

(No Model.)

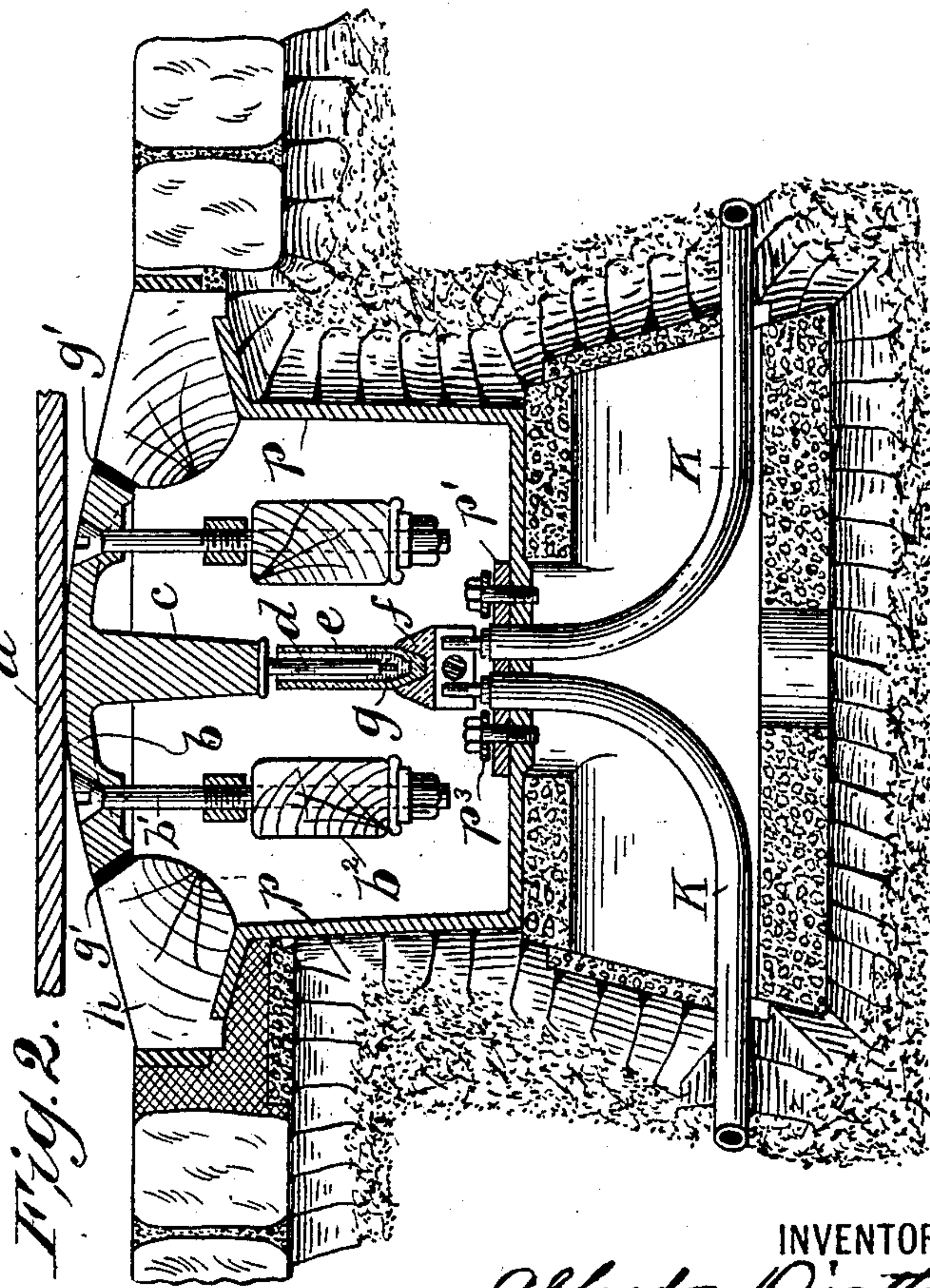
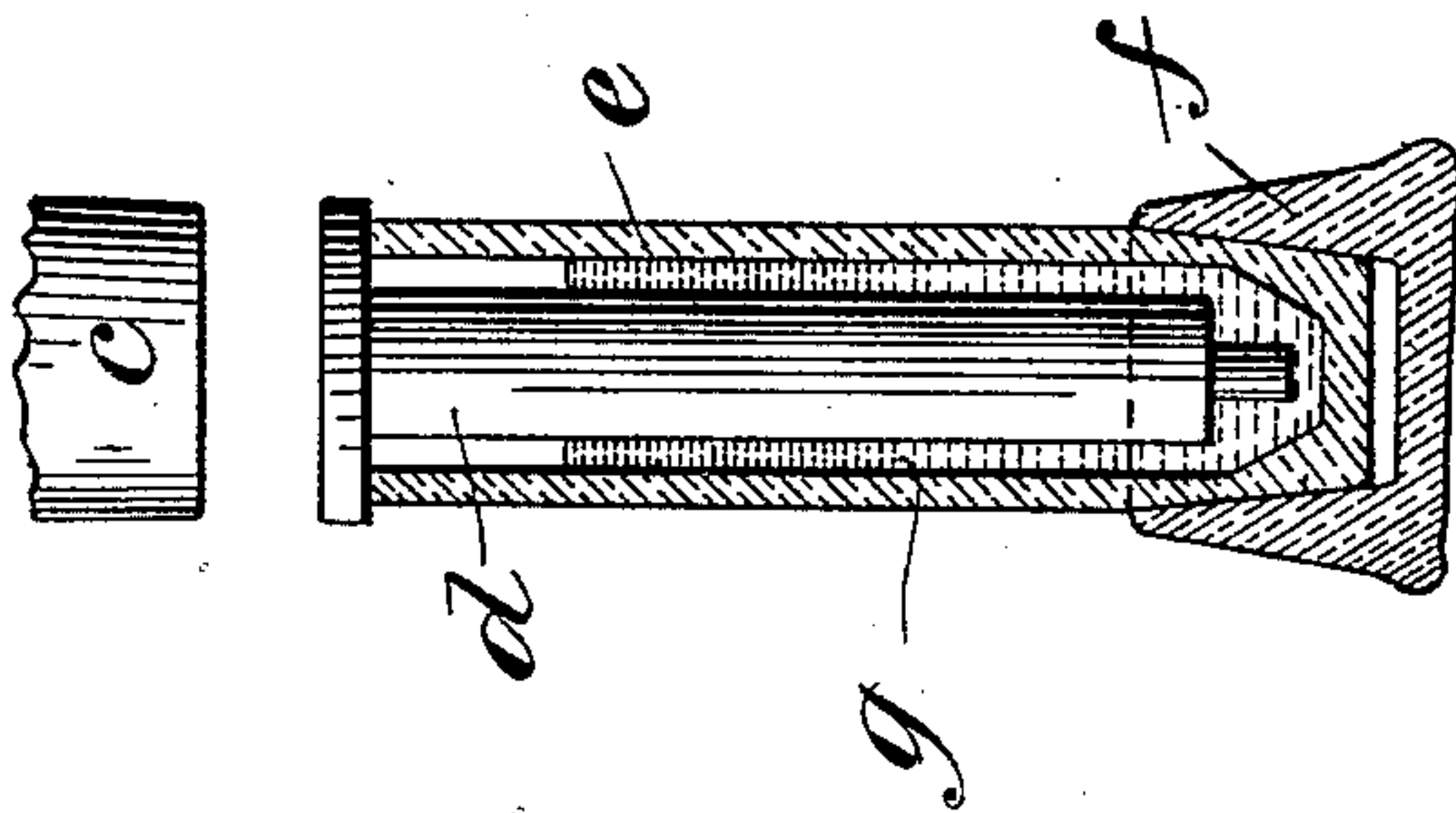
