(No Model.)

4 Sheets—Sheet 1.

J. RAMSEY, Jr. & E. W. HARDEN.

ELECTRIC SIGNAL, SWITCH MOVING, AND INTERLOCKING MECHANISM.

No. 494,489. Patented Mar. 28, 1893.

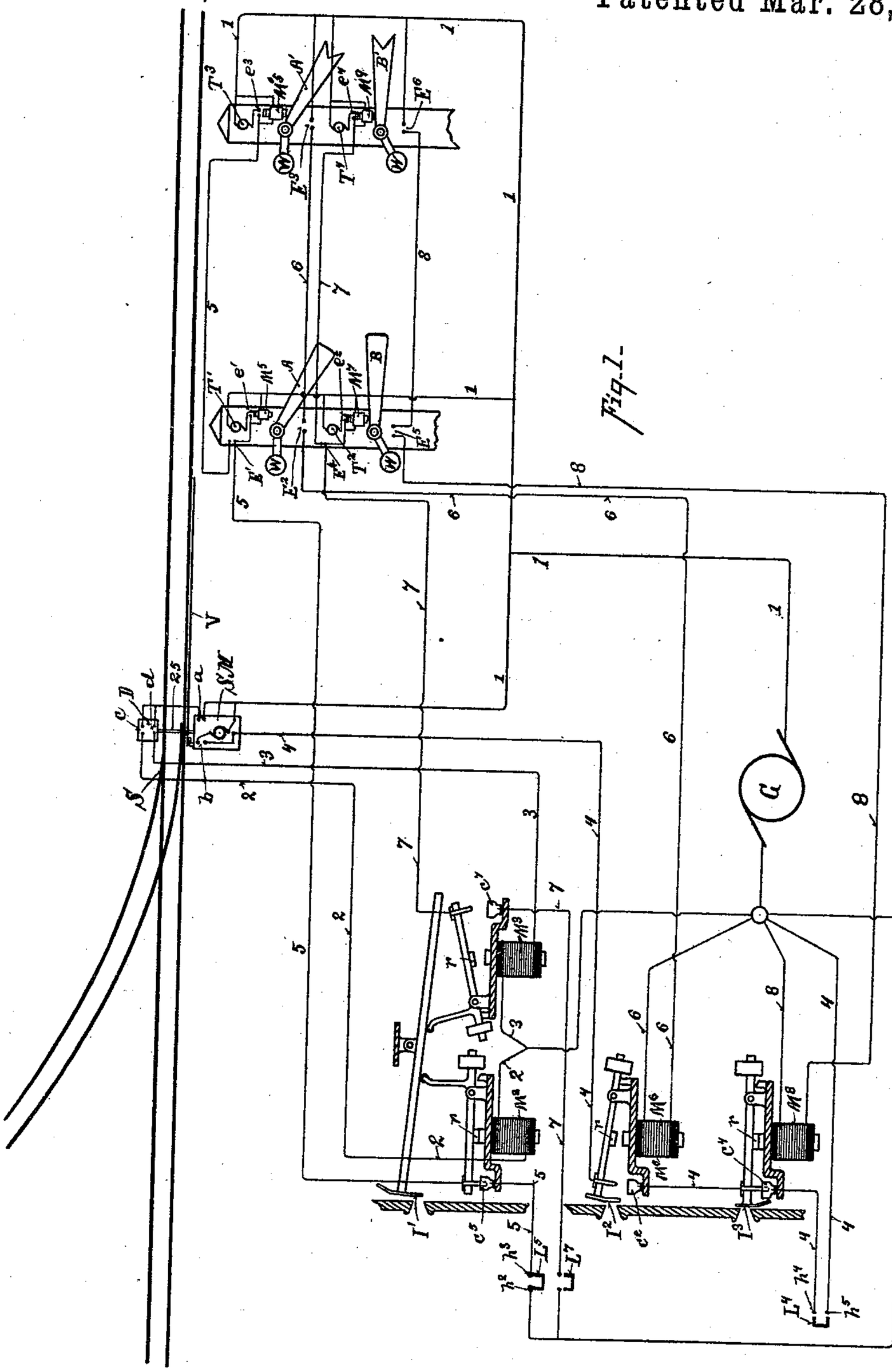

Fig. 1.

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4 Sheets—Sheet 2.

