

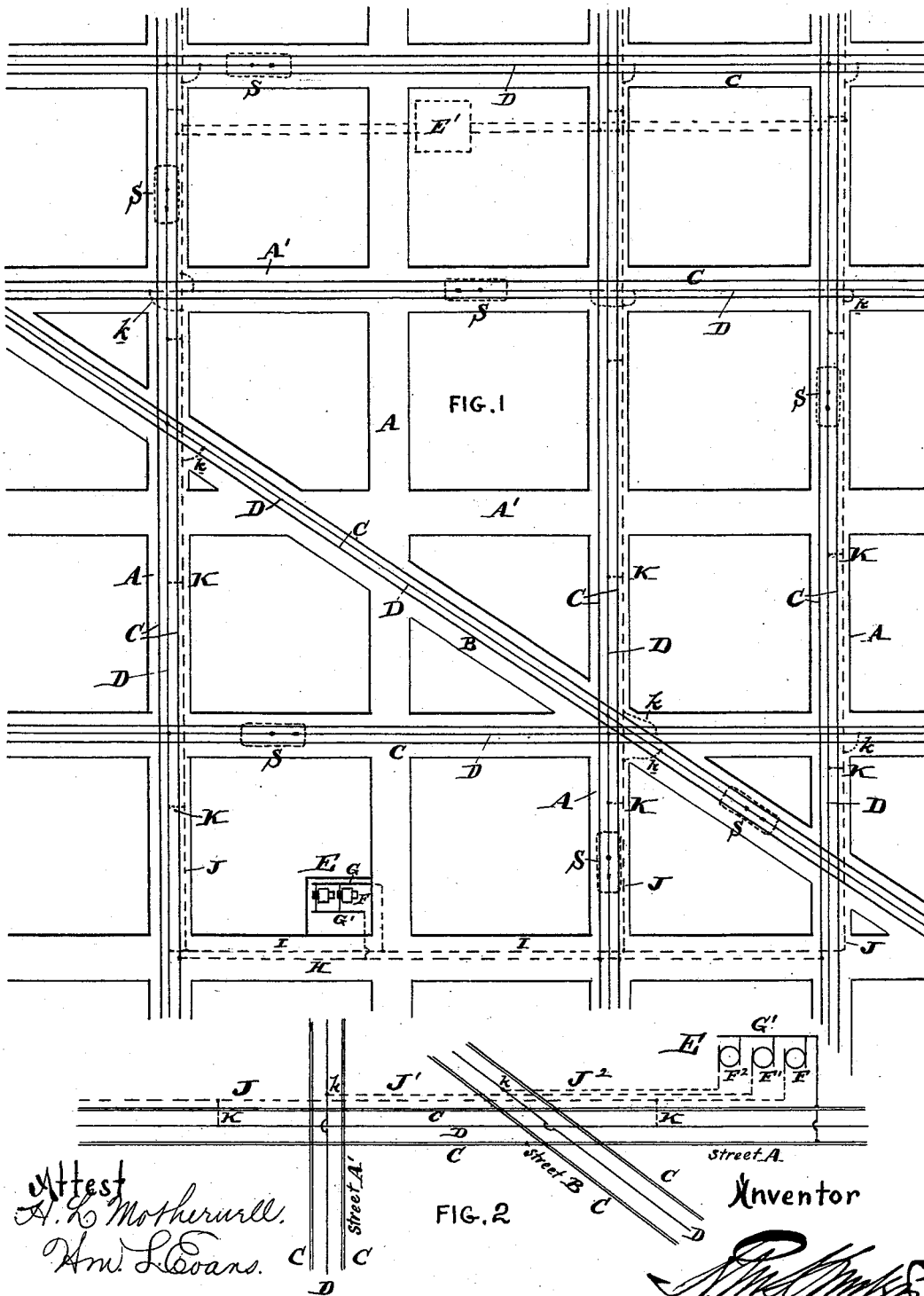
(No Model.)

2 Sheets—Sheet 1.

R. M. HUNTER.
ELECTRIC RAILWAY SUPPLY CIRCUIT.

No. 522,374.

Patented July 3, 1894.



Attest
A. L. Motherwell.
And L. Coars.

FIG. 2

Inventor

[Signature]

(No Model.)

