C. J. KINTNER.

RAILWAY SIGNAL.

APPLICATION FILED JULY 20, 1903.

915,190.

Patented Mar. 16, 1909.

4 SHEETS—SHEET 1.

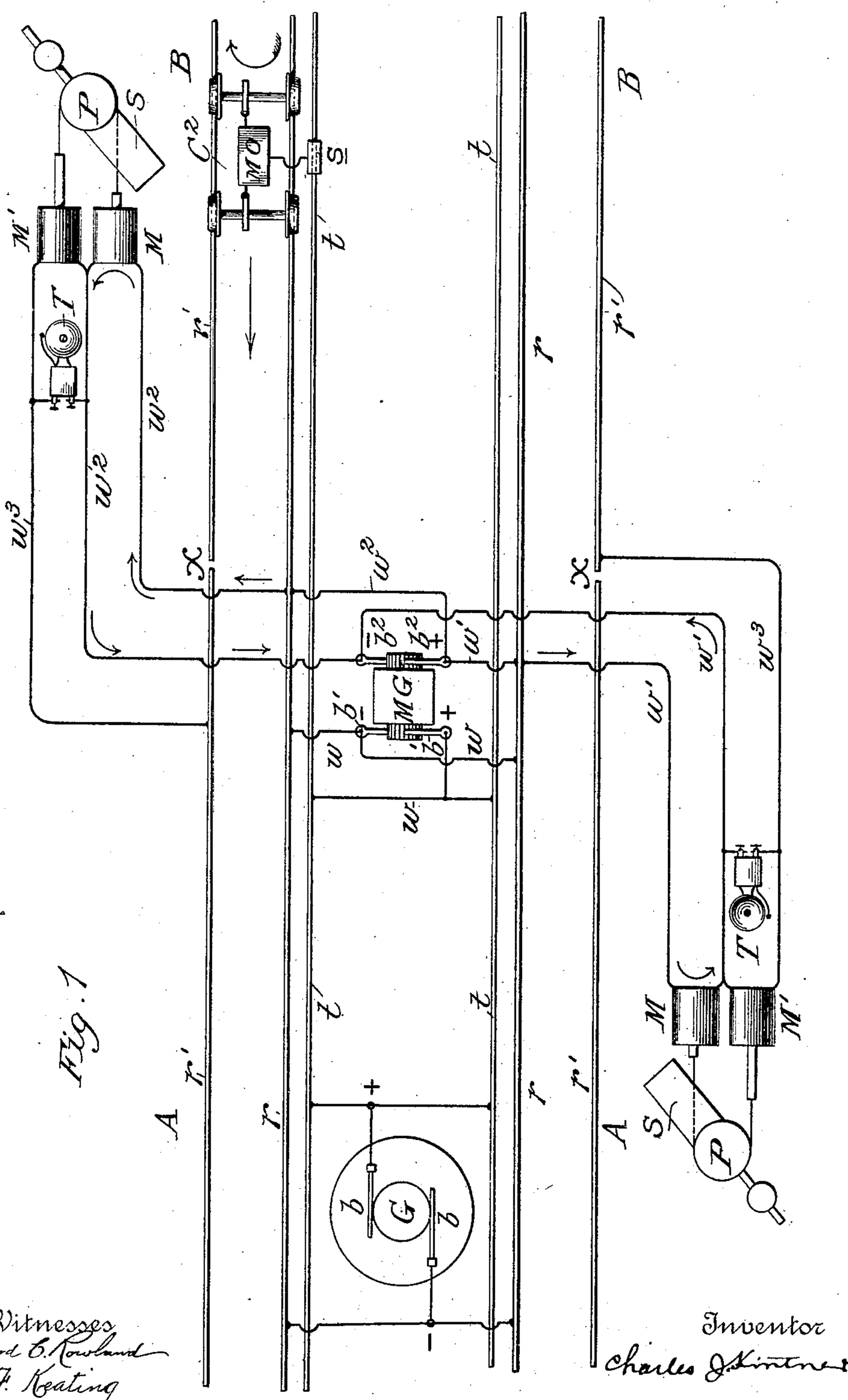

Fig. 1.

