(No Model.) 2 Sheets—Sheet 1.

G. T. WOODS.

ELECTRIC RAILWAY SYSTEM.

No. 463,020. Patented Nov. 10, 1891.

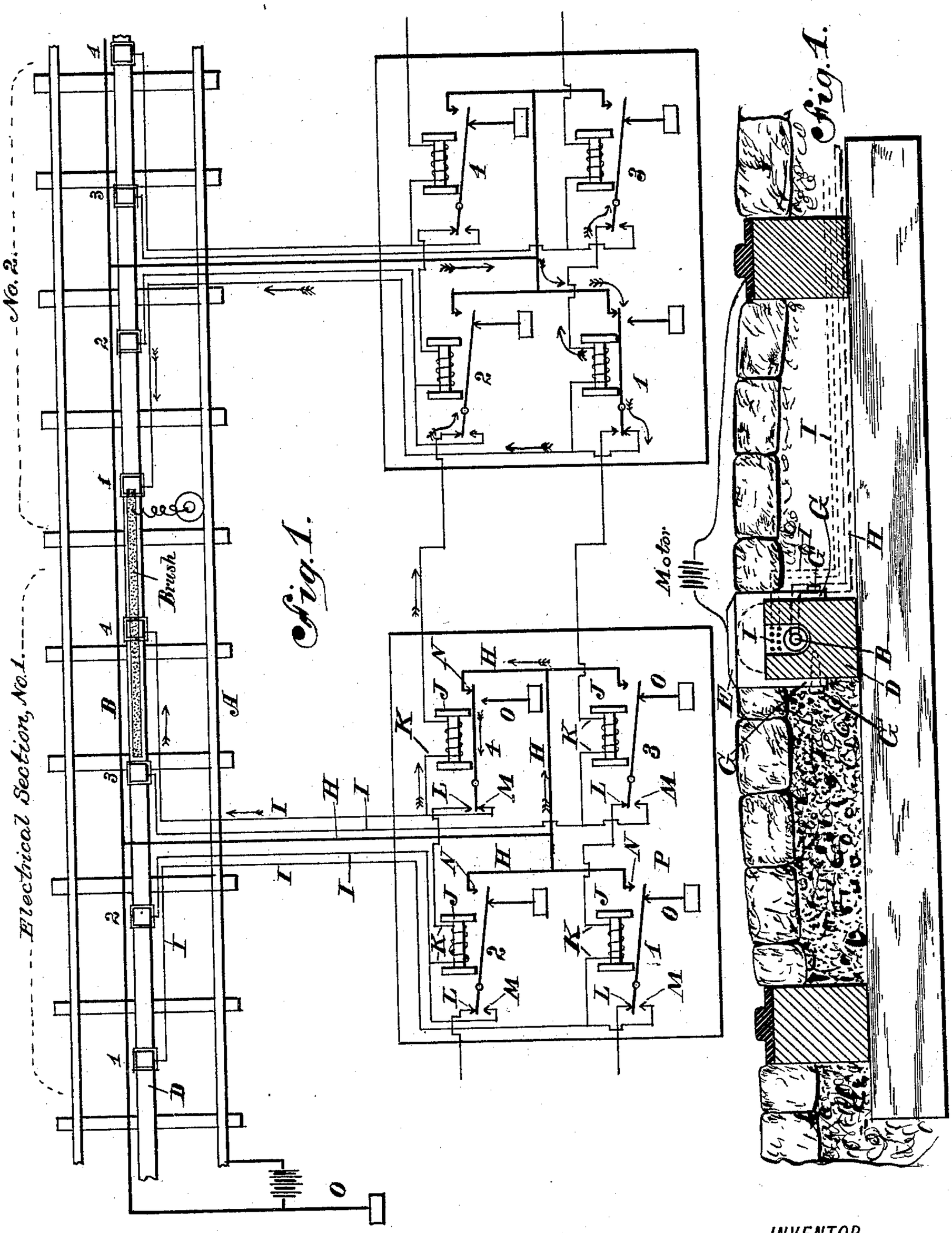

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