S. D. STROHM.

RAILWAY SIGNALING.

APPLICATION FILED AUG. 29, 1891.

916,896.

Patented Mar. 30, 1909.

7 SHEETS—SHEET 1.

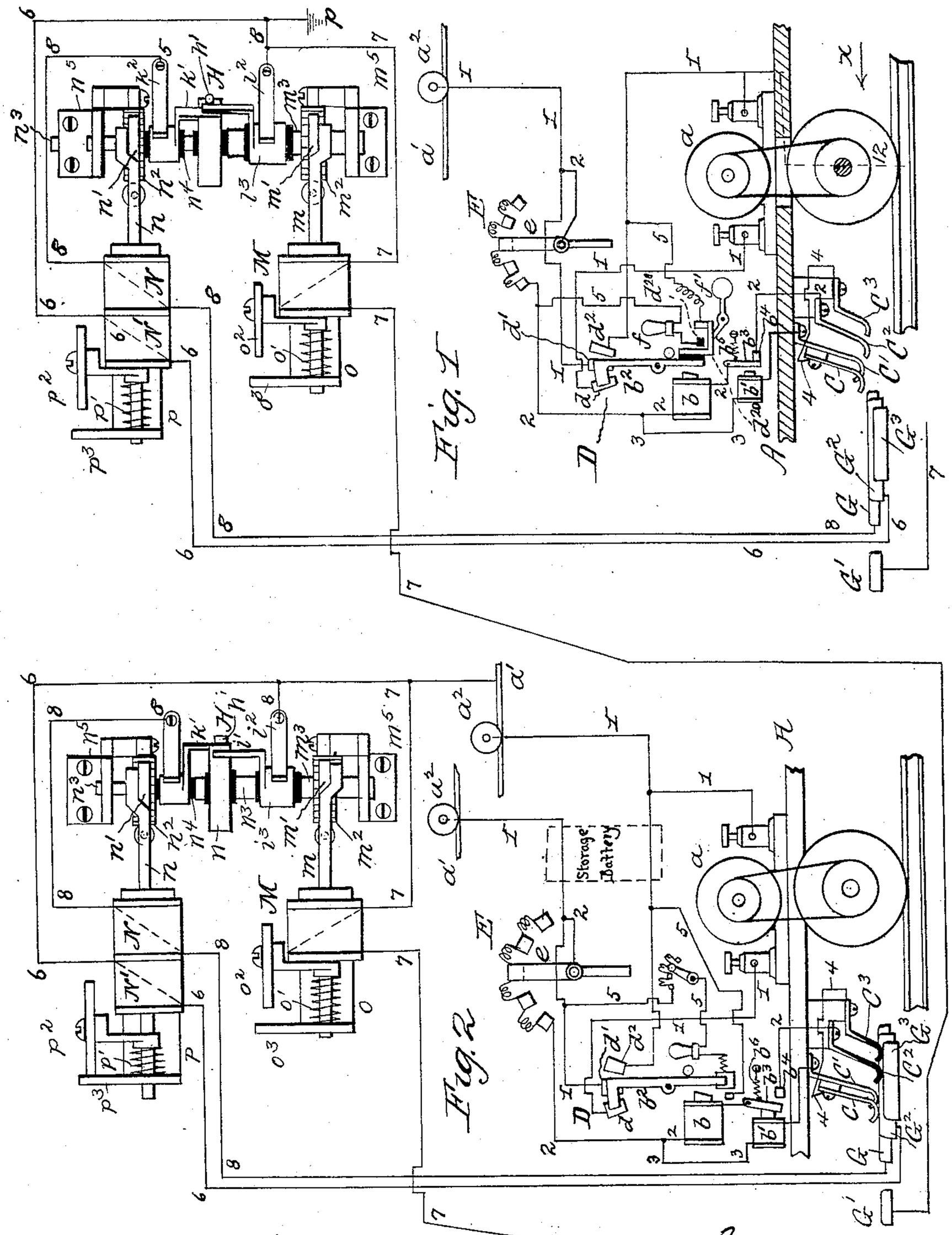

Fig. 1

Fig. 2

Witnesses:
L. R. Miller
V. W. Middleton.

