(No Model.) 2 Sheets—Sheet 1.

E. W. v. SIEMENS.

ELECTRIC RAILWAY.

No. 520,274. Patented May 22, 1894.

Fig. 1.

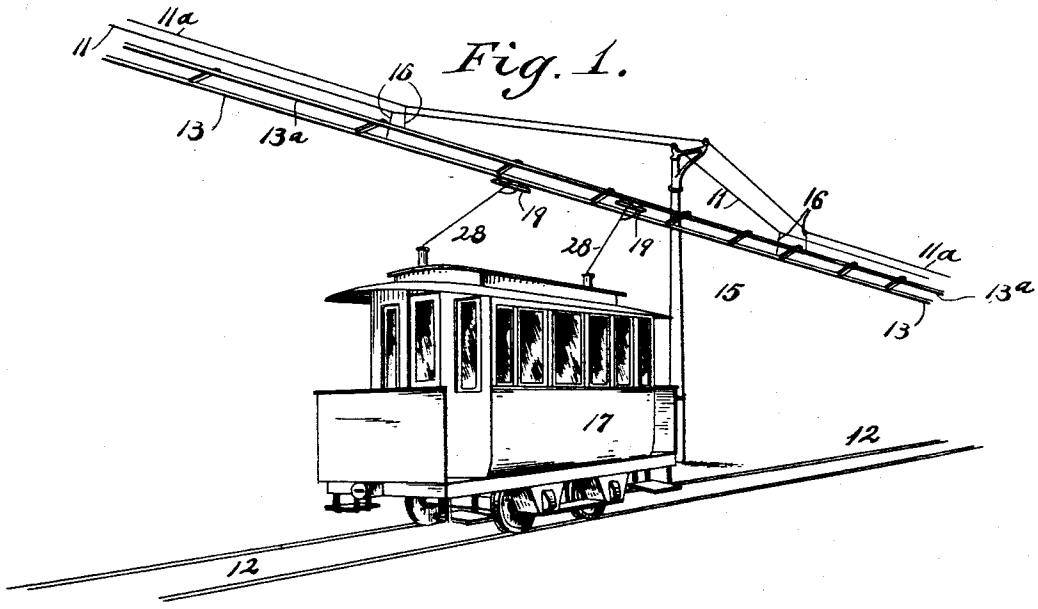


Fig. 2.

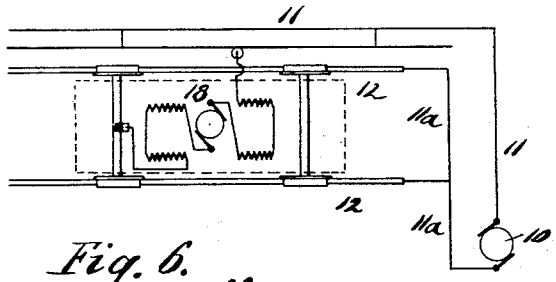


Fig. 6.

Fig. 3.

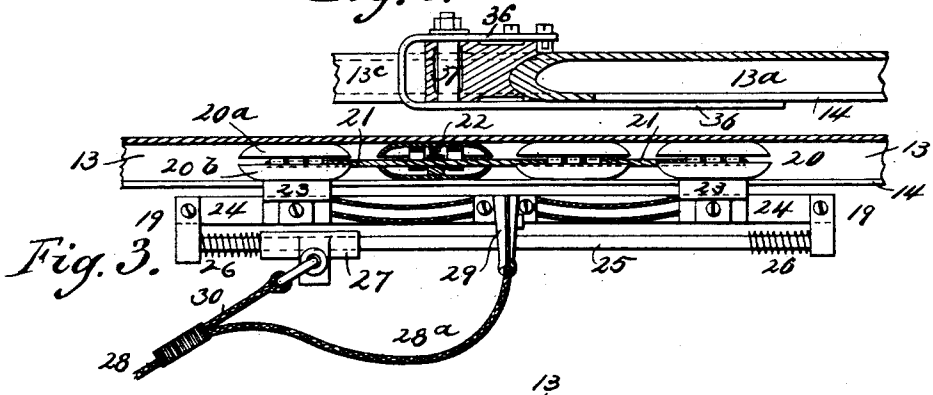
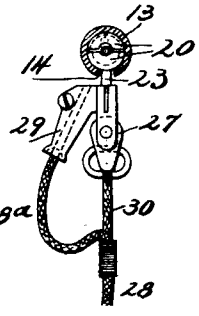


Fig. 4.



