H. W. SOUDER.

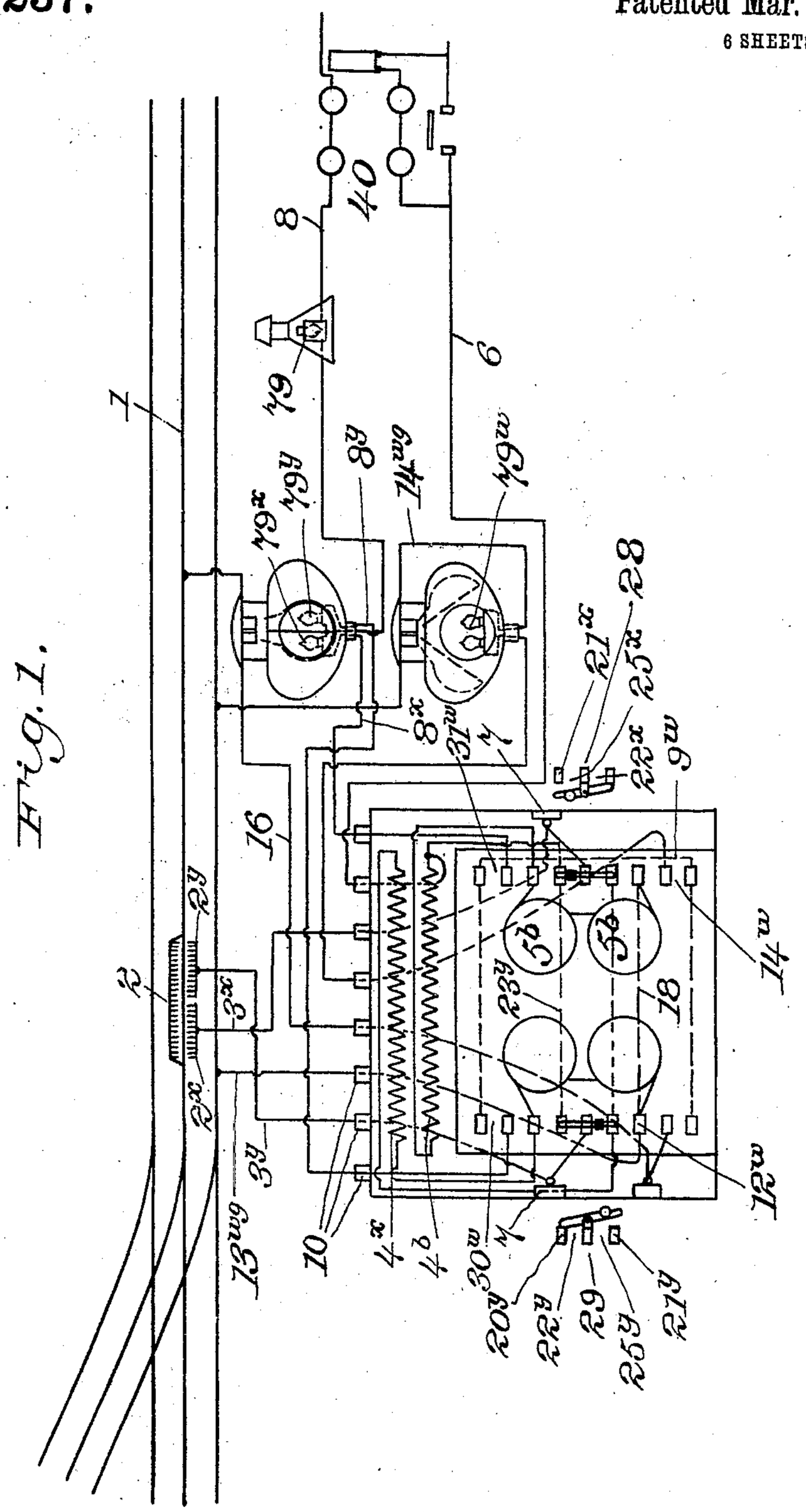
ELECTRIC SIGNALING SYSTEM.

APPLICATION FILED JUNE 10, 1907.

915,237.

Patented Mar. 16, 1909.

6 SHEETS—SHEET 1.



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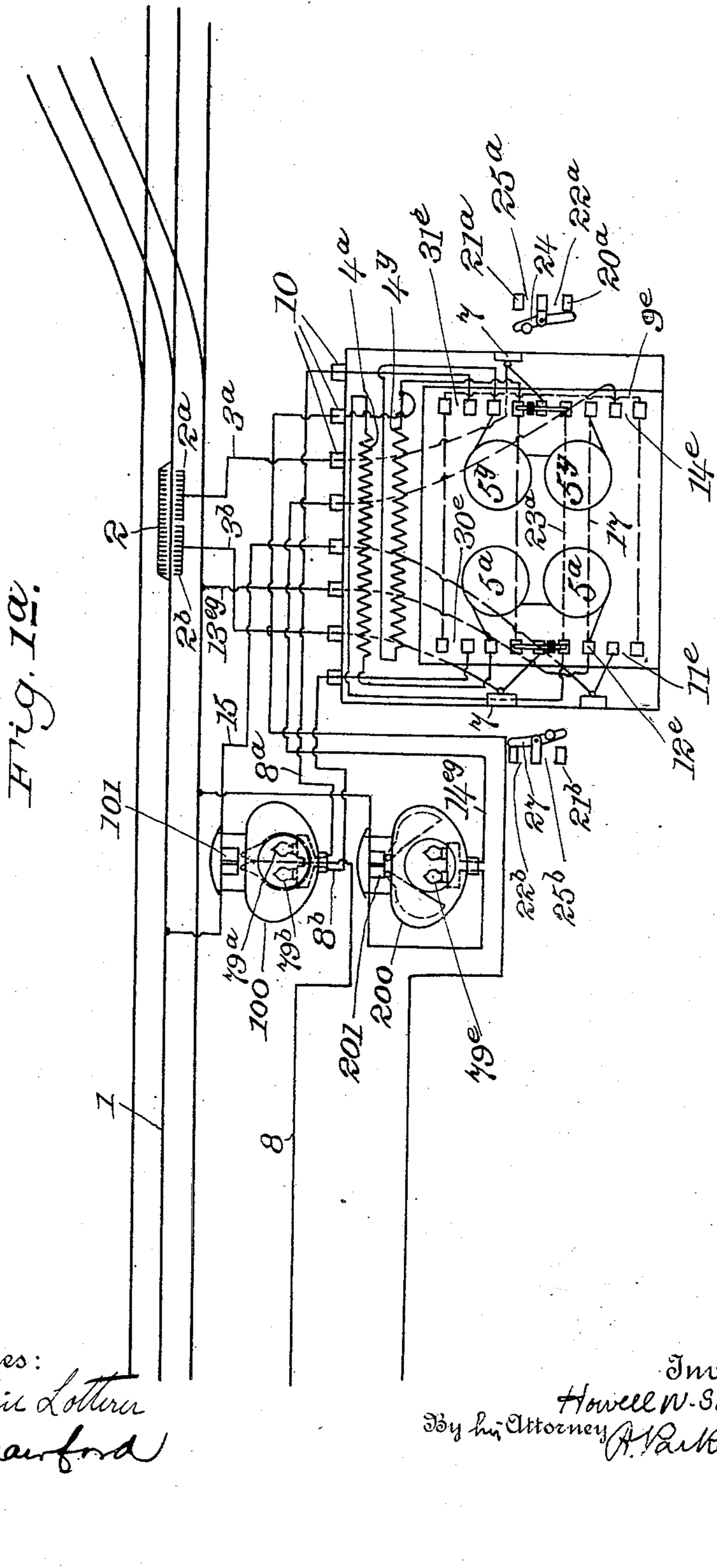
6 SHEETS—SHEET 2.

