(No Model.) 5 Sheets—Sheet 1

G. F. GREEN.

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS.

No. 504,977. Patented Sept. 12, 1893.

Fig. 1.

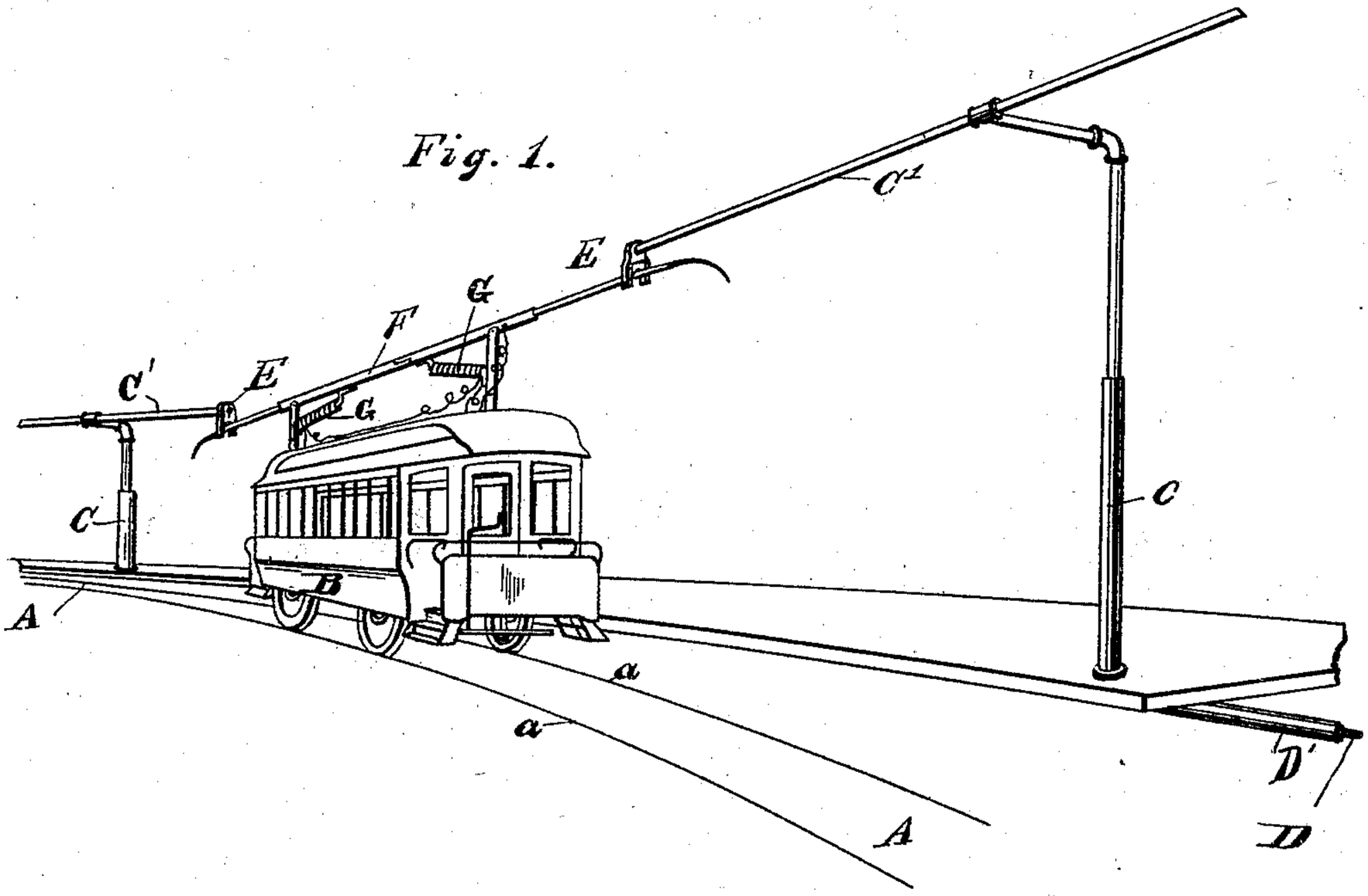
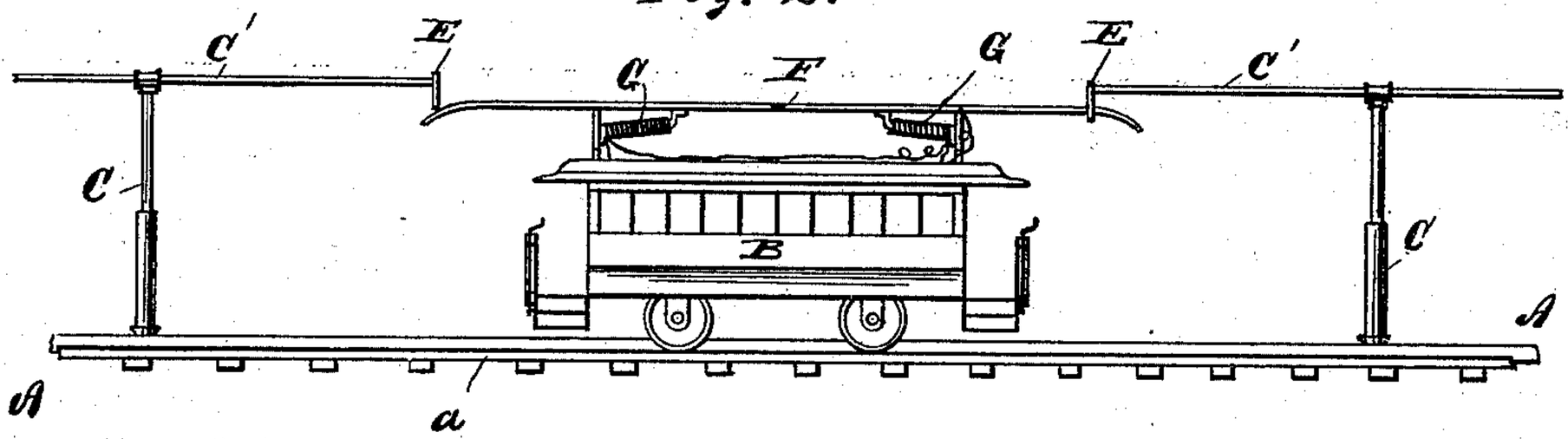


Fig. 2.



