(No Model.) 3 Sheets—Sheet 1.

C. J. KINTNER.

CLOSED CONDUIT RAILWAY.

No. 512,444. Patented Jan. 9, 1894.

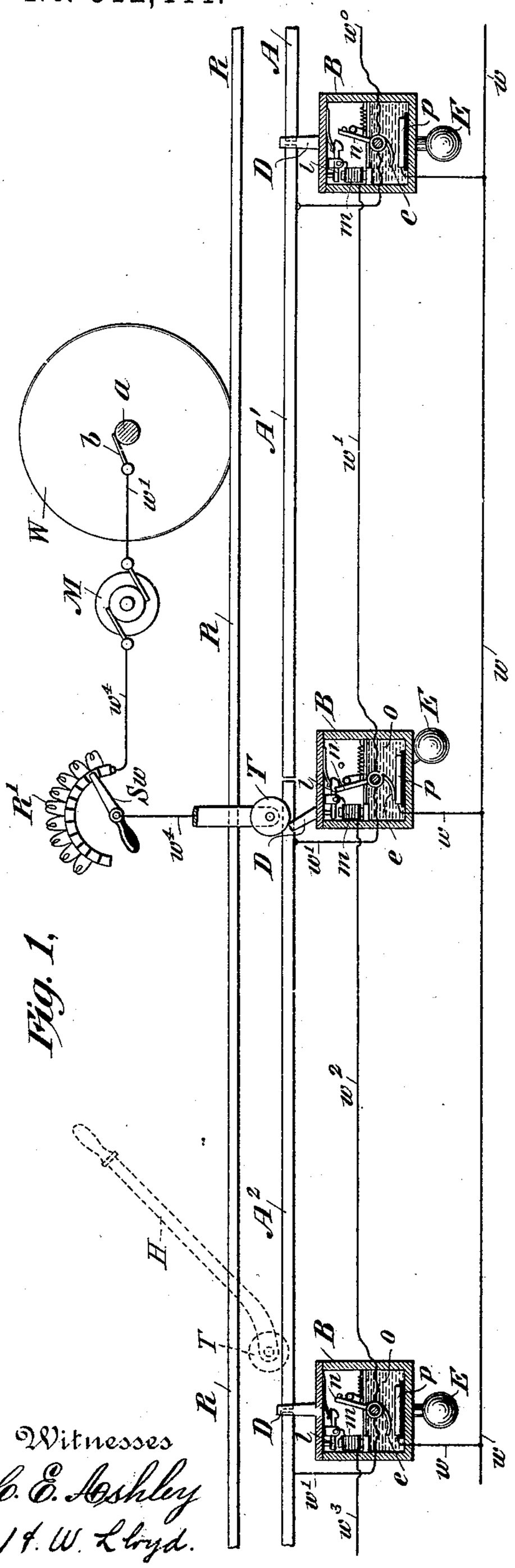

Fig. 1.

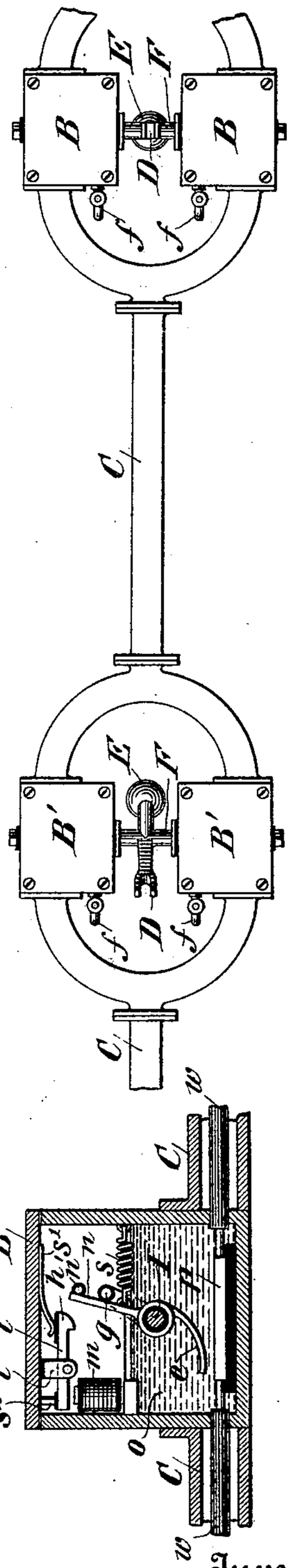

Fig. 2.

