

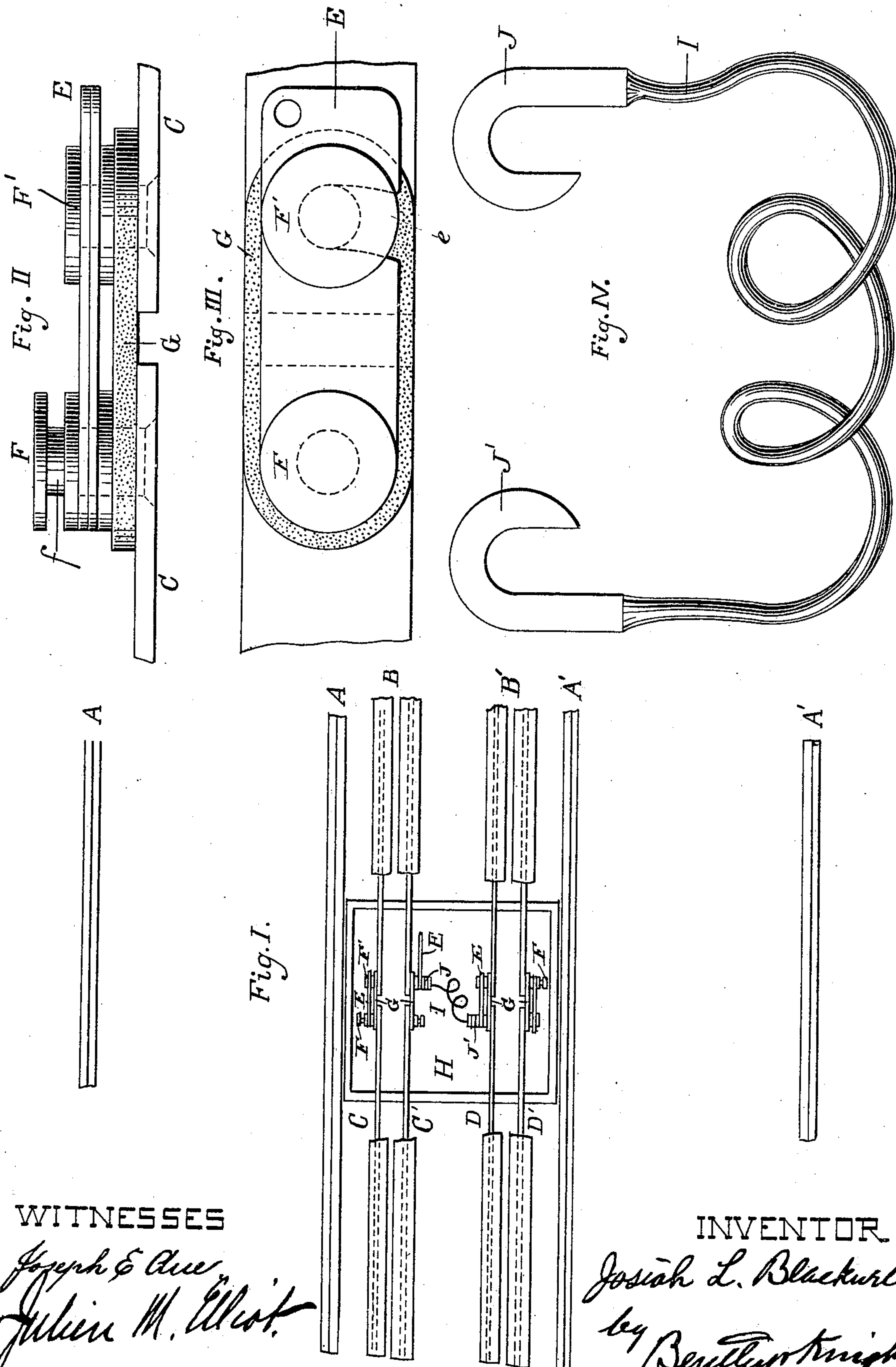
(No Model.)

2 Sheets—Sheet 1.

J. L. BLACKWELL.  
ELECTRIC RAILWAY CIRCUIT.

No. 406,421.

