No. 889,482.

PATENTED JUNE 2, 1908.

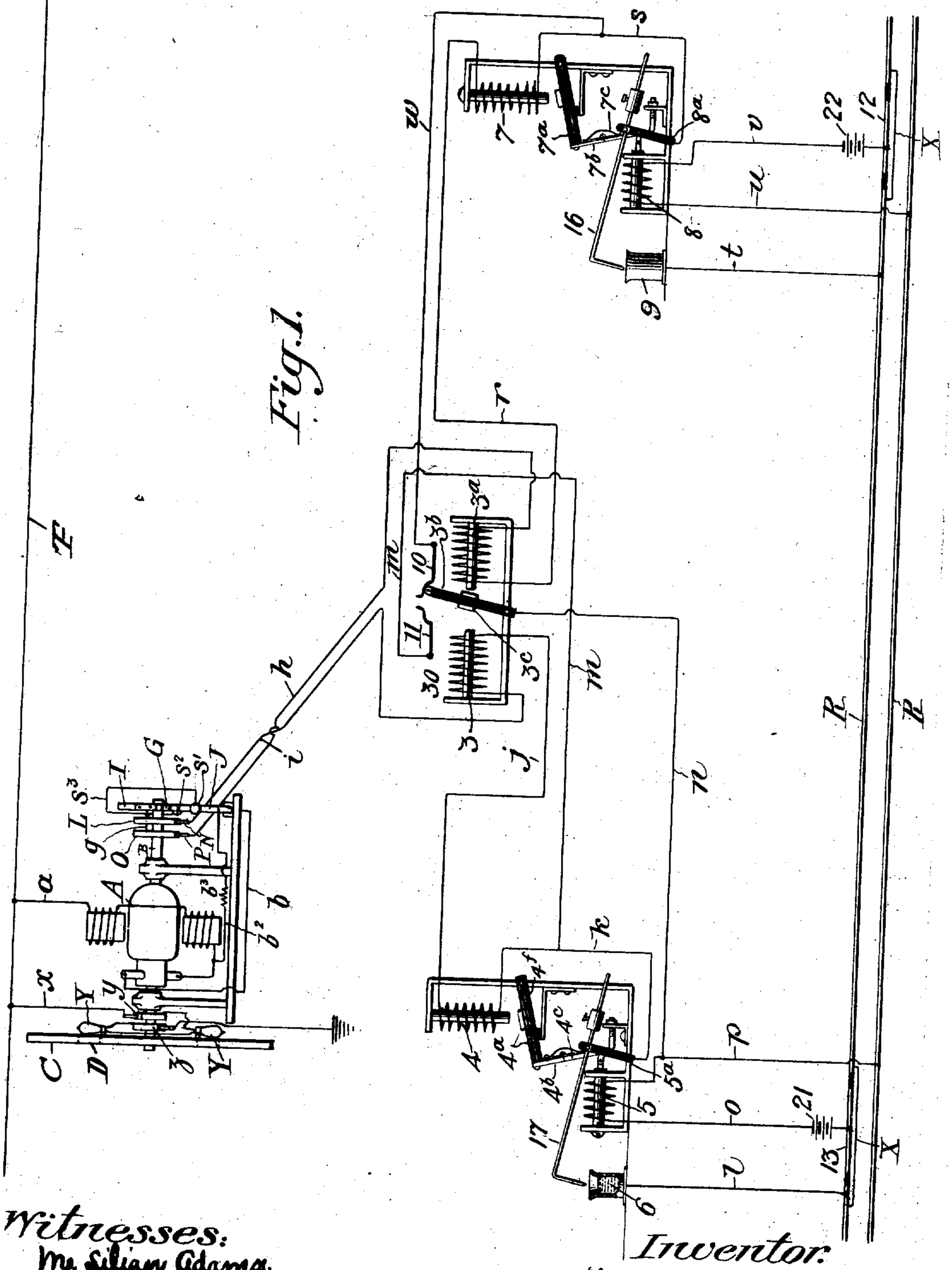
F. L. O'BRYAN.

ELECTRIC SIGNALING SYSTEM.

APPLICATION FILED JAN. 8, 1908.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 2.