Fig. 3.

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(No Model.)

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Fig. 4,

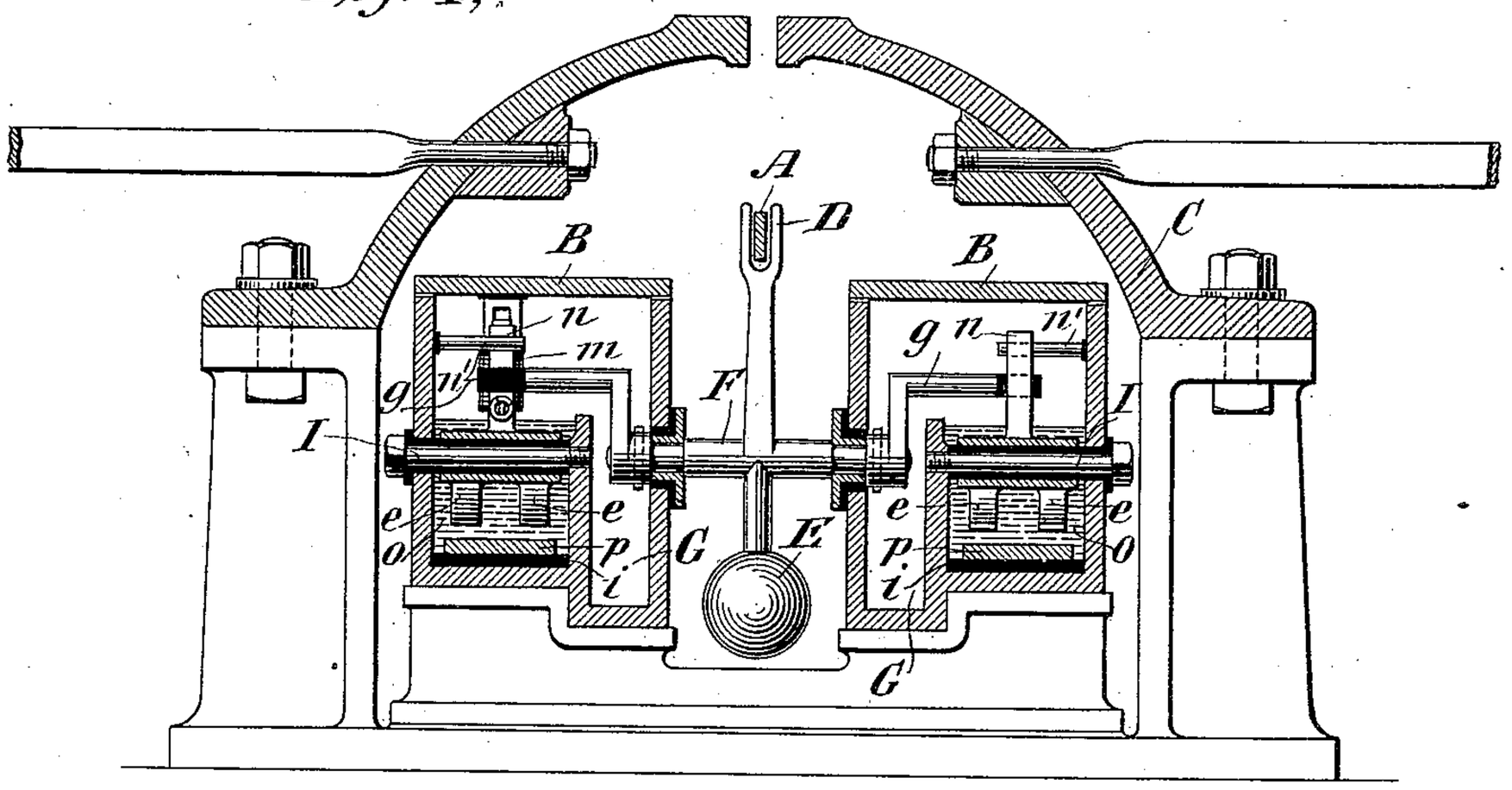
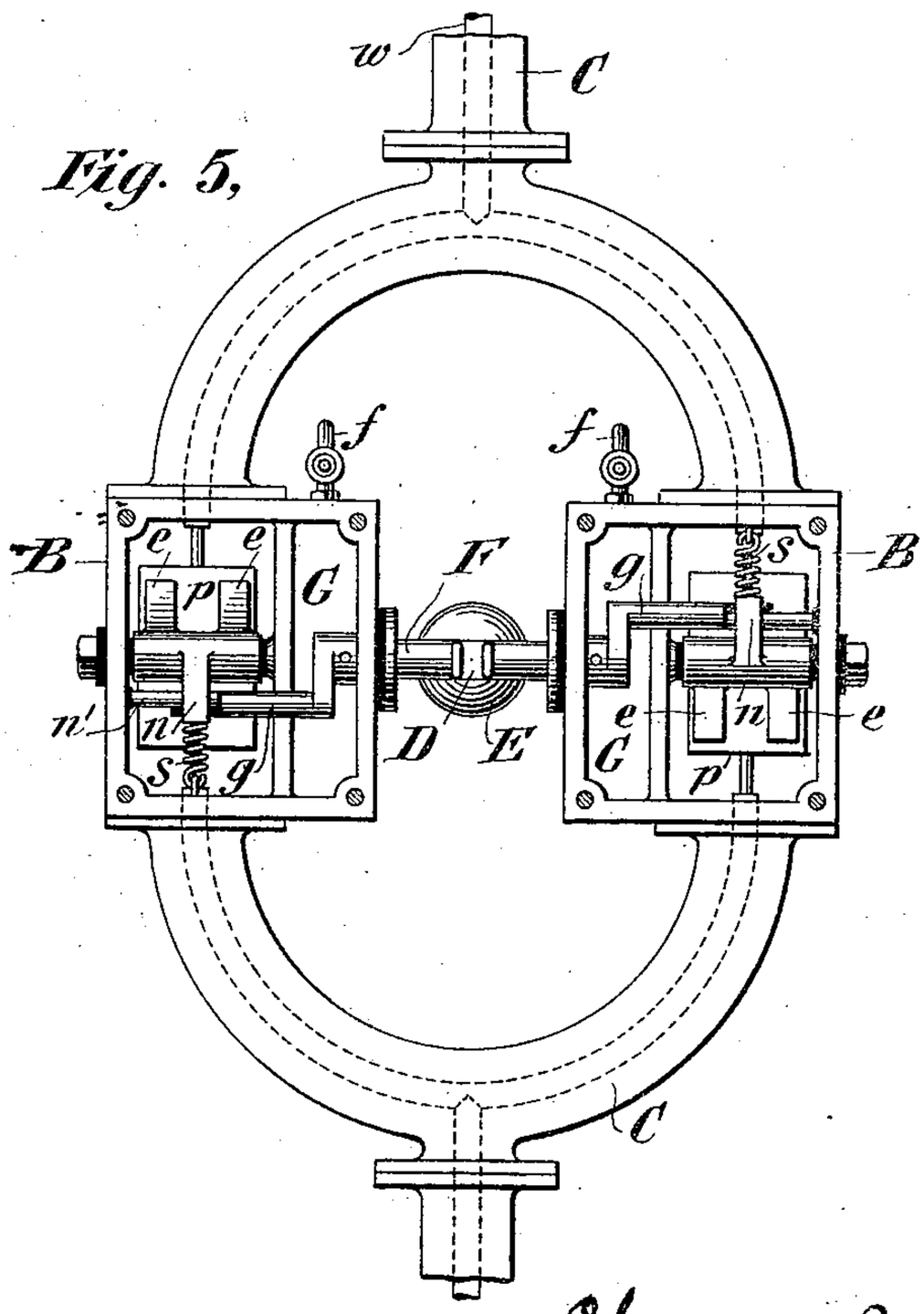