Inventor:
Samuel D. Strohm
By E. J. Vanstavoren
attorney

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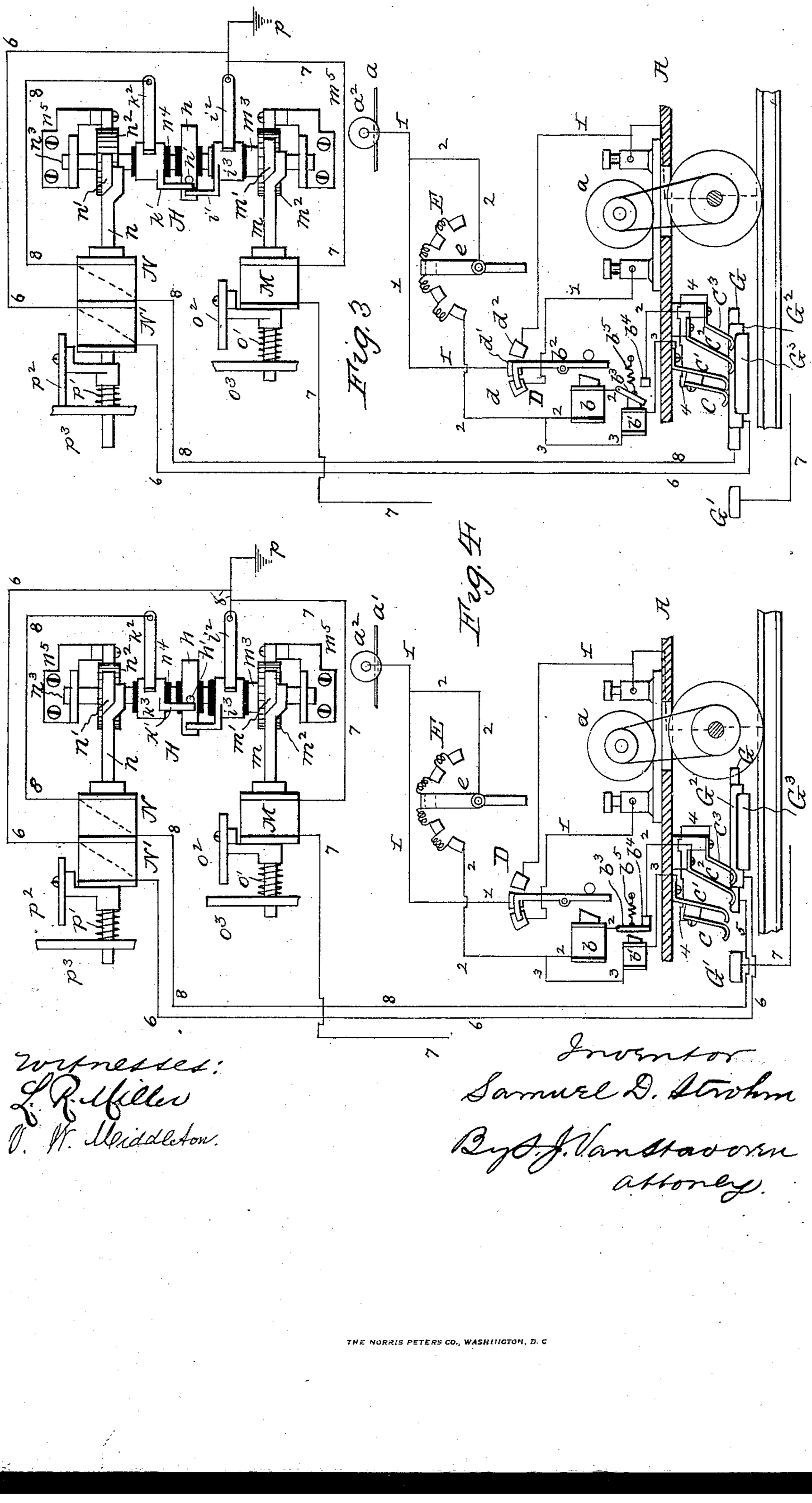

Fig. 3

Fig. 4

Witnesses:
L. R. Miller
O. W. Middleton.

Inventor
Samuel D. Strohm
By S. J. Vanstadoren
attorney.

S. D. STROHM.

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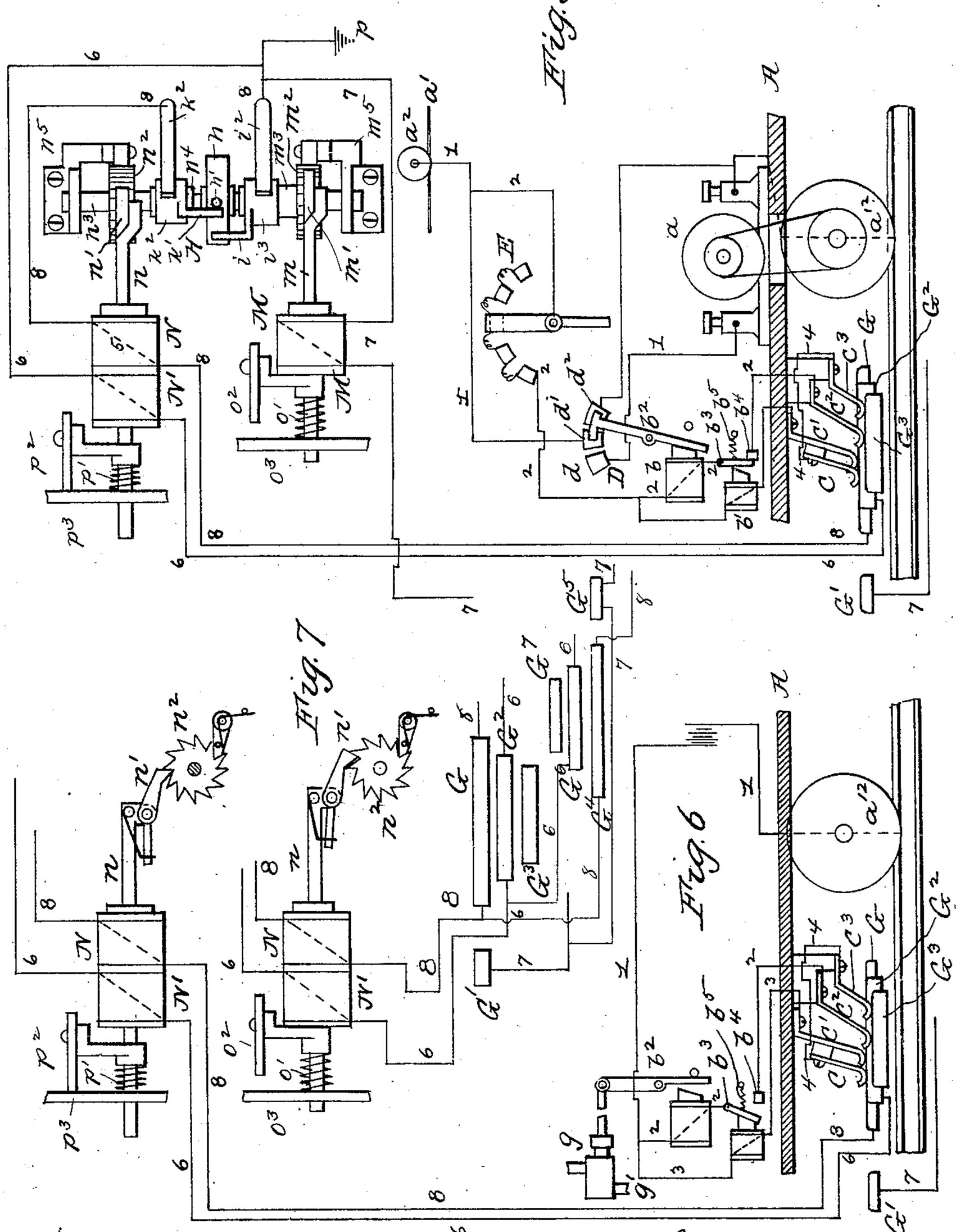