Fig. 1a.



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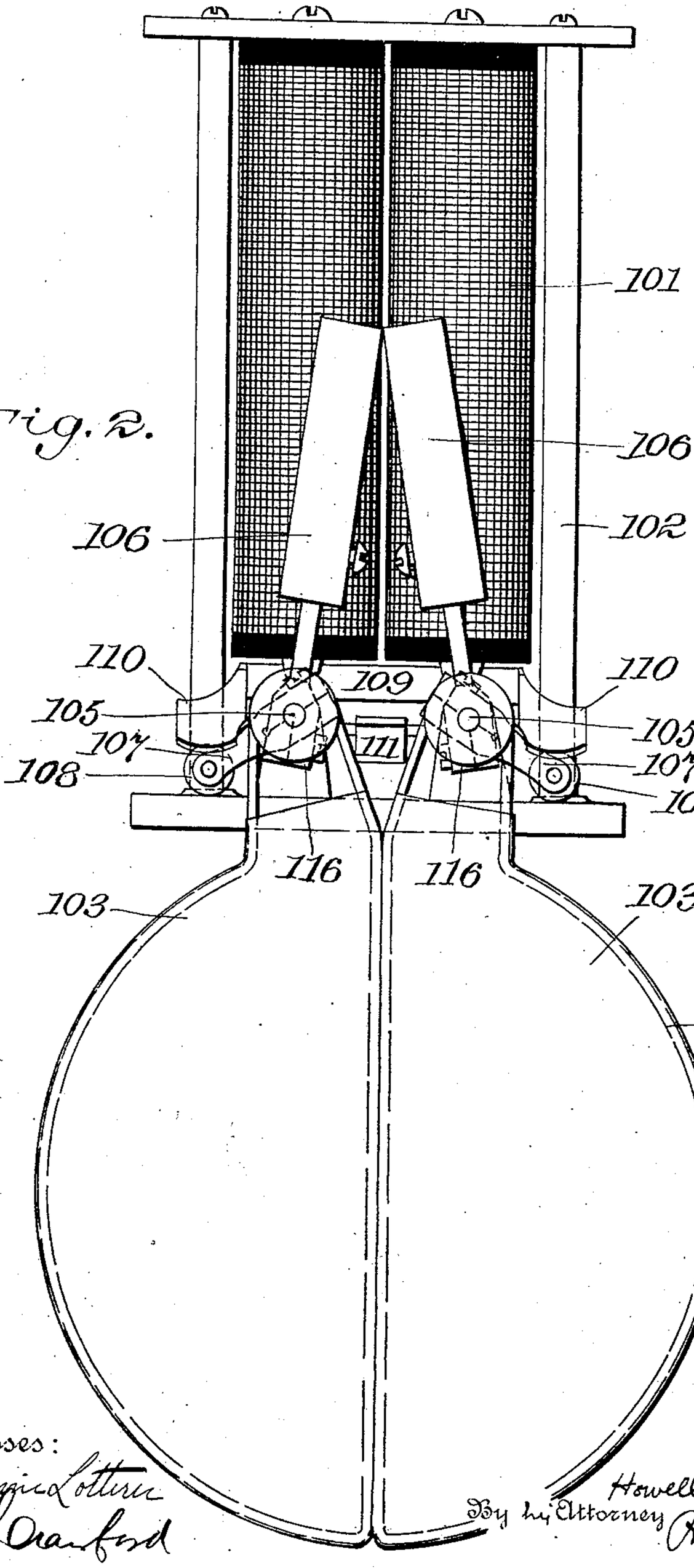
6 SHEETS—SHEET 3.

Fig. 2.



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6 SHEETS—SHEET 4.

Fig. 3.