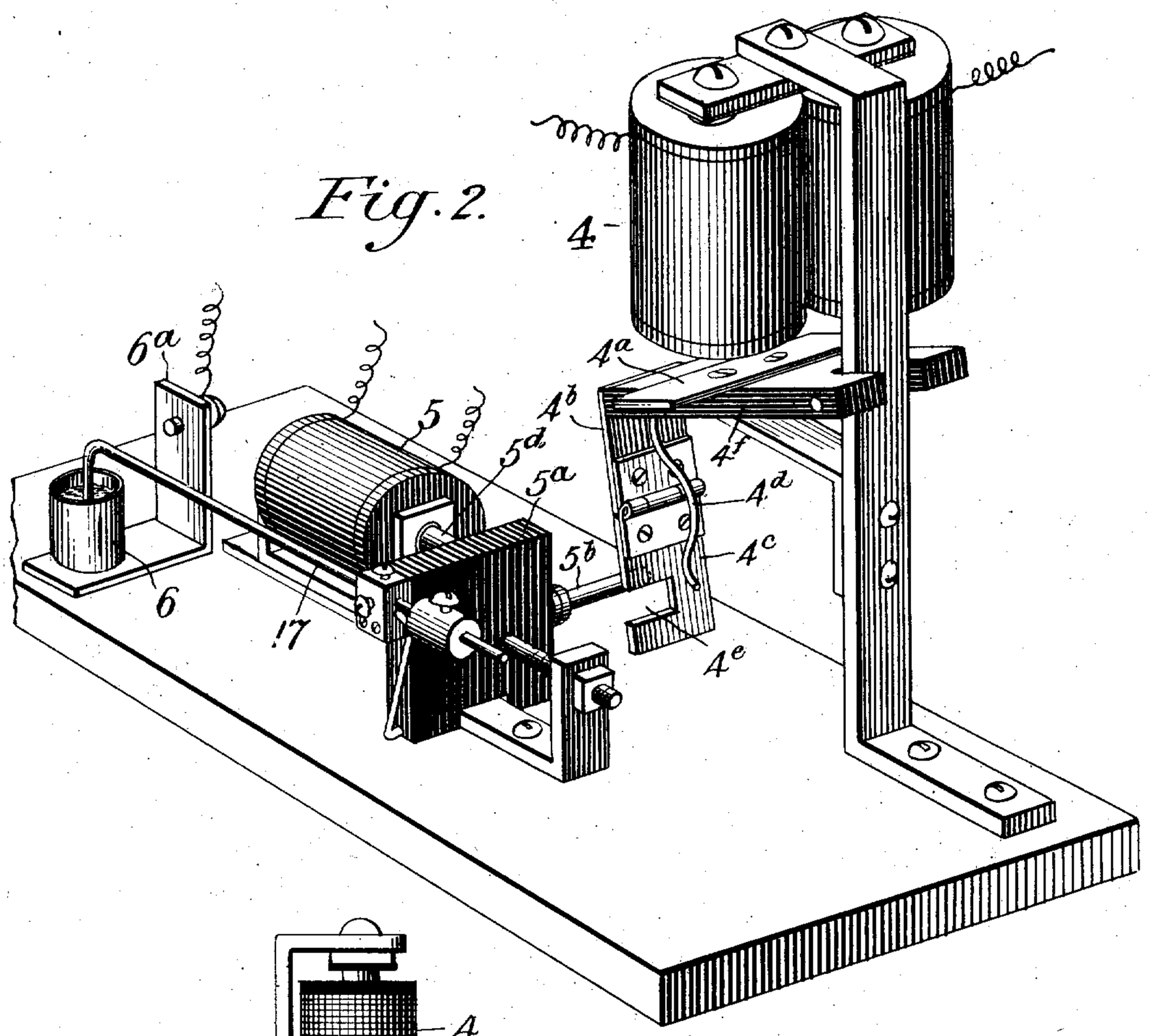