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(No Model.) 2 Sheets—Sheet 2.

E. W. v. SIEMENS.

ELECTRIC RAILWAY.

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Fig. 5.

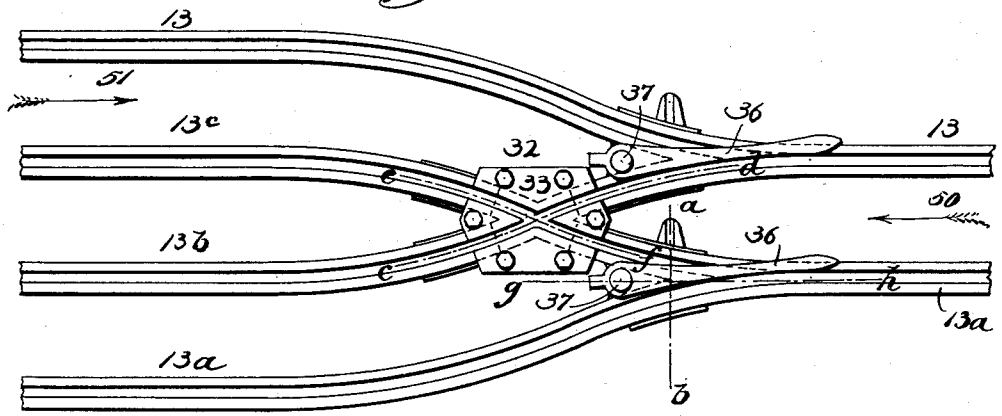


Fig. 8.

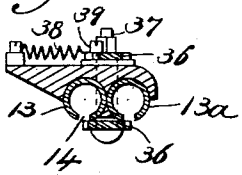


Fig. 7.

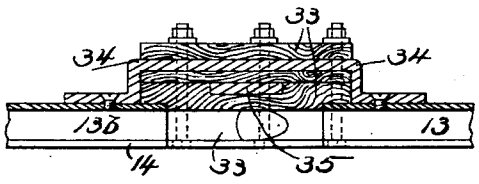


Fig. 9.

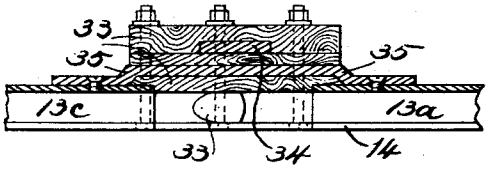
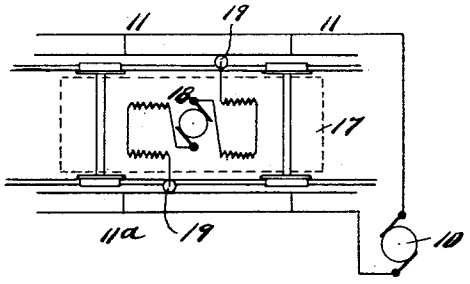


Fig. 10.



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ERNST WERNER VON SIEMENS, OF BERLIN, GERMANY, ASSIGNOR TO SIEMENS & HALSKE, OF SAME PLACE.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 520,274, dated May 22, 1894.

Application filed September 30, 1892. Serial No. 447,448. (No model.) Patented in Germany July 28, 1883, No. 25,766; in England October 17, 1883, No. 4,945, and in France August 4, 1889, No. 134,765.

To all whom it may concern:

Be it known that I, ERNST WERNER VON SIEMENS, a subject of the Emperor of Germany, residing at Berlin, Germany, have invented new and useful Improvements in Electric Railways, of which the following is a specification, and for which I have received patents in the following countries on the subject-matter of this application, namely: Germany, No. 25,766, dated July 28, 1883; France, August 4, 1885, No. 134,765, and Great Britain, No. 4,945, dated October 17, 1883.