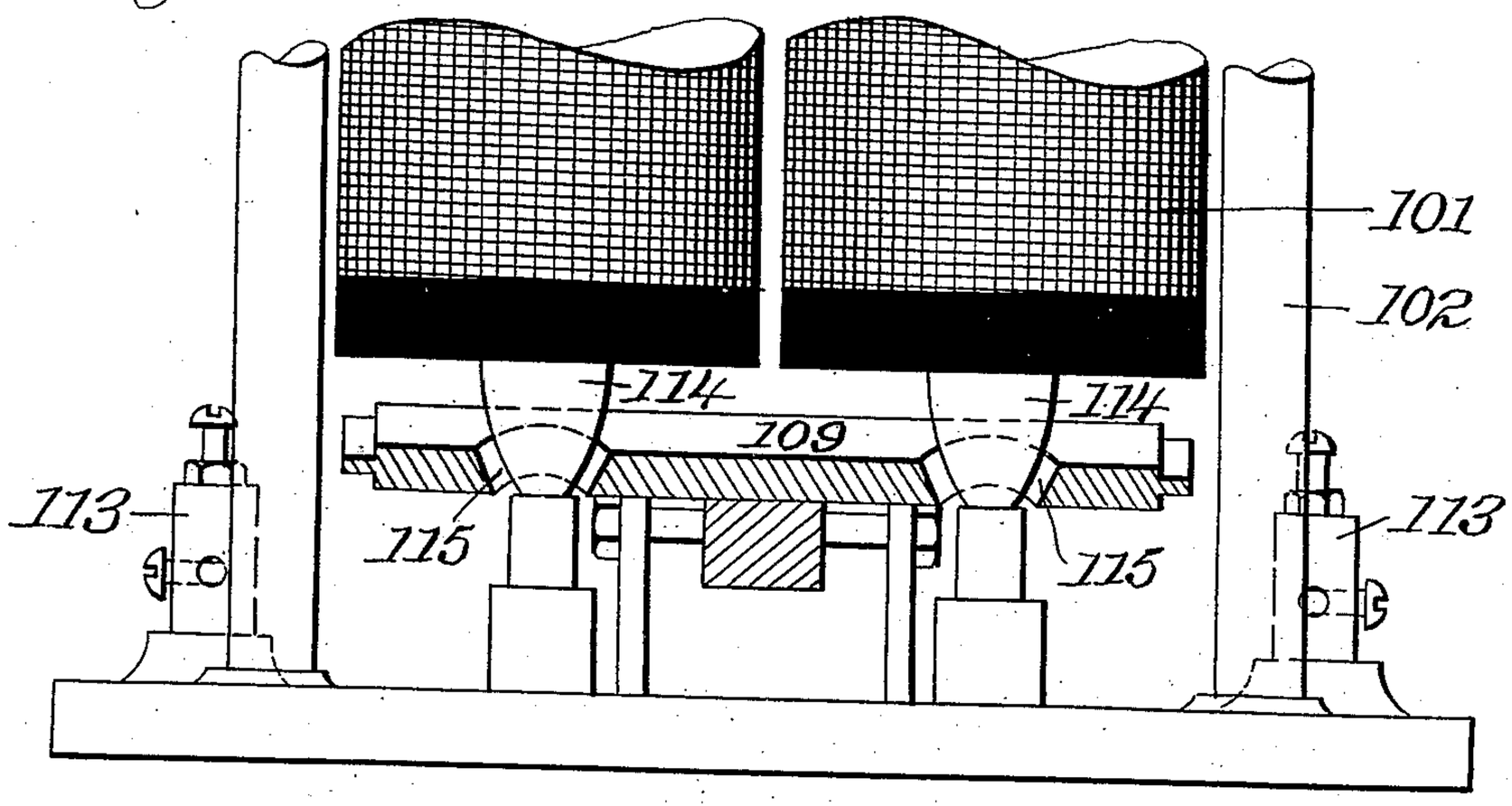
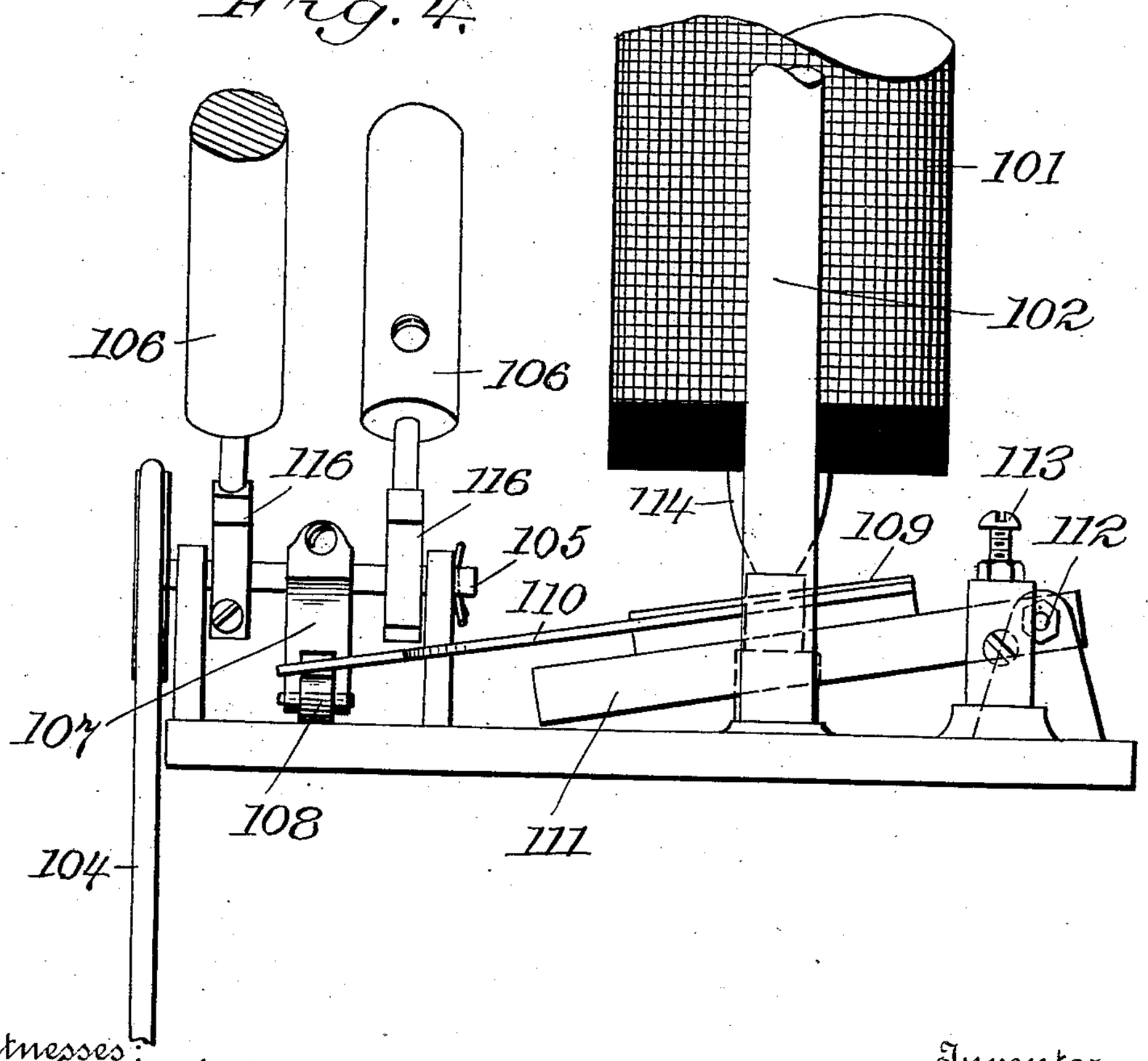


Fig. 4.