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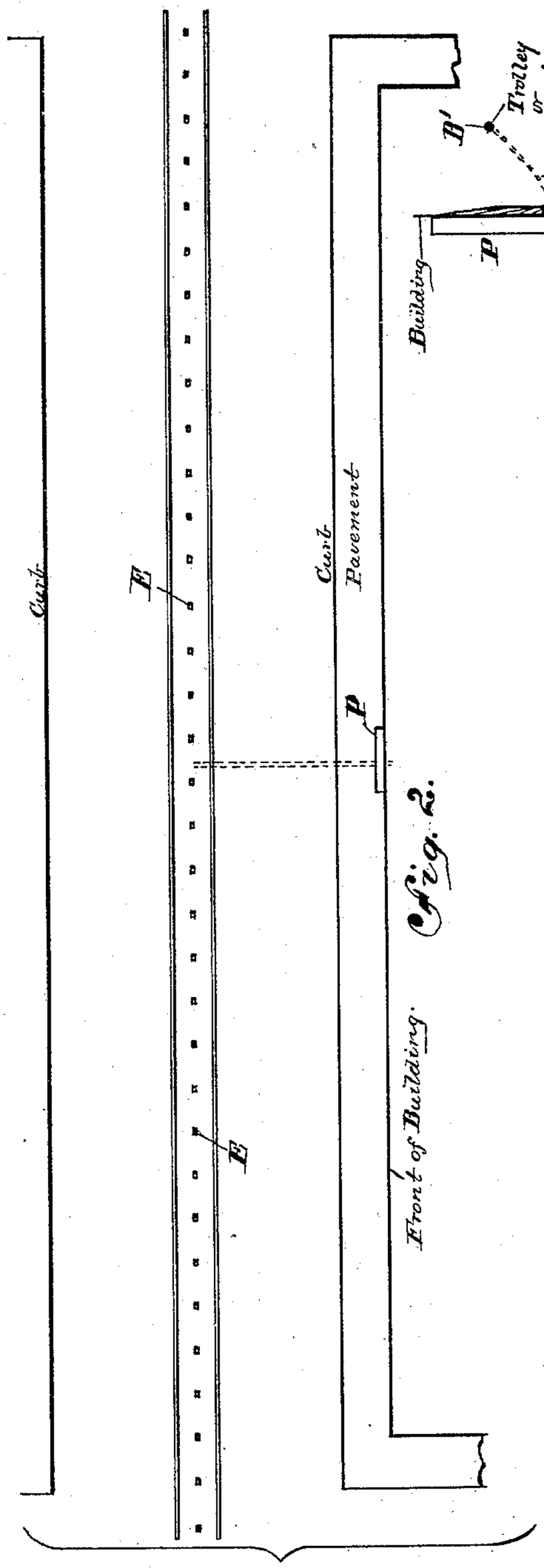

Fig. 2.

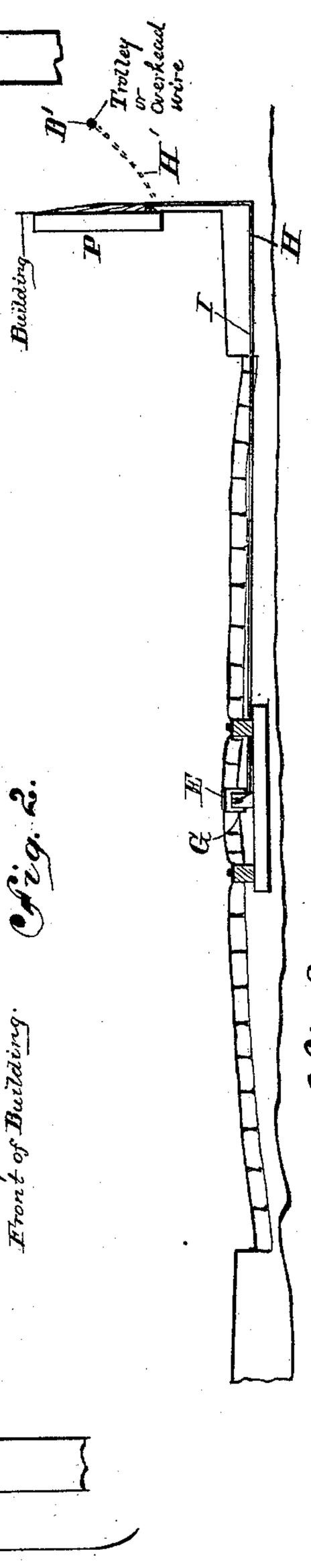

Fig. 3.