Witnesses:
L. R. Miller
V. W. Middleton

Inventor
Samuel D. Strohm
By A. J. Vanstavoren
Attorney

S. D. STROHM.

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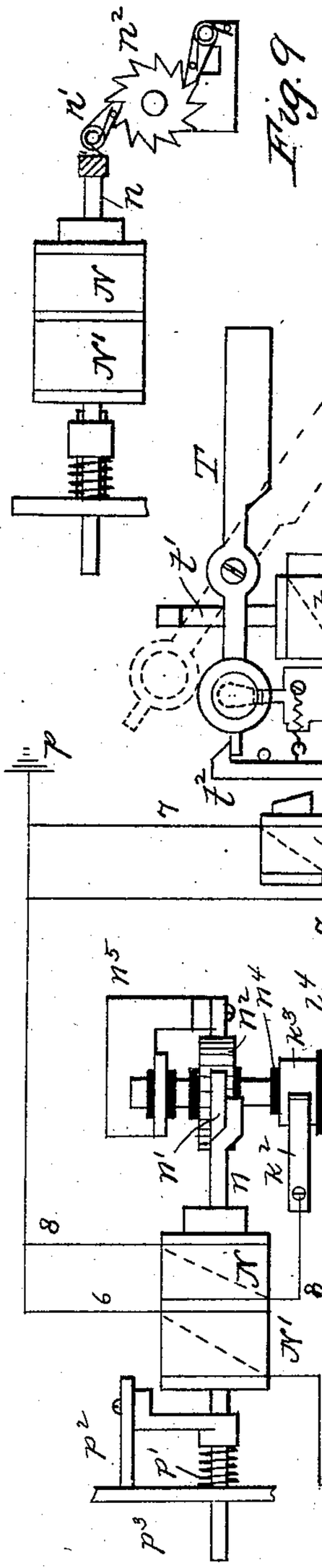

Fig. 9

Fig. 8

Fig. 10

Witnesses:
L. R. Miller
V. W. Middleton.

Inventor
Samuel D. Strohm
By F. J. Van Stavoorn
Attorney

S. D. STROHM.

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7 SHEETS—SHEET 5.

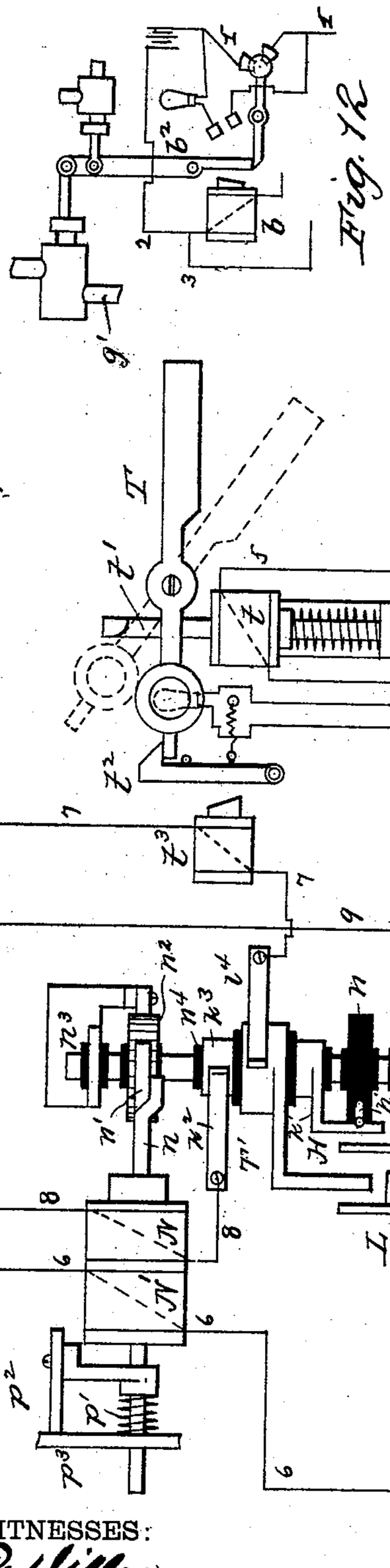

Fig. 12.

Fig. 11.

WITNESSES:

L. Griffin

T. W. Middleton

INVENTOR

Samuel D. Strohm

By C. J. Vanstavoren

Attorney

S. D. STROHM.

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7 SHEETS—SHEET 6.

Fig. 15

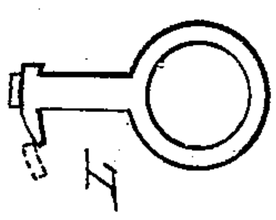

Fig. 13

Fig. 14

WITNESSES:

L. R. Miller

C. W. Middleton

INVENTOR

Samuel D Strohm

By S. J. Vanstavoren

Attorney

S. D. STROHM.

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7 SHEETS—SHEET 7.