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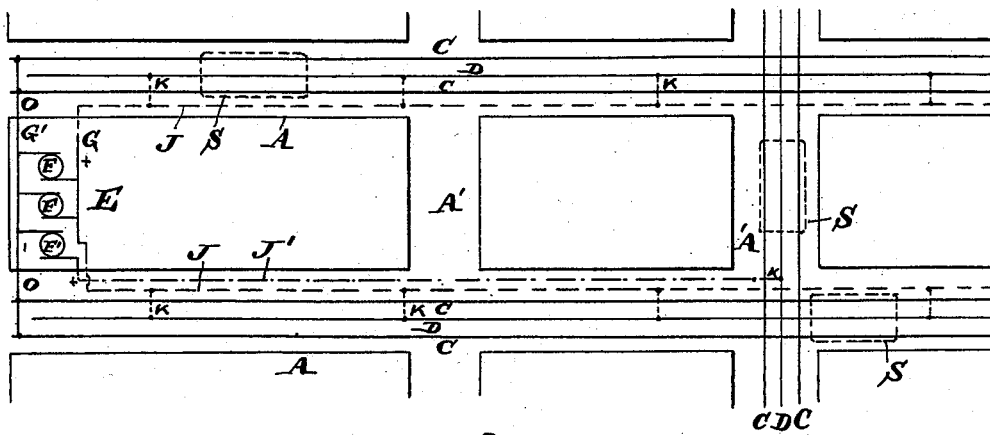


FIG. 3

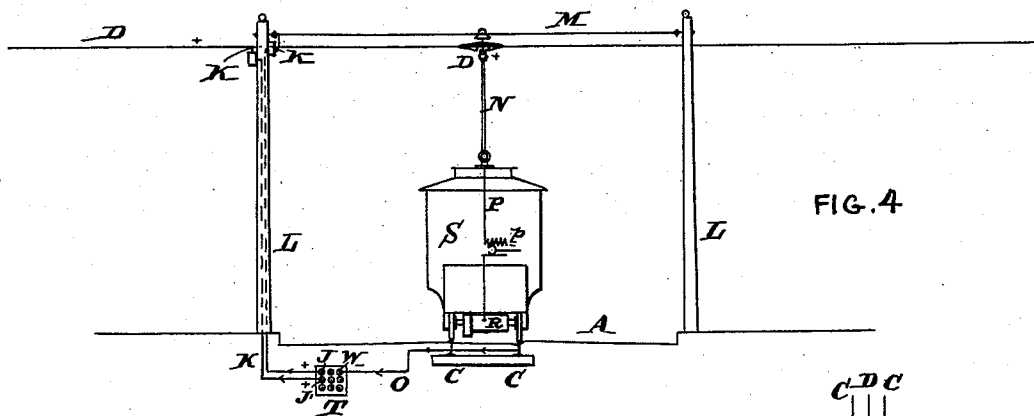


FIG. 4

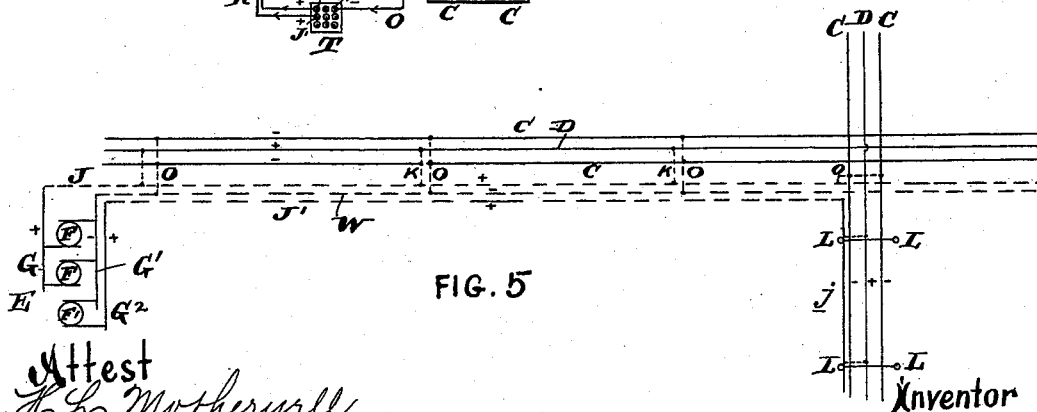


FIG. 5

Attest
L. L. Motherwell
Am. L. Evans.