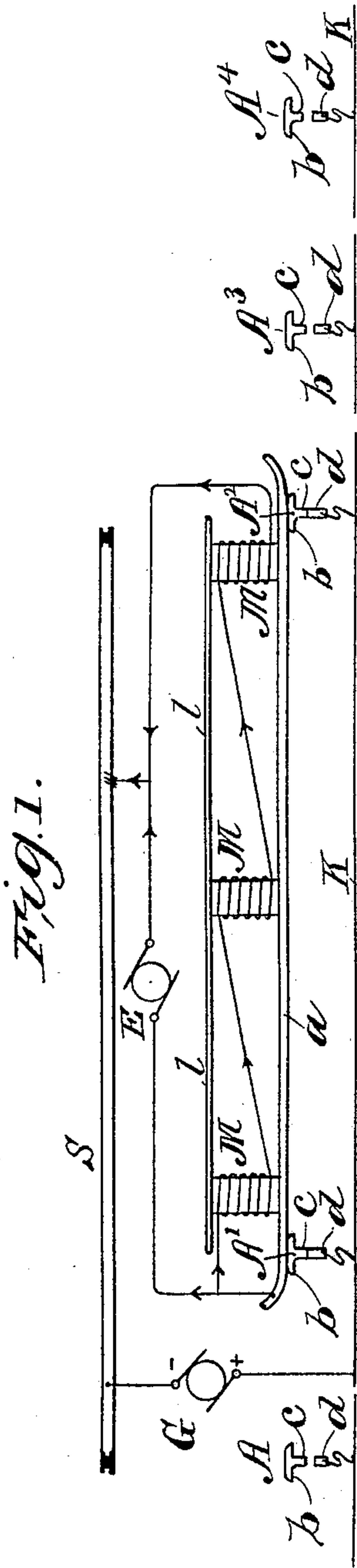
2 Sheets—Sheet 1.