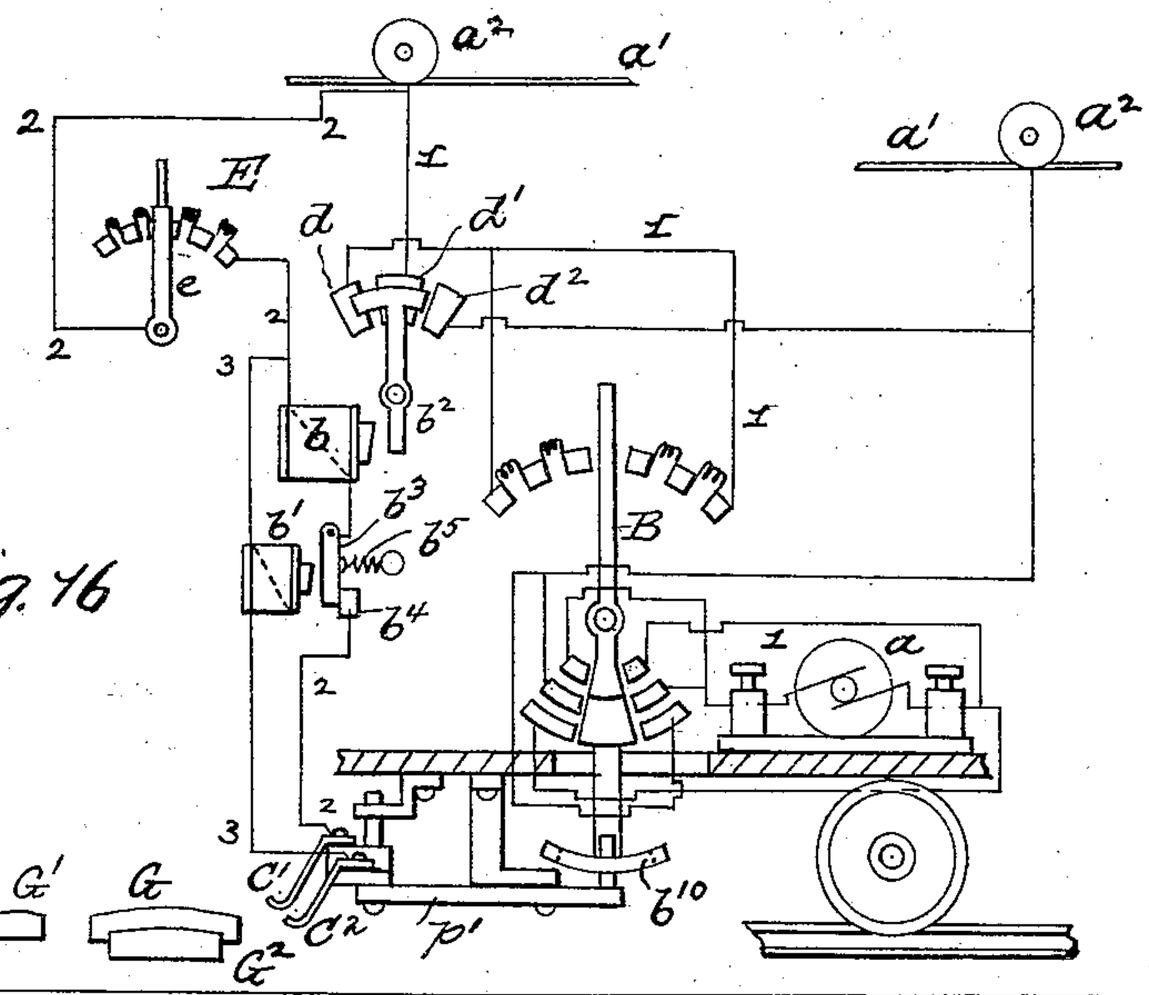

Fig. 16

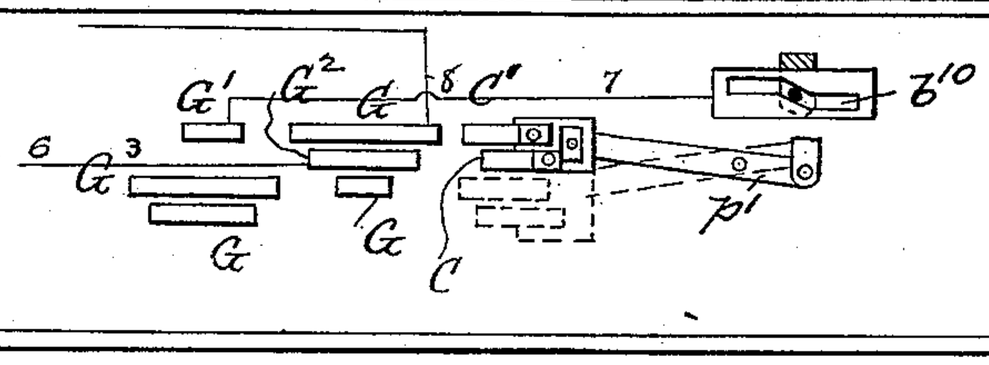

Fig. 17

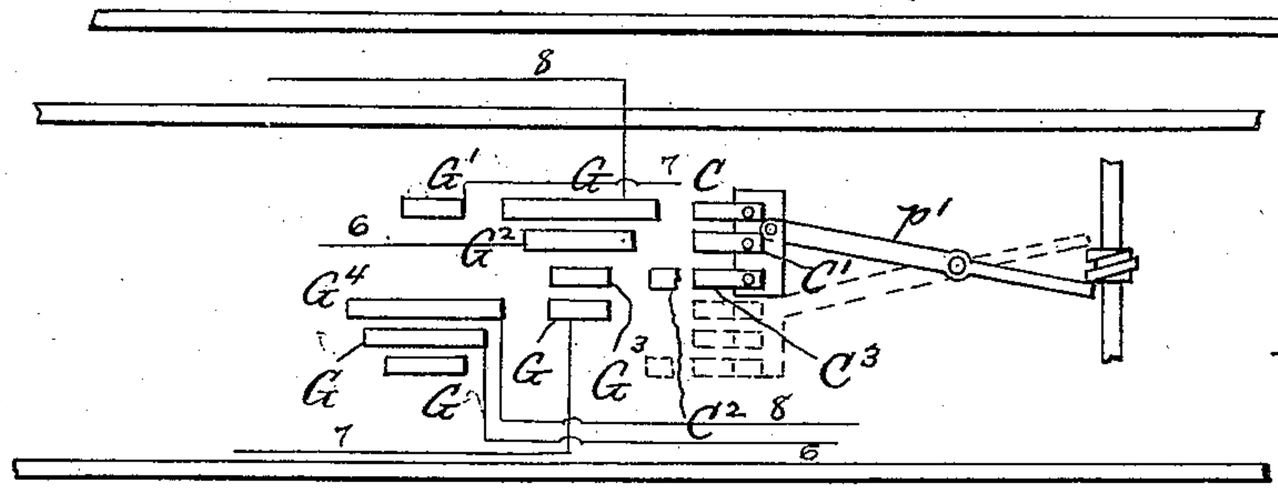

Fig. 18

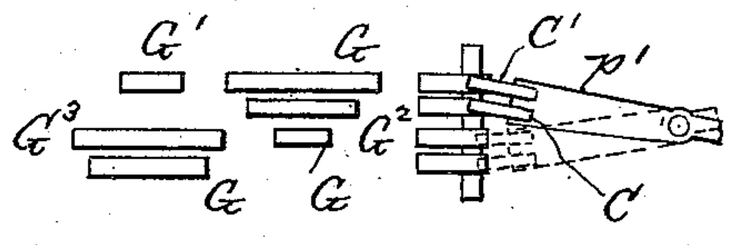

Fig. 19

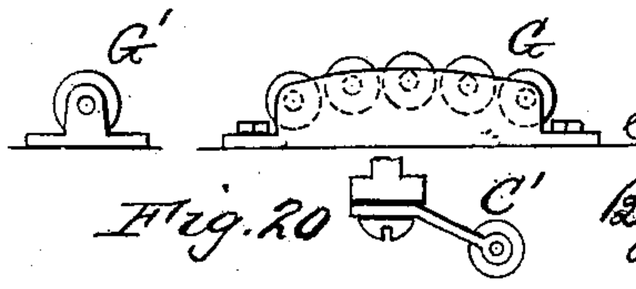

Fig. 20

Witnesses
L. R. Sfiller
J. W. Middleton.

Inventor
Samuel D. Strohm
By S. J. Vanstavoorn
Attorney

UNITED STATES PATENT OFFICE.

SAMUEL D. STROHM, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR OF ONE-EIGHTH TO JOSEPH F. KRAYER, OF PHILADELPHIA, PENNSYLVANIA.

RAILWAY SIGNALING.

No. 916,896. Specification of Letters Patent. Patented March 30, 1909.

Application filed August 29, 1891. Serial No. 404,147.

To all whom it may concern:

Be it known that I, SAMUEL D. STROHM, citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Railway Signaling; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention has relation principally to controlling the engines or trains of railways, and particularly electrically propelled cars to prevent collisions, by means of station electro magnetic appurtenances in circuit connection with contact-plates located beside or adjacent to the track-rails, and of motor-car or train electro-magnetic appliances having contact brushes and circuit connections controlling the motive power supply for the engine or motor-car, and has further relation to the same when it is provided or combined with electrically actuated semaphores located at the stations and actuated simultaneously with the magnetic appurtenances for controlling the train or motor-car, the same actuating in either direction of movement of the passing cars or trains.

My invention has for its principal object the provision of electrically actuated appliances on the electric motor-car or train for controlling the power supply for the motor, thereby dispensing with sliding or movable bars contacting with elevations or inclines located adjacent to the track-rails and also with electric generators separate from the motive power for the engine or motor car.

My invention accordingly consists of the combinations, constructions, and arrangements of parts as hereinafter described in the specification and pointed out in the claims.

Reference is had to the accompanying drawings, wherein—

Figures 1, 2, 3, 4 and 5 are diagrammatic views of station electro-magnetic appurtenances, and an electrically propelled car equipped with a form of magnetic appliances in accordance with my invention, showing successive contacts of the car brushes with the station contact-plates; Fig. 6, is a like view showing a steam or other power propelled engine or motor-car; Fig. 7 is a diagrammatic view showing station contact-plates and part of magnetic appurtenances for the stations; Figs. 8, 11 and 13 are diagrammatic views showing station appurtenances and semaphore actuating mechanism in circuit therewith and engine or motor-car equipped in modified form in accordance with my invention; Figs. 9 and 10 are sectional elevations of solenoids and core actuating mechanism for the stations; Fig. 