 9′, which extends downwardly through the partition 5, so that the partition 5 acts as a guide-bearing and support for the gear 8 and segmental gear 9 and the other parts mounted upon the shaft 7.

11 is a pinion rigidly mounted upon the hub 9′ and meshes with a rack 11′, secured to the rod 2.

12 is the lock-bolt which engages the lock-rod 3 by passing through a transverse hole in the locking-frame 13 and through holes in the lock-rod 3, which register with the hole in the locking-frame 13 when the rail-switch is fully home in either position. The lock-bolt is reciprocated by the following means: A yoke composed of two side members 14 and 14′ (see Fig. 6) and of two end portions 15 and 15′ is rigidly secured on one side to the lock-bolt 12 and on the other side to a short shaft 19, which is free to move longitudinally in a bearing 18. A disk 16 is mounted rigidly

upon the shaft 7, and rigidly mounted upon the disk 16 is a pin 17, which lies in the plane of the yoke 14 14′. The sides 14 and 14′ are segments of circles having the same radius and a radius equal to the distance from the center of the shaft 7 to the outer surface of the pin 17. The centers of the segments 14 and 14′ are in the axis of the lock-bolt 12 and are so positioned that when the bolt is locked the pins 17 may travel freely over the inner surface of the segment 14′ and so that when the bolt 12 is in the unlocked position the pin 17 may travel freely upon the inner surface of the segment 14. The ends of the two segments 14 and 14′ are joined by the small semicircular portions 15 and 15′, and it will now be evident that if the pin be moved toward the unlocked position it will travel over the surface of the segment 14 without producing movement of the lock-bolt 12 until it shall have reached the semicircular portion 15. Advancing further it will strike the inner upper portion of the segment 15 and force the yoke toward the locked position until the segment 14′ coincides as to its center with the center of the disk 16. A reverse movement will move the yoke in like manner to the unlocked position—that shown in the drawings. The motor (not shown) drives the spur-gear 10. This spur-gear is in mesh with the gear 8 at all times and with the segmental gear 9 when it is brought into action, as hereinafter described.

I will now describe the mechanism for putting the segmental gear 9 in and out of engagement with the spur-gear 10. Mounted upon a diameter of the segmental gear 9 are two locking-dogs 20 20′. These dogs lie in slots in the gear 9 and are pivotally mounted to rotate upon a diameter of said gear. The gear 8 has slots 21 21′ and 22 22′. These slots are concentric with the gear 8 and are diametrically opposite each other. They are so positioned and of such width as to permit a part of the dogs 20 and 20′ to swing into them. Slots 24 and 24′ diametrically opposite to each other and capable of registering with the slots 21 21′ are made in the partition-plate 5, as clearly shown in Fig. 6. The locking-dogs 20 and 20′ have wings *a* and *b* opposite each other and a lug *c* at right angles thereto. (See Figs. 5 and 9.) The wing *a* is capable of engaging in the slot 24 or the slot 21′. The wing *b* is capable of engaging in the slot 21 or the slot 24′, and the lug *c* is capable of engaging in the slots 22 and 22′.

I will now describe a movement of the rail-switch mechanism. Suppose the rail-switch to be set for the main track, as shown in the drawings, and suppose it is desired to set it for the side track. The motor will rotate in the direction to rotate the gear 8 to the right, (as the hands of a clock.) This will first withdraw the bolt 12 by the pin 17 moving the yoke 14 to the position shown in the drawings. The spoke 23 will strike the wing *b* of the dog 20 and the spoke 23′ will strike the wing *a* of the dog 20′. This will force the lugs *c* of the dogs 20 and 20′ into the slots 22 and 22′, respectively. Further rotation of the gear 8 will cause the walls of the slots 22 and 22′ to strike the lugs *c* of the dogs 20 and 20′ and bring the flat bottoms of the dogs onto the surface of the partition 5. This locks the segmental gear 9 with the gear 8 and compels it to rotate with it for a half-rotation. This movement of the segmental gear moves the rail-switch to set it for the side track. As this movement of the rail-switch is completed the wing *b* of the dog 20 tips into the slot 24′ and the wing *a* of the dog 20′ tips into the slot 24. At the same time the lugs *c* of both dogs have tipped out of the slots 22 and 22′, and the wing *a* of the dog 20 enters the slot 21′, and the wing *b* of the dog 21′ enters the slot 20. Since the slots 21 and 21′ are extended for nearly ninety degrees, the gear 8 may continue rotating a considerable period after the segmental gear 9 has come to rest. After the rail-switch movement is complete and the segmental gear has come to rest the gear 8 continues to move until the pin 17 on the disk 16 strikes the side 14′ of the yoke and drives the lock-bolt 12 home. Immediately thereafter the electric switch is thrown, as hereinafter described, and the motor presently comes to rest; but while the motor is coming to a stop the disk 16 continues to revolve and the pin 17 travels over the surface of the side 14′ of the yoke. A reverse movement would be practically a repetition of the steps just explained and need not be further described.

