No. 688,922. Patented Dec. 17, 1901.

R. BINGHAM & C. SCHLECHTIGER.

ELECTRIC RAILWAY.

(Application filed Aug. 22, 1901.)

(No Model.) 3 Sheets—Sheet 1.

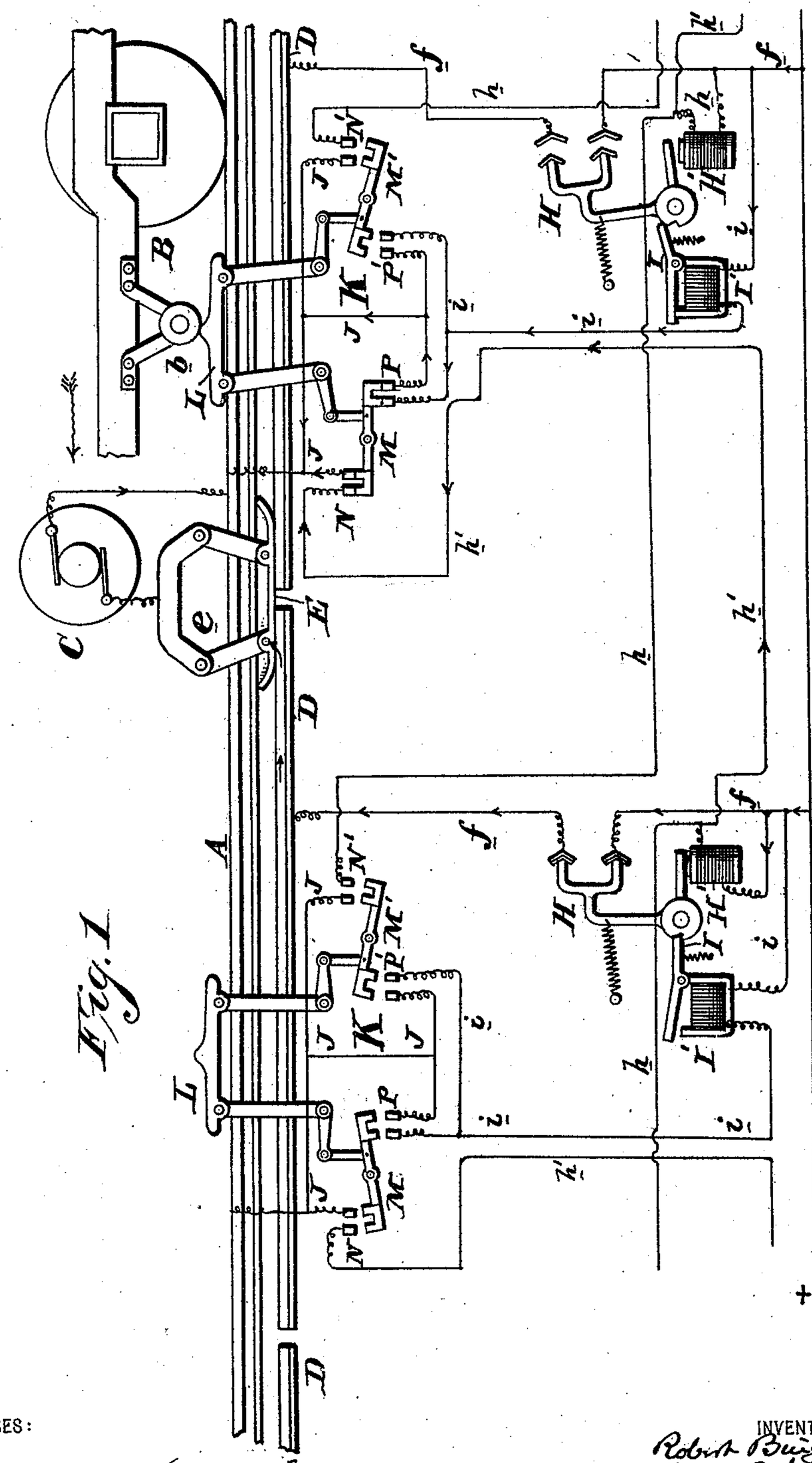


Fig. 1.

WITNESSES:

Louis D. Heinrichs

N. H. Flanders.

INVENTORS

Robert Bingham &

Charles Schlechtiger

BY

ATTORNEY.

No. 688,922. Patented Dec. 17, 1901.

R. BINGHAM & C. SCHLECHTIGER.

ELECTRIC RAILWAY.