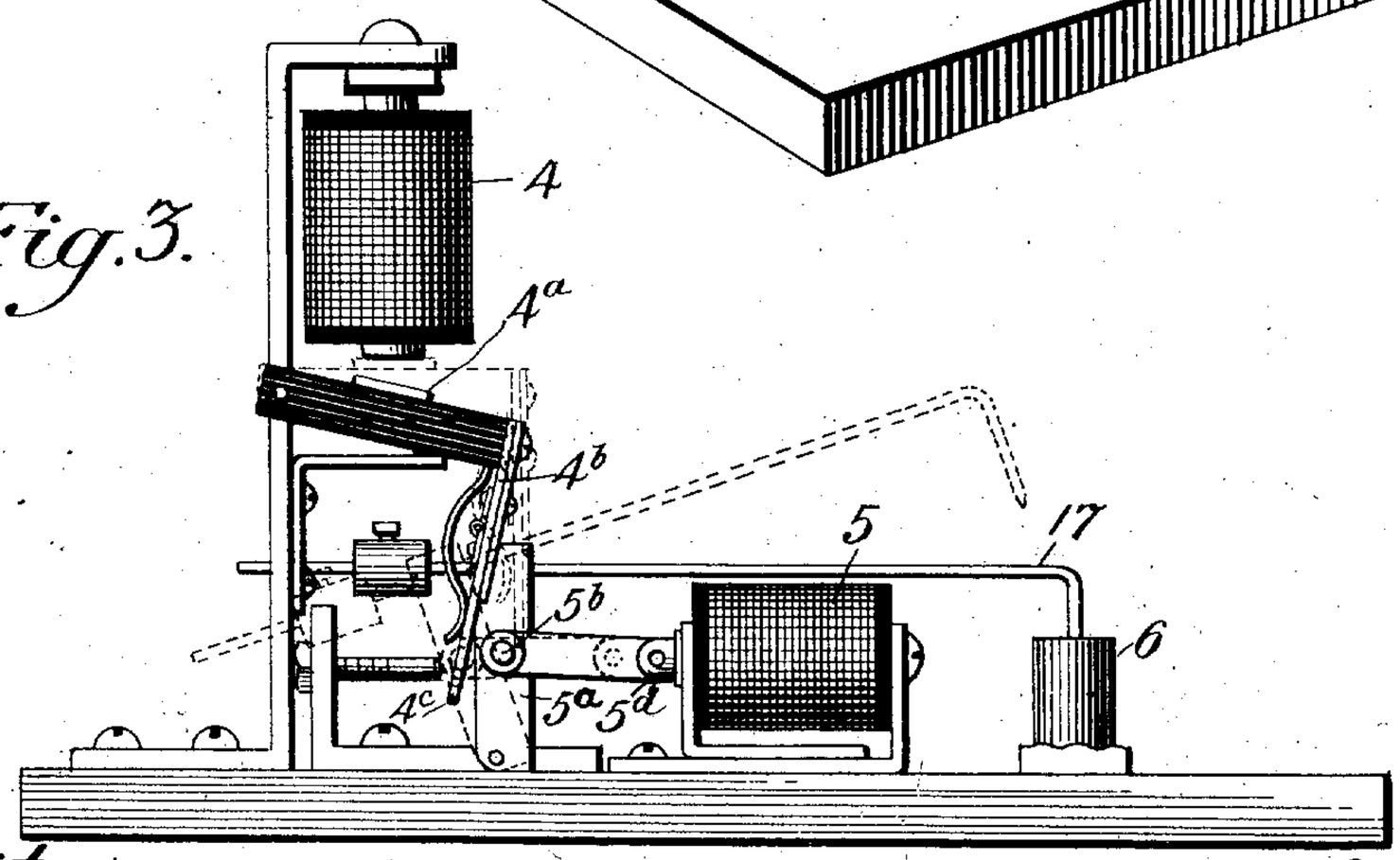