It will be observed that I may use merely a disk in place of the segmental gear 9. I prefer, however, to use a segmental gear for the reason that it reduces friction, for without the segmental gear the faces of the dogs 20 20′ ride heavily upon the adjacent surface of the plate 5 for the entire movement of the disk, whereas with the segmental gear as soon as it is in mesh with the driving-gear the load is practically removed from the dogs. It will also be observed that I employ two dogs diametrically opposite each other. While a single dog will do the work, whatever strain there may be in locking the gears together is better distributed over the mechanism with two dogs, as shown; but it is to be noted that when the dogs lock the gear 8 and the segmental gear 9 together the relation of the parts of the dogs and the slots in which they engage are so adjusted that the moment the two gears are locked together the teeth of the two gears register exactly, and as soon as the spur-gear 10 engages the teeth of the segmental gear 9 the load is taken off the dogs, thus reducing the friction. Thus it will be seen that in the utilization of the power of

the motor but one function is performed at a time. The first function is unlocking, (and before the motor actually begins this task it has gained considerable momentum,) and while this is done the motor has no other load and the load being light considerable momentum is attained before the next function begins. The second function is moving the rail-switch. To this the motor comes with acquired momentum and is handicapped by no other load. The third function is locking. This is performed after the motor is free from its heavy load. The fourth function is operating the electric switch, which function is the only load on the motor at that time. It will be evident to one familiar with the said Taylor dynamic-indication system that this sequence of movement and the cutting off of all load at the time the electric switch is moved (or before that time, which is a mere matter of adjustment) is of the highest importance. It will also be evident that the raising and lowering of the detector-bar in the usual manner may be readily performed by inserting cam or pin-and-yoke arrangement for raising the detector-bar before the switch is unlocked and lowering the same immediately after the lock-bolt is home.