12 is a detailed view of modification of power supply controlling mechanism and signal light in the engine or motor-car; Fig. 14 is a longitudinal section of circuit breakers for the station magnetic appliances and semaphore actuating devices shown in Figs. 8–11 and 13; Fig. 15 is an end elevation of one of the members of one of said circuit breakers; Fig. 16 is a diagrammatic view partly sectional, showing engine with electric motor and regulating and reversing lever with magnetic appliances, shifting contact brushes and circuit connections; Fig. 17 is a plan showing station contact plates and part of shifting mechanism for the engine brushes; Fig. 18, is a like view of modification of some; Fig. 19, a similar view of still another modification; and Fig 20 shows different forms of roller or movable surface contact plates and brushes.

A represents an engine or motor-car in Figs. 1 to 5, which I will first describe. Such car is provided with an electric motor a having its supply by means of a single wire a' and trolley a^2 by way of circuit 1—1 and ground 12 through the axles and wheels of the car, see Fig. 1 or by a return metallic circuit as indicated in Fig. 2, and is provided with any suitable regulating and reversing lever or device B, see more plainly Fig. 16. Said car is also provided with magnets b and b' having armature levers b^2 and b^3 respectively and separate brushes C C′ and a pair of brushes C^2 C^3 in line with each other. The circuit 1—1 includes an electrical switch D, the lever of which may be a part of armature lever b^2 and having contact points d d' and d^2. The circuit 1—1 is by way of switch contact d^1 and switch lever to contact d, thence to the motor a to ground or return wire for supplying power to the motor for propelling the car. The purpose of the ground connection is to put the brake in circuit. From circuit 1—1 in advance of the motor, leads a branch or shunt circuit 2—2 having a resistance box

E with actuating lever e and including magnet b, armature lever b^3 contact plate b^4 for said armature lever b^3 and brush C^2, said armature lever having a retracting spring b^5 to move it into contact with plate b^4 when the magnet b' is not active. From circuit 2—2 leads a branch or shunt circuit 3—3 including magnet b' and brush C' and brushes C C^3 Figs. 1 to 6 are connected by a wire 4. The resistance box E and lever e are used to control the supply of current to the engine and station appurtenances.

If desired the armature and switch lever b^2 may control an electric lamp signal f included in a shunt or branch 5—5 from circuit 2—2 and grounded through 12, by means of an electric switch d^{20} attached to lever b^2 and contact d^{21} of circuit 5—5, as shown in Fig. 1, or by means of a drop signal or bar f' controlled by lever b^2, and when free to do so bridging the two contacts d^{21} of circuit 5—5, as indicated in Fig. 8. If desired, lever b^2 may control the drop signal or semaphore f', as shown in said last named figure, or as indicated in Fig. 1.

