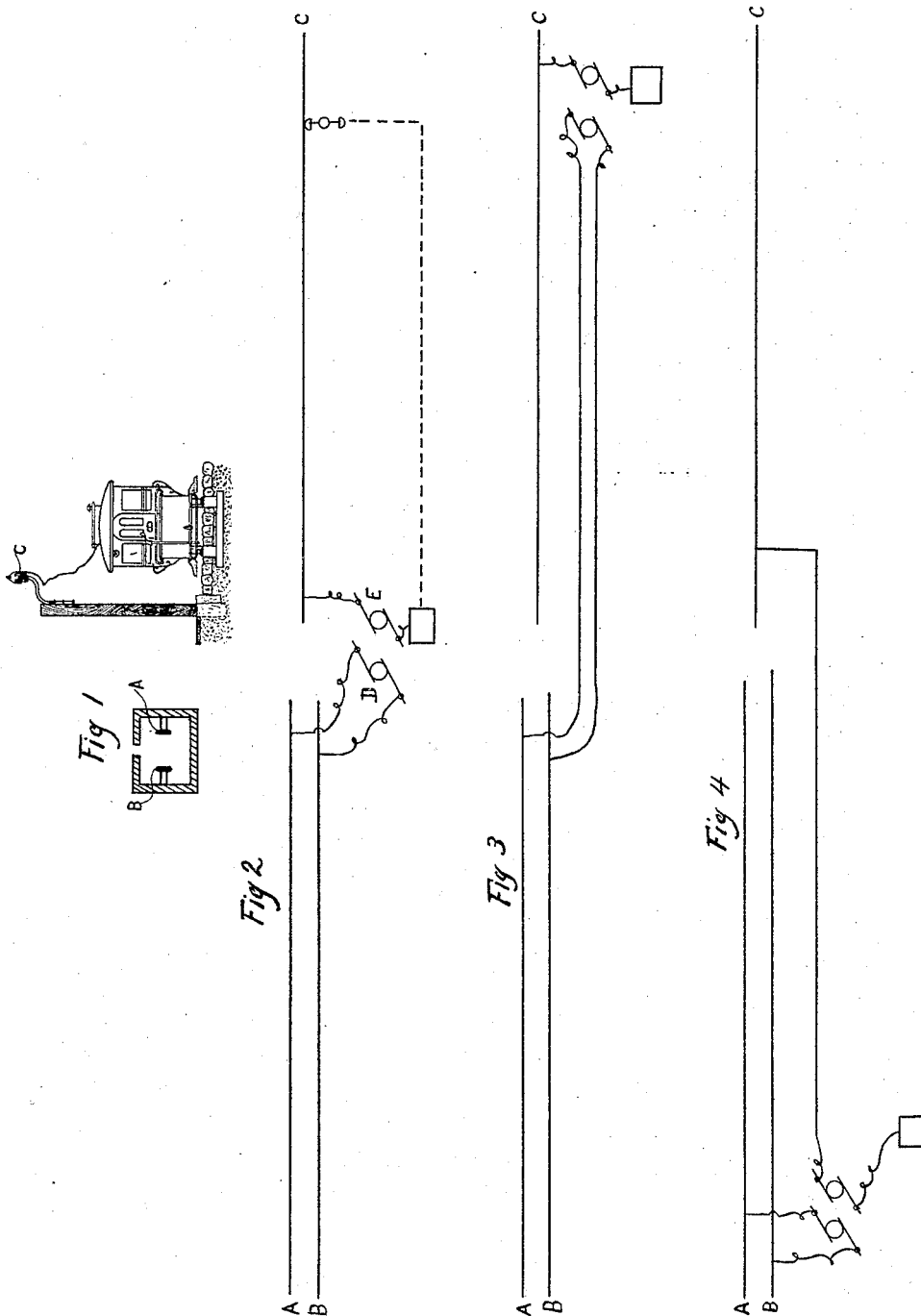


E. M. BENTLEY.  
ELECTRIC RAILWAY SYSTEM.

No. 385,787.