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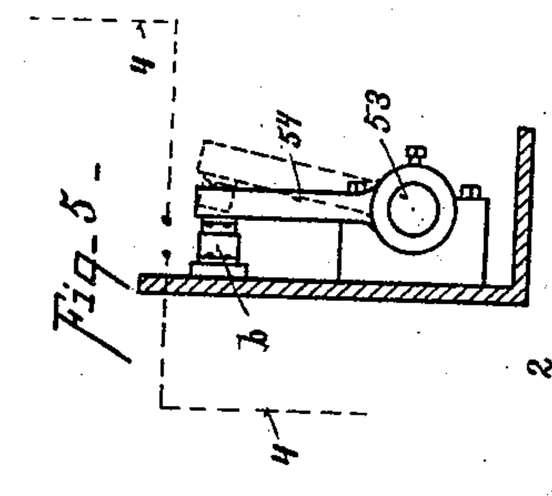

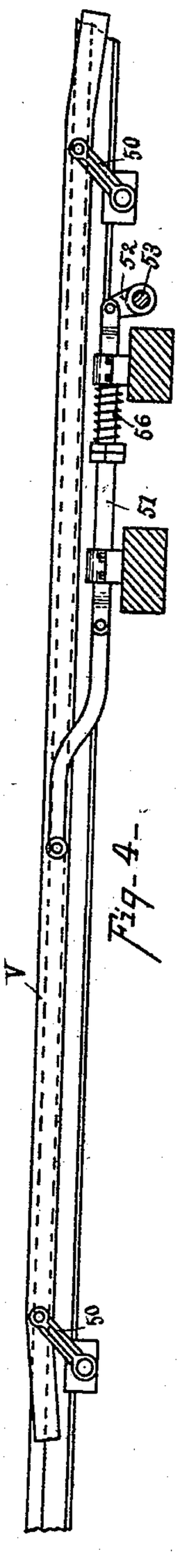

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(No Model.) 4 Sheets—Sheet 3.

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ELECTRIC SIGNAL, SWITCH MOVING, AND INTERLOCKING MECHANISM.

No. 494,489. Patented Mar. 28, 1893.

Fig. 6.