Witnesses
Chas. E. Riordon.
H. E. McCabe.

Inventor
Geo. F. Green
By his Attorneys
Butterworth & Dowell

(No Model.) 5 Sheets—Sheet 2.

G. F. GREEN.

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS.

No. 504,977. Patented Sept. 12, 1893.

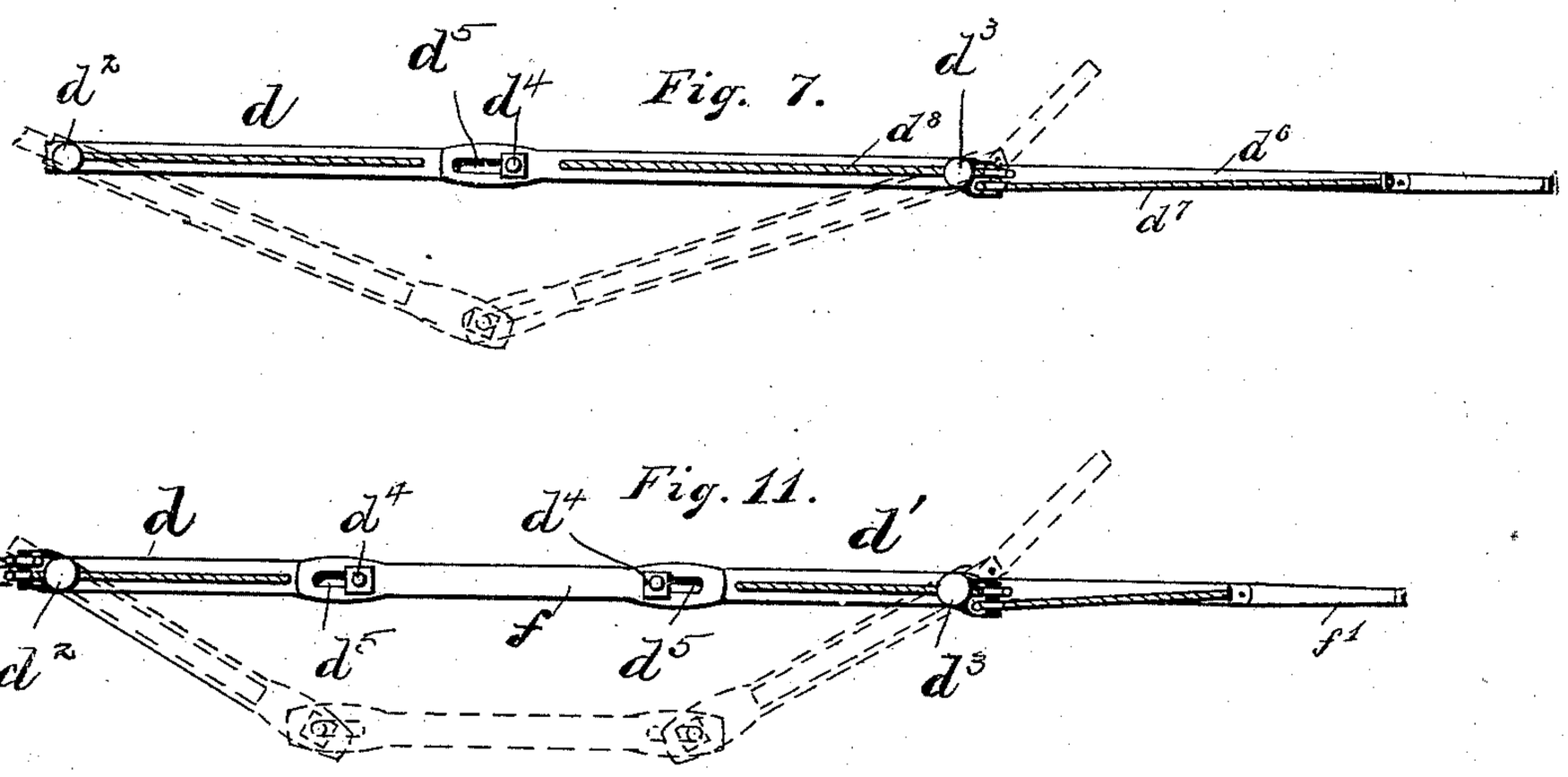


Fig. 7.

Fig. 11.