Patented July 10, 1888.



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Edward S. McKinney,  
Geo. Blackwell

INVENTOR,  
Edward M. Bentley,  
by Butler & Knight  
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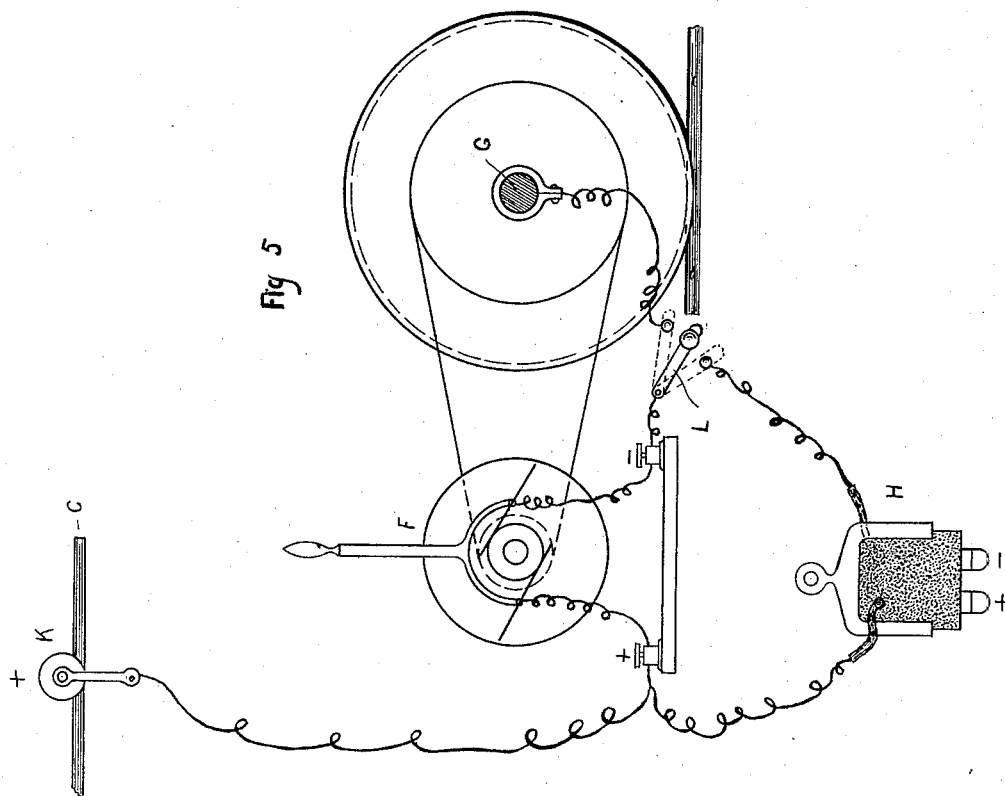
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2 Sheets—Sheet 2.

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by Bentley Knight.  
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# UNITED STATES PATENT OFFICE.

EDWARD M. BENTLEY, OF NEW YORK, N. Y.

## ELECTRIC-RAILWAY SYSTEM.

SPECIFICATION forming part of Letters Patent No. 385,787, dated July 10, 1888.

Application filed May 10, 1888. Serial No. 273,465. (No model.)

*To all whom it may concern:*

Be it known that I, EDWARD M. BENTLEY, 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 Systems, of which the following is a specification.

My invention pertains to electric railways; and it consists in a system wherein one section of a railway is provided with two supply-conductors independently insulated and inclosed in a slotted conduit, while the succeeding section is supplied with an exposed single conductor, preferably elevated above the roadway and having a ground-return.

