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2,728,819

ELECTRICAL TROLLEY CONSTRUCTION

Filed Sept. 13, 1950

3 Sheets-Sheet 1

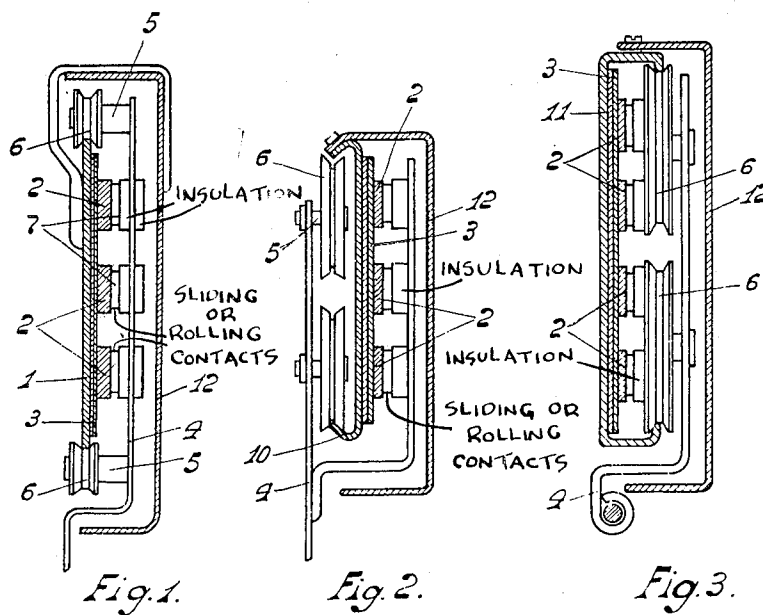
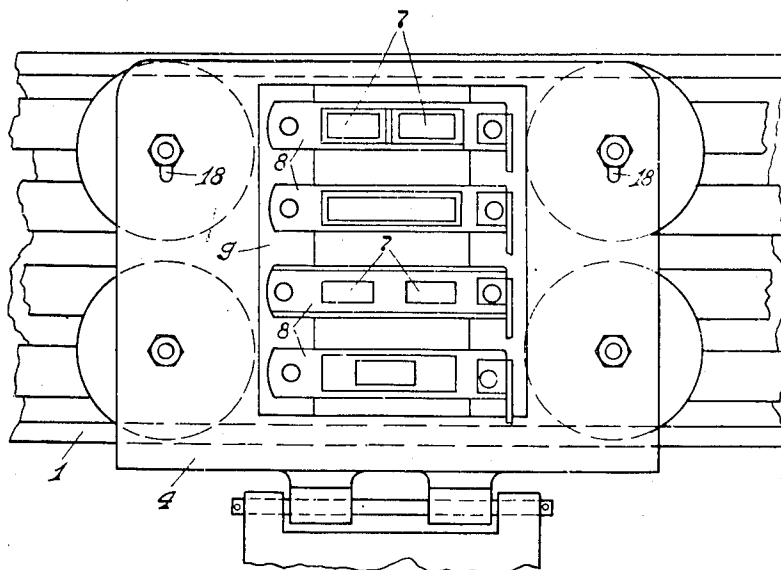


Fig. 4.

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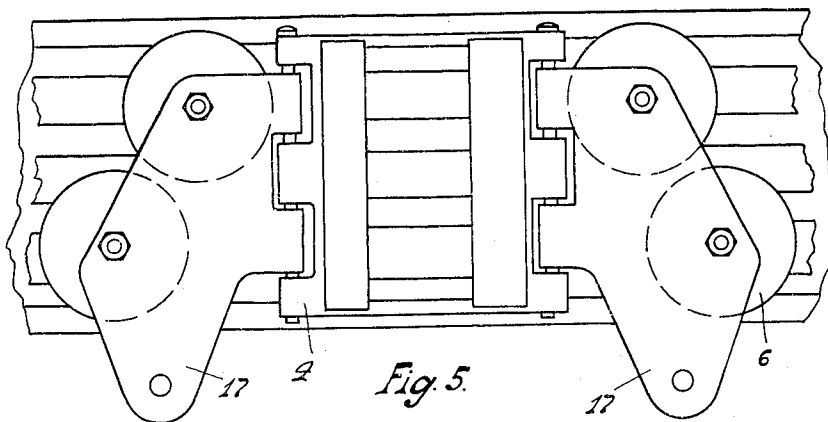


Fig. 5.