Fig. 3.



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3 SHEETS—SHEET 3.

Fig. 4.

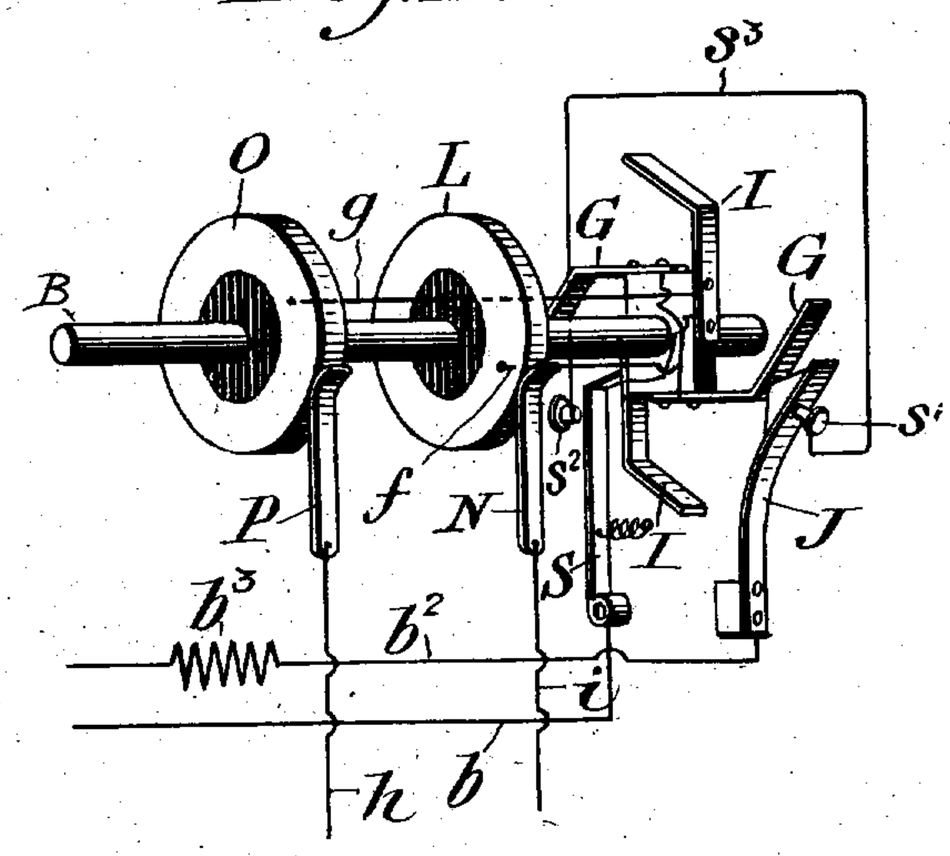
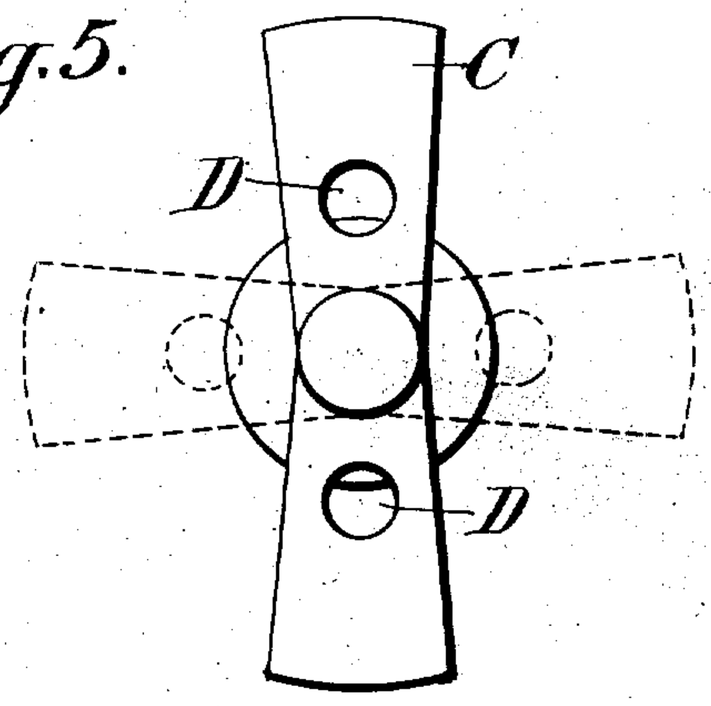


Fig. 5.



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UNITED STATES PATENT OFFICE.

FRANCIS L. O'BRYAN, OF SOUTH FRAMINGHAM, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO HIRAM STANLEY MARSH, OF CAMBRIDGE, MASSACHUSETTS.

ELECTRIC SIGNALING SYSTEM.

No. 889,482. Specification of Letters Patent. Patented June 2, 1908.

Application filed January 8, 1908. Serial No. 409,867.

To all whom it may concern:

Be it known that I, FRANCIS L. O'BRYAN, a citizen of the United States, residing in South Framingham, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Electric Signaling Systems, of which the following is a specification.

The invention relates to electrically operated signals for railways, and has for its object to provide a signal system that is simple and positive in operation; that is not liable to derangement or false indications and that will automatically correct abnormal conditions due to the temporary failure of the current in the main supply circuit, the signal being set to danger by a car or train entering at one end of the block and restored to safety by the train or car leaving the block at the opposite end, special means being provided for effecting the proper actuation of the signal by a second car or train entering the block under the permissive system, while a first train is still in the block, so as to insure the signal remaining at danger at all times while a train is in the block guarded thereby.