(Application filed Aug. 22, 1901.)

(No Model.) 3 Sheets—Sheet 2.

Fig. 2

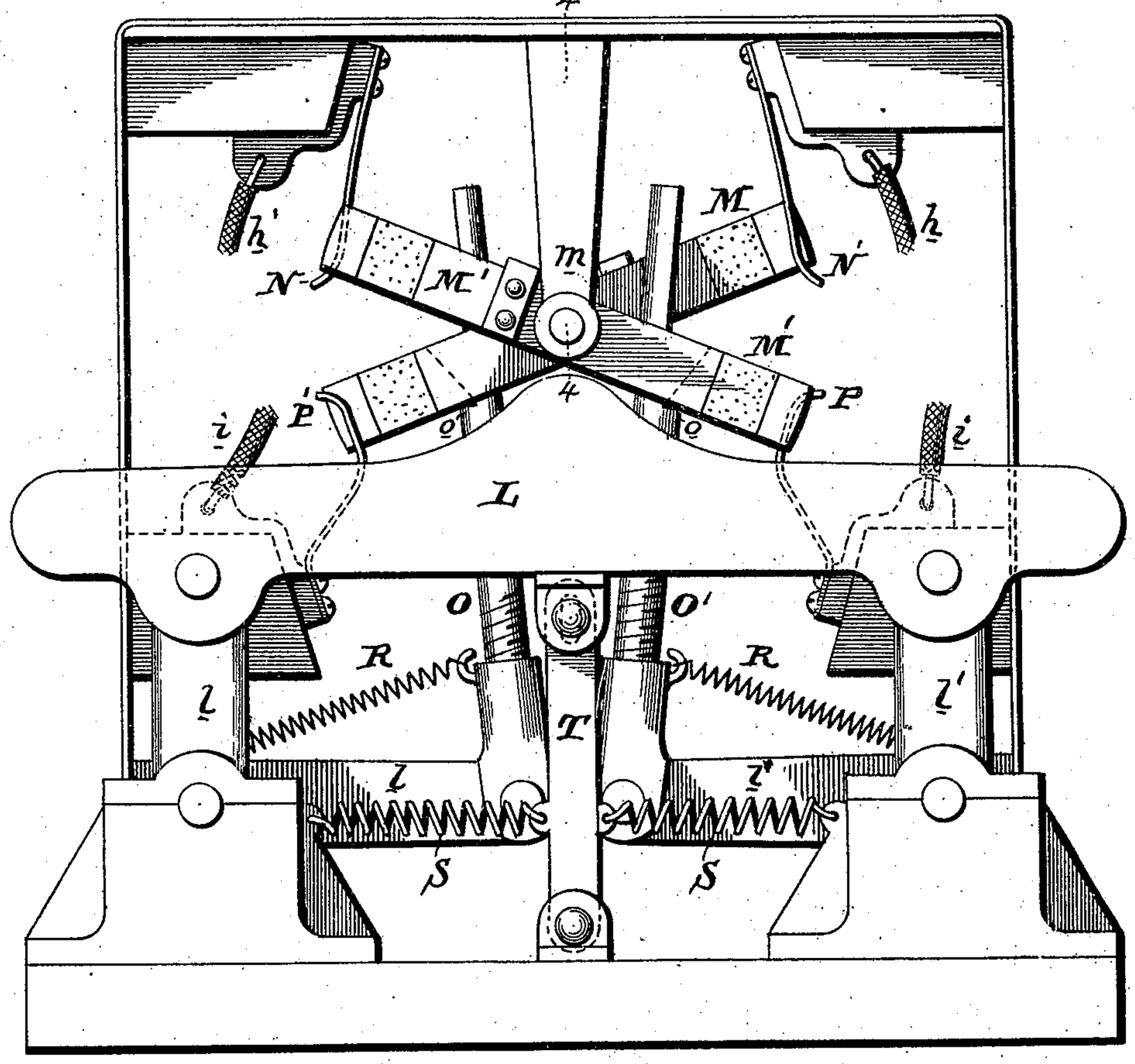
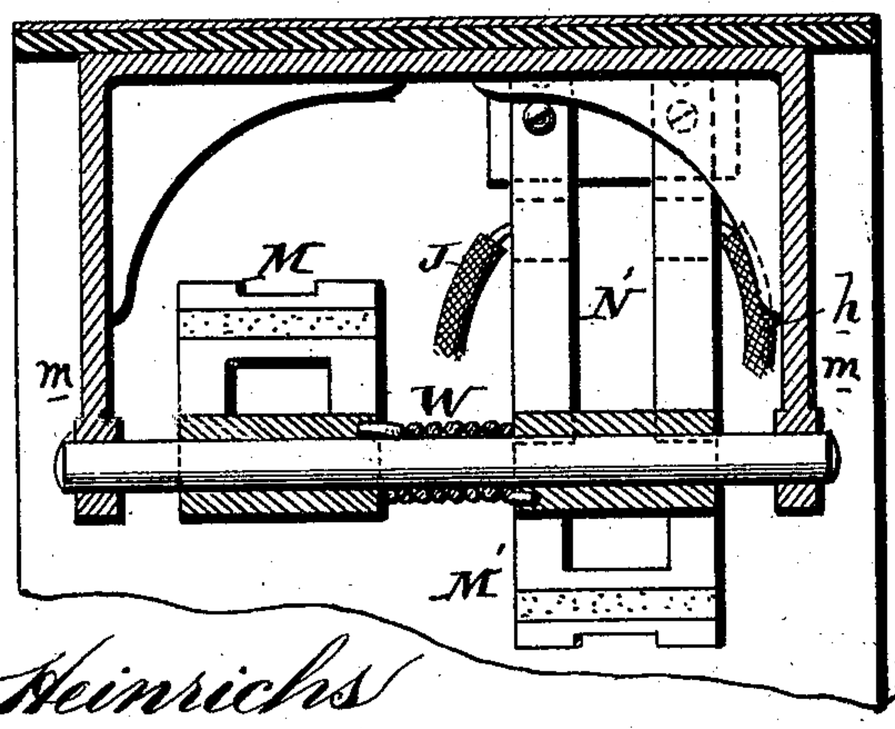