I have found from practical experience that when an electric-supply conductor for a railway is inclosed in a conduit it is preferable to provide two conductors, each independently insulated, since the liability to ground-connections is great, and with two conductors one of them may be accidentally grounded without interfering with the operation of the railway. When this accident occurs, it will be often possible to discover and repair the defect without any interruption in the operation of the road. With an overhead conductor, however, there is practically no danger of a ground-connection, and it is quite feasible in such a case to employ but a single conductor, using the ground and the rails as a return. By a combination of these systems I secure the maximum reliability in the operation of a roadway, and am able to use at the same time the minimum amount of copper in the conductors. In such a system it is of course necessary that each of the two sections be provided with an independent generator, since one of the generators must have a permanent ground-connection, and on that account cannot be employed for the section where both conductors are insulated. It is also essential that a vehicle with a propelling electric motor adapted for the combination system must have a ground-connection over one part of its course, and on the other part must be completely insulated.

In the accompanying drawings, Figure 1 indicates that the succeeding sections of electric railway shown in diagram in the following figures have one of them two supply-conductors inclosed in a conduit, and the other a single

conductor elevated above the roadway. Figs. 2, 3, and 4 are diagrams showing different arrangements of the central station in my system. Fig. 5 is a diagram of the connections for a propelling-motor of a vehicle on the line.

In Fig. 2, A B are two insulated electric-supply conductors for one section of a road inclosed in a conduit. C represents a single conductor for the succeeding section of road having a ground-return. In this case the central station is at the junction of the two connections. D is a generator at the central station, having both its terminals insulated from the ground, and connected, respectively, to the supply-lines A B. E is a second generator at the same station, having one of its terminals connected to the ground and its other terminals connected to supply-lines C.

In Fig. 3 the central station is shown at the farther extremity of the single-wire section, while in Fig. 4 the central station is at the farther extremity of the double-line section.

In each of the cases shown in Figs. 3 and 4 there are independent conductors leading along one section to connect with the supply-conductor of the succeeding section.

In Fig. 5, F represents a propelling-motor geared to the axle G of a vehicle. This motor is provided with the following electrical connections: First, it has two wires leading to the ordinary plow or contact device, H, for the inclosed or conduit section; secondly, it has a connection leading to the trolley or similar contact device, K, adapted for the elevated conductor C; thirdly, it has a connection leading to the axle G, by which it is connected with the ground during its progress along the overhead section of roadway. In this third connection is a circuit-breaker, L, shown here as a switch connecting the negative pole of the motor alternately to the ground and to one contact of plow H. Any other similar device by which one terminal of the motor may be grounded at will may be employed.

What I claim, and desire to secure by Letters Patent, is—

1. In an electric railway, the combination, with a section having two insulated supply-conductors inclosed in a conduit, of a succeeding section having a single exposed supply-conductor with a ground-return, and a common

central station for said sections having two independent generators, one with its terminals insulated from the ground, and connected, respectively, to the two inclosed conductors, and  
5 the other generator having one of its terminals permanently connected to the ground, the other connected to the single exposed supply-conductor.

2. In an electric railway, the combination,  
10 with a section having two insulated supply-conductors inclosed in a conduit, of a succeeding section having a single exposed supply-conductor with a ground-return, a common central station at the extremity of one section  
15 having two generators, one generator connected to the conductor or conductors on the adjacent section, and the other generator having an independent line extending along to connect with the conductor or conductors of  
20 the remote succeeding section.

3. In an electric railway, the combination, with a section having two insulated supply-conductors inclosed in a conduit, of a succeeding section having a single exposed supply-conductor with a ground-return, of two independent generators for said sections, respectively, a vehicle adapted to travel along both sections, and a propelling-motor for said vehicle having the following connections: first, two conductors leading to a contact device for  
30 the inclosed section; second, a conductor leading to the contact device for the overhead section, and, third, a ground-connection provided with a circuit-breaker for interrupting the ground-connection while the vehicle is on the  
35 conduit-section of the roadway.

EDWARD M. BENTLEY.

Witnesses:

E. A. CHARTRAND,  
JULIEN M. ELLIOT.