In the accompanying drawings—Figure 1 is a diagrammatic view of the signaling system as a whole; Fig. 2 is a perspective view of the preferred form of track relay and restoring magnet therefor; Fig. 3 is a side elevation of the same; Fig. 4 is a detail perspective view of the switching or circuit controlling and braking means on the motor shaft; Fig. 5 is an enlarged detail view of the semaphore.

Referring to the drawings R, R represent, for instance, the east bound rails of a double track road, said road being divided into blocks of appropriate lengths. At the forward end of the block there is an insulated rail section 13, to which is connected one terminal of the battery 21, connected by a lead *o* to one terminal of a track relay 5, the other terminal of said track relay being grounded by wire *p*, so that when the wheels of a train bridge rail section 13 and the opposite rail, said track relay 5 is energized. The magnet of relay 5 is preferably a solenoid, to the core 5^d of which is connected by a suitable hinged-joint a pivoted block 5^a, rigidly attached to which is a contact arm 17, which latter, when the core of the solenoid is attracted, dips into a stationary mercury contact 6 mounted upon a suitable connecting piece 6^a. Said mercury contact 6 is grounded conveniently on one of the track rails by a lead *l*.

To the contact arm 17 is connected a lead *k* which, in turn, is connected with the one terminal of an electro-magnet 4 located adjacent to track relay 5. Said magnet 4, which is conveniently arranged in upright position upon a standard adjacent to track relay 5, is provided with an armature 4^a mounted upon an arm 4^f pivoted to the standard. On the forward edge of said arm is secured a pendent arm 4^b, to which is attached, by a suitable hinge, a detent 4^c, which latter is provided with a lateral opening 4^e, and said detent 4^c; when the armatures of both magnet 4 and relay 5 are attracted, lies in front of a lateral arm 5^b secured to the block 5^a, which is attached to and moves with the core or armature of relay 5. When, however, armature 4^a of magnet 4 falls, the portion of detent 4^c below the opening 4^e engages arm 5^b and retracts the core of relay 5, swings block 5^a backward and lifts contact arm 17 out of the mercury cup 6, thereby breaking the circuit established by the track relay 5 and block 5^a approaches the limit of its rearward movement, the opening 4^e comes opposite arm 5^b and permits detent 4^c to move behind said arm 5^b, as indicated in Fig. 2. On the other hand, should the armature 4^a be attracted by magnet 4, after track relay 5 has been actuated to attract its core, the hinged joint between detent 4^c and pendent arm 4^b permits the detent to be swung backward until lateral arm 5^b passes below the end of said detent, when a spring 4^d immediately restores the detent to its normal position in alinement with pendent arm 4^b and said detent 4^c lies in front of arm 5^b. Should armature 4^a be attracted by magnet 4 while the relay 5 is deenergized, the lateral arm 5^b will pass through the opening 4^e of the detent 4^c and block 5^a may be subsequently moved forward by the solenoid 5 until arm 5^b lies just behind detent 4^c without affecting the relation of magnet 4 and its armature.

The opposite terminal of magnet 4 is connected to a lead *j* which, in turn, is connected to one terminal of the magnet 3 of relay 30, the other terminal of said magnet being connected by lead *i* with a brush N which contacts with a slip ring L mounted upon the shaft B of the motor A. Said motor A,

which may be of the ordinary series type, is mounted and housed in any appropriate manner upon a signal post located near the forward end of the block. Mounted on the shaft is a semaphore arm C, which is provided with openings D, behind which are mounted electric lamps Y, which are preferably lighted when the signal is moved to danger position to show a red light through the openings D, which may be effected by either placing red glasses in the openings D or coloring the bulbs of the lamps Y, red.

Mounted upon the forward end of the motor shaft, adjacent to slip rings L and O, is a switching or commutating device, consisting of an insulated hub from which projects four bent spring arms I, I and G, G, which are adapted to engage successively a brush or contact arm S, the intervals between adjacent springs G and I being sufficient to rupture any arc which would tend to form when the brush S breaks contact with any of the said springs. From brush S the circuit passes by lead *b* through the motor and by way of lead *a* to a trolley wire T, or other suitable source of electric supply. At the opposite end of the block there is located a similar arrangement of track relay and restoring magnet, said relay 8 being connected by a lead *u* to the track, and by a lead *v* through battery 22 to insulate track section 12. 16 and 9 indicate a contact arm and mercury contact similar in all respects to corresponding contacts 17 and 6 at the opposite end of the block.