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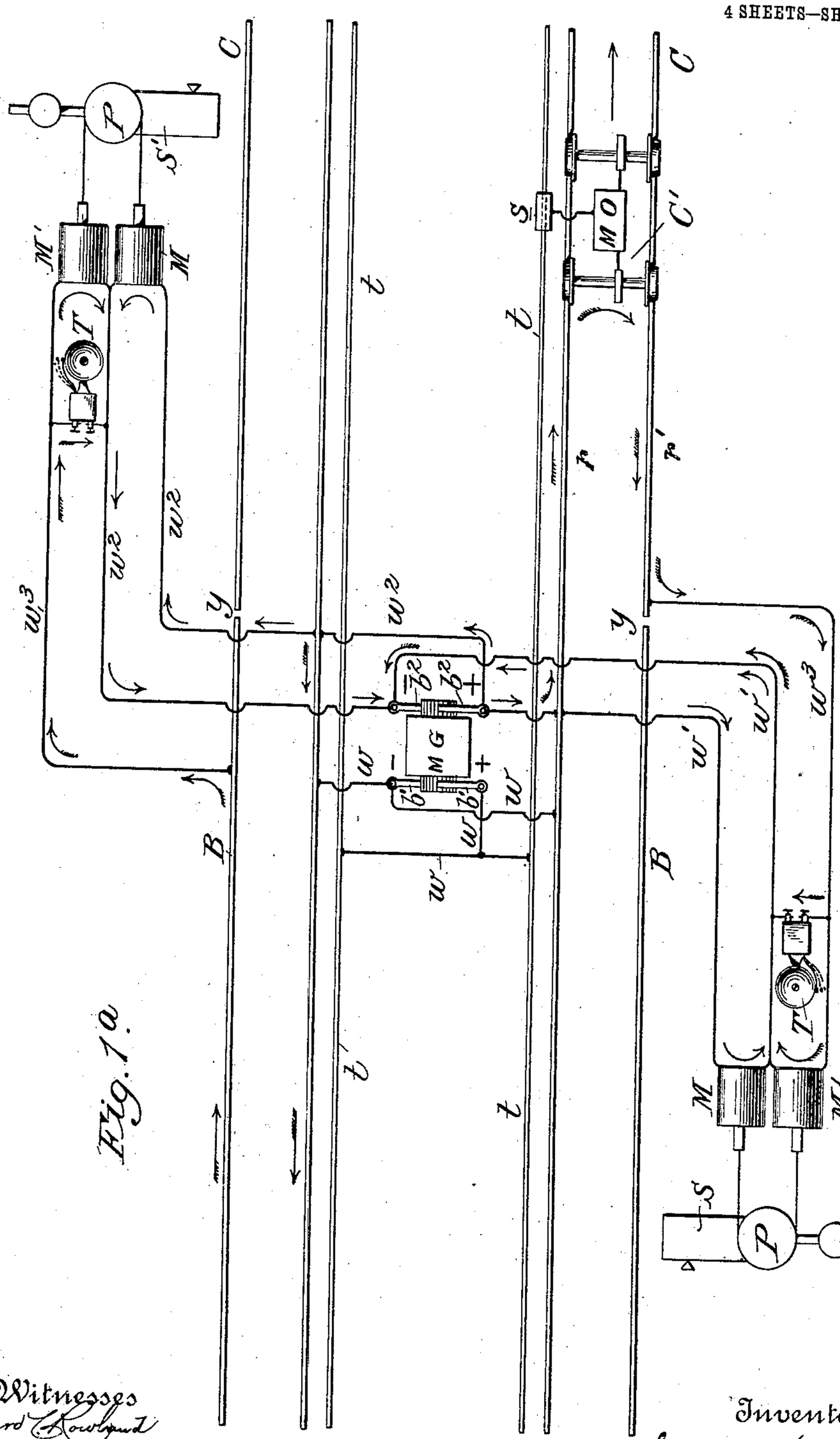

Fig. 1a.