A. DIATTO.

# ELECTRIC TRAMWAY WITH UNDERGROUND DISTRIBUTION OF CURRENT.

No. 550,319.

Patented Nov. 26, 1895.



WITNESSES:

W. E. Bowen  
W. C. Pinckney

**INVENTOR :**

Alfredo Diatto,

BY

*J. E. Dorney*  
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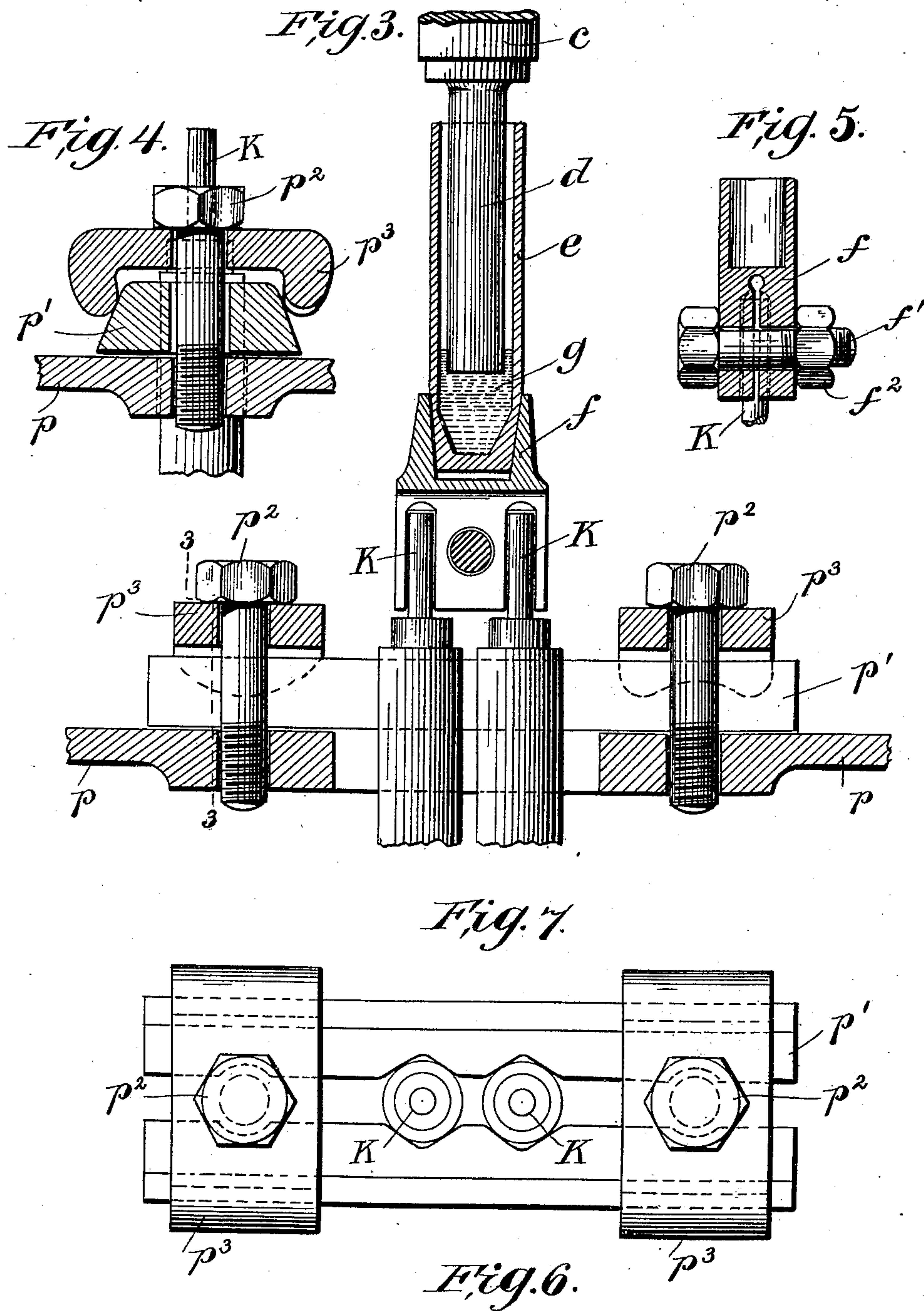
ATTORNEY