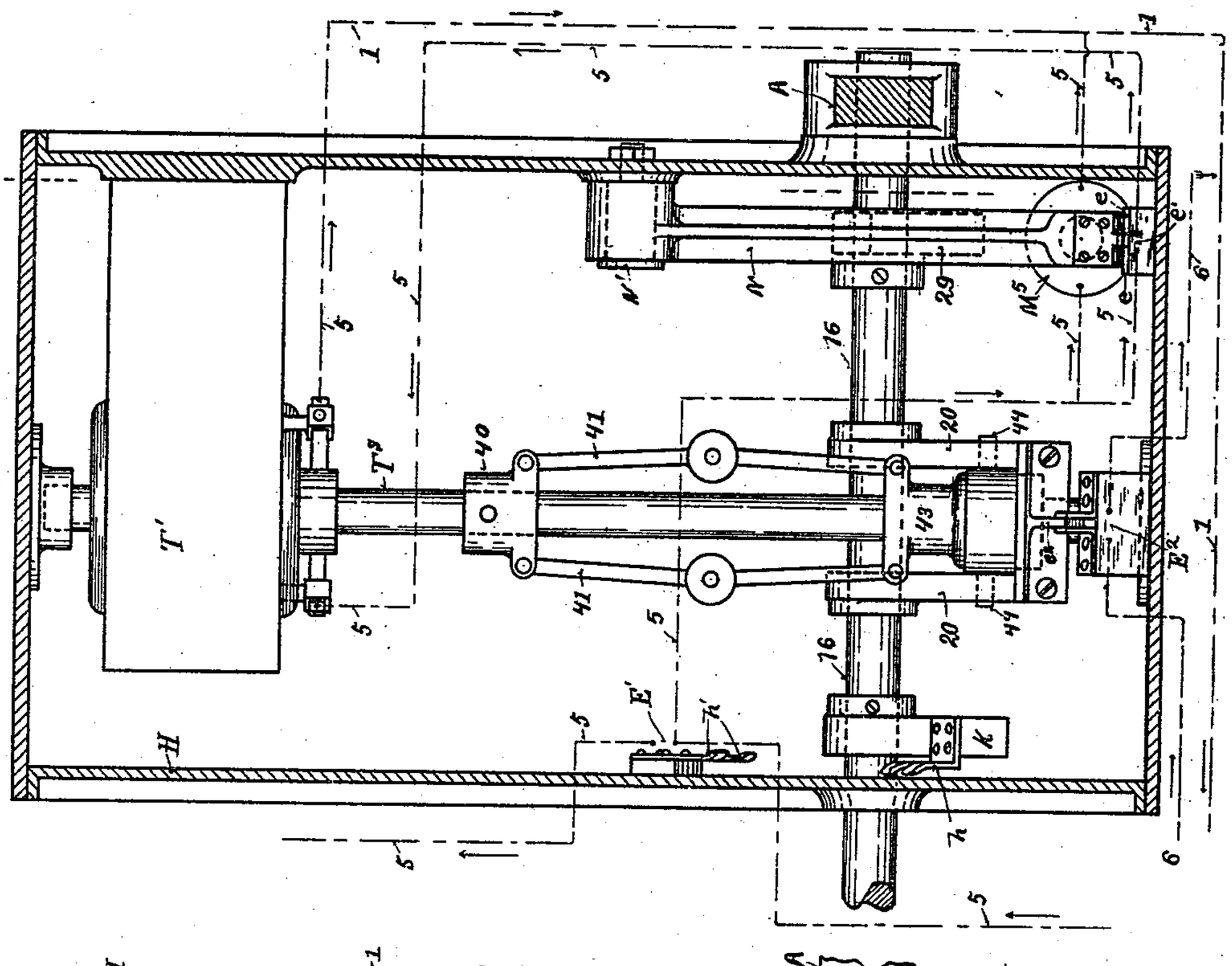
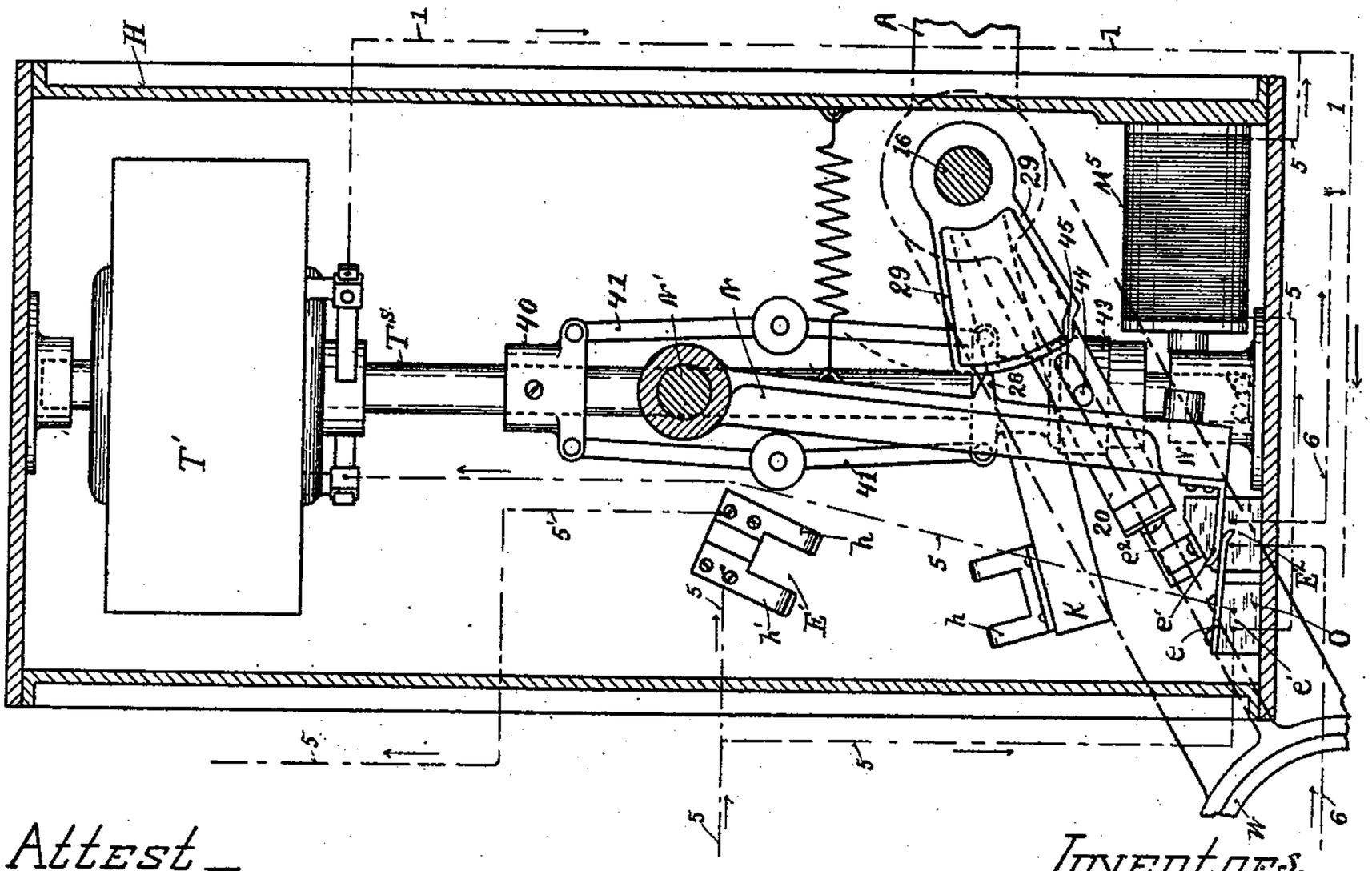


Fig. 7.



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4 Sheets—Sheet 4.