I will now describe the electric switch-moving mechanism, which is arranged as required by my said system shown and described in my said pending application, Serial No. 198,220. It will be noted by reference to the system of said patent that a pole-changing switch is employed, and that a half-throw of the pole-changing switch closes a circuit of the battery including the indicating-magnet to produce indication and to produce the final movement of the controller, and that after the movement of the controller, the circuit being broken thereby, the pole-changing switch is sent to full reverse. Referring now to Fig. 1, 57 and 58 are the magnets indicated by corresponding characters of reference in said application Serial No. 198,220. 50 is the armature governed by said magnets, and 47 is the bar pivoted to a lug on the pole-changing switch 25. This is the same construction as is shown in said application Serial No. 198,220. Rigidly secured to the gear 8 are two pins 26 and 26′. Mounted in bearings 30 and 30′, secured to the shelf 6, is a square shaft 28, and centrally upon said shaft 28 is secured a lug 27, which lies in the path of rotation of said pins 26 and 26′. Helical springs 29 and 29′ take over said shaft 28 and abut against said lug 27 and the inner faces of the bearings 30 and 30′. One end of said shaft is bent at right angles, as shown at 31, and has secured to its side oppositely the springs 32 and 32′. Lying in the path of movement of said springs 32 and 32′ are lugs 33 and 33′, which are secured to or integral with a bar 35. This bar 35 is dovetailed to move longitudinally in a base 37, which is secured to the shelf 6. A bar 36, pivoted to the bar 35, is pivoted at the other end to a lug on the pole-changing switch 25. A lever 38 (see Fig. 2) is pivoted to a bracket 39, secured to the partition 5. One end of this lever 38 is bent at right angles and is capable of entering the bolt-hole in the locking-frame 13. The L-shaped portion is of such length as to be forced out of the locking-bolt hole when the lock-bolt is home and to swing the lever 38 for the purpose which will presently be evident. The other end of said lever 38 is rigidly secured to a bar 40, which extends upwardly through openings in the partitions 5 and shelf 6, which bar 40 is pivoted to a rod 41. (See Fig. 1.) This rod 41 is pivoted to a lever 42, which in turn is pivoted centrally to a lug (not shown) on the shelf 6. The other end of this lever 42 is pivoted to a bolt 43, which slides in a bearing 44, secured to the shelf 6. The lever 42 is centrally pivoted to a lug on the shelf 6. A lug 33′, secured to or integral with the plate 35, lies in the path of the bolt 43 when the locking-bolt is withdrawn or even not fully home. A spring 46, mounted upon the shelf 6, bears against the lever 42 and tends to force the bolt 43 into the path of the lug 33′ and to force the L-shaped end of the lever 38 into the bolt-hole in the locking-frame. The parts thus indicated, I will now describe the operation of this mechanism. As soon as the lock-bolt 12 is withdrawn from the locking-frame 13 the end of the lever 38 enters the bolt-hole compelled by the spring 46, and at the same time the lever 42 drives the bolt 43 into the path of the lug 33′. When the rail-switch has been moved and just before the lock-bolt has gone home, the pin 26 strikes the lug 27 and compresses the spring 29′ and at the same time brings the spring 32′ against the lug 33′. This causes the lug 33′ to bear against the bolt 43, and since the lug 33′ is thus held the spring 31′ is compressed. In the meantime (as fully explained in my said application Serial No. 198,220) the magnet 57 has been energized, and the armature 50 is held in the position to prevent the pole-changing switch 25 making but a half-throw while the magnet 57 is energized. As soon as the lock-bolt 12 goes home it pushes the L end of the lever 38 out of the bolt-hole, and this through the bar 40, rod 41, and lever 42 moves the bolt 43 out of the path of the lug 33′. This permits the bar 35 to respond to the pressure of the spring 32′, and the pole-changing switch is thrown; but the magnet 57 through the armature 50 and the bar 47 prevents a full throw of the pole-changing switch. The momentum of the motor will during this time further compress the spring 32′, and as soon as the battery-circuit is broken at the controller (as fully described in my said application) the magnet 57 is deënergized, and the pressure of the spring 32′ will

complete the movement of the pole-changing switch. As soon as the momentum of the motor is expended (and the compression of the spring 29′ rapidly expends it) the spring 29′ will rotate the motor in the opposite direction and bring the parts in position for the next movement—*i. e.*, places the springs 32 and 32′ in the medial position. The reverse movement will be readily understood. The pin 26′ will come in play instead of the pin 26, and the spring 32 will engage the lug 33, and so on. The sequence of movement, as before mentioned, is now evident. No two functions are performed at the same time. The motor in unlocking the switch acquires momentum of material use in starting the rail-switch. After the rail-switch is moved and during the time the locking-bolt is going home and after abundant momentum is acquired to insure in the system herein shown the final throw of the pole-changing switch and in the Taylor dynamic system abundant momentum to produce the indication.

Referring now to Figs. 10, 11, and 12, I will describe the electric switch mechanism adapted to my system disclosed in my said pending application Serial No. 246,538. It will be noted that the electric switch 36′ 25′ is thrown by the same general mechanism as shown in Fig. 1. Instead of a pole-changing switch, however, this system requires merely an electric switch which shall open the operating-circuit and then close the same after indication. This I accomplish by securing to the bar 35′, but insulated from it, a spring-arm 36^a, which carries a V-shaped contact 36′, (see Fig. 11,) which rests in V-shaped notches, one in the contact-plate 25′ and the two notches 25^a and 25^b, as the case may be. The notch 25′ is connected to one of the wires of the circuit, and the V-shaped contact 36′ is connected to the other wire of the circuit. The notches 25^a and 25^b are not connected electrically, as hereinafter explained.