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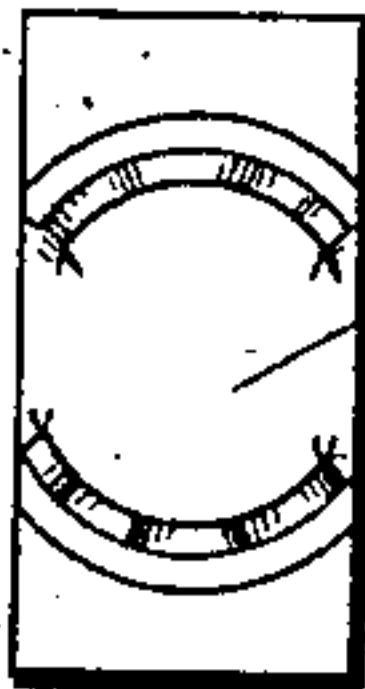
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# UNITED STATES PATENT OFFICE.

ALFREDO DIATTO, OF TURIN, ITALY.

ELECTRIC TRAMWAY WITH UNDERGROUND DISTRIBUTION OF CURRENT.

SPECIFICATION forming part of Letters Patent No. 550,319, dated November 26, 1895.

Application filed September 18, 1894. Serial No. 523,410. (No model.)

*To all whom it may concern:*

Be it known that I, ALFREDO DIATTO, a subject of the King of Italy, residing at 12 Piazze Gran Madre di Dio, Turin, Italy, have invented certain new and useful Improvements in Electric Tramways with Underground Distribution of Current, of which the following is a specification.

This invention relates to an electric tramway wherein each car or carriage is equipped with means for receiving the electric current through magnetic induction from a source of underground distribution by sliding over contact-pieces located at suitable intervals over a subway and suitably insulated and extending slightly above the surrounding surface of the ground, such contact-pieces being adapted through the medium of suitable circuit-closing devices beneath the same and within the subway to be placed in communication with the electric cable in the subway simultaneously with the passage of the car or carriage over such contact-pieces, the said circuit-closing devices being inclosed within a casing constituting a part of the subway.

A leading feature of this invention is that the magnetic induction is produced through a bar polarized north or south for its whole length, which length is about that of the car or carriage and greater than the distance between two successive contact-points and adapted to be brought in contact with a soft-iron switch-block communicating with the underground conductor, the said switch-block being attracted by aforesaid contact-pieces as the polarized bar on the carriage slides over them, the said switch-block falling back into its resting-place as the car or carriage passes by and in consequence of the magnetic action of the bar ceasing.