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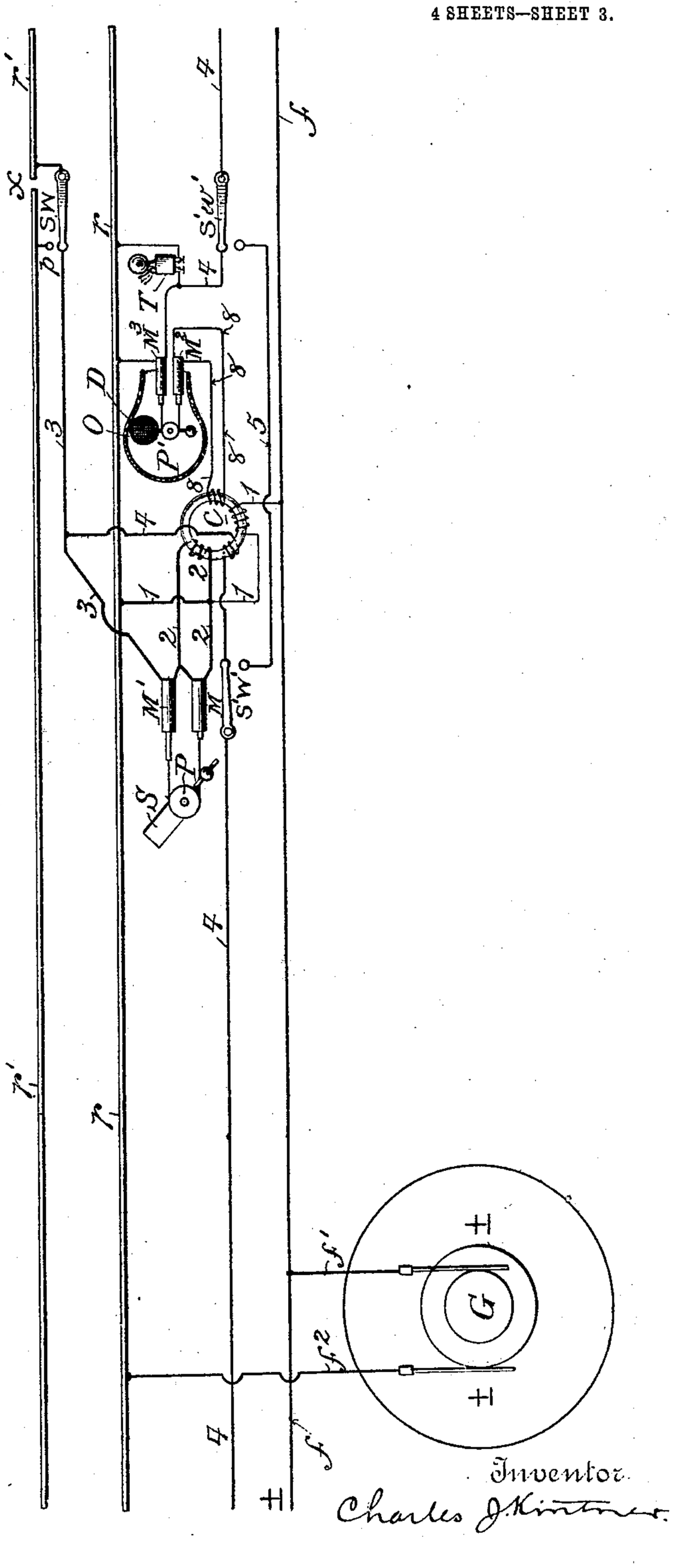
4 SHEETS—SHEET 3.

Fig. 2.



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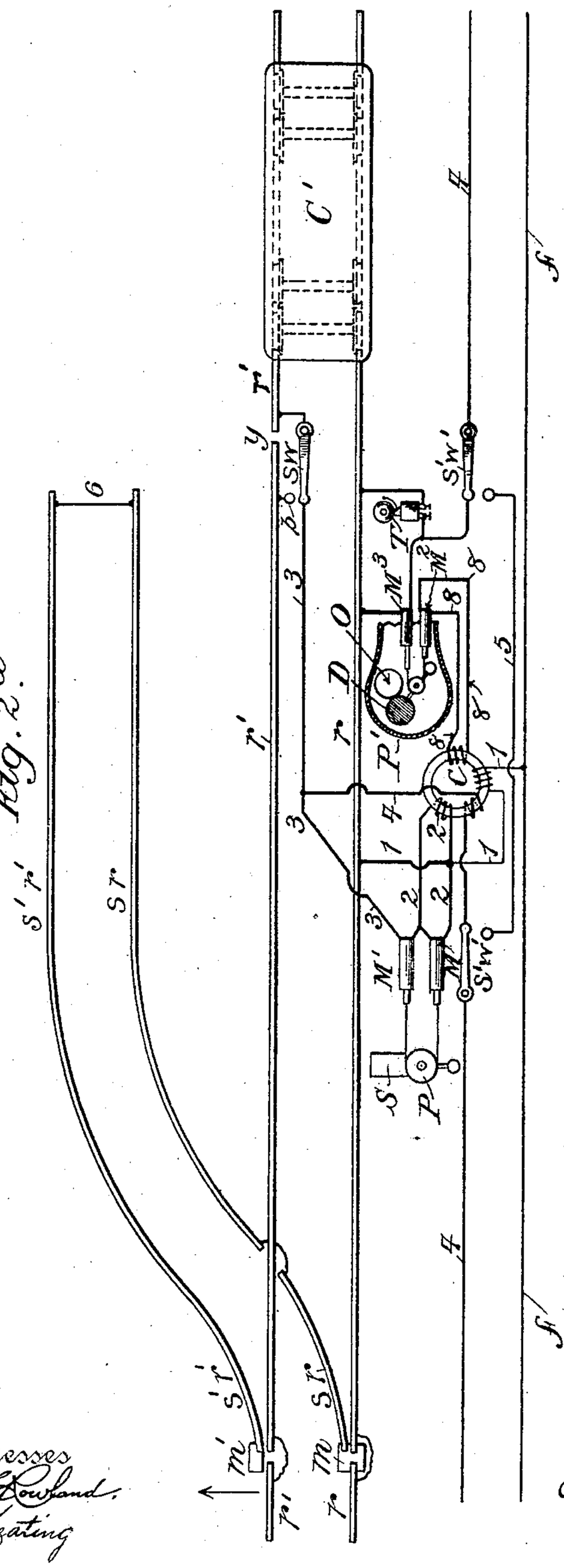

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UNITED STATES PATENT OFFICE.

CHARLES J. KINTNER, OF NEW YORK, N. Y.

RAILWAY-SIGNAL.