The restoring magnet for the relay is indicated at 7, and its construction and operation are practically the same as that hereinbefore described. The circuit established by track relay 8 through the electric motor is substantially as follows: Trolley wire T, lead *a* through the field and armature of the motor by way of lead *b*, brush S, contact arm I, lead *g*, to slip ring O mounted on shaft B of the motor A, from said slip ring O by way of brush P, lead *h* to magnet 3^a located opposite magnet 3 of the relay 30, hereinbefore referred to, thence by lead *r* through magnet 7 and lead *s* to contact arm 16, mercury contact 9 and lead *t* to ground.

With respect to the relation of slip rings L and O and commutator arms G and I, it will be noted that the arms I, I are cross connected as are the arms G, G, said arms being located alternately and substantially ninety degrees apart, and each set of arms is connected to an appropriate slip ring, to wit, the arms I are connected by lead *g* to slip ring O, and arms G are connected to slip ring L by lead *f*, as will be more particularly observed from Fig. 4.

Relay 30, which consists of opposite magnets 3 and 3^a and an interposed armature 3^c mounted upon a pivoted arm 3^b, is to close the shunts about the contacts 6 and 17, and 9 and 16, respectively, after the corresponding relays have been actuated, in order to prevent the signal remaining in inoperative position should the current from the source of power fail before the operation of the signal is completed. To effect the closing of these shunts, it will be noted the end of the arm 3^c is provided with a contact which engages one or the other of stationary spring contacts 10 and 11. Spring contact 11 is connected by lead *m* with wire *k*, which connects arm 17 with magnet 4, and the contact on the end of arm 3^c is connected by lead *n* with ground wire *p*, so that when arm 3^c engages contact 11, *m* and *n* constitute a shunt about the terminals 6 and 17, through which the circuit of the motor is closed and through which shunt a current, which may have been interrupted and which is subsequently reëstablished, will completely actuate the signal without disturbing the relation of track relay 5 and magnet 4. The shunt about terminals 9 and 16 is established when arm 3^c engages spring 10, said shunt being by way of lead *n*, arm 3^c, spring 10, and lead *w* to lead *s*, which is a continuation of the motor circuit through magnet 7.

To effect the lighting of the lamps Y, when the signal moves to danger the circuit to said lamps is closed between trolley wire T and the ground by way of a lead *x* attached to said trolley wire, which connects by means of a suitable brush to a commutator ring *y* on the shaft B of the motor A. From said commutator ring a lead passes through both lamps and is connected to a second commutator ring *z* mounted on the motor shaft whence the current is taken by a suitable brush to ground. It will be understood, of course, that the conductor portions of the commutator rings will be so arranged as to come under the brushes each time the semaphore arm moves to danger position so as to light the lamps.

In order to brake the motor A and arrest the movement of the semaphore at the proper time, means are provided for short circuiting the motor armature through a suitable resistance, just before the signal arm reaches the end of its movement to either danger or safety position.

Referring particularly to Figs. 1 and 4, it will be noted that there is mounted opposite brush S and in operative relation to the spring arms I, I and G, G a spring contact member J which is normally held in engagement with the spring member I or G, which happens to lie adjacent to the same. Said contact member J is connected by a lead b^2 with the motor brush opposite that to which lead *b* is connected. Interposed in the lead b^2 is a suitable resistance b^3. Contact member S is adapted to be forced into engagement with a stationary contact s^2 by spring arms I, G as the commutating switch rotates.

Similarly contact brush J is adapted to be moved into engagement with a stationary contact s^1 by springs I, G and said contact s^1 and s^2 are connected by a lead s^3. Assuming that the motor is just starting, it will be noted that contact member S is out of engagement with stationary contact s^2. As the switch member begins to rotate, lower spring arm I, moves contact S toward stationary contact s^2 and just before right hand spring G passes out of engagement with contact spring J, contact S engages stationary contact s^2 thereby closing the shunt about the motor armature by way of lead b, brush S, stationary contact s^2, lead s^3, stationary contact s', contact spring J, lead b^2, and resistance b^3, which immediately checks the speed of the motor so that when the upper spring member I engages the contact spring J, the motor will stop and the opposite spring I, which serves to move pivoted contact S into engagement with stationary contact s^2 is snapped past the end of said contact S and permits the latter to move back to its normal position, thereby breaking a shunt, about the motor armature. It will be understood, of course, that this breaking operation is effected for each actuation of the signal and serves as an efficient means for stopping the semaphore arm at the proper positions.