My invention relates to electric railways, and especially to the means whereby the current from the source of energy is conveyed to and distributed along the line, and in such a manner that a practically uniform current will be fed to the motors upon the different vehicles upon the line, irrespective of the number of said vehicles and their distances from the source of energy.

My invention further relates to the means whereby the current is collected from the working conductor and conveyed to the electro motive vehicles upon the line.

It also relates to a system of crossings and automatic switches whereby an electro motive vehicle is diverted from the main to a branch line, or vice versa.

In the former patent, No. 322,859, issued to me July 21, 1885, I have described and claimed an improvement in electric railways in which the current supply conductor consisted of a wire cable suspended from supports erected alongside of the line, and from which the current was collected by means of a small contact trolley running upon the upper surface of said cable and conveyed through a flexible conductive connection to an electro motive vehicle located upon and adapted to move along the line. For practical reasons, such means of collecting the current has been found objectionable, as ice is liable to be formed upon the conductor, and thus tend to insulate the trolley from the conductor; and in the case where heavy grades, switches, &c., have to be taken into consideration, it was found difficult to maintain the trolley upon the conductor. In order to overcome these objections, as stated, and to obtain a more perfect electrical contact between the trolley and the conductor from which it collects current than is possible with the construction stated, I provide, as working conductors, tubes of iron or other metal slotted on their under side, and within these tubes I place a contact device having projections extending beyond the tube, which, when connected to the electro motive vehicle, may be drawn along the interior of the tube in either direction. By this arrangement I am enabled to maintain a very perfect spring-pressed contact, which is not open to the objections found in the case of the overrunning trolley described in my former patent aforesaid.

Referring to the accompanying drawings and diagrams which illustrate my invention, similar reference numerals indicate like parts.

Figure 1 is a perspective view illustrating a construction embodying my invention, and in which there are shown an electro motive vehicle mounted upon a line, a pair of working conductors suspended over the line, a pair of suspending supply conductors, and contact devices for conveying the current to and from the electro motive vehicle. Fig. 2 is a diagram illustrating a modification of my invention and in which but one suspended working conductor is employed—this conductor forming the outgoing conductor from the source of energy, and the traffic rails the return conductor thereto. Fig. 3 is a longitudinal section of a tubular conductor, and also shows the sliding spring-pressed contact device partially in section. Fig. 4 is a transverse section through the tubular conductor, and an end view of the sliding spring-pressed contact device therein. Fig. 5 is an under side plan showing the construction employed at switches and crossings. Fig. 6 is a section on the line *g*, *h* of Fig. 5. Figs. 7, 8 and 9 are respectively sections on the lines *c*, *d*, *a*, *b* and *e*, *f* of Fig. 5. Fig. 10 is a diagram illustrating the circuit connections in the arrangement shown in Fig. 1.

In the drawings, 10 (Figs. 2 and 10) indicates a dynamo electric machine or other suitable source of energy. 11, 11^a, supply conductors leading therefrom.

In Figs. 1 and 10 two suspended supply

conductors 11, 11ª are indicated, one of which forms the outgoing and the other the return conductor to the source of energy. In Fig. 2 but one suspended supply conductor 11 is indicated, which forms the outgoing conductor, while the return conductor is, in this case, formed in part by the rails 12 and the return supply conductor 11ª.

13, 13ª represent the working conductors. These conductors are preferably given a tubular shape, and in order to permit a contact device to be moved along their interior, are slotted on their under side.

The supply conductors are shown as carried along the line and suitably fastened to insulators upon posts or supports 15. The working conductors are connected to and suspended from the supply conductors at intervals by the wires 16. By reason of this arrangement a more equal distribution of current is effected along the length of the line than is possible where the working conductors are directly connected to the source of energy.

Mounted upon the rails 12 is a vehicle 17 having mounted thereon an electro-motor 18, which may be of any suitable type, and is connected with the wheels of the motor in any approved manner to produce motion in either direction, as desired.