In operation, suppose the spring 32′ to be compressed, as in the case of the other switch mechanism above described. As soon as the lugs on the lever 42′ permit the bar 36^a to move the spring 32′ forces the contact 36′ out of the notch 25′ and sends it into the notch 25^a. This breaks the circuit and causes the motor to come to rest; but in the meantime the spring 29′ has been set up, and as soon as current is cut off from the motor the said spring 29′, through the lug 27, will rotate the gear 8 in the opposite direction until the compression of the spring 29 is relieved. This will result in moving the bar 28 so that the spring 32 engages the lug 33, and as soon as sufficient pressure is put upon the spring 32 to overcome the action of the spring 36^a, holding the contact 36′ in the notch 25^a, the contact 36′ will be snapped back into the notch 25′. Movement of the mechanism in the reverse direction will bring the notch 25^b into action instead of the notch 25^a, the springs 32 and 32′ reversing their functions. It will thus be seen that, as in the case of the electric switch mechanism first described, indication cannot be had (for indication in this system depends upon opening the circuit after each movement) until the lock-bolt is home, and it will also be observed that the reëstablishment of the circuit cannot be had unless the circuit has been properly broken and the circuit intact.

Having thus described my invention, what I claim is—

1. In combination with a motor, a driving-gear, a driven gear in mesh therewith, a fixed plate, a segmental gear mounted concentrically with said driven gear and between it and said plate, a locking-dog, and a slot in said driven gear to lock said disk in rotation with it.

2. In combination with a motor, a driving-gear, a driven gear in mesh therewith, a fixed plate, a segmental gear mounted concentrically with said driven gear and between it and said plate, a locking-dog pivoted to said segmental gear, a slot in said driven gear to lock said segmental gear in rotation with it, and a slot in said driven gear and in said plate to unlock said driven gear and said segmental gear.

3. In combination with a motor, a driving-gear, a driven gear, mechanism actuated by said driven gear to unlock and lock a rail-switch, a segmental gear capable of meshing with said driving-gear, and mechanism actuated by said segmental gear for moving a rail-switch, a plate, a dog in said segmental gear slots in said driven gear and in said plate to receive the wings of said dog to unlock said driven and segmental gears, a slot in said driven gear to engage the lug of said dog to lock said gears together, whereby the rail-switch is unlocked by the rotation of the driven gear; whereby the segmental gear is locked with said driven gear to move the rail-switch; whereby said segmental gear and said driven gear are unlocked at the completion of a switch movement; and whereby the lock-bolt is sent home by the continued rotation of the driven gear after the switch movement is completed.

4. In combination with a motor, a driving-gear, a driven gear, a locking-bolt for the rail-switch, an electric switch, a locking-bolt for the electric switch, means for locking the electric switch when the rail-switch is unlocked and locking the rail-switch when the electric switch is unlocked actuated by the rotation of the driven gear, a segmental gear and mechanism for moving the rail-switch by the rotation of said segmental gear, a plate, dogs for locking said driven gear and said segmental gear together in rotation when the rail-switch is unlocked and the electric switch is locked, and for unlocking said gears

when the rail-switch movement is complete, and a bolt actuated mediately by the entrance of the rail-switch-locking bolt in the locking-frame to unlock said electric switch, and means for throwing said switch actuated by the continued rotation of said driven gear.

5. In combination with a motor and a driving-gear, a driven gear in mesh with said driving-gear, mechanism actuated by said driven gear to unlock the rail-switch, a segmental gear and means for actuating the rail-switch by the rotation of the segmental gear, and means for locking said segmental gear in rotation with said driven gear when the rail-switch is unlocked and means for unlocking said driven gear and said segmental gear when the rail-switch movement is completed, and mechanism actuated by the continued rotation of the said driven gear to lock said rail-switch.

6. In combination with a motor, a driving-gear, a driven gear, a fixed plate and a segmental gear, said segmental gear being mounted between said driven gear and said plate and concentric with said driven gear, dogs pivoted in the web of said segmental gear, concentric slots in said driven gear and said plate to lock and unlock said gears, a pinion driven by said segmental gear, a rack on the switch-rod meshing with said pinion, a locking-bolt, a yoke, a disk rigidly mounted to rotate with said driven gear, and a pin in said disk to engage said yoke to unlock the rail-switch to permit movement and to lock said switch after movement.

7. In combination with a driven gear, a fixed plate, a segmental gear, all arranged concentrically and placed adjacent to each other, a driving-gear capable of meshing with both of said gears, dogs pivoted in said segmental gear having their axes in a common diameter of said gear, concentric slots in said driven gear to engage the wings of said dogs, and slots in said driving-gear to engage the locking-lugs of said dogs to lock said driven gear and said segmental gear to mesh with said driving-gear.