J. RAMSEY, Jr. & E. W. HARDEN.

ELECTRIC SIGNAL, SWITCH MOVING, AND INTERLOCKING MECHANISM.

No. 494,489. Patented Mar. 28, 1893.

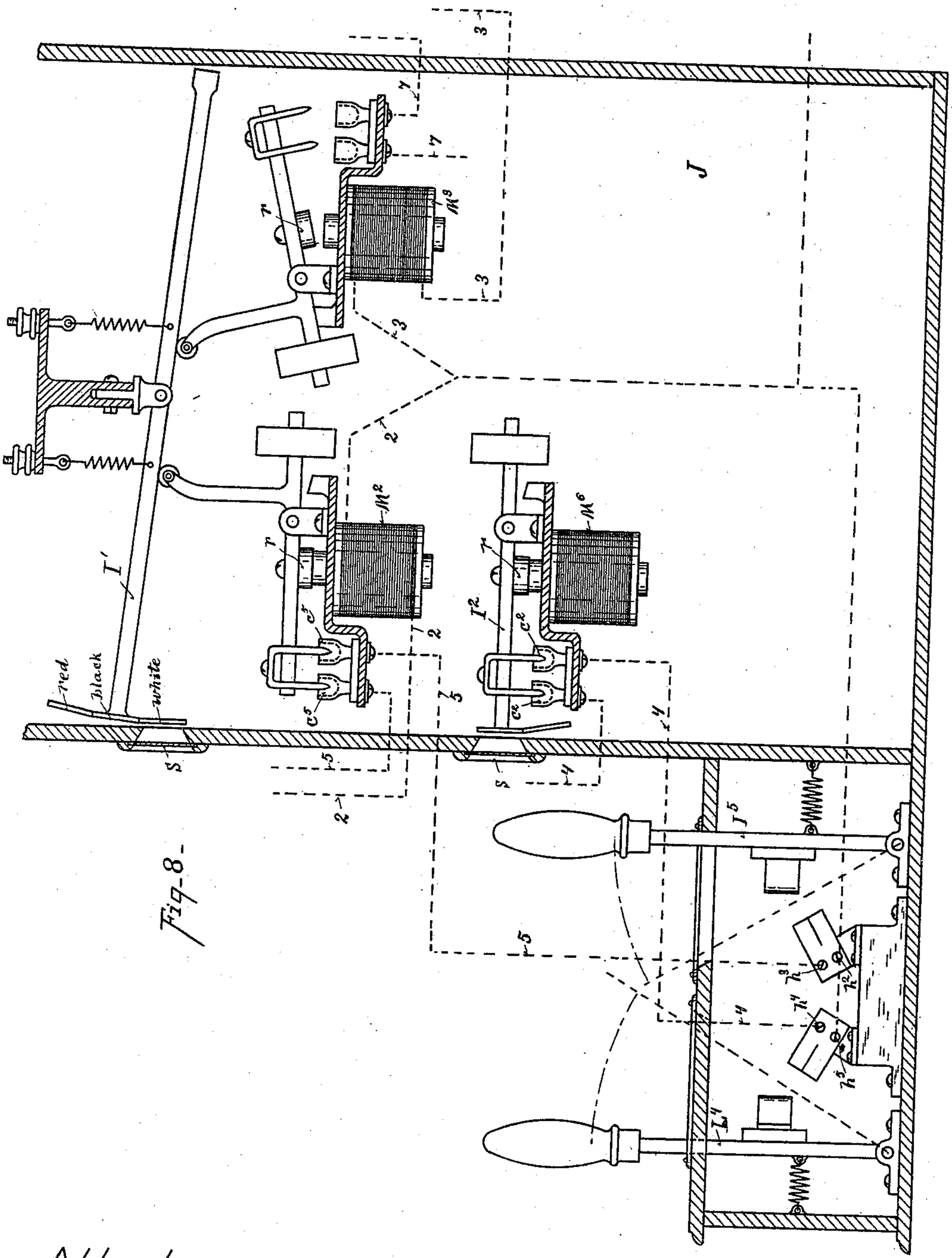

Fig-8-

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UNITED STATES PATENT OFFICE.

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ASSIGNORS TO FREDERIC C. WEIR, OF SAME PLACE.

ELECTRIC SIGNAL, SWITCH MOVING, AND INTERLOCKING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 494,489, dated March 28, 1893.

Application filed August 13, 1892. Serial No. 443,026. (No model.)

To all whom it may concern:

Be it known that we, JOSEPH RAMSEY, Jr., and EDWARD W. HARDEN, citizens of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Electrical Signal, Switch Moving, and Interlocking Mechanism, of which the following is a specification.

One of the objects of our invention is to provide an electric interlocking system so arranged that the switch can only be operated when the target signals are at danger; the switch motor circuit being cut out by the movement of its dependent signals in the system to the safety position; and with the several signal systems so arranged that the movement of one set of signals to safety prevents the operation of the other set of signals until the first set has been returned to danger.