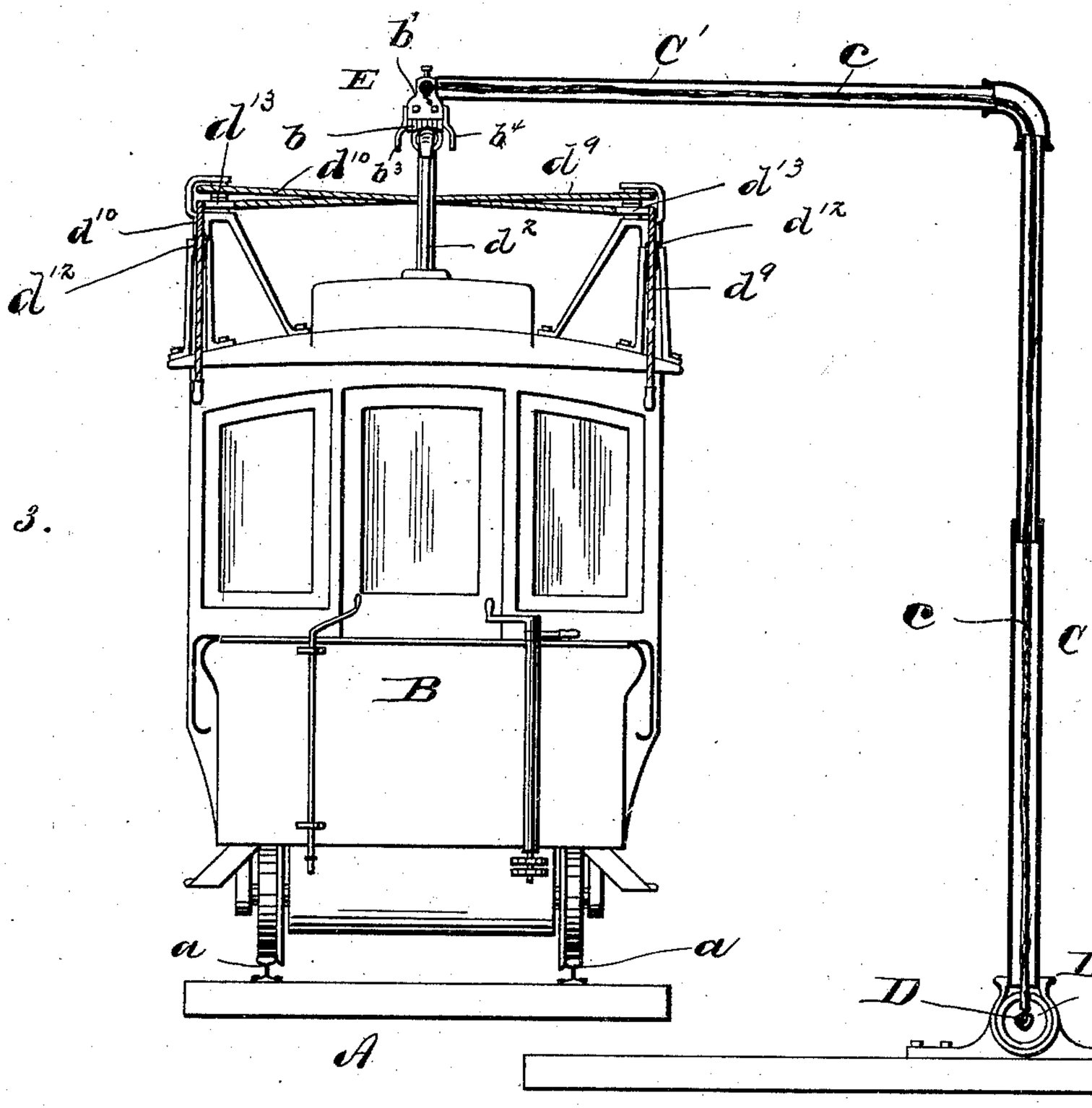


Fig. 3.

Witnesses
Chas. E. Riordon.
N. E. McCabe.

Inventor
Geo. F. Green
By his Attorneys
Butterworth & Dowell

(No Model.) 5 Sheets—Sheet 3

G. F. GREEN.

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS.

No. 504,977. Patented Sept. 12, 1893.