The station magnetic appliances shown in Figs. 1 to 5 are constructed and operate as follows: M, N and N' represent the station electro-magnets, preferably in the form of solenoids as shown having sliding cores. The solenoids N N^1 have a common core n and the solenoid M has a core m. The cores n m are mounted in suitable frames o p respectively and have retracting springs o' p' and adjustable governing bars o^2 p^2 abutting against stops o^3 p^3 on the frames o p to limit the range of motion of the cores when electrically moved. A disk h of insulating material having a contact pin h' of conducting material is arranged to one side of the solenoids M N and said disk is mounted on and revolves with one section of the shaft n^3. A contact collar i^3 is carried on a shaft m^3 and on said collar i^3 is carried a contact finger i' which is adapted to contact with the pin h' and the shaft m^3 is caused to revolve in one direction by means of a ratchet wheel m^2 with which engages a dog m' carried by solenoid core m. A shaft n^3 which is journaled at one end in a stationary frame n^5, passes through the shaft m^3 but turns freely therein and the shaft m^3 is journaled at one end in a stationary frame m^5, so that the shafts while in alinement are free to turn independently one of the other. The shaft n^3 carries an insulating collar n^4 upon which is fastened a contact finger k' that is adapted to contact with the pin h'. The contact finger k' has a bushing k^3 of conducting material upon which bears a brush k^2 and the contact finger i' has a bushing i^3 upon which bears a brush i^2. The shaft n^3 is caused to revolve in the same direction as the shaft m^3 by means of a ratchet wheel n^2 with which engages a dog n' carried by solenoid core n. The station circuit 8—8 leading to ground p, passes through the brushes k^2 i^2 and the contact fingers k' i' and when these fingers are in contact with the pin h' the circuit is closed to ground, but when one of said fingers is out of contact with the pin h' the circuit is broken. The operation of these parts is as follows. When the solenoid N has been energized by the passage of a current through its coils, it draws in its core n and when said current ceases to flow through the coils the core is driven out by the force of a spring l which has been compressed by the inward movement of the core and this outward movement of the core causes the shaft n^3 to revolve a single step, through the action of the dog n' on ratchet wheel n^2, thus moving the pin h' and the contact finger k' one step away from the contact finger. i' The passage of a current through the coils of solenoid M operates in the same manner to advance the contact finger i' through the movement of its core m and dog m' and thus the contact finger i' is caused to follow step by step the movement of pin h' and contact finger k' until such time as by the cessation of movement of the pin h' and contact finger k', the contact finger i' comes into contact with the pin h' and reëstablishes circuit of line 8—8 to ground p.

At each station in the type of devices shown in Figs. 1 to 7 is a set of four contact plates G G' G^2 G^3 for contact with the engine or car brushes when moving in one direction and another set of like number of plates G^4 G^5 G^6 G^7 reversely arranged, as shown in Fig. 7 for contact with said brushes when the engine or car is moving in an opposite direction, said brushes being automatically or otherwise shifted from one set to the other as the engine or car reverses its direction of motion. The plates G G' and G^4 G^5 of each set are in line and the other brushes of a set are out of line. From plates G G^4 of a station leads a circuit 8—8 to solenoid N and circuit breaker H when closed to ground p, and from plates G^2 G^6 a circuit 6—6 to solenoid N' to ground p; and from plates G' G^5 a circuit 7—7 to solenoid M to said ground see Fig. 7. These circuits may connect to magnetic appurtenances of the same or distant stations as desired. A train or motor-car approaching a station in the direction of arrow x, Fig. 1 has its magnetic appurtenances in circuit as shown in Fig. 1 and the circuit breaker H of the station is closed to safety ground. Engine brushes C C' contact with their respective plates G^2 G G' and brushes C C^3 with plate G^2. The engine circuit 3—3 is first grounded through G C station circuit 8—8 by way of solenoid N and circuit breaker H, said solenoid and engine magnet b' are rendered active and the latter attracts its arma-

ture b^3 to break the engine circuit 2—2 or cut out magnet b which is then not active, see Fig. 2, and the train or car passes on, the solenoid core n meanwhile acting to open the circuit breaker H to break ground p for station circuit 8—8 for a following train, which if it reaches said station before the circuit breaker H is restored or reëstablished the contact of its brush C′ with plate G finds no ground through engine circuit 3—3, the magnet b' does not then attract its armature b^3 and the engine magnet circuit 2—2 finding a ground through brush C^2, plate G^3, brush C^3, wire 4, to brush C and contact plate G^2 and station circuit 6—6 to ground p energizes solenoid N′ and magnet b, then the latter actuates switch lever b^2 to make contact with plates d' d^2 to cut the motor out of the circuit. 1—1 to stop the train, meanwhile the solenoid core n has again acted to still farther open or step the members of the circuit breaker away from each other, and such successive stepping of such members apart is effected by each passing train arriving at such station.

In passing out of a block or section the engine or car brush C contacting with plate G′ closes the engine circuit 3—3 to ground through the station circuit 7—7 to actuate solenoid M at a distant station, and its core m moves to actuate or step the members of the circuit breaker H toward each other one step at a time, each such passing train making such members move one step together until the last train passing off of the block closes the circuit breaker and restores or reestablishes station circuit 8—8 for a safety ground for following trains. It will be noted therefore that in the type of appliances described, the engine brush C′ finds a station ground indicating safety ahead and causes a rupture of such ground as it passes a station, and if such ground is not made by said brush the engine is stopped but another ground by way of brushes C^2 C^3, wire 4 and brush C is made for actuating the circuit breaker H, as set forth. The use of the last named brushes C C^2 C^3 avoids the necessity of having sliding or movable bars with shoes for contact with inclines or elevations on plates located adjacent to the track-rails.

Fig. 6 shows the armature lever b^2 controlling the cut-off g of a steam or other engine or motor and also the engineer's valve g', of an air brake system, the same being applicable for all motor cars.