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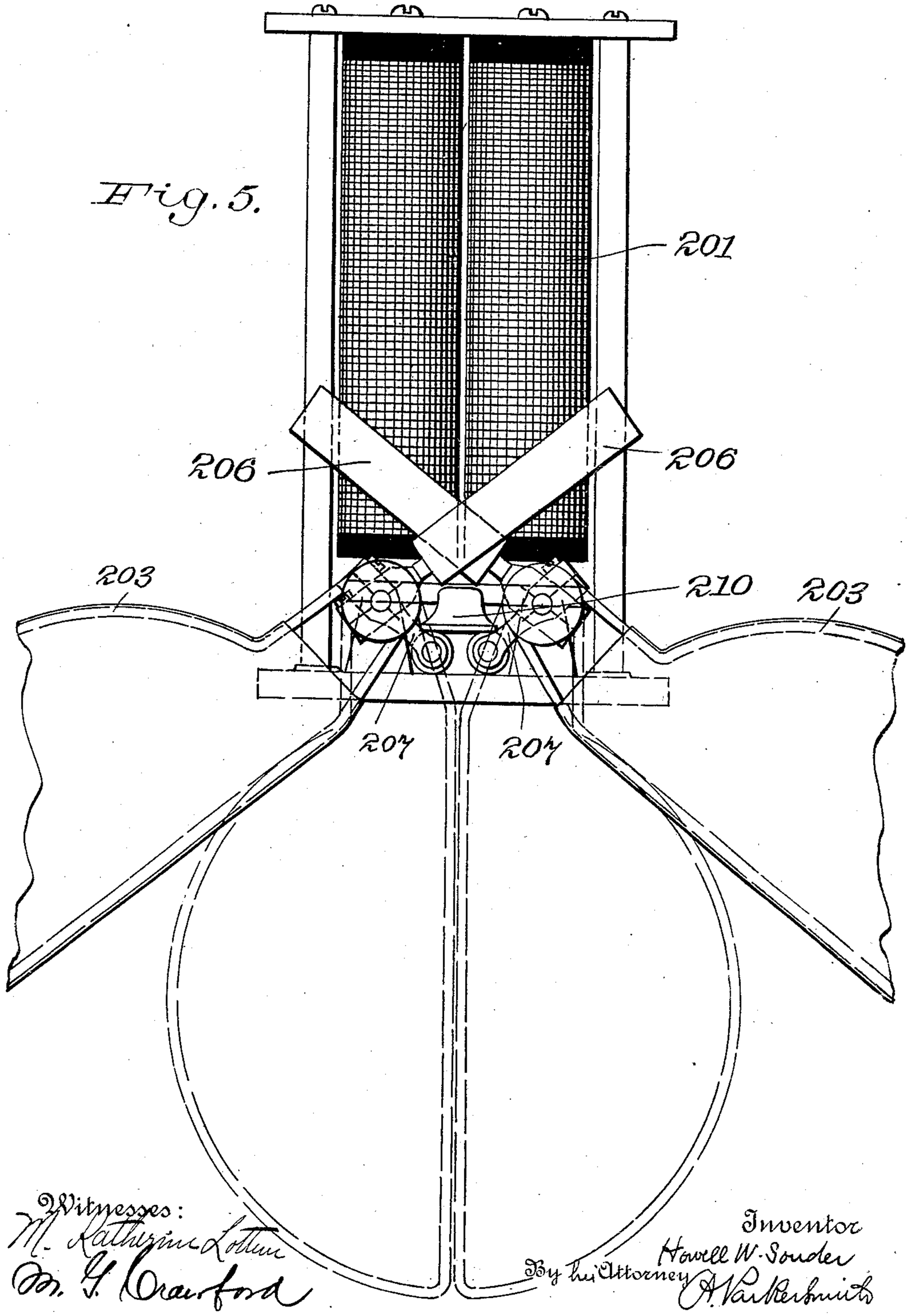
6 SHEETS—SHEET 5.

Fig. 5.



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6 SHEETS—SHEET 6.