Inventor

[Signature]

UNITED STATES PATENT OFFICE.

RUDOLPH M. HUNTER, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO
THE THOMSON-HOUSTON ELECTRIC COMPANY, OF CONNECTICUT.

ELECTRIC-RAILWAY SUPPLY-CIRCUIT.

SPECIFICATION forming part of Letters Patent No. 522,374, dated July 3, 1894.

Application filed May 8, 1894. Serial No. 510,467. (No model.)

To all whom it may concern:

Be it known that I, RUDOLPH M. HUNTER, of the city and county of Philadelphia, State of Pennsylvania, have invented an Improvement in Electric Railways, of which the following is a specification.

My invention has reference to electric railways, and consists of certain improvements which are set forth in the following specification and shown in the accompanying drawings, which form a part thereof.

This application, Case No. 274, has particular reference to means for supplying electricity to two or more railways in a city from a single central station, or two or more central stations operated in parallel.

The object of my invention is to provide a suitable system of circuits for supplying electricity to the working conductors of the two or more railways, which shall involve the least expenditure of capital in the permanent equipment. Primarily my object is to feed the working circuits of railways distant from the central station through circuits arranged parallel to railways leading to or near the central station, and arranged transversely to the first mentioned railways. In practice the feeding conductor circuits of the various working conductors will normally be contained in underground conduits arranged parallel to one system of tracks, and said feeding conductors will be connected at intervals with the working circuits of the two or more railway tracks. In this manner all of the conductors of one polarity of the various railways may be coupled in parallel so as to arrange in the ground a net work of conductors adapted to return the current to the central station, or to supply the current to the cars with the least possible resistance to the working conductors of the several railways. While this system is especially adapted to cases where all of the positive conductors of the several railways are to be worked under the same potential and receive current from the same generators, nevertheless my invention may be applied to those cases where the return or rail circuit of the two or more railways returns the current to a bus conductor in the central station, and the positive or suspended working conductors of the respective

railways receive current from independent generators, which system may have a particular provision for overcoming the differences in drop of potential in the various circuits.

My invention will be better understood by reference to the accompanying drawings, in which—

Figure 1 is a plan view of a portion of a city showing electric circuits embodying my invention. Fig. 2 is a plan view of a modification thereof, showing the several positive conductors of the different railways supplied from independent generators. Fig. 3 is a similar view of another modification of my improvements. Fig. 4 is a transverse sectional elevation substantially at the juncture of two railways embodying my improvements; and Fig. 5 is a plan view illustrating the electric circuits applied to another modification of my invention.

A represents streets running in one direction, or for example, north and south.

A' represents streets running in an opposite direction, or east and west; and B represents a diagonal street.

C represents the tracks on the various streets, and D represents the suspended or positive working conductor on the several streets.

S in the various figures indicates electrically propelled cars, and may be of any suitable construction adapted to the particular circuits which may be employed. In Fig. 4 this car is indicated as being provided with an electric motor R to rotate the axles, an upwardly extending trolley or collector device N making an under running contact with the suspender D, and provided with an electric circuit P, having an electrical controller *p*. It is to be understood that I do not confine myself to any particular details for propelling or controlling the car or for supplying current thereto.

In the particular type of railway shown, the rails C, C act as the return conductors. Where trolley wires are employed as the positive working conductors they may be suspended from poles L by cross or span wires M in any of the well known ways.

E represents a central station, located at any

convenient place and it is provided with bus wires G, G' receiving current from the generators F, F' and F² as the case may be.

Referring now more specifically to Fig. 1, 5 part of the streets A or those of them provided with electric railways are furnished with conduits T, arranged parallel to the tracks and below the roadway. Such conduits are indicated in Fig. 4. In these conduits are arranged the feeding or supply 10 conductors J, which are insulated and connected at intervals with the trolley or positive working conductors D by means of branch conductors K, which may extend up through the 15 poles and be formed in part by the cross or span wires M. The poles and span wires are not shown in Figs. 1, 2 and 3, to avoid complication, and further because it is not essential that the positive feeding conductor shall 20 be a suspended conductor, as it may be arranged in any suitable manner as heretofore well known.

