(No Model.)

3 Sheets—Sheet 1.

J. C. LOVE.

ELECTRICAL RAILWAY.

No. 381,395. Patented Apr. 17, 1888.

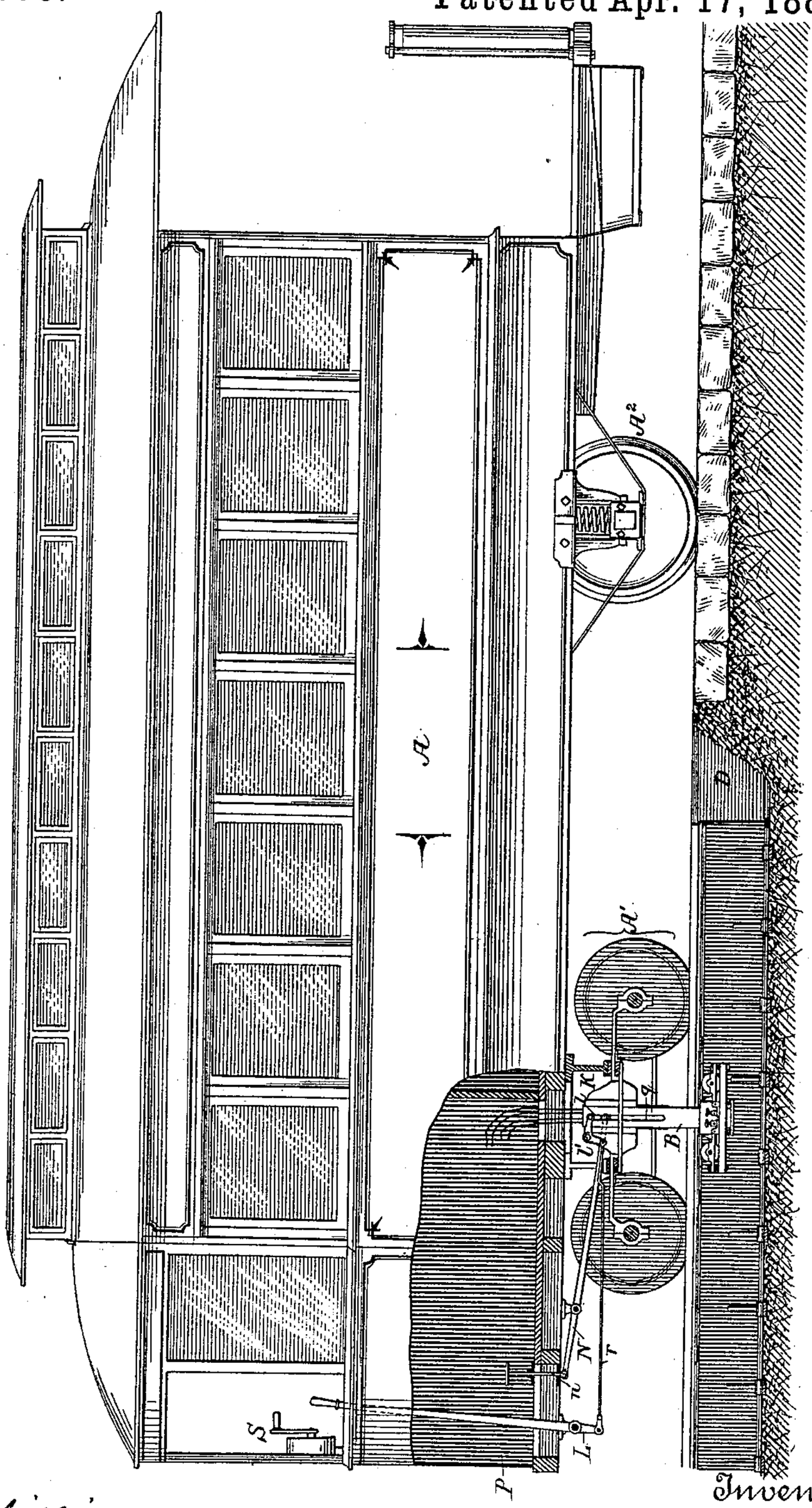

FIG. 1.