Fig. 4



WITNESSES:

Louis D. Heinrichs

N. H. Flanders.

INVENTORS

Robert Bingham and

Charles Schlechtiger

BY

ATTORNEY.

No. 688,922. Patented Dec. 17, 1901.

R. BINGHAM & C. SCHLECHTIGER.

ELECTRIC RAILWAY.

(Application filed Aug. 22, 1901.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 3

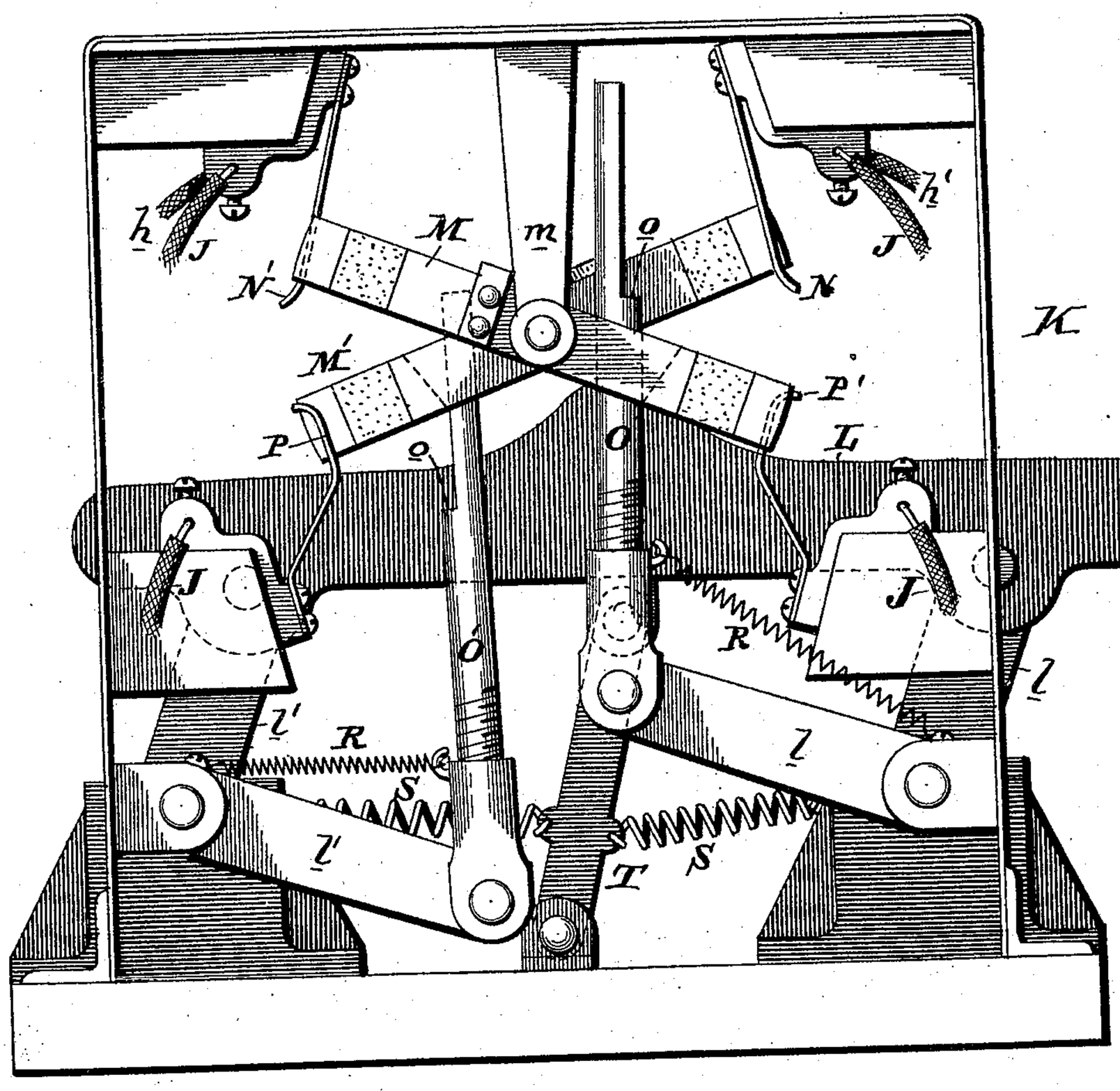
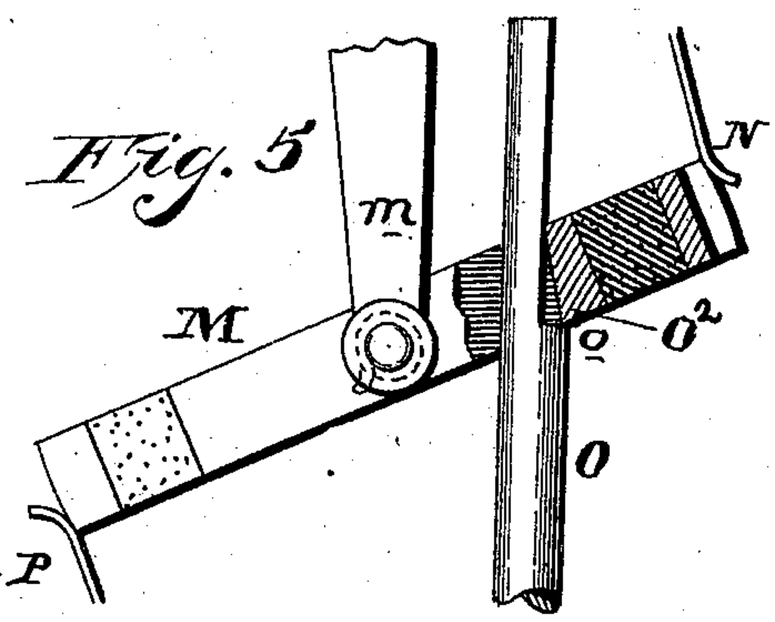


Fig. 5



WITNESSES:

Louis D. Heinrichs

W. H. Glanders

INVENTORS

Robert Bingham &

Charles Schlechtiger

BY

ATTORNEY.

UNITED STATES PATENT OFFICE.

ROBERT BINGHAM, OF WEST HADDONFIELD, NEW JERSEY, AND CHARLES SCHLECHTIGER, OF NANTASKET, MASSACHUSETTS.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 688,922, dated December 17, 1901.

Application filed August 22, 1901. Serial No. 72,880. (No model.)

To all whom it may concern:

Be it known that we, ROBERT BINGHAM, of West Haddonfield, county of Camden, State of New Jersey, and CHARLES SCHLECHTIGER, of Nantasket, county of Plymouth, State of Massachusetts, have invented an Improvement in Electric Railways, of which the following is a specification.

Our invention has reference to electric railways; and it consists of certain improvements fully set forth in the following specification and shown in the accompanying drawings, which form a part thereof.

Our improvements more particularly refer to a system of electric supply to that class of electric railways known as the "sectional conductor" or "safety third-rail" system—namely, one in which a current is supplied to a sectional conductor extending along a line of railway only during the passage of the electrically-propelled vehicle or train.