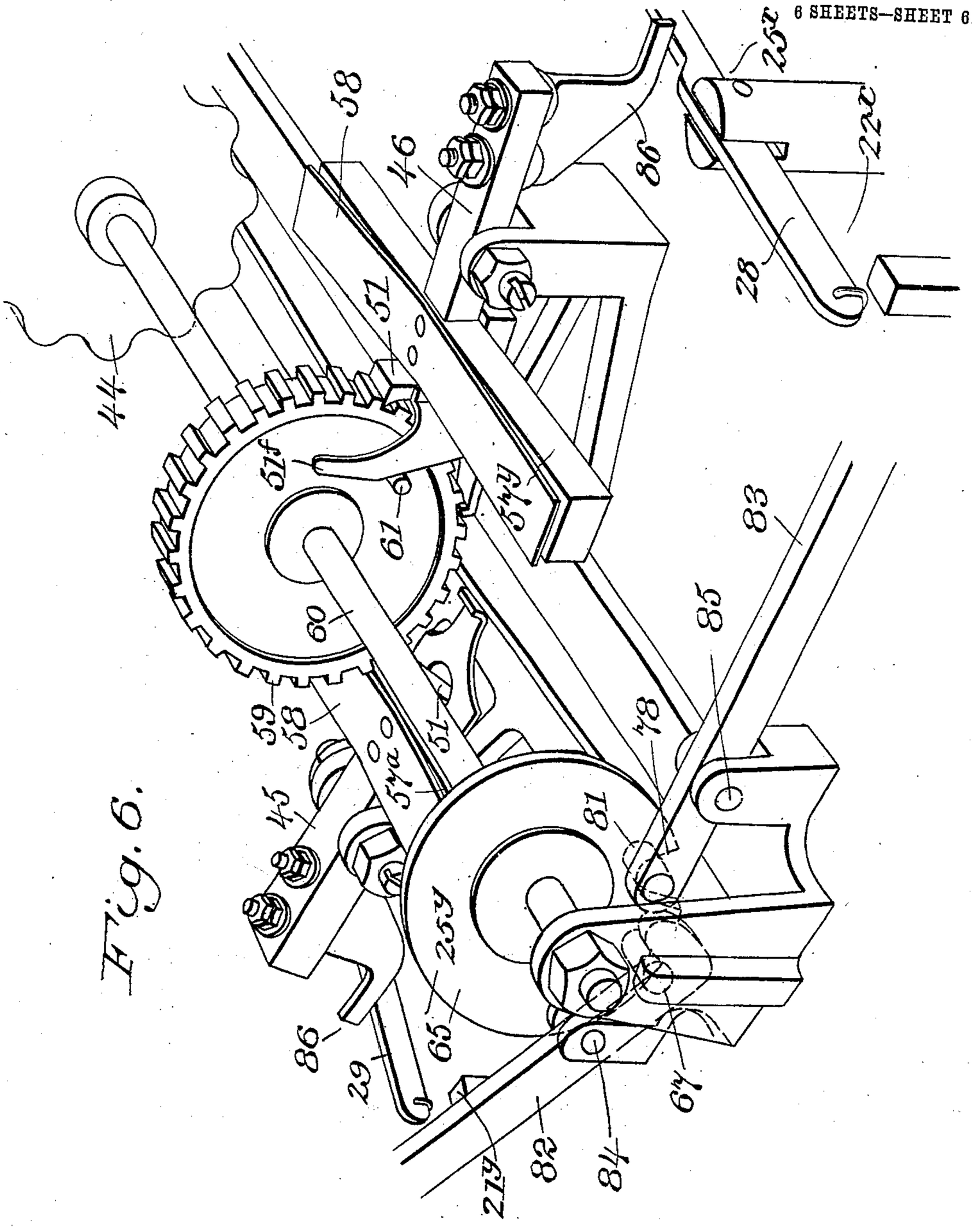

Fig. 6.

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UNITED STATES PATENT OFFICE.

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ELECTRIC SIGNALING SYSTEM.

No. 915,237. Specification of Letters Patent. Patented March 16, 1909.

Application filed June 10, 1907. Serial No. 378,048.

To all whom it may concern:

Be it known that I, HOWELL W. SOUDER, a citizen of the United States of America, and a resident of Tamaqua, county of Schuylkill, State of Pennsylvania, have invented certain new and useful Improvements in Electric Signaling Systems, of which the following is a specification.

My invention relates to electric signaling apparatus for railroads, and comprises certain improvements on the system and apparatus shown and described in my Patent No. 795,314, dated July 25, 1905.

The preferred form of apparatus embodying my invention is illustrated in the accompanying six sheets of drawings, in which:

Figures 1—1[a] is a diagram of one block of an electric trolley road and the circuits and connections employed in operating my apparatus. Fig. 2 is a detail front elevation of the operating portion of the semaphore or shutter employed in the home signal. Fig. 3 is a detail view in cross section showing the arrangement of magnets and armature therefor for operating such semaphore or shutter. Fig. 4 is a detail view of the same and other parts taken on a plane at right angles to that of Figs. 2 and 3. Fig. 5 is a front elevation of the slightly varied form of mechanism used in the semaphore or lantern constituting the distant signal, and Fig. 6 is a perspective view of a portion of the main circuit controller mechanism installed at each end of each block.

Throughout the drawings, like reference figures indicate like parts.

1 is the trolley wire, and 2, 2, are contact makers located in operative relation to said trolley wire at each end of each block. 2[a] is the finger plate of one of said contact makers first brought into contact with the trolley wheel of a car going into the east end of the block and 2[x] is a similar finger plate at the other end of the block.

2[b] is the finger plate first brought into contact with the trolley wheel of a car going out of the block at the east end, and 2[y] is a similar finger plate for outgoing cars at the west end of the block.

3[a], 3[b], 3[x], and 3[y] are connections from these finger plates to the main circuit controllers.

4[a], 4[b], 4[x] and 4[y] are resistances included in such connections. In the same way the other parts represented in Figs. 1—1[a] are nearly all given similar reference figures to those employed for the same or equivalent parts shown and described in my previous Patent No. 795,314, and I will therefore proceed with the explanation of the operation of the modified system herein shown without further enumeration of these duplicate or equivalent parts.

A car entering the block from the east end coming west will have its trolley wheel bridge the space between the main finger plate and the finger plate 2[a] of the contact maker at that end of the block. This will send a current from the trolley wire through the wire 3[a] and one of the circuit controller binding posts 10 to the fuse block 7, and thence to the direction switch lever 24 through which it passes across the normally closed gap 22[a] to the switch contact 20[a], thence through the connecting wire 23[a] to the switch contact 21[b]. The direction switch lever 27 being in the position shown in Fig. 1[a], there is no flow of current therethrough, but the current continues on through the resistance 4[a] and back through the magnet 5[a], thence to the ground binding post 12[e] and down through the connection 13[eg] to the trolley rail or other ground. This energizes the magnet 5[a] and causes it to attract its armature 57[a] (see Fig. 6) with the result that the pawl lever 45 is swung up so that the pawl 51 engages the ratchet teeth 59 on the ratchet wheel and rotates the same one tooth. This partial rotation of the ratchet wheel and shaft 60 of the east circuit controller produces two results.

It swings the pin 67 on the disk 65 away from the end of the feed switch lever 82, pivoted at 84, and permits the outer end of said lever to drop, thereby bridging the gap 11[e] and connecting the feed wire 15 with the wire 9[e] which is on the under side of the slab which forms the base of the circuit controller. This sends current through said wire 9[e] across one or the other of the switch gaps 30[e] or 31[e] according to which is closed and through one or the other of the branch signal circuit wires 8[a] or 8[b] and lamp 79[a] or 79[b] thence out on the main signal circuit 8 extending the length of the block. At the other end of the block the current from the signal circuit 8 after passing through the intermediate signal lamp 79 located at any

convenient point along the block, goes to one or the other of the lamps 79^x, 79^y in the home signal at the other end of the block and through one of the branch circuits 8^x or 8^y across one of the switch gaps 30^w or 31^w to the wire 9^w, across the switch gap 14^w which is normally closed and through the ground connection 14^{wg} to the trolley track. The same motion of the east circuit controller forces the roller 81 on the end of the ground switch lever 83 pivoted at 85 out of the notch 78 in the disk 65 and lifts the outer end of said switch lever so that the switch gap 14^e is left open and the ground connection of the signal circuit at that end of the block is broken. The other operation performed by this initial movement of the circuit controller is to cause the toe 86 on the outer end of pawl lever 45 to fall upon the direction switch lever 27, tipping the same so as to bring it in contact with 21^b, bridging the gap 25^b and opening the gap 22^b. As a result, when the trolley wheel goes into contact with the finger plate 2^b, current passes through the wire 3^b, fuse block 7 to the direction control switch 27, across to contact 21^b, through resistance 4^a and magnet 5^a to ground, as before, this retaining the circuit controller in the same position and not destroying the circuits previously established.