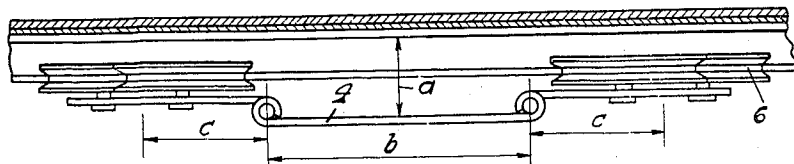


Fig. 6.

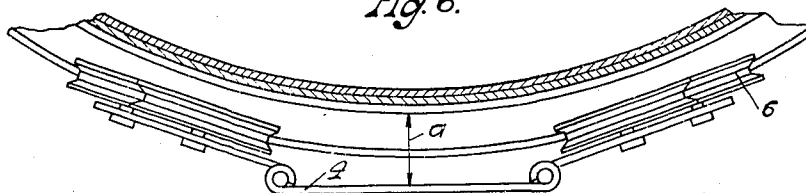


Fig. 7

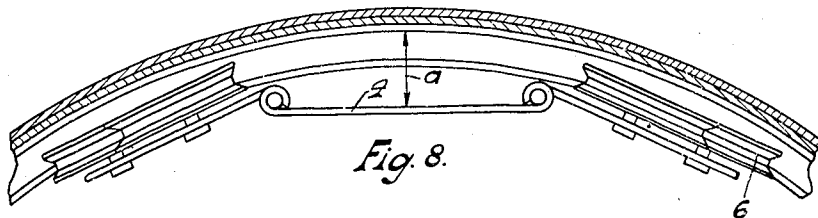


Fig. 8.

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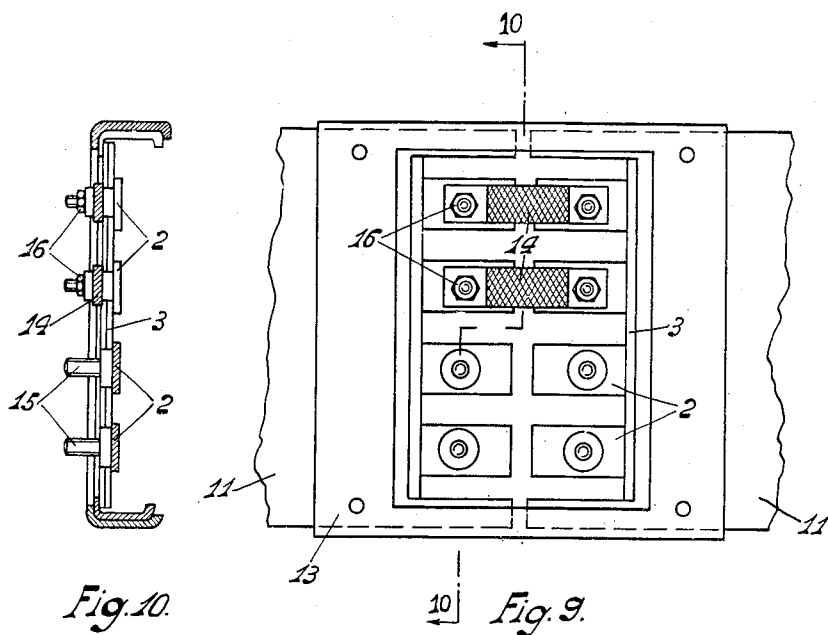
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ELECTRICAL TROLLEY CONSTRUCTION

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Claims priority, application Switzerland
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13 Claims. (Cl. 191—23)

The invention relates to a current carrying system from which the electric current can be taken at anyone of a desired number of places with stationary or sliding current collectors. Such systems are known, and generally several current conductors are laid open beside or over each other.

The endeavour to diminish the danger to life from touching the current conductors has led to their being laid in grooves with U-shaped section and high side walls or in box-shaped protecting casings with narrow slots for collecting the current. In the former case only a slight protection against touching is furnished; in the latter case practically perfect security against touching can be attained, but the constructing and installing entail considerable difficulties and expenses, and the installations could no longer be supervised with regard to their working free from trouble, perfect collecting of the current or any causes of trouble. Further, in the latter system the current collectors can no longer be inserted at any desired place. In particular box-shaped casings can only be constructed in curved shape with the necessary accuracy under very great difficulties and at correspondingly high costs. Through the present invention the existing defects are to be eliminated and further great fields of application are to be opened up for the circuit line with current being taken from it at any place.