Our invention comprehends more particularly certain improvements in the controlling devices actuated by the passing car or train for automatically putting the sectional conductors into and out of electric circuit in succession with the supply or feeding conductor leading from the source of energy. It further embodies, in connection with the said switch or controlling devices, certain circuits whereby the act which causes the current to be supplied to one sectional conductor for delivery to the car or train automatically causes the section of the sectional or working conductor immediately in the rear of the train or car to be automatically disconnected from the source of supply.

In carrying out our invention we provide a sectional working conductor arranged along the railway, the sections of which are connected by branch circuits with a supply or feeding conductor extending along the railway. The rails may act as a return-conductor, if so desired, and in that case will be connected with one terminal of the source of energy and the supply-conductor with the other terminal. The branch circuits are provided with electrically-actuated circuit-closing switches, and these are energized by a controlswitch arranged to be actuated by the electrically-propelled car or train when in circuit with the section of the sectional working conductor in the rear. The electrically-actuated section-switches are locked in their closed positions by an electrically-actuated lock, which automatically releases the switches when the car or train has passed out of circuit of that particular section of the sectional working conductor. The circuit-closing switches and the electrically-actuated locking devices are energized by current from the source of supply and controlled by a controlling-switch mechanism of special construction adapted to be operated by the passing car or train and so as to temporarily close the circuits, including the electrically-actuated section-switch and the electrically-actuated locking device; but the locking device so actuated is that belonging to the sectional switch immediately in the rear of the car or train, as its function is to open the section-switch in the rear simultaneously with the closing of the section-switch of the next section of the working conductor in advance. The controlling-switch is preferably adapted to be operated mechanically and to only close the circuits for a short interval of time—namely, just sufficient to insure the energizing of the section switch and lock, but otherwise to remain in open circuit.

Our improvements are adapted to trains operating in one or both directions on the same track, and the details of these improvements will be better understood by reference to the drawings, in which—

Figure 1 is a diagrammatic view illustrating the circuits of our invention applied to an electric railway. Figs. 2 and 3 are elevations of the section control-switch. Fig. 4 is a section of the latter on line 4 4 of Fig. 2, and Fig. 5 is a detail showing the trip for the control-switch.

Referring to Fig. 1, A is the railway proper and may have its rails arranged in any suitable manner, they preferably acting as the return-circuit of the system. B is the electrically-propelled car or train. C is the electric motor of the car or train for propelling it. E is the contact-shoe or collector for making a sliding contact with the sectional working conductor D and is hung from the car by a suspension device *e* of any suitable con-

struction. The current is delivered to the motor by the collector E and returns by the rails. The working conductor is made in sections D, insulated from the rails and ground and arranged along the length of the track. Its location is immaterial, so far as our invention is concerned, and hence the said sectional conductor may be placed on the roadbed below the ground, as in a conduit, or suspended, as in the case of the well-known trolley systems. The collector would be made to suit any change in the location of the working conductor. F is the supply or feeding conductor and leads from the source of electrical energy and preferably extends parallel to and along the railway. It is connected at intervals with the several sections D of the working conductor by branch circuits *f*, each having an electrically-actuated circuit-closing switch H of any suitable construction. As shown, these switches are each operated by an electromagnet H′ and locked in closed position by locking-arms I under the action of springs. These switches are each unlocked by an electromagnet operating the locking-arms to release the switches and allow them to open under the action of suitable springs. We do not confine ourselves to any special features of these circuit-closing switches, as they are well known in the art and extensively employed in central-station work.

In connection with the above-mentioned switches we employ for each section of working conductor a special type of control-switch, (shown at K and more fully illustrated in detail in Figs. 2 to 5.) The object of this switch is to provide means under the control of the passing car or train to energize the electromagnets H′ of the circuit-closing switches and the electromagnets I′ of their locks in such a manner that the lock of the switch corresponding to the section included in circuit with the car shall be operated to open the circuit-closing switch H of said section and the circuit-closing switch H of the next section in advance shall be automatically closed, so that as the car advances to the next section its collector E will be brought into circuit with an active section of working conductor D. In this manner only a short length of the working conductor need be active, and hence much danger is removed and liability of loss from leakage of current guarded against. The supply-conductor and switches can be well protected, while this is not possible with the exposed working conductor, especially when used as a third-rail system, and hence it is important to keep it out of circuit except when required to supply current to a passing car or train.