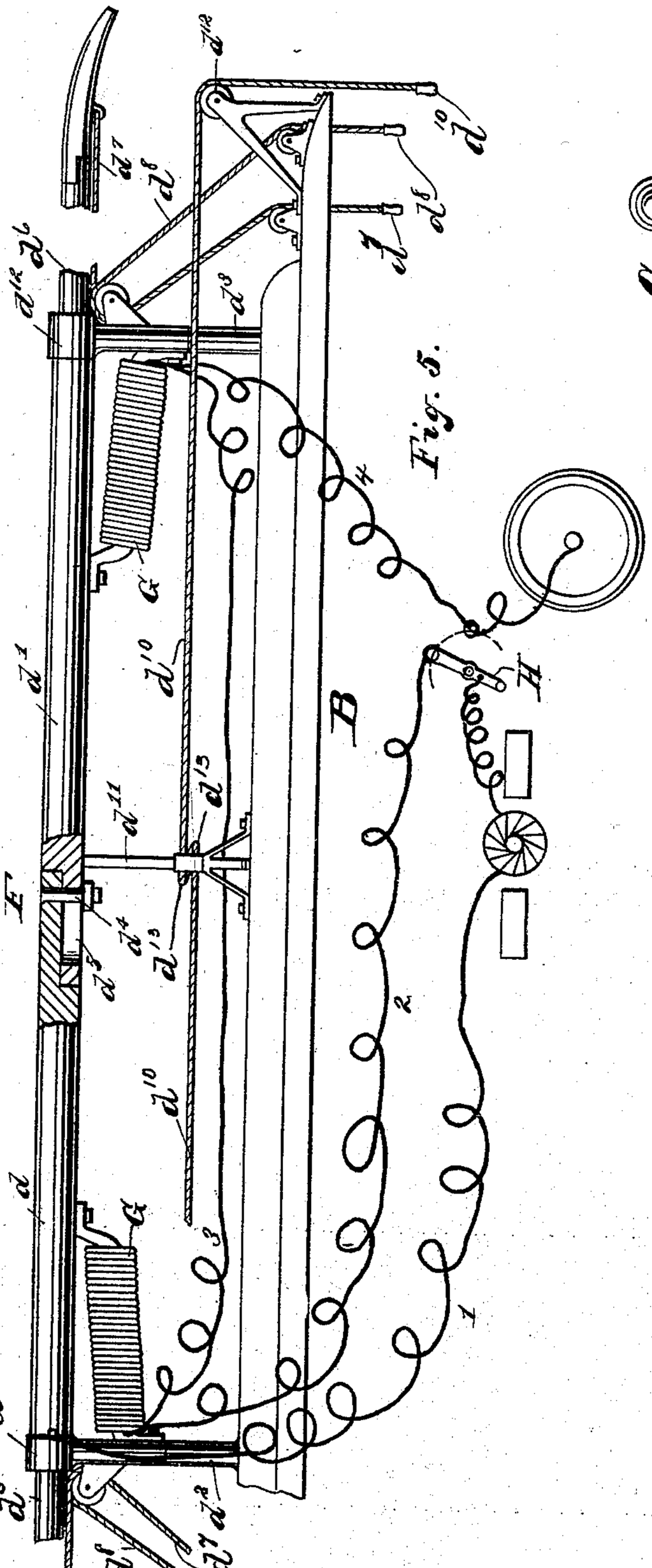


Fig. 5.

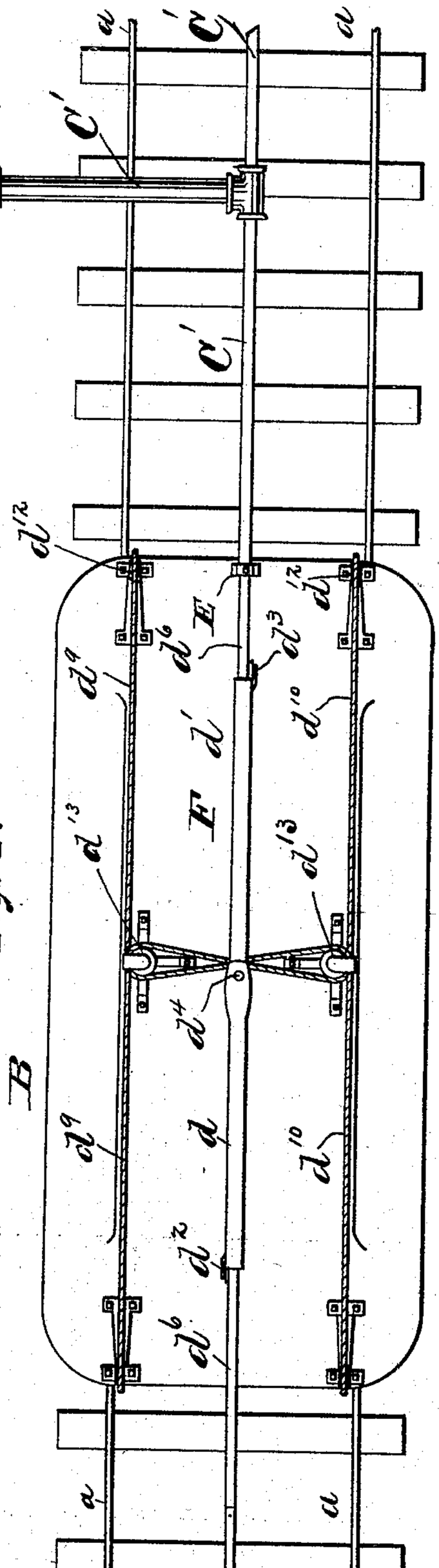


Fig. 4.

Witnesses
Chas. E. Riordon.
N. E. McCabe

Inventor
Geo. F. Green
By his Attorneys
Butterworth & Dowell

(No Model.) 5 Sheets—Sheet 4.

G. F. GREEN.

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS.

No. 504,977. Patented Sept. 12, 1893.