The attraction of the soft-iron switch-block by the contact-piece can be facilitated by establishing communication between it and the underground cable through a body of mercury, a part of which the switch-block displaces during its normal position of repose, the weight of that part of the mercury thus displaced being about equal to the weight of the switch-block. The weight of the switch-block is thus reduced to a minimum at the moment of attraction, and when attracted to the point of contact it displaces very little

mercury, in consequence of which fact the switch-block having regained nearly all of its weight more readily returns to its position of repose.

Important objects of the invention are to assure the breaking of the current upon the happening of an accident of any description, to reduce to a minimum the number of insulated points, the amount of insulating material required, and the number of points at which the current is fed, and to reduce the cost of installation.

The technical advantages appertaining to my improvements will appear from a consideration of the following description.

In the accompanying drawings, which form a part of this specification, and wherein like parts are indicated by like letters of reference, Figure 1 represents, diagrammatically, the general arrangement of a system embodying my invention. Fig. 2 is a vertical cross-section of the switching mechanism and of the casing inclosing the same. Fig. 3 is a fragmentary sectional view, on an enlarged scale, of the switch-block or circuit-closing device and means for connecting the cables K K to the reservoir containing the mercury. Fig. 4 is a detail sectional view on the line 3 3 of Fig. 3. Fig. 5 is a detail sectional view through the coupling-piece *f* at right angles to Fig. 3. Fig. 6 is a top plan view of the coupling-piece *f*. Fig. 7 is a top plan view of the means for connecting the cables to the coupling-piece *f*; and Fig. 8 is a vertical sectional view, on an enlarged scale, of the switch-block in its normal condition of repose and of the connection between it and the underground cable, the said view also showing in elevation a fragment of the post depending from the contact-piece.

Referring to the drawings, S indicates the rails; K, the underground conductor for the electric current; A A' A<sup>2</sup> A<sup>3</sup> A<sup>n</sup>, a series of contacts or devices for feeding the current, one of which being shown on an enlarged scale in section in Fig. 2.

G indicates the dynamo for supplying the current, E an electromotor, and M the electromagnets by which the bar *a* is magnetized. The electromagnets M, the number and position of which may be varied, are excited by a shunt or block circuit, and they all im-



part to the bar *a* polarization of the same nature. The electromagnets *M* form, together with the bar *a* and the auxiliary bar *l*, a truss, which is adapted to be located conveniently  
 5 under a car or carriage and carried thereby and to be insulated therefrom.

The switching mechanism is inclosed in the casing *p*, which is preferably round and beneath which is located the conduit for the  
 10 electric cable *K*, as shown in Fig. 2. A part of the top casing is composed of soft iron and is indicated by *b*, and it serves as a contact-piece and as a medium through which the magnetic forces attract the circuit-closing device  
 15 *d*, which I otherwise term a "switch-block." The contact-plate *b* projects above the ground sufficiently to permit of proper and suitable sliding contact of the polarized bar *a*, which serves to collect the current. The contact-  
 20 plate *b* is provided with a post or projection on its under surface, which attracts the circuit-closing device or switch-block *d*, as presently explained. The contact plate or piece *b* is insulated magnetically and electrically  
 25 with reference to the cast-metal casing *p* by means of suitably-prepared wooden blocks *h* and strips of pure rubber *g'*, all as shown in Fig. 2. The wooden blocks *h* rest upon the casing *p*, as shown in Fig. 2, and are held in  
 30 place by the pressure of the cover or contact plate *b*, which latter is secured in place by posts *b'*, connected to the contact-piece *b* and to an insulated stirrup co-operating with the wooden sleeper *b*<sup>2</sup>.