Specifically referring to Fig. 1, we have at each control-switch four sets of terminals—namely, N N′ and P P′. One of each of these terminals is electrically connected by circuit J with the rails A. The other terminals P P′ are connected by conductor *i* with the supply-circuit F and include the electromagnet I′ of the lock. The terminal N is connected by wire *h*′ with the supply-conductor F, but leads to the circuit-closing switch of the next section in advance and includes its electromagnet H′. The remaining terminal N′ is connected with wire *h*, which leads to the next section in the rear and includes the circuit-closing switch-magnet H′ of that section. It also connects with the supply-conductor F beyond the switch-magnet. These various circuits are momentarily closed during the passing of the car or train, but those N P alone when the car travels in the direction of the arrow and those N′ P′ when it travels in the opposite direction. Of course it is evident that if the cars or trains are to run always in the same direction the terminals N′ P′ and their associated parts and circuits may be omitted and the apparatus somewhat simplified. M and M′ are two circuit-closing arms adapted, respectively, to control the terminals N P and N′ P′, and these are normally held out of circuit with the terminals by spring W. They are one at a time brought into circuit to close the terminals N P or N′ P′ under the action of the following mechanism: The arms M M′ are pivoted at their central portions, carried by a frame *m*, and are adapted to be rocked by trip-rods O O′, hinged at their lower ends, respectively, with one of the arms of the oppositely-arranged bell-crank levers *l l*′. The other or upright arms of these bell-crank levers carry the cam-bar L, to which they are hinged. The central portion of this cam-bar is raised to present an obstruction, which is struck by a roller *b* on the car or train. The control-switch K is arranged close to the track, so as to bring the cam-bar L into position parallel to the rails, whereby it is adapted to be within convenient reach of the said roller *b* of the car. A rocker-arm T is also hinged to the cam-bar and rocks with it, and springs S S tend to bring this rocker-arm normally to a central position to centralize the cam-bar when unacted upon by the roller *b*. The normal position is shown in Fig. 2. Springs R R operate upon the trip-rods O O′ to pull them normally against the shoulders O^2 of the circuit-closing arms, so as to cause the shoulders *o* to strike said shoulders O^2 of the arms M M′.

Assuming the switch K to be as shown in Fig. 2 and the switch H of the corresponding section of working conductor closed, as the car passes its roller *b* rocks the cam-bar L, as shown in Figs. 1 and 3. This action raises trip-rod O and rocks the circuit-closing arm M, bringing its contact ends into position to close the contact-terminals N and P, and immediately thereafter the arm M presses back the trip-rod, so that the two shoulders *o* O^2 clear themselves, as shown in Fig. 5, and the arm M returns to its original and normal position. As soon as the car passes the cam-bar and trip-rods return to the positions shown in Fig. 2. The result of this operation of the control-switch is to close the circuits *h*′ and *i* for

an interval of time sufficient to energize the lock-magnet I′ to release the switch H and open the circuit *f* of the section of working conductor corresponding to the control-switch K being actuated and also for energizing the electromagnet H′ of the circuit-closing switch H corresponding to the section of working conductor next in advance, whereby it is energized when the car reaches it. This same operation is repeated as the car passes each section of working conductor, always putting into circuit the next section in advance and cutting out of circuit the section which the car is just leaving. The same operation takes place when the car runs in the opposite direction, only in this case the other set of contact-terminals N′ P′ and circuit-closing arm M′ come into play.

While we have shown the two arms M M′ and their contact-terminals in the same compact structure, it is evident that they may be kept separated, if so desired, each having its own cam-bar, especially so if they were arranged at a great distance apart—as, for instance, when the conductor-sections D are of great length. It is evident that when the arm M is active the arm M′ is out of action, and vice versa. Hence their juxtaposition is not necessary and they would be located relatively as found most convenient and suitable for the length of the conductor-sections D used.

While we prefer the constructions shown, the details thereof may be modified without departing from the spirit of the invention.

Having now described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In an electric railway, a supply-conductor extending along the railway, a return-circuit, and a sectional-working-conductor circuit, in combination with an electrically-propelled car receiving current from the sectional conductor, branch conductors between the supply-conductor and sections of working conductor, electrically-actuated circuit-closing switches in said branch conductors, electrically-actuated locks for said switches, control-switches for each section of working conductor consisting of two pairs of normally open terminals, a movable switch-arm for intermittently closing said terminals in pairs, and a mechanical device actuated by the car in passing for moving said switch-arm to close and open the said terminals, a conductor including the electrically-actuated lock of the circuit-closing switch of the section corresponding to the control-switch also one pair of terminals and in circuit with the supply-conductor and return-circuit, and a second conductor also in circuit with the supply-conductor and return-circuit and including the other pair of terminals and the electric circuit-closing switch of the section of working conductor next in advance.