According to the invention the current conductors are laid as flat as possible on a flat supporting rail, so that the supporting rail together with the current conductors have great strength in one direction and can accordingly be weight loaded, but in the other direction may easily be bent without any essential alteration in cross-section, in curves which are not too sharp. The edges of the supporting rails form the guiding and travelling tracks for the rollers of the current collector carriages. With this arrangement of the supporting rails as supports for the current conductors and as guide track for the current collectors, they remain always in the same position with respect to each other, and disturbances through uncertain contact making are avoided.

In addition to this, such an installation may be connected to a source of current by means of suitable suspension devices or the like and provisionally put into service, so that the running of the current collector carriages, the contact conditions, etc., can be accurately and easily observed before any protecting casing is installed. The protecting casing for protecting against unintentional touching forms, according to the invention, an independent complement to the installation, which can be fitted on and again removed in separate parts in a simple manner without disturbing the guide track, and serves accordingly exclusively as protection against touching. In consequence of this simple purpose for which the casing is required, its shape can be made very simple and no great requirements will be stipulated with regard to accuracy of execution, so that even this casing can be easily placed in position in curved tracks.

If the current conductors are disposed one above an-

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other, it is then accordingly possible without difficulty to equip an installation having curves, switch-points, turntables and the like, with the known means for erecting, operating and controlling. For very narrow curved tracks the invention provides an articulated carriage which maintains a constant distance between the contact support and the current conductors in each curve.

A particular advantage of the arrangement according to the invention consists in that the current collector carriages can be taken out and inserted without hindrance at any desired place. A circuit line according to the invention is preferably constructed on site, not in the required length but in short, transportable separate lengths, which can be joined together as desired to make long plants. But since the circuit line consists of parts which have not all the same thermal coefficient of expansion, this circumstance must be taken into account when joining the lengths together. The insulating parts do not require any connection, but the parts stressed mechanically or by weights, i. e. the supporting rails, must be rigidly connected to each other. The current conductors serving only for supplying the electric current and for guiding the contacts may therefore also not be rigidly connected to each other, must, however, be connected together electrically so that under normal circumstances no interruption occurs to the flow of current. A connection with sliding contacts subject only to spring pressure does not offer this security.

According to the invention therefore the current conductors are allowed to expand by gaps being provided at the connecting places. These gaps are bridged-over by stranded wires or the like, firmly bolted or soldered onto the current conductors; these strands can easily expand or contract.

The invention is diagrammatically illustrated in the accompanying drawing, where several examples of execution are given.

Fig. 1 shows a first form of execution of the circuit line in cross-section with quite flat supporting rails,

Fig. 2 a second form of execution of the circuit line in cross-section, in which the conducting rail has bent-over edges,

Fig. 3 a third form of execution, also in cross-section, but with channel-shaped bent-over edges,

Fig. 4 the front view of a current collector carriage as shown in Fig. 3 with various executions of the current collecting contacts,

Fig. 5 another form of execution of the carriage shown without current collector contacts, but with articulations for passing over sharp curves;

Figs. 6, 7 and 8 show a view looking onto the carriage according to Fig. 5 illustrated in different curves;

Fig. 9 shows the view of a connecting place between two separate parts of the circuit line and

Fig. 10 a section through the circuit line on the line 10—10 in Fig. 9 at a connecting place.

The simplest manner of laying several current conductors according to the idea of the invention as flat as possible on a supporting rail, must be by making the supporting rail of smooth strip metal 1 set on edge and of suitable width, on which strip the current conductors 2, also consisting of thin metal strips, are fixed, being separated by thin strips or bands of insulating material 3. The fixing may, for instance, be effected by the current conductors being fixed by thin clamps or rivets to a stiff but thin strip of insulating material, this latter being then connected to the supporting rail 1, the clamping means being also insulated.

Such a supporting rail 1 with the current conductors fixed to it in an insulated manner represents a very stable circuit line, whereby the supporting rail 1 serves not only as support for the current conductor 2, but in known

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manner also as protection against touching and as track for carriages which can serve both for collecting current from the current conductors as also simultaneously for conveying loads. Differing, however, from the known executions, the supporting rail forms only a part of the protection against touching, and the narrow longitudinal edges of the supporting rail are utilised as conveying track. In this way it is possible for such a plant to be put into service as desired as bare circuit line, when the condition and the behaviour of each part during the service can be observed. Further, it is an easy matter to make the longitudinal edges of the supporting rails to run exactly parallel with the current conductors, so that they may be best suited for guiding the current collector carriages.