Another object of our invention is to connect with each signal motor circuit and each switch motor circuit an indicator circuit with the contact points of the signal and switch motor circuits made in the tower apparatus and through the indicator circuits, the switch motor circuits being opened or closed by the signal and switch indicator circuits, and the signal motor circuits being opened or closed by the switch and signal indicator circuits, whereby it is impossible to move the switch or signal except at the appropriate time.

Another object of our invention is to provide mechanism for cutting out the signal motor and employing a magnet to hold the signal to position of safety when the motor is cut out and so long as its circuit is unbroken, thereby saving the necessity of using a signal motor to hold the signal in safety position.

Another object of this invention is to arrange devices with the circuits which accurately indicate in the tower the position of all signals and switches, showing which are open and which are closed.

Another object of the invention is to provide a mechanism for breaking the switch motor circuit when a train is at the switch, so as to prevent it from being inopportunely thrown.

The various features of our invention are fully set forth in the description of the accompanying drawings making a part of this specification, in which—

Figure 1 is a diagram representing a single main track, a branch, and a switch motor circuit and connecting mechanism, two signal motor circuits and connecting mechanism, four indicator circuits and their connecting mechanism. Fig. 2 is a plan view showing the relation of the switch motor with the track and indicator box. Fig. 3 is a detail view of mechanism for closing the indicator circuit. Fig. 4 is a side elevation showing a detail view of the detector bar operated by the train to break the switch motor circuit. Fig. 5 is a detail view of the circuit breaking mechanism operated by the said detector bar. Fig. 6 is a plan view of the signal motor mechanism. Fig. 7 is a section on line x, x, Fig. 6. Fig. 8 is a central vertical section of the case and operating mechanism in the tower.

In the accompanying drawings there is shown a single main track, a branch track, a switch and switch motor mechanism, and four signals connected therewith, two for the main and two for the branch track, so as to illustrate our electric interlocking system applied in a simple form. As many additional switches and signals may be combined as is desired to operate a more extended system.

This switch motor mechanism is constructed substantially in accordance with Letters Patent No. 458,489, granted August 25, 1891, and is illustrated in Figs. 2 and 3 sufficiently to show the method of circuit connections made through the said mechanism, parts of which are omitted. This switch motor mechanism is constructed and operated precisely in the manner shown in said former patent except that the locking lever 22 engaging with notches in the drum 14 is provided with a circuit breaker a, which engages with a plate a' for making and breaking the indicator circuits through the switch motor box, see Fig. 3.

D represents a box in which are placed two sets of circuit making and breaking devices c, d, one or the other being closed according to the position of the switch. These circuit breakers are operated by the connecting rod 25, operated by crank 26, connected to the shaft of the drum 14. When the crank and connecting rod are in the position shown in

Fig. 2, the circuit terminals *c* are closed, and those at *d* are open. When the crank is in the reverse position the circuit terminals *d* are closed and those of *c* are open. By this means the indicator circuit 2 is cut out when indicator circuit 3 is closed, and vice versa, according to the position of the switch; and neither circuit is completed unless the switch is locked by lever 22 in position for main or branch rails.

The signal moving mechanism is constructed substantially as shown in Letters Patent No. 427,361, granted J. Ramsey, Jr., May 6, 1890, with our improvements attached thereto, as shown in Figs. 6 and 7.

T′ represents the target or signal motor; T^5 the driving shaft of the motor; 40 a collar rigidly secured to the shaft; 41′ weighted links hinged thereto; 43 a sliding collar to which the opposite end of the weighted links are hinged; 44 pins projecting up from the collar 43. 45 represents slots in bifurcated arm 20 in which said pins engage; these arms 20 move the signal blade in the same manner as described in the said former patent No. 427,361. Through the mechanism inclosed in the box H are established various circuits which are made and broken by the operation of the mechanism contained therein.

5 represents the circuit for driving the motor T′ and energizing the magnet M^5, the two being in parallel circuit.

6 represents an indicator circuit.

Normally the apparatus is in the position shown in Fig. 7.