No. 915,190. Specification of Letters Patent. Patented March 16, 1909.

Application filed July 20, 1903. Serial No. 166,361.

To all whom it may concern:

Be it known that I, CHARLES J. KINTNER, a citizen of the United States, residing at New York, borough of Manhattan, county and State of New York, have made a new and useful Invention in Railway-Signals, of which the following is a specification.

My invention is directed particularly to improvements in electrically controlled railway signals in which the control thereof is effected by currents of relatively low potential and the tram or service rails utilized for effecting such control, and it has for its objects, first, the adaptation of dynamically generated electrical currents of relatively low voltage in connection with double track systems of rails; second, to control or operate both home and distant signals in a block signal system and in such manner that the entire control or operation of both sets of such signals is effected wholly by the movements of cars over the rails and without the intervention of any circuit interrupting devices or relays, other than the wheels, axles and track rails, third, to provide an electrically controlled or operated block system of signals with switches whereby any home signal may be disconnected from the circuit, the adjacent sectional rails or conductors connected in series relation, the corresponding distant signal accompanying such home signal disconnected also from the circuit, and the circuits for the distant signals be so rearranged that the cutting out of the corresponding signals will not interfere with traffic and that the signal blocks may be lengthened or shortened at will, fourth, to combine with an electrically controlled or operated block system of signals, in which dynamically generated electrical currents or relatively low voltage are used through the tram or service rails, switching devices so arranged that the misplacement of the rail switching devices of the main track will give indication of the fact, the arrangement being such that a car or train may be side-tracked and that during the time that it is being side-tracked the signals will remain at danger until the switch-rails are restored to the normal or safety condition.

My invention will be fully understood by referring to the accompanying drawings, in which—

Figures 1 and 1ª illustrate diagrammatically, when placed end to end with Fig. 1 upon the left, a double track block system of electric railways with a power house generator, a series of motor generators electrically connected thereto at intervals and to electromotive devices for controlling or operating similar signals for both tracks; two cars being shown traveling in opposite directions, one on each track. Figs. 2 and 2ª, when placed end to end in succession, illustrate diagrammatically a block signal system embodying my invention with electrically controlled or operated home and distant signals, an alternating current generator of relatively high potential and a feeder extending over the route; a siding track being shown in Fig. 2ª.

Referring now to the drawings in detail and first to Figs. 1 and 1ª, r, r^1, r, r^1 represent two parallel sets of tram or service rails in a double track system, the rails r, r, being bonded together throughout their length and connected by a cross conductor to the negative pole of a power house generator G through one of the commutator brushes b thereof, the other commutator brush being connected by a similar cross conductor to continuous third rails t, t, one for each track. The remaining lines of tram rails r^1, r^1 of each set are divided into block signal sections A, B, C, etc., of the desired length, insulated from each other at the points x, x, y, y, etc. At or near the end of each section is located a motor-generator MG having one of its commutator brushes b^1 connected directly to the third rails t, t, by a cross-conductor w, the other commutator brush b^1 thereof being connected by a similar cross conductor w at its opposite ends to the continuous tram or service rails r, r, and hence to the negative pole of the power house dynamo G. The commutator brushes b^2, b^2 of the generator parts of the motor-generators are connected in permanently closed circuits in multiple by conductors w^1, w^1, w^2, w^2 with electromotive devices M, M preferably of solenoid form, the movable parts of which here shown as solenoid cores are connected in turn by cords or chains to pulleys P located each upon a rotary shaft carrying a signal or semaphore arm S weighted at its outer end, as shown. The motor parts of the motor-generators MG are preferably designed to operate with currents of relatively high voltage, such as are now ordinarily used in the art of electric railways, while the generator parts thereof are designed to generate currents of relatively low voltage, preferably of from 1 to 2 volts and of the desired ampere

capacity to operate the differential electromotive devices which control or move the signals S, S¹. M¹, M¹ are electromotive devices or solenoids similar in all respects to the electromotive devices or solenoids M, M. These electromotive devices M, M¹, M¹ are connected permanently in circuit with the generator parts of the motor generators MG and the continuous and sectional track rails *r*, *r*¹. The electromotive devices M¹ for the lower track are connected each on one side by the conductor *w*¹ to the negative commutator brush of the generator part of the motor-generator MG, and on the other side by the conductor *w*³ to the corresponding sectional tram or service rail *r*¹ at a point near the incoming end thereof as a car approaches the same from left to right; the other electromotive devices M¹ being similarly connected on one side to the negative commutator brush by a conductor *w*² and on the other side by a conductor *w*³ to the incoming end of the sectional tram or service rail *r*¹ of the upper track at a point near the incoming end thereof for a car approaching the same from right to left. The solenoid cores or movable parts of the electromotive devices or solenoids M¹ are connected by cords to the pulleys P and are designed to oppose or balance the operation of the first-named electromotive devices or solenoids M. Electromotive devices of this nature which oppose each other in their action I have denominated as differential electromotive devices because their action upon the signals as herein shown and described is of a differential nature. T, T, T, T are tap-bells located in multiple relation with the electromotive devices or solenoids M¹, M¹ and designed to operate at the same time that said electromotive devices or solenoids are made operative, so as to give in each instance an audible signal at the same time that a visual signal is displayed. C¹ (Fig. 1ª) represents a car on the lower track on section C traveling from left to right in the direction of the tailless arrow and C² (Fig. 1) another car upon section B traveling from right to left upon the upper track.