2. In an electric railway, a supply-conductor extending along the railway, a return-circuit, and a sectional-working-conductor circuit, in combination with an electrically-propelled car receiving current from the sectional conductor, branch conductors between the supply-conductor and sections of working conductor, electrically-actuated circuit-closing switches in said branch conductors, conductors leading from the return-circuit adjacent to one section of working conductor to and connecting with the supply-conductor adjacent to the sections of working conductor to the rear and in advance and respectively including the electrically-actuated circuit-closing switches of said advance and rear sections, circuit-controlling arms for opening and closing said conductors, and a mechanically-actuated mechanism independent of the circuit-closing switches and under the control of a passing car for operating said arms to close one conductor in going in one direction and the other conductor in going in the other direction.

3. In an electric railway, a supply-conductor extending along the railway, a return-circuit, and a sectional-working-conductor circuit, in combination with an electrically-propelled car receiving current from the sectional conductor, branch conductors between the supply-conductor and sections of working conductor, electrically-actuated circuit-closing switches in said branch conductors, conductors leading from the return-circuit adjacent to one section of working conductor to and connecting with the supply-conductor adjacent to the sections of working conductor to the rear and in advance and respectively including the electrically-actuated circuit-closing switches of said advance and rear sections, circuit-controlling arms for opening and closing said conductors, and a mechanically-actuated mechanism under the control of a passing car for operating said arms to close one conductor in going in one direction and the other conductor in going in the other direction, electric locks for locking the circuit-closing switches in closed position, and means under the control of the passing car for energizing the locks to release the switches when the car is leaving the working-conductor section corresponding to the switch to be unlocked.

4. In an electric railway, a sectional working conductor extending along the railway, a supply or feeding conductor also extending along the railway, an electromagnetic circuit-closing switch for connecting or disconnecting the supply-conductor electrically with one section of the working conductor, a normally open circuit leading to a distant place along the railway for actuating the electromagnetic circuit-closing switch, a circuit-closing contact for temporarily closing said normally open circuit at intervals corresponding to the passage of a car, and mechanical devices operated by the passing car for quickly closing and opening the circuit-closing contact.

5. In an electric railway, a sectional working conductor extending along the railway, a

supply or feeding conductor also extending along the railway, an electromagnetic circuit-closing switch for connecting or disconnecting the supply-conductor electrically with one section of the working conductor, a normally open circuit leading to a distant place along the railway for actuating the electromagnetic circuit-closing switch, a circuit-closing contact for temporarily closing said normally open circuit at intervals corresponding to the passage of a car, and mechanical devices operated by the passing car for quickly closing and opening the circuit-closing contact, an electrically-actuated lock for normally locking the circuit-closing switch when closed, and means controlled by the car when leaving the working conductor corresponding to the circuit-closing switch for energizing the lock to release the circuit-closing switch.

6. In an electric railway, a sectional working conductor extending along the railway, a supply or feeding conductor also extending along the railway, an electromagnetic circuit-closing switch for connecting or disconnecting the supply-conductor electrically with one section of the working conductor, a normally open circuit leading to a distant place along the railway for actuating the electromagnetic circuit-closing switch, a circuit-closing contact for temporarily closing said normally open circuit at intervals corresponding to the passage of a car, and mechanical devices operated by the passing car for quickly closing and opening the circuit-closing contact, consisting of a cam-bar, pivoted levers for supporting the cam-bar, and an actuating trip-rod for moving the circuit-closing contact and then automatically releasing it for one continuous movement of the cam-bar.

7. In an electric railway, a sectional working conductor extending along the railway, a supply or feeding conductor also extending along the railway, an electromagnetic circuit-closing switch for connecting or disconnecting the working conductor, means operated by the car at a distance for energizing the circuit-closing switch, a lock for automatically locking the circuit-closing switch in its closed position, an electromagnetic device for releasing the lock to permit the switch to open, a circuit to energize the electromagnetic device, and a circuit-controlling mechanism actuated by the passing car when receiving current from the section of working conductor controlled by the electromagnetic circuit-closing switch.

8. In an electric-railway-section control-switch the combination of two pairs of terminals of two circuits, a movable circuit-closing arm for simultaneously closing both pairs of terminals but normally in open position, a cam-bar adapted to be operated by the passing car, a pivoted lever mechanism for supporting the cam-bar, and a trip-rod actuated by the lever mechanism and adapted to move the arm to close the terminals and then automatically release it for a single forward movement of the cam-bar.