The feeding conductors J are connected in parallel with the generators F by the bus wire 25 G and conductors I, which latter are also preferably buried in conduits and connecting at intervals with the various feeding wires or conductors J. It is quite evident that each of the feeding conductors might be supplied 30 from a separate generator if desired. These feeding conductors J are connected at intervals with the positive working conductor D of the corresponding track and also at intervals with the positive working conductor D of the 35 railway on the transverse streets A', B, so that the same conduits and same underground supply conductors are employed to supply current to the conductors of the transverse railways and thereby obviate the neces- 40 sity of laying parallel feeding conductors throughout the length of the said transverse railways.

In large cities, where the railways are practically under one control, and where almost 45 every street contains a railway, if the feeding conductors of the north and south streets are adapted to supply current to the working conductors of the transverse or east and west streets, we should have the said working 50 conductors of the east and west streets receiving current of the same or substantially the same potential at intervals throughout their length, and without the necessity of providing parallel feeding conductors and conduits on these 55 east and west streets. In this manner great economy results in the equipment of the railway and its maintenance, and at the same time the resistance of the entire circuit is more nearly equalized for different parts ob- 60 viating in a measure the excessive drop of potential in long lines. By connecting the various circuits in parallel, the current may find a passage through those conductors which are less burdened with duty, and there is 65 therefore less liability of an excessive current being required to flow through any spe-

cial conductor than where specific feeders are employed for each individual railway.

The rails may act as the return conductors, or independent conductors may be employed 70 in any of the manners heretofore well known. To avoid as far as possible electrolytic action upon the water and gas pipes the rails C, C may be connected at intervals with a return conductor W of low resistance and also if de- 75 sired arranged in the conduit T. The various tracks are connected in parallel and the entire system of railway tracks acts as a means of returning the current to the central station E. The tracks of the various north 80 and south streets for example, or any of the tracks running near the central station, may be connected with the negative bus wire G' by conductors H.

Referring now to Fig. 2, we have substan- 85 tially the same streets although but one of the streets A is indicated in this figure; in this case the feeding conductors for the several tracks are indicated as J, J' and J² leading to the positive terminals of separate generators 90 F, F' and F² at the central station E, the negative terminals of said generators being connected to a bus wire G' in electrical circuit with the tracks of the several railways, which act as a common return circuit. The various 95 conductors J, J' and J² are arranged parallel to the street A as in the case of Fig. 1, and are connected with the positive conductors D of the several transverse railways where said railways cross the railway of the street A. 100 The only difference between this construction and that of Fig. 1, lies in the fact that the positive working conductors of the several railways may be insulated from each other, and receive current from independent feed- 105 ing conductors. It will also be understood that while I speak of only one central station, that more than one central station may be employed if desired, connected to the feeding conductors and rails so that the two central 110 stations work in parallel. Such an additional station is indicated at E' in Fig. 1. This would be resorted to where the area covered is very large.

In the construction shown in Fig. 3, I have 115 illustrated two parallel streets A, each containing a railway and one railway upon a cross street A'. In this figure we have two generators F, F' connected to a bus wire G, which is electrically connected with the two 120 feeding conductors J, J' in the respective streets A, while the rails of the railways of the said streets are connected at O with the bus wire G' of the generators. The negative 125 terminal of the third generator F' connects with the bus wire G', and its positive terminal connects with the feeding conductor J' extending parallel with the tracks of one of the streets A and electrically connected with the positive working conductor D of the trans- 130 verse street A'. These circuits are very similar to the circuits shown in Fig. 2, but in this

case I have shown two railways on the street A corresponding more nearly to what is shown in Fig. 1.

Referring to Fig. 5, we have a central station E provided with two generators F, F in parallel, the positive terminals of which are connected to a bus wire G supplying current to the feeding conductor J, connected at intervals by branch conductors K with the positive conductor of one of the railways, for instance that which would correspond to the street A. The negative conductors of the generators F, F connect with the bus wire G' which supplies current to a return feeder W, connected at intervals with the rail return C, on streets A and also the rails C at a distance from the generating station corresponding to the transverse railway. This transverse railway has its positive conductor D supplied from a suspended feeding conductor j, which may be carried upon the poles or otherwise, the said feeding conductor being supplied with current through a feeding conductor J', arranged parallel to the feeding conductors J and W and connecting with the positive terminals of the generator F' through what may be called a bus wire G². The negative terminal of said generator is connected with the negative bus wire G'. In this manner we have the conductors J, J' and W arranged in parallel to one of the tracks and preferably in a conduit T, one of said conductors J being connected with the positive conductor of the track parallel to it, and the other conductor J, being connected to the positive working conductor of a transverse track at a distance from the generating station, and connecting with said positive conductor of the transverse track through an auxiliary feeder j, connected at intervals with the said positive working conductor. The conductor W is connected with the rails at intervals by branch connections O. The conductor W connected with the rails, need not necessarily be arranged in the conduit T, in cases where the rails act as the return circuit, but it is preferable to arrange it within the conduit on account of repairs.