When the car goes out of the black at the west end, it first makes contact with the finger plate 2^y, sends current through the wire 3^y, fuse block 7, direction switch 29 across switch gap 22^y to contact 20^y, thence along the wire 23^y across the base of the circuit controller to contact 21^x. The direction control switch 28 being in the position shown, the gap 25^x is open and there is no division of the current, but it passes on through the resistance 4^b back through the magnet 5^b across the circuit controller base by the wire 18 to the ground binding post 12^w and out through the ground connection 13^{wg}. This energizes the magnet 5^b, which causes it to attract its armature corresponding to 57^y, and swing the pawl lever corresponding to 46 (see Fig. 6), but the pin 61 having been thrust against the disabling finger 51^f by the last previous operation of the west circuit controller, the pawl 51 is held out of engagement with the ratchet wheel 59 and the movement of the pawl lever 46 has no effect upon the ratchet wheel or upon the west circuit controller except that the toe 86 is dropped upon the direction switch lever 28 so as to force it down into contact with 21^x, closing the gap 25^x and opening the gap 22^x. Consequently when the trolley wheel goes on to finger plate 2^x current will flow through the wire 3^x to fuse 7 to switch 28, to contact 21^x and then through the resistance 4^b and magnet 5^b to the ground, thus retaining the direction control switch in this position until the trolley wheel leaves the contact maker. The current does not all pass through resistance 4^b and magnet 5^b, however, but part of it is shunted through the resetting circuit 6, auxiliary controller 40, which is of the construction shown in my Patent No. 773,166 dated October 25, 1904, over to the resistance 4^y in the east circuit controller. Current passes through this resistance through the magnet 5^y, ground binding post 12^e, wire 17 and ground connection 13^{eg} to the ground. This causes the magnet 5^y to attract its armature 57^y and upon the upward swing of the pawl lever 46, the pawl 51 will engage the ratchet wheel 59 and swing the same back into its orignial position. This causes the pin 61 to strike the disabling finger 51^f and throw the pawl 51 out of engagement so that further vibration of the pawl lever 46 would have no effect upon the ratchet wheel. This movement also causes the pin 67 to strike the end of the feed switch 82, breaking the feed connection previously established at 11^e and permits the end of the roller 81 on the ground switch lever 83 to rise into the notch 78, thus permitting the ground connection switch to close the gap 14^e and reestablish the ground connection for the signal circuit.

The before described operation is in accordance with the principle of operation of my system as explained in my previous patents in so far as the signal circuit is normally grounded at each end of the block and cut off from the feed connection, but upon the entry of a car into one end of the block, the ground connection at that end is broken and the feed connection established, this sending current through the signal circuit to the ground at the other end of the block, while on the passing of the car out of the block at the other end, it breaks the feed connection at the first end and reëstablishes the ground again.

The construction of the circuit controller and its operation have been simplified in several respects, however, among which may be mentioned the modification by which the resetting circuit 6 has a permanent ground connection of unvarying resistance at each end of the block so that no matter at which end of the block the said resetting circuit is connected to the feed wire, the current passes through the circuit and to the ground at each end of the block in practically equal quantities. The connection of this resetting circuit to the ground at the east end is through the resistance 4^y and magnet 5^y. At the west end, the connection is through the resistance 4^b and magnet 5^b. The magnets 5^y and 5^b are therefore equally energized whether a car is leaving a block at one end or at the other end, and the armature of each magnet is attracted with equal force and moves the pawl lever to which it is attached through the same arc with the same force. This causes positive,

equal and certain action of the direction control switches, but it only causes action of one of the main circuit controllers because the disabling finger of the other is in operation. That is to say, when a block is empty the pin 61 is against finger 51^f in both circuit controllers. If a car enters at the east end of the block, it by so doing causes the pin 61 to leave the disabling finger 51^f and permits the pawl 51 to drop into operative position in the east circuit controller. Consequently, when it goes out of the west end of the block and delivers current to the resetting circuit at a point intermediate of the two resetting devices, that current will pass through both resetting devices, but the pin 61 in the west circuit controller being up against the disabling finger 51^f, the movement of the pawl 51 does not affect the ratchet wheel 59, but the movement of the corresponding pawl in the east circuit controller does actuate its ratchet wheel 59 and rotates the same back into zero position.

The signal devices employed in my present system differ from the simple incandescent lamps described in my previous patents. These devices consist of a home signal 100 which is in circuit with the feed and signal connections and the distant signal 200 which is in circuit with the ground connection of the signal circuit. These two signals are preferably placed one over the other as shown in Figs. 1—1^a. Each signal consists of a casing or lantern containing two incandescent lamps and having an opening in the face of the casing. In the casing 100 is a magnet 101, supported on a frame 102, in which are journaled two swinging shutters or semaphore blades 103, 103. Preferably these shutters are formed of some translucent material such as a thin cloth supported on a frame 104, and painted or dyed red. These semaphore plates or shutters are supported on shafts 105, 105, each of which has clamped on it a crank arm 116 which carries a counterweight 106. There is also adjustably clamped to each shaft 105, an operating crank 107 terminating in a friction roller 108. The magnet has an armature 109 which is supported on a pivoted lever 111 journaled in a bearing at 112, and having a bifurcated projecting piece 110, the extremities of which rest upon friction rollers 108. As shown, the magnet cores 114 pass through openings 115 in the armature 109, and are tapered or otherwise formed so as to serve as a stop limiting the upward motion of such armature, and also prevent transverse strains on the pole pieces otherwise tending to pull them out of alinement.

113, 113, represent binding posts to which the signal circuit wires are connected.

The distant signal 200 is of similar construction except as shown in Fig. 5, the operating cranks 207 for the shutters project inwardly and are forced down by a single armature projection 210. Also the counterweights 206 in this lantern are adjusted at a shorter leverage than those 106 in the home signal. The counterweights 106 are given leverage enough to overbalance the shutters 103 and cause them to swing apart whenever the weight of the armature is lifted from the friction rollers 108. On the other hand, the counterweights 206 have not leverage enough to overbalance the shutters, but just enough to swing them out in the position shown in Fig. 5 when the downward pressure of the armature projection 210 is added to the pull of the counterweghts. By the above described arrangement the same mechanism may be used either for the home or distant signal, the counterweights 206 in the distant signal being adjusted near enough to the pivot of the semaphore to permit the semaphore blade to slightly overbalance said counterweight, while in the home signal the counterweight 106 is adjusted farther from the pivot so as to permit it to slightly overbalance the weight of the semaphore.