Fig. 5,



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3 Sheets—Sheet 3.

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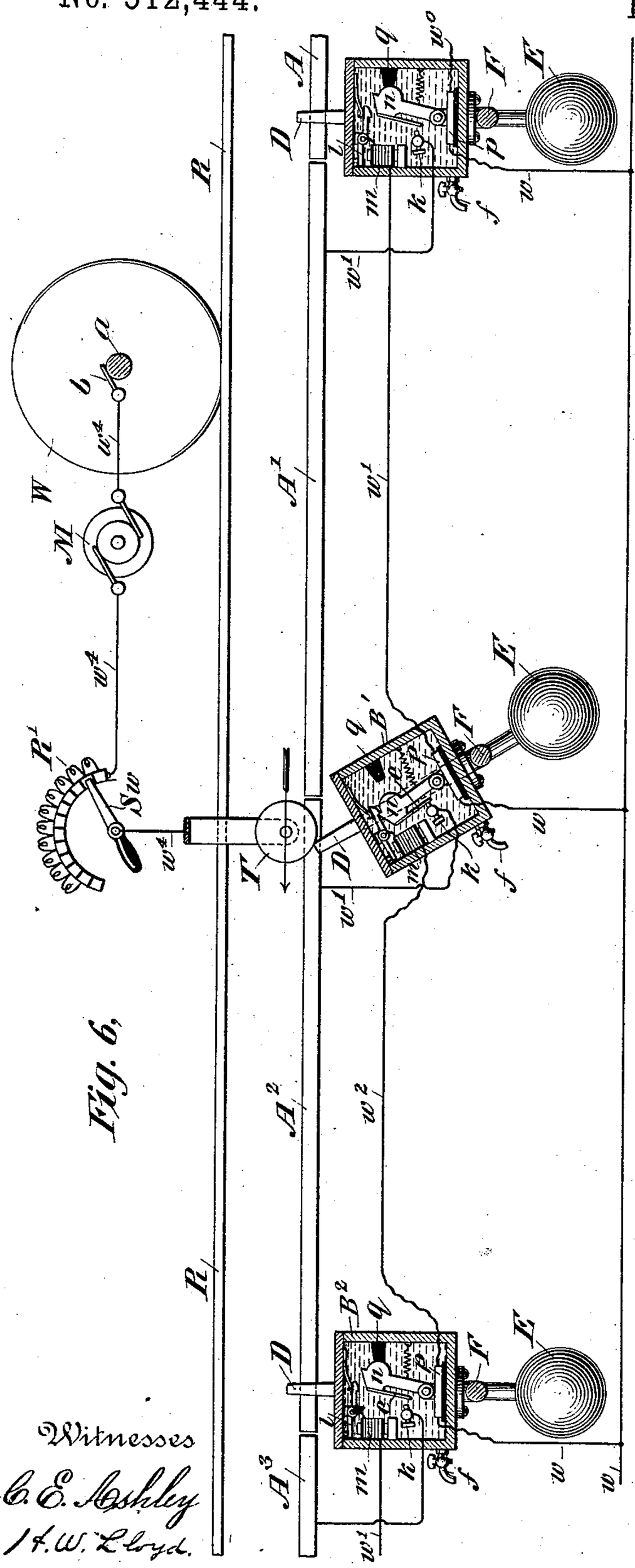

Fig. 6,

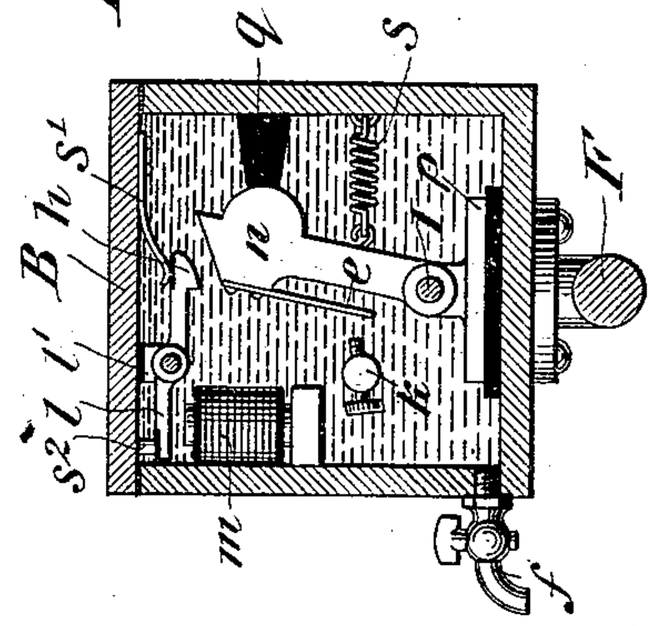

Fig. 8.