The operation is as follows—So long as the power house generator G is in operation it is furnishing current directly in multiple to both third rails *t*, *t*, and hence to the motors MO on the cars C¹, C² by way of the current collectors or trolley shoes *s*, *s* and usual circuit connections and controllers. At the same time a branch of the current is flowing through all of the motor parts of the motor generators MG by way of the cross conductors *w*, *w*, and commutator brushes *b*¹, *b*¹ thereby causing the generator parts of the motor generators to establish or set up currents of relatively low voltage, say 1 to 2 volts, flowing continuously from the commutator brushes *b*², *b*² through the multiple conductors *w*¹, *w*¹ *w*², *w*² of all of the electromotive devices M, M in the direction shown by the tailless arrows; consequently, all of the signals S in the system where no cars are located are held in their lower or safety position in the manner indicated in Fig. 1.

In Fig. 1ª the car C¹ is passing over section C from left to right; consequently, a branch circuit is closed from the generator part of the motor generator MG of that section by way of the commutator brush *b*² to the tram-rail *r;* thence through the wheels and axles of the car C¹ to the sectional tram-rail *r*¹ in the direction of the tailed arrows by way of conductor *w*³, through the electromotive device or solenoid M¹ by way of conductor *w*¹, to the negative commutator brush *b*²; consequently, the electromotive device M is balanced or over-powered and the weight at the free end of the signal S causes the same to assume the position shown at right angles to the track or that of danger. At the same time a multiple branch of the current is flowing through the tap bell T causing it to ring continuously. The signal or semaphore S will remain displayed at danger and the tap bell T will continue to ring as long as the car C¹ is standing upon or passing over section C. As soon as it passes into the next section on the right the tap bell T will stop ringing and the electromotive device or solenoid M will restore the signal to safety. For like reasons the singal S¹ in Fig. 1ª is displayed at danger and the tap bell T is ringing and this condition of affairs will continue so long as the car C² remains upon or is passing over section B Fig. 1 of the upper track. When, however, this car passes out of section B and into section A in the direction of the arrow the same condition of affairs will prevail with relation to the signal or semaphore S and the tap bell T of that section, while the signal S¹ nd tap bell T of section B Fig. 1ª will cease to indicate danger. With such an arrangement of circuits, therefore, I am enabled to utilize a single current potential reducing device at the end of each block section for two signals or sets of signals, one for each track and to effect the operation or control of the signals whether they be visual or audible, or both, through the agency of dynamically generated currents of relatively low potential, passing through the wheels and axles of the cars as they proceed over the route, and this result is effected wholly through the movements of the cars and without the agency of any relays, circuit making or breaking devices, or other appliances, other than the wheels, axles and track rails. It is obvious that in place of motor generators MG I may substitute any of the well known current potential reducing devices now in general use and that alternating current generators with current potential reducing devices such

as are illustrated in Figs. 2 and 2ª may be so substituted, such matters being well within the skill of those versed in the art.

Reference is now had to Figs. 2 and 2ª for a clear understanding of my invention as applied to both home and distant signals. In these figures of the drawings, as above indicated, I employ an alternating current generator G which is connected by branch conductors f^1, f^2 to a high potential feeder f and continuous tram rail r extending entirely over the route; c, c, being transformers having their primaries connected in multiple with the current feeder f and the tram rail r which, as before, is bonded throughout its length; the other tram rail r^1 being divided into insulated block sections at the points x, y, etc. sr, s^1r^1 are side track tram or service rails for side tracking cars as desired. S, S represent home signals and M, M^1 electromotive devices or solenoids for operating or controlling the same through the agency of pulleys P. D, D are distant signals located as is customary at points near the home signals, said distant signals being designed to operate with their corresponding home signals as is ordinarily the case. M^2, M^3 are electromotive devices or solenoids for controlling the movements of the distant signals D through the agency of their movable parts or solenoid cores and pulleys, all of said parts being located in semaphore posts P^1 provided with openings O similar to well known types of existing railway signals. 2, 2, are normally closed secondary circuits of the transformer c of relatively low voltage, preferably not exceeding two volts, the arrangement being such that the secondary circuits will generate currents of the desired quantity to operate continuously their corresponding electromotive devices or solenoids M. 3, 3, are branch conductors running from the electromotive devices or solenoids M^1 to the adjacent ends of the sectional tram or service rails r^1, sw being switches for disconnecting said branch conductors and connecting said sectional tram or service rails together in series relation when it is desired to cut out any home signal. 4, 4, are sectional conductors connected in multiple with the conductors 3, 3 and hence with the sectional tram rails r^1, through additional low potential secondary windings upon the transformers c, c, through switches s^1w^1, s^1w^1, to electromotive devices or solenoids M^3 where they are connected directly to the continuous tram rail r, T, T being tap bells located in multiple relation thereto. 8, 8, 8 are permanently closed low potential circuits or conductors connected with electromotive devices or solenoids M^2 and additional secondary coils of the transformers C at points where the distant signals are located. 5, 5, are shunt circuits having contacts at their opposite ends for contacting with the free ends of the switches s^1w^1, s^1w^1 so as to enable one to cut out the distant signal which corresponds to any home signal which has been cut out by operation of the switch sw and to establish a new distant signal.