When suitably suspended, the flat supporting rail is suitable for supporting comparatively heavy weights and is, as well as its edges, very resistant to changes of shape caused by loading through weights.

In Fig. 1 it is shown by way of example how a carriage can be guided on the edges of the supporting rail in that the upper and lower roller axles are fixed to a baseplate 4, the rollers 6 fitted with guide grooves being carried on these axles. The baseplate 4 is guided along the current conductors 2 and exactly parallel to them by means of the rollers 6, so that the contact 7 fitted insulated on the baseplate 4 can slide or roll with uniform pressure on the current conductors.

Even when an installation according to the invention is capable of service without protection against touching and can be utilised for testing purposes, the danger of contact with the electric current nevertheless requires a reliable protection against unintentional touching, i. e. the current conductors must be covered all round in such a way that current can be taken from them by a special current collector carriage or the like, but access to the conductors is impossible for tools and parts of the members which are not particularly bent for the purpose.

According to the invention, such a protection against touching can be obtained by a simple protecting plate 12 bent U-shaped, which together with the supporting rail 1 to a certain extent surrounds the current conductor 2 and also the current collector carriage 4—7. The slots remaining open can be arranged and dimensioned in such a way that unintentional touching is impossible and that contact can only be made by special devices and special tools.

The fundamental form of execution of the invention according to Fig. 1 can be modified by turning or bending the longitudinal edges of the supporting rail inwards. In this way, on the one hand a great resistance to distortion of the supporting rail is obtained, and on the other hand a reduced overall height and a more compact construction, since the rollers no longer need run above and below the supporting rail, but can run alongside it. In Fig. 2 such a circuit line is illustrated, in which a metal strip 10, bent through about 45° on the longitudinal edge, is adopted as supporting rail for the current conductor, in such a way that the supporting rail 10 is bent over towards the side away from the current conductors 2.

In Fig. 3 a further form of execution of the invention is illustrated, and here a metal strip 11 serving as supporting rail is sharply bent over in the shape of a U towards the side of the current conductor 2, so that the rollers 6 can roll on the edges alongside the supporting rail. Since the edges of the supporting rail 11 are only sharply bent, the supporting rail remains flat enough to allow of its being slightly bent in curves that are not far too sharp. The fitting of a channel-shaped casing 12 to protect against touching is the simplest thing imaginable, by attaching it to one side of the supporting rail 11 as shown in Fig. 3.

The circuit line system according to the invention serves

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the purpose of making it possible to collect current without danger at any place on the circuit line, and that can be done with current collectors which are stationary or moving along the line.

The so-called carriages serve for this purpose according to the invention, their track being formed by the edges of the supporting rail. The carriages have two different tasks to fulfill; on the one hand they follow the current conductors 2 and make it possible to collect current without interruption at any place even when moving along, and on the other hand they ought to be able to support the weight of small machines, machine-tools or apparatus, corresponding to the load which the rail is capable of supporting.

An appropriate execution of carriage is shown in Fig. 4. On the carriage-baseplate 4, the upper and lower roller axles 5 for the rollers 6 are fixed, which rollers run with their guide grooves on the edges of the supporting rail 1. The upper roller axles 5 are for example adjustably arranged in a slot 18, so that the rollers 6 can be raised from the guide track and the carriage may consequently be taken out at any place. According to the invention therefore the removing of the carriages takes place not merely at definite places along the circuit line or through alterations in it, but at any desired place by a displacement made on the carriage.

The baseplate 4 is cut out in the middle for the collector contacts 7. The contacts 7 may be made in known manner as sliding contacts pressed on by springs or as rolling contacts; they may be arranged singly or in duplicate on each conductor, as is indicated in Fig. 4 by the different contacts. The contacts 7 are led or supported in guides 8 which are supported by insulations 9. From the contacts 7, insulated conductors along the baseplate 4 lead to the consumers of energy.