Fig. 8

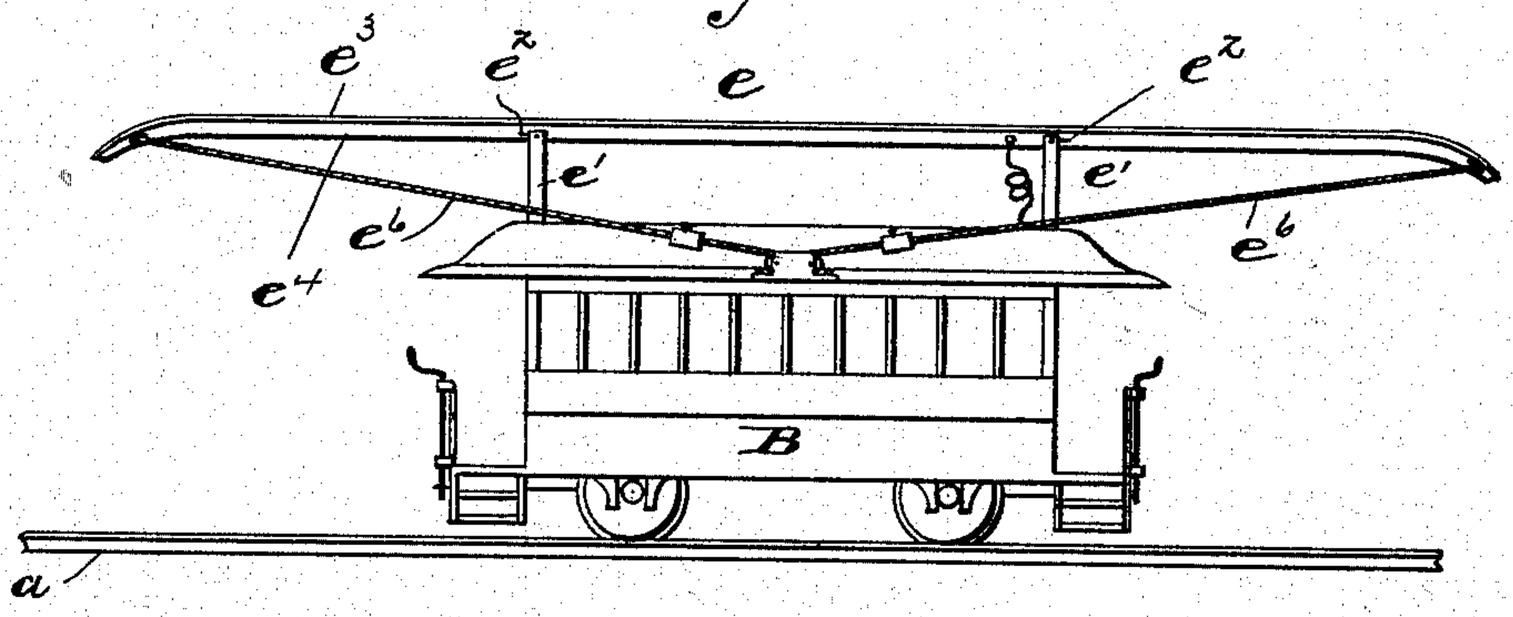


Fig. 9

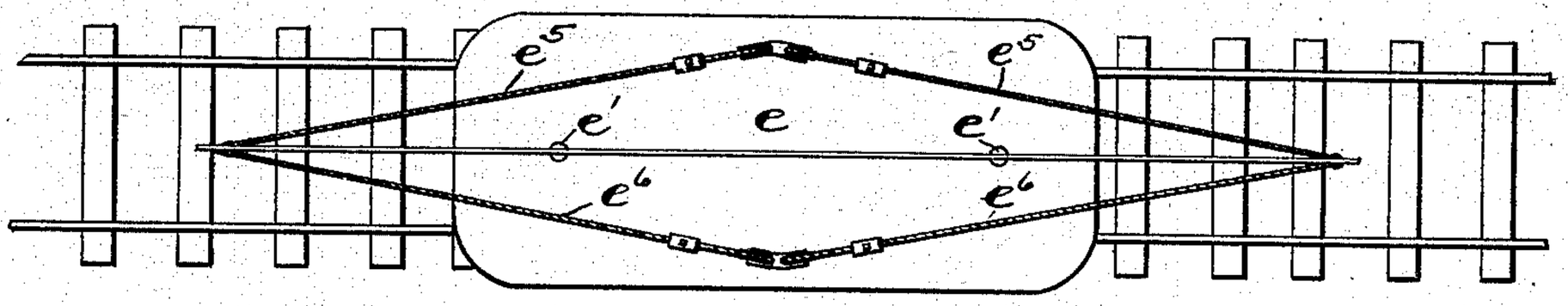


Fig. 10

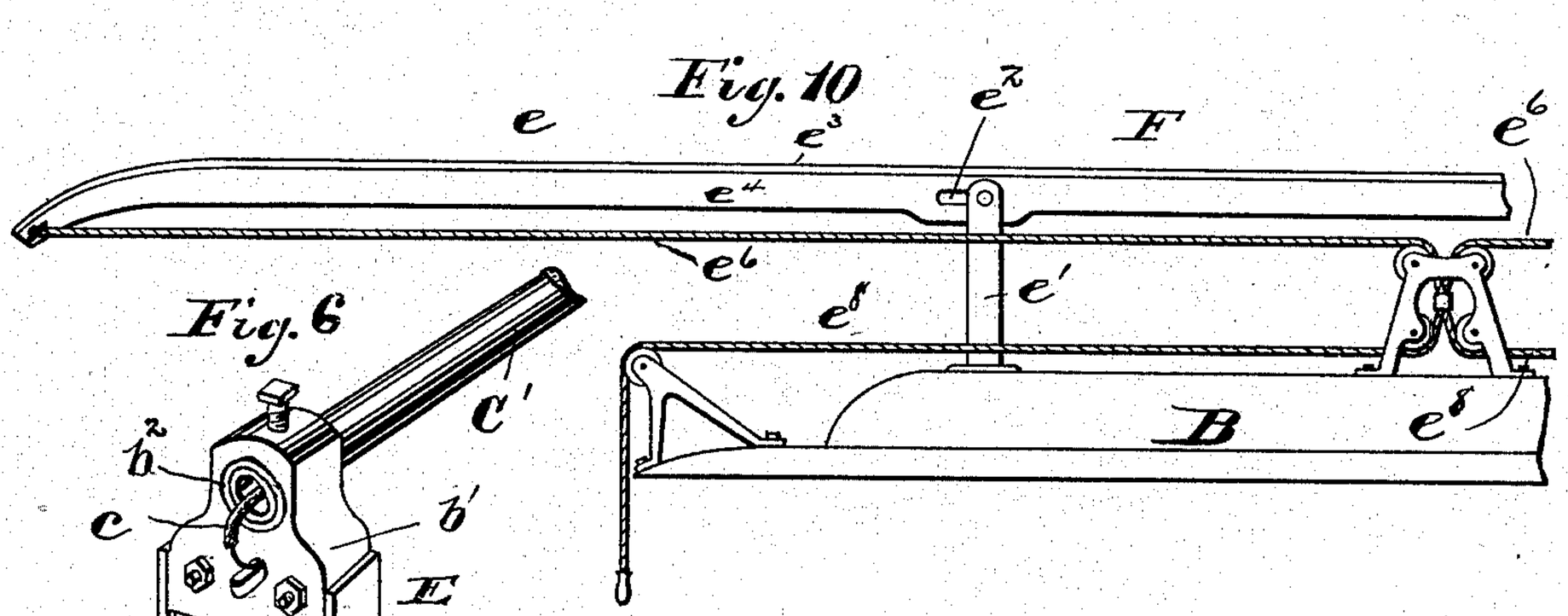


Fig. 6

Witnesses
Chas. C. Linday
N. E. McCabe

Inventor
Geo. F. Green
By his Attorneys
Butterworth & Dowell

(No Model.) 5 Sheets—Sheet 5.