Witnesses:
David S. Williams.
Alex. Barkoff.

Inventor:
John C. Love.

By his Attorneys.
Howson & Howson.

(No Model.)

3 Sheets—Sheet 2.

J. C. LOVE.

ELECTRICAL RAILWAY.

No. 381,395. Patented Apr. 17, 1888.

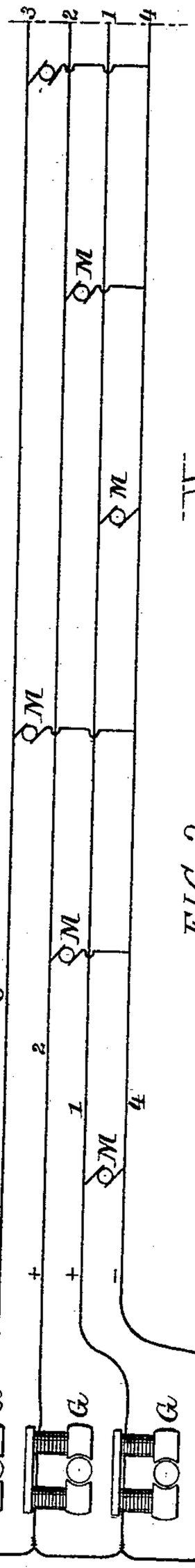

FIG. 6.