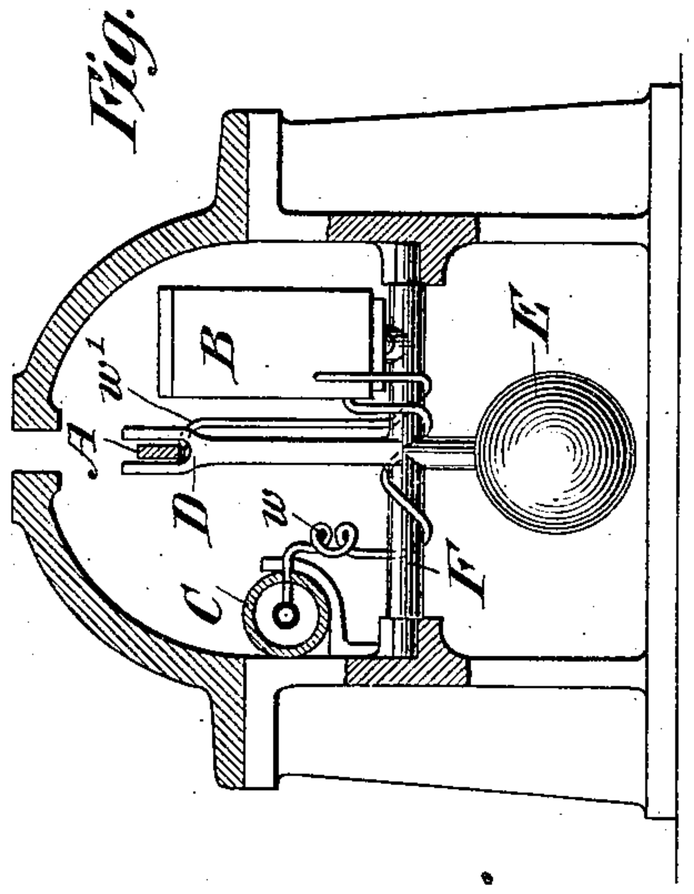

Fig. 7,

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UNITED STATES PATENT OFFICE.

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

CLOSED-CONDUIT RAILWAY.

SPECIFICATION forming part of Letters Patent No. 512,444, dated January 9, 1894.

Application filed June 22, 1893. Serial No. 478,425. (No model.)

To all whom it may concern:

Be it known that I, CHARLES J. KINTNER, a citizen of the United States, residing at New York, in the county of New York and State of New York, have made a new and useful invention in Electric Railways, of which the following is a specification.

My invention relates to electric railways of the conduit type and is directed to improvements upon an invention disclosed in a prior patent granted to me on the 6th day of June, 1893, and numbered 498,852, in which patent is described a conduit system of electric railways having sectional trolley conductors located in a slitted conduit, an insulated feeder or main located adjacent thereto and switch boxes having mechanically operated switching devices adapted to connect the current main with the trolley sections to and through the trolley carried by the car as the latter advances.

The present invention is an improvement upon the apparatus referred to, in that I do away with direct mechanical connection between the switching levers and the switches, thereby affording better insulation to these parts of the apparatus and I also do away with the long trolley shoe carried by the car and provide means whereby I am enabled to make the conducting trolley sections of any desired length and not dependent upon the length of the car as was the case with my prior invention.

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

Figure 1 is a part elevational part sectional view of one form of my improved apparatus, the electrical circuits therefor being shown in diagrammatic view. Fig. 2 is a plan view thereof with the sectional conductors and tramway rails removed. Fig. 3 is a longitudinal sectional view of a switch box and circuit connections therefor. Fig. 4 is a transverse sectional view of the conduit and one pair of switch boxes with the operating lever and its mechanical connections shown in elevation. Fig. 5 is a plan view of the same illustrating also the current main or feeder in dotted lines. Fig. 6 is a part elevational part sectional view of a modified form of my improved apparatus, the electrical circuits therefore being shown in diagrammatic view. Fig. 7 is a cross sectional view through this modified form of the apparatus showing also the insulated current main in cross section and the switch box and operating lever in elevation. Fig. 8 is a transverse section through the switch box of this modified form of the apparatus illustrating the circuit connections and operative parts of the electrical switching apparatus.

In the present apparatus the current main *w* which is attached directly to one pole of the generator at the power station is inclosed preferably in an iron tube C and thoroughly insulated therein in any preferred manner; switch boxes B B′, B^2, &c., are located at stated intervals and are secured in pairs to branches of the conduit at which points the current main divides into two multiple arc branches in the same manner as described in my prior patent above referred to and as clearly illustrated in Figs. 2 and 5, although this multiple arc branch arrangement is not absolutely necessary in this system unless the apparatus be designed for use with a single track railway where the cars run in both directions thereon.