G. F. GREEN.

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS.

No. 504,977. Patented Sept. 12, 1893.

Fig. 12.

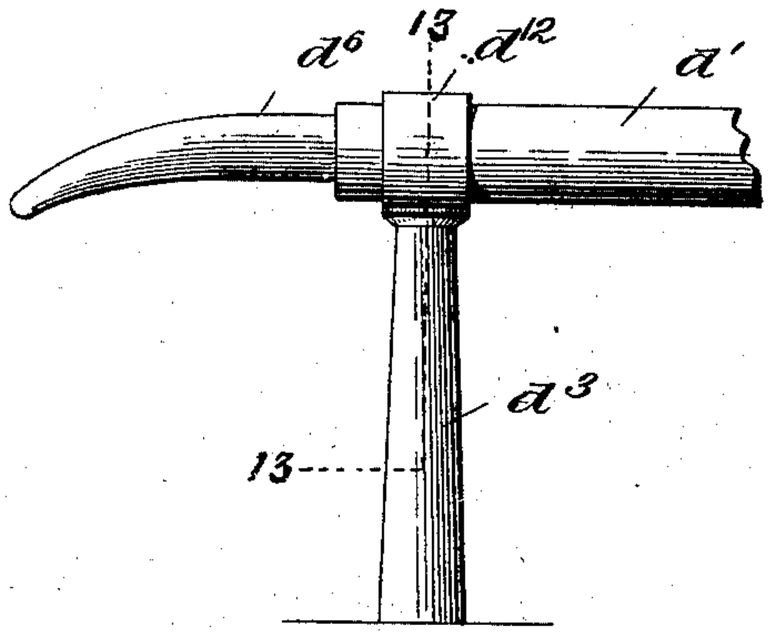


Fig. 13.

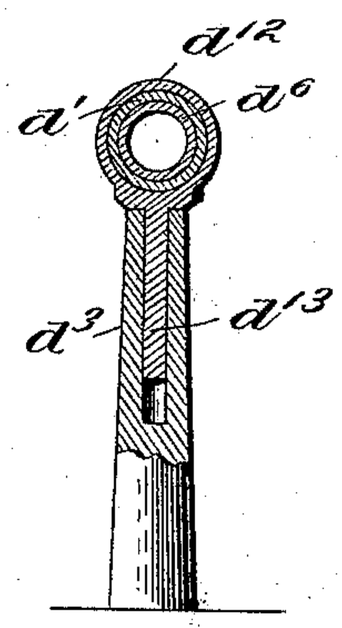


Fig. 14.

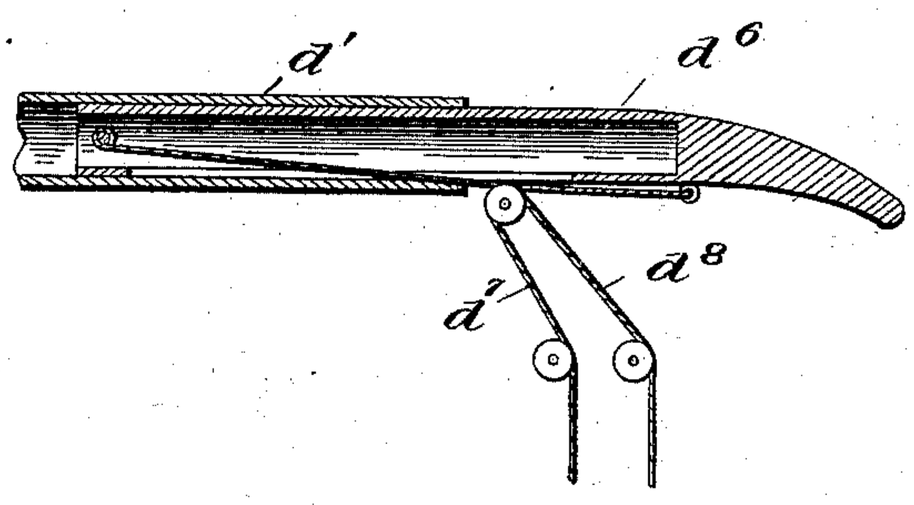
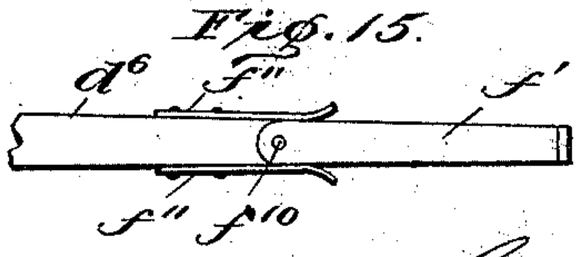


Fig. 15.



Witnesses
Edwin L. Bradford
E. Everett Ellis

Inventor
George F. Green
By Butterworth & McDowell
his Attorneys

UNITED STATES PATENT OFFICE.

GEORGE F. GREEN, OF KALAMAZOO, MICHIGAN, ASSIGNOR OF ONE-HALF TO OLIVER S. KELLY, OF SPRINGFIELD, OHIO; MARTHA L. GREEN EXECUTRIX OF SAID GEORGE F. GREEN, DECEASED.

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 504,977, dated September 12, 1893.

Application filed February 13, 1892. Serial No. 421,440. (No model.)

To all whom it may concern:

Be it known that I, GEORGE F. GREEN, a citizen of the United States, residing at Kalamazoo, in the county of Kalamazoo and State of Michigan, have invented certain new and useful Improvements in Electric Railways, of which the following is a specification.