Patented July 9, 1889.



WITNESSES

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INVENTOR

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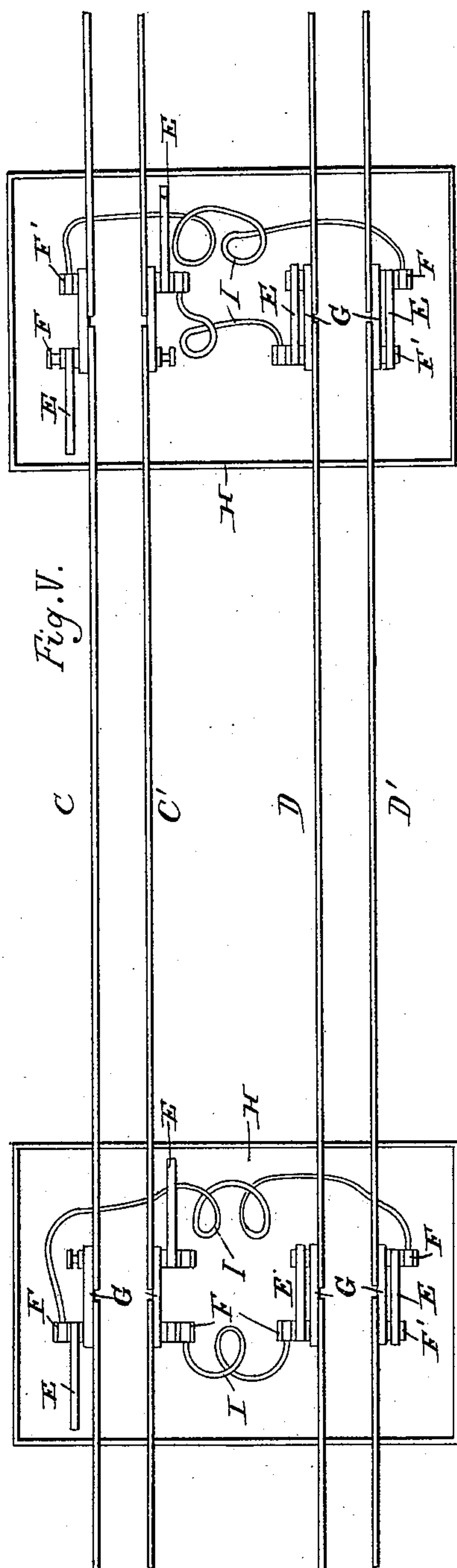
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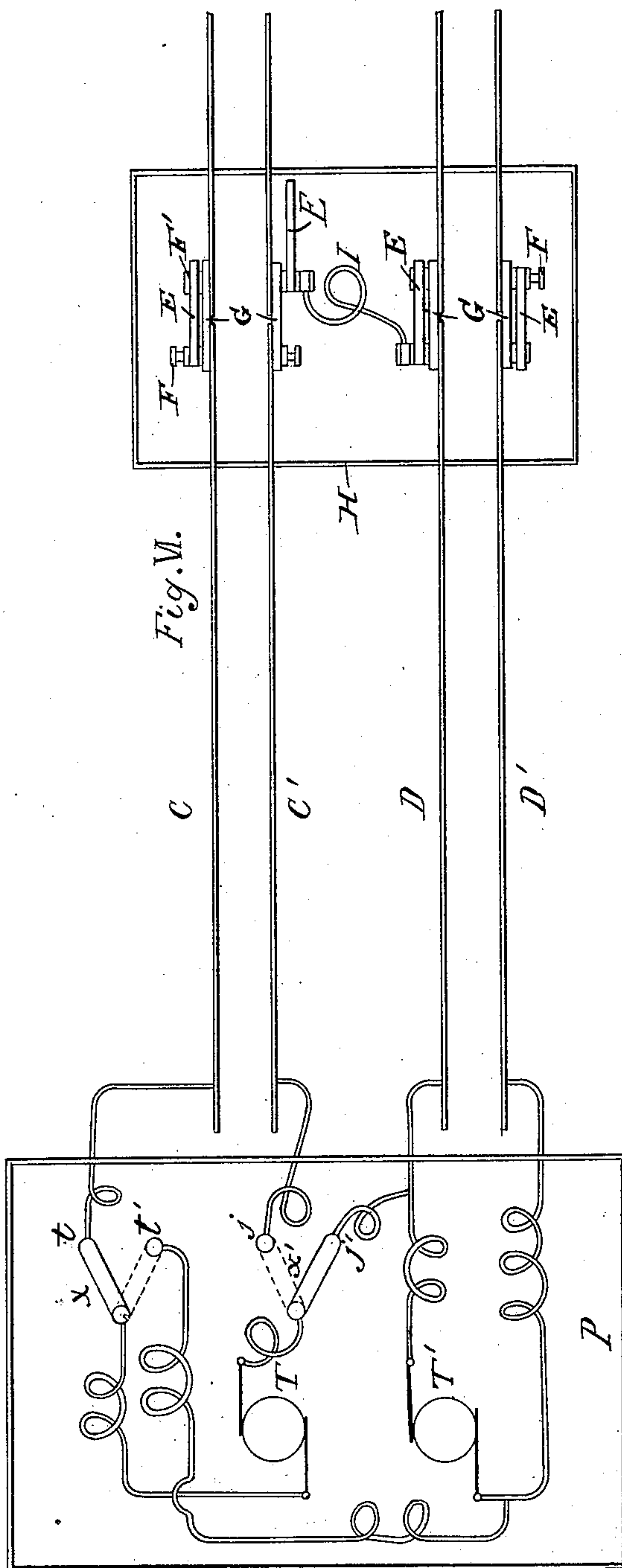
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# UNITED STATES PATENT OFFICE.