9. In an electric railway, the combination of two pairs of terminals of two circuits, a movable circuit-closing arm for simultaneously closing both pairs of terminals but normally in open position, a cam-bar adapted to be operated by the passing car, a pivoted lever mechanism for supporting the cam-bar, a trip-rod actuated by the lever mechanism and adapted to move the arm to close the terminals and then automatically release it for a single forward movement of the cam-bar, circuit-closing switches for controlling the supply of current to the railway, locks for locking said switches, electromagnetic devices for unlocking said switches, a circuit including one of said pairs of terminals and one of the electromagnetic circuit-closing switches, and a second circuit including the other pair of terminals and the electromagnetic devices for unlocking another of the circuit-closing switches.

10. In an electric-railway-section control-switch, the combination of two pairs of terminals, separate movable contact-closing devices for each pair of terminals, a movable cam-bar adapted to be shifted in either direction by the passing car, pivoted lever mechanism for supporting the cam-bar, and trip mechanism for operating one of the movable contact-closing devices alone when the cam-bar is moved in one direction and the other movable contact-closing device alone when moved in the other direction.

11. In an electric railway, the combination of two pairs of terminals, separate movable contact-closing devices for each pair of terminals, a movable cam-bar adapted to be shifted in either direction by the passing car, pivoted lever mechanism for supporting the cam-bar, trip mechanism for operating one of the movable contact-closing devices alone when the cam-bar is moved in one direction and the other movable contact-closing device alone when moved in the other direction, a sectional working conductor extending along the railway, a supply-conductor also extending along the railway, electric circuit-closing switches for successively connecting the working-conductor sections with the supply-conductor, and circuits leading from two distant electric circuit-closing switches to the respective pairs of terminals.

12. In an electric railway, the combination of two pairs of terminals, separate movable contact-closing devices for each pair of terminals, a movable cam-bar adapted to be shifted in either direction by the passing car, pivoted lever mechanism for supporting the cam-bar, trip mechanism for operating one of the movable contact-closing devices when the cam-bar is moved in one direction and the other movable contact-closing device when moved in the other direction, a sectional working conductor extending along the rail-

way, a supply-conductor also extending along the railway, electric circuit-closing switches for successively connecting the working-conductor sections with the supply-conductor, circuits leading from two distant electric circuit-closing switches to the respective pairs of terminals electrically-controlled locking devices for said electric circuit-closing switches, and means common to both of the movable devices for energizing the electrically-controlled locking devices.

13. In an electric-railway-section control-switch, the combination of two pairs of terminals, separate movable contact-closing devices for each pair of terminals, a movable cam-bar adapted to be shifted in either direction by the passing car, pivoted lever mechanism for supporting the cam-bar, and trip mechanism for operating one of the movable contact-closing devices when the cam-bar is moved in one direction and the other movable contact-closing device when moved in the other direction, and circuit-controlling devices for a locking-circuit common to both of the movable contact devices.

14. In an electric railway a controlling-switch adapted to be operated by the car for controlling the supply of electric energy to the car from a line conductor consisting of the combination of a movable circuit-closing switch, a spring to move the said switch into open-circuit position, a trip device for moving the switch into opposition or circuit-closing direction and then releasing it, a lever mechanism for operating the said trip, and a cam-bar for operating the lever mechanism adapted to be shifted by the passing car.

15. In an electric railway a controlling-switch adapted to be operated by the car for controlling the supply of electric energy to the car from a line conductor consisting of the combination of two pivoted circuit-closing arms independently movable, means for normally bringing the said arms into open-circuit position, a longitudinal cam-bar adapted to be operated by the passing car in either direction, pivoted lever-supports for said cam-bar, and an independent trip mechanism for each of the circuit-closing arms adapted to be operated by said lever-supports one of said trip mechanisms operating when the cam-bar is moved in one direction and the other operating when it is moved in the other direction for the purpose of temporarily bringing the circuit-closing arms to their circuit-closing positions and then releasing them.

In testimony of which invention we have hereunto set our hands.

ROBERT BINGHAM.
CHARLES SCHLECHTIGER.

Witnesses to signature of Robert Bingham:
WALTER B. FOSTER,
R. M. HUNTER.

Witnesses to signature of Charles Schlechtiger:
WALTER B. FOSTER,
J. W. KENWORTHY.