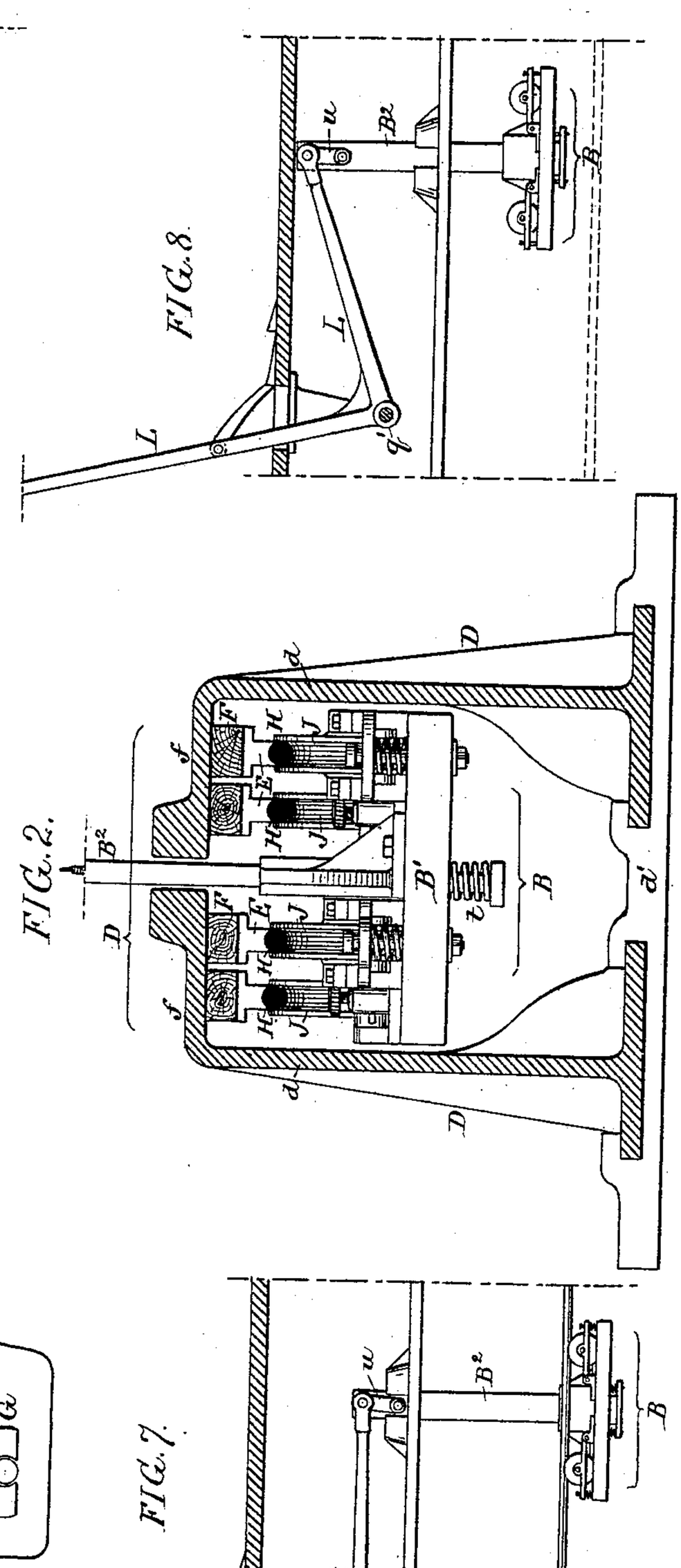

FIG. 2.

FIG. 7.

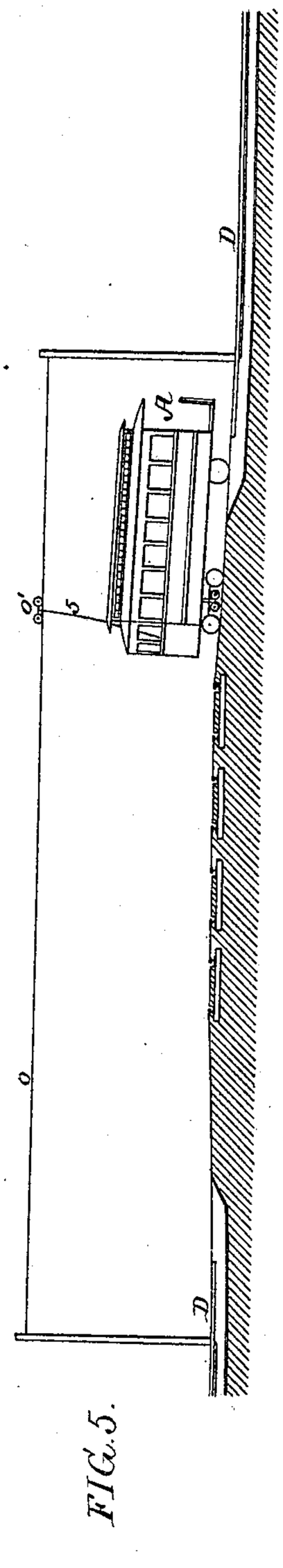

FIG. 5.

Witnesses
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Inventor
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(No Model.)

3 Sheets—Sheet 3.

J. C. LOVE.

ELECTRICAL RAILWAY.

No. 381,395. Patented Apr. 17, 1888.

FIG. 3.