As shown in Figs. 8, 11 and 13, the electric brake mechanism comprises a solenoid g^2, supported by the car and having a sliding core g^3, on the end of which is mounted a brake shoe g^4, to contact with a car wheel. A spiral spring g^5, surrounds the rear end of the core g^3 and abuts against a stationary bar g^5. The solenoid is in circuit 1, 1 and when this circuit is closed by conditions herein described requiring the car to be stopped, the core g^2 is projected forward and the brake shoe applied to the wheel.

In Figs. 8, 11 and 13 is shown a modified type of station and engine appurtenances wherein only three contact plates G G′ G^2 for a set are used at a station, and only two engine brushes C′, C^2 are required, and further a semaphore T at each station has a solenoid or magnet t with core t' for raising the semaphore to danger, a locking lever t^2 for holding it in its danger position, and a magnet t^3 for releasing said locking lever and permitting the semaphore to set itself in safety position; the solenoid t being included in the station circuit 8—8, the magnet t^3 in circuit 7—7, the latter of which is provided with a circuit breaker L and the circuit 8—8 with a corresponding breaker H a longitudinal section of same being shown in Fig. 14, and an end elevation of one of the members of breaker L being illustrated in Fig. 15.

The station appurtenances shown in Figs. 8, 11 and 13 are a modified form of those shown in Figs. 1, 2, 3 and 4 and are adapted not only to make and break circuit for the engine appurtenances but also to operate a semaphore at the station and I will now proceed to describe the same. In this form of station appurtenances the solenoid M is arranged on the opposite side of the circuit breaker to the solenoids N, N′ and instead of propelling the ratchet wheel by pushing it, the dog on core m is so constructed that it will pull the ratchet around toward the solenoid. In addition to the pin h' and contact fingers i' k' and their brushes the apparatus shown in Figs 8, 11 and 12 and in section in Fig. 14 is provided with contact fingers R, S and T′ which have brushes r, s and t^4, the contact fingers R and S being fixed on but insulated from the shaft m^3 while the contact finger T′ is fixed on but insulated from the shaft n^3. As shown in Fig. 14 the shaft m^3 is hollow and formed of insulating material and turns on the shaft n^3. The contact finger R is provided with a spring tongue l which normally rests on top of contact finger S, thereby establishing electric connection between the contact fingers R and S, which connection is broken when the contact finger T′, which, as shown in Fig. 15, is formed with a beveled upper surface, is brought under the spring tongue l by the revolution of the shaft N^3. The brush R of contact finger r is connected by a line 7 with solenoid M, from whence line 7 leads to contact plate G′; the brush s of contact finger S is connected to ground p by a line 9 and the brush t^4 of contact finger T′ is connected to an electro-magnet t^3 by a line 7 which is continued from said electro-magnet to ground p. The line 8 leading to brush k^2 of contact finger k' is continued

from the brush i^2 of contact finger i' to and through a solenoid t and thence to the contact plate G alongside the track.

The operation of the station appurtenances shown in Figs. 8, 11 and 13 is as follows: When brush C′ contacts with plate G and finds ground through circuit 8—8, see Fig. 8, the magnet b' attracts armature b^3 and breaks circuit 2—2 for magnet b for safety. If such ground is not found then such circuit 2—2 remains intact, see Fig. 11 and magnet b attracts lever b^2 to cut the motor out of circuit 1—1 to stop the car or train. At the same time when the brush C^2 contacts with plate G^2 a ground is made through station ground 6—6 to step the circuit breakers. Meanwhile when such contacts are made the semaphores are actuated to danger and safety position in the following manner. When the brush C′ of the car contacts with plate G and the circuit through line 8 is complete to ground through contact fingers k', i', the solenoid t is energized and drawing in its core elevates the semaphore T to danger position, in which position it is retained by the catch on armature t^2. At the same time the solenoid N is energized to step the contact finger k' away from contact finger i' to break the ground through line 8—8 and at the same time the contact finger T′ is moved out of contact with the spring plate l thus opening circuit on line 7—7 and the magnet t^3 and allowing the armature t^2 to hold the semaphore in the position to indicate danger. When the plate l is allowed to descend and contact with contact finger S as above described the circuit of line 7—9 is completed to ground and so remains as long as the contact finger T′ is out of contact with plate l. Following trains arriving at plate G before the leaders have passed off the block or station find no ground through line 8—8 and are stopped, the raised semaphore also indicating danger ahead. As the trains pass off of the section or block the contact of the engine brush C′ with plate G′ steps the contact finger i' at a rear station toward the contact finger h' and when the last train has passed off the block this operation has resulted in bringing contact fingers k' i' together so that both are in contact with pin h' thereby establishing circuit to ground through line 8—8 for a following train and at the same time establishing ground through line 7—7, energizing magnet t^3 and allowing the semaphore to drop and indicate safety.

In Fig. 16 the shifting lever p' for the engine brushes is shown under the control of the regulating and reversing lever B for the motor preferably through the medium of a slot b^{10} having a neutral point and mounted on a shaft on the engine as shown in Fig. 17. In Fig. 18 such lever p' is shown actuated by a cam or worm on the axle of a car or engine, and in Fig. 19 such brushes are shown moving in an arc of a circle when shifted. Fig. 20 shows the contact plates and brushes constructed for a rolling contact, the brushes may have the roller or rollers and the plates be flat or vice versa.

I do not confine myself to the construction and arrangement of parts as herein shown and described as the same may be variously constructed and arranged without departing from the spirit of the invention.

It will be noted that the motor car shown is an electrically propelled one, and the circuits therein controlling the switches or power-controlling devices for the motor are in a shunt from the latter, thereby dispensing with any electric supply or power apart from that which propels the car.

In this application I do not confine myself to any particular arrangement of shunt circuit and magnetic devices therein, nor to the number and arrangement of the contact brushes on the car and the contact-plates on the line of way, and in this respect this application differs from concurrent pending application Serial No. 404,148 in that special constructions and arrangements of said equipments are shown, described and claimed.