N represents an armature lever for the magnet M^5 journaled upon stud shaft N′ and carrying on its foot a switch or contact point *e*′, which is normally in contact with and connecting with the stationary terminals *e*, *e*, on the block O; on the under side of said lever N is a lug 28 which rests on the segment 29; said segment is attached to the rock shaft 16; the motor T′ being normally in circuit, when the circuit 5 is completed and the motor set in motion, the weighted links expand and draw the lever 20 up, rocking the shaft 16 thereby moving the segment 29 forward so that the lug 28 drops behind it allowing the armature N^2 to come in contact with magnet M^5 and opening the motor circuit at *e*, *e*, the magnet remaining in circuit holds lever N and rock shaft 16 which operates the signal blade in that position, until the circuit 5 is broken when the counter weight W of the signal will rock the shaft 16 backward so as to bring the parts back into position shown in Fig. 7. When the arm K, likewise journaled on said rock shaft is moved forward by the action of the motor T′ a circuit is established at E′ through the terminals *h*, *h*′, leading to the distant signal A′; thus it will be seen that A′ cannot be brought to clear until after A is brought to clear. An indicator circuit 6 is established through the terminals E^2 E^3, by circuit closer e^2 on the lever 20, the breaking of which circuit by the movement of lever 20 demagnetizes the magnet M^6 releases armature *r*, breaks circuit 4 and moves the indicator I^2, at the tower. These circuits 5 and 6 are both connected with the wire 1, which is the return wire of all the circuits in the system. The method of closing circuits at the tower is illustrated in Fig. 1.

L^5 represents, say the lever for making and breaking the circuit 5, and is closed by bringing the contact lever L^5 in contact with the terminals h^2, h^3.

L^4 represents a contact lever, and it closes the switch motor circuit 4 at L^4 by moving in contact with the terminals h^4, h^5.

The indicating devices are preferably inclosed in a box J and are operated by the armature levers of the magnets M^2 M^3 M^6 M^8.

It is to be noted that no one of the circuits 4, 5 and 7, can be completed by the closing of the levers L^4 L^5 L^7 at the tower, unless the proper relation exists between the position of the switch and signals, whose position control the circuits 2, 3, 6, 8, and hence, through the magnets in tower M^2 M^3 M^6 M^8 and their armatures also control the circuits 4, 5 and 7, at c^2 c^4 c^5 and c^7.

The normal position of the parts is as follows: The switch set for the main track; the signals at danger; A represents the home or near signal for the main track, and A′ the distant signal; B the home signal for the side track, and B′ the distant signal; M^2 M^3 M^6 M^8 magnets for operating the indicators in the tower; M^5 magnet for holding the home signal at clear; M'^5 magnet for holding the distant signal at clear; M^7, M^9, magnets for holding the signals B and B′ at clear, respectively. c^2 c^4 c^5 and c^7 represent mercury contact cups which form circuit making and breaking devices in the tower, and by means of the magnets, their armatures, and the operating levers, the signal and switch circuits are made and broken.

The diagram Fig. 1, illustrates the path of the several circuits; 1 represents the terminal wire leading from the various operating devices to the battery or dynamo G which is the electric source of power. 4 represents the switch motor circuit. 2 represents one of the switch indicator circuits for said switch motor, and 3 the other switch indicator circuit, which are alternately made or broken by the movement of the switch, as shown in Fig. 2. 5 represents the signal motor circuit with the motors T′ and T^3 and magnets M^5 and M'^5 in parallel circuit therewith. 6 represents the indicator circuit for said signals A A′. 7 represents the signal motor circuit for the signals B B′, the magnets M^7 M^9 being in parallel circuit with said signal motors. 8 represents the indicator circuit of signals B B′. These circuits are so connected up that the switch cannot be moved except when the signals are in the danger position. The circuits 4, 5 and 7, are each opened and closed by the movements of the levers L^4 L^5 L^7, respectively.

I′ represents the switch indicator which is

preferably provided with a red face, marked red in drawings, a black face, and a white face; when the white is opposite the aperture *s* of the box it indicates that the switch is set and locked for the main track; when the red face is opposite it indicates the switch is set and locked for the side track; when the black face is opposite the aperture it indicates that the switch has not made a complete throw or is not locked in position. In the normal position we represent the signals at block with the switch set for the main track; in Fig. 1 the switch is shown set for the main track with the signals governing that track at clear. They are brought into this position as follows: In the normal position the mercury contact cup c^2 is closed by means of the armature *r* being held down by the magnet, M^6 being energized; the signals for the main track A A′ in this case are at block. The circuit 5 is represented as completed, L^5 being moved so as to close the terminals h^2, h^3. Magnet M^2 is in circuit 2 which is completed because the terminals *c* in the box D are closed and the lock contact *a* in switch motor box is also closed, and so long as this is the position of the switch the circuit 5 can be completed. But if circuit 2 be broken at the switch box D or at the lock contact *a* then the circuit 5 will be broken by the raising of armature *r* of magnet M^2, and indicator circuit 2 will have to be established before the signal A can be pulled to safety position.