Referring first to Figs. 1, 2, 3, 4, and 5, R represents one of the rails of an ordinary tramway. C is a conduit, preferably of metal, located beneath the surface of the roadway and resting upon the cross-ties, and B B, B′ B′, B^2 B^2, &c., are pairs of switch boxes located directly in branches of the conduit. F is a tilting switch shaft journaled in the inner faces of the switch boxes and provided with an upwardly extending arm D which is forked as shown in Fig. 4, so as to lie when held in its upward position by the weight or ball E with the forks on opposite sides of one of the sectional trolley conductors A, all of which are thoroughly insulated from the conduit and from each other. *p p* are contact plates securely insulated from the switch boxes and connected directly to the current main *w* as clearly shown in Fig. 3. I I are bolts extending from the outer sides of the switch boxes to the inner walls thereof and provided with insulating sleeves which constitute journal bearings for the switching levers *n n*, to the lower ends of which are attached two pairs of yielding contact springs *e e*, *e e*. *n′ n′* are back stops for the switch-

ing levers *n n*. It will be noticed that the switching arms *n n* are each provided with strong spiral springs *s s* but located respectively upon opposite sides thereof and adapted to hold them normally against their corresponding back stops or pins *n' n'*, which latter are insulated from the switch boxes. It will also be seen that those ends of the shaft F which are located inside of the switch boxes B are provided each with a bell crank arm *g*, the inner ends of which are insulated so as to avoid any possibility of electrical contact between the switching arms, the arm F, lever D and trolley rails A, and also that these arms *g* are located respectively on opposite sides of the switching arms *n* and out of contact therewith when the lever D is held in its upper position by the weight of the ball E. *f f* are faucets or cocks for drawing off any water which may accumulate in the outer chambers G of the switch boxes B. These switch boxes are divided each into two chambers for the purpose of preventing any moisture from penetrating the inner and upper chambers which contain the switching contact springs *e e*. If preferred, the journal bolts I may be inserted in reverse direction so that the screw-threaded ends project into the exterior walls, while the heads of the bolts rest against the outer faces of the inner walls, thereby avoiding the additional openings in the outer walls and securing better insulation. I have shown them as inserted from the outer sides for the purpose of rendering them more easily accessible. *m m* are electro-magnets located in the switch boxes, and *l l* are armature levers therefor. *w'*, *w*^{2}, *w*^{3}, &c., are branch conductors running in each instance from the switching contact springs to and through the electro-magnet *m* in the next succeeding box in the rear, its armature lever *l* and switching lever *n*, and contact springs *e* back to the current main *w* when the rear switch is set, the function of these branch circuits being to release the switches as the car passes on to succeeding sections. Each of the armature levers *l* is pivoted to the top of the switch box upon a shoulder *l'* and is provided with a back stop *s*^{2} and a hook *h*, and a retractile spring *s'*, see Fig. 3, the arrangement being such that when the switch lever *n* is in its forward position it will be held by the hook *h* until released when the trolley T passes on to the next section A in advance.

In Fig. 1 I have represented diagrammatically the circuit connections for a car traveling from right to left, T being the trolley carried by the trolley arm which is attached to the body of the car in any preferred manner, and *w*^{4} the trolley conductor, S*w* a switch operatively connected through a rheostat R' and a propelling electric motor M, brush *b*, axle *a* and wheel W to the rail R which is connected to the ground or return circuit.

o represents a light oil or insulating liquid which is designed to increase the insulation and the switch box may be entirely filled with this liquid if preferred, or it may be done away with entirely if thought best.

H, shown in dotted lines in Fig. 1, represents a hand trolley for use of the motor-man or conductor in establishing circuit connections for any one of the trolley sections by hand in the event of said sections having been disconnected by the passage of a previous car while a second car was upon the same section. This apparatus consists simply of a heavy trolley T which is secured to a well insulated operating handle H having sufficient weight to enable the motor-man or conductor to operate the switch lever D in the same manner as it is operated in the passage of the car. Each car is provided with one of these hand operating trolley devices which is simply lowered into the position shown, and pushed forward by the motor-man or conductor until the switch is actuated in the same manner that it is actuated by the car trolley T, as will now be described, after which it is withdrawn and stored away in its proper place on board the car.