Carriages according to Fig. 4 are principally suited for straight or slightly bent circuit lines; for sharp bends it is necessary to have a carriage whose rollers can set themselves according to the bends. Such a carriage is shown in Fig. 5. The special feature of this carriage consists in that, in the middle where the current collector contacts are fitted, it remains always at the same distance from the current conductors in curves of any shape or any curvature, so that the contact pressure remains unchanged and current can be reliably collected; such carriages also cannot remain stuck in the curves. This is obtained by the rollers 6 being carried not on the baseplate 4, but on hinge-like connected wings 17, and by their being arranged on these wings 17 not exactly one above the other, but staggered with respect to each other (in a definite ratio) in the direction of the guiding edges.

If the size of the baseplate between the two hinge pins be denoted by b , and the distance from the hinge pins to the middle between the two roller axles of one side by c , the relation

$$c = \frac{b}{2}$$

exists when the distance a of the baseplate from the current conductors 2 is to remain the same for all radii of curvature. Figs. 6 to 8 show clearly how the rollers 6 set themselves in the direction of the tangents to the curve in consequence of their staggered arrangement, and how the distance a of the baseplate 4 from the current conductors 2 remains in all cases unaltered, no matter whether the supporting rail with the current conductors is straight, or is bent outwards or inwards. The removal of the carriage according to Fig. 5 is effected in a simple manner, in that the pins of one hinged joint are withdrawn, so that a wing 17 with rollers 6 can be taken out alone, after which the baseplate 4 is swung out and also removed together with the second wing 17.

Circuit lines according to the invention are required in different lengths, and this can be obtained by connecting rather short structural lengths with each other. Figs. 9

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and 10 illustrate a connection between two current conducting lines according to the invention. The rigid connection of the supporting rail 11 is effected by bolting-on a metal strip or a sleeve 13 with a part cut out in the middle for connecting the current conductor 2.

Also the supporting rails 11 and the insulating pieces 3 are cut out at the ends in order to make the conductor ends accessible from behind. From Fig. 9 it can be seen that the current conductors 2 have the possibility of expanding lengthways. In order to connect the ends of the conductors together so that they conduct current, they are according to the invention connected to each other by flexible strips of conducting metal, braided wire, twisted metal cable, corrugated metal strips, or the like. The braided wire strips or the like can be brazed or bolted on, or otherwise firmly, securely and conductively connected to the current conductors. In Figs. 9 and 10 the connection is illustrated with bolts 15 brazed or welded on, nuts 16, and braided wire strips 14 clamped between them. Such an extensible connecting of the current conductors makes it also possible to construct switch-points with movable circuit line rails.

What I claim is:

1. In an electric trolley construction, a flat supporting rail having upper and lower edges, a plurality of current conductors extending parallel to one another along a flat side of said rail, means including flat strip insulators securing the conductors to said rail in insulated relation thereto to provide a thin, flat assembly, a casing of U-shaped cross section substantially enclosing the side of said rail on which the conductors are mounted and having a top portion overlying and secured to the upper portion of said rail, a vertical portion approximately parallel to said rail and a bottom portion directly beneath the lower edge of said rail but leaving a vertical space between the casing and the lower edge of the rail to provide a labyrinth-like slot opening first horizontally and then vertically into the space enclosed by the rail and casing and containing the conductors, whereby straight line access to said conductors is prevented, and means releasably securing the casing to the rail.

2. In an electric trolley construction, a flat supporting rail having inturned lower and upper edge portions, a plurality of parallel conductors extending along one side of said rail and mounted thereon, flat strip insulators between said conductors and rail to insulate the conductors electrically from the rail and a casing of U-shaped cross section substantially enclosing the side of the rail on which said conductors are mounted and having a top portion overlying and removably secured to the upper portion of the rail, a vertical portion approximately parallel to said rail and a bottom portion directly beneath the lower edge of said rail and spaced from the lower edge of the rail in a direction parallel to the plane of the rail and transverse to the length of the rail to provide a labyrinth-like slot opening first horizontally and then vertically into the space enclosed by the rail and casing and barring straight line access to said conductors.

3. In an electric trolley construction, a flat supporting rail having upper and lower edges, a plurality of parallel conductors extending along one face of said rail, means including flat strip insulators mounting said conductors on the rail in electrical insulating relation thereto, a casing of U-shaped cross-section having a top portion overlying and removably secured to the upper edge portion of the rail on which said conductors are mounted and a vertical portion approximately parallel to the rail, and a bottom portion directly beneath the lower edge of said rail, the bottom portion of the casing being spaced from the lower edge of the rail in a direction parallel to the plane of the rail and transverse to the length of the rail to provide a labyrinth-like slot opening first horizontally and then vertically into the space enclosed by the rail and casing and containing the conductors and a carriage comprising a base plate having a horizontal portion ex-

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tending into said slot and a second portion at an angle to the first and lying approximately parallel to said rail, contactors mounted on and insulated from said second portion and positioned to engage the conductors and rollers engaging the opposite edges of said rail.