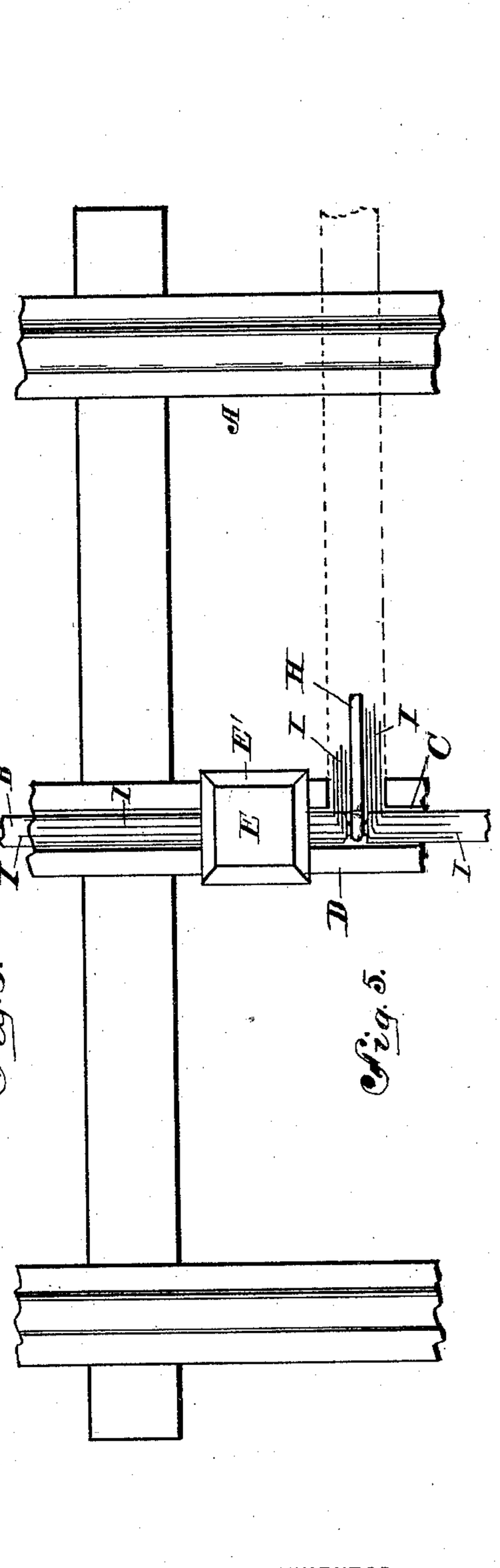

Fig. 5.

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UNITED STATES PATENT OFFICE.

GRANVILLE T. WOODS, OF NEW YORK, N. Y., ASSIGNOR TO THE AMERICAN ENGINEERING COMPANY, OF SAME PLACE.

ELECTRIC-RAILWAY SYSTEM.

SPECIFICATION forming part of Letters Patent No. 463,020, dated November 10, 1891.

Application filed August 31, 1891. Serial No. 404,309. (No model.)

To all whom it may concern:

Be it known that I, GRANVILLE T. WOODS, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Electric Railways, of which the following is a specification.

The object of this invention is to construct a cheap, simple, and efficient electric-railway system adapted as well for existing lines of street-railways as for new lines and which entirely dispenses with overhead wires or with exposed feeders and does not require conduits or openings in the street for the purpose of connecting with the main feeder.