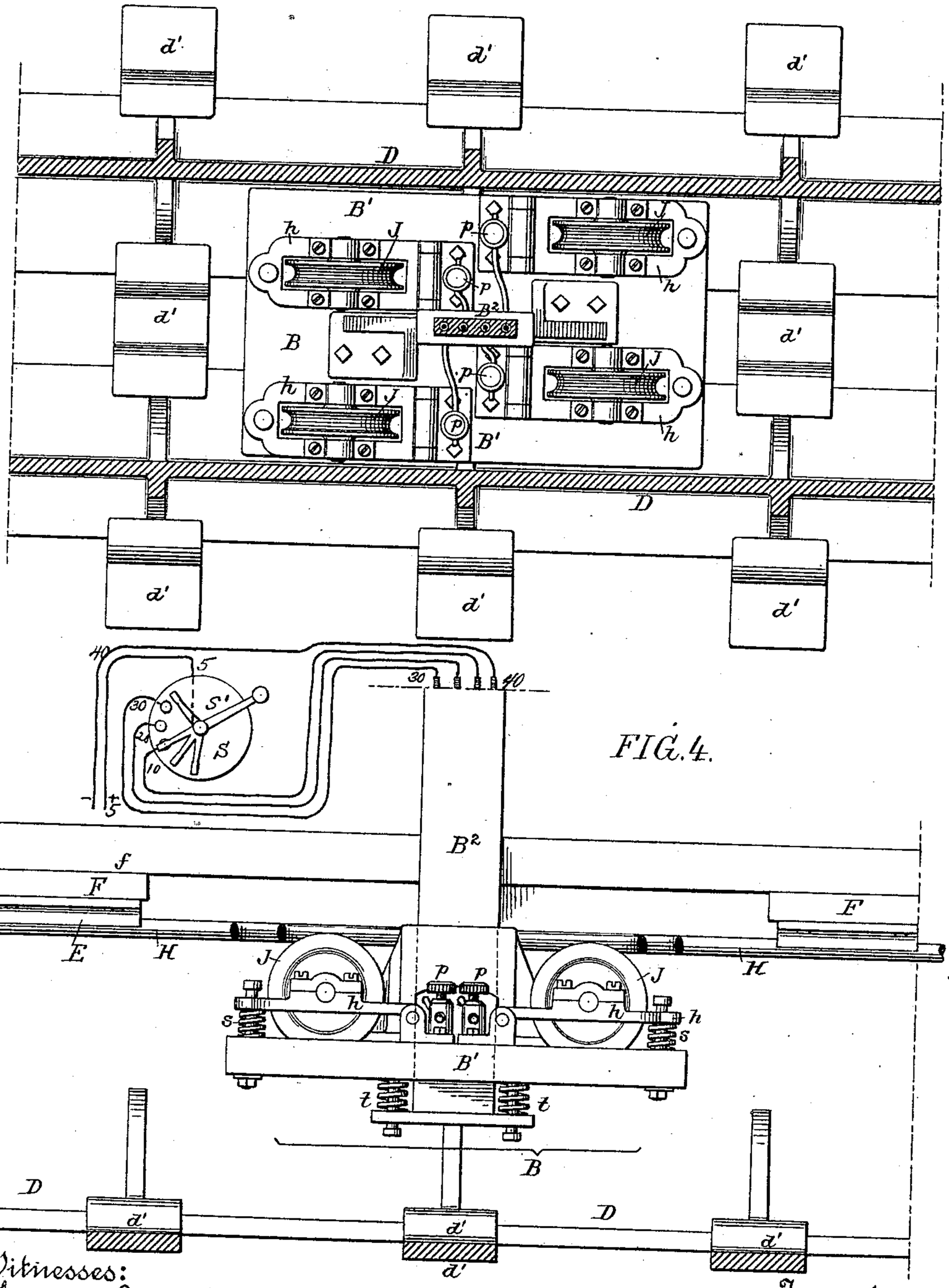

FIG. 4.

Witnesses:
David S. Williams.
Alex. Barkoff

Inventor:
John C. Love.

By his Attorneys.
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UNITED STATES PATENT OFFICE.

JOHN C. LOVE, OF PHILADELPHIA, PENNSYLVANIA.

ELECTRICAL RAILWAY.

SPECIFICATION forming part of Letters Patent No. 381,395, dated April 17, 1888.

Application filed October 4, 1887. Serial No. 251,437. (No model.)

To all whom it may concern:

Be it known that I, JOHN C. LOVE, a citizen of the United States, and a resident of Philadelphia, Pennsylvania, have invented certain Improvements in Electrical Railways, (Case A,) of which the following is a specification.

My invention consists of certain improvements in electric railways, more particularly of that class in which the conductors are carried in conduits underground; but some of my improvements may be applied to other constructions of electric railways.

In the accompanying drawings, Figure 1 is a side view of a car contact-carrier, with the conduit partly in section, and a part of the car being in section. Fig. 2 is an enlarged transverse section of the conduit in which travels the contact-carrier, the latter being shown in elevation. Fig. 3 is a sectional plan view of the carrier and conduit, drawn to an enlarged scale. Fig. 4 is a side view of the carrier in the conduit. Fig. 5 is a view of an arrangement for transferring from one conduit to another. Fig. 6 is a diagram of the circuits, and Figs. 7 and 8 are views of a modification.