The operation of the apparatus is substantially as follows: When a car or train enters the forward end of the block the wheels bridge insulated rail section 13 and the opposite rail R, thereby closing the circuit to track relay 5, as hereinbefore described. The armature of said relay is attracted and closes contacts 6 and 17, thereby establishing a circuit from feed wire T, lead a, through motor A, lead b, brush S, contact G, lead f, slip-ring O, brush P, lead i, magnet 3, lead j, magnet 4, lead K, arm 17, mercury contact 6, lead l to ground, thereby energizing motor A, and magnets 3 and 4. Magnet 3 of relay 30 attracts arm 3^c, so that it engages spring contact 11. Magnet 4 lifts its armature until detent 4^c passes in front of lateral arm 5^b. When the motor A has made one-quarter of a revolution, brush S passes out of contact with the commutator arm G and breaks the motor circuit, but immediately passes into contact with one of the arms I, as shown in Fig. 4. At this time the shunt to the motor armature is closed by the rotary switch, as described and the movement of the motor is quickly arrested. The breaking of the motor circuit likewise deënergizes magnet 4, whose armature falls and detent 4^c striking lateral arm 5^b retracts the core of the track relay 5, and thereby lifts contact arm 17 out of engagement with the mercury cup 6. The breaking of the motor circuit, however, does not affect armature 3^c of relay 30, for the reason that said armature is pivoted at the bottom and remains in any position to which it is moved unless attracted by a magnet opposite the one by which it was last moved. The engagement of springs 11 and 10 with the end of said arm 3^c also tends to retain said arm in any position to which it is moved. The signal having been moved to danger by the motor and the motor circuit broken at the commutator contacts G and S, and also at the track relay contacts 6 and 17, it will be noted that another car or train passing over rail section 13 will not actuate the signal, although it will operate track relay 5. As the train, which is entitled to right-of-way in the block, proceeds toward the end of the block and its wheels bridge insulated rail section 12 and the opposite rail R, the circuit to track relay 8 is closed, thereby closing contacts 9 and 16, and establishing the motor circuit as follows: lead a through the motor, lead b through the brush S, commutator arm I, lead g, slip-ring L, brush N, lead h, magnet 3^a, lead r, magnet 7, lead s, contact arm 16, contact 9, lead t to ground. This causes the motor to rotate another quarter of a revolution and restore the signal to safety position, at the same time extinguishing the lights Y, Y behind the semaphore. This movement of the motor causes brush S to again engage one of the commutator arms G, which places the system in position to be operated by the next train entering the block to set the signal at danger.

It will be noted that should the current fail in the trolley wire T for a brief interval, owing to the blowing of the circuit breakers or any other cause, while the signal is being operated but has not been completely set, the shunts established by relay 30 around contacts 6 and 17, and 9 and 16, respectively, afford proper paths for the circuit through the motor as soon as the current is reëstablished and until the signal has been moved to either danger or safety, as the case may be. It will also be noted that, should a second train be permitted to enter the block while the first train is still in the block, it will not interfere with the proper actuation of the signals for, although the first train on leaving the block will clear the signal, the latter will immediately go to danger for the reason that the track relay 5 has been again actuated by the second train to close one break in the motor circuit, the other break being closed as soon as brush S moves from engagement with one commutator arm I in contact with the succeeding commutator arm G, thereby completing the circuit through the motor to cause the same to continue its movement to set the semaphore at danger. When the second train leaves the block the signal will be cleared in the regular way.

It will be understood that the signal system hereinbefore described is applicable to railways generally, whether they be steam.

electric or of any other character. The system is particularly adapted to electric railways and when so employed and the rails are used to complete the return circuit of the power current used in operating the cars, it will be desirable, of course, to bond the rails at the joints, and in order to render the rail which contains the insulated sections at the block ends, continuous, a bond wire as X is run around the insulated sections, in the manner shown at sections 12 and 13 in Fig. 1.