As shown in Figs. 1—1^a, the magnet 101 of the home signal is in circuit with the feed wire 15 or 16 at each end of the block, and the lamps 79^a, 79^b, 79^x and 79^y are in circuit with the branches 8^a, 8^b, 8^x and 8^y of the signal circuit. The magnet 201 of the distant signal is in circuit with the ground connection 14^{eg} or 14^{we} and the two lamps 79^e or 79^w are connected in series with one another and with this magnet. The operation of this portion of the invention is then as follows: The alternating switches described in my previous patent No. 795,314 (not shown here) are operated by the star wheel 44 (see Fig. 6) in the manner therein described so as to alternately throw one or the other of the lamps in the home signal at each end of the block into the signal circuit. Normally, both magnets 101 and 201 being dead, and their armatures dropped, the shutters 103 of the home signal will be closed or moved in front of the lamps, as shown in Fig. 2, and the shutters 203 of the distant signal will be held open or away from the front of the lamps, as shown in Fig. 3. When a car enters one end of the block and current flows through the feed connection, as 15, if the car has entered the east end of the block, the magnet 101 in the home signal at that end of the block will be energized, its armature will be lifted, the projections 110 will be lifted from the shutter cranks, the counterweights 106 will come into action and open the shutters 103, moving them away from before the lamps. The current flowing through the signal circuit and out through the ground connection 14^{wg} at the other end of the block will light one of the lamps 79^x or 79^y, but

not energize the magnet in the west home signal. It will energize the magnet 201 in the distant signal at that end of the block, and lift its armature, take the pressure of its armature extension 210 off the shutter operating cranks and permit the same to swing down in front of the lamps 79^w. The result will be, as all the lamps referred to are lighted, that the red board will be lifted from the home signal at the end of the block entered by the car and dropped into view at the distant signal at the other end of the block. If another car enters behind the first, the only change is to put out the lamp previously burning in the home signal at that end of the block and light the other lamp in said signal, thus proving to the second motorman that the system is in operation and that another car is ahead of him in the block. The method of use of the signals is then as follows: A motorman approaching an empty block will find the home signal at "danger" and the distant signal at "safety" with the lamps unlighted. As his car passes the contact maker the red board will swing up from the home signal and one of the lamps therein light up, thus putting both signals at safety, indicating that the block is free. The same operation drops the red board in the distant signal at the other end of the block and lights the lamp therein. Consequently, a motorman approaching the block from that end will see both signals at danger, the red boards being displayed and the lamps lighted behind them, know that the block is occupied by a car coming toward him, and stay on the siding until the distant signal goes back to safety and the lamps go out in both lanterns, which will indicate that the last car has come out of the block. A second car following the first car will find both signals at safety, but with a lamp lighted in the home signal, and on passing the contact maker the motorman will see the lamps change in the home signal and be thereby assured that the signal system is in normal operation, but that there is a car ahead of him in the block so that he must go through under control. These signals are equally effective by day or night, as the lamps showing through the translucent colored material of the shutter show the red color as clearly at night as during the day time.

All the lamps are provided with shunt resistances as shown in my previous patent. Thus if a lamp burns out, the closed path around it permits enough current to flow to keep the other lamps in series aglow and the semaphores in proper operation. By use of resistances, therefore, the operation of the semaphores is independent of the lamps and burned out lamps are easily located. The lower or distant semaphore having two lamps always in circuit, the semaphore is still lighted if one lamp breaks down. The armatures, as 57^a and 57^y are provided with spring faces 58, 58, which serve to overcome any residual magnetism which sometimes tends to "freeze" the armatures to the magnet poles, after the circuits are broken, when the operating currents are heavy.

The advantages of my present invention comprise among other things the greater simplicity and certainty of action of the circuit controllers, and the completeness of the information given by the combined semaphore and lamp signals, as to the exact condition of the block.

It should be understood that the circuit controllers are duplicates, the only difference in their action being due to the fact that the wires 3^x and 3^y leading to the west circuit controller are crossed, as shown in Fig. 1, while those 3^a and 3^b leading to the east circuit controller are not crossed (see Fig. 1^a).

In Fig. 6 the pawl lever 45 is shown in its position of rest assumed when its magnet is not energized, while the pawl lever 46 is shown raised in the position it occupies when the magnet corresponding to it is energized.

It is understood of course that when a car enters the west end of the block the operation of the west circuit controller is the same as that described with reference to the east circuit controller when a car enters at that end. The direction switch 29 is forced down on contact 21^y, to close gap 25^y and open gap 22^y. In the same way, when the car goes out at the east end of the block, direction switch 24 is forced down on to contact 21^a to close gap 25^a and open gap 22^a.

Having, therefore, described my invention, I claim:

1. In an electric block signal system for railroads, the combination of a signal circuit extending the length of the block, a feed conductor, a connection from the signal circuit to the feed conductor at each end of the block, a connection from the signal circuit to the ground at each end of the block, circuit controlling devices for said connections adapted to be operated by a passing car, an electro-magnetic home signal included in each feed connection, and an electro-magnetic distant signal included in each ground connection, each of said signals comprising an electric lamp, a movable shutter for the lamp, and an electro-magnetic device for moving said shutter, the magnet of the home signal being included in the feed connection and the lamp being included in the signal circuit.

2. In an electric block signal system for railroads, the combination of a signal circuit extending the length of the block, a feed conductor, a connection from the signal circuit to the feed conductor at each end of the

block, a connection from the signal circuit to the ground at each end of the block, circuit controlling devices for said connections adapted to be operated by a passing car, an electromagnetic home signal included in each feed connection, and an electro-magnetic distant signal included in each ground connection, each of said signals comprising an electric lamp, a movable shutter for the lamp, and an electromagnetic device for moving said shutter, the magnet of the home signal being arranged to move the shutter away from the lamp when energized, and the magnet of the distant signal being arranged to move its shutter before the lamp when energized.

3. In an electric block signal system, the combination with a signal circuit extending the length of the block, a feed and ground connection at each end and a circuit controller for alternately cutting in the feed and cutting out the ground, of a home signal included in each feed connection normally at danger when the feed connection is cut out and at safety when the feed connection is established, and a distant signal in each ground connection normally at safety when no current is passing through the ground connection, but at danger when current is passing through said ground connection.

4. A signal lantern for electric railways comprising in combination a casing, an electric lamp in said casing, a pivoted shutter normally dropped before said lamp, an electro-magnet, an armature below the magnet normally resting on the shutter so as to swing it away from before the lamp, and an electric circuit including the magnet and lamp.