The connection between the coupling-piece *f* and the cables *K K* is illustrated in Figs. 3 to 5, in which *p'* indicates a plate resting on the bottom of the casing *p* and secured in place by the screw-bolts and lock-nuts *p*<sup>2</sup> *p*<sup>3</sup>.  
 40 Through the center of plate *p* passes the cables *K K*, the ends of which are secured within the screw-threaded openings of the split base of the coupling-piece *f* by the bolt and nut *f'* *f*<sup>2</sup>, as shown in Fig. 5. This piece *f*,  
 45 Figs. 2 and 3, serves to unite the wires of the cables *K K* and also as the feeder for the current. Its upper end is made of conical form, which is adapted to receive the lower end of a reservoir *e*, containing mercury *q*, into which  
 50 the circuit-closing device *d* is adapted to dip. The mercury-inclosure and the mercury are used to form an electric connection between the coupling-piece *f* and the circuit-closing device *d*, and the connection is made between  
 55 circuit-closer *d* and the projection *c* by magnetic adherence when the bar *a* slides over contact-plate *b*, and when this occurs the current is from cable *K* to coupling *f*, reservoir *e*, mercury *q*, circuit-closer *d*, projection *c*, to  
 60 contact-plate *b*.

The attraction of the switch-block or circuit-closing device *d* by the contact-plate *b* is effected, owing to the fact that as the magnetized bar *a* slides over contact-piece *b* there  
 65 is produced at the end of its post or projection *c* a pole of the same nature as that in the bar *a*. The contact-surfaces of the projec-

tion *c* and switch-block *d* are carefully galvanized, or instead thereof they may be plain surfaces capable of magnetic adherents, with  
 70 mercury inclosure and depending upon the movement of switch-block *d*.

The circuit-closing mechanism is all within the casing *p*, and the atmosphere is the only insulating material.  
 75

It will be seen that the switch-block *d* is attracted by the contact-piece *b* only while the bar *a* is in sliding contact with said contact-piece, and that the switch-block falls back into its resting-place when the car carrying  
 80 the magnetized bar passes beyond the particular contact-piece and thus uncovers it. The contact pieces or plates are arranged uniform distances apart, and the distance is something less than the length of the bar *a*,  
 85 so that in operation the circuit is always closed, but only through the medium of that particular contact-plate that is for the time being covered and protected by the car or carriage.  
 90

If, owing to any possible accident, any carriage should come to a stop, the same would be promptly set in motion again by placing upon the contact-plate *b* of one of the casings  
 95 *p* a permanent magnet of sufficient force and of the same character as magnets *M*, the circuit-closing device *d* within the casing will be attracted to the projection *c*, and the contact-plate *b* will then become active and an electrical connection will be formed between the  
 100 contact-plate *b* and the bar *a* of the car, thus exciting electromagnets *M* of the car, and thereby establishing an electric current between said magnets and the underground cables. By means of these temporary connections any one of the parts involved can be  
 105 readily exchanged without stopping the travel of the carriages on the line.

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

1. The combination with a conduit inclosing the underground conductor or conductors, a series of contact plates or pieces in the top of said conduit and insulated from the ground  
 115 and provided with projections on their inner surfaces, and circuit-closers comprising a bar of soft iron and a cylinder containing mercury, said circuit-closers communicating with the underground conductor, of electrical ap-  
 120 pliances supported on a car or carriage and including a magnetized bar which is adapted to glide over aforesaid contact plates or pieces and thus connect said plates or pieces with the underground conductor through magnetic  
 125 induction from the carriage, the aforesaid circuit-closers returning to the position of repose by their own weight when the magnetized bar completely uncovers the contact plates, substantially as set forth.  
 130

2. The combination with an underground conductor, a series of contact plates in the top of the underground conduit and electrical appliances supported on a car or carriage and



including a magnetized bar, of circuit closing devices in permanent connection with the underground conductor through a body of mercury, the said circuit closing devices operating to displace a portion of the mercury whereby the weight of the said devices is diminished at the moment of attraction by the contact plates, substantially as set forth.

3. In an electric railway, with underground distribution of current, a circuit closing device comprising a cylinder, as *e*, containing a quantity of mercury, a rod or piston operating

ing within the mercury in said cylinder and a coupling piece, as *f*, serving to unite the wires of the conducting cable and as a feeder for the current, substantially as set forth. 15

Signed at the consulate of the United States of America at Turin, Italy, this 22d day of August, 1894.

ALFREDO DIATTO.

Witnesses:

SENSO HELLOS,  
RAFFAELE ROSSE.