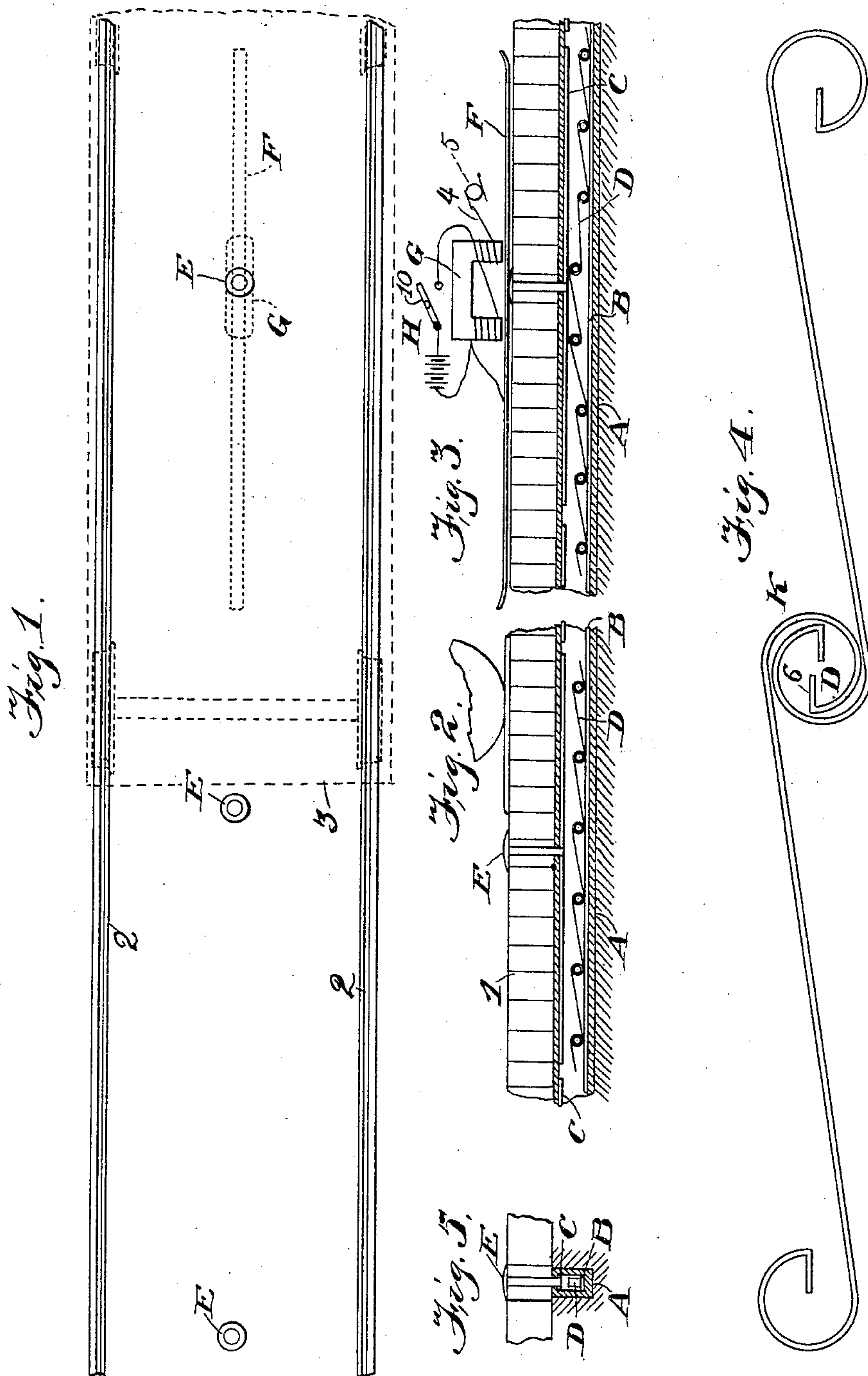


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PATENTED DEC. 27, 1904.

H. B. GREENWOOD.
ELECTRIC TRACTION.

APPLICATION FILED JULY 16, 1904.



WITNESSES:

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ELECTRIC TRACTION.

SPECIFICATION forming part of Letters Patent No. 778,832, dated December 27, 1904.

Application filed July 16, 1904. Serial No. 216,916.