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## ELECTRIC-RAILWAY CIRCUIT.

SPECIFICATION forming part of Letters Patent No. 406,421, dated July 9, 1889.

Application filed March 11, 1889. Serial No. 302,830. (No model.)

*To all whom it may concern:*

Be it known that I, JOSIAH L. BLACKWELL, a citizen of the United States, residing at New York, in the county of New York, State of New York, have invented certain new and useful Improvements in Electric-Railway Circuits, of which the following is a specification.

My invention relates to electric railways, and more particularly to a double-track road having an independent continuous-line conductor supplying current to the motors upon each of the two tracks; and its object is to provide means for readily establishing a loop-circuit around any fault which may occur upon either line-conductor, whereby the traffic upon the road will not be impeded except upon that portion of the line in the immediate vicinity of the fault. A convenient way of accomplishing this desired object is to make the line-conductors of independent sections normally connected up in circuit by bridging-switches, and to provide a supplementary conductor long enough to extend from the supply-conductor of one road to the corresponding supply-conductor of like polarity of the other road, so that when a fault occurs upon either supply-conductor all that is necessary is to cut out the faulty section and to connect the conductor across to the corresponding conductor of the other road. The faulty section can then be repaired while the cars are running normally upon the rest of the line.

My invention is illustrated in the accompanying sheets of drawings, wherein—

Figure I is a plan view of a double-track road provided with conduits and inclosed conductors, with a section of one conductor cut out and the supplementary conductor in place. Figs. II and III are respectively top and side views of adjacent conductor-sections and the bridging-switch. Fig. IV shows the supplementary emergency-conductor. Fig. V is a diagrammatic view showing one entire section of the conductors of one road cut out, and Fig. VI shows the generators as arranged in the supply-station.

A A A' A' represent, respectively, the tracks of a double-track road. B B' are slotted conduits placed between the two tracks, and in these there are housed the supply-conductors C C' and D D', though it will be apparent that my invention will be equally useful if

the single-wire system of conductors be employed. Each of these lines of supply-conductors consists of bared insulated sections, 55 of copper or other conducting material, placed end to end in line with one another, and all the sections of the same conductor are normally coupled up in circuit by bridging-switches. These switches are arranged in the following 60 manner:

Studs F F' project from the rear side of the conductor-sections, and the switch E is pivoted upon one of these studs and swings into and out of engagement with the other. A 65 radial slot *e* is cut in the switch, forming in effect a hook or catch for engaging the stud and holding the switch against accidental displacement. Between the switch and the conductor there is placed a backing of insulating material G, forming a mechanical, but 70 not an electrical, connection between the sections, thereby holding them in place. The stud F has an exposed terminal bearing *f*, to which the supplementary conductor I is connected, as hereinafter described. 75

The conduits B B' are preferably placed between the two tracks of the railway, and the conductors of the two lines are so arranged that their sections terminate substantially opposite one another, at which point is located a common catch-pit or similar opening H, permitting access to the conductors and switches of both lines. 80

I is a supplementary emergency-conductor, 85 which will usually, for the sake of convenience, be made flexible, and at its two ends are suitable engaging devices of conducting material—as, for instance, hooks J J'—either of which readily engages the terminal bearing *f* upon the stud F. 90

The manner of using my invention is shown in Figs. I and V, for, supposing the left-hand section of conductor C' has a fault thereon, the switch E will be turned so as to break the 95 circuit at that point, and then by connecting the supplementary conductor to the right-hand section of C' and to the corresponding conductor of like polarity D of the other road the circuit will be preserved through all that 100 portion of C' which lies to the right of the break.

In Fig. V, I show one entire section C cut out and a loop-circuit around said cut-out



section, consisting in part of the supplementary conductors I I and in part of the line-conductor D of the other road; and I also show that in the same way both wires of a two-wire system may be cut out and connected around, as will readily appear from the illustration. The location of the supply-conductors of both roads between the two tracks adds to the ease with which these connections can be made, because the supplementary conductor need not cross either set of rails. The common catch-pit also is a matter of great practical convenience. The location of a fault upon the line may be determined in any desired manner, and the switches E may be used for this purpose, as well as for simply cutting out the sections, for by operating the switches successively, and noting the presence or absence of an arc when the circuit is broken, the faulty section can be readily detected.

In Fig. VI there are shown the generators supplying the two roads and switches for shifting the circuit of the generators from one to the other, as the requirements of the service may demand.

T T' are two generators, each of which may consist of a single dynamo or group of dynamos in circuit with the line-conductors of the roads, respectively, and supplying current thereto independently. The generators will usually be located in a common supply-station, and switches are provided thereat for shifting either or both of the normal connections of either generator and the supply-conductors of the corresponding road to the conductor or conductors of like polarity of the other road. In the drawings the circuit of conductor C' is shown broken by switch E, and the supplementary conductor I joins C' and D, while in order to maintain the supply of current upon the line C C' the switch  $\alpha'$  has been shifted from terminal  $j$  in circuit with conductor C' to terminal  $j'$  in circuit with conductor D. Should it be necessary to cut out a portion of conductor C, a similar change in the generator-circuit would be made by shifting the switch  $\alpha$  from terminal  $t$  to terminal  $t'$ , and if both conductors C C' be cut out both generators will be put in circuit with conductors D D'. I have shown simply the switches for shifting the circuit of generator T to the conductors D D'; but it is evident that by a duplication of the arrangement of switches the generator T' may be shifted upon line C C' when desired.

I claim as my invention—

1. The combination of a supply-conductor extending along the line of an electric railway with the supplementary flexible emergency-conductor I, normally forming no part of the line-circuit, but placed in engagement with the supply-conductor upon the interruption of the circuit therein for temporarily bridging the break in said supply-conductor.

2. The combination, in an electric railway, of two parallel tracks, bared supply-conduct-

ors of like polarity extending along said tracks, and a loop-circuit for bridging a fault upon the supply-conductor of one road, said loop-circuit consisting in part of the supply-conductor of the second road.

3. The combination, in an electric railway, of two supply-conductors of like polarity between the tracks of two parallel roads supplying current to the motors upon the said roads, respectively, and a flexible supplementary conductor connecting the two said conductors upon the occurrence of a fault on either one.

4. The combination, in an electric railway, of two parallel tracks, supply-conductors of like polarity extending along the said tracks, respectively, said conductors being each made up of independent sections normally in circuit with one another, switches at intervals for breaking the circuit of the supply-conductors, and a supplementary conductor connecting the supply-conductors of the two roads when the circuit of one is interrupted.