The system, briefly stated, provides for placing the main feeder, which is insulated throughout, in a hermetically-sealed channel in the road-bed or carrying it parallel with the road, but not necessarily contiguous thereto, and locating in the road-bed at intervals along the track terminal heads, and then connecting each terminal head with the main feeder, and interposing in this working circuit from each terminal an electro-magnetically-controlled switch or cut-out, which is located at any point along the route, and in order to make the system more practical and efficient I group together all the electro-magnetic contact devices which connect with the corresponding terminal heads in a section or block of the road, so that when the road is in operation and any terminal head should appear to be out of order or damaged the head could be instantly located by examining the case which contains the magnetic device in connection therewith. By this system, therefore, the road-bed contains no operative mechanism of any kind whatever. Hence no derangement could possibly take place in the road, and as all the operating mechanism for forming the working circuit through the motor is located by the side of the road—as, for instance, on the sides of buildings or in cellars or area-ways—the mechanism can be inspected and kept in repair, and as in practice only one case or group of these contact devices is placed in each block the cost of inspection will be small, and in event of accident no test is required to locate the particular portion of the road where the difficulty lies. It should be stated that this system provides for placing these terminal heads preferably between the tracks of the railway, and that normally all the heads are out of the circuit and can be brought into the circuit only by the passage of a car having brushes of sufficient length to nearly span three adjacent terminal heads, and that the current, when once established through two of the heads or terminals, will positively cut out the rear terminal by the electrical mechanism which throws in a new terminal, so that an absolute means is provided for making all the terminals fore and aft of the car "dead," and thus guarding against any liability of danger from "live" terminals, as will now be set forth in detail.

In the accompanying drawings, Figure 1 is a plan view of a railway, showing manner of placing the main feeder, return-conductor, and terminal heads therein and the operative parts of the system connected up; Fig. 2, a plan view of a section of the road, showing manner of equipping one group or electrical section; Fig. 3, a cross-section of a street equipped with my improved electric-railway system; Fig. 4, an enlarged cross-section of a road-bed, showing details of equipment and portion of the working circuit through the motor; and Fig. 5, a top or plan view of the same.

In carrying out my invention I employ, as is now customary, one rail A for the ground or return conductor and an insulated wire B for the main feeder. This feeder is preferably located in the channel C of a stringer D, which is placed centrally between the tracks and secured to the ties E, thereby necessitating the removal of only the paving blocks or material in the road-bed above the ties, and as the stringer is narrow only a narrow trench or portion of the paving need be removed. The importance of this is apparent in cases where the system is applied to existing road-beds. The stringer D, when so located, has its upper surface considerably lower than the surface of the street, so that when the paving is replaced the space above the stringer and between the paving-blocks can be filled in with asphaltum. Before filling in this space

the main feeder B is placed in the channel and well covered with asphaltum, and at intervals along this stringer I place what are here called "terminals" or "terminal heads" E. In practice these terminals are placed such a distance apart, preferably, as to enable the brush on the car to nearly span three successive terminals. These terminal heads can be made in any desired shape or form best adapted for the purpose, so that they can be readily attached to the stringer and securely held in place. I prefer to have these terminals E project slightly above the surface of the street, as shown, with four corners E' cut away at an angle, so as to offer as little resistance or obstruction as possible to the travel of the street and still be sufficiently exposed to enable me to secure ample contact with the brush on the car. As one form of attaching this terminal to the stringer, I cast therewith downwardly-projecting wings G, which rest against the opposite sides of the stringer and are held in place by bolts or lag-screws G', passing through these wings and into the stringer D. In connecting up these terminals and the main feeder I run a sub-feeder H from the main feeder to the side of the street and a branch wire I from each terminal to the side of the street, so that while the main feeder passes through a channel in the stringer in which the terminal heads are located there is no connection, electrically or otherwise, between them in the road-bed. For all practical purposes the main feeder could as well be carried over poles or over the building parallel with the road, as shown by the trolley or overhead wire B', Fig. 3, and such construction is also contemplated and may be desirable where it can be conveniently done. In that case I run the sub-feeder from the overhead wire B' to the case, as shown by dotted line H'. In such cases the system would operate in substantially the same manner, and the electrical mechanism and the peculiar manner of connecting up the parts would be similar.

In order to understand the important feature in this system, it should be stated that while each terminal E has a branch wire or connection which leads to the side of the street the main feeder has a sub-feeder or connection at longer intervals—say one connection for each block or other determined section of the railway-line—which sub-feeder extends to and is connected with a case located midway in the block or section of the line. This case contains all the electrical mechanism for that block or section of the line, which is composed of an electro-magnetically-controlled contact mechanism or cut out for each terminal, so grouped together that when the car passes over that section each magnet will be successively brought into operation to throw in and cut out the terminals over which the car passes.