To all whom it may concern:

Be it known that I, HENRY BROWN GREENWOOD, a citizen of Great Britain, residing at 291 Calle San Martin, in the city of Buenos Ayres, Argentina, have invented certain new and useful Improvements in Electric Traction, of which the following is a specification, reference being had therein to the accompanying drawings.

10 This invention relates to electric railways, and particularly to the class in which the current for operating the traction-motor traverses a conductor upon or in the ground; and its object is to provide improved means for insur-
15 ing safety to those walking upon or across the railway.

I employ a conduit, preferably underground, for containing the main conductor, which owing to its situation cannot become acci-
20 dentally short-circuited with the tram-rails which usually form the other side of the traction-circuit, and in order to conduct current from said main conductor to the car I employ a shoe or skate upon the latter, which is adapted
25 to engage a succession of well-separated contacts projecting slightly above the ground. Said contacts are normally out of electrical connection with the said main conductor, and hence no short-circuiting can occur between
30 one of said contacts and one of the tram-rails; and one of the main features of my invention consists in the provision of novel means for enabling the passage of the car to effect electrical connection between said main conductor and
35 said contacts in succession.

In the accompanying drawings, Figure 1 represents a portion of an electric railway, showing in dotted lines a portion of a car thereon. Fig. 2 is a longitudinal sectional
40 elevation showing the construction of a conduit and the arrangement of parts therein. Fig. 3 is a similar view to Fig. 2, but showing the position of the parts when a car is passing over a section, the contact-shoe upon
45 the car being illustrated as well as a magnet thereon which controls a cable shown in the conduit. Fig. 4 is a view, upon a larger scale, of a portion of the preferred form of cable for the conduit. Fig. 5 is a cross-section
50 through the conduit.

Immediately beneath the ground or paving
1 I place a conduit A of small cross-section, which may be either insulated or composed of insulating material. Lying upon the floor of said conduit and extending throughout its
55 length, and preferably fixed to the conduit or embedded therein, is a continuous or unbroken electric conductor B, which I call the "main" conductor. Within the conduit and at-
60 tached to its roof or upper part is a succession or series of strips or sections C of conducting material, forming contact-plates. These sections are insulated each from the next, preferably by merely setting them at short inter-
65 vals, as shown. Each section may be about three meters long.

Lying directly upon the main conductor is a flexible cable D, which extends through the conduit for its entire length. This cable preferably consists of a succession of similar links
70 loosely connected. It may consist of a combination of chain and ribbon or be variously formed within the scope of the invention. It is liftable by a magnet carried by the car and presently to be described, and for this
75 purpose the cable is preferably made of iron or steel, to be attracted by the magnet, although a combination of metals may be used. This cable may be termed a "subconductor."

Midway between the tram-rails 2 I place a
80 series of contacts E protruding slightly above the ground, each contact extending down through the paving 1 to one of the sections C and being electrically connected thereto. Owing to the insulation of the sections C from
85 one another, there is no electrical connection between successive contacts E, these being separated by intervals equaling the length of a section C.

Suspended from the tram-car 3 is a shoe or
90 contact F, preferably beneath the car, and of such length as to contact simultaneously with two of the contacts E—that is, having a length slightly in excess of the distance between two
95 of the contacts E—so that at no time is the car disconnected from a contact E. Upon the car is provided an electromagnet G, which at first may be temporarily excited by means of an accumulator provided upon the car. This
100 magnet stands directly over the conduit and

is placed at the bottom of the car and has sufficient power to lift up the underlying links of the cable D and force them into effective contact with the sections C, the cable remaining of course unbroken, whereby electrical connection is established between the main conductor B and the section or sections C immediately beneath the car. The magnet G is excited by the current furnished by a few cells of accumulators H and attracts the underlying portion of the cable or subconductor D from the lower to the upper portion of the conduit, lifting the same against the overlying section C, thereby making the electrical connection from the main conductor to the latter. The current now traverses the main conductor B, the cable D, including the up-lifted link or links, the contact plate or section C, which is beneath the car, the contact E, the shoe F, the motor-circuit 4, the motor 5, and the rails 2. The electromagnet G is included in the motor-circuit, and after the car is started the accumulators H may be cut out. This may be effected by means of the switch 10. The successive portions of the cable are lifted during the progress of the car, so that the motor-circuit is always supplied with current, no matter at what part of the line the car may happen to be. When connection with the main conductor is established, the current is caused to operate the motor by means of the contact-switch in the usual way. If the cable should be dropped at any time, as by stoppage of the car, it may be again picked up by the electromagnet upon causing the accumulator to excite the latter.