What I claim is:

1. A railway having station electro-magnetic appurtenances, electric connections and contact plates located adjacent to the line of way, a motor car having an electric motor a source of electric supply and circuit connections between the motor and supply including a power controlling switch and an additional circuit including electro-magnetic devices for controlling the power controlling switch for the motor, substantially as described.

2. An engine or motor car having a partial circuit including an electro-magnet, electrical switch and contact brush, an armature lever for said magnet, and a shunt or divided circuit including an electro-magnet controlling said switch, and a contact brush for said shunt, substantially as described.

3. A railway having station magnetic appurtenances, contact plates and circuit connections, an engine having divided circuits including magnetic appliances and contact brushes in both circuits, and a circuit breaker in one of the said circuits controlled by a magnetic appliance in the other, substantially as described.

4. The combination, substantially as described, with an electrically propelled car or vehicle, and the driving electric motor therefor, of a hand lever acting on a suitable switch for governing the speed or power of such motor, an electric switch governing the action of said motor, and controllable independently of said hand lever and irrespective of the position thereof, an electro-magnet governing said switch, and a contact car-

ried by the vehicle and connected with said magnet, and a contact along the permanent way adapted to be engaged by the contact carried by the vehicle.

5. The combination, substantially as described, with an electrically propelled vehicle and a driving motor therefor, of a manual device acting on a controlling switch for governing the speed or power of such electric motor, an electric switch governing the action of said motor and controlled independently of said manual device and irrespective of the position of the latter, an electro magnet governing said switch, and means upon the permanent way for bringing said magnet into operation when the car or vehicle passes a given point.

6. The combination, with an electrically propelled vehicle and its propelling electric motor, of a manual device such as a handle, acting on any suitable controller for governing the speed or movement of said motor at will, an electric switch governing the circuit of said motor, means for automatically bringing said switch into operation without any manual operation on the vehicle when the said vehicle passes a given point in its route, a single device, and actuating means therefor controlled through the medium of said switch.

7. The combination, substantially as described with an electrically propelled vehicle and its propelling motor, of a hand lever acting on a controlling switch for governing the speed or power of said motor, an electric switch controllable independently of said hand lever and irrespective of the position of the latter for governing the action of said motor, an electro magnet governing said switch, and said switch controlling the circuits of an electric brake, as and for the purpose described.

8. The combination, substantially as described, with an electrically propelled vehicle and its propelling electric motor, of a manual device such as a handle, acting on suitable electric controlling apparatus for governing the speed or movement of the motor at will, an electric switch controlled independently of said manual device, and governing the circuit of said motor, an electro magnet carried by the vehicle and governing said switch, and means upon the road bed or permanent way for governing the circuit of said magnet.

9. The combination, substantially as described, with an electrically propelled vehicle and its propelling motor, of a manual device such as a handle acting on an electric controller for governing the speed or power of said motor, an electric switch governing a circuit of said motor and controllable independently of said manual device, an electro magnet energized from the road bed when the vehicle passes a certain point thereon for governing said switch, and a braking appliance brought into operation simultaneously with the action of said independently controllable switch, as and for the purpose described.

10. The combination of a permanent way, a vehicle movable thereon, motive appliances for propelling the vehicle, controlling mechanism for said motive appliances, an electro-magnetic device for operating said controlling mechanism, a circuit for actuating said electro magnetic device, a contact brush for said circuit, and a contact in the line of travel of said brush and with which the brush makes contact to actuate said electro-magnetic device and thereby effect movement of the controlling mechanism of the motive appliances, substantially as set forth.

11. In an electrically operated railway having a supply wire or wires, electrically actuated station appurtenances operated by a passing motor car, two series of contacts along the line of way and each connected with station appurtenances in front of and behind the same, contact devices carried by the car and adapted to co-act with said contacts, and power controlling and reversing mechanism also carried by the car, said controlling mechanism being adapted to be automatically actuated substantially as described.

12. A motor car having an electric motor, and circuit connections with a source of power, a regulating and reversing switch in said circuit, a controlling switch, connections for the motor, a shunt or branch circuit from the line or course of supply and including a resistance switch, electro-magnetic devices for operating said controlling switch, contact brushes and contacts along the line of way adapted to be engaged by the contact brushes, substantially as set forth.

13. A motor car having an electric motor line supply circuit therefor, including switch D, shunt or branch circuit including a resistance switch E, electro-magnetic devices for controlling said switch D, a contact brush carried by said car, and contact plates along the line of way adapted to be engaged by said brush, substantially as set forth.

14. In an electrically operated railway having a supply wire or wires, electrically actuated station appurtenances operated by a passing motor car, in either direction of its movement, two series of contacts along the line of way and each connected with station appurtenances in front of and behind the same, contact devices carried by the car and adapted to co-act with said contacts, and regulating and reversing mechanism also carried by the car and electrically connected with the contact devices, said controlling mechanism being adapted to be automatic-

ally actuated when the station electrical appurtenances are in an abnormal condition, substantially as described.

15. An engine or motor car having an electric motor, a source of electric supply, a regulating device for controlling the motive power, a reversing device, circuit connections, a shunt or branch circuit including electro-magnetic devices for said regulating device, contact brushes and devices controlled by the forward and backward movement of the car for automatically changing the line of travel or contact of said brushes, substantially as described.

16. In an electrically operated railway having a supply wire or wires, electrically actuated station appurtenances, two series of contact plates along the line of way and each connected with station appurtenances in front of and behind the same, a brush on the car making contact with either of said series of plates, a controlling switch for the car motor, and an electro-magnetic device in circuit with said brush for operating the controlling switch when the electrical station appurtenances are in an abnormal condition, substantially as described.

17. In an electrically operated railway having a supply wire or wires, electrically actuated station appurtenances, two series of contact plates along the line of way and each connected with station appurtenances in front of and behind the same, a brush on the car making contact with either of said series of plates, a controlling switch for the car motor, means controlled by changes in direction of movement of the car for shifting said brush, and an electro-magnetic device in circuit with said brush for operating the controlling switch when the electrical station appurtenances are in an abnormal condition, substantially as described.

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

SAMUEL D. STROHM.

Witnesses:

CHAS. F. VAN HORN,

R. W. VAN STAVOREN.