19 indicates the contact device by which the electric current is collected and conveyed from the tubular conductors to the electro motive vehicle. The contact device consists of a number of sliding pieces 20 connected together by a flexible copper rope 21. Each sliding piece is formed of two shells 20ª, 20ᵇ, which in order to establish reliable contact between the sliding pieces and the tube, are forced apart and pressed against the walls of the tube by means of a spring 22. Connected to or formed integrally with the bottom portions 20ᵇ of the end sliding pieces 20 are plates 23, which project through the slot 14 of the tubular conductor, and are suitably fastened to a bar 24. Connected to the bar 24 is a bar 25, which is preferably round and at each end supports a helical spring 26.

27 is a slide mounted upon the bar 26.

28 represents a conductive rope attached at one end to the top of the electro-motive vehicle. Its other end is formed as a loop 28ª which is fastened to a clamp 29, from which suitable conducting wires lead to the sliding pieces 20 of the contact device to convey current thereto. A hauling rope 30 fastened to the conductor 28 is fixed to an eye linked to the slide 27. By reason of this arrangement shocks and jars in the hauling or towing operations of the contact device are rendered harmless, as when the vehicle moves in either direction the contact device buffs against one of the springs 26; and (as permitted by the loop 28ª in the conductor 28) the slide 27 compresses one of the springs before traction is made on the contact device. As a consequence, no strain is exerted upon the contact device. The conductor loop 28ª allows the slide 27 to be readily slid from one end to the other of the bar 25, to accommodate hauling of the contact device from either end and in opposite directions.

In carrying my invention into effect, it is necessary to arrange for switches, branch tracks and sidings. In order to accomplish this and yet maintain the integrity of each line of conductors without interrupting the current thereon, I use the arrangement shown in Fig. 5. The working conductors 13, 13ª, arranged parallel, branch out preferably with an equal curvature at the switch point. Thus the conductor 13 is extended as 13 and 13ᵇ, and the conductor 13ª, as 13ª and 13ᶜ. The conductors 13ᵇ, 13ª thus constitute continuations of the main line, while those 13, 13ᶜ beyond the switch point form the turn-out or siding track which allows electro-motive vehicles running in opposite directions to be operated on a single track railway. At the switch or crossing 32, is inserted a block of insulating material 33, such as hard wood, in which are formed continuations of the cylindrical passages of the tubes. By this means the tubes and the ends of the tubes are insulated from each other at the crossing, while free passage is given the contact device. The electrical connection which is necessary between the tube sections 13 and 13ᵇ is effected by means of the conducting plate 34 (Fig. 7) secured at one end to the conductor 13 and the other end to the conductor 13ᵇ, while the conductor 13ª is electrically connected to the branch 13ᶜ through the conductor 35 (Fig. 9). The drawings show that these plates are properly insulated from each other, and that the plate 34 crosses the plate 35 at a higher level in or at the block 33 of insulating material. At the crossings are provided switches 36, each of which consists of a tongue pivoted at 37.

38 is a spring connected to the upper short arm of the switch tongue and draws said short arm to a stop 39, whereby the long arm or main switch tongue is always maintained in position to hold the line open from 13, 13ª to 13ª, 13ᵇ, as shown in Fig. 5, wherein the main line is supposed to be open.

A vehicle contact using conductors 13, 13ª and running in direction of arrow 50 will pass the switches 36 to the branch conductors 13ᵇ, 13ª, and after passing the turnout or siding will again take the main line, whereas the contact of a vehicle moving in the opposite direction, as indicated by arrow 51, will run along conductors 13, 13ᶜ, and in passing will automatically throw the switch tongues 36, to allow the plates of the contact devices, which extend through the slots, to pass into the slots of the main conductors 13, 13ª, of the main line at the farther end of the turn-out or siding. The switches may be moved by hand or may be actuated automatically, as desired.

Although I have described in this specification but one embodiment of my improved system, I do not desire to limit myself to the

details thereof, since I consider myself to be the first inventor of the broad idea of employing a sliding contact connected to an electrically propelled vehicle. I also believe that I am the first to use slotted tubular conductors, branches and sidings connected therewith, automatically moving switches, and sliding contacts moving within said tubular conductors and connected to an electrically propelled vehicle.

I claim—

1. In an electric railway system, an overhead tubular conductor extending along the line of railway and having a longitudinal slot, a traveling contact within said tubular conductor, said contact having a yielding or flexible connection extending through the longitudinal slot to an electrically propelled car.