Referring now to Fig. 2ª, sr, s^1r^1 are side track rails connected together at their free ends by a conductor 6, the rail sr at its junction with the main track resting upon and connected to a metal or other conducting block m and the rail s^1r^1 upon and connected to a corresponding metal or conducting block m^1, the rails r^1 and r and sr being bonded as shown and the arrangement such that when the switch rails of the main track are moved in the direction of the arrow the circuit will be closed through the block m, rail sr, cross conductor 6, rail s^1r^1, block m^1 and switch rail r^1.

I will now describe the mode of operation of the invention as illustrated in Figs. 2 and 2ª. So long as the generator G continues to operate currents of relatively high potential are passing over the feeder f and in multiple arc circuits through the branches 1 and primary coils of the transformers c, c (Figs. 2 and 2ª) by the return or continuous tram or service rail r to the generator; consequently, currents of relatively low voltage are being generated in the continuously closed secondary circuits 2, 2, through the electromotive devices M, M in all of the several sets of signal apparatus, so that so long as the conditions are normal all of the signals where there are no cars traveling over corresponding sections will be held by reason of the movable parts of the electromotive devices M in their upper or safety position. For like reason the electromotive devices or solenoids M^2 of the distant signals will be held in their upper or safety positions under similar conditions attributable to the permanently closed circuits 8, 8, it being understood, however, that in these distant signals D, D the weight of the signal disks preponderates so that when no current is flowing through the circuits 8, 8, said disks will assume their warning positions. When the car C^1 (Fig. 2ª) entered the section upon which it is now standing a branch circuit was closed from the low potential secondary of the converter c by way of circuit 2, electromotive device or solenoid M^1, conductor 3, switch sw, sectional tram or service rail r^1, wheels and axles of the car C^1, continuous tram or service rail r, conductor 1, back to the low potential secondary coil, thereby balancing the effect of the electromotive device M upon the pulley P of the home signal S and allowing the same to be placed into the danger position. At the same time a branch circuit is closed from the additional low potential secondary included in the sectional conductor 4 and running from the conductor 3 through said low potential secondary, switch s^1w^1, conductor 4, to the rear to the switch s^1w^1 (Fig. 2) by

conductor 4, through the electromotive device or solenoid M^3 of the distant signal D, returning by the continuous tram or service rail *r* to the wheels and axles of the car C^1 by way of sectional rail r^1, switch *sw*, conductor 3 to the starting point. This overcomes or balances the effect of the low potential circuit, 8, 8, including the secondary of the transformer *c* and the electromotive device or solenoid M^2 of the distant signal D causing the same to assume a position behind the opening O, as shown. At the same time the tap bell T is operated thus giving warning at that point, both visual and audible, that the car C^1 is two sections ahead; consequently, a following motorman is warned by a distant signal and should he pass the same will be similarly warned as to actual danger by the home signal S. Similar tap bells of deeper and louder tone might be placed between the circuits 2 and 3 in shunt relation to the electromotive devices M^1 of the home signals S for giving an additional danger warning at that point. It will be understood, of course, that where solenoids M, M^1, M^2, M^3 and tap bells T are used with alternating currents the movable parts thereof should be provided with the necessary laminated cores for effecting the best operation. Should it become desirable to cut out any signal, say the signal for instance illustrated in Fig. 2^a, it is only necessary to throw the free end of the switch *sw* upon the contact point *p* at the same time throwing the two switches s^1w^1, s^1w^1 at that point upon the contacts at the ends of the shunt circuit 5, so as to make the conductor 4 for operating the distant signal continuous from the next section on the right to the next section in the rear.

Referring now to Fig. 2^a for a description of the siding and its operation, it will be apparent that should the switch rails be misplaced by moving them in the direction of the arrow circuit will be closed through the conducting blocks *m*, m^1 and both of the rails *sr*, s^1r^1 and conductor 6 so that the home signal S illustrated in Fig. 2 will be set at caution until the switch points be restored to their normal condition. For like reason when any car is being transferred from the main track to the siding these signals will be set at danger and caution until the car is wholly on the side track and the switch point restored to their normal or closed position with relation to the main track.