8. The combination with a driving-gear, a switch-rod and a lock-rod, a gear 8, a segmental gear 9, a plate 5, dogs 20 and 20′, slots 21 and 21′ in said gear 8 and slots 24 and 24′ in said plate to permit said dogs to rotate out of lock, and slots 22 and 22′ and intervening spokes 23 and 23′ in said driven gear 8 for rotating said dogs into lock.

9. In combination with a motor, a driving-gear, a driven gear, a fixed plate and a segmental gear, said segmental gear being mounted between said driven gear and said plate and concentric with said driven gear, dogs pivoted to the web of said segmental gear, concentric slots in said driven gear and said plate to lock and unlock said gears, a pinion driven by said segmental gear, a rack on the switch-rod meshing with said pinion, a locking-bolt, a yoke, a disk rigidly mounted to rotate with said driven gear, a pin in said disk to engage said yoke to unlock the rail-switch to permit movement and to lock the switch after movement, and an electric switch for performing the function of indication, a locking-bolt locking said electric switch against movement while the locking-bolt of the rail-switch is not home and preventing indication until the locking-bolt of the rail-switch has gone to full locked position in the locking-frame.

10. In combination with a motor, a driving-gear and an electric switch, a driven gear in mesh with said driving-gear, mechanism actuated by the rotation of said driven gear to unlock the rail-switch and to lock said electric switch, a segmental gear capable of meshing with said driving-gear and means for moving the rail-switch by the rotation of said segmental gear, means for locking said segmental gear in rotation with said driven gear as soon as the rail-switch is unlocked, means for unlocking said driven gear and said segmental gear as soon as the rail-switch has been moved, mechanism actuated by the continued rotation of said driven gear to lock said rail-switch, and for unlocking said electric switch as soon as the rail-switch bolt is home in the locking-frame.

11. In combination with a motor, and a driving-gear, a driven gear in mesh with said driving-gear for unlocking the rail-switch, a segmental gear, dogs for locking said segmental gear with said driven gear as soon as the rail-switch is unlocked and means for moving said rail-switch when said gears are locked in rotation, means for unlocking said gears when the rail-switch movement is completed, and means for locking said rail-switch after the switch movement is completed, whereby the several movements involved are sequential, to take the load of locking and unlocking from the motor when the rail-switch is being moved.

12. In combination with a motor, a driving-gear, and an electric switch, a driven gear, a segmental gear capable of meshing with said driving-gear, a fixed plate, locking-dogs in said segmental gear, slots in said plate and in said driven gear for locking and unlocking said segmental gear to and from said driven gear, all so arranged, and mechanism provided for performing the several functions involved, whereby the functions preparatory to the moving of the rail-switch are successively performed in their proper order by the rotation of said driven gear, whereby the rail-switch is moved by the rotation of said segmental gear, and whereby the functions following the movement of the rail-switch are performed in sequence by said driven gear.

13. The combination with a driving-gear, a switch-rod and a lock-rod, a driven gear 8, a

segmental gear 9, a plate 5, dogs 20 and 20′, slots 21 and 21′ in said gear 8 and slots 24 and 24′ in said plate to permit said dogs to rotate out of lock, slots 22 and 22′ and spokes 23 and 23′ in said gear 8 for rotating said dogs into lock, an electric switch, means for throwing the same, comprising, the bar 28, the lug 27, springs 32 and 32′, an arm 31, lugs 33, 33′, and means for preventing movement of the electric switch at any time when the track-switch is not locked, comprising, a lever 38, having an L end to enter the hole in the locking-frame 13, a lever 42 mediately actuated thereby, a bolt 43, a lug 45 and a spring 46.

14. In a two-wire battery-indication system, in which indication depends upon the opening and closing of the circuit adjacent to the rail-switch, means for moving the rail-switch, comprising, a segmental gear, a driven gear, a driving-gear, dogs for locking said driven and segmental gears to mesh with said driving-gear to move the rail-switch and then unlocking said gears, an electric snap-switch, springs, pins on said driven gear to set up one of said springs to throw said snap-switch to open the circuit, and to reëstablish the circuit after indication by the action of said set-up spring moving said snap-switch to close the circuit.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

WILLIAM MACOMBER.

Witnesses:
A. W. Macomber,
E. F. Branch.