The car is supposed to be moving from right to left, see Fig. 1, and the trolley T to have just passed from one section A' of the trolley conductors to a succeeding section A^2. Under this condition of affairs the trolley rides over the free forked end of the operating lever D tilting it into its forward position, thereby causing the shaft F and arm *g* to actuate the switching lever *n* against the stress of its retractile spring *s*, or pivoted weight F or both. In doing this the upper end of said lever is carried forward and held in its forward position by the hooked end *h* of the armature lever *l*. At the same time the contact springs *e* in the switch box are brought into electrical contact with the fixed contact plate *p*, thereby affording a direct current connection from the main or lead *w* into the switch box through plate *p*, contact springs *e*, the hub which supports them, through branch conductor *w'* which is insulated from the box to and through the sectional trolley conductor A^2 on which the trolley T now rests, thereby establishing circuit directly from the current main *w* to and through the motor to the rail R back to the generator. At the same instant of time a branch circuit is closed from the current main or lead *w* through the contact plate *p*, contact spring *e*, switching lever *n*, armature lever *l* and electro-magnet *m* of the next switch box in the rear, the switching lever *n* having been left in locked position during the time that the trolley T was on the section A just passed over. This branch circuit is closed therefore through the conductor *w'* and joins the first circuit through the switch box B over which the trolley now stands, thereby energizing the electro-magnet *m*, actuating its armature lever *l* and releasing the the spring actuated switch lever *n*, the mechanically actuated lever D of that box hav-

ing returned to its normal position immediately after the trolley passed over it by virtue of its weight E.

It is to be understood of course that the relative resistances of the circuits which supply current through the switch boxes to the sectional trolley rails from the feeder *w* and the branch or derived circuits *w'*, *w*², *w*³, &c., through the electro-magnets *m* in the switch boxes shall be such that sufficient current will pass through the magnets in these derived circuits and energize each of them in succession from section to section as the car passes. This may be effected in any manner well understood by electricians, such for instance as the placing of resistance coils directly in the main circuit *w* between each pair of branches running to adjacent switch boxes, which resistance shall in each instance, if deemed best, approximate that of any one of the magnets in the switch boxes, such matters of proportioning the distribution of electrical currents being well understood by those skilled in the art. It is clear therefore that as the car advances each trolley section in advance is operatively connected with the current main or lead and each corresponding trolley section just passed over is disconnected therefrom. The car may therefore continue on its journey and the switches be actuated in succession so long as it passes in this direction.

It would not be absolutely necessary to provide more than one switch box for each trolley section in the case of a double track system, that is to say, so long as the cars run in one direction. When, however, it becomes necessary to run the cars in a reverse direction, I provide the double switch box system with the mechanical operating arms *g* located on opposite sides of the switching levers *n* and also provide a corresponding set of electro-magnets for the additional switch boxes with like electrical and mechanical connections, the arrangement being such, as is apparent on inspection of Figs. 4 and 5, that the actuated switching levers D will return always to normal position after they have been passed in either direction by the trolley and will actuate the proper switching levers therefor.

In the modified form of apparatus shown in Figs. 6, 7 and 8 only one switch box B B', B², &c., is shown for each trolley section and these boxes are secured directly to the cross shafting F journaled as before, in the opposite sides of the conduit, the arrangement being such that when the operating lever D is actuated by the trolley T the entire switch box is tilted in the manner shown in the central portion of Fig. 6. The entire switch box and its operating parts as thus pivotally sustained in the sides of the conduit is detachable or removable therefrom, and the branch or feed conductor of the main *w* may be disconnected from the switch box and the entire apparatus easily removed for repairs or replacement. The insulated branch conductor running from the main or lead is wound around the shaft F and thoroughly insulated therefrom entering by an insulating joint the switch box B and is attached to an electrical conducting plate *p* which is insulated from the interior of the box and carries a tilting weighted armature lever *n*, the upper end of which is adapted to assume either one of two positions, namely, the disconnected position shown on the right and the left of Fig. 6 and in Fig. 8, or the forward or connected position shown in the center of Fig. 6. This form of tilting switch box, however, shown in Figs. 6, 7 and 8 is adapted for use in connection with cars running only in one direction. *k* is a contact point carried on the interior of and insulated from the switch box B and is connected through an insulating joint located in the side of the switch box by a conductor *w'* directly with the trolley section A, all of the switch box connections being identically alike. *e* is a contact spring carried at the upper end of the weighted pivoted contact lever *n*, and *s* is a retractile spring for said weighted lever, *f* being a cock for withdrawing any liquid from the interior of the switch box, and *m* the operating electro-magnet for releasing the switching lever *n* when tilted into its forward position. The operation of this modified form of apparatus is as follows: The trolley T has passed from the section A' and is just passing upon the next section A² in advance. In doing this it tilted the weighted shaft F and switch box B' through the agency of the arm D into its forward position. When the center of gravity of the upper end of the levér *n* passed its pivoted supporting point I, see Fig. 8, its weight was sufficient to tilt it into its forward position and carry it away from the insulating plug *q*, thereby allowing it to assume the position shown in the center of Fig. 6 and permitting the hook *h* of the armature lever *l* to retain it in its forward position after the trolley T passed on and the switch box assumed a vertical position. At the same time a branch circuit was closed from the current main or lead through the rear switch box, contact plate *p*, switching lever *n*, armature lever *l*, electro-magnet *m*, branch conductor *w'*, thereby releasing the rear switch lever *n* and allowing it by its own weight to assume the position shown. As the car advances therefore each switch box is tilted forward and caused to automatically make the circuit connections for the trolley section upon which the trolley is just entering and simultaneously each rear section is automatically released.