I do not limit my invention to the details of construction and especial circuit relations illustrated in the accompanying drawings, as a number of the features thereof might be materially departed from and still come within the scope of my claims hereinafter made. To make a single illustration, instead of utilizing low potential currents for controlling the permanent display or operation of the signals illustrated in the drawings by the circuits 2, 2, 2, 2, these electromotive devices M, M might be included directly in multiple high potential branches between the feeder *f* and the continuous tram rail the low potential currents being used with electromotive devices M^1, M^1, solely for track circuits; or, if preferred, the electromotive devices might be included in series relation with the high potential circuits which operate the motors of the motor generator and connected in such series relation directly between the current feeder and the continuous tram rail, the low potential currents being used as before for track circuits with the electromotive devices M^1, and my claims hereinafter made contemplate all such obvious modified arrangements of circuits, the essence of the invention lying in the adaptability or use of low potential dynamically generated currents for the control or operation of railway signals with track circuits.

I make no claim in the present application to a system of railway signals in which the signals are all displayed at safety by a continuously flowing current of electricity and placed at danger each by the application of a low voltage current passing through the tram-rails and the signaling apparatus in such manner that by reason of the differential action of the currents the signals indicate danger. Nor do I make any claim hereinafter to a system of block signals embracing differential acting electromotive devices for controlling the movements of the signals through the agency of currents of low voltage passing through the track rails, as a car passes thereover, and combining therewith switching devices for varying the lengths of the block sections where home signals alone are used, as these features constitute in particular the subject matter of another application filed by me in the U. S. Patent Office on the 14th day of April, 1903, bearing Serial No. 152,494. Nor do I claim hereinafter broadly the combination of a system of block signals controlled by sectional track rails and electrical circuits combined with switches for varying the lengths of the signal sections, as this feature is claimed in still another pending application filed by me in the U. S. Patent Office on the 26th of Jan., 1903, bearing Serial No. 140,585.

I am aware that it has heretofore been proposed to combine a series of motor generators or converters with a sectional third rail system of electric railways and a series of signals operatively controlled by low potential currents set up by the motor generators or converters primarily controlled by the working current and to successively connect the signal controlling magnets or electromotive devices in circuit with the low potential generators as a car or train passes over the route, said low potential generators being normally out of circuit; that is to say nor-

mally open circuited, and I make no claims hereinafter broad enough to include such a structural system, my claims in this particular being limited to the distinct feature of low potential generators and signal controlling or operating electromotive devices included permanently in circuit so that the signals are all displayed at danger by the presence of the current flowing therethrough.

Having thus described my invention what I claim and desire to secure by Letters Patent of the United States is—

1. A double track system of railways provided with means located at intervals along the roadway for dynamically generating electric currents of relatively low voltage; in combination with signals for each track operatively connected in closed circuit to said generators in pairs and to the tram or service rails of the corresponding tracks in normally open circuit, the arrangement being such that the signals are operated or controlled by said low voltage currents which flow from the generators through the tram or service rails, the wheels and axles of the cars and the signals as cars pass in opposite directions over the route.

2. A double track system of railways embracing sectional tram or service rails and means for dynamically generating electric currents said means being located at or near the ends of the sections and adapted to generate currents of relatively low voltage; in combination with signals for each track connected to the generators and to the respective tracks in pairs in closed circuit and to the tram or service rails of the corresponding tracks in normally open circuit.

3. A double track system of railways embracing sectional tram or service rails electrically insulated from each other; in combination with an electrical generator adapted to generate currents of relatively high voltage; current potential reducing devices located at intervals and adapted to transform the high voltage currents into currents of relatively low voltage; together with signals for each track electrically connected in pairs in closed circuit to the current potential reducing devices and to the track sections in normally open circuit, the arrangement being such that the signals are operated or controlled wholly by the passage of the cars as they pass over the route in opposite directions.

4. A railway signal system embracing home and distant signals electrically connected each to means for dynamically generating electric currents of relatively low voltage and to a sectional tram or service rail, the circuit connections for both sets of signals being continuous or closed, when a car is on any section, through the current generating means and the tram or service rails, whereby the signals are operated without relays or circuit makers and breakers other than the wheels and axles of the cars and the tram rails.

5. In a railway block signal system a home and a distant signal for each block included in multiple circuit with means for dynamically generating electric currents of relatively low voltage, the tram or service rails and the wheels and axles of a car; both of said signals being made simultaneously operative solely by the presence of a car upon the tram or service rails.

6. A railway signal system embracing home and distant signals; a source of electrical energy adapted to generate currents of high voltage; current potential reducing devices located at intervals; sectional tram or service rails electrically insulated from each other and operatively connected each to the signals in pairs and to the current potential reducing devices, the circuit connections being continuous or closed, when a car is on any section, through a home and a distant signal and the corresponding current potential reducing devices, the tram rails and wheels and axles of the car.