So far as my present invention is concerned, the car A and the electric motor or motors thereon may be of any suitable construction and the motor may be mounted on the car at any suitable point. It has not been thought necessary to illustrate this. In the present instance the car is mounted on a truck, A′, at the front and wheels A^2 at the rear, running on rails, as usual. The motor-man is intended to occupy the front platform, P, and to have within his reach the switch or switches S, Fig. 1, turning the current or currents onto or cutting them off from the motor, and in addition a lever or levers for controlling the contact-carrier B. In the present instance I have shown this contact-carrier B as mounted on the frame of the front truck of the car and as adapted to be moved vertically in guides therein. The lower part of the carrier, on which the contact-wheels are mounted, passes through the slot of the conduit D. This conduit is preferably placed or laid between the railway-tracks, and I prefer to make it of the construction illustrated more clearly in Fig. 2—that is, having flanged side pieces, *d*, the flanges of which approach each other at the top to form the slot, and which have large bases secured by cleats or bolts, or otherwise, to base-pieces *d′*. An open slot is left between the top flanges, *f*, of these side pieces, and to the under sides of these top flanges are secured at suitable intervals pieces or blocks F, of wood or other insulating material, to which line-conductors H are secured. In the present instance I have shown two of these wires on each side of the slot of the conduit, for purposes which I will explain hereinafter; but the number may be varied as found desirable.

I find it preferable to make the line-conductors of a round section and to secure them to the insulating-blocks under the roof of the conduit at the opposite sides of the slot by means of brackets E. The conductors may be soldered, brazed, or otherwise suitably secured to the brackets.

The advantages of securing the conductors in the manner described are that the liability of moisture creeping onto the wires and grounding the circuits is greatly lessened, and the wires, being secured only at intervals, are free to expand and contract longitudinally between the carrying-brackets.

The contact-wheels J on the carrier B are grooved, as illustrated in Fig. 2, and bear up against the under side of the conductors.

In order to allow for variations in the relative positions of the line-conductors, due to sagging or otherwise, I make each of the contact-wheels free to move independently of the others to a limited extent vertically, and I introduce springs which tend to lift each independent wheel up into contact at all times with its own conductor. For this purpose I mount each of the contact-wheels in a bracket or arm, *h*, hinged or pivoted to a block, B′, on the lower end of the contact-carrier and acted on at the other end by a suitable spring, *s*, which tends to lift each contact-wheel upward against the corresponding line-conductor.

The block B′ at the lower end of the contact-carrier is of insulating material, or the several contact-wheels may be insulated from each other by other means, and each contact-wheel has in electrical connection with its arm a binding-post, *p*, to which is attached a con-

ductor passing through the stem B^2 of the contact-carrier. Thence one of the wires, 40, leads to one pole of the motor, while the other wires, 10, 20, and 30, connect with contacts on a suitable switch, S, Fig. 4, on the car within reach of the driver. The movable lever *s'* of this switch is connected with the other pole of the motor by a conductor, 5. This stem B^2, in addition to being guided in brackets K on the truck of the car, passes through the block B' of the contact-carrier and is flanged at its lower end. A spring or springs, *t*, introduced between this flange and the under side of the block B', afford a yielding connection between the stem and the block of the contact-carrier, in order to allow for any jumping or upward swaying of the car in running on the rails. These springs are not, however, necessary in all cases when a lever is used, as I will now describe.

I put the contact-carrier under the control of a lever in the hands of the motor-man on the front platform, in order that he may himself keep the wheels up in perfect contact with the line-conductors by a slight pressure on the lever, and so allow for jumping of the car. For this purpose, as I have said, the stem of the contact-carrier is mounted in guides in the front truck of the car, so as to be free to be moved vertically therein, and to the stem is connected, as shown in Fig. 1, a link, *l*, which in turn is pivoted to a bell-crank lever, *l'*, on the bracket K. The other arm of this bell-crank lever is connected through a suitable rod, *r*, to the lever L, pivoted to the body of the car, and having at its upper end a handle, to be grasped by the motor-man. By slight forward pressure upon this lever the contact-wheels on the contact-carrier can be at all times kept up in contact with the line-conductors in the conduit, notwithstanding any irregularities therein or vertical movements of the car when in motion. Furthermore, the motor-man can, by the same means and independently of the switches, throw the motor out of circuit, if he so desires, in certain emergencies by simply allowing the contact-carrier to drop down with the wheels a little below the conductors.