The entire system will be operated as follows: The switch S being set for the main track as shown in the drawings, the circuit 2—2 is closed in the box D at *c*, and the magnet M^2 closes the mercury contact C^5 and the switch indicator I′ shows switch locked for main track. The signal lever L^5 is then lifted by hand and the circuit 5 is closed to home signal A; the motor pulls signal A to safety or clear position (as shown in drawings) when clear position is fully reached the break in circuit 5 at E′ is closed, and the distance signal A′ is operated and pulled to clear position; as signals A and A′ reach the clear position, magnets M^5 and M'^5 cut out of circuit the signal motors T′ and T^3 respectively, and the signals are held at clear by them until the circuit is broken at the tower. At the first movement of the signals from normal position circuit 6 is broken at points E^2 and E^3 and the indicator magnet M^2 is demagnetized and circuit 4 is broken at c^2, the indicator I^3, showing that either or both signals A and A′ have left the clear position. Circuit 6 cannot be closed until signals A and A′ are returned to block by opening lever L^5, cutting off the current, demagnetizing M^5 and M'^5, thus unlocking the signals, when the counter weights *w*, *w*, bring the signals to a horizontal position when the circuit 6 is closed and magnet M^6 operates its armature and closes the circuit 4 at cup c^2. The closing of circuit 4 at cup c^2 brings about the normal position and switch S can then be set for the branch track by lifting lever L^4 completing circuit 4, when the switch motor S M is operated, unlocking the switch and breaking circuit 2 at *a* (see Figs. 2 and 3) throwing the switch, breaking circuit 2 releasing magnet M^2, breaking mercury contact at c^5 and indicator I′ goes to a horizontal position and remains thus until the switch movement is completed, and circuit 3 closed at *d*, and circuit 3 is completed at locking contact *a*, when magnet M^3 is energized and its armature is operated, closing circuit 7 at cup c^7, and moving indicator I′ to final position, showing red. The track is now safe for trains using the branch, and lifting lever L^7, signals B and B′, with their circuit controllers E^4 E^5 E^6, locks magnets M^7 and M^9. Magnet M^8 and indicator I^3, are operated to clear position and returned to danger or normal position as fully described in operation of signals A and A′. Indicator I′ shows three colors, white when switch is closed for main track, black (or other distinctive color) when being operated, and red when closed for branch track.

In order to prevent throwing a switch when a train or engine is immediately in front of it we provide the following instrumentalities: V represents a detector bar hung on links 50, Fig. 4, normally elevated above the rail; the train wheels depress this bar, the links 50 oscillating and moving the connecting rod 51 hinged to the bar V, rocking crank 52 and its shaft 53, and moving the arm 54 away from its contact point *b;* thus breaking circuit 4, Fig. 2. As soon as the train leaves the detector bar V the spring 56 will force it back to normal position closing the contact lever 54 against its contact *b*, thus placing the circuit 4 in position to be operated when the other circuit making and breaking points are in proper position. It will be seen thus that switch 4 can not be operated in either direction until both the signals A and signals B are at block; that the indicator circuits 2 and 3 disclose at all times the position of the switch. It will be seen that the making and breaking of the switch motor circuit and the signal motor circuits are through the apparatus in the box J at the tower controlled by the position of the switch and signals themselves; that the switch and signals are locked against one another through these controlling parts.

It is obvious there may be a plurality of switch motor circuits and signal motor circuits operated in the same manner, so that each signal and each switch will have its appropriate indicator and be operated in its appropriate order.

It will be observed that the switch motor circuit 4 is completed at the tower only when circuit 6 is closed, and the armature of magnet M^6 is closed, and that the circuit 6 is only completed in the signal box H when they are in normal position shown in Fig. 7, or at block, hence, the switch motors M can be brought into operation only when the signals are at

danger position. It will be also observed that the signal motor circuit 5 cannot be completed by lever L^5 unless the magnet M^2 is energized to bring its armature terminal in contact with the mercury cup c^5; hence, the signals A A′ can only be moved by completing the circuit 5 when the indicator circuit 2 is completed through the armature of M^2, and this position of the armature of magnet M^2 is maintained only when the switch is set for the main track; and that the signals B B′ can not be moved by the operation of lever L^7 until circuit 3 is closed through the terminals of armature of magnet M^3, and that this position of the armature is obtained by the closing of circuit 3 when the switch is set for the side track, the terminals d of circuit 3 in the box D then being in contact. In this case circuit 5 is inoperative and circuit 7 is operated to move the signals B B′ for the branch, hence, the moving of the signals A A′ can only be accomplished when the switch is set for the main track; and the moving of signals B B′ can only be accomplished when the switch is set for the side track, and that the switch circuit can not be operated except both sets of signals are at danger; the armatures of magnet M^3 and M^6 must first be closed, before the circuit 4 can be completed by the movement of lever L^4. Thus, there is a complete interlocking of the signals and locking devices and neither can be inopportunely moved.

Having described our invention, what we claim is—

1. In an electric interlocking system, the combination of the railway switch with the switch motor and its circuit, a signal motor and its circuit, a signal indicator circuit 6 and the magnet M^6 at the tower in said circuit 6, with an armature for making and breaking the switch motor circuit, whereby the switch circuit is broken when the signals are at safety, substantially as described.