7. A railway block signal system embracing home and distant signals for each block arranged in pairs and connected, each pair, in multiple relation with a tram or service rail, a dynamic source of electrical energy of relatively low voltage and the other tram or service rail, the arrangement being such that both signals of any block are operated simultaneously by the presence of a car upon that section through the agency of a current passing through the wheels and axles thereof.

8. A railway signal system embracing a source of electrical energy of relatively high voltage, and a feeder extending over the route; current potential reducing devices located at intervals; pairs of home and distant signals; one of the tram rails being continuous and constituting the return circuit for the high potential generator; the other tram rail being divided into sections insulated from each other and electrically connected each to a home and a distant signal and to a current potential reducing device.

9. A railway signal system embracing home and distant signals arranged in pairs; sectional conductors for each pair of signals and switching devices for cutting out any pair of signals and for connecting the corresponding sectional conductors of each signal in series relation whereby the signaling sections for both may be lengthened or shortened at will.

10. A railway signal system embracing pairs of home and distant signals; sectional track circuits for both sets of signals and

sectional conductors for the distant signals; in combination with switches for varying the length of the signaling sections of both sets of signals.

11. A railway system embracing sectional tram or service rails electrically insulated from each other; in combination with an electrical generator adapted to generate currents of relatively high voltage; a siding having a pair of switch rails electrically connected together and provided with circuit connections located at or near the movable ends thereof for varying the relation of the current flow between the main track and the siding track rails; a current potential reducing device electrically connected to a signal and the siding track rails; when the switch rails are in alinement with the main track rails together with circuit connections so arranged that when the switch rails are in line with the main track rails the signal remains at safety through the continuous application of an electrical current, and when said switch rails are in line with the siding, the signal is displayed at danger by the application of low potential currents flowing through the siding track rails and the signal.

12. A railway signal system embracing a relatively high potential generator; a series of signals having electromotive controlling or operating devices included in permanently closed circuits and normally open branch circuits extending to the track rails and the generator portion of a low potential generator controlled or operated by the beforementioned high potential generator.

13. A railway signal system embracing a power house generator electrically connected to a feeder extending over the route and to one of the track rails, the other track rail being divided into sections insulated from each other; in combination with current potential reducing devices connected in multiple with the feeder and continuous track rail and signals operated or controlled by electromotive devices connected permanently in circuit with the current potential reducing devices and in normally open circuits connected with the continuous track rail and the sectional track rails.

14. In an electric railway system a line of way embracing a pair of tram or track rails, one of which is electrically continuous throughout its length, the other being divided into sections electrically insulated from each other; a current feeder or trolley conductor extending over the route; a power generator having one pole thereof connected to the feeder and the other to the continuous tram or track rail; a plurality of current potential reducing devices operatively connected on one side with the current feeder and the continuous tram or track rail and on the other in continuously closed circuit with an electro-motive device for normally holding a signal at safety, the circuit relations between the electro-motive device and the tram or track rails and the low potential part of the current potential reducing device being such that when a car is standing upon or passing over any section the current effects of the electromotive devices are nullified through the conductivity of the wheels of the car and the signal therefor permitted to go to danger through the application of gravity.

15. In an electric railway system a line of way embracing a pair of tram or track rails, one of which is electrically continuous throughout its length, the other being divided into sections electrically insulated from each other; a current feeder or trolley conductor extending over the route; a power generator having one pole thereof connected to the feeder and the other to the continuous tram or track rail; a plurality of dynamic current generating devices driven by electrical currents of relatively high potential and adapted to generate currents of relatively low potential, the circuits for such low potential currents being connected respectively with the continuous tram or track rail. and the sectional track rails and operatively including each an electromotive device connected in turn with a signal in such manner that all of the signals are normally held electrically to indicate safety against the action of gravity, the circuit relations being such that by the presence of a car upon any section the current effects through the wheels and axles of the car and the rails of that section nullify the current effects upon the electromotive device and permit that particular signal to be moved to danger by the application of the force of gravity.

16. In an electric railway system a line of way embracing a pair of tram or track rails, one of which is electrically continuous throughout its length, the other being divided into sections electrically insulated from each other; a current feeder or trolley conductor extending over the route; a power generator having one pole thereof connected to the feeder and the other to the continuous tram or track rail; a plurality of dynamically driven low potential generators connected on one side with a high potential generator and on the other with the sectional tram or track rails and the continuous tram or track rails, said low potential generators being connected also each to a signal controlling electromotive device in such manner that normally all of the signals controlled thereby are electrically held in a definite position against the force of gravity, the circuit relations of the generators and the electromotive devices being such that when a car is stand-

ing upon or passing over any section the wheels thereof constitute current conductors for varying the current relations to the corresponding electromotive devices in such manner as to demagnetize the same thereby allowing the signal to assume a different position under the influence of gravity.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES J. KINTNER.

Witnesses:

JAMES P. J. MORRIS,

M. F. KEATING.