5. A signal lantern for electric railways comprising in combination, a casing, an electric lamp, a pivoted shutter mounted so as to swing in front of the lamp, a counterweight for the shutter normally tending to swing it away from before the lamp, an electro-magnet, an armature below the magnet and normally resting on the shutter so as to overbalance the counterweight and swing the shutter before the lamp, and an electrc circuit including the magnet and lamp.

6. The combination in an electric block signal system for railways, of a signal circuit extending along the block, a circuit controller at each end of the block adapted to throw the signals into operation when actuated in one direction, and to cut them out of operation when actuated in the opposite direction, electro-magnetic apparatus in each circuit controller adapted to actuate the same in the last mentioned direction, a resetting circuit extending along the block through the electro-magnetic apparatus at each end and direct to ground through a permanent connection of unvarying resistance, and means for supplying current to said circuit operated by a car passing out of the block at either end.

7. The combination in an electric block signal system for railways, of a signal circuit extending along the block, a circuit controller at each end of the block adapted to throw the signals into operation when actuated in one direction, and to cut them out of operation when actuated in the opposite direction, electro-magnetic apparatus in each circuit controller adapted to actuate the same in the last mentioned direction, a resetting circuit extending along the block through the electro-magnetic apparatus at each end and direct to ground through a permanent connection of unvarying resistance, and means for supplying current to said circuit operated by a car passing out of the block at either end, said means comprising a contact maker at each end of the block adapted to be bridged into connection with the feed wire by a passing car and a branch connection from the resetting circuit at each end of the block extending from a point in said circuit between the two electro-magnetic devices to the contact maker at that end of the block.

8. In a block signal system, the combination with a signal circuit extending along the block, a circuit controller at each end of the block comprising an electro-magnetic resetting device, a resetting circuit extending the length of the block, through each resetting device and to the ground through a permanent connection of unvarying resistance and means operated by a car leaving the block for delivering current to the resetting circuit at a point intermediate of the two resetting devices.

9. A circuit controller for electric signal systems which comprises in combination a ratchet wheel, a pawl, a pawl lever on which said pawl is pivoted, an armature carried by said pawl lever, an electro-magnet, and a projection on the ratchet wheel adapted to strike the pawl and push it out of engagement with the ratchet wheel when the latter reaches a certain position.

10. A circuit controller for electric signal systems which comprises in combination a ratchet wheel, a pawl, a pawl lever on which said pawl is pivoted, an armature carried by said pawl lever, an electro-magnet, and a projection on the ratchet wheel adapted to strike the pawl and push it out of engagement with the ratchet wheel when the latter reaches a certain position after being rotated into said position by the previous reciprocation of the pawl.

11. In an electric block signal system for railroads, the combination of a signal circuit extending the length of the block, a feed con-

ductor, a connection from the signal circuit to the feed conductor at each end of the block, a connection from the signal circuit to the ground at each end of the block, circuit controlling devices for said connections adapted to be operated by a passing car, an electro-magnetic home signal included in each feed connection, and an electro-magnetic distant signal included in each ground connection, each of said signals comprising a swinging semaphore, a casing therefor, and an electro-magnet adapted to swing said semaphore into and out of said casing, the magnet of the home signal being arranged to swing its semaphore into its casing when energized, and the magnet of the distant signal being arranged to swing the semaphore out of its casing when energized.

12. In an electric block signal system for railroads, the combination of a signal circuit extending the length of the block, a feed conductor, a connection from the signal circuit to the feed conductor at each end of the block, a connection from the signal circuit to the ground at each end of the block, circuit controlling devices for said connections adapted to be operated by a passing car, and a signal at each end of the block comprising an electric lamp included in the signal circuit, an electromagnet included in the feed circuit, a semaphore, and mechanism by which said magnet when energized swings the semaphore.

13. A signal lantern for electric railways comprising in combination, a casing, an electric lamp, a pivoted shutter mounted so as to swing in front of the lamp, a counterweight for the shutter normally tending to swing it away from before the lamp, an electro-magnet, an armature below the magnet and normally resting on the shutter so as to overbalance the counterweight and swing the shutter before the lamp, and an electric circuit including the magnet lamp, said semaphore being located in front of said lamp.

14. In an electric block signal system for railroads, the combination of a signal circuit extending the length of the block, a feed conductor, a connection from the signal circuit to the feed conductor at each end of the block, a connection from the signal circuit to the ground at each end of the block, circuit controlling devices for said connections adapted to be operated by a passing car, and a signal at each end of the block comprising an electric lamp included in the signal circuit, an electro-magnet included in the feed circuits, a semaphore, and mechanism by which said magnet when energized swings the semaphore away from before the lamp but when deënergized, permits said semaphore to drop in front of the lamp.

15. In an electric signal the combination of a frame, a semaphore pivoted in said frame, an electro-magnet, an armature therefor normally resting on a projection from the semaphore, and a counterweight for the semaphore adjustable toward and from the pivot thereof.

16. In a circuit controller for electric signaling systems, the combination of a revoluble disk and two pivoted switch levers arranged tangentially to said disk with their adjacent ends provided with projections extending toward the center of said disk, said disk being provided with a projecting pin which engages the projection of one switch lever, and a circumferential notch which simultaneously engages the projection on the other lever, together with means for revolving said disk, whereby the movement thereof frees both the pin and the notch from engagement with their coöperating switch lever projections.

17. In a circuit controller for electric signaling systems, the combination of a revoluble disk and two pivoted switch levers arranged tangentially to said disk with their adjacent ends provided with projections extending toward the center of said disk, said disk being provided with a projecting pin which engages the projection of one switch lever, and a circumferential notch which simultaneously engages the projection on the other lever, together with means for revolving said disk, whereby the movement thereof frees both the pin and the notch from engagement with their coöperating switch lever projections, said means comprising a ratchet wheel, a vibrating pawl for rotating said ratchet wheel in a direction to produce said disengagement and a second vibrating pawl for rotating said ratchet wheel in a direction to reëstablish engagement, the latter pawl being provided with a disabling attachment thrown into operation by the mechanism when in position of engagement with the switch levers.

18. In an electric signal system the combination of a lantern signal, a signal circuit, and two electric lamps in said circuit located in the lantern, said lamps being in series and each having a permanently closed high resistance shunt around it.

Signed at Tamaqua, Pa., this 4th day of December, 1908.

HOWELL W. SOUDER.

Witnesses:

JOHN H. BORNSCHIER,

JOHN H. ICHTER.