This mechanism is illustrated in Fig. 1, in which J represents the magnet having a shunt-wire K, one end of the shunt being attached to the branch wire I and the other end of the shunt-wire carried over and attached to the upper back stops L of the armature of the second succeeding magnet. The end of the terminal branch wire I is connected with the lower back stop M. The sub-feeder H is connected with the upper front stop N of the armature and the ground-conductor O with the lower front stop P.

In order to more fully illustrate this system of electrical sections, I show two sections in Fig. 1, each section having four terminals 1, 2, 3, and 4 in the road-bed, and by the side of the street, located against a wall or other object where it can be easily reached, is a case containing the mechanism just described. Suppose the brush of the moving car is in contact, as shown, with terminal 4 of the first section and terminal 1 of the second section, the armature of magnet 4 would be drawn up, thus closing the breach between the branch I, which leads to the terminal head and the sub-feeders H. In its movement the armature opened the shunt-circuit, which passes around magnet 2, thereby causing the armature of No. 2 to drop, thus cutting out the sub-feeder H and rendering terminal block No. 2, first section, "dead." A portion of the current flowing from the feeder B through the sub-feeder H is shunted through magnet 4 to the upper back stop L of magnet-armature 2, section 2, thence through the armature to the ground. In the meantime the car in its motion has brought its contact-brush in communication with terminal head 1, section 2. A portion of the current flowing into the brush from terminal head 4, section 1, passes through terminal head 1, section 2, branch circuit I to magnet 1, section 2, and thence to the ground. The armature of magnet 1, being drawn up by the action of said circuit, breaks the circuit through magnet 3, section 1. As the armature of said magnet 3 is not now under its influence, it falls away, thus breaking the circuit between the sub-feeder H and the branch I. It will be observed that a magnet when once energized will so remain until after the contact-brush has touched two successive terminal heads after leaving the head which controls said energized magnet.

The case P, in which the switching mechanism is located, a top view of which is shown in Fig. 2, is of any convenient shape and size best adapted for the purpose, and is preferably made so that it can be locked up; but as the feature is reserved for a separate application, further description of its construction is unnecessary. Instead of locating these cases by the sides of buildings along the route, man-holes may be provided at intersections of streets, or at convenient points within which this mechanism can be placed; but it is obvious that the cases are preferable, as they are more easily inspected, and all mechanism containing operative parts are wholly removed from the street.

In Fig. 1 I show the main feeder B and the branch wires I outside of the stringer D. I have so represented them for convenience herein. In practice all these wires are placed in the channel C of the stringer D, as represented in Fig. 4, thereby employing this stringer not only as a support for the terminal heads, but also as a means for carrying the conductor, thereby enabling me to construct an electrical system very cheaply and adapting it for application to any street-railway road-bed without taking up the rails or removing the ties and sleepers. As there is no slotted conduit or open way in the road-bed, no downward-projecting arms from the car are necessary, except those containing the surface contact-brush, and as the terminal heads are thrown in and cut out successively by the passing car by mechanism which is positively operative in its character, moisture around these terminal heads will not affect their action.

What I claim as new is—

1. In electric railways, a system of electrical distribution composed of a group of electro-magnetically-controlled contacts outside of the road-bed and accessible, each contact being electrically connected with one exposed terminal head in the road-bed.

2. In electric railways, a system of electrical distribution composed of groups of electro-magnetically-controlled contacts outside of the road-bed and accessible, each contact being electrically connected with one terminal in the road-bed contiguous to the brush of the operating-car.

3. In electric railways, a system of electrical distribution, which consists of exposed terminals at regular intervals along the road-bed, an electro-magnetically-controlled contact for connecting and disconnecting each terminal with the main feeder located in groups or a series of groups at any point along the route by leading-in wires.

4. In electric railways, a system of electrical distribution, which consists in exposed terminals at regular intervals along the road-bed, an electro-magnetically-controlled contact for connecting and disconnecting each terminal with the main feeder, said magnetically-controlled contacts being grouped together to form distributing-stations along the line of the route at convenient points.