5. The combination, in an electric railway, with two sectional supply-conductors of like polarity extending along the line of two parallel roads and supplying current to the motors traveling upon the two roads, respectively, of switches normally coupling up in circuit the sections of each supply-conductor, and two supplementary conductors, substantially as described, whereby one section of supply-conductor may be cut out and the circuit completed around said section through the supplementary conductors and supply-conductor of the parallel road.

6. The combination of two slotted conduits between the tracks of a double-track road, supply-conductors of like polarity inclosed therein and supplying current to the motors upon the two roads, respectively, a common opening affording access to the conductors of both roads, and a supplementary conductor in said opening joining the supply-conductors of both roads upon the interruption of the circuit upon either one of them.

7. The combination, with two parallel tracks, of two conduits between the tracks, and sectional supply-conductors inclosed therein supplying current to the motors upon the two tracks, respectively, with switches normally uniting the adjacent sections of each supply-conductor, and a common opening permitting access to the conductors of both roads and their bridging-switches.

8. The combination, with the two tracks, of a double-track road, two conduits between the said tracks, and an inclosed supply-conductor in each conduit, with a common pit or opening permitting access from the street to the conductors of both roads.

9. The combination of the conduits with a common pit, inclosed sectional conductors of like polarity supplying current to the motors upon the tracks of a double-track road, and having adjacent sections terminating in said pit, the switches for connecting and discon-



necting adjacent sections, and the supplementary conductor connecting the supply-conductors of the two roads upon the interruption of the circuit on either one of them.

5 10. The combination, with the sectional supply-conductors of like polarity of two parallel roads, of the switches for connecting and disconnecting adjacent sections of each supply-conductor, the exposed terminals adjacent to said switches, and the supplementary conductor adapted to engage said terminals, whereby the circuit of either conductor may be broken and connection made to the second conductor, substantially as described.

15 11. The combination, with the supply-conductors of like polarity of two parallel roads, of the supplementary flexible emergency-conductor I, joining the supply-conductors upon the interruption of the circuit in either one.

20 12. The combination, with a sectional supply-conductor extending along the line of an electric railway, of a bridging-switch between adjacent sections, pivotally connected with one and engaging the other of said sections.

25 13. The combination, with the sectional supply-conductor extending along the line of an electric railway, of the insulating-backing at the break between adjacent sections, and a bridging-switch behind said backing.

30 14. The combination, with a sectional supply-conductor extending along the line of an electric railway, of the studs projecting from adjacent sections, and a switch pivoted upon one of said studs and engaging the other.

35 15. The combination, with a sectional supply-conductor extending along the line of an electric railway, of an insulated mechanical connection between adjacent sections, and a switch for establishing an electrical connection at will.

40 16. The combination of a sectional supply-conductor extending along the line of an electric railway with a bridging-switch forming an electrical connection between adjacent sections, and a catch for said switch holding the same against accidental displacement.

45 the same against accidental displacement.

17. The combination of two line-conductors of like polarity supplying current to motors traveling upon an electric railway, and generators normally in circuit with the line-conductors, respectively, with a supplementary conductor for joining the said supply-conductors, and a switch for coupling up the generators in circuit with either line-conductor at will.

55 18. The combination of two line-conductors of like polarity supplying current to motors traveling upon two parallel roads, respectively, a generator normally in circuit with each conductor, and a switch for cutting out a portion of one of the line-conductors, with a supplementary conductor joining the line-conductors, and a switch at the supply-station for shifting the circuit of the generator from the cut-out section to the conductor of the other line, substantially as described.

65 19. The combination, with the supply-conductors of two roads, and an independent generator normally supplying current to the motors upon each road, of the supplementary conductors for joining the supply-conductors of like polarity upon the two roads, and the switches at the supply-station for shifting the circuit of the generators from one line to the other.

75 20. The combination, in an electric railway, of two parallel roads, and an independent generator normally supplying current to each road, with switches and circuit-connections for putting both generators in circuit with one of the roads, as set forth.

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Witnesses:

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