In the construction shown in Fig. 5, the transverse railway at the lower part indicates a portion extending into the suburbs, or where there is no special objection to arranging a feeder on the poles, it would also be applicable to those cases where a portion of the railway runs to a considerable distance away from the main system of the tracks in the city, and where it is desirable to employ over a portion of the transverse tracks an auxiliary feeder.

It will be observed that in all of these constructions the east and west tracks receive their current either through the tracks of the north and south streets or through feeding conductors arranged in said streets, and are supplied from a central station or stations common to said north and south tracks. This obviates any necessity of laying conduits

or burying feeders in the transverse streets, and also provides for the transverse railways a series of possible circuits for the current from the central station to the cars traveling upon said transverse circuits. In the system shown in Fig. 1 the potential on all of the railways should be substantially the same, but in the construction shown in Figs. 2, 3 and 5, the potential on the several railways might be different. It is to be understood that when I have spoken of north and south streets or east and west streets, that these terms have only been used to simplify the explanation. I do not confine myself to any particular details of construction, as they may be modified in various ways without departing from the features of my invention.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an electric railway, the combination of two or more parallel or substantially parallel railways each having a positive and a negative conductor, a central station supplying current to the positive and negative conductors of said railways, one or more transverse railways having positive and negative conductors, feeding conductors arranged parallel to the conductors of the first mentioned railways and connected at intervals with the electric circuits thereof, and electrical connections between the positive conductor of the transverse railway and the two or more feeding conductors of the first mentioned railways whereby the feeding conductors of the first mentioned railways are utilized in supplying currents at intervals to the transverse railways.

2. In an electric railway, the combination of two or more parallel or substantially parallel railways each having a positive and a negative conductor, a central station supplying current to the positive and negative conductors of said railways, one or more transverse railways having positive and negative conductors, feeding conductors arranged parallel to the conductors of the first mentioned railways and connected at intervals with the electric circuits thereof, electrical connections between the positive conductor of the transverse railway and the two or more feeding conductors of the first mentioned railway whereby the feeding conductors of the first mentioned railways are utilized in supplying currents at intervals to the transverse railways, and a series of independently operated electric cars receiving current from the conductors of the several railways and operating in parallel.

3. In an electric railway, the combination of two or more parallel or substantially parallel railways each having a positive and a negative conductor, a central station supplying current to the positive and negative conductors of said railways, one or more transverse railways having positive and negative conductors, feeding conductors arranged parallel to the conductors of the first mentioned

railways and connected at intervals with the electric circuits thereof, electrical connections between the positive conductor of the transverse railway and the two or more feeding conductors of the first mentioned railways, and a return circuit system between the central station and the negative conductors of all of the railways.

4. In an electric railway, the combination of two or more parallel or substantially parallel railways each having a positive and a negative conductor, a central station supplying current to the positive and negative conductors of said railways, one or more transverse railways having positive and negative conductors, underground conduits embedded in the roadway parallel to the tracks of the first mentioned railways, feeding conductors arranged within the conduits and parallel to the conductors of the first mentioned railways and connected at intervals with the electric circuits thereof, and electrical connections between the positive conductor of the transverse railway and the two or more feeding conductors of the first mentioned railways.

5. In an electric railway, the combination of two or more parallel or substantially parallel railways each having a positive and a negative conductor, a central station supplying current to the positive and negative conductors of said railways, one or more transverse railways having positive and negative conductors, and a series of feeding conductors leading from the central station and arranged parallel to the first mentioned railways and positively connected with a conductor of each of the several railways.

6. In an electric railway, the combination of two or more parallel or substantially parallel railways each having a positive and a negative conductor, a central station supplying current to the positive and negative conductors of said railways, one or more transverse railways having positive and negative conductors, a series of feeding conductors leading from the central station and arranged parallel to the first mentioned railways and positively connected with a conductor of each of the several railways, and a common return circuit between the conductors of all of the railways and the central station.