5. In electric railways, a system composed of a main feeder and return-conductor in the road-bed, with exposed terminal heads or faces at intervals along the road-bed and intermediate between the main feeders and the terminal heads, accessible switching mechanism located at any point distant from the road-bed, but connected electrically with said main feeder and terminals, whereby the make-and-break mechanism of each terminal is not located in the road-bed but placed at suitable points adjacent to the road along the entire route in groups to form distributing-stations.

6. In an electric-railway system, a main feeder and a return-conductor in the road-bed and terminal heads at intervals along the route, with an electro-magnetical cut-out or switch between each terminal head, and the main feeder so arranged that two of the adjoining heads are practically continuously in circuit with the motor and as the motor moves the last terminal head is cut out of the circuit by the new head, which is brought into the circuit.

7. In an electric-railway system, a main feeder and a return-conductor in the road-bed and terminal heads at intervals along the route, with an accessible electro-magnetical cut-out or switch between each terminal head, and the main feeder located out of the road-bed, so arranged that as the car moves along the brush is constantly in contact with one terminal and engages with the third terminal immediately after leaving the first terminal, whereby the first terminal is cut out electrically by the action of the magnet in the third terminal throwing in said terminal.

8. In a system of electrical distribution for railways, the combination of an insulated main feeder, a series of grouped terminals distributed apart along the surface and normally disconnected from the main feeder, and corresponding groups of accessible electro-magnetic switching devices for connecting each of said terminal heads in turn with the main feeder as the motor advances.

9. In electric railways, a series of terminal heads projecting slightly above the surface of the street, each provided with a branch wire, and a main feeder having at longer intervals sub-feeders electro-magnetically connected with the branch wires from said terminal heads, and intermediate switching mechanism between said sub-feeders and branch wires, substantially as set forth.

10. In electric railways, a channeled stringer in the road-bed having at intervals terminal heads which project slightly above the surface of the street, and a main feeder, sub-feeder, and branch wires within said channel, substantially as set forth.

11. In electric railways, a channeled stringer in the road-bed below the street-surface having at short intervals terminal heads permanently secured thereto, which project slightly above the surface of the street, and branch wires from each terminal head, and sub-feeders connected with the main feeder at greater intervals than the terminal heads, substantially as set forth.

12. In electric railways, a channeled stringer midway between the rails below the surface of the street, provided with terminal heads at short intervals, which project slightly above the surface of the street and having in said channel a main feeder, a branch wire from each terminal head, and a sub-feeder connected with the main feeder at greater intervals than the terminal heads, which sub-feeders and branch wires extend to the side of

the street and are connected up in a case with intermediate cut-out mechanism, substantially as set forth.

13. In an electric-railway system having at intervals of a block or other predetermined section a case located at any convenient point adjacent to the road, provided with an electric switching device for each terminal head within said block or section, and a single sub-feeder from the main feeder, substantially as set forth.

14. An electric-railway system having at intervals of a block or other predetermined section a case located at any convenient point adjacent to the road, provided with an electrical switching device for each terminal head within said block or section, a single sub-feeder from the main feeder, and a branch wire from each terminal head to said case, substantially as herein set forth.

15. An electric railway having in the street along the line of the rails exposed terminal heads at regular intervals, in combination with a main feeder, a switching device between each terminal head operated by an electro-magnet, the shunt-wire of the first magnet being grounded through the open armature of the third magnet and the second with the fourth magnet, and so on, whereby the closing of the armature of the third magnet will cut out the first magnet and its corresponding terminal head, substantially as set forth.

16. In electric railways, the combination, with a motor, of a series of terminal heads slightly projecting above the surface of the street, a main feeder, sub-feeders connected with the main feeder, a branch wire from each terminal head, and intermediate between the said sub-feeder and branch wires a switching device, substantially as set forth.

17. In electric railways, the combination, with a motor, of a series of terminal heads, a main feeder, sub-feeders connected with the main feeder, branch wires from the terminal heads, and cases located at intervals along the road containing switching mechanism between said sub-feeders, and branch wires from the terminal heads, substantially as set forth.

Signed at New York, in the county of New York and State of New York, this 29th day of August, A. D. 1891.

GRANVILLE T. WOODS.

Witnesses:
J. S. ZERBE,
C. C. BOWEN.