In some cases it may become necessary to break the continuity of the conduit—as, for instance, at the terminus, or where the track crosses steam-railways. Under such circumstances I can, by the means above described, lift the entire contact-carrier out of the conduit, which at the end approaching the steam-railway track is provided with an opening large enough to allow the contact-carrier to emerge. The car can then be traversed across the railway-tracks by horse-power or other means and the contact-carrier then depressed into the open end of the conduit at the other side. For such an emergency as this I can provide for crossing from one conduit to the other an overhead line, *o*, Fig. 5, in circuit with the conductors in the conduits D, and provided with the usual trolley, *o'*, running on the overhead line and having depending conductors 5, which, as the car comes to the end of the conduit, can be grasped by the motor-man and connected up with the motor, so that the current will be supplied from the line-conductors to the motor through the overhead connection until the other conduit is reached.

To lift the contact-carrier B out of the conduit, I may use means independent of the lever L. In the drawings, Fig. 1, I have illustrated these devices as consisting of a lever, N, pivoted to the under side of the car and connected at one end to the stem of the contact-carrier, and having at the other end an upright rod, *n*, passing through the floor of the front platform of the car within reach of the foot of the motor-man, so that by pressing on this stem the contact-carrier may be lifted out of the conduit at the proper time. To allow for this full movement of the contact-carrier B without affecting the lever L, the link *l* is connected to the stem B' by a pin entering a slot, *q*, in the stem and normally at the upper end thereof. If preferred, but one lever may be used, as illustrated in Figs. 7 and 8, the former of which shows the carrier as in position with its wheels in contact with the conductors, while Fig. 8 shows the carrier as lifted out of the conduit. In this construction the lever L is shown as a bell-crank lever pivoted at *q* to the truck, and having its lower arm connected by a link, *u*, to the stem of the carrier.

In the drawings I have shown my electric-railway system as provided with four conductors, 1 2 3 4—two on each side of the slot; but this number may be increased or reduced. I prefer in all cases, however, to have three or more of these conductors, whether the system be an underground, surface, or overhead one, with a corresponding number of contact-wheels on the contact-carrier and conductors leading from these wheels to the switch or switches within the control of the motor-man, and thence to the motor on the car, so that the motor on any car can be connected up with any of the line-conductors.

At the station I provide a separate electric generator, G, for each outgoing line-conductor, and by preference use only one return-wire, 4, common to the outgoing wires, as illustrated in the diagram, Fig. 6. By this means I provide a system in which a great many more motors, M, can be run than in the ordinary way, where only an outgoing and a return conductor are used with one generator, for I can run a certain number of cars on the circuit represented by the wires numbered 1 and 4—for instance, a certain number on the circuit 2 and 4 and still others on the circuit 3 and 4.

If desired, the conduit itself may be used as the return-conductor; but this I do not prefer.

I claim as my invention—

1. The combination of an underground conduit, carrying the line-conductors of an electrical railway in its upper part, with a car having guides, a contact-carrier vertically

movable in said guides and provided with contacts adapted to be held up in electrical connection with the conductors, and a hand-lever pivoted to the car and connected to the said carrier to press the contacts up against the under sides of the conductors, substantially as described.

2. An electrical railway having three or more line-conductors, of which one is a common return-wire and the others are outgoing wires, a generator for each circuit, anumber of cars, each carrying a motor and contacts for all of the several conductors, and a switch, with which the several contacts are in electrical connection, substantially as described.

3. The underground conduits of an electrical-railway system and a car having the contact-carrier movable into and out of the conduit, in combination with an overhead line between the interrupted ends of the conduits, a trolley running on the overhead line, and depending conductors on the trolley to be connected up with the motor on each succeeding car, all substantially as described.

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

JOHN C. LOVE.

Witnesses:
HARRY SMITH,
HENRY HOWSON.