7. In an electric railway, the combination of two or more parallel or substantially parallel railways each having a positive and a negative conductor, a central station supplying current to the positive and negative conductors of said railways, one or more transverse railways having positive and negative conductors, a series of feeding conductors leading from the central station and arranged parallel to the first mentioned railways and positively connected with a conductor of each of the several railways, and one or more underground conduits arranged parallel to the first mentioned railways for containing the feeding conductors leading to the several railways.

8. In an electric railway, the combination of two or more parallel or substantially parallel railways each having a positive and a negative conductor, a central station supplying current to the positive and negative conductors of said railways, one or more transverse railways having positive and negative conductors, a series of feeding conductors leading from the central station and arranged parallel to the first mentioned railways and positively connected with a conductor of each of the several railways, a common return circuit between the conductors of all of the railways and the central station, and feeding conductors arranged parallel to the first mentioned railways, and electrically connected with the return conductors of the several railways whereby they are connected in parallel.

9. In an electric railway, the combination of two or more parallel or substantially parallel railways each having a positive and a negative conductor, a central station supplying current to the positive and negative conductors of the said railways, one or more transverse railways having positive and negative conductors, a series of feeding conductors leading from the central station and arranged parallel to the first mentioned railways and positively connected with a conductor of each of the several railways, a common return circuit between the conductors of all of the railways and the central station, feeding conductors arranged parallel to the first mentioned railways and electrically connected with the return conductors of the several railways whereby they are connected in parallel, and an underground conduit containing the several feeding conductors in insulated condition relative to each other.

10. In an electric railway, the combination of two or more parallel or substantially parallel railways each having a positive and a negative conductor, a central station supplying current to the positive and negative conductors of said railways, one or more transverse railways having positive and negative conductors, feeding conductors arranged parallel to the first mentioned tracks and electrically connected at intervals therewith, feeding conductor or conductors to the transverse track arranged parallel and in close proximity to the feeding conductors of the first mentioned tracks, an electric generator or generators connected to the feeding conductors of the first mentioned tracks, an electric generator connected to the feeding conductor of the transverse track, and a common electric return circuit to all of the tracks connected with the similar poles of all of the generators.

11. In an electric railway, the combination of two or more parallel or substantially parallel railways each having a positive and a negative conductor, a central station supplying current to the positive and negative conductors of said railways, one or more transverse railways having positive and negative conductors, feeding conductors arranged par-

allel to the first mentioned tracks and electrically connected at intervals therewith, feeding conductor or conductors to the transverse track arranged parallel and in close proximity to the feeding conductors of the first mentioned tracks, an electric generator or generators connected to the feeding conductors of the first mentioned tracks, an electric generator connected to the feeding conductor of the transverse track, a common electric return circuit to all of the tracks connected with the similar poles of all of the generators, an inclosing conduit embedded in the streets parallel to the first mentioned tracks for the feeding conductors, and electrical connections from the feeding conductors in said conduit with the respective conductors of these several tracks.

12. In an electric railway, the combination of two railway tracks, feeding conductors connecting respectively with the conductor of similar polarity of the two railways, separate generators having their similar poles respectively connected with the two supply conductors, and a common return circuit connecting conductors of other polarity in parallel and in electrical connection with the other terminals of the said generators.

13. In an electric railway, the combination of two railway tracks, feeding conductors connecting respectively with the conductor of

similar polarity of the two railways, separate generators having their similar poles respectively connected with the two supply conductors, a common return circuit connecting the conductors of other polarity in parallel and in electrical connection with the other terminals of the said generators, and independently operated electrically propelled cars operating on the two railways and receiving current from the same central station plant.

14. In an electric railway, the combination of two railway tracks, feeding conductors connecting respectively with the conductor of similar polarity of the two railways, separate generators having their similar poles respectively connected with the two supply conductors, a common return circuit connecting conductors of the other polarity in parallel and in electrical circuit with the other terminals of the said generators, and a return feeding conductor electrically connected with the last mentioned conductors of the two railways and with the other terminals of all of the generators.

In testimony of which invention I hereunto set my hand.

R. M. HUNTER.

Witnesses:

ERNEST HOWARD HUNTER,
HELEN L. MOTHERWELL.