What I claim as my invention is:

1. In a railway signaling system, the combination of a signal, a motor for actuating the same, a track relay for closing the motor circuit, and an electro-magnet in the motor circuit having an armature adapted to break the motor circuit at the track relay after the signal has been actuated.

2. In a railway signaling system, the combination of a signal, a motor for actuating the same, a track relay for closing the motor circuit, and an electro-magnet in the motor circuit adapted to engage and retract the armature of the track relay to break the motor circuit after the signal has been actuated.

3. In a railway signaling system, the combination of a signal, a motor for actuating the same, a track relay for closing the motor circuit, switch mechanism controlled by the motor for opening the motor circuit when the signal has been actuated, and an electro-magnet in the motor circuit for restoring the armature of the track relay and breaking the motor circuit at said track relay.

4. In a railway signaling system, the combination of a signal, a motor for actuating the same, a track relay for closing the motor circuit, an electro-magnet in the motor circuit having an armature adapted to break the motor circuit at the track relay when the signal has been actuated, and a relay in the motor circuit adapted to close a shunt about the track relay contacts in the motor circuit to prevent the signal being left in inoperative relation upon temporary cessation of current in the motor circuit.

5. In a railway signaling system, the combination of a signal, a motor for actuating the same, a track relay for closing the motor circuit, an electro-magnet in the motor circuit adapted to engage and retract the armature of the track relay to break the motor circuit when the signal has been actuated, and a relay in the motor circuit adapted to close a shunt about the track relay contacts in the motor circuit to prevent the signal being left in inoperative relation upon temporary cessation of current in the motor circuit.

6. In a railway signaling system, the combination of a signal, a motor for actuating the same, a track relay for closing the motor circuit, switch mechanism controlled by the motor for opening the motor circuit when the signal has been actuated, an electro-magnet in the motor circuit for restoring the armature of the track relay and breaking the motor circuit at said track relay, and a relay in the motor circuit adapted to close a shunt about the track relay contacts in the motor circuit to prevent the signal being left in inoperative relation upon temporary cessation of current in the motor circuit.

7. In a railway signaling system, the combination of a signal, a motor for moving said signal, a track relay for closing the motor circuit, switch mechanism controlled by the motor for opening the motor circuit when the signal has been actuated, and a relay in the motor circuit for closing a shunt about the track relay contacts, as and for the purpose described.

8. In a railway signaling system, the combination of a semaphore, a motor for rotating said semaphore, substantially one-quarter of a revolution for each successive signaling position, a track relay for closing the motor circuit, switch mechanism controlled by the motor for opening the motor circuit when the signal has been actuated, and a relay in the motor circuit for closing a shunt about the track relay contacts, as and for the purpose described.

9. A railway signaling system, comprising a signal at one end of a track section or block, a motor for actuating the signal, a track relay at each end of the block for closing motor circuit contacts, and switch mechanism controlled by the motor for opening the motor circuit controlled by one track relay and closing the motor circuit controlled by the other track relay, whereby the signal is set to danger by the car entering the block and cleared by the car leaving the block.

10. A railway signaling system comprising a signal at one end of a track section or block, a motor for actuating the signal, a track relay at each end of the block for closing motor circuit contacts, switch mechanism controlled by the motor for opening the motor circuit controlled by one track relay and closing the motor circuit controlled by the other track relay, and a relay interposed between the respective track relays and the motor for closing shunts about the respective track relay contacts to prevent the signal being left in inoperative position upon temporary cessation of current in the motor circuit.

11. In a railway signaling system, the combination with a track relay having a pivoted member, of an electro-magnet coöperating with said track relay to retract the armature thereof and break the signaling circuit established thereby at the track relay contacts, said electro-magnet having an armature carrying a pivoted detent adapted to

swing past the pivoted member of the track relay when said armature is attracted by the magnet and to engage said pivoted member and retract the same when said magnet is de-energized.

12. The combination of a relay 5 having a pivoted member 5^a connected with the armature thereof and an electro-magnet 4 provided with an armature 4^a having a hinged member 4^c secured thereto and provided with an opening 4^e, so constructed and arranged that the fall of said armature 4^a will retract the pivoted member 5^a and the armature of said relay 5.

In testimony whereof, I have hereunto subscribed my name.

FRANCIS L. O'BRYAN.

Witnesses:

LYNETTE CLARK,

JOHN H. TEMPLE.