I do not limit myself to the specific apparatus herein shown and described as many of the details may be departed from materially and still come within the scope of my claims. To make a single illustration, the novel forms of switching mechanism herein shown and described might, if preferred, be actuated by a long traveling shoe like that shown and de-

scribed in my prior patent above referred to in which event the locking mechanism would of course be dispensed with but I prefer the arrangement described.

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

1. In an electric railway system a current main or lead insulated throughout its length and inclosed in a pipe or tube located adjacent to a slitted conduit; a series of sectional trolley conductors located parallel thereto, a series of pivoted switch boxes carried each by a shaft journaled on opposite sides of the conduit and provided with weighted pivoted switch levers insulated from the boxes and adapted when the switch box is tilted forward to close circuit to the main through the sectional trolley conductor over which the car is passing, in combination with locking devices and electro-magnets adapted to lock and release the switching devices in sequence as the car advances, substantially as described.

2. In an electric railway system a series of removable pivoted switching boxes carried each by a shaft journaled in the sides of the conduit, and mechanically actuated switching devices inclosed wholly in said boxes, substantially as shown and described.

3. In an electric railway system a slitted conduit, a series of sectional or trolley conductors located beneath the slit, an insulated current main or lead and a series of pivoted removable switch boxes provided with switching apparatus located wholly in said boxes and circuit connections between said switching devices the trolley sections and the current main, substantially as shown and described.

4. In an electric railway water tight switch boxes inclosing switching mechanism connected through insulated conductors with a current main or lead, said switch boxes being pivotally secured in the road bed and removable therefrom for repairs or replacement, substantially as described.

5. In an electric railway an insulated current main, a series of pivoted switching levers and sectional trolley conductors in combination with an actuating lever for each switching lever; said actuating levers being pivoted in a slitted conduit at right angles thereto and having movement independent from that of the switching levers.

6. In an electric railway a current main insulated throughout its length, a series of sectional trolley conductors, a series of pivoted switches for connecting said sectional conductors to the current main in sequence and locking and releasing mechanism for effecting such connection and release, the pivoted switches all having movement in the direction in which the propelled vehicle travels.

7. In an electric railway a current main insulated throughout its length, a series of pivoted switching levers located at fixed intervals for connecting the current main to a motor carried on board of a vehicle to be propelled, said switching levers being inclosed in water tight switch boxes and pivotally secured so that their movement is in the direction of motion of the vehicle; in combination with pivoted switch actuating levers controlled by the vehicle and having movement independent from and in the same direction as the pivoted switches.

8. A switch box for an electric railway having a pivoted switch wholly inclosed therein, in combination with a switch actuating lever pivotally secured in the path of a trolley or arm carried by a propelled vehicle, said switch actuating lever having vibratory or rocking motion independent of but in the same direction with the pivoted switch.

9. An insulated current main, a series of wholly inclosed pivoted switches having branch connections with the main, a series of pivoted switch actuating levers which have movement independent from that of the switches and in the same direction with the propelled vehicle.

10. An insulated current main, pivoted switch levers located in a slitted conduit and wholly inclosed in switch boxes, actuating levers therefor pivoted on opposite sides of the conduit and having movement independent from that of the switching levers but in the same direction, in combination with branch circuit connections from the current main through the switch levers to a trolley carried by the car or vehicle.

In testimony whereof I have hereunto subscribed my name this 9th day of June, 1893.

CHARLES J. KINTNER.

Witnesses:
M. M. ROBINSON,
EUGENE M. FITZGERALD.