My invention relates to improvements in electric railways and it especially relates to improvements in the means for conveying an electric current to a moving car.

The primary object of my invention is to dispense with the ordinary overhead conductors, commonly known as the trolley wire and to provide means for forming an electrical connection between the moving car and stationary source of electric supply.

My invention consists in the various constructions and combinations of parts hereinafter described and pointed out in the claims.

In the accompanying drawings Figure 1 is a view in perspective of a portion of an electric railway to which my invention has been applied. Fig. 2 is a side elevation of the same. Fig. 3 is an end elevation of the same some of the parts being shown in section in each of said views. Fig. 4 is a plan view showing a modification of some of the parts. Fig. 5 is a partial sectional elevation of the same, the arrangement of the circuits being illustrated in diagram. Fig. 6 is a detail in perspective of one of the stationary contact devices. Fig. 7 is a bottom plan of the moving contact device in detail. Figs. 8 and 9 are respectively, an elevation and a plan showing a modification. Fig. 10 is a detail in elevation of a portion of the same on a larger scale. Fig. 11 is a plan view showing in detail a further modification in the moving contact device. Fig. 12, is a detail side view showing the manner of pivotally connecting the members d, d', of the conductor F to the standards d^3. Fig. 13, is a section on the line 13—13 of Fig. 12. Fig. 14 is a detail sectional view showing the manner of telescoping the fingers d^6 within the conductor F; and Fig. 15 is a detail view showing the manner of pivoting the finger points f' to the members d^6.

Like parts are represented by similar letters and figures of reference in the several views.

It has been common in operating electric railways to employ a continuous overhead conductor constantly charged with an electric current and to furnish the electro-motive force to propel a moving car through the medium of a conductor on said moving car which moves in contact with said overhead conductor. The conductor thus employed, usually termed a trolley wire, cannot be insulated from the very nature of the work it has to perform. Its use is therefore attended with considerable danger. I overcome this difficulty by employing a series of contact points or stations normally charged from a conductor which may be insulated and is preferably laid under ground or in a suitable conduit at or near the surface of the ground, the contact stations being removed from each other and being so constructed that they may be insulated or protected against contact with other wires or conductors.

In the drawings A A, represents a line of railway, B, a car adapted to travel over the rails a a, of the railway, which are preferably adapted to form the return circuit for the electric current after it has passed through the motors on the car.

C C, are supporting posts arranged at suitable intervals along the line of road and when the railway occupies the street of a town or city, the post C, may be placed at or near the curb line of the said street. Extending along under the respective posts C, or in proximity thereto is the conductor D, which leads from the stationary source of supply of the current and which preferably passes through a conduit or subway D', below the surface of the street or side-walk. Each of the posts C, is provided with an extended arm or arms C', which are branched or curved so as to lie adjacent to and preferably over the line of railway A A. The supporting-arms C' of the said posts C, are provided with contact devices E, which are arranged at the ends of the respective arms on each side of the respective posts but preferably vertically above the railway track. The contact devices E, are preferably

formed in the nature of brushes *b*, constructed of copper or other resilient metal and supported in a suitable frame *b'*, connected to the supporting arm C', and insulated from said arm preferably by means of a rubber sleeve b^2, located between said arm and the frame *b'*, the brushes *b*, being kept in electrical connection with the conductor D, through the medium of a suitable connecting wire *c*, which passes through the arms C', and the post C, to the main conductor D, the post and arms being preferably formed hollow for this purpose.

Located on the car B, is the contact device F, preferably mounted on top of the car and above the roof of the same and extended throughout the length of the car for a considerable distance beyond the respective ends thereof, the length of the contact device or conductor F, being slightly greater than the distance between any two of the normally stationary contact devices E, so that one end of the conductor F, remains in electrical connection with a stationary contact device E, until it contacts with the next succeeding device.

From the contacting device F, a circuit is provided which includes the ordinary circuit controllers, the motors which operate the car and the car-wheels in the ordinary manner, so that any current received by the conductor F, can be conveyed in the ordinary way through the motors and discharged to the rails in any well known and suitable manner.

To provide for changing direction passing around curves, &c., I preferably form the contacting conductor F, in parts jointed together in such a manner that the several parts may assume different angular positions with reference to each other, so that the said conductor may remain in electrical connection with the stationary contact devices E, on the supporting posts. I also preferably form the extending arms of the supporting posts of metal with a certain amount of resiliency to permit them to yield in any direction with the same end in view.

To further assist in bringing the moving conductor into electrical connection with the stationary contact devices I provide means for establishing a magnetic field in the conductor F, adapted, as the conductor approaches one of the stationary contact points to cause the respective contact devices to be attracted to each other and thus insure the contact between the same. This I accomplish by providing electro-magnets G, the magnetic cores of which are connected to the conductor F, the coils of said magnet being excited by passing the current which operates the motors through said coils before passing it to the rails, as illustrated in Fig. 5, a circuit controlling device H being placed in convenient reach of the operator, by means of which the current may be passed direct to the rails from the motor or through the coils of the electro-magnets G, as desired. When the controlling device is in the position shown in Fig. 5 the current passes from the source of supply through the conductor F thence down through the wire 1, through the motor, from thence to the controlling device H, through the magnet coils over the wires 2, 3 and down the wire 4 to the wheels and rails. The magnets G are thus excited and operate to attract the conductor F and brushes E toward each other, it being borne in mind that one of said brushes is constantly in electrical connection with the conductor F. By swinging the controlling device H over into contact with the wire 4 the magnets are cut out of the circuit which then passes directly from the conductor F through the wire 1 to the motor and from thence to the rails.