2. In an electric interlocking system, the combination of the railway switch with the switch motor and its circuit, a signal motor and its circuit, signal indicator circuit 6 with magnet M^6 at the tower in said circuit 6, operating an indicator I^2, with an armature for making and breaking the switch motor circuit, whereby the switch motor circuit is broken when the signals are at safety, substantially as specified.

3. In combination with the switch motor circuit 4, the signal motor circuits 5 and 7, the signal motors T′ T^2, the signal indicator circuits 6 and 8, the magnets M^6, M^8, and their armatures r controlling circuit breakers for said circuit 4, whereby said circuit 4 can only be completed when the circuits 6 and 8 are closed by the operation of the signal devices in circuits 5 and 7, substantially as specified.

4. In combination with a railway switch, a switch motor circuit 4, a signal motor circuit 5, a switch indicator circuit 2, of the magnet M^2 with its armature r controlling terminals for the switch circuit 5, operated by the circuit 2, the magnet M^2 being located in the tower, and the circuit making and breaking terminals c being located in box D near the switch and operated automatically by said switch, substantially as herein specified.

5. In combination with a railway switch, a switch motor circuit 4, a signal motor circuit 5, a switch indicator 3, the magnet M^3, with its armature r controlling terminals for the switch circuit 5, operated by the circuit 3, the magnet M^3, being located in the tower and the circuit making and breaking terminals d being located in box D near the switch, and operated automatically by said switch, substantially as specified.

6. The combination of a switch, a track box, the electric circuits 2 and 3, the magnets M^2 and M^3 in said circuits, their armatures, the signals, and their circuits 5 and 7 with circuit controllers c^5 and c^7 contained in said circuits 5 and 7, and operated by the armatures of the magnets M^2 and M^3, substantially as specified.

7. In combination with a railway switch, a switch motor and circuit closing mechanism, the circuit terminals a operated by the arm 22 of the switch motor mechanism, the switch indicator circuits 2 and 3, provided with terminals c, d, located in box D and operated by the switch connecting rod 25, the magnets M^2 and M^3 located at the tower, connected up respectively in circuits 2 and 3, and the signal motor circuits 5 and 7 alternating closed or opened by the operation of the armature of magnets M^2 and M^3, whereby the signal circuits 5 and 7 are under the control of the switch motor mechanism, and their condition indicated at the tower, substantially as specified.

8. In an electric interlocking system having one or more signal circuits, and signal indicator circuits, the switch motor M S, located at the switch, the switch indicator circuits 2 and 3, with the circuit making and breaking devices c, d, in box D, operated by the switch rod 25, the magnets M^2 M^3 connected up respectively with different indicator circuits, with their respective armatures operated to make and break alternately the signal circuits 5 and 7, by the operation of the switch motor mechanism, substantially as specified.

9. In a switch motor mechanism, the combination of the switch, the switch motor box, the circuits 2 and 3, and the switch motor S M, having a locking lever 22 for making and breaking the circuits at a', whereby said circuits are respectively opened and closed in the switch motor box when the switch is shifted to either extreme position by the operation of the switch motor, substantially as described.

10. In combination with the signal motor mechanism located in box H, the terminals h', the lever 5 provided with the conducting strip h, mounted on the rock shaft 16, adapted to open and close a secondary or distant signal motor circuit by the operation of the sig-

nal motor within said box, substantially as specified.

11. the combination of the signal motor, the block O having terminals *e e* thereon, the magnet M^5, and the armature lever N journaled on the stud shaft N′ and having the switch or contact point *e′* whereby the signal motor circuit is opened and closed automatically at *e e′* by the operation of the signal motor mechanism, substantially as described.

12. In combination with the signal motor and the magnet M^5, in parallel connection therewith, the circuit terminals *e e′* the lever armature N, and the locking mechanism 28 and 29, whereby the said magnet holds the signal in a given position when the motor is cut out, substantially as specified.

13. In combination with the signal motor, and the magnet in parallel circuit therewith, the lever K operated to open and close the terminals *h h′*, the armature lever N operated to open and close the circuit terminals *e e′*, the lever 15 carrying the circuit closer e^2, said levers N, 15, and K, being operated automatically by the rock shaft 16, to cut in and out the motor and lock the shaft 16, and to cut in and out the signal indicator, and to open and close a distant signal circuit, substantially as specified.

14. In combination with the switch motor, the detector bar V connecting rod 51 with crank 52, shaft 53, operating the circuit closer *b* to make and break the switch motor circuit 4, substantially as specified.

In testimony whereof we have hereunto set our hands.

JOSEPH RAMSEY, JR.
EDWARD W. HARDEN.

Witnesses:
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C. W. MILES.