The particular form of subconductor or cable shown at Fig. 4 consists of a chain composed of links of sheet metal each nearly the width of the conduit, so as to be guided thereby, while moving freely up and down therein, and each link is longer than the distance between the main conductor B and the overlying section C, so that it slants from one to the other, while in contact with both, although in some instances the link may be lifted bodily upward and lie full length against the section C, while of course remaining a part of the cable, and hence electrically connected to B. Preferably each link is several times the length of a line extending vertically from B to C. The links may hook together, each link being S shape for this purpose, and they may curl, as shown at Fig. 4, K, one end up and the other end down, the curl in each link terminating in a short horizontal offset portion 6 for better security. The links are readily caught together by inserting one side-wise into another to form the chain. Their form insures perfect freedom of motion and facility for removing any particular link, while at the same time insuring perfect contact between the main conductor B and the contact-plates C without presenting any intermediate joints.

Variations may be resorted to within the scope of my invention.

Having thus described my invention, I claim—

1. In combination, a conduit, a main conductor extending through said conduit, a succession of separated conductor-sections in position for engagement with a contact or shoe carried by a car, and a cable comprising a succession of links detachably hooked together and lying against said main conductor in said conduit and liftable at successive points by a magnet upon the car so as to form electrical connection between said main conductor and said sections in succession during the progress of the car, each link being formed of sheet metal and being of nearly the width of the conduit so as to be guided thereby while moving freely up and down, and being materially longer than the distance between the main conductor and the overlying section.

2. In combination, a conduit, a main conductor extending through said conduit, a succession of separated conductor-sections having portions for engagement with a contact or shoe carried by a car, and a cable comprising a succession of links detachably connected and lying against said main conductor in said conduit and liftable at successive points by a magnet upon the car so as to form electrical connection between said main conductor and said sections in succession during the progress of the car; the length of each link being several times greater than the distance separating said main conductor from said sections.

3. In combination, a railway comprising a pair of rails or tracks laid along the ground, a conduit extending along the railway between said tracks, a main conductor extending through said conduit, a succession of separated conductor-sections sunken below the surface of the ground and having portions for engagement with a contact or shoe carried by a car, and a cable comprising a succession of links and lying against said main conductor below said sections and out of contact with the latter and liftable at any point by a magnet upon the car, so as to form electrical connection between said main conductor and said sections in succession during the progress of the car; each link being of a width to nearly fill the conduit, and of a length several times greater than the distance separating said main conductor from said sections.

4. In combination, a main conductor, a succession of separated conductor-sections having parts for engagement with a contact carried by a railway-car, and a cable comprising a succession of links and lying upon said main conductor at a short distance below said sections and liftable by a magnet upon the car so as to form electrical connection between said main conductor and said sections in succession during the progress of the car; each link being of a length several times greater than the dis-

tance between the main conductor and the sections, and of a width nearly equal to the width of the conduit, and consisting of a single piece and being detachable from the next link.

5 5. In combination, a main conductor, a succession of separated conductor-sections having parts for engagement with a contact carried by a railway-car, and a cable comprising a succession of links and lying upon said main conductor and out of contact with said sections and liftable into contact with the latter by a magnet upon the car, each link having ends which hook into the adjoining links, and being of a length several times greater than the
10 distance between the main conductor and the sections and of a width nearly equal to the width of the conduit.

6. In combination, a main conductor, a succession of separated conductor-sections having
20 parts for engagement with a contact carried by a railway-car, and a cable comprising a succession of links and lying upon said main conductor and out of contact with said sections and liftable into contact with the latter by a
25 magnet upon the car, each link having the

form of an **S** and hooking into the adjoining links.

7. In combination, a conduit of insulating material, a main conductor extending there-
through, a succession of separated conductor- 30 sections above said main conductor and having parts for engagement with a contact carried by a railway-car, and a cable comprising a succession of links and lying upon said main conductor and out of contact with said sections 35 and liftable into contact with the latter by a magnet upon the car, each link being formed of strip or sheet metal actuatable by the magnet and of a width to nearly fill the conduit, and having the form of an **S** and hooking into 40 the adjoining links, and being of a length several times greater than the distance between the main conductor and the sections.

In testimony whereof I have hereunto affixed my signature in presence of two wit- 45 nesses.

HENRY BROWN GREENWOOD.

Witnesses:

D. E. MILLER,
JUAN ESTEVAN.