4. A construction according to claim 3, in which the upper and lower edges of the rail are turned in and the rollers are disposed between the inturned edges of the rail.

5. A construction according to claim 4, in which the rollers are on one face of the rail and the conductors and contactors are on the opposite face.

6. A construction according to claim 3, in which the upper and lower edges of the rail are turned in and the rollers are disposed between the inturned edges of the rail, the rollers and contactors being disposed on the same side of the rail.

7. A construction according to claim 3, in which the rail is disposed in an approximately vertical plane.

8. A construction according to claim 3, in which the edges of the rail are turned in and the conductors are disposed in the space defined between said rail and a plane connecting the inturned edges.

9. In an electric trolley construction, a flat supporting rail having upper and lower edges, a plurality of parallel conductors extending along a face of said rail, means including insulators mounting said conductors on the rail in electrical insulating relation thereto, a casing of U-shaped cross-section having a top portion overlying the upper edge portion of the rail on which said conductors are mounted, a vertical portion approximately parallel to the rail and a bottom portion beneath the lower edge of said rail, the bottom portion of the casing being spaced from the lower edge of the rail in a direction parallel to the plane of the rail and transverse to the length of the rail to provide a labyrinth-like slot opening first horizontally and then vertically into the space enclosed by the rail and casing and containing the conductors and a carriage comprising a base plate extending into said slot and having a portion lying approximately parallel to said rail, contactors mounted on and insulated from said parallel portion and positioned to engage said conductors, said base plate comprising a plurality of sections hingedly joined to provide an articulated structure and rollers rotatably mounted on different ones of said sections and engaging the opposite edges of said rail.

10. In an electric trolley construction, a flat supporting rail having upper and lower edges, a plurality of parallel conductors extending along one face of said rail means including insulators mounting said conductors on the rail in electrical insulating relation thereto, said conductors comprising a plurality of sections disposed end to end with adjacent ends spaced and flexible bridging means of conducting material electrically connecting adjacent ends of said conductor sections, a casing of U-shaped cross section having a top portion overlying the upper edge portion of the rail on which said conductors are mounted, a vertical portion approximately parallel to the rail and bottom portion beneath the lower edge of said rail, the bottom portion of the casing being spaced from the lower edge of the rail in a direction parallel to the plane of the rail and transverse to the length of the rail to provide a labyrinth-like slot opening first horizontally and then vertically into the space enclosed by the rail and the casing and containing the conductors and a carriage comprising a base plate having a horizontal portion extending into said slot and a second portion at an angle to said horizontal portion and lying approximately parallel to said rail, contactors mounted on and insulated from said second portion and positioned to engage the conductors and rollers rotatably mounted on the base plate and engaging the opposite edges of said rail.

11. In an electric trolley construction, a flat supporting rail having upper and lower edges, a plurality of parallel conductors extending along one face of said rail, means

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including insulators mounting said conductors on the rail in electrical insulating relation thereto, a casing of U-shaped cross section having a top portion overlying the upper edge portion of the rail on which said conductors are mounted, a vertical portion approximately parallel to the rail and a bottom portion beneath the lower edge of said rail, the bottom portion of the casing being spaced from the lower edge of the rail in a direction parallel to the plane of the rail and transverse to the length of the rail to provide a labyrinth-like slot opening first horizontally and then vertically into the space enclosed by the rail casing and containing the conductors and a carriage comprising a base plate extending into said slot and comprising an intermediate portion lying approximately parallel to said rail and wing portions hingedly connected to said intermediate portion, contactors mounted on and insulated from said intermediate portion and positioned to engage the conductors and rollers rotatably mounted on said wing portions and engaging the opposite edges of said rail.

12. A construction according to claim 11, in which each of said wing portions carries two rollers which are disposed at different distances from the hinge line of said wing portion.

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13. A construction according to claim 12, in which one of said wing portions is removable from said intermediate portion so that the carriage can be mounted on and removed from the rail at any desired point along the rail.

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