In Figs. 4, 5 and 7 I have shown a construction of the conductor F, in which two central portions *d d'*, are pivotally connected to supporting standards d^2, d^3, on the car and pivotally connected together at or near their centers by a pivot connection d^4, which passes through a slotted opening d^5, in one of the parts. Each of the parts *d d'*, is formed hollow and is adapted to receive at its outer extremity a movable arm or finger d^6, adapted to be telescoped into or out of the part *d'*, and thus extend or reduce the length of the conductor F. This movement of the fingers d^6 is effected by ropes d^7 and d^8 (see Fig. 5). The rope d^7 is secured near the outer end of the finger and then passes over suitable pulleys to a point where it can be easily reached by the operator. A slight pull on this rope d^7 forces the finger into the hollow conductor F. The cord d^8 is attached to the finger d^6 at a point adjacent to its inner end, and passes over a pulley located near the end of the car roof. This cord serves to draw the finger outwardly to extend the length of the conductor F. This may be accomplished by making the finger d^6 hollow and slotting it for a portion of its length, as shown in Fig. 14, the cord d^8 passing up through the slot and into the interior of the hollow finger d^6 and secured thereto near its inner end. In practice there will be provided two sets of cords d^7, d^8, one at each end of the car, whereby the fingers d^6 may be independently operated according to the direction in which the car may be traveling.

I also preferably provide means for deflecting the respective parts *d d'*, to cause them to assume different angular positions in making contact with the stationary contact devices. This may be accomplished by the employment of rope connections d^9, d^{10}, on each side of the conductor F, the ends of which are connected to a rod or arm d^{11} depending from the conductor F, the said rope connections passing over suitable supporting pulleys d^{12} d^{13} to within convenient reach of the operator, so that the pivoted parts *d d'*, may be moved

laterally in either direction at the center to cause them to assume different angular positions as shown in dotted lines in Fig. 7.

In Figs. 8, 9 and 10 I have shown a conductor F, of different mechanical construction. In this construction I preferably employ a single bar *e*, supported on standards *e'*, to which it is connected through slotted openings e^2. This bar is preferably formed of two or more different metals e^3 e^4, the upper part e^3, being preferably formed of copper or some other good electrical conductor and the lower part e^4, being formed of steel with a certain amount of resiliency to permit it to bend or yield laterally in either direction. Rope connections e^5 e^6, are extended from the respective ends of the flexible conductor to a point at or near the middle of the length of the car but at one side of the same, the respective ropes e^5 e^5 and e^6 e^6, from opposite ends of the conductor being joined together at this point and attached to ropes e^7 e^8, which lead to opposite ends of the car in convenient reach of the operator, means being thus provided by which the respective ends of the flexible conductor may be moved laterally to cause it to assume the arc of a circle in passing curves or changing direction.

In Fig. 11 I have shown still a different modification, a central bar *f*, being in this case provided between the pivoted bars *d d'*, as shown in Figs. 4, 5 and 7. I have also shown in this view and more clearly shown in Fig. 15 a pivoted finger *f'*, at the outer extremity of the telescopic arm d^6, and pivoted thereto, as at f^{10}, adapted to be moved by the magnetic influence exerted between the stationary contact device and said finger, when the coils of the electro-magnets are excited, as hereinbefore described.

It should be stated that the supporting posts C, and their arms, C', are preferably made of a tubular construction, the conductors which pass to the respective contact devices E, extending through the hollow portions thereof, said conductors being suitably insulated. The brushes *b*, which form the contact proper in the stationary devices E, are also preferably formed of alternate strips of copper and iron or some other metal susceptible to magnetic influences. I also preferably provide said contact devices with guide-wings b^3 b^4 which project downwardly at each side of the brushes to assist in guiding the moving conductor through the stationary contact device and in contact with said brushes, these guides as well as the frame which supports the contacting brushes being preferably made of iron or other metal susceptible to magnetic influences.

The switch H, is designed to control the flow of current to the magnets G. When said switch is open as shown in Fig. 5 the magnets are included in the motor circuit, but when the switch is closed, the magnets are cut out and the current will pass directly to the rails or ground.

It is obvious that various other modifications of the devices herein described may be employed without departing from the spirit of my invention. I do not, therefore, limit myself to the exact construction herein set forth, but

I claim, broadly, as my invention—

1. In an electric railway, the combination with a source of supply and with a moving car, of stationary contact devices located at intervals along the line of railway and constantly in electrical connection with the source of supply, a contacting conductor on the car adapted to successively contact with said stationary devices, electro-magnets for magnetizing said conductor, and a switch for cutting said magnets out of circuit, substantially as described.

2. In an electric railway the combination with a source of supply and a moving car, of stationary contact devices connected electrically with the source of supply, and located at intervals along the line of railway, and a contacting conductor on the car, provided with adjustable arms, and means for extending and contracting the length of said conductor, substantially as described.

3. The combination with a source of supply, a moving car, and stationary contact points located at intervals along the line of the railway, of a contacting conductor carried by the car, means for magnetizing said conductor, and means for varying the length thereof, substantially as described.

4. The combination with the source of supply, of a moving car, stationary contacts located at intervals along the railway, a contacting conductor carried by the car and consisting of sections pivotally secured together at their adjacent ends and sliding in pivoted bearings at their opposite ends, and means under control of the operator for adjusting said sections laterally, substantially as described.

5. The combination with the source of supply, of a moving car; stationary contacts located at intervals along the line of the railway; a contacting conductor on the car; means for adjusting said conductor longitudinally and means for effecting lateral movements thereof, substantially as described.

6. The combination with the source of supply, the moving car and the stationary contact points, of a conductor carried by the car and provided with telescoping arms; and cords and pulleys for adjusting said arms, substantially as described.

In testimony whereof I have hereunto set my hand this 1st day of February, A. D. 1892.

GEORGE F. GREEN.

Witnesses:
H. O. OSTER,
FRANK WAIT.