2. In an electric railway system, an overhead tubular conductor extending along a railway and having a longitudinal slot on its under side, a traveling spring pressed contact within said tubular conductor, and having a yielding or flexible connection extending through said slot to an electrically propelled car.

3. In an electric railway system, an overhead traveling contact consisting of spring contact cheeks connected by a flexible conductor, the end contact cheeks having stems attached to them, a frame connected to said stems, a sliding piece on said frame, and end springs on said frame to protect said sliding piece, and a yielding or flexible connection extending between said sliding contact and an electrically propelled car.

4. In an electric railway system, an insulated overhead slotted tubular conductor extending along a line of railway, and an electrically propelled car having a traveling contact within said tubular conductor.

5. In an electric railway system, a main overhead slotted tubular conductor extending along a line of railway, branch conductors extending from said main conductors, and crossing of insulating material between the branch and the main conductors.

6. In an electric railway system, a main overhead slotted tubular conductor extending along a line of railway, branch conductors extending from said main conductors and crossings of insulating material between the branch and the main conductors, the two parts of each conductor on each side of the crossing being electrically connected by a bridge piece of conducting material.

7. In an electric railway system, a main overhead slotted tubular conductor extending along a line of railway, branch conductors extending from said main conductors and crossing, insulating material between the branch and the main conductors, the two parts of each conductor on each side of the crossing being electrically connected by an insulated bridge piece of conducting material.

8. In an electric railway system, a main overhead slotted tubular conductor extending along a line of railway, branch conductors extending from said main conductors, and switches at the junction of said main and branch conductors.

9. In an electric railway system, a main overhead slotted tubular conductor extending along a line of railway, branch conductors extending from said main conductors, and automatically operating pivoted switches at the junction of said main and branch conductors.

10. In an electric railway system, a main overhead slotted tubular conductor extending along a line of railway, branch conductors extending from said main conductors, and automatically pivoted switches operating at the junction of said main and branch conductors, and a stop or stops limiting the movement of said switches.

11. In an electric railway system, two overhead tubular conductors, each having a slot and a vehicle having traveling contacts extending from within the tubular conductors through the slots to the vehicle.

12. In an electric railway system, the combination with an overhead tubular conductor extending along the line of railway and having a longitudinal slot, of a movable spring pressed contact within said tubular conductor, said contact having an electrical connection extending through the slot to an electrically propelled car.

13. In an electric railway system, the combination with a supply conductor extending along the line of railway, of a contact in movable and electrical relation thereto, and an electrically propelled vehicle provided with an electrical connection with said contact, said connection having a limited cushioned movement relative to said contact at the point of attachment with the latter.

14. In an electric railway system, the combination with an overhead tubular conductor extending along the line of railway and having a longitudinal slot, of a movable contact within said conductor and comprising two longitudinally arranged parts flexibly connected, said contact having an electrical connection extending through the slot to an electrically propelled car.

15. In an electric railway system, the combination with an overhead slotted tubular conductor extending along the line of railway and having a branch, a laterally variable contact within said conductor and having an electrical connection extending through the slot to an electrically propelled car.

16. In an electric railway system, the combination with an overhead slotted tubular conductor extending along the line of railway and having a branch, a contact within said conductor comprising two flexibly connected and longitudinally arranged portions, said contact having an electrical connection extending through the slot to an electrically propelled car.

17. In an electric railway system, the combination with an overhead slotted tubular con-

ductor extending along the line of railway and having a branch, a laterally variable contact within said conductor, an electrically propelled car and connection therefor attached to the contact and admitting of a limited cushioned movement relative to the contact.

18. In an electric railway system, the combination with an overhead slotted tubular conductor and branches extending therefrom, of automatically operating pivoted switches at the junction of said main and branch conductors, a contact movable in said conductors, an electrically propelled car having a connection with the contact capable of a limited cushioned movement at its attachment therewith.

In testimony whereof I affix my signature in the presence of two witnesses.

ERNST WERNER VON SIEMENS.

Witnesses:
GUSTAV STENZEL,
MAX WAGNER.